2013

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PROCEED-
ING

re-new
digital arts forum

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Selection

The re-new call for participation was published March 29, 2013, and is republished below. A total of 358 submissions were made in all categories of the call. All submissions in the paper and art tracks were subject to a single-blind peer review process by a group of international experts. Reviewed submissions in the art track were programmed by a senior curator.

Paper track

Of 112 submissions in the different paper categories, the following numbers of submissions have been selected:

51 oral presentations
8 workshops

Art track

Of 246 submissions in different artwork categories, the following numbers of submissions have been selected:

17 performances
26 installations

Call for proposals

The Big Picture – the confluence of art, science and technology

Since 2007 *re-new* has presented electronic and digital artworks that explore and challenge technology and artistic practice, while fostering exchange between academics and artists. In addition to its internationally recognized media arts festivals, *re-new* has organized leading conferences in the field, including CMMR 2008 and 2009 and IMAC 2011 and 2012. These events have received over 2000 artwork submissions and 800 academic submissions, and reached a total audience of 12.000.

Beginning in 2013 *re-new* will join the media arts festival with its own academic platform. Our goal is to stimulate critical dialog, collaboration and networking between leading scholars, technologists and artists. re-new 2013 will make possible hybrid presentation formats where the confluence of art, science and technology is discussed in its full complexity.

TOPICS FOR SUBMISSION

Scholars, technologists and artists are invited to submit high-quality proposals outlining original research and/or artworks that contribute to this rapidly advancing field. Appropriate topics include but are not limited to:

- performing arts technology
- technology-mediated art performance
- technological/digital art installations
- slow media
- wearables / e-textiles
- (neuro) physiological data, biofeedback and art
- affective computing and art
- cognitive technologies and art
- neuroaesthetics
- adaptive technologies and art
- artificial creativity/intelligence and art
- augmented/virtual/hybrid reality and art
- immersive technologies and art
- ubiquitous/pervasive/context-aware technologies and art
- physical computing and tangible interaction
- liveness in a mediatized culture
- participatory art
- new interfaces for artistic expression
- gestural/multimodal/haptic/mobile interfaces and art
- embodiment and art
- media ecology
- networking and social media
- sustainability
- surveillance and privacy
- aesthetic computing and computational aesthetics
- big data
- visualization and sonification
- nanotechnology
- mobility

PAPERS

Papers must present original material and will be assessed on their contribution to the field.

SUBMISSION PROCEDURE – PAPERS

Initial submission format: 400 word abstracts with supporting media files are due on June 15, 2013. Abstracts must be uploaded to the easychair conference management system.

Final papers may be 4 or 8 pages long in Springer LNCS format. All papers will undergo the same review and publication process once past the initial round of abstract selection. The length should match the contribution. Authors may propose the presentation format that they feel best suits their contribution (short or long talk, demo, interactive exhibit, or both talk and demo/exhibit). *re-new* remains committed to the principle followed in previous *re-new* conferences – that all submissions are valued equally.

At least one author of each accepted abstract submission must register for the conference before the registration deadline in order for the final paper version to be published in the conference proceedings. The camera-ready deadline for the full paper is October 1, 2013. Please contact *conf@re-new.org* with questions about paper submissions.

ARTWORKS

Artworks may include objects, installations, performances, networked media, urban screens, socially engaged projects and other public interventions. Submissions will be assessed on their own merits and their relevance to the conference theme.

SUBMISSION PROCEDURE – ARTWORKS

Submissions must be uploaded to the easychair conference management system by June 24, 2013.

Artists whose artworks are selected will not be required to register for the event, but may be asked to give a presentation about their work. Professional video documentation of all activities and artworks will be undertaken by *re-new* and published in our web archive. Artists may freely use this material for their own purposes.

STUDIOS

re-new also invites proposals for studios to be held in multiple tracks on Monday, October 28, 2013.

SUBMISSION PROCEDURE – STUDIOS

Proposals must be uploaded to the easychair conference management system by June 24, 2013.

Studios are likely to focus on hands-on activities that offer new approaches and unexpected experiences to conference attendees, combining the arts with emerging technologies. They will be open to anyone who has registered for the conference, and each Studio will accommodate around 10-15 participants. Additional fees might be required for equipment, if needed for a particular workshop. Each Studio will be represented by a 4-page extended abstract that will be included in the Proceedings and published together with the other accepted submissions. Organizers are also encouraged to arrange for later publications of a studio's creative output, such as participation in the Leonardo Electronic Almanac series mentioned below.

Studios should encourage new and enriching perspectives in the field of art and technology. Through the studios, organizers can share their work with other professionals, engage in co-creation and gain feedback to broaden their research experience. Studio topics could include for example, the exploration of new tools or techniques, creative approaches to merging technology with the arts, artistic or research-oriented topics, etc., or could take the form of technical experiments or creative sessions. We look forward to creative and original studios that will open attendees' minds to fresh and innovative experiences in the field!

PUBLICATION DETAILS

All articles and artworks will be published in electronic format on completion of the event in *re-new 2013 proceedings* (ISSN 2245-7801).

An external panel will select the best academic and artistic works from the proceedings for a second editing and peer-reviewing process, which will result in a subsequent publication in the Leonardo Electronic Almanac series (LEA). Additional publication possibilities are being explored.

The abstracts will be available to registered delegates online before the event and an electronic copy will be presented to delegates at the event. All artworks, academic presentations, panel discussions and studios will be video documented and made available at *re-new's* online public access database.

Paper sessions overview
re-new 2013

Tuesday October 29

10.00-13.00 at Ko-op

Automated Interventions

Paula Gaetano Adi and Gustavo Crembil	*Mestizo Robotics*
Christoph Trappe	*Programmable Tapes - A Romance with the Material*
Wade Marynowsky	*The Acconci Robot*
Michael R. Schmidt	*AutoDJ: An Adaptive Music Player Utilizing Computer Vision and Machine Learning*

10.00-13.00 at Small Hall

In Collaboration

Angus Forbes	*Media Arts Methodologies for Art-Science Collaboration*
Emile Devereaux and Helen Pritchard	*Transgenic Swimming Pools: Testing Bodies in Art and Science Experimentation*
Gabriella Arrigoni	*Speculative culture: design fiction in user-centred innovation labs*

14.00-17.00 at Ko-op

Framing Media

Guillaume Lafleur	*Curating Media and Digital Art in an Age of New Hybrid Forms*
Elif Ayiter and Heidi Dahlsveen	*Little Red Riding Hood: The other side of the story*
Melanie Binette	*The ambivalence between distance and intimacy: active contemplation and connection in David Rosenberg's and Glen Neath's Ring*
Lars Bo Løfgreen	*Old questions, New aesthetic*
Sandra Alvaro	*Postdigital Art: building appropriable information apparatuses*

14.00-17.00 at Small Hall

Conducting Sound, Coding Performance

Enrico Bertelli and Emily Robertson	*Conductive Music: building DIY drum synths, drawing digital music notation, and designing for urban youth*
Morten Riis	*The Switch of Carpentry – Memories from a Cassette Tape Recorder*
Andreas Bergsland and Robert Wechsler	*MotionComposer - An interactive movement-music environment for persons with (and without) disabilities*

Wednesday October 30

10.00-13.00 at Ko-op

Data Spaces, Data Narratives

Javier Villegas and Angus Forbes	*Automatic Double-Meaning Animations*
Philippa Bateman, Brad Miller and Ian McArthur	*Art in the age of imaging data: mediated_moments and plasma_flow*
Je-ho Oh, So-young Kim, Seung-hun Kim and Chung-kon Shi	*Interactive Art in Enhanced Narrative Form: "Magic Monkey Flies"*
Colin Johnson	*Semantic Mass*

13.00 at Small Hall

Media (Dis)locations

Alexander Carôt and Jason Reizner	*A Telematic Approach for Mass Music Ensembles*
Juan Pablo Carrascal	*TuneMap: an interactive geolocated musical information browser*
Joe Reinsel	*Sound Cairns: Virtual Spaces*
Stephen Cartwright	*Data Sculpture*
Everardo Reyes-Garcia	*Motion structures: aesthetics of spatial and temporal transformations*

14.00-17.00 at Ko-op

Tarrying with Nature

Juan M Castro	*Human-cyanobacteria interaction: an interkingdom communication system centered on the stimulation, analysis and interpretation of physiological processes at the cellular and animal level.*
Lauren Fenton and Clea T Waite	*Expanded Cinema as "Universe-in-a-Box": the Book of Luna and the neo-baroque poetics of space.*
Maria Luiza Fragoso and Carlos Augusto Moreira Da Nobrega	*NANO LAB – exploring artistic interfaces with natural/organic elements in telematic environments*
Shane Mecklenburger	*The End & Beginning of Everything*

14.00-17.00 at Small Hall

Theorizing Media Arts

Charissa Terranova	*Operational Blindness in the Twentieth Century The Emerging Digital Image in Art from Gestalt to Distributed Network*
Alannah Gunter	*Remotely Framed: an exploration into the aesthetics of the live pixelated experience*
Giacomo Pala	*Links and Connections : Future's Past*
Ewa Wójtowicz	*Allegorical Procedures Renewed - The Artist as a Semionaut in the Network-based Culture.*
Barbara Pires E Castro, Doris Clara Kosminsky and Luiz Carlos Pacheco Rodrigues Velho	*Corporeal interval - sensory indeterminacy as the poetic bloom of interactive art*

Thursday October 31

10.00-13.00 at Small Hall

Corporeal Interactions

Christina Grammatikopoulou	*Decoding the body: Towards a technologically enhanced and artistically generated experience of the corporeal*
Stella Sylaiou, Leonidas Gelos and Yiannis Ziogas	*Exploring roads less travelled: eye-tracking in art*
Maciej Ozog	*Tactical media in the age of communicative capitalism – closed story, unfinished project or current alternative?*
Jonathan Impett	*Speak - Active Sound-Space and the Performer*
Maxim Safioulline	*Eloe: Application of Brain-Computer Interfaces in Visual Creativity*

10.00-13.00 at Ko-op

Mediated Bodies

Anne Pasek	*Seeing Yourself Strangely: Media Mirroring and the Avatar*
Seraina Valtsani	*The stethoscope and its influence from the telegraph to "Sonic Body"*
Michelle Lewis-King	*Pulse Project: An Encounter between Art, Science, East, West, Self and Other*
Valerie Lamontagne	*DIY Second Skin*

14.00-17.00 at Small Hall

Speculative Visions

Lígia Dabul	*Poem's body on the web*
Jacob Lillemose	*The City Re-imagined and Augmented - The Merging of Digital Media and Collective Visions of Public Space in the Work Radiant Copenhagen by Kristoffer* Ørum*, Anders Boyen et al.*
Selavy Oh and Stefan Glasauer	*Time machine: A dystopian new-media investigation*
S Raoul and Shubigi Rao	*The Tuning Fork of the Mind*
Elizabeth Clare	*One With One*

14.00-17.00 at Ko-op

Gesture in Interaction

Morten Søndergaard	*Responsive Radio Interfaces - Redesigning the Way We Listen*
Andrea Sosa	*The Device In Interactive Art: Interactivity, Gesture and Sense.*
Deborah Lawler-Dormer	*Artistic experimentation using computational modeling of the human brain*
Ricky Graham and Brian Bridges	*Mapping and Meaning: embodied metaphors and non–localised structures in performance system design*

Conferences are excellent barometers of the critical ideas that define our discourses and practices at that moment in time and this conference is no different in that regard. The primary themes that preoccupy many of the papers in this conference include the technological concomitants of and impacts on embodiment, the complex ways in which technology expands and complicates our spatial and locative imaginaries, the contours of interactive experience and the new creative vocabulary afforded by data manipulations and coding.

In an age where our online and mobile communications have increased the reach and continuity of our professional connections, the conference needs to enact a very different kind of exchange and interaction. The face-to-face interactions afforded by the conference need to become more than occasions for us to recite our scholarly findings and instead enable us to engage in the rich and lively interactions all ideas deserve. Proceedings like these play a critical role in unleashing or at least eliciting this kind of meaningful exchange between conference attendees. So, we sincerely hope that the availability of the conference proceedings will go some way to invigorate your conversations during the conference.

As conference chair I am deeply grateful for the opportunity to work with an amazing team of collaborators on the re-new Digital Arts Festival but most importantly, Edward Shanken, Senior Curator of the festival and Lars Graugaard, the festival organizer. We would also like to thank Hrvoje Hiršl for his excellent design of the conference proceedings.

We wish you an exciting conference!

— **Gunalan Nadarajan**

Conference Chair,
re-new 2013

Content

SPECULA-
TIVE
VISIONS

SPECULATIVE VISIONS

Poem's body on the web

Lígia Dabul

(Universidade Federal Fluminense – Brazil)
Rua Professor Ortiz Monteiro

Abstract: This article focuses on changes concerning the forms of creating poetry and the body of poems that occurred alongside a democratisation of web poetry writing. Studying poetry and poets by means of what is shown on the Net allows us to reach unusual realities, based on original elements, with new nature, so to speak, more than access to data. We would like to point out some ways in which poets and non-poets interact on the Internet, evaluating practices linked to poetry. Also, we would like to present some of the new configurations that creating poems has been appearing in that support, especially the ones concerning significant modifications on their body, and, as a consequence, on their image — their outline, colour, texture, visual ambience.

*We find in art, in literature and in many other spheres of socia*l life an adoption of certain behaviours towards World Wide Web, perhaps due to the new expression and creation possibilities we can experience with them, as well as meeting new people.[1] Naturalising a series of communication procedures and ways of sharing space on the Internet always seems to overlap and come along with a surprise towards innovations that are quickly presented to us and then assimilated. Poet and visual artist Laura Erber posted on Facebook a protest — generally not very explicit, probably not very common - about the act of getting comfortable in the ways of interaction that almost automatically come along when taking part in social networks:

LAURA ERBER

Thursday, February 25, 2010 at 12:53

does anyone here managed to understand the idea that Facebook is based on, I mean, the friendship that tie us within these justified margins (I still long for italic and verse break inclusions)? there are many ideas, of course, and each one has an inflexion of his or her own, but I wonder (yet without an answer) why this chain is somehow painful. I try to imagine the shape of that slutty friendship. tremendously, frighteningly vast and unlimited. pure monotony. boredom without spleen. what to do? say it's enough, rest one's hand on the delete key? But how can one define that filter? let it be. I never make it. Virtual life carries on its estrange course of aggregates. Wouldn't it be some kind of relief when here we come across good old piques, strifes, punches, verses d'escarnio & maldizer, HUMPFS and PAFFS and blocks. life signs? cheers.

Fig. 1: *Laura Erber's Facebook post on Thursday, February 25, 2010 at 12:53.*

People who follow poetic production that others make and deliver on the Internet possess a familiarity with all the innovations and transformations that have been appearing on such field for about twenty years. However, as in many other areas of social life, studying poetry and poets by what is seen on websites makes possible – apart from accessing data – to contact

uncommon realities, based on original elements, with new nature, so to speak. The Internet has the power of establishing realities that echo and create events beyond screens, technologies, languages, habits, leading the variety of experiences that we have not yet studied by asking questions and using appropriate conceptual apparatuses that are part of the singularity of these phenomena. In this article we point out some ways by which poets and non-poets interact on the Internet according to poetry-linked assessments and practises, and we present some new configurations that poetic creation has been assuming on this platform.

FAR AND WIDE

By observing the recent poetic production on the Internet we can visualise relevant dimensions and events of contemporary Brazilian poetry, and even many of the new mechanisms to constitute identities and to consecrate poets. On the Internet, poets create networks of poetry, at the same time they lead non-virtual pre-existent networks, which stop being the same after they visit these virtual spaces. These are also of another kind, read in a different way, in many different ways, and it changes very quickly. An example of this is the *As escolhas afetivas* [*The affective choices*] blog,[2] organised in Brazil by Aníbal Cristóbo,[3] where poets introduce themselves and their poetry, naming other poets from their circle, who name others who will name others, making explicit, deforming, redefining preferences maps, acclamations, identification between poets – which will be commented and added to their lives by different means, far and wide.[4] Poets' blogs also select and suggest other poets' blogs, following a common nominating procedure, normally in a crossed fashion, based on clear reciprocity, together with non-poet bloggers.[5] These so noticeable relationships and ways of interacting between poets – on blogs that involve so many poets, as happens in *As escolhas afetivas* blog, in which the author, the owner, interacts with readers, with visitors, poets and non-poets, in sites like Facebook, in which poets interact with other poets – are developed mainly like in other areas of social life. However, we can wonder about how web creation affects poetic production – ways to transform and constitute the identity of poets and their mechanisms to create.

One of the effects of using written language during web-based communication is that it brings about new and different ways to write, even poetry.[6] Along with the great number of ways to disseminate poetry, we can affirm that there are users repeating the consecration of well-known poets, long publicised by the educational and editorial system and by critics, scholars and poets. In Portuguese, writings by Fernando Pessoa, Carlos Drummond de Andrade, Clarice Lispector, Cecília Meireles, many being unauthentic or in inaccurate reproductions, are scattered over e-mails, blogs, websites, news and online events. We also found important changes in writing and in the forms of "unknowledgeable" consecration, less valued by social actors and institutions that study and zeal what we call literature — such as academies, universities, official events, editors. In fact, due to the generalised boost of traffic of information caused by the Internet, which also affected poetry, poems and poets are wanted, read and publicised, despite the fact that they were only accepted among few social actors in the past, perhaps known by these poets because of a very close relationships, such as friends, family, colleagues, neighbours.

That is to say, what we call public, and literature's "unknowledgeable" products, is shown, asserted and widened. Poetic production, disseminated far and wide, was increased,[7] meaning it became visible, and that it presented itself whenever, posted together with traditionally consecrated poets and with those poets consecrated by specialists. The mechanisms applied to outline what is poetry and what are poets — like *As Escolhas Afetivas* does — remain present, as they have always done and probably will do; additionally, now they can be easily reached by many more people that were not paying enough attention to those spaces back then. Yet several lists, groups and poets' networks that are not accepted by traditional mechanisms and/or institutions that hierarchise poets and poetry are equally visible and coexist.

DISSEMINATED, INSEMINATED

A direct outcome of poets occupying and creating spaces on the Internet, such as blogs, is that poems withdraw from the traditional white page support, remarkably increase their possibilities using colours instead of black letters as it was before, and it has been made explicit the existence of a body for poems, shapeable in types of fonts, in sharpness, in size, in justification, in relation with the background which invades poems with modifications and intensities that are recently known. In addition, poems detach themselves from books, which are a reference to its old home; although that is not always the case and it sometimes does not even exist, as when poems are made known to public without having had a home for poems, belonged to a family of poems, to a book, etc. In other words, poems have moved.[8]

In poets' blogs, poems tend to get mixed with other authors' poems, as well as with posts and news aboutpoets' personal life, with poetry related events — book releases, courses, workshops, readings — with literature texts, and sometimes, as it happens in Ademir Assunção's blog, *Espelunca*,[9] with chronicles and harsh judgements on public policies focused on literature, among other subjects. In most cases, there are not only characters in the environment of a poem. Besides the changes in size, texture and colour that directly affect the poem's body, poets make use of visual material, which does not mean only illustrations. The *Cantar a Pele do Lontra* blog[10], from poet Claudio Daniel, regularly shows pictures on every post, normally belonging to professional photographers or plastic artists, in the "Gallery" section. Furthermore, there are poets that frequently add their own visual works next to their writings on their blogs, as does João Miguel Henriques, a Portuguese poet, in *Quartos Escuros*.[11] Also, in *Literatura no Brasil,* a Projeto Cultural Literatura no Brasil's blog,[12] founded in 2004 and which has been adding several writers ever since, poems and pictures of uncountable events and participants are presented side by side. Both poets and non-poets unmake the margins of the poem by placing it together with so different images. Talis Andrade, in *Poesia e Pintura: ARTE VERSOS*[13] blog presents conjointly paintings and poems, an association that is commented by his readers.

In online-only literature magazines there seems to be a special approach by editor poets towards what was not so generalised in the field of poetry until then, but rather was in visual artists' work. In *Zunái. Revista de Poesia & Debates*,[14] founded by Claudio Daniel and Rodrigo Souza Leão and with artwork by visual artist and poet Ana Peluso, in "Poetry" section, poems are called "sound sculptures". Even in poetry publications that already existed in print form and have now been reproduced on the Internet, we find a visual makeup, a new body and a new semantic field, also with visual markers, which now house poems. As an example, see the *Panorama da Palavra*,[15] in issue 69, edited by poet Helena Ortiz.

Furthermore, there is a poetic production that makes the most of sound and image in the form of processes that run through, join and determine creation by means of the word. Poet and musician Cid Campos highlights the impact of digital technology's arrival on poetic creation developments, especially associated to music.[16] Andre Vallias, a poet and a graphic artist, was one of the pioneers of that kind of visual and sound production in Brazil. *Revista Errática*[17] publishes audiovisual materials involving writing in different ways. For example, the poem *Alegria e dor*,[18] unpublished at the time, by Armando Freitas Filho, is included in *Errática* with an audiovisual treatment, providing it with a reading experience that greatly differs from the one usually achieved using books from this poet. Arnaldo Antunes, on the other hand, creates a "sound collage" of the poem called *Tradição*,[19] which receives a graphic and animated treatment by André Vallias. In this poem the possibilities of presentation are submitted to the choices made by the reader-spectator-participant, who chooses the possibilities and applies a rhythm with the mixtures he or she likes by clicking on the image.

The participation of the reader/spectator public in virtual poetic production is stimulated by the *open-source* fashion, by the permanent possibility of changing finished works, as occurs with *Tradição*. It has become common to see poems still in process, not yet finished, being published. Lau Siqueira, keeps posting on his blogs *Pele Sem Pele*[20] and *Poesia Sim*[21]. On *Poesia Sim* he shows, alongside works from other poets,

comments, news about cultural events, illustrations and what he calls "red poems", which are poems still in process, easily recognised because of their colour on the blog. Writer Rosana Caiado[22], who owned *Pseudônimos*[23] blog for some years, founded *Complete a frase* [Complete the sentence], directly aimed at making readers participate, by welcoming them to create "answers" to the sentences she starts. Somehow, presenting unfinished works – with or without the reader's participation in writing them – opens users access to a stage of poems that is usually kept by poets or exposed to a reduced circle of poets and their friends and relatives. That restricted circle of sharing can become public, as happens in *Oui! à l'inspiration*, by poet Claudia Roquette-Pinto.[24] Focusing straight on a circle of people – most of them poets – with who she wanted to talk about her literary production — now related to collages —, she sends an e-mail with the subject "my new blog", announcing the blog on which she will present her works still in process:

> *my new blog*
> *hello, friends,*
> *I just finished creating a blog (oui! à l'inspiration), where I've been posting separated (and random) pieces from my new book, in prose, yet to be written – that will probably be called entre*
> *lobo e cão [half wolf, half dog].*
> *I'm also posting on it, on the blog, my collage works. I hope you like it – and if you can, send me an opinion...*
> *kindest regards from*
> *Claudia*
> *http://ouialinspiration.blogspot.com/*

EXIT

In this paper, we pointed out some variations of how are produced a poet's identity and the criteria to measure what is web poetry. We also showed changes in the body of poems, and even exposed their unfinished states. However, if we look closer, we can find the wandering poet on the Web, everywhere, interacting and strolling at a speed that is mainly determined by technology innovations and by its own will to create life signals.

In her last post on *Pseudônimos*, Rosana Caiado gives us a certain dimension of the series

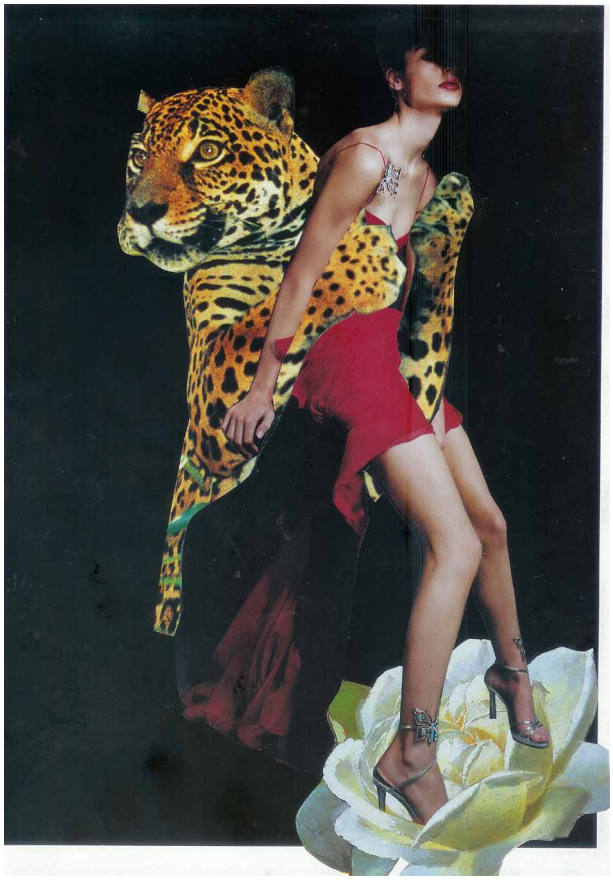

Fig. 2: *Collage work by Claudia Roquette-Pinto on Oui! à l'inspiration blog and attached to the e-mail 'my new blog' (24.09.2008).*

of places for exhibiting works and interacting with people, created and/or occupied by writers:

> 1.3.10
> *The end*
> *Pseudônimos lost its meaning long time ago, but only now the courage came to end it.*
> *To follow my column on MSN, click here.*
> *To Complete de Sentence, click here.*
> *To follow me on Twitter, click here.*
> *To add me on Facebook, click here.*
> *Or send an e-mail at any time to rosanacaiado@gmail.com*
> *Written by Rosana Caiado Ferreira, who hates good-byes.*

Fig. 3: *Rosana Caiado's Pseudonimo website, on March 1, 2010.*

Alongside this, poets build personae who are kept by time, although journeying and writing on several websites. These most special avatars remain and act on their own will, somehow constituted from the use of tools that reach their hands and their mind, and from answers from contact with readers — or spectators, for those

who already add to poetry a visual and sound production beyond the evident, constitutive, existence of visual and sound aspects of any writing. However, in this situation, we would be dealing with other subject, continuing and extrapolating this work.

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ENDNOTES

1 This work is a construction of some questions about the production of poets and poetry in Portuguese on the Internet. We base our study on some works about the impact that new technologies have on artistic production, as the Diana Domingues's ones – cf Domingues (2003). We also develop some thoughts on artistic creation as a social activity, as in Tim Ingold and Elizabeth Hallam (2007) and Lígia Dabul (2007), and on ritual aspects of artistic creation, as in Lígia Dabul and Bianca Pires (2009).

2 *http://www.asescolhasafectivas.blogspot.com/*

3 There are blogs made by poets, organised as this one, in several countries of Latin America and Europe. Poet Aníbal Cristóbo also owns the *Kriller 71* blog *http://kriller71.blogspot.com/2009/08/lektion-4-por-favor-quien-es-usted.html*

4 Note that in the structure of this network, identifications and prestige markers are linked not only to the number of nominations that an individual receives, but to the author of those nominations and how quickly was a poet nominated, which takes him or her closer to the centre of poets that the network was built around.

5 E. Nascimento (2009: 295) lists the nominations she found in websites and blogs in *Projeto Cultural do Brasil's* [*Cultural Project of Brazil*] blog – *http://www.literaturanobrasil.blogspot.com/* – from late 2004 to late 2005: *http://www.quilombhoje.com.br*; *http://www.capao.com.br*; *http://www.enraizados.com.br*; *http://www.cotaeditorial.cjb.net*; *http://www.suburbanoconvicto.blogger.com.br*; *http://www.leialivro.com.br*; *http://www.recantodaspalavras.com.br/autores/sacolinha*; *http://www.leiabrasil.org.br*; *http://www.1dasul.blogspot.com*; *http://www.movimentoliterario.com.br*; *http://www.ferrez.blgspot.com*

6 Here we can imagine that there isn't a differentiation between writing / image / sound: the writing – therefore the poem – has a body and bears a sound in every case. Further we will include this concern in our analysis.

7 I point out that there are kinds of poetry and poetics with social concentrations of poets' attributes in an interview with Thiago Ponce in *Algaravaria*. *http://algaravaria.bloguespot.com/2006/08/algaravariaes-12-lgia-dabul.html*

8 Poems' individualisation and detachment somehow goes with a displacement made by other written materials in network environments, kept away from publications where they originally came out, fitting in a different context and, for that reason, obtaining new meanings. J. Furtado (2006) shows that these units now "freed" on the Internet — such as poems and scientific works — consist in fragments of a book, whose shattering would accompany the removal of its parts.

9 *http://zonabranca.blog.uol.com.br/*

10 *http://cantarapeledelontra.blogspot.com/*

11 *http://www.quartosescuros.blogspot.com/*

12 *http://www.literaturanobrasil.blogspot.com/*

13 As an example, view in this blog a poem from Adélia Prado alongside a painting by W. Kandinsky *http://fotolog.terra.com.br/talisandrade:559*

14 *http://www.revistazunai.com/*

15 *http://www.panoramadapalavra.com.br/*

16 Vide C. Campos (2008).

17 *http://www.erratica.com.br/*

18 *http://www.erratica.com.br/opus/74/index.html*

19 *http://www.erratica.com.br/opus/89/index.html*

20 *http://www.lau-siqueira.blogspot.com/*

21 *Poesia Sim*, *http://www.poesia-sim-poesia.blogspot.com*, is presented as "a space to create and to make quick thoughts about the ever challenging Poetry and its processes within Literature and cultural contexts."

22 In *Complete a frase*, *http://www.completeafrase.blogger.com.br*, she writes: "Rosana Caiado Ferreira was born in Rio de Janeiro in 1977. She is a screenwriter, columnist on *MSN Mulher* [Women's] and is writing a book."

23 *http://www.pseudonimos.blogger.com.br/*

24 Claudia Roquette-Pinto has published several books. With *Corola* she received the Prêmio Jabuti de Poesia 2002 [Jabuti Poetry Award]. She published a children's book called *Botoque e Jaguar: A origem do fogo*. She also translates. The *oui! à l'inspiration* blog is not online anymore.

The City Re-imagined and Augmented - The Merging of Digital Media and Collective Visions of Public Space in the Work *Radiant Copenhagen* by Kristoffer Ørum, Anders Boyen et al.

Jacob Lillemose

"The imaginary is what tends to become real."

– Andre Breton, 1932

The future does not exist in Copenhagen. Not in the socio political sense of "no future" that the punk movement declared throughout the 1980s. The future of Copenhagen simply does not figure on the imaginary horizon of the Danes. The startling lack of any kind of Copenhagen-based fiction wondering what the city might be like 25, 50, and 100 years from now is a revealing reflection of this absence of visions of different tomorrows. Rather Copenhagen is city that excels in dealing with the contemporary. Especially since the mid 1990s politicians in collaborations with scientists and cultural workers has developed a public image of the city based on the ability to handle the present conditions in smart and sustainable ways. The process has to a certain degree been informed by a touch of the welfare idealism that Denmark was celebrated for around the world. The basic approach however is a pragmatic one, in the sense that it is focused on making urban life liveable and to some extent also exciting with the means at hand. Moreover, since Copenhagen is such a rich city and these means are so full of possibilities, there seems to be no need to venture into speculations of a change of scenario. In other words, the future does not exist in Copenhagen because the city is comfortable and satisfied with the present.

But what if one does not accept this closing off of the future perspective for Copenhagen? If one – contrary to the realist outlook and rational logic that pervade the ubiquitous pragmatics – conceives the imagination of a future Copenhagen as the critical and visionary means to engage with the development of the city?

One answer is that then you have something like the project *Radiant Copenhagen*. Initiated by the artists Kristoffer Ørum and Anders Boyen in 2008, the project is a collectively produced version of a future Copenhagen. It is based on a modified GoogleMap of Copenhagen on which is pinned more than a hundred multimedia contributions by literary scholars, musicians, architects, inventors, data linguists, art historians and other artists, all dealing with imaginary future

scenarios of the Danish capitol. It constitutes an elaborate experimental fantasy that trumps the pragmatic approach to contemporary city life with science-fiction and avant-garde aesthetics.

You enter the project as you would any other website. The first page informs you about your technical set-up and lists the names of the contributors. Clicking on the logo – the silhouette of the Copenhagen skyline set to a background of "Asian" sunrays – you are taken to a pop up window that welcomes you and encourages you to take a tour and suggesting a random starting point while images from the radiant city circulates at the bottom of the window accompanied by a chaotic sound track that mixes real sound with classical compositions, pop music, cartoon jingles and much more.

Once you arrive at the Google map the different stories are accessible as text bits. When you click on a text bit the screen zooms in and a window pops up with the specific story. Some of the stories are very short but nearly all of them link to other stories forming an intertextual web.

The historical horizon of the stories spans from the then near future of 2012 and the decision to turn the shopping mall Fisketorvet into a squatter commune to the distant 2192 publication of the Venetian traveller and nobleman Field DeFol's travelogue *Luminous Copenhagen: Light Footsteps in the Star of the North*. In between these two points in time one can find stories about The School of the New Radiant Living in Nørrebro, the realisation of a six-lane highway along the inner city lakes, the flooding of Christianshavn due to global warming, the appearance of graffiti visible for only a few seconds quoting former prime ministers on the walls of the parliament and the 2139 destruction of large parts of central Copenhagen by a giant monster of the classic Godzilla breed.

As is obvious from these examples *Radiant Copenhagen* does not try to be a sales pitch for the politicians, city planners, and investors that manage the city's development. If anything, the work tells them that they are misguided and will be out of work in a few years time due to circumstances and events that exceed their frame of mind.

As a social critique and vision the significance of *Radiant Copenhagen* does not hinge on its plausibility. Neither, does it try to convince you that all this will eventually happen. It is not a classic piece of sci-fi make-belief. While the project is certainly open to the possibility that some of it will actually happen in some form or another, the work is primarily concerned with fictive propositions of what *could* happen, of seeing Copenhagen from the point of view of a radical imagination that leaves reason and reality behind in order to open new doors of perception to the dear old city. These doors lead to a particular form of wisdom that challenges us to see the city we are so familiar with in a strange light, to leave our preconceptions behind and venture forward towards speculative – of if you will, dreamy – alternatives.

In opposition to the (unrealised) modernist vision of constructing the ideal city for man and his environment that Le Corbusier published in *The Radiant City* (1935) – an obvious ironic reference to the project – *Radiant Copenhagen* presents a heterogeneous city where the relation between man and his environment has mutated in all sorts of complex ways defying any notion of a master plan. Instead presenting one narrative of future Copenhagen the project points in multiple directions without any illusion of adding up to a coherent whole.

Furthermore, the project also counters the ecstatic optimism expressed in *Radiant Shanghai*, a city development strategy that taps into the widespread idea of Asia as the centre of the future of the world. In comparison, the mix of positive and disastrous developments found in *Radiant Copenhagen* projects a complex, if not schizophrenic image of Copenhagen. Its radiance is not simply a question of promising projections but – in the tradition of dystopian science fiction – of shedding light on the darker aspects of the city's future.

The kaleidoscopic view partly turns postcard picturesque Copenhagen into a highly ambiguous city, partly opens it up to expanded explorations. As such *Radiant Copenhagen* connects with the Situationist tradition of charging urban life with the power or agency of the imagination to escape the society of the spectacle. Like a psycho-geographic map it transgresses existing urban structures allowing for a new kind of playful, liberated experience.

Radiant Copenhagen is a relatively low-tech project. Compared to contemporary smart devices and the app revolution they've sparked its use of a web site platform seems almost anachronistic.

However, the significance of *Radiant Copenhagen* in this context is not the technology itself but the project's conceptualisation of a feedback exchange between urban space, technology and the imagination.

To understand the significance of this conceptualisation it's useful to see *Radiant Copenhagen* as a peculiar expression of what Lev Manovich has called "the poetics of augmented space." A brief definition of augmented space by Manovich is, "the physical space overlaid with dynamically charged information."

With the advent of this augmented space we are like modern day fighter pilots who experience and navigate physical space through a layer or an interface of digital data. Hence, the digital is no longer part of some other, detached virtual reality but is an integral part of the reality of non-digital bodies and objects. Moreover, in the augmented space the digital is not simply a flashy ornamentation of the physical but functions as an interpretation of the physical and as such fundamentally influences our perception of and engagement with the physical.

While the augmented space of *Radiant Copenhagen* in it current form might not be as technological dyna+mic as the one Manovich envisions, it is every bit as imaginary dynamic as the examples he mentions. Modifying the photographic tool of the GoogleMap the project superimpose a digitally constructed fiction on a series of physical locations in Copenhagen thus enabling the experience and navigation of the actual Copenhagen through stories of an imaginary future Copenhagen. It augments the physical – AND temporal – space of Copenhagen not only with digital means but also with the means of the imagination.

This might not be such a remarkable feat in relation to cities like New York and Los Angeles where the happy and not so happy future has been depicted over and over again by Hollywood to the degree that it has become inseparable from how we perceive these cities. However, in relation to Copenhagen where the future does not exist – neither in movies nor on the streets – it is a rather radical proposition that – to use a notion introduced by Jacques Rancière – "redistributes the sensible", in the sense that it challenges the established ways in which something common – here, the city of Copenhagen – lends itself to experience and participation. Without adhering to Rancière's democratic politics or any political ideology for that matter, *Radiant Copenhagen* envisions the spaces, times and forms of activities of urban life anew according far beyond the consensual order, which *R*ancière sees as the epitome of contemporary society of control. The collective imagination that feeds *Radiant Copenhagen* is not orderly, it is rather full of contradictions and distortions. But it is also full of virtual possibilities that serve a critical and liberating function by offering an approach to Copenhagen that is unrestricted by contemporary circumstances and considerations.

Continuing this line of thought, perhaps *Radiant Copenhagen* can be seen as a prototype of a new type of moving image which do not unfold on a static screen placed at one specific site but like Vertov's "man with a moving camera" is constructed by the user's moving through urban space with his or her smart device. A new practice of everyday life.

This will allow for a new aesthetic exploration of the moving image as an open-ended montage structure and of public space itself as an expanded network of intersecting, diverting and open-ended narratives.

Moreover, while LED screens are invading cities around the globe this form of the moving image does not have to fight with advertisements, news updates and pop cultural phenomenon for the precious and limited spaces of the existing screens in the city. Bypassing the hierarchies of access embodied in these screens it allows for more open conditions of production and distribution.

As such, this type of moving image seems to be a format to explore in the future with all imaginary means possible, and not just in Copenhagen.

Time machine: A dystopian new-media investigation

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Abstract. A time machine is proposed that allows visiting the past and, under certain circumstances, even changing the present. This time machine, while impossible in the real world, can be realized in a virtual world: digital data can be recorded and stored continuously for revisiting at will. Our metaphor of a virtual time machine can be compared with human episodic memory, but also has unsettling implications: not only would the complete past be open for investigation, the time machine would, under certain restrictions such as avoiding inconsistencies in the time stream, allow changing the past as normative intervention in history. Modifying the past would even permit influencing the present. Thus, the idea of time travel turns into a dystopia that has astonishing counterparts in contemporary data collection and surveillance programs.

1. INTRODUCTION

Duration is the transformation of a succession into a reversion. In other words: THE BECOMING OF A MEMORY

— Alfred Jarry
How to construct a Time Machine. 1899

The desire to overcome the boundaries of time is as old as mankind. Prophets and oracles incarnated the hope for a window to the future that, given we could see clearly enough, would allow manipulating our otherwise inevitable destiny. The idea of literally traveling time along both directions, to the future and to the past, has become a common dream ever since HG Wells famous novel published in 1895 [1]. Notably, Wells was not even the first fiction author to propose a time machine - a couple of years earlier, a Spanish author publish a novel on the topic [2], which, however, was soon forgotten and only recently rediscovered. Time machines soon became popular and even entered avant-garde literature [3].

However, time travel is not just a topic of fiction. Established physicists and mathematicians have devoted considerable thought to whether time travel would be possible. For example, the mathematician Kurt Gödel famously showed that a special case of solutions to Einstein's relativistic field equations leads to a universe in which time travel is possible because it contains closed trajectories in spacetime [4],[5] see Savitt 2005). Even in our universe relativistic time dilation could, in principle, be used to travel into the future, but just to get stranded there without any possibility to even tell these revelations to the contemporaries left behind, not to speak about physically getting back. Any time machine that would allow traveling back in time seems physically completely impossible (but see, for example, [6] for a discussion of relativistic time travel making use of spacetime abnormalities). Even more so, the perspicuous reason of visiting the past to change the present and thus allowing to completely fool destiny - see popular science fiction from Stanislavs Lem (The Star Diaries:

The Seventh Voyage; [7]) to the contemporary Terminator movie series - would defy the inevitable laws of causality. Note, however, that according to contemporary philosophy time travel is *logically* possible, as long as it does not involve changing history [8].

2. THE TIME MACHINE

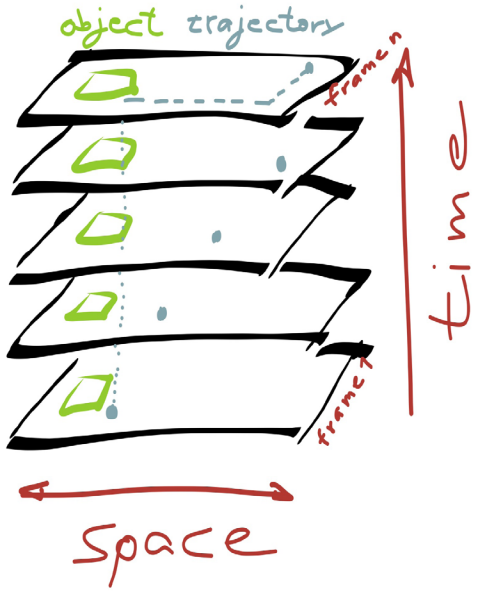
With the project presented here we attempt the ostensibly impossible: we propose a time machine that allows to visit the past and, under certain circumstances, even to change the past in order to influence the present. This time machine, however, will not exist in the real world, but can be realized in a virtual world. Fortunately, virtual worlds need not adhere to the laws of physics as we know them [9]. Time travel could happen in continuous time as in Wells' novel, or it could be discontinuous with the possibility to jump from one time point to another. The latter would also solve some of the problems of discussed in the literature [10]. In virtual worlds it already is a custom to allow discontinuous spatial travel, commonly called "beaming", so time travel sounds like an evident extension.

2.1 IMPLEMENTATION OF THE TIME MACHINE

The basic idea is simple: it is the well-known idea of making a backup of digital content (note that Apple's backup software is called "time machine"). For such a backup to function like a time machine, backup has to happen but not just every hour, but continuously, i.e., with the frame rate of the update of the virtual world. Since any virtual world runs on a computer, the limitation of continuous backup is the frame rate of updating the world and the number of unpredictable changes happening at a given time frame. Even though a single full backup of an OpenSim[1] region might require several hundred Gigabyte of hard disk space, continuous backup only needs to register unpredictable frame-to-frame differences such as user interventions. Since a virtual world is otherwise deterministic, anything else can be predicted or reconstructed from the initial conditions, which have to be saved once, of course. With today's technical possibilities, a continuous backup of a small region of a virtual world would not pose any serious problems to a decent hardware. Once a quasi-continuous memory trace of everything that happened in the world including the actions of the avatars present at any given moment is available, it is also possible to playback this memory trace. The playback, being the exact replicate of the former state of our virtual world, can now be visited.

2.2 PROBLEMS: AGENCY, PRIVACY, RECURSIVITY

However, even in a virtual world with all its possibilities some of the usual time-travel problems still would exist: the visitor from the future would be in a recorded scene, not in a presence. Thus, the visitor would have to feel like a ghost: unable to interact with the world around her. For example, manipulating objects, communicating with other avatars, or even leaving a trace on the floor would not be possible (but see below). Despite this missing agency, it would be possible to watch the visitor's own past appearance or visit any desired place, even if the visitor has not been there at that time. Of course, the time machine would not have to run in real time, but could allow fast-backward, watching the past in slow motion, or even stopping time to contemplate that one moment in all its aspects.



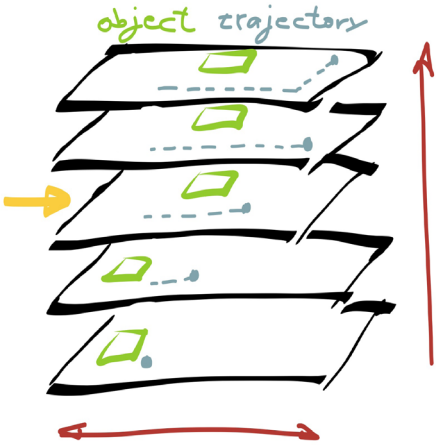


Fig. 1. *Left: Frame-wise backup of a virtual environment. The blue dot represents a user's avatar moving through the environment. The object represents a static obstacle. The time axis is pointing upward with the uppermost frame being "now". Right: Intervention changing the past. The green object has been displaced (yellow arrow denotes time point of intervention) to a position where it does not interfere with the trajectory of the avatar throughout the time stream. In the illustration, the modification has been propagated forward through time until "now".*

But that's also were the problems start: for the ghostly visitor it would be no problem to listen to the conversation of strangers, to look into that hidden locker, to walk into the neighbors bedroom, or to perform any other investigation. Unlike your smartphone movie of your sister's wedding, the continuous backup done by the virtual time machine would allow complete transparency of the past event. Being able to visit the past, even though just a virtual part of your past, means giving up privacy completely for that part of your life.

Nonetheless, another limitation of the time machine is storage space. How much of the virtual past can you continuously store without being forced to overwrite part of the past (that is what your backup software does)? While this will strongly depend on the amount of change happening to your virtual world, the problem does not become more complicated by recording your visiting the past. For such a case, you just have to record what you did in that past, but nothing more, since the past already is recorded. There is no such thing as a vicious loop for the time travel proposed here.

2.2 CHANGING THE PAST

So far we have seen that contemporary technology can indeed make it possible to construct a time machine that allows visiting the past. The next question then is: is it possible to visit the past, change something there, which then has an effect on the present? That is one of the ongoing themes in science fiction and it often has been shown to lead to unsolvable paradoxes: what if you go back and kill your grandfather, does it mean you immediately die? However, that's the extreme version of the story and certainly not possible. It is also not possible for our virtual past because of obvious reasons. But, as we show, changing the past to influence the present is, contrary to our intuitions, not impossible in general.

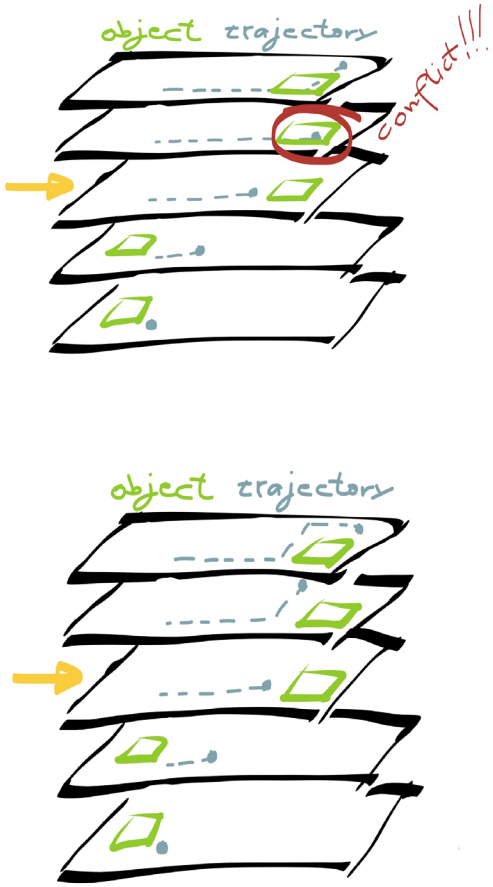


Fig. 2. *Left: Object relocation causing a conflict. Right: Conflict resolution by changing the recorded trajectory of the avatar. Note that this change does not affect the final current position, of the avatar (same in the right and left images), i.e., it has no influence on the avatar's "now", but changes its history. Space-time conventions as in Figure 1.*

Consider a stone in front of your house. Nobody touched it since several weeks. Travel back two weeks, take it, and move it to another place. Would that cause any paradox? No, it wouldn't, as long as you place it somewhere where it is not, for example, an obstacle for anyone in the two weeks between then and now (Fig.1 right side). For the virtual time machine it means: the time machine would have to go through all time points from the time of manipulation to the present to check whether the manipulation would cause any conflict with movements of other objects or agents that happened during that time. If it does, for example because your friend Kurt crossed the new location of the displaced stone a week later, then the manipulation would not be allowed (Fig.2 left side). Similarly, if Kurt used the stone for chasing away your neighbor's dog a week ago, the manipulation cannot be done, since it conflicts with Kurt's past actions. If not, the manipulation can be propagated through time to the present, where suddenly a stone would jump from one location to another (this is possible in a virtual world). It is a matter of debate whether one would need to check that nobody even observed this event or any of the locations during that time, but a conflict would be prevented by the proposed procedure.

By virtue of the propagation through time, the manipulation of the past performed by the time machine becomes a manipulation of history that can even affect the present. It is not just one moment in time that is changed, but the complete trace of memorized history has been changed. Note that propagation to the past might also be necessary, otherwise someone going back in time could notice the spontaneous displacement of the stone that happened two weeks ago.

Evidently, we could even go one step further: in the example above, Kurt crossed the location where you wanted to place that stone. If you also temporarily changed the path of Kurt, the conflict would be avoided - notably even without affecting Kurt's present (Fig. 2, right side) - and the manipulation would be permitted. However, as we already can see, a small alteration of the past may necessitate an increasing number of changes, which might not be resolvable.

Pseudocode for coherence checking of an object Object being dislocated in the past at time StartTime to a new location NewLocation:

```
function CoherenceCheck(Object,NewLocation,StartTime)
% check whether Object can be replaced
 for t=StartTime to Now(),
 if not History(t).IsUsed(Object) and
 not History(t).IsOccupied(Newlocation),
 History(t).Location(Object):=NewLocation;
 else
 CoherenceCheck:=false;
 exit();
 endif;
 endfor;
 CoherenceCheck:=true;
end.
```


3. DISCUSSION

We have shown that virtual worlds permit constructing time machines for visiting the past. As argued above, such time machines will even allow a certain extent of manipulation of the present by changing the recorded history. While such a time machine does not yet exist, we hope that our ideas might give inspiration to gifted programmers who could implement them in an open source multi-user environment such as OpenSim.

In the following, we will use the virtual time machine as metaphor for two different memory systems: 1) the data collection performed by surveillance programs such as PRISM or TEMPORA; 2) the episodic memory system of the human brain.

3.1 MANIPULATING HISTORY

The data collecting and storing of programs such as NSA's PRISM is likely to be the closest realization of our virtual time machine with respect to the real world, even though NSA won't allow us to visit the past, they just do it themselves. However, even though this seems to be the main focus of the contemporary debate, in our view the breach of privacy allowed by these programs, which opens the personal past for unlimited investigation, is not the most unsettling consequence. If the recorded data are considered to constitute a normative archive and documentation of history, the indubitable proof

for an historical event, but also for your own past, would be the data stored in the 'time machine', whatever your personal memories might tell you. Consequently, as shown by the time machine proposed here, in surveillance programs such as PRISM, manipulating history by modifying stored data is already possible and could even be automated. Such a manipulation would be much more profound than the documented feeble attempts to change history by, for example, removing a person from an historical event by editing photos or even erasing events from history books. Modifying the stored data and thus the past would intervene with history, change the collective historical memory, and override your unreliable personal episodic memory.

3.2 MANIPULATING MEMORY

The process of changing the past is, however, even better comparable with modifying episodic memories. While modification of human memory by machines or drugs still belongs to the realm of science fiction and computer games (e.g., Remember Me[2]), it is, at least to a certain degree, experimentally possible in mice and rats [e.g. 11]. Over the last decades, psychology and neuroscience have recognized that our episodic memories are not like photographs or movie clips that faithfully recorded past events, but are modifiable [12] and can be reshaped by reinterpretation, new evidence, and recall [13]. Even though our memory seems to be organized in separate episodes rather than a continuous stream - see also Fig. 3 showing sketches for Selavy Oh's installation CONSTRUCT, a work in a virtual world on the topic of reconfigurable memories - the comparison of episodic memory to a time machine suggests itself. The process of remembering the past and predicting the future [14],[15] has even given rise to the metaphor of a mental time machine [16]. Although the coherence constraints briefly described above need not hold as rigorously for our memories as for the time machine, we propose that similar coherence-checking is employed by memory processes to maintain or even construct a coherent narrative of our own personal history: changing your memory for a better future [17].

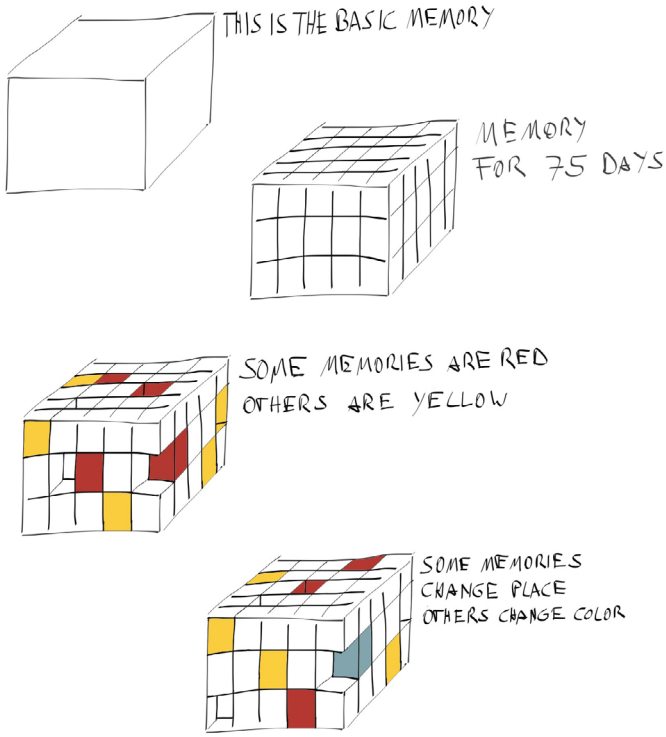


Fig. 3. *Sketch for the interactive installation CONSTRUCT by Selavy Oh using the virtual world of Second Life™(2011)[3]. The installation was set up like a diary; during the 75 days of her stay at the Yoshikaze Residency (Humlab, Umeå University, Sweden), the artist added one box with mostly interactive content. Visiting the installation changed its appearance and the order of the boxes within the memory. The diary became an ever-changing dynamic memory modified by each revisiting that formed new connections and associations going beyond temporal order or semantic similarity.*

3.3 BACK TO THE FUTURE.

The consequence of these considerations is paradoxical: the reliable data storage by digital media and the amount of data we can store to document our past will not lead to more accurate recording of history. Similar to the turn from photography to digital image editing, which reset images to what they were in the times of painting – namely subjective pictorial representations, digital data storage will reset writing of history to the malleable narrative it always has been, much more akin to our unreliable memories than to the analog recording techniques of the 20th century. Consequently, we need to assure that the massive data collections by today's intelligence services are considered as being as unreliable as our own personal memories.

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ENDNOTES

1 *http://opensimulator.org/wiki/Main_Page*

2 *http://www.remembermegame.com*

3 *http://ohselavy.blogspot.de/2011/05/construct-humlab.html*

The Tuning Fork of the Mind: On the Extraordinary Effects of Art on the Wits of the Unwary

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Abstract. S. Raoul, erstwhile scientist, theorist, and scapegoat, charted the collisions between the unwary viewer and contemporary art to prove how the mental gymnastics and cognitive leaps required to comprehend art generate vibrations at frequencies calculated to specifically, and with singular malicious focus, derange the brain. Key areas of interaction observed here are those that occur in the minds of the artist, critic and viewer. Also examined are the impossibility of visual contemplation beyond the 2.5sec attention span, neuron communication, frequency modulations and the dreadful consequences of such exposure. Drawing on existing foundational aspects of neuroscientific endeavour (studies on *Aplysia californica*, for instance), the theory ignores conventionally prescribed notions (as they "only point to the obvious") in favour of more biologically esoteric specimen study. S. Raoul's work nevertheless remains an important (if still somewhat obscure) treatise on the deranging effects of over-exposure to Contemporary Art.

1. INTRODUCTION

This paper presents the preliminary findings of S. Raoul's theory of The Tuning Fork of the Mind, and is compiled posthumously by his biographer Shubigi Rao (secondary author) from his laboratory notes, journal entries, notations and marginalia. The abbreviated and introductory nature of the text reflects the fragmentary nature of its sources and the isolationist nature of the study. Given the wide ranging scope of the endeavour, only two main areas have been included in this paper that present S. Raoul's findings and analysis, namely 'Damage at the Front', and 'Intentionality'.

2. DAMAGE AT THE FRONT: S. RAOUL ON ART, THE ARTIST, THE CRITIC AND THE VIEWER

2.1 TO INVESTIGATE THE ART OBJECT

The Aural Metaphor. The experiential description of the 'viewed' artwork as waves and frequencies emitted, as if from a tuning fork. It is inferred that for the Brain to be involved in the deciphering of the confounding codes of multiple frequencies that are emitted by the Art Object is nothing less than essential. No apparatus can function without an Overseer, and the Brain participates quite suitably in this regard.

In which we Observe the Effects of Exposure to Multiple *Objets d'Art*. Subject A: (Recorded 12:51pm, on an empty stomach) – scattered waves, dissipated frequencies, no cohesive connection/ resonance/ transmission/ cognitive assimilation/ articulate output. Subject B: (Recorded 12:51pm, in a partially replete state, digestively speaking) – scattering less pronounced, frequency modulations better defined, understood & assimilated, less cognitive dissonance. Conclusion: We would venture, tentatively, that Art should not be experienced on an empty stomach, and most certainly not without an empty mind. Worse, if one's auditory tools are disconnected from one's cognitive apparatus then the vibrations are magnified. To approach art without apathy or befuddlement is also no guarantor of immunity to derangement.

On the Hydra, *Aplysia californica*, the Human Slime and how Art is to the Human Slug as the Flame is to the Moth. [Ed: S. Raoul's preoccupation with the sea squirt stems not only from its study casting much light on the human brain. He was also fascinated by its ability to digest its brain once it had no further use of the latter's locomotor controls].

Look then at the sea squirt, armed with a primitive brain and a digestive system. Once the brain transports the slug to a suitable settling place, the former is promptly digested, as it has no further use. It is perhaps rather telling that some of the most illuminating Findings on the Human Brain come from Research conducted on a Giant Sea Slug, especially in patterns of Memory Formation, the building blocks of our Sense of Self. This might help explain why most ego-centric, pompous pedants are complete Slugs. This also explains why encounters with such individuals leave a trace of Slime.

The art object shares echoes with the simple Hydra. Both have no radial symmetry, are prone to rear their unwelcome heads, and have similar structures of transmission, connection and communication. Yet the Hydra has the possibility of cephalization – the evolutionary ability to grow a brain. The art object will never have an anterior capable of higher thought and purpose.

2.2 TO THE FRONT: TO INVESTIGATE THE MIND OF THE ARTIST

The explosive growth of the Frontal Cortex over the evolutionary timeline of the *Sapien* is worthy of remark. Consider first, that this frontal cortex is the machine responsible for the collation of all the disparate, fragmented and fractured bits of information from the rather widely separated regions of the brain. This highly complex centre for processing and synthesis engenders analysis, and it is here that we awaken to a sense of 'Self'. Apt then, it must be, to take up this region as being at the vanguard of our study, for only here, perhaps, may we find the raison d'etre of the Artifice, the Artist, the Viewer, the Critic, and all those brain-damaged in between.

On Losing all Sense of Proportion: The Mantle. A hardy pre-frontal cortex is essential, it would seem, given its ability to allow the Viewer to process visual information (external stimuli) *in relation* and with a sense of proper *proportion* to inner Beliefs and Mores. Abnormal PF cortices invariably manifest themselves in the Viewer with irrational dislikes and an over-emphasis on the 'Artistic Merit' (perceived, and most often completely Over-Imagined on the part of the Viewer) of the Object. This is manifested in the *Mantle* (of Mores, Morals, Social Responsibility, Ethical Integrity and all such grey areas) being foisted on the Art and the Artist.

Table 1.

Strata	Assumption	Digestible aspects
Perceptions	formalist	colour, composition, brightness
	non-formalist	texture, contrast
Indications	extant	visual cues
Memories	extinct	echolocating clues
Intentions	open	misleading
Judgements	closed	spot, value, of any stripe
Matters of Taste	selective	substantial, mere filling
Critical Appraisal	objectivity	throwaway references, padding
Actionable Consequence	implicated	triggers
Consequential Action	implied	endings

On why Art may not be Held Hostage by the Pleasure Principle. How then can the Artist and the Object hope to compete? The Pleasure Principle must therefore be re-examined in its (previously sanctified) position as the Ideal Reaction to the Visual Art Object. This of course then renders null much of the sentiment one is wont to express when confronted by the non-pleasure-stimulating Object. But render them void we must, for surely the Art Object must have a higher purpose (non-manteled (sic) though it may be) than that of a Pin-up on a wall, or a Dildo in the drawers?

On the Stratification of Sensory Information in the Brain. Sensation is streamed and stratified and 'coded' with assumptions based on secondary information, perceived status and accompanying populist and critical literature. See Table 1 for an example of stratification post-exposure to contemporary art forms.

Examination of transmission along the optic nerve (including the inner and outer plexiform and nuclear layers) led to two areas being identified as (a) area of apathetic reception and (b) gap in perception. The latter is not to be confused with sensation. Both A and B prove the existence of decaying transmitters, when the retina is exposed to too much artwork of the Modernist Rothko variety. After studying A and B we conclude that colour field = empty field.

The Artist. 1. Damaged frontal cortex = impairment in the ability of the *Sapien* to work out schemes, plans, actions, consequences and all other manner of civilised, repressed behaviour. 2. in the Brains of the Artificers, or Artists, we have observed (a) a grossly enlarged frontal cortex (in physical terms) => over-inflated sense of self. (b) corresponding with areas of deficiencies in said cortex => inability to organise schemes that would endear the subject to those with rank-and-file cephalonic developments, without pandering to the Lowest Common Denominator => Inability/ Impaired ability to anticipate consequences of Artistic Actions, whereby what is 'informed' to the Artist, is 'idiotic' and 'most certainly not sensible' to the Viewer.

The Myth of the Misunderstood Artist. "The divergence of corollary discharges in preference followed by multi-sensory convergence into the entorhinal cortex as the basis for gestalt formation."[1] Those of a sensible disposition, predisposed to an outlook engendered by the Scientific Method, tend to view perception as an occasion of the active variety, "holding the humans and other animals to maintain a stance of attention and expectation", embodying, thus, an Unintentional need or desire to be heard, seen, felt, and known. Yet there are conditional aspects too – simply put, Artists want to be known while retaining a mythic mystery, a regarded reticence, and the ownership of their Creations rendered correctly. For themselves, they wish to be felt, but not smelt (a tragic pity, for as we know the olfactory connection is all too often the most powerful trigger).

2.3 TO INVESTIGATE THE MIND OF THE CRITIC/VIEWER

(Based on journal entries and studies of the transmission/nervous system of the leech) The marvellous frequently arises from the mundane, witness Flaubert: "It is strange how the most banal of utterances sometimes make me marvel." It could simply mean, though, that one is too often assaulted by the most banal of utterances, a case that most often presents itself in the precincts of a Museum, a Gallery, an area of Exhibition or Artistic Expression. Even the most arguably transcendent Art has given rise to statements of the utmost Idiocy.

To Investigate the Brain of the Critic/Viewer: An inability to make sensible predictions about the future. The Brain of the Viewer can quite effectively erase, or disregard that which it regards as superfluous or extraneous (to its presumed assumptions or its *a priori non perceptum*). No wonder then that the Average Viewer more concerned with pecuniary and domestic matters is unable, at times, to transcend these matters and actually 'see' the Object. This Perceptual Blindness is at its most selective (and pervasive) when the Viewer is concentrating with singular focus on matters of definition and categorical thought. Thus, if you hear yourself think "This is not Art", it is because you do not know what Art is, or far worse, you have an Opinion but no Soul. If we look at the importance of perception, (given its much-vaunted significance), we must accept how impoverished we are as a species. Compared

to a cockroach, we are quite bereft of sensory perception. How sincere can our $^{\text{Opinion}}/_{\text{output}}$ be if our $^{\text{Reception}}/_{\text{input}}$ is so meagre? This turns the convention of profaning the Artist on its head (the convention, not the Artist), for to say "The Artist is a Dog" is to accord great sensory depth, sensibility, sensitivity and power, with translates naturally into correspondingly wondrous Perceptive Depth.

On Custodians, an Ill-Defined Populace and the Foolish Artist. This foisting of the Mantle is an ignominious spectacle most often witnessed at Expository Events, and practised most by the supposed Custodians of Public Sentiment; the Public – by definition – remains obdurately unwilling to be defined, at the most being ill-defined when sufficient Force is applied to ensure concordance and conformity and worse, commitment to Common Cause. However, it suits the Self-Appointed Custodians of Morals to claim to be the voices of an Amorphous, Inert Citizenry, Staid yet Powerful in its Immensity.

On the Capricious Criteria, and the Witless Artist. The problem is compounded by the Foolish Artist who seeks Approbation from his Peers – a most Fickle Band if ever there was. To this end, the Foolish Artist seeks to validate his Consciousness/Ego through External Conditional Situating, whereby Status is accorded by the most capricious of criteria, via the Critic. The Artist who finds himself only though such Conditional Definition (without any application of Humour and of Irony in its pure form stripped of shallow cynicism, and armed only with the utmost unsmiling Gravity) will also find himself rendered quite Cruelly, as all Caricatures invariably must (sic). A Guilt-Edged Bargain, if not a Freudian one, perhaps? To keep one's Wits about one then, is to remember the attenuating power of Wit on the most dire of situations, and come away largely untarnished, if not covered in gold.

3. INTENTIONALITY: CONTEMPLATION, COMMUNICATION, CONSEQUENCES

3.1 ON THE IMPOSSIBILITY OF VISUAL CONTEMPLATION BEYOND THE 2.5 SEC ATTENTION SPAN

Empirical $^{\text{observations}}/_{\text{evidence}}$ inform us that the average Viewer of the Art Object wastes no more than 2.5 seconds before each piece of work.

Like ganglion cells, it is quite possible to be ON centre or OFF it – there need be no more reason for this than random $^{\text{firings}}/_{\text{bursts}}$ of electrical energy. The greedy, acquisitive nature of the visual process is underscored by the manic, frantic nature of the movement of the Eyeballing Public, darting hither & tither, under the dictatorial command of the Brain, thirsting for visual stimulation. With such motives lying at the very centre (cephalonic centre, to be sure!) of the visual process, small wonder, then, that dissatisfaction should arise – it is not in the nature of the eye to dwell languidly without being yanked aside by the Brain for fear of languishing.

[Ed: S. Raoul's notations on the ability of the eye to glaze over (a form of stillness, however apathetic it may be) were unfortunately destroyed. Extensive searches have yielded fragments, which seem to point to a fascinating need for the Brain, when confronted with inputs that require more energetic analysis and response than "hmm...interesting", to power down and release soporific doses of Eye Glaze™]

3.2 ON REACTION TO VISUAL STIMULI

On the Delights of Pleasure, and of Stimulation. Neither pleasure nor fear is unique to the sophisticated Brain. Rodents have a fairly well determined pleasure principle at work, and we need not defend our contention any further than noting the tail-wagging dog. Pleasure then, long regarded to be the primary response from the Viewer most sought after by the Artist, can be readily obtained from non-Art Objects too. The arts of ingestion, successful excretion, and of course, the Intimate Act (and even its mere contemplation) between 2 or more persons is quite strongly associated with the pleasure principle. Of what use then, is the foisting of the Mantle of Aesthetics on Art, when the Aesthete, much like the Rodent or the Dog, can more readily find pleasure elsewhere?

3.3 NEURON COMMUNICATION

On the Dreadful Consequences of Exposure to the Visible Artwork. Neuron-to-neuron communication: Electrical action potential (nerve impulse) travelling at up to 120m/s along the axon of the presynaptic neuron. (Impulse releases neurotransmitters). Receptor reactions cause

postsynaptic neuron to either a) be excited or b) inhibited. Inhibitory synaptic potential would dip resulting potential = postsynaptic neuron ↓ firing an action potential. (Inhibitory responses in the brain of the conservative – see recent studies on fear and the Republican brain.)

Presynaptic neuron → Neurotransmitter. Receptor → Postsynaptic neuron → ad infinitum... ...Action Potential...Synaptic Potential...Action Potential...

The restful stage of a neuron existing as a negative (-70mv) across the membrane is *always* disrupted by viewing/experiencing artwork. Kelvin's 'length constant' proves that the visible, faulty and downright inefficient transmission systems of the neuron are rendered even more (often exponentially) decrepit by constant exposure to Art.

The complex appearance of the development of the human cerebral cortex, looking at (a) neuropril, with axons, dendrites and constantly changing synaptic connections, (b) Glia, in a supportive role, (c) The conventional 6 layers of neurons in the neurocortex (a few mm thick) → Each cubic mm holding many 1000s of neurons.

Unable to record our full horror at backfiring synapses, misfiring connections and muddled neuronic/ moronic activity post-exposure to a real piece of work.

The Reticular Theory. Complex morphologies, branching, never entangling, quivering with their self-importance as our Transmission Devices. Between Du Bois-Reynard and the Spaniard Cajal, we have a fairly comprehensive theoretical framework available to us, and are thus able to re-direct our attention to what cannot be so easily defined – the reticulum.

More so than any other cell, neurons are extremely diverse and wonderfully complex. The Brain is now no longer a morass of messy enlargements. The reticulum is no longer reticent in giving up its secrets. Complexity in this case has arisen from a pressing need to do no more than communicate fruitfully with one's neighbours.

As can be inferred, neither complexity of shape, nor richness of texture, nor purposeful branching, is any indication of actual performance of the neuron in the brain. Presuming of course, that we have faith in the inviolable superiority of the Human Brain.

3.4 INTENTIONALITY: FREQUENCY MODULATIONS AND STAGES

A separation of the stages from input, through to physical/visual realisation. Or, the stages of material changes, and the cognitive dissonances caused by the workings of that dreadful malcontent – the Mind of the Artist.

FREQUENCY MODULATIONS

A. Sequence clear, uninterrupted by wall text, labels or institutional critique
B. Sequence starts simply, devolves into complex issues, none representative of the interests of the populace
C. Sequence interrupted by declamatory *ad hoc* statements, of which the Artist/Viewer are ill-informed. Hence the break in clear transmission
D. Sequence dissipating, indicative of rapidly degenerating audience interest, participation and willingness to be receptive to transmission. Note also the inability of the Artist to transmit clearly, without schlock or gimmick

MORE FREQUENCIES & MODULATIONS

A. Sequence clear – steady stream of information = this surely is a Most Pleasant Artwork
B. Sequence constant, with only 1 hiccup when viewer realises dark undercurrents beneath an apparently Placid Piece
C. Sequence shows obdurate stubborn behaviour on part of Viewer – a Mulish Obstinate Resistance to even entertain the possibility of this being a Valid Work
D. Sequence shows 'bursts' of electrical energy between Artwork and Viewer – possibly disruptive, yet paradoxically, mystifyingly, Viewer exhibits Pleasure. Perhaps this is from a sense of Moral Superiority or Smugness?

Yet more Frequency Modulations

A. Sequence shows steady, if banal streaming of information & sensory content No mental gymnastics required here. A thoroughly likeable but middling Work
B. Sequence shows (illegible) Bumps & Lapses in Concentration. No attributable reason obvious
C. Sequence not mature enough to be visible in the spectrum
D. (too faint, illegible)

Failed Lines of Communication

A. Too vacuous to be entertained
B. Sequences destroyed
C. Disrupted
D. (blank)

Stages I-VII.

From initial exposure to terminal stage, with calamitous results.

Stage I. In this stage the state transition of an excitatory population from a point attractor with zero activity to a non-zero point attractor with steady-state activity (is reinforced) by positive feedback. (Notations: (a) no feedback (b) positive feedback (c) negative feedback)

Stage II. The emergence of oscillation through negative feedback between excitatory and inhibitory neural populations. Also known as the 'wearing off of the high', or 'the tarnishing of the novelty'. (Notations: A solid curve, and a dashed good one too. A dashed curve is superfluous, to shallow to remark upon, except by acquisition. An interesting example of navel-gazing, thought it may seem (to the Viewer) more akin to an ingrown toe-nail. Peanut sized brain complex. A spiralling into depression, self-doubt, and other forms of delightful self-indulgence)

Stage III. The state transition from a point attractor to a limit cycle attractor that regulates steady-state oscillation of a mixed-excitatory inhibitory cortical population.

(Notations: Naïve. Attenuating. Habitual. Superficial. Absent. 1. Before learning one's lesson. 2. After learning one's lesson)

Stage IV. The genesis of chaos as background activity by combined negative and positive feedback. Spangling over the cortex as a wave of previously undetected mixtures – none of which would seem too obvious except under the glare of hard-edged science. (Notations: 'The con-glomerous'. Trumpeting one's existence. Lateral olfactory tract. Anterior olfactory nucleus. P. C. (political connections). The unequivocal result of uninspired cognitive corrections)

Stage V. The distributed wave of chaotic dendritic activity that carries a spatial pattern of amplitude modulation made by the cresting of the wave.

8x8 array of electrodes => 4x4 sq. mm projected onto a bulbar surface

64 traces of EEG contain short episodes of oscillation

Stage VI. The First Step in Perception. Nonlinear feedback (aka critical appraisal) = random gain. Variables: Population fatigue, Market trends, Peer reviews, Peer envy, Commercial approbation, Critical turpitude. This input is driven by a mixed population => ampl. & modulation patterns severely disruptable => massive $^{loss}/_{gain}$ in ego. (Notations: Loss/gain. State transition in sensory cortex. Asymmetric sigmoid curve. Preternatural development → devolution. Lopsided development → devolution. SHOCK – input dependent gain is the 6th stage of intentionality.

Stage VII: The Embodiment of Meaning. "In Amplitude Modulation Patterns of Neural Activity, the Embodiment of Meaning is shaped by synaptic interactions that have been modified through learning".

OR Every $^{critical}/_{commercial}$ $^{success}/_{disaster}$ => corresponding $^{gain}/_{loss}$ in $^{E}/_{I}$

Interlude: Recourse to a Simple Frontal Lobotomy. Materials such as Banana Oil, Amyl Acetate, Butyl Alcohol, Sawdust, Familiarisation, Naïveté, Attenuation, Perspex, Sodium Chloride, a Modern EEG, a Singular Purpose, an Inflexive Reflex, and the playing of Soothing Musick are required at the outset of the Prep. Stage.

OR An Iron Bar, a railroad worker (a Gage), a measuring device (a Gauge), a short fuse (Tempered) and some explosive material (a Book).

Stage VIII: Terminal. Sequences of global patterns of chaotic activity that $^{integrate}/_{disintegrate}$ and direct the intentional state of an entire hemisphere. Resulting derangement unavoidable and irreversible.

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One With One: An interactive installation to encourage self-talk therapy

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Abstract. *One With One* is a responsive private space for its participant to talk freely, releasing what is on his or her mind. The installation offers a new system for verbal disclosure to allow for insight and introspection into personal issues. This paper discusses the impetus and need for creating such a space, methodology of building this work, and outcomes from users' interaction in *One With One*.

1. INTRODUCTION

1.1 CONCEPT STATEMENT

One With One is a responsive, private space for its participant to talk freely, releasing what is on his or her mind. Language helps us organize and make sense of personal issues or events. By translating thoughts from our minds into words, we can understand our thoughts with a heightened awareness or with a new perspective [1]. Though there can be great benefit from conversing and sharing with others for release, support, and feedback, there can also be repercussions. When immersed and talking to oneself in the *One With One* space, its participant experiences the system's response -- visual metaphors prompted by what the user offers verbally. The system responds to the sounds of language and silence, mimicking stages of conversations and interaction we have with others. *One With One* offers a safe place to work things out verbally and to get non-obtrusive feedback. By creating a new system for verbal disclosure, there is the potential to offer receptiveness to what a participant chooses to share: a responsivity that is both reacting and mirroring, simultaneously presenting both an objective and subjective interpretation of the participant's expression.

1.2 IMPETUS AND STANCE

Talk Therapy. *One With One* developed from my interest in constructing intimacy and the possibility of constructing environments that meaningfully enable it. I became obsessed with the universal human trait of secrets. Why do we have them? Why do we choose to share, and why do we choose to conceal? What are emotional processes we work through as we have this internal struggle, of ruminating on our own thoughts, and why does sharing something, however intimate, often make us feel better?

Thomas J. Scheff, in *Catharsis in Healing, Ritual, and Drama* expands on Arlie Hothchild's definition of emotion work to define it as "manipulating attitudes, thoughts, or behaviors in the service of changing one's own feelings or those of others" [2]. Within emotion work, catharsis can then act as a necessary tool for therapeutic change. To occur, one needs a ritual to evoke the unresolved distress within a safe environment

and circumstance [3]. Some contemporary rituals could include weekly therapy sessions, or going to confessionals, or even meeting with a friend. Through these rituals, bodily tensions such as shakiness, a churning stomach (manifestations of the anxieties, fears, or other ruminations from bottled emotions) can be released, and an individual can feel physically better, lighter, calmer.

Revealers have both better physical and mental health, improving the immune system and mental clarity [4]. Disclosure can discharge previously constrained emotions that hindered creative growth [5]. Concealers, those who don't practice talk therapy, whether formally or informally, can suffer from adverse effects. The introduction of the Self-Concealment Scale SCS in 1990 spawned many studies, including King et al, (1992) who used the SCS to gather data on the possible effects of inhibition. Results illustrated positive correlations between high self-concealment and "with scores on measures of ambivalence over emotional expression (r=.67), emotional inhibition (r=.39), alexithymia (i.e. lack of access to one's emotions) (r=.19), emotional control rehearsal (i.e., a measure of rumination) (r=.30), and obsessional thinking" [6].

Self-Talk. To reap the benefits of personal disclosure, the need for a trusted non-judgmental, and supportive recipient must be emphasized [7]. Consequences of negative responses from a recipient include rejection, judgment, and damaged relations and personas, which often motivates concealment. Pennebacker explains:

"A particularly efficient way to organize and ultimately understand events is to translate the experiences into language, which usually occurs in normal social interaction. One problem with many traumas, however, is that people either are unable or unwilling to talk to others about upsetting experiences for fear of embarrassment, disapproval, or punishment. When this occurs, people must actively inhibit their desire to talk about the significant events" [8].

With so many potential repercussions for disclosing one's thoughts to others, one might choose to talk to oneself instead. Doing so can stamp out fears, and still allow for new insight and perspective, as well as a reframing of thoughts. Alan Morin (1993), a proponent for self-talk, argues that the three main ways that we learn about ourselves (in order to better ourselves) are through the social world, the physical environment, and the self. His argument is that much of the interaction we have in the social world can be re-created within our own cognitive processes, and therefore that self-talk can mediate self-understanding; greater insight and self-awareness [9]. When we talk to ourselves, we often imagine or create "an other"-- a listener, a recipient. The "other" allows for us to create a more objective stance on what we are saying, to get out of our heads, so to speak, and to try and see our thoughts from a new perspective. According to Cooley, this allows one to question self-information. External opinions can become an intra-personal method of regulation and transmission of self-information [10]. If we can internalize this process, this means that there can be the duality of giving ourselves both a subjective and objective response to what we share; by verbalizing new information to ourselves, we can still hear the content in a new form, and evaluate it from a new perspective. We can use self-talk as a means to adapting our emotions and behaviors.

1.3 DESIGN QUESTIONS

Self-talk of course presents its' own set of issues. First, self-talkers risk the social stigma of mental instability. Another issue is the need for a ritual--a space or time to engage deeply with yourself and your thoughts, for deeper matters, even matters that have not fully cognitively surfaced yet. That sort of vulnerability requires patience, time, privacy, and encouragement. Further, one needs to be in the mood, and such ambiance may not necessarily be re-created within the bounds of our existing personal spaces. Successful self-talk may require a designated space. These constraints led me to ask myself the following design question, which drove my final thesis project: *How can I design a responsive system that could relay the feeling to each of its participants of being seen and heard as they are, and open the possibility of considering their thoughts with a different perspective?*

2. DOMAINS

2.1 DISCIPLINES

The nature of the research I did informed my design process. While my thesis is centrally located within talk therapy, my argument focuses on catharsis, introspection, and learning more about oneself through talk therapy, my work conceptually touches on other disciplinary branches. To learn more about the how talk-therapy inspired my work, please refer to Section 1.

Intrapersonal Communication. Some forms of intrapersonal communication are especially related to user interaction with *One With One*. Monologues are similar, but are more pre-conceived. Improvisation is key for talking to oneself because the idea is that one would react to what they are saying, build upon it, or change their perceptions about why they are saying such. While the user experience is designed to be personal, there are parallels to soliloquy, a tactic used in theatre for characters to relate their inner feelings, which are then learned by the audience. Through soliloquy's projected self-talk, which is not addressed to anyone in particular, can understand them better, though there is no opportunity to know if soliloquy has produced change in its speaker. The performative aspect of speaking this way is similar to the way one creates "the other" an imaginary listener. This is a defining factor of self-talk: "to address an absent other or to address ourselves in the name of some standard-bearing voice" [11]. Within my work this sort of imagined other is really a personification of the space I have created.

Interpersonal Communication. Interpersonal Communications, verbal interactions we have with others, directly relates to talk therapy and thus the incentives for my system's response. Specifically, I considered the stages of conversations that lead to disclosure. I thought a lot about the initial introductions (stepping into the booth, lying down on the couch, taking a seat at a bar) and how a conversation might unfold, starting light, being polite, then kind of going one-sided as one person relays their thoughts, and the other responds, giving various types of feedback, depending on the situation. *One With One* took a lot of cues from these sorts of therapeutic rituals, but with a twist: a specific space that people might be able to relate to themselves with a constructed other, with an interactive space that is responsive enough, but is also just a reflection of the person. Furthermore, the interaction is not physical or bodily, it is screen-based, digitized. The idea that a space could prompt one to release what's on their mind has a lot of inferences. Refer to Section 1.2 for more on the importance of space and ritual.

Another core impetus for this project is my own personal interest in constructing or mechanizing the intimacy, the "human" interaction we have with others. I have observed within my own generation there has been a switch with communication where interaction somehow feeling easier, less consuming when on a screen. The protocol of our devices and software has set standards on what we want and expect in the physical world. Technological developments have changed expectations about how we should relate to others and to ourselves. Jarod Lanier describes the adaption of technologist invention as the following: "[Technologists] make up extensions to your being, like remote eyes and ears (webcams and mobile phones) and expanded memory (the world of details you can search for online). These become the structures by which you connect to the world and other people. These structures in turn can change how you conceive of yourself and the world. We tinker with your philosophy by direct manipulation of your cognitive experience, not indirectly, through argument" [12].

Contemporary Human Relations within Cities. How can city life affect the moods and human relationships of those who live within them? Specifically, how can city life affect our social desires and needs?

Each day we step outside of our apartments into the city environment, we are faced with interactions and experiences that are outside of our control. There is noise pollution, close physical proximity to strangers, unexpected run-ins with people we may wish never to see, but are stuck with in a long elevator ride. Whether for business or pleasure often times we converse with others, never knowing if they fully

understand what we mean, nor being completely sure of what they feel. The cacophony of the city, despite the beloved excitement and stimulation, can wear down a person. Georg Simmel, who examined the effects of the metropolis on the soul, argued, "The psychological foundation, upon which the metropolitan identity was erected, is the intensification of emotional life due to the swift and continuous shift of external and internal stimuli" [13].

Modern architecture has reflected this mentality. Apartment buildings, which can house many people in close proximity, still limit potential interaction. Common structures give each apartment dweller their own kitchen and recreation area, and often own laundry machines and patios, rather than sharing these amenities between each other. Even a shared bathroom amongst one floor can be a deal-breaker for potential renters. Social theorist Walter Benjamin argues that the desire for personal space is created through "using the most cutting-edge technology in order to orchestrate the most archaic of all needs, the need to immunize existence by constructing protective islands" [14].

Within these protective islands, city-dwellers try to fulfill many of their wants and needs. In *Architecture as an Art of Immersion*, Peter Sloterdijk connects architecture as a form of totalitarianism, as structures of control. "Architecture's totalitarianism is a totalitarianism of love, of the love of space, of being enraptured by not only what stands over against us but which envelops us. [Architecture is] attempting to produce the space where we open up completely" [15]. Controlled screen relations, in conjunction with a city-dweller's desire for four walls, created a lot of incentive for this work. These subject areas were probes for to ask: What sort of designed space might one person feel comfortable being verbally intimate? Furthermore, how could blend the expectancies technology with the unpredictability of both personal revelation and human interaction?

2.2 INFLUENCES

As part of my impetus, I first researched the process of telling a secret, the reasons for and the benefits of disclosing [16] as well as one the processes and prerequisites for cathartic release [17]. Alan Morin's "Self-Talk and Self-Awareness: On the Nature of Revelation" taught me more about the benefits of self-talk, and how we create an imagined listener in order to get an objective perspective. I made charts where I saw overlaps between research, and also what I felt I personally experienced. This process inspired user flow diagrams of how I envisioned the interaction between two people, which later helped me choose and develop user input and system feedback.

Through development of this project, I realized the work needed more specific inputs to gauge what a user was trying to convey. Intonation, how we say what we say, was a huge influence for me. An article titled "Human Potential: Is Your Voice Saying the Wrong Things About You?" from the Center for Association Leadership website, discussing voice and perception, was a catalyst for why I started focusing on how the user "would sound and be understood" by the system, and trying to reward users for making clear definitive statements. One focus of the article is the tempo maintained by speakers. "The key to controlling your rate of speech is to learn to punctuate your speech with pauses. Pausing for breaths as you speak — essentially adding commas to your thoughts--helps break down your thoughts into smaller, more manageable units, which regulates your speed. It also gives your listener more time to absorb what you're saying" [18]. I also looked through numerous at diagrams of changes of pitch over time, and tried to find consistencies [19] [20] [21] [22] [23].

3. METHODOLOGY

3.1 PRETENSE TO DESIGN

What would I want, should I find myself interacting with an artwork or designed space whose goal was to sooth and prompt me? Following much thought and respondent questioning, my overarching finalized design decision was to focus on conversation, using a screen-based platform.

I reconsidered the reasons people have for sharing information. I surveyed others about why they share the more intimate details of themselves with other people. "Why do you choose

to share your secrets?" I should note here that when I use the word secret, I define it loosely as personal information that one is cautious to initially spit out, but somehow have a desire to share with others. This information is more often than not something one is thinking about heavily. Some responses that stuck with me were "to be known, to gain new insight, to think about something from a new angle." One of my design questions then became How can I design a responsive system that could relay the feeling to its participants of being seen and heard as they are, and open the possibility of considering their thoughts with a different perspective?

As I began to build and style sections of the interaction I imagined what would happen within my space I also took an afternoon to ask friends to take four minutes, go into a room, and talk to themselves, and allow me to record it. In fact this was not a difficult favor; most were more than willing (and dare I say a little excited) to be asked to do so. None of the content was the same, yet each person spoke to himself or herself as though there was an "other" there; they worked out their thoughts in their heads. Questions were asked and answered. One person even came up with an entire fictitious conversation, as if he was on the phone. This reinforced my hunch that certain people do indeed already talk to themselves freely, and can gain something out of it.

Choosing methods for interaction also came from creating numerous user-flow diagrams. Generative design seemed more inline with my belief that one gains from what they give; the more one invests in working something out, the closer they get. I considered input from the user I could actually get, measure and analyze from speech input, and how such verbal cues correlate to conversations. Intonation and speech analysis became important here as I thought about how a user might make a defining statement (which I considered being a sort of realization) or a question, a yearning to know more or re-consider whatever information they would be sharing. Once I built enough of the screen responsivity, I proceeded with iterative user testing: as I tested and got feedback, I adapted the system and moved forward.

3.2 FINAL DESIGN

Interface Design Choices. The interface of *One With One* has many layers. Certain bodily presences would be best measured with sensors, therefore Arduino made sense as a tool. In addition MAX/MSP had great capabilities in terms of audio and video processing and analysis. Inside the *One With One*, there is a switch for the user to indicate to those outside, whether the installation is vacant or occupied, shining either a red or green light. There is another switch embedded within the headphones to indicate when a user has put them on, and is ready to engage with the system. This switch activates the max-patch, which is otherwise frozen, displaying an abstract blue image. The switch is connected to Arduino, and initiates communication with MAX/MSP when activated. Screen interaction is based on verbal user input. Within MAX/MSP, my vocal analysis includes amplitude range, duration of speech and pauses, as well as pitch measurement, which I am doing with an external plugin object called pitch~. I am using this to measure whether the pitch increases or decreases over time and by how much. All of this sound analysis will trigger different jitter effects (a branch within MAX/MSP that is dedicated to processing real-time video) that transforms and distorts the real-time video stream caught from a web camera, inside the installation, which is angled towards the seat the user will sit on during their speech interaction. I also decided to use AUVI, a group of external plug-ins for jitter. While they are very heavy on processing, they have the ability to manipulate video that jitter can't do alone. Considerable time and energy has gone into understanding, selecting, researching, and applying technology enablers that best support use, especially flow of experience.

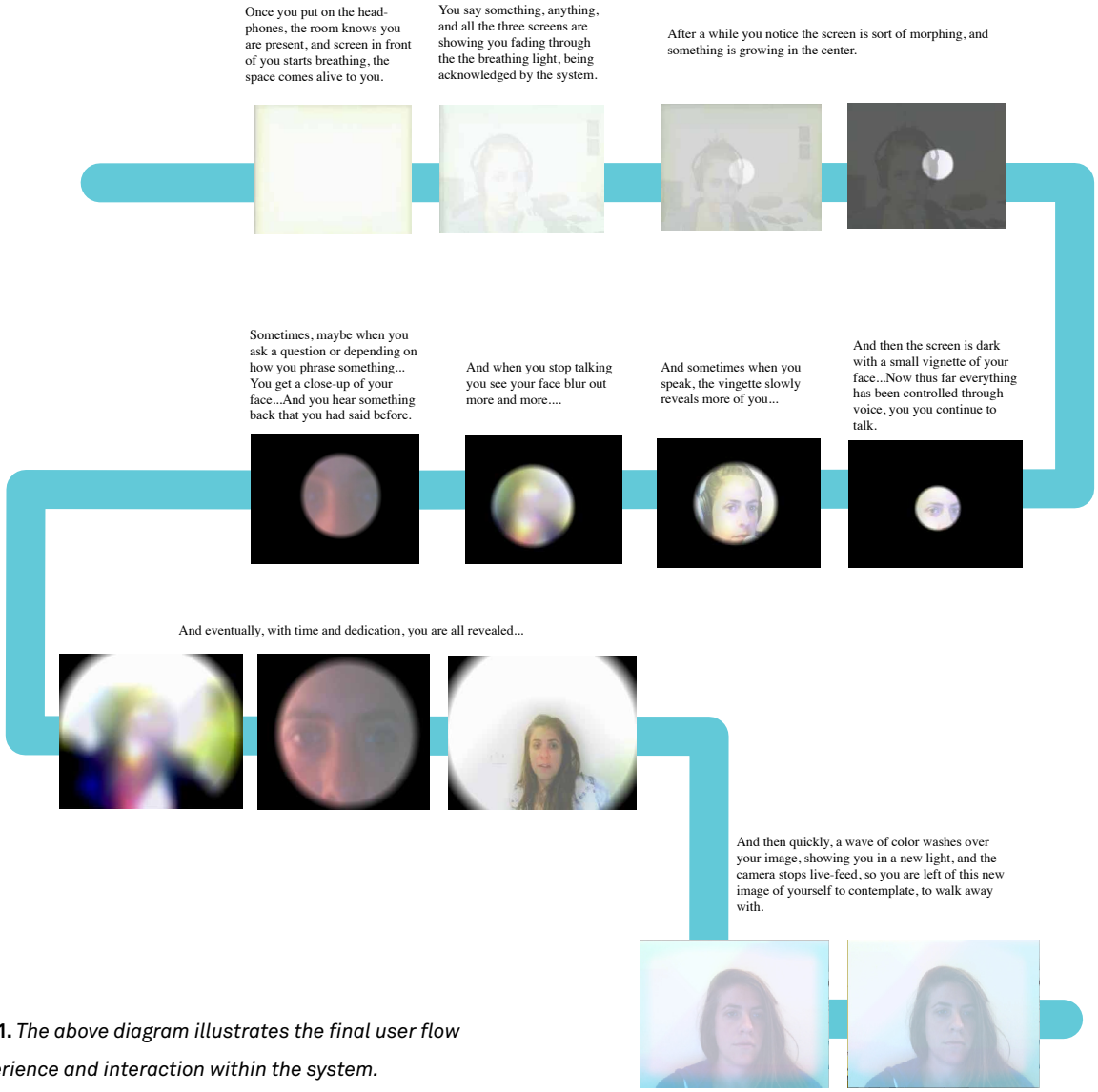

Fig. 1. *The above diagram illustrates the final user flow experience and interaction within the system.*

Spatial Design Choices. To reiterate, much of the experience of my work is feeling like you are entering a private, intimate and also comfortable environment, as well as believing your verbalizations will not be heard outside the installation. Due to the sound analysis within my system, outside sound also should not affect the audio triggers within the max patch. I was also limited by costs and fire restrictions. With both musicians and sound technicians I discussed sound isolating materials, and researched recording studios, both professional and DIY hacks. I went with a simple alternative instead, to simply build regular walls, a room inside a room, which would block out most of the noise.

My final spatial and building materials were as follows: I had four walls built of beams, insulation and sheetrock. I created the room at the end of the narrow room I was allotted for exhibition. The interior room was a trapezoid, because I learned that exact square shapes tend to give off more echoes of sound, and I wanted what was verbalized to be isolated and kept within the space. To each of the four walls, I attached cubes of sound absorbing foam, which I covered in white fabric to match the aesthetic of the room. Because the room inside the room was at the other end of the entrance, I created a pathway with a curtain conveying a feeling like you are really entering a new space. Because I could not have a completely enclosed roof, I had a frame of two by fours to which I attached panels of fabric hung in canopy style. While this by no means stopped sound from entering or leaving, it did allow me to have diffused light within the space (helping to create a peaceful atmosphere) as well as raising a bit of curiosity in users, an extra pull to walk down the dark corridor to see what is inside.

4. EVALUATION

4.1 PARTICIPANT EXPERIENCE AND FEEDBACK

One of the benefits of the thesis exhibition of this specific project was my being on-site to speak to people about their own reactions and experiences with *One With One*. Feedback that I received from this installation was very useful. Many who walked into the installation without reading the signage or context for the work commented on sound and sense deprivation—where 'deprivation' then really becomes an absence of chaotic noise and visuals. Many users still did not have the attention span, therefore missed the intended experience. I think this has to do with two factors: patience and intonation. In a rushed interaction, or an uninformed interaction, are users really considering what they are saying and how they are verbalizing (intonation) to the system? This relates to the engrained expectation of immediate call and response.

Some feedback was deeply encouraging, and reinforced my investment in this subject matter. One woman went in, interacted, then came out and asked me questions. I advised speaking clearly and devoting more time to the space. She went back in and spent a significant amount of time in the room. After, She told me she really enjoyed the experience: she felt like the reason it resonated with her is because she felt she succeeded in it. Another woman told me she felt like she was in a recording booth/therapy/confessional, and that the whole experience felt very ephemeral and made her feel vulnerable. A gentleman told me he really liked being inside three screens, which really helped him immerse himself within his headspace. A friend went in *One With One* days after the opening (she had user-tested initial interactions, but at that time, had not been in a mood to talk.) She responded to the level of required engagement: how she had to put on the headphones, had to speak directly into the microphone; she appreciated how demanding the system was in order for her to obtain a responsive.

One component that I think was not successful was the vacancy indicator switch. Some users didn't utilize it, and were therefore interrupted so they were either interrupted, or left the room as "occupied", discouraging others from entering. Because I feel much of the success of *One With One*'s interaction comes from fluid call and response, rather than direct input, in future iterations I would indicate vacancy through sensors indicating user presence.

Another aspect needing improvement is the sound as input. Certainly, this interaction was too slow, or too demanding for some. Most probably the analysis for those whose first language is not English was not extremely reactive to the way they offered verbal disclosure. Thus, any intonation I may have accounted for would be completely disregarded. Different languages have different flows and enunciations, so different parts of phrases are emphasized. A solution has not yet been found for this. I don't want the system's responsiveness to be immediate, to be "too simple". One possibility would be to add more stages and possibilities to the feedback offered by the system, or to offer a choice of language detection for users to select initially.

4.2 THE SIGNIFICANCE

The personal importance of this work lies in my interest in re-creating and re-interpreting human interactions in constructed and mechanical ways. We can build so many different experiences with new media: it is interesting to consider how much or little is needed to make something feel human. Additionally, I believe there is a somewhat sad or dystopian element in our capacity to mimic the natural world and human interaction with the artificial. *One With One* touches on peripheral themes of our relationship to technology and held expectations of immediacy and direct responses from our input to built systems, and, significantly to our apprehensions about how another person may react or interpret our own input. We expect more transparency with man-made creations then we do from another human being. There is an input and output, and our preference is for more efficient, obvious, and helpful feedback than we may get from people. This work explores the relationship between what we offer to what we receive back: it requires dedication, patience and time. I think these characteristics are necessary for self-revelation and awareness, yet are increasingly rare

in a fast-paced technologically driven culture, which often affords and encourages immediacy.

4.3 ENVISIONING FUTURE END STATES

Through feedback and reflection, towards creating an enjoyable and worthwhile experience, I realize now this installation requires a specific sort of environment to be truly appreciated in. In a gallery, one does not usually presume to have to perform or offer anything: a visitor typically expects to be an audience member. As pointed out to me later, both a private home and a space of healing may be ideal locations for such a work. A private home is suggested because any sort of hesitation or intimidation of being asked to speak would have fewer barriers within the home; a space of healing because the audience or potential users would be mentally open to feeling better, as well as ideally a peaceful environment.

In future iterations I might add more physical feedback: creating a breeze at the end of the interaction could be a soothing physical takeaway. Another option might be developing the means of entering the space further: to amplify the transition from the outer space into the installation. I would also like to replace switches with more sensors, to create a more seamless, esoteric experience. This work opened many doors in terms of my interests in spaces addressing specific human behaviors and needs. Specifically, I have been more intrigued by the desire for ritual in the everyday experience. I intend to continue on with further installations exploring these human behaviors.

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CORPOREAL INTERAC-TIONS

CORPOREAL INTERACTIONS

Eloe: Application of Brain-Computer Interfaces in Visual Creativity

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Abstract. *"Eloe" is a computer program that explores the application of BCIs in visual creativity. It uses NeuroSky MindSet brain-computer interface to obtain the data about the brainwave activity. This data defines parameters for a line drawn on a computer screen with the Microsoft Kinect interface or a computer mouse/drawing tablet. This interaction gives artists an opportunity to explore the aesthetic possibilities of affecting the visuals directly with brain waves. "Eloe" emerged on the intersection of body, art and technology and it examines the possibilities for the application of modern technology in art in the context of using human body as an artistic medium. The interaction model is focused on augmenting one HCI interface with another to overcome the limitations of both.*

Keywords: *Brain-computer interfaces, design for creativity, augmented interfaces, interaction bandwidth*

1. INTRODUCTION

1.1 CONCEPT

"Eloe" is a computer program that gives artists an opportunity to explore the possibilities of using their brainwave activity in their creations. The interaction is structured around drawing either with a mouse/drawing tablet or with a Microsoft Kinect interface. In addition to the input of hand movement the program uses NeuroSky MindSet brain-computer interface (BCI) to read electrical activity of the user's brain. This data is processed to obtain two values representative of the user's mental state - the levels of "Attention" and "Meditation". Those values are used the set the parameters of a line being drawn. "Attention" affects the weight of the stroke - the more attentive a user is the thinner the line. "Meditation" sets the color of the line. A calmer and more relaxed mental state produces softer, more pastel colors while an anxious state gives darker and more saturated colors (Fig. 1).

As an artist's tool this software offers a possibility to explore the process of creating art and include this process in the work in a very direct way. The levels of attention and calmness of the artist affect the outcome of the drawing process and the art itself becomes a visual representation of the creative process and the mental state of the artist during the creation of a piece.

For an artist this project brings up an important issue of control and authorship. Most artists would have minimal control over the choice of colors and the types of lines in the interaction model of "Eloe". At the same time it is the artist's body which determines those choices. The question of authorship becomes a part of a much larger question of the relationship and the distinction between body and mind. "Eloe" allows artists to engage in this discourse and state their own positions through their methodology. But regardless of the artist's individual views on this matter this system brings artist's "self" to the center of the artwork.

2. CONTEXT AND PRECEDENTS

2.1 CONTEXT

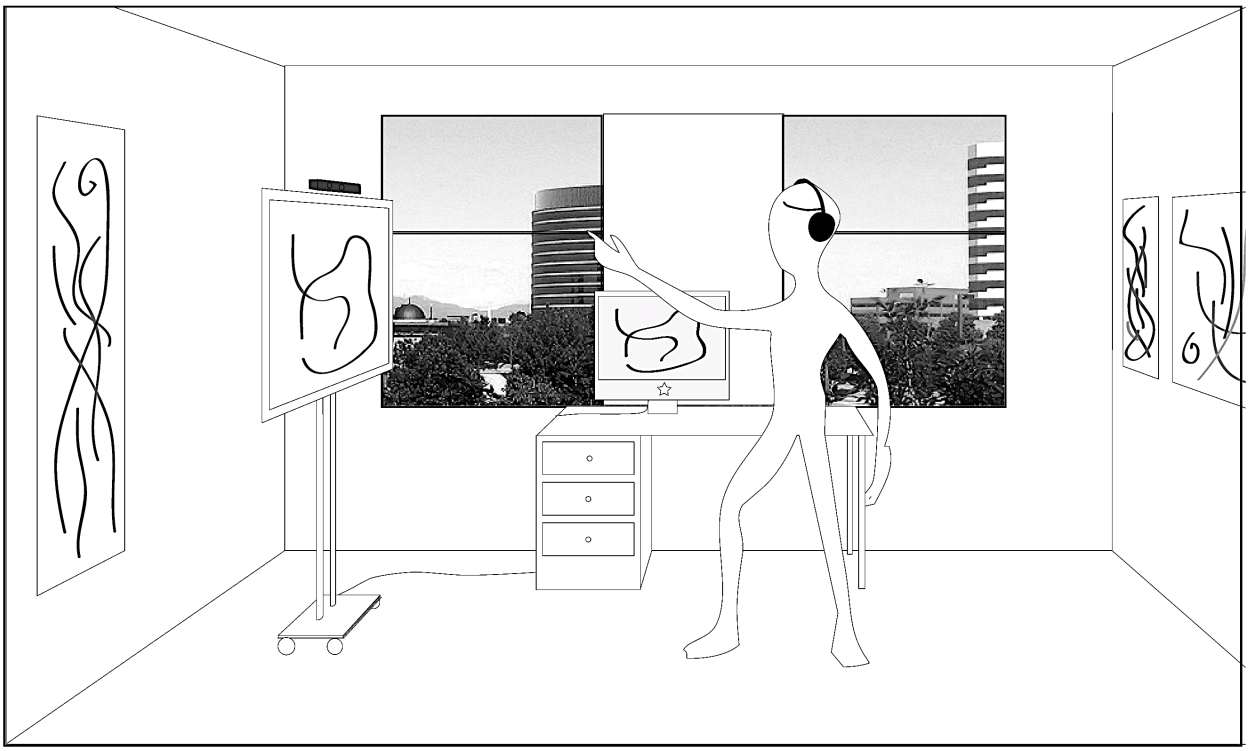

Fig. 1. *"Eloe" system as a proposed installation in an artist's studio*

This project explores the use of physiological function of a human body - the electrical activity of the brain - as a medium. This function is not used directly, it is abstracted in a data set, and the brainwaves are represented as a stream of data. This positions the project on the intersection of two important themes in modern art - "body as medium" and "data as medium." In the exploration of these themes artists have often turned to technology in search for an appropriate tool set, but role of technology in this project is larger then that of an enabler. The advancements in technology have brought about the impetus for the exploration of both themes and served as an inspiration for the search of new forms of artistic expression.

Body and Art. The relationship between artist's body and mind has been explored in depth in the works of French performance artist ORLAN. Here body became the medium out of which the work was contracted and yet it remained the expression of her identity, in itself is an assumed identity - which, of course poses the question - where is her "real self"? She outlines this duality in her "Carnal Art Manifesto" [1]. This exploration of artist's "self" is key to understanding the issues of "self-expression" and authorship in "Eloe". Is it artist's mind or artist's body that creates the work? And which of those the artist identifies as "self"?

Marina Abramovic explored another aspect of body as an artistic medium. In an interview at PBS she emphasised the "real" quality of the performance art - in opposition to theatre or dance "the knives are real, the blood is real" [2]. A similar concern was expressed by Stefan Sagmeister, a well-known Austrian graphic designer and artist, in relation to his "AIGA Detroit" poster. The words were carved into his body and photographed with a large-format camera "to make every pore visible" to ensure that it would show that the work was not retouched or altered [3]. This issue of authenticity is central for my project as well. Brain-computer interfaces are not widely used and most artists are not familiar with their capabilities. It was paramount that the artist feels that clear connection between the mental state and the creation of the artwork, unobstructed by the technology that enables this connection.

Relationship between art and technology. The conversation on the relationships between art and technology is a very deep and multi-facetted one. With the development of technology the ability to utilise it's innovations in art as tools and as media has enriched both the worlds of technology and art. In parallel with that the deeper understanding of engineering and programming methodologies has provided artists with new ways to approach their work. Programmers and engineers, in their turn, started thinking extensively on aesthetic aspects of their work and the implication of their creations on creativity and self-expression.

From conceptual to generative art one tendency has been very pronounced - digital technology replaces the craftsman, the executioner and becomes a part of artistic methodology. Parallel to that several artistic movements outlined in Victoria Vesna's "Database Aesthetics" regard information itself as an artistic medium [4].

"Eloe" echoes these tendencies both as a set of instructions and procedures which define the outcome of the creative process and a tool wielded by an artist. And as a tool "Eloe" allows artists to work with a medium of a dual nature - on one hand it is their body and it's physiology in the tradition of body art. At the same time it is an abstraction of the body in the form of data, which places the artwork in the new context of information art.

2.2 PRECEDENTS

Since the proliferation of electroencephalogram in the 1920s many artists have tried to explore the possibilities of the brainwaves in art. In the 1960's Erkki Kurenniemi's DIMI-T synthesizer was one of the first art projects to use brain activity - specifically the activity in the Alpha range measured by an encephalograph - to control the sound [5]. Another example of this line of artistic exploration is a series of EEG DECONcert performances by Regenerative Music in the early 2000's that used electroencephalogram sensors and collective performances to turn brainwaves into music [6].

The investigation of the artistic potential of the brainwave activity did not stop at the sound - Luciana Haill at the Institute of Unnecessary Research used Interactive Brainwave Visual Analyzer to create a series of audio-visual performances called Augmented States of Consciousness. Lenara Verle and Marion Barrios of ZKM Institute in Karlsruhe, Germany developed a system for audio/video performances called MIND VJ [7].

But all those projects take a very representational approach to the aesthetic possibilities of BCIs missing out on the opportunity to modify and transform the data in an artistic way. This is what's different in a project by Mariko Mori called Wave UFO [8]. The project seeks to unite three individuals in an aesthetic journey through visuals and sound fueled by their brain activity.

It seems that the research and experimentation in applying BCI in art took two specific paths. One explores the potential of using brainwaves as a controller for a time-based medium - sound or video. The other took representational approach and tries to find aesthetic value in the brainwave activity itself.

I propose a conceptually different approach which combines elements of the other two and proposes additional elements in the interaction and in the resulting work. On one hand I regard brain-computer interface as a controller, but I don't see why its application should be limited to time-based media. I also see value in visual representation on brainwave activity but the typical one-to-one mapping seems to simplistic, not matter what the visual outcome looks like.

3. METHODOLOGY

The system developed for user testing consists of three essential parts: Microsoft Kinect interface, Neurosky MindSet brain-computer interface (BCI) and the program written in Processing programming language.

3.1 BRAIN-COMPUTER INTERFACE

MindSet has been created by the NeuroSky company as an alternative for large-scale electroencephalography apparatuses. It was initially intended for usability research where it was critical to measure user's mental state in situ, which would preclude the use of large equipment. It has been later utilised for gaming and educational purposes. Several studies have been conducted

Brainwave Type	Frequency range	Menta-l States and conditions
Delta	*0.1Hz - 3Hz*	*Deep, dreamless sleep, non-REM sleep, unconscious*
Theta	*4Hz - 7Hz*	*Intuitive, creative, recall, fantasy, imaginary, dream*
Alpha	*8Hz - 12Hz*	*Relaxed, but not drowsy, tranquil, conscious*
Low Beta	*12Hz - 15Hz*	*Formerly SMR, relaxed yet focused, integrated*
Midrange Beta	*16Hz - 20Hz*	*Thinking, aware of self and surroundings*
High Beta	*16Hz - 20Hz*	*Alertness, agitation*
Gamma	*30Hz - 100Hz*	*Motor Functions, higher mental activity*

Table 1. *Brainwave types and associated mental states.*

to examine its ability to accurately measure human mental states and emotional responses. It has been proven relatively accurate and reliable, with one study outlining the possible caveats for developers [9].

It is a single-electrode interface which uses a mono-polar montage system of measurement. The voltages are measured at a rate of 512Hz and then subjected to Fast Fourier Analysis to determine the composition of the signal across the frequency ranges. The ranges represent different types of mental activities [10].

The processor in the unit calculates composite values for "attention" and "meditation" at the same rate. "Attention" is based oh the activity in the Beta frequency range and "meditation" on the activity in the Alpha range. Those values are scaled on an arbitrary scale from 0 to 100. It is important to note that the range of values returned by MindSet depends a great deal on personal physiology and is not consistent for all users.

3.2 BUILDING THE INTERACTION

The standard human-computer interaction practice is to order tasks hierarchically according to their relevance to the prospective user - given that we know user's preferences. Interactions supporting creativity cannot rely on this method since the very nature of these interactions is unpredictable. It is necessary to rely on the user to participate in the design of the interface.

One of the solutions proposed by Viveka Weiley's and Ernest Edmonds [11] was to engage target users in the iterative cycle of design. A direct way to engage users would be to actively collaborate with an artist throughout the whole process, co-designing it in a way. An indirect way would be for a designer to observe the process of interaction during user tests and track important issues that arise. I chose the latter path because my concerns for this system were of a general kind - how this technology can be applied in a creative field, rather then development for a specific art project.

One important issue that came up during the testing of one of the prototypes was the two painting techniques used by practicing artists. Some artists are very meticulous and detail-oriented in their work and pay a lot of attention to every line they draw, while others "go all Jackson Pollock on that thing", using the physicality of their bodies and focusing on translation of emotion rather then small details. A pencil or a brush can be used in either style but while a mouse and a tablet facilitate the first approach they are hardly suited for the more expressive style.

Looking for an input device that would be more expressive I turned to Microsoft Kinect. Designers have long been looking to eliminate the controller from the interaction and Kinect presents this capability. Aaron Levinsohn believes "that users should remain unaware of the controller so that the screen can be the dominant focus of attention. This works particularly well because humans are very good at keeping awareness of their bodies in the background" [12]. This aspect is very important for my hypothesis because by enabling the natural interaction I am decreasing the challenge of performing the task thus adjusting one of the key conditions for achieving the "flow."

Knowing how important environment is for applications designed for creativity I constructed a system which attempted to mimic the typical drawing or painting set-up. The screen is set on a stand to invoke a similarity with a canvas on an easel. The hand motions in front of the screen do not emulate the use of a paintbrush, because they lack the natural physical feedback of the pressure but evoke another familiar technique - using airbrush or spray paint.

4. USER TESTING AND EVALUATION

4.1 METHODOLOGY OF USER TESTING AND DATA COLLECTION

The test combined elements of heuristic evaluation as described by Jakob Nielsen [13] with interview and observation methods proposed by Patrick W. Jordan [14]. The tests were set in large room with an LCD screen on a stand and laptop computer on a table in front of it. The environment was constructed to emulate a typical artist's studio as much as possible in order to avoid additional distractions by unfamiliar setting.

I have selected 7 artists for the test. The number was determined by the findings of Jakob Nielsen on effectiveness of usability testing. He determined that 5 prospective users or usability experts would be able to find 75% of usability problem and 10 would approach the possible maximum for findings. The users varied across demographics a great deal - from 21 to 54. I had 1 new media artist, 1 illustrator, 4 painters/fine artists and 1 architect/draftsman.

4.2 ANALYSIS AND RESULTS

In the analysis of the results I was conscious of the "novelty factor" in the interaction - the fact that the interaction mode was affected by the fact that the user had never seen a system like that before. The results were adjusted to this factor.

Two important findings that came up from the testing. Kinect also caused a great rift in opinions. Two testers were strongly opposed to the idea of using it in creative process. Three others were very excited about this idea and spent most of the time with the Kinect obviously enjoying the process. Their style of painting is very expressive and physical which also added to the experience. Building up on the existing platform of experience with this type of interaction they came closest to achieving "flow" - they were obviously engulfed in the process and were able to cross the "novelty" barrier very quickly, producing abstract, but very deliberate work, rather then simply doodling to explore the possibilities of the interaction.

MindSet itself produced much less of a sensation - possibly because it does not require any active participation to be included in the interaction. Some artists tried to consciously control their level of attention and relaxation, with limited success. Only two reported that they were able to change the levels deliberately. I also found that in one case there was a very consistent pattern of attention activity - when the artist was drawing small details the attention level would go up resulting in much thinner lines and when the artists was filling or shading the attention would go down producing thicker lines. This was very advantageous to the technique that the artist was using.

One concept about MindSet that most artists were very quick to grasp was the fact that the mind is not controlling the drawing, but the brain is. To quote one of the participants: "Seeing them both collide, but work in unison - that's a great concept!" A related issue had to do with letting go of control over the process, especially for the people who were used to very precise and detailed drawing. Two of the subjects found the process "very liberating." Both of them with addition of two other people, for whom letting go of control came a lot more naturally, stated that they would use this system to "loosen up before drawing."

4.3 CONCLUSIONS

The augmentation of a brain-computer interface with a gestural interface was very successful, especially in a creative environment. Comparing the outcome of the drawing sessions where "Eloe" was used with other art created with BCIs I found a much greater level of control and deliberation in the artwork on one hand and a much richer experience in the process of creation on the other. Artists were actively involved in the process and fully engaged the duality of using their body both as a medium and as an instrument.

The artists who were a lot more flexible in their attitudes towards control, the ones who

were able to allow the medium make decisions during the creating process were much more likely to get into the "creative zone." Kinect interface played a significant role in this process, too. By increasing the challenge in interaction for some users it had a balancing effect on a skill level required to have a meaningful drawing experience. For other people, especially artists used to drawing with precision it either raised the required skill level too high or drops it too low and they became bored and disinterested.

Overall the system seems to introduce a very novel and valuable mode of interaction in a creative environment and opens many new doors for artists looking to experiment in body art and computer-assisted art.

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Decoding the body: Towards a technologically enhanced and artistically generated experience of the corporeal

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Abstract. The intersection of information technologies and artistic practices has created a new field of experimentation, where a new perception of the body, the self and the urban space takes place. Based on Roy Ascott's idea of Cyberception and Don Ihde's Post-Phenomenology, this analysis focuses on artworks that are based on interactive participation, biofeedback and information technologies. Within this context, art emerges as an alternative means of theoretical discourse and scientific research.

Essential reflection upon technology and decisive confrontation with it must happen in a realm that is, on the one hand, akin to the essence of technology and, on the other, fundamentally different from it. Such a realm is art.

— Martin Heidegger [1]

1. INTRODUCTION

Digital technologies map a new space, where the traditional hierarchies within the cultural sphere are being questioned and transformed, in favour of a heightened collectivism and body awareness. It is the fertile soil where new ideas emerge, re-defining the role of the individual in the production of culture and meaning. As the cultural object becomes disassociated from its material substance, emerging through the mediation of multiple layers of technology, the communicative potential of artistic creation is transformed into an open process, where the public can participate as well.

This development is linked to new ways of perception and multiple possibilities for embodiment. In this sense, contemporary artworks that are linked to information technologies and participation follow closely the philosophical discourse about phenomenology and post-phenomenology; not as illustrations of an existing theory, but more as means of delivering scientific and philosophical inquiries, thus creating a discourse through visual means.

This paper will highlight the aforementioned discourse by bringing together visual culture and theory. The objective is to show how the body has become the centre of perception, both in visual arts and philosophy.

2. CYBER-FANTASIES AND TECH-EMBODIMENT

Information technologies initially seemed destined to fulfil the Cartesian promise land, where the mind would finally be free from the 'inferior' body, being allowed to flow in an immense immaterial space while allowing the

empty shell of the body to contribute to this 'journey' only through a minimal participation of the eyes and the hands. However, this vision – prominent in William Gibson's *Neuromancer*, where the main character, Case, lives "for the bodiless exultation of cyberspace"[2]- was soon dropped for more body-centric approaches [3].

Contemporary technology follows the users as they move, engages the entire body into the action and incorporates certain bodily movements, as it strives to be as intuitive as possible. It highlights the role of experience as the centre of perception; thus, it follows the phenomenological approach on perception, as an active, bodily involvement with the world, rather than a distant observation.

The evolution of mobile devices and high-tech garments demonstrates how information technologies form part of the day-to-day activities of the public. Thecla Schiphorst focuses her artistic –and scientific- research on wearable technologies, thus ensuring that the artistic work will not remain within the confines of the exhibition space, but could potentially follow the user in the urban space, altering drastically perception. *Exhale* (2007)[1] is based on a set of wearable high tech garments, which measure the breathing rate of the person who wears them and transfer it to another person or a group of participants [4]. The artwork permits three kinds of interactions: self to self (meaning that the users observe their own breathing), self to other (when they choose to send their breathing pattern to a different person, who receives it as subtle ventilation under his/her skirt) and self to group (when all users synchronize their breaths and thus activate dimming lights on the surface of their skirts)[5]. Therefore, the artwork functions in many different levels, contributing to self-understanding, communication and collaborative effort. The participants that wore those dresses during workshops mentioned a feeling of calmness, introspection, of being at ease within the sounds and motions generated by the dress. This suggests that the artwork changed the way they perceived their surroundings and the others.

3. TECHNOLOGICALLY ENHANCED PERCEPTION

The aforementioned work encourages a "technologically augmented perception/conception"[6], which was labelled by Roy Ascott as *cyberception.* This term encompasses the main characteristics of technology-based art, such as transformation, interaction and omnipresence. Ascott highlights how the focus on technology-based art has been shifted from appearance to the process of creation and the emergence of meanings. Within this context, the public plays a decisive role, by taking part in the creation of the artwork.

On the other hand, as digital technologies disassociate presence from the physical space, the outreach potential of the artistic process is maximized, enabling users to 'zap at will across multiple universes' [7]. In short, cyberception is described as a non-linear, all-at-once perception through multiple viewpoints, which acknowledges the associative and transient nature of thought and guides the public into gaining a new sense of the self.

This transition between the real and virtual space and among multiple associative paths is a main axis in the work of Rafael Lozano-Hemmer. In works such as Voz Alta (Loud Voice, 2008)[2], we see how collective memory is linked to the individual body and the urban space. The work is conceived as a memorial for the 40th anniversary of the 1968 student massacre in Tlatelolco. The participants are invited to speak into a megaphone in the place where the events happened. During the course of the installation, they are free to make statements, art performances, poetry recitations, calls for protests or even marriage proposals. The pulse and intensity of their voices is transformed into a sequence of flashes, projected by powerful searchlights, visible at a distance of up to fifteen kilometres within the city. The searchlights move accordingly to the voice that is heard through the megaphone; thus the voice, which has started as a breath within the interior of the speaker's body, becomes an expression of an emotional charge and a reminiscence of a corporeal presence. At the same time, the narrations were being broadcasted on the radio, thus enabling the magnified voice of each narrator to transgress the limits of physical space and to reach a larger audience. Thus the

voice –with its origins in the strictly corporeal limits of the chest cavity- could accompany the radio audience in their wanderings around the city, connecting the body with individual memory, collective history and the urban space.

3. THE INTERACTIVE BODY

This shows the multitude of meanings that arise through the interaction of body with technology. Perception emerges as a result of active involvement with technology and the real world. In this regard, Don Ihde's postphenomenological, technology-related inquiries extend and complete Ascott's idea of cyberception [8].

Ihde's theoretical edifice covers all aspects of embodiment, taking into account the earthly body of phenomenology and the socially and politically constructed body of postmodern discourse; to these viewpoints he adds the idea of the body which is interactive with technology [9]. The basic idea behind the latter is that technology becomes a mediator in the relations between people and the world, highlighting that 'the experience of one's body image is not fixed but malleably extendable and/or reducible in terms of the material or technological mediations that may be embodied' [10].

Following the phenomenological doctrine that active engagement is an indispensable step in the perceptive process, post-phenomenology further justifies that our sense of the body is filtered through our experience with technology, changing in the process. A development that exemplifies the above theory is the emergence of biofeedback technologies, which monitor electronically internal functions –like breathing or heartbeat- and "feed" them back to the subject of observation in the form of audiovisual stimuli, contributing to the understanding and control of the body.

George Khut is an artist who uses biofeedback in order to establish a close connection between the corporeal and the digital, the participants and the artwork [11]. In *The Heart Library Project* (2008)[3] biofeedback technology returns to the place where it is usually applied: the installation took place in a hospital, manifesting the connection between the state of the mind and the body in a particularly prominent way. In this interactive installation, the participants would rest on a bed, with their heart rate monitored; initially, they would look onto a reflection of themselves on the ceiling, which would become gradually altered by ripples –as if it were reflected on the surface of water- and by a multi-layered field of coloured spots. These changes reflected the changes in the heart rhythm of the participants, inviting them to contemplate on the link between their emotional state and the subtle physical changes in their body and challenging them to control the interaction by evoking different kinds of memories. After the interaction, the participants could share their experience by participating in a hand painted 'experience map'. The place of the installation is significant as well; in hospitals the body often becomes objectified by technology, as it is being scanned, observed and analysed during medical exams. On the contrary, in Khut's installation the participant has a certain control over the action; thus the artwork becomes a bridge between the technological interface, the body and the mind.

4. CONCLUSION

It is this balance between introspection and communication that becomes the common thread between the aforementioned artworks. In Schiphorst's technologically enhanced garments, this was expressed through a focus on breath and a research into alternative paths of bodily communication. In Lozano-Hemmer's work the presence of the body is reduced to a pulsing light, in order to leave room for the emergence of memory and history as a connective tissue within the urban space. George Khut, on the other hand, makes a more subtle reference to thought and memory, as elements that can impact the state of the body, and encourages the participants to understand and control their physical and psychological fluctuations.

Their interactive work is guided by the awareness that the new media can bring about changes in perception. Maintaining a clearly phenomenological stance, where understanding and knowledge rely on full-body immersion within the real and digital space, they follow closely Roy Ascott's ideas on Cyberception and Don Ihde's Post-Phenomenology. Through their work they create a rich theoretical discourse about the relation of technology to the personal, the

political and the corporeal. This takes place within an experimental path, where new experiences and knowledge take shape. In this sense, they follow Heidegger's idea that art could become a tool of technological research and theoretical reflection about technology.

Using scientific theories and tools, without being bound by the conventions of scientific research, artists can provide creative solutions to diverse theoretical and practical issues. This way, art becomes an area of experimentation with the potential to open new roads in science and technology.

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ENDNOTES

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2005, Emerging Technologies and Art Gallery, Siggraph, Los Angeles, USA.
2006, Fleshing Out, Symposium + Workshop, V2_Lab, Rotterdam, The Netherlands.
2006, Digifest: mods, Harbourfront Centre and Ontario Science Centre, Toronto, Canada.
2007, Speculative Data and the Creative Imaginary: shared visions between art and technology, National Academy of Sciences, Washington D.C, USA.

2 Exhibitions:
Unsaid/Spoken, The Cisneros Fontanals Art Foundation, Miami, Florida, United States, 2012 - 2013 Voz Alta Prototype .
Play with me, Museum of Latin American Art, Los Angeles, California, United States, 2012.
Freedom to Create, The National Museum of Bosnia and Herzegovina, Sarajevo, Bosnia and Herzegovina, 2011 (video).
Freedom to Create, Galerie Mirchandani + Steinruecke, Mumbai, India, 2011 (video).
InTERvenciones, Consejo Nacional de la Cultura y de las Artes, Valparaiso, Chile, 2010 (video).
Atopia, CCCB, Barcelona, Spain, 2010 (video).
Transition States, Haunch of Venison Gallery, New York City, New York, United States, 2009 (prototype and video).
Being in the World, The Cisneros Fontanals Foundation in Miami, Miami, Florida, United States, 2009 (prototype and video).
Recent works, Galerie Guy Bärtschi, Geneva, Switzerland, 2009 (video).
5 Solos, Galería OMR, Mexico City, Mexico, 2009 (video).

Voz Alta, Memorial for the Tlatelolco student massacre, Mexico City, Mexico, 2008.

3 Exhibitions:
2007, Performance Space (creative development residency) “The Living Room Project”, Australia
2008, “Enfoldings and Disclosures” exhibition with Lisa Jones, UTS Gallery, Sydney NSW.
2008, “Mirror States” group exhibition, Campbelltown Art Centre (NSW) and Moving Image Centre (NZ).
2009, The Heart Library Project: St. Vincent’s Public Hospital, Darlinghurst (NSW).
2012, “Wonderland” group exhibition, Museum of Contemporary Art (MoCA) Taipei (TW).

Exploring roads less traveled: eye-tracking in art

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Abstract. Eye-tracking technology provides valuable help to interdisciplinary collaboration between various domains, such as human-computer interaction, digital art and creative media, so as artistic creativity can be expressed and developed. In this paper we present (a) an overview of eye-tracking technology in art and (b) the first results of a digital art research project, entitled DiBaB, which were based on paintings made by vegetal dyes for the creation -via eye tracking technology- of new artworks. The result was experimentations with artworks that have made visible the invisible, becoming a window to artist's mind.

1. INTRODUCTION

The direction of gaze plays an important role from a very early age in communicating with other people; and transmitting information about people emotions and mental state. Furthermore, the ability to see, focus on things and visually perceive them, helped people to understand their surroundings and make sense of the world. Thus, the eye-tracking research can play a very significant role to enhance insights and understanding into human perception and cognition. The first era of eye-tracking research dates back to ca. 1879–1920 and is limited to the recording of the basic eye movements, the second era (ca. 1930–1958) is related to behaviorism in experimental psychology, the third era (ca. 1970–1998) achieved easily obtained eye movement recording and the fourth era there is the appearance of interactive tools and technologies that permit accurate information recording and processing tasks [1]. Eye-movements are closely related to attention imagination [2] and perception [3, 4]. Buswell [5] made a research about how people look at art images and Yarbus [6] studied systematically the eye movement and made some really interesting points about eye fixations to important –according to the viewer-points, the center of the image where usually the eye tends to look and the repeating eye fixations. Eye-movement recordings can provide a path of the direction of a person's visual attention in relation to visual stimuli. Various studies explored the fixation location and duration [7], visual interest in art [8], symmetry [9], memory [10], level of expertise [11] etc. The use of digital technology in contemporary art creation is often referred to as new media art. In this paper we present and overview the eye tracking applications in contemporary and new media art and the digital art research project "Saccadic Universe" that connects applied contemporary art, such as painting with vegetal dyes, with eye-tracking technology.

2. EYE TRACKING TECHNOLOGY

Eye tracking technology uses optical sensors and projection patterns to collect eye movements and gaze direction. Using eye tracking technology the point of gaze and the eye motion can be measured and recorded in real time and in high accuracy.

Therefore, it is possible to capture the fixations, pauses over informative regions of interest, and the saccades, quick eye movements usually occurring three to four times every second between fixations that are the basis for calculation of other metrics, such as scanpath measurements.

The usefulness of this technology is important both for designing new ways of interacting and evaluating of user experience by interpreting the results of the detection mechanism, the eye tracker. Eye-tracking technology can provide answers for two basic questions, *what* one considers interesting and *how* someone sees it. The last years, eye tracking technology is used by a wide range of disciplines: psychology, medicine, cognitive linguistics, product design, cognitive science, human-computer interaction, usability evaluation, and recently also in the field of culture and art. In the later, eye tracking is used as plethora of research areas in culture, such as museum installations, an alternative interpretation medium of human behavior [12, 13], personalization [14] and learning for virtual museum visits [15], virtual search, art perception [16], guidance of viewer's eye [17], expertise [18, 19, 20], perception [21], understanding [22] and performance [23].

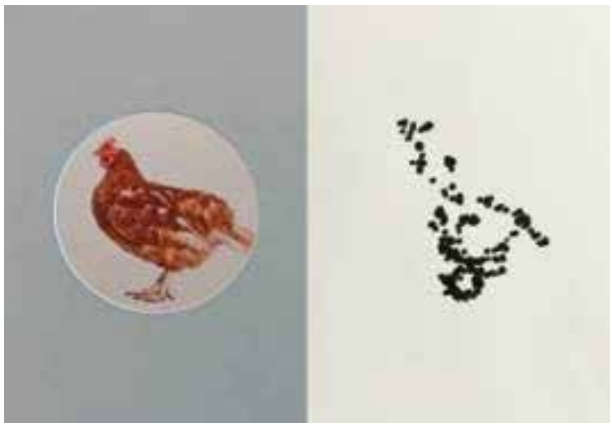
3. EYE TRACKING EXPERIMENTATIONS IN ART

A number of contemporary artists have experimented with eye tracking technology that can provide a valuable insight to cognitive processes, trigger creativity and get transformed to artworks. Seiko Mikami incorporated eye tracking technology in an interactive media art installation entitled "Molecular Informatics" [24]. In his exhibition the viewer becomes a creator wearing a pair of Virtual Reality (VR) glasses with an eye tracking sensor and creating -via his/her eye movements- new structures in a VR space that consists of molecules and molecular formations (Fig. 1).

This exhibition communicates the relationship between biology and informatics in an attempt to explore the boundaries between art, interaction and transformality. Visitor experience a virtual world that interacts with and get transformed in real-time by his/her eye movements. In his interactive installation entitled "Eye-Tracking Informatics" the artist creates an installation for 'observing the act of observation' and 'consciously and unconsciously established lines of vision' [25]. The installation has used the 'EyeWriter ver 2.0', an open-source eye-tracking apparatus and software initially used by artists with paralysis by Amyotrophic Lateral Sclerosis to draw using only their eyes [26], in order to provide the opportunity to the visitors to utilize eye control technology without wearing any kind of device, and to navigate within the naked eye's field of view. In this installation the artist has visualized visitors' lines-of-sight -that act as a 'complex, organic, architectural construct- in 3D space, introducing the concept of bio-architecture.

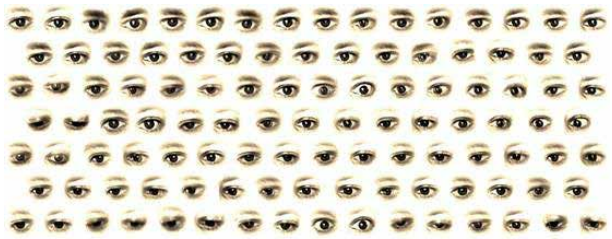
Molecular Informatics installation. Source: http://www.virtualart.at/database/general/work/molecular-informatics-morphogenic-substance-via-eye-tracking.html [last accessed 30 June 2013]

In "Saccadic Sightings" the artist Rune Peitersen collected eye movement data from various environments and created videos as 'filmic representations of the visual information received by the eyes' [27]. These videos were used for installations and presentations that intended to incorporate eye movements into video footage in order to 'create a representation of the input the eye receives from its surroundings – capture the 'raw' footage as it were, before the input is processed' [28]. Nils Völker cooperated with Christien Meindertsma, a designer of *we-make-money-not-art*, in order to create a robot that replicates the way the visitors look. An eye-tracker has been used to record the movement of visitor's eyes, while s/he was looking at various images. It has been connected to the Lego robot that made a dot for every point they have just been looking at and painted what the visitors saw in the exhibition (Fig. 2) [29, 30]. One of the project's intentions was to reveal the different was the same objects have been perceived.



Robot painting what visitors saw. Source: http://www.nilsvoelker.com/content/mu/ Mika Satomi inspired the 'game-of-life' - an interactive art installation that permitted the viewers to walk and explore a virtual city with eye gaze movements (Fig.3) [31].

game_of_life,
Source: http://www.nerding.at/projects/index.php?project=6
Golan Levin created Eyecode, an interactive installation whose display is wholly generated by the eyes of the people that view it. With the aid of a hidden camera, the installation records brief video clips articulated by the duration between two of the viewer's blinks and replays it. This procedure results to a 'typographic tapestry of recursive observation' (Fig.4) [32].



Eyecode, Source: http://www.flong.com/projects/eyecode/ [last accessed 30 June 2013]

EyeMusic is a project of the Cognitive Modeling and Eye Tracking Lab at the University of Oregon, in which an eye tracker is connected to a multimedia performance environment, in order to perform a musical composition, create computer music and interactive art based on eye movements. In other words, the eye movements are sonified to demonstrate the place the person is looking using sound and how this can create music in real time [33, 34]. Olafur Eliasson designed an installation in the ARKEN art museum of Copenhagen entitled "Din blinde passage" (Your blind passenger), which is a 90-metre-long tunnel [35, 36]. When entering the tunnel, visitor's body is surrounded by fog with visibility 1.5 meters, white and yellow colour lights and the eye tracker records visitors' eyes. Thus, the visitors can see the way the eyes behave inside the tunnel when there are no other stimuli.

4. FRUITFUL INTERSECTIONS

Visual March is a march in successive trails from Florina to Prespes in northern Greece that aims to introduce the artists that participate in contemporary concepts by experiencing the environment of the area of Prespes. Already in its sixth year, in Prespes is a 7 days activity that takes place in Prespes (Florina, Greece). Borders and Beyond (BaB) project is the main theme of Visual March in Prespes and was initiated from the need for an artistic practice that defends art created from the organic relations of culture, place, society and the individual [37, 38, 39, 40, 41]. The BaB project is the culmination of the Visual March process created an international network of artistic and scientific research groups and practices that explore the idea of border in every possible aspect: as borderline, as limit, as frontier etc. The results of BaB are published via a webpage [42]. At a second stage, the process is open to groups that relate their research to social research and cultural intervention of critical artistic and scientific practice.

Digital Borders and Beyond (DiBAB) is an ongoing project in collaboration with the Laboratory of Photogrammetry and Remote Sensing of the Aristotle University of Thessaloniki and aims at expanding human interaction with artworks using ICT. This shift is about involving artists and the viewers and enhancing cultural experience and participation. The project is being conducted by creative researchers with various scientific backgrounds to provide innovative and exciting ways of experiencing art, permit artistic experimentation and artworks re-visit/re-use. In this paper we present the first results

from the application of eye tracking technologies to paintings.

4.1 First Phase- Prespes Visual march

The paintings of Leonidas Gelos [43] -selected for experimentation with ICT- were inspired during the Visual march in the lake of Prespa. Visual march provided the means to create a travel in reality, or rather in realities of the landscape, Time and history. The procedure introduced the artistic practice of the artist-thinker-researcher that will focus on the creation of the artistic outcome in itself. This practice is separating itself from the prevailing practice dictated from the predominant Dantonian practice and its local representatives. The Dantonian practice relies itself by stabling the artist as a professional creator of self-referential works. Visual March in Prespes is the predominant request of artistic experience through life itself without the motivation for a professional return. The process is initiated and driven by the need to fullfill artistic goals, or –even better- for the sake of artistic practices itself [44].

An important part of the process is the research on artworks works exclusively created from materials derived from Nature that can also be absorbed to the environment. Along with that there will be a study of the way contemporary technologies can be used in that environment. In their most creative application the trails will explore any techniques that can derive from the experience of the landscape, in an effort of the artist to better understand and effectively communicate with the landscape and the environment [ibid].

4.2 Second Phase- Artworks/ Stimuli

The artworks were created with vegetal dyes from plants collected from the area with water from the lake Prespa and inspired and powered by the beliefs of Zarathustra (630-553 B.C.), Empedocles (circa 400 B.C.) and Aristotle (384-322 B.C.) that life is composed of four elements of nature: earth, air, fire and water. Thus, the artworks depict and were named after these four elements not only representing the balance of the environment, but also proposing a balancing coexistence with the environment (Figures 5, 6, 7, 8). The materials for their creation (herbs, water and soil)

Fig.5. Earth

Fig.6. Air

Fig.7. Fire

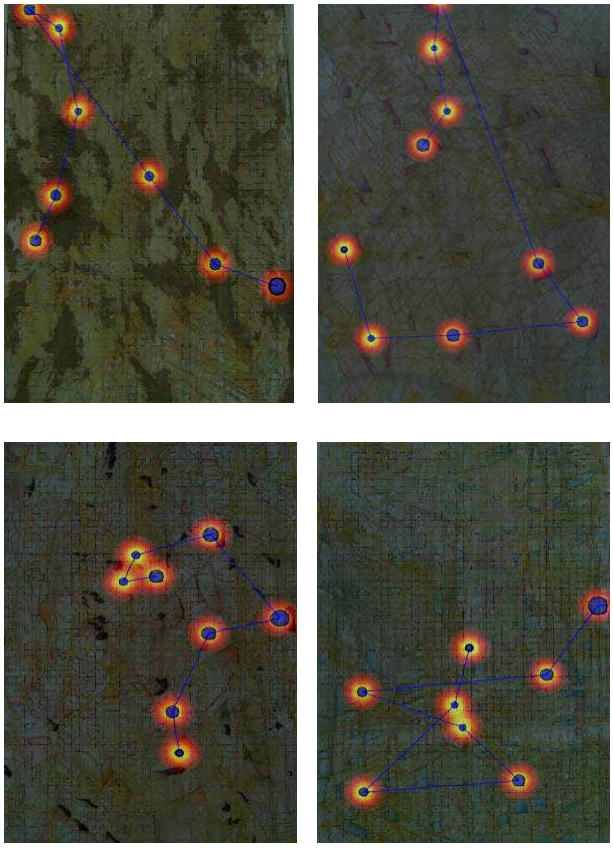
Fig.8. Water

Source: http://leonidasgkelos.com/artworks.htm [last accessed 31 August 2013]

4.3 THIRD PHASE- EYE TRACKING EXPERIMENTATION

Ever since Renaissance the body of the artist was placed against the object that was observed. The way the body perceives reality – the artworks in our case- and the way it shapes these stimuli into visual artworks is one of the on-going quests of art. The artist was calculating the distances, the angles. The experience of that result created space, as the artist perceived it. In contemporary art the body of the artist has become by itself the observer and observant as well. The body of the artist in contemporary art moves inside space and experiences the impressions of reality. ICT and more specifically eye tracking technologies provide the opportunity to externalize and materialize what is hidden and unrevealed, the reception of art as an active and continuously updated procedure. "Visual experience is dynamic" [3, p. 11]. Even, in Plato, Timaeus states that the eyes give 'gentle' light, "they formed into a substance akin to the light of

every-day life; and the pure fire which is within us and related thereto they made to flow through the eyes in a stream smooth and dense, compressing the whole eye, and especially the centre part, so that it kept out everything of a coarser nature, and allowed to pass only this pure element" [45]. Thus, he considers that the fire, which burns inside the human beings, comes out of eyes as a smooth and dense stream of light. Via eye-tracking this 'stream of light' was visualized and recorded on the paintings. A S2 mirametrix eye tracker [46] has been used for the project in the premises of the company MindsSearch in Athens. The aims was to visualize the mental activity and learn how the artist look at his artworks, where do the artist look first, what is the path artist's eyes follow, how the eyes receive the visual stimuli, and share the same visual reality with him. This is important, because the artist creates the artwork, but the experience of art itself is personal, unique and –most of the times- not easily recognizable by the artwork viewers, it leaves 'an ambiguous territory for the viewer to inhabit' [47]. The four paintings created have investigated the territory of artists' mind by means of eye tracking technologies (Fig. 9, 10, 11, 12). This kind of interactive art can visualize mental activity, thoughts and perceptions can provide the artist the opportunity to interact with the artworks and create new ones. "Vision is not a mechanical recording of elements but rather the apprehension of significant structural patterns" [3, p. 6]. Synergistically with nature and technology the new project cartography stimuli generated by thoughts and travels of artist's eyes, in order to construct rebuild images. It is possible to see what the eyes see, what information has been selected and the focus is directed, before any further mental processing, before the input to be interpreted by his brain.



Source: http://leonidasgkelos.com/artworks.htm [last accessed 31 August 2013]

The four eyelines have been merged and 'mapped' on the landscape from which the materials for the artworks have been collected into a cultural topography. Since abstract expressionism the body seems to be more and more present in the construction of the artwork. It is not accidental that Allan Kaprow considered Pollock to be his immediate forunner. For Pollock visual image is created from the movement on the surface of the painting/field. From then on, the idea of perceiving painting and visual surface is not considered as a screen of projection, but rather as an arena of gestures that has deeply influenced visual arts. The art since Pollock and the Abstract expressionists become bodycentric; the body is characterizing the image and not vice versa. Visual Arts are transformed from image-centric to body-centric.

Saccadic approach lies in that fine succession of artistic processes since 1950 that have placed their body in the center of their visual activity. Saccadic process offers a way to measure that approach. In this case the aim

was to reconstruct the materiality of the perceived object. However, in the saccadic process the accuracy of the recording is dematerializing the stimuli and what remains is the recording of the energy of observation. The most recent approaches of critical thinking are introducing ways to understand and shape visual image in their socio-historical content. Critical thinking is an effort to move beyond subjectivity and shape an understanding where reason becomes important in the analysis of visual artwork. The understanding that art is bodycentric and the use of saccadic processes as a method to objectify perception is adding further to critical thinking and allows in the broadening of methodology. Saccadic view is the very fine moment when human ability transforms the perception of something material to something that is the ideogramatic transformation of it. The artwork with the gigantic ideogram in the slope of the hill (Fig. 13) exemplifies that approach. At the same time he makes a very clear contrast between the concreteness and reality of the actual stimulus (landscate) to the way the saccadic process transforms it into something non-material. Somehow it is an immediate result of Aristotles' thinking: the interplay between the materiality of what is there to the way senses are shaping into a non- material outcome: the way we sense it.

Mapping the eyelines, Source: http://leonidasgkelos.com/installations.htm [last accessed 31 August 2013]

5. CONCLUSIONS AND FUTURE RESEARCH

In this paper the first results of DiBaB digital art research project were presented. ICT are used to trigger artistic and cultural expression as a basis for creating innovative forms of contemporary art, connecting applied art, such as painting with vegetal dyes with new media and eye-tracking technologies and acting as a source of inspiration in artistic explorations. It is also suggested that hybrid environments can permit a new perception of the physical space and materiality and get merged, transformed and reconstructed by digitality and new technologies, leading to a whole new understanding of art.

A continuation of the project has been scheduled, in order to test the scanpaths of various visitors groups, which is planned to be students from the Visual and Applied Arts Department, simple end-users and historians of art. The goal is to compare the similarities and differences. It is planned to create 3D models of trees -with the help of a laser scanner- from the landscape in Prespes that will be projected on the artworks. Furthermore, we aim to experiment with Kinect, a motion sensing input device and permit the movement of the 3D models of the trees on the artworks according to the viewers' movements.

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Movement-Music Relationships and Sound Design in MotionComposer, an Interactive Environment for Persons with (and without) Disabilities

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Abstract. MotionComposer (MC) is a device that turns human movement into music using state-of-the-art video based and 3D sensing motion-tracking technology combined with tailor made sound generating software. The device is developed particularly for disabled people, both for therapeutic reasons (encourage activity, stimulate motor control and sensing, coordination etc.), emotional expression, entertainment, and aesthetic pleasure. In this article, we will give a brief outline of how the device works. We then discuss movement-music relationships in general and how these can be mapped in video based systems like MC. In particular, we go into details about these questions regarding the *Particles* environment, one of several interactive environments included in the MC. For the latter, we also discuss issues of sound design, including narrative versus abstract strategies and different ordering approaches.

1. INTRODUCTION

Motion tracking technologies have gradually found their way into a number of areas in society the last decades, including in research, arts and performance disciplines [1]. These technologies detect human movements and turn them into analogue and/or digital signals, which in turn can be analyzed, converted and/or manipulated. Camera based motion tracking is an important part of this technological landscape, and the advantages of being non-intrusive and being able to detect holistic body movements has made it popular in dance, music and art installations [2]. These advantages also make this technology suitable for applications that aim at letting non-musicians express themselves musically through bodily movements and most especially persons with disabilities. MotionComposer is one such application. In this paper we will discuss some of its salient features.

2. MOTIONCOMPOSER – THE DEVICE

The MotionComposer (MC) is a device that turns human movement into music using state-of-the-art video based and 3D sensing motion-tracking technology combined with tailor made sound generating software (Figure 1).[1] It contains a video camera providing low-latency and high-resolution images, crucial for achieving "immediate" response from the system and with high accuracy. In addition, the device will be equipped with a custom 3D sensor, providing depth information, necessary for producing data about the user's localization and posture in front of the sensor, among other things.

The high-resolution video images and 3D data are first fed into a mini computer running custom motion tracking software. This software then produces many streams of high-rate control data (using the OSC protocol), which is subsequently passed to sound generation software where sound output is created based on the data streams. A tablet, wirelessly connected to the box, provides control of the functionality of the box along with a video feed from the camera. The user can thus localize him/herself in front of the camera and choose between available settings while the box remains stationary on a stable surface facing the user.

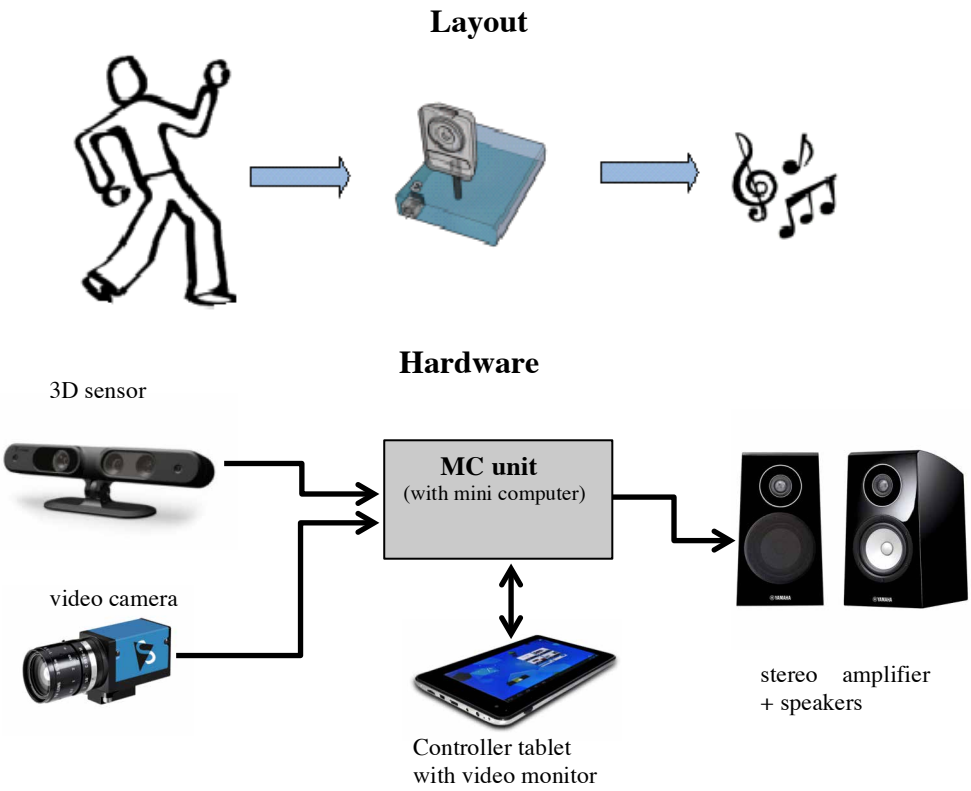


Fig. 1. *The MotionComposer device. Layout (top), hardware (middle), and software (bottom)*

While the MC device is thought to be a commercial product directed towards disabled users, we also want to apply the device in artistic projects, both because many of the developers have a background in artistic and performance disciplines, but also because we feel that the dynamics of artistic processes can open up new possibilities for the device. Lastly, the state-of-the-art technology implemented in the MC device lends itself very well to a range of artistic applications, including interactive dance performance and art installation.

3. MOVEMENT-MUSIC RELATIONSHIPS

3.1 GENERAL CONSIDERATIONS

Dance and music are two expressions of a single urge. Many languages have a single word for both dance and music (English does not). In Portuguese, when I say “Capoeira”, I am referring to something that is in equal parts a music and movement tradition. Small children begin to dance and make music without any understanding of what they are doing or clear distinction between the two. Dance and music have been practiced by every people who have ever walked the earth.

There are many ways to turn movement into movement; musical instruments for example. Still, the MC differs from musical instruments in a number of respects. For one thing, musical instruments are generally played with the extremities: fingers, hands, mouth, sometimes the feet. Dance, it is said, comes from the center of the body, the solar plexus. Dance is based on full-body movements, shifts of weight, swings, extension and contraction, angular momentum (turning movements). The MC project concerns encouraging creative movement of all kinds, not just the “controlling” kind we use when we want a repeatable result.

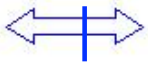
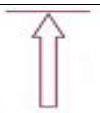
#	pictogram	name	Description
1		Small Movements	When the body is still, our focus naturally goes to the small and precise movements of our fingers, hands, eyes, mouth, etc. Because these gestures are discrete -- with clear beginnings and endings -- they lend themselves to strong association with discrete sounds, for example single notes in a scale or sound particles.
2		Gestural Movements	These are the typical movements we do with arms, hands and head (though any body part may be involved). They are fairly discrete, but in contrast to Small Movements, we tend to experience them as continuous modulations, curving up and down along with our movements.
3		Large Movements	Adults generally make large movements only during sports, running for a bus or in a genuine emergency. In any case, Large Movements are associated with high volume, high velocity (in musical instruments) and perhaps distortions of the same sounds applied to Gestural Movements. They can be mapped as individual "bangs", or bursts of high energy and, like Small Movements, are Boolean in nature.
5		Stillness (not moving)	While often overlooked, stillness is actually a special activity. It is not merely the absence of motion, since it generally requires concentration with specific intent. Nevertheless, it is something most people can do without much practice.
6		Center-X	Assuming we have a sense of communication in our movements, we usually assume a direction in the room we call "front". Movement perpendicular to this direction we refer to as Center-X. Center-X offers a one-dimensional location-orientation and maps well to content-bearing sound elements.
7		Width	Width is like expansion. When we stretch out our arms or legs we grow in size. Increasing loudness is a simple option, but there are other sound transformations that may more closely resemble this action. For example, think of the formant changes that occur as the mouth is opened wider and wider while speaking or singing.
8		Height	Height maps intuitively to pitch (up = higher pitch), but as with width, there are other implications as well. e.g. low = rumbling, tumbling, grumbling, growling vs. high = thin, flighty, suspended, stretched. Indeed, when a voice goes from low to high it is not simply the pitch that changes!

Fig. 2. *Some of the motion tracking parameters applied in the Particles environment, along with suggestions of mappings.*

Indeed, the MC limits ones control over the sound. For example, while it might give the user a high degree of temporal control, the choice of *which* sound is heard might be elusive and, to an extent, pre-selected by the software of the device with the intent that the sounds that come out of it are attractive. And there is another difference: When we make musical sounds directly through our gestures in space, it alters our proprioception. Our self-image is extended beyond the boundary of the physical body and into the (aural) environment around us. When these sounds are beautiful, and when we are convinced that we made them, an innate sense of joy and confidence results and it means that one movement leads to the next and the next. Explorative, creative movements is the result and this has wide ranging health benefits both physical and psychological, particularly for persons who, for reasons for mental or physical disability are limited in expression [2].

To convince the user that he or she has made music merely by making gestures in front of a camera, it is of crucial importance that the *mapping* of the system, i.e. how the movement analysis data is used to control musical parameters, is carefully set up. Through extensive experimentation and user testing, the MC team has over the years established a set of convincing mappings. In Figure 2, we have included a few of the motion tracking parameters we use along with some suggestions of how they can be applied (for a more comprehensive list, see [2]).

3.2 MOVEMENT-MUSIC RELATIONSHIPS IN THE *PARTICLES* ENVIRONMENT

One approach we are using is to base the aural environment on sound particles, short sound objects with duration of less than one second (0.15-1s.).[2] Naming the environment *Particles was therefore quite evident. These sound particles are either played individually, or in most cases, chained together in sequences. Thus, the sound synthesis part of the system for this environment could be characterized as a form of corpus based concatenative synthesis, with some similarities to systems like CataRT [4].*[3]

The sound palette of the *Particles* environment is based a high number of unique pre-recorded sound files organized in sets, each defining the sound "flavor" of one single environment. The user (or the therapist) can then switch between these sets using the controller tablet. One set should preferably have more than 50 sound particles to ensure enough sonic variability in the environment, and in many cases, one set can have several hundreds. In addition to providing variability, a high number of sounds in a set will warrant that even small changes in location will cause a change in sound particle, since the more particles one has in a set, the less one will have to change in localization to change the sound. This is important, because repeated triggerings of the same sound can quickly feel tiring to the ear.

Basic mapping. The mapping of this environment is based on the idea that that the localization of the user in the room (*Center-X in Figure 2)* determines the choice of sound particle (illustrated in Figure 3), and that the quantity of bodily activity *(Small Movements, Gestural Movements and Large Movements in Figure 2)* determines the rate in which the chosen particle(s) are played back (illustrated in Figure 4). Together, these two basic features make up an environment that is both highly intuitive, in that the user can feel and hear every movement, and very interesting sonically, at least if one is careful in the choice of sounds and their spatial layout. The idea is that the *Particles* environment should arouse not only an urge to move around, but at the same time feel these movements in the sound, but also that it should evoke interest and curiosity in the user for exploring the sonic richness and possibilities that the environment offers.

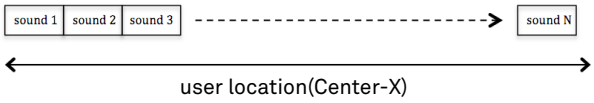


Fig. 3. *User localization orthogonal to camera direction is mapped to choice of sound particle.*

Sensitives. From a mapping perspective, the *Particles environment can offer the possibility of marking out discrete and precise points in time.*[4] This creates an opportunity for the direct correlation of single sound particles and *Small Movement* actions with a high degree of temporal precision. Short and discrete actions, like opening or closing an eyelid or moving a finger, can thereby result in a similarly short and discrete sound (see Figure 4c). We label this mapping element sensitives.

For more complex movements of longer duration we apply two different strategies: The first is based on what we call the *Creaking Door Principle* and the second we call *Clouds*:

The Creaking Door Principle. This principle says that typical human gestures (mapped as *Gestural Movements)* can be interpreted as a series of discrete particles much the way a creaking door sound is comprised of many small "creaks". When the door moves faster, the increased desity of the creaks will eventually create a pitched sensation. Thus, as movements progress from tiny to large, the transition is continuous and the creaks will take on a pitched quality, where pitch fluctuations correspond to variations in the movement dynamic (see Figure 4 a and b).

All this requires, however, that all the sound particles one triggers have a marked attack with a relatively homogeneous sound quality. Hence, it means that one needs to be careful in the choice of sounds to achieve the effect. When this is successfully achieved, one will experience a gliding transition between discrete temporal articulations and continuous pitched sequences, similar to those explored in compositions like Stockhausen's *Kontakte* (1960) and Henry's ÷(1963).[5] An additional effect caused by triggering a lot of sound particles in a short time, is that the sound intensity will increase markedly, thereby constituting a simple activity-to-intensity mapping, as suggested by Winkler [5].

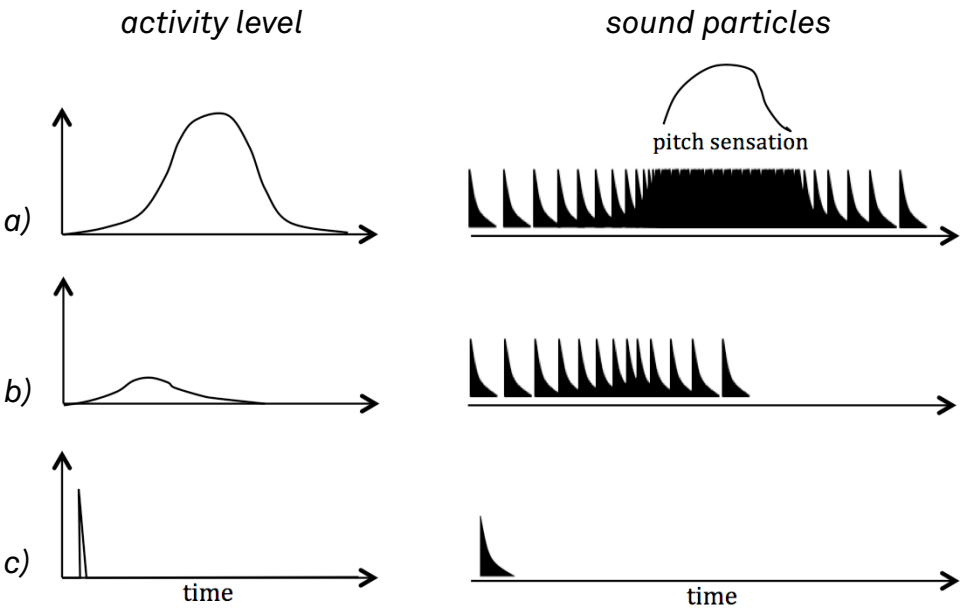


Fig. 4 a, b and c. *Activity level is mapped to sound particle triggering rate in the Particles environment. In a) and b), the creaking door principle is illustrated. Low activity, as in b), will give a chain of sound particles with a triggering rate corresponding to activity level. Activity above a certain level, as in a), will cause the rate of triggered sound particles to cross the threshold of pitch, so that a tone with a pitch corresponding to the activity level can be heard. In c), a discrete movement causes the triggering of a single sound particle.*

Clouds. This second movement-music relationship strategy for larger movements of longer duration depends less on precise temporal articulation and more on flow. By using a set of more heterogeneous sounds with gradual attacks one hears dense masses of sounds as the triggering rate increases above a certain level. Thus *high activity* will in such cases create a cloud with *high density*, whereas *lower activity* will make the sonic clouds sparse, until the point where clouds will dissolve and individual sound particles can be identified.

Through these two strategies, one can see how the characteristics of the sound particles and their assignment to correlates in human movement are integral to the design of intuitive movement-music environments. The choice of sounds and their ordering within such a system represents an equally important aspect of the process and will therefore now be discussed in more detail.

4. SOUND DESIGN IN THE *PARTICLES* ENVIRONMENT

In addition to an intuitive movement-music relationship, creating environments that spur explorative behavior and heighten aural curiosity and sensitivity for the users has been a second area of concern for the authors. Here, we have particularly been interested in exploring different weightings of variability versus continuity/coherence, locally as well as globally. Furthermore, we have explored different techniques for aiding the user's cognitive structuring of the sonic environment, among them using sounds with a high degree of referential potential and using over-all ordering based on acoustic properties. We will have a look on each of these issues in turn.

It became clear very early in the development that one of the attractive features of the *Particles environment lay in having a high degree of variability in the sound particles within each set. However, a lot of experimentation has taught us that variability in most cases needs to be balanced against sonic continuity, or the effect can quickly become one of chaos.*3 E.g. if one localizes many sounds with highly different characteristics in the immediate vicinity of each other easily, the relatively disordered result can in some cases be interesting, but tends to be tiring over time. At the other end, having too smooth transitions between sounds, e.g. using interpolated morphs in between recorded sound particles, tends to sound uninteresting and mechanic.

A nice compromise between variability and

continuity can be achieved by creating local zones for which the intra-variability is relatively small (using e.g. recordings of different excitations of the same physical objects), and where there is greater inter-variability between zones. This can potentially make the user want to explore the finer details within the zones, and subsequently seek greater changes by switching zones. This approach also has the advantage of creating cognitive markers for the users, thereby providing a mental structure for the sonic spatial layout.

Another strategy for creating a good balance between variability and continuity has been to order the sound particles based on certain acoustic properties, in particular spectral brightness and/or pitch. In that way, one can make the user go from duller to brighter, or low pitched to high pitched sounds when she or he moves across the space. This way of organizing the sounds is easily apprehended and understood by the users, and also allows for larger contrasts between neighboring particles.

Set coherence. We have also been concerned with giving each *Particles* set a particular identity or character, thus giving it an inner coherence. To pursuit this goal, we have explored the use of sounds made with a particular material or object, like glass or metal containers, sounds belonging to a common category, like orchestral instruments or synthetic noise sounds, and vocal sounds made by a single person. All these strategies have seemed to gain some success in creating an environment with coherence. Probably, it is not just the acoustic similarity, but also the sounds' potential for evoking associations that plays an important part here. Sound's associative qualities can in our experience play an important part in creating clear cognitive markers for the users, both for a whole set, and for a restricted zone within a set. By using zones with different associations, but which nevertheless are bound together by a more overreaching association, one can even build up complex environments. For instance, we are now working with putting different sounds together in a set associated with a forest: birds, water, animals and trees. Hence, we are approaching a highly narrative sound design, similar to what one can experience in video games and movies.

5. CONCLUSION

The collaborations of these authors, one a choreographer and one a composer, have been in the area of mapping and the search for interactive sound environments that give users a natural synaesthetic response, i.e. the sense of "hearing movement". This investigation, which seems at first to be straightforward, quickly grows in complexity into a deeply psychological quest involving kinesthetic awareness, proprioception and psychoacoustics. The interplay of these (in Western cultures) separate art forms – dance and music – correlated interactively, represents a rich and heretofore little-explored area of research, one with important implications for motion tracking-based performances and therapy for persons with and without disabilities.

The approach of the current work, involving sound particles – which are at once discrete, yet at the same time, when clustered, malleable and manifold in expressive quality – offers a promising general approach.

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ENDNOTES

1 It is currently under development, but most of the crucial hardware and software elements are already fully functional. While the technological elements are not yet integrated in a physical unit, the development plan includes the eventual integration of all technology for motion tracking and sound production in one single chassis.

2 This is what Curtis Roads would define as belonging to the sound object time scale: ”A basic unit of musical structure, generalizing the traditional concept of note to include complex and mutating sound events on a time scale ranging from a fraction of a second to several seconds” [3].

3 Although this system has implemented off-line feature analysis and sorting based on these features, the system does not currently use it.

4 This depends on, however, that the sound particles have an abrupt and marked attack that offer maximal precision to the temporal articulation.

5 Whereas the former piece of music uses synthetic sounds, the latter uses the actual sounds of creaking doors.

6 In some cases a chaotic feeling can still be interesting. E.g. we have a set designed by Goran Vejvoda using wholly synthesized sounds, which has a lot of interesting variety often verging on the chaotic.

MEDIATED BODIES

MEDIATED BODIES

Seeing Yourself Strangely: Media Mirroring and The Third Eye Project

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Abstract. There is a long history of technologies and techniques that seek to make the body strange through its mediated self-perception. Artworks that mirror the body through electronic media have often done so at points of disjuncture or distortion. Traditionally, such artworks have been interpreted as enframing or narcissistic gestures. However, it does not necessarily follow that this bodily strangeness is inherently negative, or even new. Recent research concerning phenomenology, cognitive science and philosophies of technology stand to contest this problematically hermetic approach to self-perception. Instead of presuming the pre-existence of a coherent body that is fragmented by technology, self-perception might be better understood as a cognitive act that is always already incomplete and technological. The nature and ethics of this mediated self-perception and its concomitant exploration of technological supports are the subjects of this paper, explored through the case study of Takehito Etani's *The Third Eye Project*.

1. ART, ELECTRONIC MEDIA, AND SELF-PERCEPTION

Seeing yourself strangely has long been seen as a destabilizing affair. A disquieting virtuality haunts our self-perception through technologies such as VR and digital video. Looking at ourselves through technology also seems to run the risk of cyborgic transformation-of bodies made alien or broken through the inorganic logic of visual media. It is out of a concern for the body and its social and epistemological importance that visual technologies of self-mirroring have been decried. Such perspectives, however, are arguably driven by a fear for the loss of a body that may have never existed in practice. An interrogation of the lived experience of embodiment, with its undisclosed techniques, propensities and supports, can intervene on these narratives, proposing new ways of accounting for the intersections between art, technology, and self-perception.

As suggested by a short appraisal of the history of video art, anxieties about virtual and technological bodies have clearly played a part in shaping the tenor of how electronic art has been interpreted. Much of this canon is figured in terms of a critique of the medium's tendency to alienate the figures it seeks to represent. Richard Serra's *Boomerang (1974) with its auditory aphasia, for example, has been alternatively described as a "prison" [1, p.53] or a "toxic media overdose" [2, p.75]. Similarly, Bruce Nauman's Live-Taped Video Corridor (1970), with its claustrophobic embodiment and retreating self-image, has been summarized as an "oppressive concept that is at the expense of the viewer" [3, p.24]. Perhaps most tellingly, Nam June Paik's TV Buddha (1974) is usually read as the dearth of spiritual possibility*-an ironic and biting commentary on the excessive reach of telecommunications media [4], [5]. If any form of embodiment is recognized in such works, it is more often assumed to be disabled by the media that support and construct these bodies.

Key to these ideas about electronic media is the presumed coherency of the perceiver who exists before representation-typically a body free of the virtual and technological conditions that are so effectively foregrounded in video. However, this appeal to a bodily integrity that precedes mediation is not supported by recent advances

in the fields of cognitive science, phenomenology, and the philosophy of technology. As these emerging perspectives suggests, embodied experience can be better understood as continuously incomplete, enactive, and contingent upon technological supports and extensions to the body's sensory world. It can thus be argued that video art and other forms of mediated self-perception, by consequence, do not so much alienate their viewers as expose the ongoing condition of their inherently fragmentary means of self-perception.

This perspective stands to significantly shift appraisals of self-perceptive media both old and new. Explored through an analysis of Takehito Etani's *The Third Eye Project (2002), it will be suggested that the virtual and technological disquiet of self-perception can be a profoundly productive condition. When the techniques of self-perception do not smooth out our own embodied strangeness, a more vivid portrait of the virtual and technological body can be reflected.*

2. THE THIRD EYE PROJECT

The Third Eye Project presents an intriguing experience of estranged self-perception. Donning the artist's device, the user's visual and corporeal understanding is profoundly altered. A pair of goggles blind one eye while exposing the other to a two-inch LCD monitor, held close enough to the eye-piece as to bracket out all other visual sensation. This screen is wired to a small, black and white surveillance camera, mounted above and behind the user's shoulders and cantilevered from bands of latex tubing wrapped around the user's head. What the user then experiences, through their monocular screen, is a live feed of their own back from an elevated, third-person perspective.

Fig. 1. Takehito Etani. *The Third Eye Project, 2002. LCD video monitor, surveillance camera, goggles, epoxy resin, latex tubing. Courtesy of the artist.*

The technological contrivance of this headgear could suggest a certain sense of alien futurity. Combined with the shaved head and white lab jacket Etani wears during performances of the piece (Fig. 1), *The Third Eye Project's outwards affectation appears to gesture towards an aesthetic of cyberpunk, the artworks of Stelarc and the techno-fetishistic cyborgs of science fiction. Peering into the device's screen, moreover, this sense of alienation is deepened. The familiar comforts of binocular, colour and frontal vision are replaced by the comparatively impoverished greys and grain of the video feed (Fig. 2). Estranged from human sight, this form of virtual self-surveillance seems at reify the familiar narrative of technology as a dominating force outside of and antagonistic to the human. Yet*-however respondent to common cultural fears this reading may be, such a conception of the body proves to be the very perspective that a more nuanced understanding of the piece stands to contest.

Fig. 2. Takehito Etani. *The Third Eye Project, 2002. Video still. "Times Square." Dual video documentation. Left: External camera's perspective. Right: Device feed. Available at http://vimeo.com/52445614. Courtesy of the artist.*

3. VIRTUAL BODIES

Part of the shock of wearing Etani's device is the degree to which one's body becomes dramatically virtualized. Rather than situating vision within the body, *The Third Eye Project shifts this site outside of its habitual envelope to a third-person perspective, mimicking the popular camera angles of video game avatars. This virtual image of a strange body to be piloted through space from some remove seems to weaken the user's connection between sight and a secure sense of materiality.*

In humanities scholarship at large, a great deal of hopes and anxieties have been raised on the subject of virtualized bodies, particularly around the figure of the cyborg [6], [7], [8]. However, as many contemporary cognitive scientists and philosophers of mind seek to prove, the virtual can be better understood outside of science-fiction and instead as a mundane function of human perception, ever-present in even the most technologically bare forms of embodiment.

Key to this perspective is an acknowledgement of the cognitive gaps and compensations that occur outside of our conscious apprehension. An examination of the physical limitations of the body's sensory organs reveals that sensory information is inherently fragmentary. Whether through blind spots, selective attention, or saccadic gaps, the paucity of the collected sensory data of the body contrasts with the richness of conscious experiences of perception. Consequently, cognitive scientists and philosophers have argued that our everyday ease and coherence in perception is an illusion-the result of active guesswork by various cognitive processes [9], [109], [11], [12]. This is to say, the perceived world is pitted with gaps later to be smoothed over with a supplementary virtuality.

An example of this argument can be found in the work of Alva Noë, a professor of both philosophy and cognitive science [9]. In his account of the perception of partially occluded objects Noë argues that the unseen aspects of objects are nevertheless present through our skill-based access to them [9, p.67]. By virtue of actively moving around objects one forms habitual conceptions of their holistic, sensory characteristics, described by Noë as a "sensorimotor profile" [9, p.78]. As objects are never fully and simultaneously disclosed, perceivers must navigate speculatively, relying on the learned contingencies of perception to fill in one's sensorial gaps as required. Perception, he argues, is thus profoundly virtual-a half-fiction that is constantly fact-checked against the perceiver's environment [9, p.52].

This rather mundane arena of experience takes on a more radical dimension when applied to the nuances of colour and detail in the visual field. As Noë explains, one's range of optical focus and clarity is unexpectedly small due to a poverty of sensory data from the periphery and the blind-spots of the eye. As a result, much of the visual field is more virtually present that materially mimetic [9, p.128]. No matter how close, consistent or focused the visual field may be, the atomicity of perceptual information is always lost to the holistic, virtually-enacted environment. This leads Noë to contend, "[t]he content of experience is virtual *all the way in" [9, p.134].*

This concept of the virtual as inherent to the phenomenology of perception, yet also somewhat undisclosed by its role in the unacknowledged dimensions of visual fields, suggests that Etani's work may reveal a strangeness that was always already there. The back of one's head, never directly perceived through the frontality of human vision, is nevertheless virtually rendered by a perceiver's sensorimotor profile of other human forms. Etani's device, therefore, merely virtualizes what already exists as virtual content: a part of the body that is absent from normal optical access to one's own form granted by the forward orientation of the eyes.

Consonant with the virtual and mediated nature of all perceptions of the self, *The Third Eye Project* does not render the back with particular clarity or unbroken ease. Instead, the visually grainy and staccato nature of the feed draws attention to the mediation of the image, refusing to bring the image into an illusory fidelity that might disguise the fragmented and enactive way in which we see. The technological stamp of the image, with its granularity and visual artifacts, can also follow a similar turn of argument. After all, there can be no direct or 'natural' way to view one's own back; this part of the body must by necessity always be mediated, whether through mirrors, photographs or video. The camera thus poised might be more readily understood as a technology of perceptual introspection rather than one of domination and de-humanization.

These two forms of deferred presence-that of the technologically-mediated image and that the sensorimotor imaginary-might be productively coalesced into a continuous category of virtualization. This is not to say, however, that the departure from biological to technological forms of perception presents an inconsequential shift, but rather that this externalization is a secondary process of an existent mechanic.

4. TECHNOLOGICAL ETHICS

Normalizing virtuality, however, does not exhaust the critiques of mediated self-perception, nor the content of *The Third Eye Project.* Several factors in the work alert the viewer to an undercurrent of biotechnology, from the naked circuit board of the headset to the white laboratory coat. The goggle's blinding eye piece, moreover, has a disparately organic shape and a bone-like colour and texture (Fig. 3). In a continuum from flesh to machine, wires and electronics are mediated into the body via translucent straps and tubing, bridging the technological and biological.

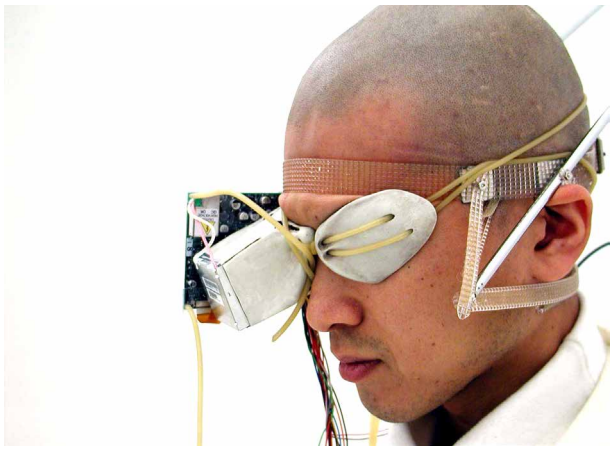

Fig. 3. Takehito Etani. *The Third Eye Project. Detail. Courtesy of the artist.*

The artist himself describes the work's aesthetic in terms techno-tribalism [13]. While referencing the imagined figure of the cyborg of the future, Etani also attempts to reach back to the prehistoric origin of tool use in his appropriation and mimicry of natural materials. In a somewhat shamanistic gesture the device was built to resemble a bird skull, echoing bone and sinew and punning on the notion of the 'bird's-eye-view' offered by the camera [13]. Technology thus figured suggests a rather more complicated trajectory than one of pure futuristic speculation. Instead, Etani's gesture is one of a return, reversing the forward-looking gaze to encircle the whole of the human-technological relationship and its role in self-perception.

The complicated origin of technology and the specter of its dehumanizing possibilities certainly pre-date contemporary anxieties of the virtual or the cyborg. Martin Heidegger, most famously, outlined the dual root of technology as a means of both revealing and enframing the natural in his essay "The Question Concerning Technology" [14]. In this work his somewhat nostalgic privileging of the craftsmanship of the past is contrasted against the technological industry of the modern period seen to so radically shift the essential and natural into an artificial standing-reserve of commodities. By Heidegger's calculation, this technologically-ordered world with its lack of autonomous objects and natural propensities, risks a dangerous solipsism wherein "man everywhere and always encounters only himself" [14, p.27].

Even this outcome, however, seems charitable when his argument is extended further to include the contemporary ways in which the body is measured as a technological potentiality. One of the predominant fears raised by cybernetics has been that of an attenuation of humanist values and the loss of the bodily integrity of human identifications [15]. As the argument goes, to see oneself as plastic tissues and prosthetic possibilities is to lose sight of the ethics and standpoint of the human condition.

These anxieties about the technological trap of visualizing entities as a standing-reserve also have a history in the visual arts, particularly that of new media. Renowned art critic Rosalind Krauss, in her historic appraisal of video art, describes the medium as inherently narcissistic, engendering an insular, psychoanalytic frame for the user to delight in their own objectified image [1]. Video's illusory erasure of the division between subjects and objects, rendered through Krauss' Lacanian frame, troubles the theorist as it seems poised to deny the materiality of art and its intentionality towards an external audience. Described as an "instrument of double-oppression" that threatens the viewer's sense of temporality and subjectivity, Krauss situates video as something for artists to expose and exploit [1, pp.58-59]. This Heideggerian paradigm, with its deep suspicion towards the technicity of self-perception, has largely foreclosed alternative appraisals of such media.

Yet, just as self-perception is an inherently virtual act, so too is it by necessity a technological one. One's sensorimotor profile of the body is

learned and iterative, adaptive to multiple techniques and mediations [9]. Through reflections, mirrors, photographs and video, a continuum of technologies support an extant practice of bodily understanding. This ability to imagine and inhabit avatar images of ourselves and others might even be said to lie at the originary point of many cultural technologies. As Maurice Merleau-Ponty notes, the architectonics of the body and its embeddedness in reciprocal forms of onto-phenomenological space (i.e. 'the flesh') form the preconditions for language, the most widely celebrated and humanized of our technological feats [16, p.155]. Mark B. N. Hansen, moreover, inverts and strengthens this claim, arguing that it was tool use's delocalization of sensation that created the conditions for the "mixed reality" of the flesh's shared sensorium [17, p.9]. If the phenomenological virtuality of the body is inextricably tied to our use and deployment of technology, then the extent to which technological forms of self-perception are necessarily enframing can be problematized.

In and as far as Heidegger claims that technology enframes, its converse potential to reveal might be further expounded-be it the disclosure of new forms of understanding or faces of truth (*aletheia*). In an example of such a feat, Heidegger describes the triumph of "things" in contradistinction of mere objects in his account of the four-fold resonance of a jug [18, p.179]. Things, by reflecting and coalescing external qualities, gain a special ontological status quite antithetical to the supposed narcissism of video. This mirroring, rather, is a multidimensional reflection, that encircles the whole of an object and its larger context, displaying its environment in its totality. As Heidegger writes, "[w]hatever becomes a thing occurs out of the ringing of the world's mirror-play. Only when… world worlds as a world… does the ring shine forth" [18, p.182]. This literary mirroring in his prose further illustrates the point: reflections and mirrors are not inherently narcissistic objects, but may rather act to conjoin disparate components of an external whole. Moreover, if one is to accomplish such a gesture within the limits human sensorium, this perception must by necessity be augmented and mediated through technology.

Philosopher David Wills, in his examination of the wider anxieties precipitated by the humanist critique of biotechnologies, follows Heidegger's gesture of ringing to situate technology as a dorsal force. Looking at the origin of tool use at the point of bipedal development in human evolution, Wills argues that the erect posture of *homo sapiens*, with its perceptual inattentiveness to the back, is the origin of technology and its unacknowledged site of enactment [19]. Through the metaphor of ambulation, Wills suggests that the perception of linear progress (i.e. walking in a straight line) is an oversimplification of a technique by which each step forward is rendered through a turn towards the back. It is thus only through a series of opposing turns and over-corrections that the body is propelled forward. The dorsal face, however, remains alien and unseen, leading to a miscategorization of movement and technology as purely frontal. If technology is defined as, per Heideggerian enframement, something external to the human, generative from its capacities but not a part of its body and substance, then the dorsal has been problematically forgotten. With the technological back unaccounted for in our sense of self, Wills notes a lacuna in our humanistic definition, thus "we are not completely human and can never become so" [19, p.62] under such terms. At the heart of the anxieties raised by the cyborg, then, is a fearful acknowledgement of this internal stranger-this dorsal presence. Just as the flesh is to Merleau-Ponty an "anonymity innate to Myself [sic]," [16, p.139] to Wills, the dorsal is "the unassimilable foreignness of that misrecognized self" [19, p.35]. As with most monsters, we fear in them that which we deny in ourselves.

In this context, *The Third Eye Project* seems to be a direct gesture towards revisiting and admitting the disquieting coexistence of the technological within the human, though this aspect may not be at first recognizable as such. Seen through technologically-mediated vision, Etani's user comprehends their own back, forced to see the rear of their head with its technological protrusions (Fig. 2). Their deferred depiction of themselves is presented without its recognizable features. There are no familiar facial traits and, in contradistinction to the learned habit

of the mirror, the movement of the right hand is not represented through the inverted left. It is thus a challenge to learn to recognize oneself through the back. In this respect, the dorsal turn of the artwork might create the conditions for a more direct relation with this internal stranger. Turning the frontality of the gaze in on itself by shifting from the internal, subjective body to its own external architecture, *The Third Eye Project* stages a relation with the self's own undisclosed supports-the technological Other.

The device thus presents a chance to chart new forms of self-understanding. Engaging with this back-turned form, learning to mobilize it, and make sense of the world from its technologically-augmented perspective, suggests not only a return the disavowed back, but a way of re-inhabiting it. Indeed, users report as much in accounts of their embodied experiences with the device. Pushed slightly beyond of the envelope of their skin, participants report feeling a partial out-of-body experience, floating within and between the camera and their shoulders [13]. Explicitly aware of their identification with their own interfaces, both bodily and digital, the users' phenomenological extension joins with that of the technological to pass full circle from the frontal to dorsal body.

5. CONCLUSIONS

This strange figure leaves this discussion at a curious point of departure. The circuitous path of its mirroring reflects a new kind of portrait of the human as supplemented, full of gaps that are filled by perceptual techniques and mediation. Nevertheless, such a portrait omits less than one that presumes the coherence of a body prior to the actions of the external forces of technology and virtuality. By returning this critique to its internal source within the human, it may be possible to gain a deeper sense of responsibility and coextention with the technologies and bodies that incite such fears.

Turning to the back, towards technological and virtual perception, ultimately stands to invite new ethical possibilities. An art and art history of the back-of the gaps in our vision, and of our own disavowed technicity-might provide fertile ground from which to better encounter electronic media and mobilize their potential to mirror that which is undisclosed in our own limited understanding of our bodies. Thus, as the reflections on the visuality and the bodily turn of *The Third Eye Project* suggest, fears of dehumanization and narcissism may actually inhibit an introspective appraisal of our virtual and technological propensities. Seeing the body made strange, it may be suggested, can be a means of self-understanding rather than solipsism, of reflection rather than enframement.

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The Stethoscope and Its Influence from the Telegraph to Sonic Body

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Abstract. The art installation Sonic Body is inspired from previous technologies and practices of hearing to the sounds of the human body, such as the stethoscope. The stethoscope influenced the evolution of the 19th century's sound machines. Throughout this connection is created a short genealogy of the most important sound regime that governs the modern era and even today forms the society's primary perceptions of the human body. Since the establishment of that sound regime the human body is the most popular profitable resource that marked the capitalistic notion and still governs the contemporary media market.

1. INTRODUCTION

The human body consists one of the most important research subjects in the postmodern era, as it is one of the first issues that preoccupied the human mind in terms of science. The research of its composition and qualities began from the ancient times although the knowledge for it continued to be configured and supplemented from various scientists and philosophers throughout history. The great breakthrough though happened in the 19th century, when the body and its functions were associated with machines and generally mechanistic functions. From then and on, the human body began to provoke interest not only as an autonomous unit which functions to perform the processes that produce and maintain life, but as a social subject claiming his share in history. Therefore, the process of connection between the body and the various machines didn't stop though changed in content and meaning.

During this process important role preoccupy the sounds that the body produces in a voluntary or involuntary way. Body sounds contributed in the development of audio and later audiovisual technologies. Until today the research of body sounds has not stopped. This tendency is often expressed throughout artworks or art installations mostly within contemporary and new media art. The majority of these artworks deals with the relation between the body and the new technologies, and tries to enhance and improve its relation with older technologies. Scientists, artists and philosophers invent new ways of study for the body and its sounds, without excluding technologies of timeless character, as is the stethoscope.

2.1 ARTWORK AND ARTISTS

For instance, **Sonic Body** (2007) is a new media artwork, which combines the scientific knowledge along with the artistic features and indicates the notion of modern society towards human body. It has been exhibited in 2007 at Blank Gallery, in Brighton, England and in 2008 at the Move Festival in Spain[1]. This is a project that deals with the sounds of the body and treats them as active and productive elements of human organic and biological status. It is an audio art installation that uses interactive technology to

create an orchestra of the human body. Three different artists collaborated for its creation, Anna Orliac, Harry Neve, Thomas Michalak, along with the heart surgeon Francis Wells to discover non-acoustic sounds of the body.

The installation appears on its exterior as a neutral cylindrical pod. But inside is a red, warm, tactile, multi-sensory space filled with oversized forms that represent the shape of the body's internal organs. Through the artwork's webpage, we are informed for the interactive character of the installation, "*The public is invited to interact and "play" with the organs, to touch, to strike and to explore them*". This creates a symphony of sounds coming from inside the body. The sounds are recorded within the body and are formed so as not to lose their natural mode.

Sonic Body, however, is not only an art installation. Initially, it constituted a personal experiment in the form of a personal performance, with all sounds recorded within Harry Neve's and his partners' bodies. The artwork is inspired from the traditional medical practice of listening to the body to diagnose illness. The artists intended to explore the scope of sonic activity that exists within the human body. During the process the artists received help from medical consultants in order to understand which organs produce sounds, when and why. For the recording of the selected sounds, the artists used conventional medical equipment, such as stethoscopes, as well as more unorthodox devices, such as a hydrophone[2].

2.2 ANATOMY, AS AN ARTISTIC TOOL

The installation draws on basic medical knowledge and practices that occupied the human mind since the Renaissance. At that time the interior of the human body was studied, due to the rise of anatomy as a new medical and scientific tool. Anatomy influenced the renaissance's artworks, such as *Anatomical studies (leg and larynx)* by Leonardo Da Vinci[3]. Therefore, new knowledge about the body and its functions are among others the subject of artistic creation in each era. Today, Sonic Body similarly expresses new knowledge about the body in late modernity, since it studies the internal organs of it and the sounds that they produce. The practice of research within the human body reflects a cultural logic that drove artists from the 16th century and on to study anatomy and render on canvas the body in a way that reveals the inside. Although Sonic Body follows in a catalogue of numerous artworks through the ages that represent and research on the body's interior environment, at the same time is differentiated from these artworks of the past because of the result that characterizes the whole installation. Sonic Body is an augmented not-so-human replica of the average human body that provokes the spectators to interact with the interior of a body presented both as their own and as a neutral object. The spectator feels the need to dominate the organs, and the tissues that are found in the oversized interior of the cylindrical pod, in an attempt to dominate his/her own organs, to hear them, talk to them, and in a weird way to communicate with them.

Anatomy, as the main science during the early modern era of Europe that sees the human body in an objective way, brought the avocation with it in the center of historical and scientific studies, turning it into an object for further exploration. During the 17th century, anatomy's development and introduction as an official medical practice, urged people to study the organs of the human body according to the general characteristics which where needed to describe them as is the shape, the form and the sound that governs them. Anatomy influenced the other medical fields and they, in turn, affected the social and economical picture until the industrial revolution's century, where the whole society was seen, through the distorted eye of machinic lens, as a vast field of body sounds that had yet to be discovered, dominated, controlled. The big breakthrough, about the perception that people had for the body was in the 19th century, when its functions were associated with the factory, the dominant production unit of the 19th century.

2.3 THE ROLE OF THE HUMAN BODY IN THE INDUSTRIAL REVOLUTION

The body, therefore, became during the 19th century an active subject of historical development. The story begins with the realization by Helmholtz and Muller[4] that the human senses operate separately and independently.

This knowledge came to the fore because of the urgency for the study of the body's senses, created by machines. The 19th century is the century of the industrial revolution and the creation of machines that operate in parallel with the body. At the same time the factory was created. Inside the factory machines and people co-existed. The body was associated with the machine and its functions, thus given rise to the thought that the body operates like a machine. This means that the body was no longer a single entity, but consisted of different parts and systems that operate in a coordinated manner. Next is that the same thing happened with the senses, which do not operate as a single entity, but independently. Then the body was studied as if it were itself a factory with many different machines, which were working in a coordinated way to preserve themselves.

Since the senses functioned autonomously, the man of the 19th century had to find a way to conquer and control them. Hearing, as one of the five senses, played an important role in this century because of the primary concern that the 19th century's society had towards listening to the internal sounds of the body and managing them. This way the man could impose its sovereignty over the body and reshape or enhance it. If he succeeded, he could coordinate the work at the factory, resulting in methodical production, which would generate more profit. All this led to the formation of a new regime, where people worked together with the machines that surrounded them, learnt to listen and to handle them without being distracted from the given task.

2.4 THE STETHOSCOPE AND THE SONIC REGIME IT CREATED

This new regime is actually a sound regime formed and consolidated after the discovery of the stethoscope by Laennec in 1819[5]. The stethoscope was an invention which allowed the doctors of that time to listen precisely to the sounds of each patient's body. The sounds of the body vary depending on whether it is healthy or sick, and help in the diagnosis of disease. The stethoscope was highly influential, and a few years later was being taught to the students of medicine, while its use was taken for granted.

Hearing the patient has been done, until the invention of the stethoscope, when the doctor's ear touched the body, usually the patient's chest. So he could hear the sounds of the body and interpret them accordingly. However, this method was not always effective, since the doctor often had trouble hearing the sounds correctly due to the nature of the patient's body or the social and cultural characteristics, which govern this kind of examination. Also, in many cases the sick body could transmit the disease to the doctor, if he approached close enough. Social differences and technical reasons, such as gender and fear of disease transmission, play a major role in the consolidation of the examination process with the stethoscope[6]. With stethoscope the nature of the medical examination has changed, as the doctor no longer need to lean over the patient's body. The examination was no longer done in a direct manner and became mediated, since between the body of the doctor and that of the patient interfered the stethoscope.

But the stethoscope did not only serve for that reason. By using it, the doctor was able to isolate each sound, to study it and to interpret it. The diagnosis happened in a much more accurate way and according to Jonathan Sterne "*The doctor became the first person in the 19th century who learned to listen "alone together", while interacting with others*"[7]. This happened because the doctor and the patient were not usually alone during the examination process, as there were also the patient's relatives or the doctor's students. Therefore, the room, where the examination took place, involved many sounds, but the doctor would only be interested by one sound at a time. Using the stethoscope, the doctor could find the sound he was interested in, study it and identify it. That way, the doctor became the first professional of the sound transmission since the stethoscope helped him to isolate the sound he wanted to listen to, while excluding all others. From the 19th century and onwards, the modern society lives in this sound regime, as the practice has passed by the medical sector, to the factory and then in communication ways of everyday life, through machines that transmit sound, such as the telegraph.

2.5 THE TELEGRAPHER AS THE FIRST TRAINED PROFESSIONAL OF SOUND TRANSMISSION

The "alone together" sound regime, which the stethoscope launched, is also a technique that helped in the improvement of the already invented telegraph. The stethoscope's impact is profound when we observe the evolution of the telegraph, "*the father of all media*"[8], to quote Friedrich Kittler's words. The Morse telegraph (1837) is a machine that transmits sounds. The sounds are coded with the universally known Morse code, which consists of dots and dashes. The telegrapher is the person who operates the telegraph, decodes and interprets the messages. In order to do that, the telegrapher has to read the dots and dashes that the telegraph prints on paper. That is doubtless a procedure that takes a lot of time. But, time in the capitalistic realm of the 19th century is translated to money.

The telegrapher had to change his tactic, concerning the received message and instead of reading it, hearing it. Hearing made the work a lot faster than the reading, because the telegrapher didn't have to wait for the written message and then interpret it, but he decoded it as he heard it. This change was not easy, because the telegrapher was hardly ever alone during his work time. Other telegraphers or customers waiting the arrival of their messages occupied the same room with him, or even the same desk. The telegrapher had to listen to the message, isolate the sounds of his machine, the difference between the sound of the dots and the dashes, and at the same time to exclude all the sounds and the noise of the room, in order to interpret it. Telegraphers are the first group of people that was actually trained to the aforementioned sound regime "alone together"[9].

This new historical subject that emerged during the 19th century, following the example of the doctors who used the stethoscope, influenced in many ways the modern society. Medicine invented the object which started the new sonic regime, telegraphers were trained that way to decipher the messages more quickly and people learned to listen according to the new sonic regime, through a series of sound machines and devices that used daily during work, entertainment time and education. The bourgeoisie exploited sound, in order to make the messages faster and increase their profit. That is one of the reasons that capitalism is closely connected with sound machines and seeks body control.

2.6 BIOPOLITICS DURING THE 19TH CENTURY

The body is one of the main sources for exploitation during the industrial revolution. The whole 19th century is dedicated to the control of the human bodies, whether these bodies were people who worked in factories, people who operated machines in general, like the telegraphers, or people who just wanted to entertain themselves. So, the true profitable source is not other than the human body and its interior functions that the stethoscope, combined with the knowledge that anatomy offered during the previous centuries, brought to the fore. The body sounds for the doctor are as valuable as the Morse code's sounds are for the telegrapher. Both sounds must be distinguished and isolated, for their correct interpretation by the human subject that operates and manages either the human body or the telegraphic machine. That way the factory worker had to learn the sounds that his machine emits, in order to avoid wounding himself or damaging the machine.

The modern society always seeks control over the human bodies. This notion of control may be expressed in more than one way. Gender, race, social class, status, caste, economical status, health, age, and so on, are all ways of control that society wants to impose over the human bodies. Foucault synopsized all these in one phrase "*Biopolitics*"[10]. That is the reason why so many sound machines, audiovisual machines, or media are some way related with the functions, sonic or not, of the human body. Human body is the eternal and renewable stock source that produces profit. Even more in the late capitalist era, the notion of control over the body imposed the creation of numerous machines through which we can see the interior of our body, hear it and rediscover it. The body is still considered to function as a machine and worse is also used as one. And, historically, this is not the first time that something like that happens.

2.7 HUMAN FLESH ATTACHED TO SOUND MACHINES

In 1874, Bell and Blake invented a sound machine, called the "phonoautograph-ear"[11]. The phonoautograph-ear is a sound recording machine of the 19th century that has a peculiar trait. The phonoautograph-ear has a human ear attached to it. The ear is an integral part of the machine and useful because of its ability to receive sounds. Graham Bell's wife was deaf and he was trying to build a machine that would hear sounds for her and record them to a piece of paper. Deaf people in 19th century were considered in the same rank with animals. But if there was a device that would hear for them there would also be a chance that deaf or generally disabled people would be socially accepted. So, the phonoautograph-ear was a machine intended to reclaim and reform the human bodies of the disabled. But, besides Bell's interest in this procedure there was a perception in 19th century's society that desired the building of these machines and believed that they would be profitable. During the 19th century sound machines were the capital for the bourgeoisie, as long as they could reform and enhance human bodies. The phonoautograph-ear demonstrated the power that certain bodies had on other bodies in the same society, and in a raw way how the human body can be a mechanical part of a machine.

2.8 CONCLUSION

New media art is an artistic practice that promotes the collaboration between many scientific fields and Sonic Body constitutes an example that verifies that technique. Sound machines of the 19th century are presented here in order to show that the human body, since the capitalism was established as a social and economical regime, represents the main capital for exploitation aiming to profit. The sounds that the human body creates play an important role, since many of the sound machines of that era were inspired from the internal functions of the human organs and tissues. These sound machines were later transformed into the first media, which formed a mass culture and forced the human bodies into very specific movements, attitudes and functions. Sonic Body, in its own unique way, criticizes this turn of events in history, and at the same time proves that the media culture is now more than ever engaged with the human body and its internal sounds. During the period of time that the installation was exhibited, people interacted with the organs and the tissues, and the sounds of their own oversized body sample in a mediated way, which was yet very intimate and personal.

This shows not only that the media and body culture are complementary on each other, but also that the human body is known and experienced in a mediated way that is camouflaged to look personal. Everything about the body in the postmodern era is either mediated or virtual. We can see and transform the inner organs of our body anytime using medical devices that form our opinion about it. We play with our organs hearing their pre-recorded sounds, as it happens with this particular installation. Media, whether they are sound machines, mass media communication micro-devices, or medical structures and equipment, continue to form the society's opinion, the view, the knowledge, the experience and even the language used to describe the human body. Biopolitics and media culture are now co-operating, while the international media market seeks one more way to keep the audience's entanglement with the human body a playful but profitable activity.

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ENDNOTES

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Pulse Project: An Encounter between Art, Science, East, West, Self and Other.

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Abstract. This paper introduces *Pulse Project*, (2011 -) a performative sound study that brings informed touch together with early Chinese medicine and music theories and SuperCollider (a real-time audio synthesis programming language) to create unique soundscapes expressive of the interior aspects of an individual's embodied being. These soundscapes are not sonifications of western principles of the circulatory system but offer another perspective from which to conceive of and listen to the interior spaces of the body. An intuitive method of diagnostic touch is used as an instrument for creating an alternative approach to the composition of embodied soundscapes in order to counter the trend within 'interactive' media that places its emphasis on the mechanical measurement and mediation of participant's vital signs, i.e., sonifying data from biosensors, etc. as the golden mean for representing the interior of the body and embodiment. [7]

1. INTRODUCTION

In this digital performance-sound study, pulse reading is used as an instrument of convergence between art and medicine, east and west, past and present, self and other. Drawing upon my experience as an artist and clinical acupuncturist with training in biomedicine, I use pulse reading to compose algorithmic soundscapes and graphic notations to interrogate the dominant axioms underpinning western medicine and digital technology through the exploration of their corollary 'other' - pre-modern Chinese medicine and music theory - in order to generate a new conceptual approach towards embodiment and soundscape composition.

Each participant's pulse is interpreted as a unique set of sound-wave images based on the theories of traditional Chinese pulse diagnostics (a complex set of 28+ waveform images corresponding to mental/ physical states of being) and also in accordance with traditional Chinese music theory. [7]

2. PULSE PROJECT

Pulse Project, (2011 -) is an art-as-research study that explores Chinese pulse diagnostics as a unique source for connecting art with science and for connecting performance with sound studies. This project investigates the use of intimate touch as a means for connecting with others and for producing embodied sounds that explore the intersubjective space/time between self and other. It is important to point out that the participants engaged in this research are of equal importance to the aims of research and the role of the researcher (myself) within the study. [6] What makes this study different from other sonic studies is its exploration of the sonic possibilities within the interior of the body when considered from a perspective alternative to standard practice in western medicine and technology. [7] In using pulse reading to touch upon the internal oscillations of others, touch is used as a method of intensive listening that enables me to translate the oscillations of subtle energies and flowing of blood within the interior universe of another into a uniquely individualised soundscape. The palpation of pulses requires many years of practice to develop the sensitivity to enable the practitioner to read pulses with accuracy. [4]

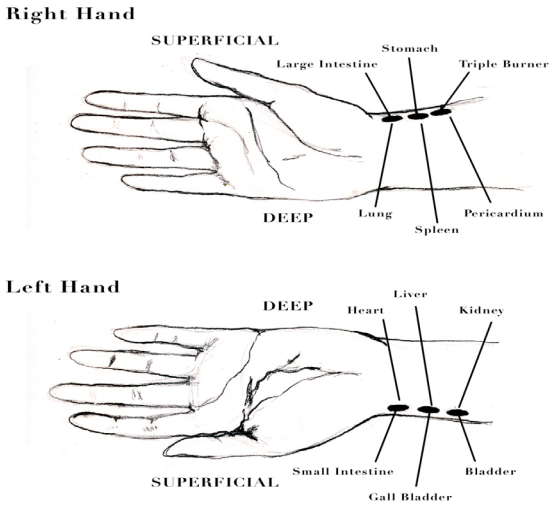

Figure 1: *Chinese Pulse Positions (2013) © Michelle Lewis-King.*

Each wrist has three positions where the practitioner's fingers are placed in order to palpate the pulse and this makes a total of six positions of palpation altogether (as demonstrated in Figure 1). From each position on the wrist (indicated by the dark circles) the practitioner registers at least two levels from which the pulse waveform qualities can be felt and are referred to as "superficial" and "deep." These levels are also associated with specific organs and networks (see Figure 2). For the purposes of differentiating the traditional Chinese conception of the organs from those of occidental medicine, Chinese "organs" are capitalised in this text and are not to be confused with the western biomedical understanding of these organs. [7]

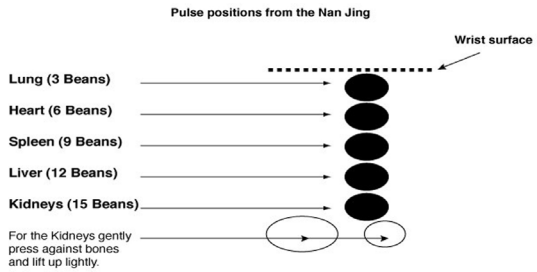

Figure 2: *The Nan Jing Pulse Classic Diagram (2013) © Michelle Lewis-King.*

There are multiple methods for pulse diagnosis in Chinese medicine. For example, according to Chinese scholar Paul Unschuld's translation of the ancient text *Huang Di nei jing su wen,* a text that is attributed to have been formulated from between 206 BCE–220 CE, [11] each pulse has a position and depth at which it is meant to be palpated at. [1] [10] For example, at one end of the spectrum, the register of Lung waveform images is ideally palpable at the pressure level of three "beans" and at the other, the register of Kidney waveform images are ideally palpated at the pressure level of fifteen "beans". (See Figure 2) If the waveform image arrives at the "wrong" position, i.e., palpated in a place other than where it is meant to be, this has clinical significance. For instance, if the practitioner feels a percussive "bowstring" sensation, which belongs to the register of Liver/Gall Bladder wave-images, at the level of 3 beans (3 beans is at the level of the Lung/Large Intestine register of waveform images – refer to Figure 2) instead of the location of 12 beans (at the level of the Liver/Gall Bladder register of waveform images – refer to Figure 2), this means a discordant relationship is developing between the Liver and Lung organ networks. [1] Each of the organs and networks (known as *zàng-fǔ*)[1] are also associated with an element, colour, tone, etc., which is further discussed in the "Composition" section below. [7]

Figure 3: *Pulse Reading 2 (2013) © Michelle Lewis-King. Photo: Nick Fudge. Participants appear with consent.*

The performance itself is staged in a public space using simple props such as a table, chair, notepaper, ink, brushes, acetate, a laptop and a white coat. Given the proper permissions, this performance is easily introduced into most public spaces and always attracts the attention of onlookers. In the interests of ethics, interested participants are asked to review the provided 'Participant Information Sheets' and give consent before taking part in the performance study, thereby circumventing key ethical issues.

Participants' pulses are individually recorded and interpreted. The collection of data is modeled on an ethnographic medical history or "case-study" basis. (See Figure 3) Clinical impressions of participants' pulses are first notated with clinical descriptions, (See Figure 4) e.g., "bowstring," "slippery," "replete," and so on. The qualities of the pulse such as speed, vibratory sensations, fullness, emptiness, etc., are also recorded and form part of the hand drawn graphic notations. The drawn lines in the graphic notations mainly describe the oscillations of the organ-networks (channels). Each participant is given their individualised graphic notion during the performance (see Figure 5) and a SuperCollider (SC) soundscape file composed uniquely for them is also sent to them post-event via email. The graphic notations and "clinical" notes are used post-performance to translate each person's pulse into algorithmic compositions using SC. (Refer to Figures 4, and 5) The notations and compositions of each participant constitute individual samples of the overall research project that is archived online on soundcloud.[2] [7]

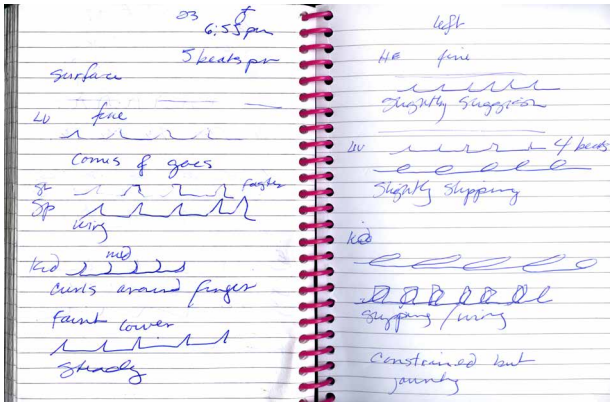

Figure 4: *Clinical Notation 1 (2011) © Michelle Lewis-King. Photo: Barbara Butkus.*

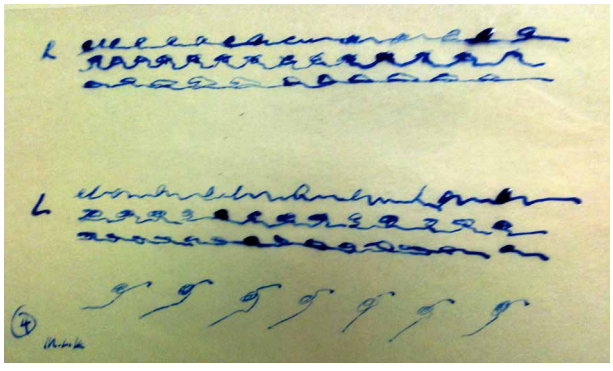

Figure 5: *V&A_4 Graphic Notation (2013) © Michelle Lewis-King.*

2.2 SUPERCOLLIDER SOUNDSCAPES

A basic outline of Chinese medicine theory in terms of how it describes the overall systems and substances which comprise the body, there are five *zàng* organs:[3] the Heart (including the "Pericardium"), Spleen, Lungs, Kidneys and Liver; and six *fǔ*[4] organs: Small Intestine, Large Intestine, Gall Bladder, Urinary Bladder, Stomach and Triple Heater. The energetic networks or 'channels' that are connected and associated with each of the above organs (refer to Figure 6) run between the depths to the outer reaches of the body. [10] There are a total of twelve networks (or channels) when including the Pericardium. These twelve channels form the fundamental structural basis for my graphic notations and SC compositions[5]. [7]

Each *zàng-fǔ* pair are also each associated with one of the five elements: Fire, Earth, Metal, Water and Wood i.e., Stomach/Spleen = Earth, Lung/Large Intestine = Metal, Kidney/Bladder, Water, Liver/Gall Bladder = Wood, Heart/Small Intestine = Fire, Triple Heater/Pericardium = "Ministerial" Fire. The *zàng-fǔ* pairs are also associated with fundamental colours: Fire = Red, Earth = Yellow, Metal = Silver/White, Water = Indigo/Black, Wood = Green. [10] Each element also has a fundamental musical tone associated with the traditional Chinese pentatonic scale, i.e., *gōng*, *shāng*, *jué*, *zhǐ*, *yǔ*. The frequencies I use in SC are calculated using these pentatonic tones. [6] [3] [7]

I compose by listening, therefore my use of SC programming language keeps to basic commands so I can intensify my focus on listening to and modulating the sine wave shapes, characteristics and amplitudes within each programming command in order to create sounds which convey the fluid and electric-like nature of the vibrations I feel within people's pulses. There is also an interpretative and intuitive element to reading peoples' pulses which is central to my composing a sonic "portrait" of others, and this allows me to place the traces of the "human" in dialogue with mechanical. [7] For those unfamiliar with SC programming language, an example of a basic command might be: "{SinOsc.ar(440, mul: 0.1)}.play;" simply telling the SC synthesis server (*scsynth*)[7] to evaluate and match the code command with a sound object - playing the sine wave at the frequency of 440 Hz at a moderate volume. [13] In

order to faithfully convey the sonic landscape of the body according to Chinese pulse diagnostics, each sine wave is carefully modulated to exemplify the signature qualities of pulse waveforms as described in the notations. (See Figures 4 and 5 above) [7] For example, the command "{SinOsc.ar(399.86.dup, mul: LFNoise0.kr(2, 2).max(0) * 0.05)}.play;" corresponds to an aspect of a pulse emitting a "thin, rapid, and irregular" waveform along the "Heart" channel and so the sine wave frequency of 399.86 corresponds to the Fire/Heart tone according to traditional tuning scales. [3] [8] Also as 'LFNoise2.kr' is a command for a 'random' sound object, I utilise and modulate this sound object to match the irregular pattern felt in an individual's pulse.

3. CONCLUSIONS

This study seeks to provide a new means for producing and understanding sound relative to embodied experience and offers an examination of the unique translation and synthesis of different disciplines that sonic research can perform. *Pulse Project* is also used as a relational tool, i.e., using touch as a method for intensive listening and also as a method for creating sonic portraiture. *Pulse Project* introduces a new method for touching and transposing sound using ancient and pre-modern approaches to the body to reconsider contemporary practices. Through creating a unique form of sonic portraiture, I attempt to convey my findings on the "living" body. This internal-medicine-as-art portraiture is created as a contradiction to and disruption of the Cartesian notion of the body-as-machine and the fixed representations of the body that were formulated from conducting dissections during the Enlightenment era which continue to influence biomedical and technological conceptions and approaches to the body to this day. [12] [5]

In utilizing touch as a translational tool and medium, I can connect art, science and technology with the complexity of 'being' in unique ways. This use of touch as a translational medium allows me to create sonic expressions more faithful to the complexities and mysteries of human experience and existence. Rather than creating another human/machine interface that is "interactive" and "user-focused" (thus mediating participation), this study publicly explores direct participation through using the creation of intimacy between the artist and audience as a context for exploring the intimate relationship between art and science. As a method that attempts to include and be responsive to the participants of the research, as stated previously, this study produces artworks that are made specifically for the participants of the study.

In answer to the question of how creative practice research might inform scientific praxis, this study also wishes to provide an "alternative to the hegemony of the clinic" [2] by taking its critique of the clinic and placing it outside into the wider context of the public domain. In using a sensitising and insightful form of touch to connect with participants, this instantly builds a mutual trust and rapport that no technical "instrument" could produce. Building rapport is also part of my methodology, as my study also engages with and includes the complex "presence" of participants within its approach to listening and composing. In trying to listen deeply into the internal vibrations of others from the position of intuitive and corporeal experience, Pulse Project takes it sonic inquiry of the clinic and attempts to open it outwards towards the direction of lived experience. In this way, this study uses the methodology of Chinese pulse diagnosis as a tool to mediate within artistic, medical and social science discourses. [7]

GLOSSARY

Scsynth - SuperCollider synthesis server which supports multiple input and output channels and uses a "bus system" to match programming commands with sound objects. [13]

Zàng-fǔ - Zàng refers to the five yīn organs of the body: Heart/Pericardium, Spleen, Liver, Lung, Kidney. Fǔ refers to the six yáng organs: Large Intestine, Small Intestine, Gall Bladder, Urinary Bladder, Stomach, Triple Burner. These zàng-fǔ each have an associated channel that extends the energy of the organs along points across the body. As simple definition of the functions of the zàng-fǔ: the five yīn organs are said to "store" and produce essential fluids, while the six yáng organs transform essences into production of movements/energy. [10]

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ENDNOTES

1 Refer to the Glossary for a description of this term.

2 To hear audio samples of the project visit the link: *https://soundcloud.com/cosmosonicsoma/sets*

3 See Glossary.

4 See Glossary.

5 To access an image of the 12 channels, refer to this acupuncture chart on wikimedia: *http://en.wikipedia.org/wiki/File:Chinese_meridians.JPG* (Public Domain Attribution). [9]

6 The tuning calculation for the pentatonic scales can be seen here: *https://commons.wikimedia.org/wiki/File%3AChinese_Music_Gamut_%26_Scales.svg* [8]

7 See Glossary.

DIY Social Skin: Performativity and Wearables

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Abstract. This paper examines the performative dimension of wearable technologies developed within the fields of design, fashion and media arts. It investigates the relationships between wearables—fashion garments embedded with interactive, responsive and electronically networked technologies—and the theories and practices associated with the concept of the performative. In order to explore the multiple relationships between wearables and performance, I focus on a close reading of theoretical texts in relation to the performance of bodies, fashion, technology and the laboratory cultures associated with them; to then examine the case study of my fashion-tech project "DIY Social Skin."

1. INTRODUCTION

This paper examines the relationship and scholarship around performativity and wearables that include: the body in movement, the expressive dimension of fashion, how technology animates objects, and the techno-scientific-social collaborations taking shape in the laboratory define the technologies worn on the body. First, I look at how the Modern body is problematized and understood as essentially performative from a social, gender and political standpoint. Next, I elaborate on theories of performance that have been utilized to analyze and understand fashion as a performance of identity construction through street culture, runway presentations, and the media apparatuses that frame and showcase fashion such as photography and video. Following along in the investigation on performance and the elements that come to comprise the wearable I consider the relationship between technology and the body as explored thus far through theories of media arts, communication and human computer interaction to better understand how the various technological mediums of wearables come to transform the body when combined with it. At last, an analysis of the complex socio-technical milieus producing technologies and fashion-tech designs —and the roles of its various contributors from machine to human—seeks to understand how performance within the of ateliers/laboratories affects the underlying construction of wearables. I argue that both concepts and acts of performance are key to elaborating a rich understanding of wearables wherein bodies, fashion and technologies are considered as conjoined and inter-related elements of performance.

I conclude with a short overview of my own wearables project "DIY Social Skin" to investigate first-hand its performative facets

2. PERFORMANCE: BODIES, TECHNOLOGY AND FASHION

The first section investigates the legacy of the "Performative Turn" in expanding the notion of performance beyond the stage, associating it with the important role of body politics, props, costumes and contexts in shaping meaning. The second section examines fashion theory's

construction of meaning through the visual orchestration of the body and garments within performance and event-based contexts related to fashion, including the runway and the street. Next I probe how media theory has problematized the relationship between the body and technology thus far. We conclude with a short overview of theories from Science Technology and Society to unveil the unfolding of human and non-human performativity within the laboratory contexts of the wearables' sites of production.

2.1 PERFORMANCE THEORY & THE PERFORMANCE OF THE BODY

I would like to begin with an overview of performance theories relating to the body. Particularly, looking to performance examples from outside the tradition of theatrical stage scholarship—in which costume traditionally plays a supporting role—to focus on contexts in which costumes are at centre stage in the construction of characters, narrative, and meaning. These contexts encompass the use of non-actor elements such as props, make-up and more particularly, costumes to create meaning within both artistic and every day contexts.

The first performance context is the artistic genre known as "performance art." Emerging at the turn of the century, performance art gained prominent acceptance from the art world in the 1960s. The foundations for performance art, as distinguished from those of theatre, were developed outside the parameters of the black box/stage, with "real world" contexts, objects, and settings fueling the construction of events. In short, performance art is about acting in real world settings and with a high degree of context awareness in which the objects, people and settings at hand are key players within the performance. This is not to argue that performance art is more "real"—it contains a high degree of imagination and abstraction—however, it does aim to create theatricality built on an actual situation in the real world, as opposed to creating imaginary realms divorced from the immediate setting as in theatre. As a craft, performance art often highlights the actual actors and their unique bodies (i.e. gender, race, sexual orientation), and costumes are used as highly codified and important elements to the construction and interpretation of the performance and the performer. In addition, the disarming charm and appeal of performance art is tied to its convergence with the "real." Performance art and performance studies theoreticians such as Carlson, Schechner and Goldberg have observed how the use of costumes, props, and settings are enlisted in creating performance within the everyday and by means of visual as opposed to dramaturgical codification [1, 2, 3, 4].

The role of the body has become increasingly important within theories of performance, from art to sociology/anthropology. Marcel Mauss' notion of the "techniques of the body" explores how the ways in which the body in movement and display is symbolically crafted [5]. Furthermore, the body itself became a highly contested zone of artistic and political agency—keenly tied to socially engaged performance art practices in the 80s and 90s—which sought to re-map the meaning(s) of people in the arts, performance arts stages, and the general public sphere by way of performative actions [6, 7, 8]. The expanding importance of performance, on both a symbolic and a practiced scale, is important when considering wearables as artistic artifacts occurring at the interstice of the body and fashion/technology, for it points to how the body, in consort with costumes, creates performance.

2.2 FASHION THEORY & THE PERFORMANCE OF THE ADORNED BODY

Performance theories discussed above were principally focused on the creation of meaning through performance contexts highlighting the body and costumes/props. However, fashion discourse is specifically focused on the garment's contribution to the construction of meaning when worn on the body. Fashion has built its own set of theories and means of interpretation attached to various practices of adornment and its relationship to the body, the individual, and society. These theories differ from those stemming from performance studies, as their primary departure point for expression is clothing, as opposed to the body. In fashion theory, emphasis is mainly placed on understanding social codes and influences as expressed through

sartorial choices and public displays of style, both of which are keenly mapped onto social and economic hierarchic structures. A number of theoretical avenues explored in fashion theory can guide us towards a richer understanding of "performativity" in artistic wearables, specifically from the perspective of the garment's contribution to expression. Of particular interest is the relationship between the body and the garment and how, when combined, new forms of performances of self can occur. As much as performance studies theory can guide us in a better understanding of the body's actions, fashion theory has a more intimate handle on the specific contribution of the garment in shaping meaning at the intersection of the body and clothing.

Theories around dress and fashion start with the garment itself. The main modes of analysis focus on two dominant narratives: emulation (based on social and economic stratification) and communication (based on individual and collective expressiveness) [9]. Early sociological texts focus on emulation in fashion, postulating that styles began at the top of the social hierarchy, with the elite forging a distinctive style of dress, which are then emulated by the lower classes, hence the "trickle-down effect" [10]. However, theories of emulation are heavily reliant on a unidirectional social flow from rich to poor, leaving little opening for individual "expressiveness" in fashion or for stylistic "reverse engineering." Emulation also proposes tensions in expressions of individualism versus collectivism, a creative push and pull still at play today between the classes [10]. Other emulation theories reliant on a psychoanalytical model see fashion as a "social regulating system," entwined in personal psychology and collective desires and other mores often found at the brink of disruption, deviation and change [11]. Philosophical and historical overviews probe the nature of emulation in fashion, revealing the increasingly democratic power of clothes where fashion is not bounded by class but rather affords a fluid political and social trajectory since the modern era [12].

Communication theory, for its part, revolves around the individual's choices in fashion and clothing to express both personal identity as well as group adherence [13, 14, 15]. From this viewpoint, clothing becomes a conduit for "the expressive culture of a community" [9]. Within a communication system, however, where clothing acquires the ability to be "read," there is a danger of also reducing clothing to sign (or semiotic interplay), divorced of bodies, action and performative "events." For example, some texts focus on a strict system of semiotic meaning to explain fashion, for example, through print itself, such as in the case of fashion magazines [16].

Recent fashion theory has begun to incorporate performance as part of fashion's expression. As fashion's influence is increasingly mediated through performance and communication technologies such as photography, film, video, runway shows and the Internet, the importance of fashion "performance" is also coming to the fore. With the rapid stylistic flux associated with fashion, change is intrinsic to its survival (in terms of both economics and relevance), and has propelled more diverse and dynamic developments conflating strict "emulation" or "communication" systems. Fashion is "of the moment" and in this way, it can be appreciated as part of a Zeitgeist linked to performance, event-making, and the constructions of mediatized time-based arts [14]. Moreover, fashion as art embodies the "phrasing of human life" which encompasses historical, mediated and performance-based modes of cultural presence [17, 18].

2.3 TECHNOLOGY AS AN EXTENSION OF THE SELF

Some analysis of our relationship with technology has to be elaborated in order to discuss the impact of wearable technologies on the body when embedded into fashion/garments. The Canadian philosopher Marshall McLuhan viewed technology as an extension of our bodies, wherein our senses were solicited to interpret and experience media [19]. McLuhan noted that "...the electric age ushers us into a world in which we live and breathe and listen with the entire epidermis" [19]. This epidermis, by which McLuhan means the outer layer of the human skin that protects the flesh, can be used as a metaphor for the second skin that is wearable technologies. As techno-fashion researcher Sabine Seymour notes, digital displays from

mobile and networked environments are merging with the organic epidermis of our bodies through wearable technologies [20]. Hence, our bodies increasingly become interfaces, mediated through technologies from interactive art, for handheld or embedded devices. This techno-organic epidermis constructs new relationships with technology, which use wearable technologies to blur the traditional limits between object, garments, information and entertainment. As the concept of the mediatized "epidermis" evolves to represent the meeting of body and technology, new kinds of technological experiences emerge. As technology becomes as extension of the garments and networks in which we participate on a daily basis (Facebook, email, blogs, news feeds, etc.) it also become closer to our body, more immediate in access and more available to interact with other interfaces. Technologies that use somatic inputs are also an important element to consider in the "performance" of wearable technologies. Further recent examples of user interfaces that depend on the body—along with media arts expression via the body—reveal the changing and increasingly intimate relationship we are developing with media interfaces [21, 22, 23].

2.4 PERFORMATIVE WEARABLES & LABORATORY CULTURES

We now look at the atelier/laboratory culture currently involved in artistic wearables research and production. As these sites cultivate the materials, technologies and modes from which techno-fashion is developed, they also stage the ways in which these objects become technologically and somatically performative. In order to follow and engage with this techno-cultural scientific design field, I call on at the ways in which Science Technology and Society (STS) theories of laboratory research and knowledge production have used performance as a platform from which to analyze labs [24, 25, 26, 27]. In particular, I look at the branch of STS literature in which performance concepts are used to examine scientific research occurring in laboratories. STS describes events taking place in the laboratory—such as material testing, prototype development, fabrication of new materials, note taking and technology testing—as "performative." Within this theoretical frame, individuals working with technology, materials and various test equipment are considered to be "performative" factors within the development of this research. This "performative" focus is used to analyze laboratories in which individuals and materials play equally "performative" roles in the process of shaping research outcomes. It owes much to mid-twentieth century sociological and anthropological theories of performance, previously previously described. However, STS theories of performativity expand into the unheralded territory of scientific and material research in order to question the otherwise deductive reasoning of laboratory operations and findings. Performativity from an STS viewpoint, as applied to artistic wearables sites of production offers a unique way to highlight the actions of all involved, from technologies and materials to individuals.

Wearables are complex designs bringing together expertise from the disparate fields of garment-making, textiles, engineering, computation and somatic knowledge. One way of examining the intertwined collaborations contributing to the design and technological innovations of artistic wearables is through the optics of performance-focused research as proposed by STS literature. The advantage of using STS performance theories has two principal purposes: a) these theories provide an opportunity to look at a rich and varied spectrum of contributing factors, including the various individuals, material sciences, technologies, and social organizations that shape each unique wearable, and b) they encompass the ateliers/laboratories within the narrative of performative events that traces its history and seeds the modalities of use on and with the body. In this way, an analysis of the studies pertaining to ateliers/laboratories that produce artistic wearables gives us the opportunity to reveal the nuances of the individuals (scientists, designers, engineers) and materials (tools, matter, technologies) that have an impact on design and use outcomes. The perception of the laboratory as a place of genesis for performative wearables informs the story of how they come into being materially and expressively.

3. DIY SOCIAL SKIN

The project DIY Social Skin, developed by the atelier 3lectromode, investigates the role of wearables as a second skin interface negotiating between the social body and its environment.

Fig. 1. *3lectromode, "Future Matter" 2012.*

3.1 3lectromode

3lectromode is a small design atelier run by myself as designer/owner and a gathering of other experts from textiles, fashion and engineering who work on an ad-hoc basis on various aspects of designing, developing, making and disseminating or marketing fashion-tech designs. Our designs range from materials exploration, fashion-tech design, and workshops that straddle the communities of high-tech, craft, arts, product design, and speculative design.

Key to 3lectromode's design ethos is the desire to create a library of open sourced fashion designs that can be easily assembled as kits by anyone with an interest in wearables, electronics or fashion. The kits designed so far come complete with the printed garment, the necessary electronics and instructions, taking the guesswork out of electronics assembly while allowing the user to create a customized and fashionable design. Designs are printed on textile printers on which also included the layout of electronic schematics and sewing directions. The methods for assembling the electronic components of the wearable are integrated into the design and can be visually followed, much like a paint-by-numbers picture, without having to refer to a manual. Each piece is uniquely designed, and comes with customizable options for different print patterns, colours, models and sizes, giving the user-end designer the agency to creating his or her own iteration. Computational variations are also included to modify the LilyPad Arduino program. So far, 3lectromode designs have focused on integration of LEDs with various sensors, using the LilyPad Arduino platform for electronic components and programming. However, this is but a starting point to later investigate emerging technologies, uses and aesthetics that could be added into the ecologies of the proposed designs and systems mapped out for assembly thus far.

Fig. 2. *3lectromode, "Strokes & Dots" 2013.*

3.2 DIY SOCIAL SKIN PERFORMATIVITY

I would like to give a short over view of the performativity of wearables via the DIY Social Skin projects developed by 3lectromode. These will be investigated along three axes: a) the performative events occurring in the laboratory; b) the performative transformation experienced by the wearer c) the performative communication emitted by the wearer.

Performativity in the 3lectromode laboratory occurs amongst the individuals on site in the atelier, along with external textile and graphic printers and engineers. The team works towards a functional wearable that is aimed at satisfying a number of parameters from the aesthetic and artistic, to the ways in which it can function on the body. As the aim of 3lectromode is to create kits that others can engage in and make, the technical elements need to be clearly visually or textually aligned. What is more, much of the performance of the garments is dependent on what the material can do: the conductivity of threads and textiles; the processing capacity of the LilyPad Arduino; the limits of what can be worn on the body and where in terms of hard circuits or fragile textiles. These parameters are negotiated between the desired outcomes; the capacities of the individuals to resolve or problem solve them; and the material limits of can be produced from DIY resources and technologies. The admixtures of these skills, abilities, and goals result in embedding the performative potentials of the designs.

In the wearing the wearables a few performative elements come together. To begin with, the garments—as they are disseminated as kits—are often worn by their makers, and hence a tangible testimony of their making engagement and skill. Hence, the wearer as maker is displayed as an intrinsic part of the garment itself. Furthermore, the ability for the garment to "perform," i.e. sense the environment, light up LEDs etc. is crucial for the "wearable" to be a technological garment! Next the internalized feeling of wearing an artifact that has the capacity to perform on "its own," so to speak, proposes various levels of playfulness and potentially transformative effects to the wearer's experience.

Finally, as a performative object, what does the wearable communicate? In the case of the DIY Social Skin a few elements can be highlighted. A close collaboration with the technology is enacted as the wearable's "performance" runs parallel to that of the lived body. As the technology (for example through accelerometer or light sensors that give information on the body's movements or environment) is set into motion, the effects (in the case of the DIY Social Skin, LEDs) have an expressive dimension not fully controllable by the actual and situated body. At times one migh have the impression that the technology speak with, for, or even on top of the body. This duplicitous relationship between a self-unfolding technology, a garment as fashion expression (what says technophile more than embedded technologies in your garment!), and a body in action, reflects the complexly negotiated performativity that is the wearable.

3. CONCLUSION

This paper has sought to unify a series of theories that converge within wearables' relationship to performance and performativity. In it, I argue that performance is a unifying element through which to better understand how wearables are produced, experienced, and analyzed.

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AUTOMATED INTERVENTIONS

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Mestizo Robotics

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Abstract. With a cultural and material 'cannibalistic' approach, in this paper, the authors aim to revise some technological discourses by introducing TZ'IJK, a 'mestizo' robotic artwork developed in the Peruvian Amazon. Far from the utopian visions of Hollywood sci-fi movies populated by highly intelligent, anthropomorphic and responsive machines, TZ'IJK employs a combination of high and low technologies that embody Latin America's anthropophagic, post-colonial, and hybrid nature. Mestizo Robotics proposes an alternative approach to the development of embodied artificial life forms, both from theoretical and technological viewpoints.

1. INTRODUCTION

"Se você tem uma ideia incrível é melhor fazer uma canção / Está provado que só é possível filosofar em alemão" (Lingua, Caetano Veloso)[1]

As Caetano Veloso argues in his song, 'the South's' contribution to humanity seems constrained to Culture –music, literature, art, films, or food. Science (even social science) is 'the North's' domain. Likewise, technology, the artifacts to operate -and dominate- the world, has remained the North's privilege, and with that the whole discursive control on the 'Future'. Could *otro*[2] future be possible?

Fig. 1. Spherical structure completed (including internal mechanism), ready to be plastered with quincha paste. San Roque de Cumbaza, Peru. Summer 2013. Photo: Alejandro Borsani.

In the early Spanish colonies, craft workshops articulated fertile operations of knowledge cross-transference between Spanish craft masters and indigenous apprentices, and established the ground base for the development of a 'Baroque subjectivity' that persists until today. *Tropicalismo*, *Mangue Bit*, along with less programmatic and popular appropriations such as the *telenovelas*, carnival, tango, and cumbia music, are just a few examples of that art that that was born as a consequence of *mestizaje*– a phenomena with a non-harmonic resolution, but "an heterogeneous juxtaposition aiming toward

hybridity"[3], interactions, interchanges, and re-appropriations [1-3].

Mestizaje is normally understood as a process that blends races or languages. Can its dynamics be extended to help better understand or experiment with the realm of making, of things? Outside the nativisms that use it to hide the contradictions (and privileges) of uneven development and cultural exploitation; could a 'mestizo technology' be possible? Can a 'mestizo technology' promote *otro* future of "*caranguejos com cérebro*"[4]; an inclusive programmatic platform where dirt and mud are not exclusively seen as a representation of poverty, but also of life and biodiversity [4-5]?

Aiming to confront these questions in the field, we arrived at San Roque de Cumbaza, in the Peruvian Amazonian highlands, to develop a robotic prototype, an art project. Initially, we were looking for contributions to our project: local artisans that could help to build our project, and for context outside the protection of our studios and labs. We arrived not knowing much, except the remoteness of this location. Not many years ago the area was under the disputed control of 'Sendero Luminoso'[5]. The local peasants often mentioned nearby *matanzas*[6] and *enfrentamientos*[7]; the new tour operators quickly dismissed the conflicts, as they did not want their eco-branding efforts tarnished with recent violence. We soon learned that *la selva*[8] was not just a metaphor, it was ominously present. In the jungle, all is gutted and swallowed, without negotiation. *Mestizaje*, here, is not a plan but a consequence. That is perhaps the most profound and radical condition of this place: despite the intentions of colonization, the attempts of capital to benefit, the ideals of missionaries and ecotourists, the jungle exerts its will and the rule is survival.
And it rains often, very often.

2. TZ'IJK

Inspired by the Quiché Maya's narration of the creation of the world, our project TZ'IJK *(in Mayan Ch'orti': mud or clay)* attempts to bring to life the most popular Latin American mytho-historical story of the earth's first human inhabitants.

The Popol Vuh[9] ascribes the creation of man only with the purpose of serving the Gods. According to the narration, man was created as far inferior to the gods, considered as nothing more than an imperfect automaton, subject to divine whims and fancies. After the earth and animals were created, the gods made several false starts in setting humanity upon the earth. The first attempt was a man created out of mud, which soon proved unsuccessful; the mud men lacked speech, souls, and intellect. They were useless, blind and clumsy automatons that just moved around without understanding, insight or perceptiveness: "*Of earth, of mud, they made man's flesh. But they saw that it was not good. It melted away, it was soft, did not move, had no strength, it fell down, it was limp, it could not move its head, its face fell to one side, its sight was blurred, it could not look behind. At first it spoke, but had no mind. Quickly it soaked in the water and could not stand"*[6].

TZ'IJK is a robotic installation comprised of a community blind, deaf and 'dumb' autonomous mobile agents made out of mud. Vanishing from the imaginary inventory of literature and mythology, humanity's quest to replicate living beings goes back thousands of years. As a natural consequence, the discourse of robotics and artificial life has always resembled different creationist myths, as if the idea of creating synthetic beings was a way to challenge god or evolution, or a way to please our profound creationist desires. Far from the utopias of super intelligent, anthropomorphic and responsive machines, TZ'IJK propose an ironic position different from the view of an agent as a competent system of autonomy and determination, which seems to be the hegemonic rhetoric when trying to make an artificial technological creature in the 'image and likeness' of the human being.

Fig. 2. *Local builders Adriel Vasquez Saavedra and Regner Cachique Sangama plastering the external quincha skin. San Roque de Cumbaza, Peru. Summer 2013. Photo: Alejandro Borsani.*

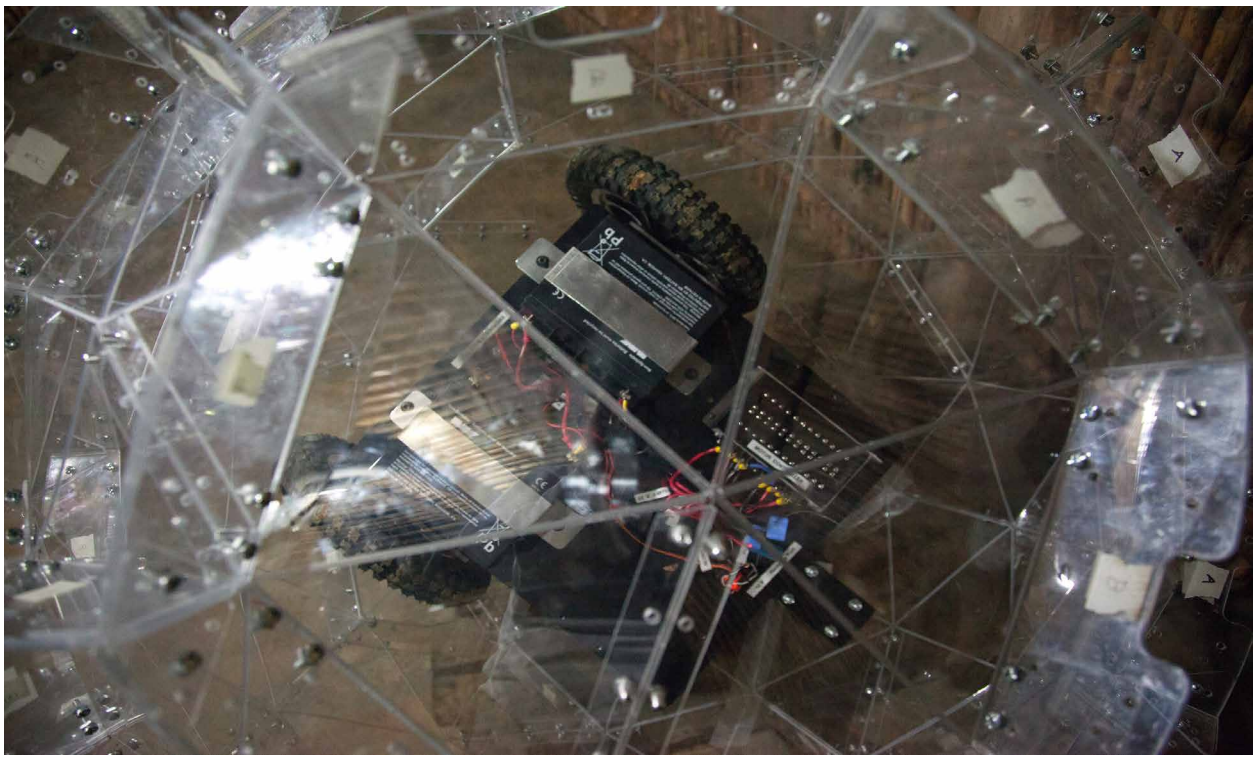

Fig. 3. *View of interior mobile mechanism, interior polycarbonate skin, and folded flaps (secondary rib frame). San Roque de Cumbaza, Peru. Summer 2013. Photo: Alejandro Borsani.*

3. AMAZONIAN PROTOTYPE

The first robotic prototype, *El Amazónico*[10], consisted of a 48-inch diameter mud-covered sphere with an internal mobile mechanism.

The structure is defined by a series of layered and interlocked geodesic systems. The first layer is an interior laser-cut transparent polycarbonate geodesic membrane (3v frequency) reinforced by a rib-frame bolted together with the folded flaps of the pentagon and hexagon faces. This layer is then tied together with a spherical circle-covering armature made with *angarilla,* a very flexible indigenous wood. The last grid-shell functions also as the base structure for the exterior *quincha*[11] system, which is completed by intertwining and plastering with a paste of mixed clay mud and thick grass.

Enclosed inside the wet-mud sphere, a battery-powered three-wheeled device runs on its interior surface altering the balance, causing the sphere to wobble and move. The mechanism weighs over 87lb and is built with two gearmotors of 1300in-lbs peak torque controlled by a motor controller that allows both remote control applications and an autonomous performance using Arduino.

Fig. 5. *Amazonico prototype recently plastered. The wet-mud skin is starting to collapse due the wobbling and vibrations. San Roque de Cumbaza, Peru. Summer 2013. Photo: Alejandro Borsani.*

4. MESTIZO ROBOTICS

In 1925, José Vasconcelos, Mexican philosopher, envisaged a mestizo race, *una mezcla de razas afines, una raza de color – la primera raza sintesis del globo*[12]. He called it a "cosmic race", a mixed race, with hybrid progeny, mutable genes and malleable identity [7].

Three years later, in 1928, 374 years after "*da Deglutição do Bispo Sardinha"*[13], Oswald de Andrade, Brazilian poet, wrote his Manifesto Antropófago. He stated that the best way to absorb the disparate, uneven, and chaotic reality of modernity and colonization was not to imitate or resist it but to eagerly absorb it: to 'cannibalize' the other culture by incorporating, re-appropriating, and regurgitating it in an entirely new creation [8].

In 2013, tension, contradictions and ambiguities continue to unfold, and Latin America remains caught between traditions that are not yet gone and a modernity that has not completely arrived. Almost a century later, we attempt to bring back those utopian fantasies of the early twentieth century, and incorporate them as a fundamental part of our techno-artistic agenda.

Drawn from the lessons of *mestizaje*, and motivated by critical theories of postcolonial technoscience[14], we claim a tactical approach to the use of technologies in which western methods, knowledges and colonial technologies are not accepted passively, but are adapted and selectively absorbed in relation to the existing traditions and local knowledges [9-10]. We call our approach Mestizo Robotics, a set of tools that not only provides us tactics for understanding how technology is embodied, appropriated, transformed and assimilated in Latin America, but also allow us to envision the emergence of a situated, embodied and enactive paradigm for the creation of artificial life creatures [11].

Mestizo Robotics offers no absolute escape from paradox, or quick cultural and technological fixes; however, taking fully advantage of the embodied and situated intelligences of the arts, propose the emergence of a new kind of synthetic agents, in which their technological hybrid embodiment determines their performance and behavior [12].

Mestizo Robotics emphasizes the 'situatedness' of technoscience and advocates for the integration of high and low technological materials, processes, and cultures. For us, *mestizaje* is not a theoretical quality but inevitable approach to making. Our attitude towards robotics promotes the intersection of computation, physical materials, and manufacturing processes, with traditional crafts and design, in hopes that we will illuminate the creation of a new robotic morphology: the mestizo robots.

Therefore, Mestizo Robotics shows an equal preoccupation with the robot's physical structure (appearance) and its performance (behavior). Here, either the robot's goal and surroundings substantially influence its design, or its design and materiality, substantially influence its goals and surroundings [13]. In Mestizo Robotics, like in any other process of *mestizaje*, behavior, materiality and environment affect each other and cannot be understood as independent entities.

Our mestizo robots are cognitive and autonomous agents that -like any other mestizo- avoid binary logic, and so escape from the cognitivist and simplistically Cartesian worldview that surrounds the 'good old fashioned artificial intelligence' and cognitive science. Mestizo robots emphasize bottom-up processes by which intelligence emerges and evolves in lived experience, particularly in interactions with the environments that enhance the agent's present situation[15] [14-15].

Within this framework, TZ'IJK is simply our first artistic attempt towards a mestizo approach to robotics. We propose an aesthetic approach that promotes a rhetoric that allows contradictions and ambiguity, complicating the traditional dichotomies of craft/technology, Western / indigenous, modern / traditional, global / local, developed / undeveloped, big-science / small-science, high / low, and theory / practice.

By recuperating native and indigenous technologies for the creation of autonomous and intelligent robotic agents, TZ'IJK does not pretend to resolve complex technological dilemmas but only proposes to become a truthful 'cannibal' and 'cosmic' agent, that can finally lead us to better understand how ideas about difference are enacted and distributed in the performance of technoscience.

ACKNOWLEDGEMENTS

TZ'IJK first robotic prototype was made possible by the "Iberoamerican Production Incentive" granted by Fundación Telefónica, VIDA 14.0: International Competition in Art and Artificial Life, 2012. Our stay in the Peruvian Amazon was part of a 1 month-long residency at Sachaqa Art Center in San Roque de Cumbaza. Design assistants: Tom Roland, Alec Dumond, Cat Callagan, and Travis Lydon. Robotic development, Chris Rogers (Inspectorbots). The final version of this paper benefited from discussions and reviews from Selma Cohen, PhD and Priscilla Solis Ybarra, PhD.

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ENDNOTES

1 "If you have an incredible idea, the best is to make a song / It has been proven that it is only possible to philosophize in German" (translation by the authors). Excerpt from the song "Lingua" from the album "Velo" (1984) by Caetano Veloso (1942 / --) who co-wrote it with Elza Soares (1937 / --).

2 From Spanish: Other, Another

3 This is a non-fusioned non-transculturalized notion of *mestizaje*. See Yudice, George: "De la antropofagia al sampling: nuevas experiencias de heterogeneidad e hibridismo en las culturas latinoamericanas". (Keynote Lecture) Conference La Jornada Literaria 2005. Rutgers University, New Brunswick, November 2005.

4 *Caranguejos com Cerebro* (Crabs with brains) is the foundational manifesto of the Mangue Bit music movement from Recife, Brazil. It was written by Fred 04 and DJ Renato in 1992. Mangue Bit (in Portuguese "mangue" means mangrove and "bit" is pronounced as computer bit and beat) distinguishes by combining dissimilar elements such as forro, maracatu and cordel folk music with hiphop, psychedelia, punk, hardcore.

5 *Sendero Luminoso* (The Shining Path) was a Maoist Peruvian insurgent group lead by Abimael Guzman that was very active since 1980 until the capture of its leader Abimael Guzman in 1992.

6 (Spanish) killings

7 (Spanish) warring

8 (Spanish) The jungle

9 The Popol Vuh (*Book of the People* in Maya Quiché) was transcribed at the beginning of the 18th century by Francisco Ximénez, parish priest of Chichicastenango in highland Guatemala. He both copied the original K'iche' text and translated it into Spanish. His work is now in the Newberry Library, Chicago.

10 (Spanish) The Amazonian

11 *Quincha* or *pau-a-pique* (Portuguese) is pre-Colombian building technique still persistent in several areas of Latin America.

12 Authors' transl. from Spanish: "*a mix of similar races, a colored race – the first synthesis race of the globe*".

13 (Portuguese): The Swallowing of Bishop Sardinha. This incident became central in Oswald de Andrade's Cannibalism Manifesto of 1928. According to the story, in the mid 16th century, the Bishop Pedro Fernandes Sardinha was shipwrecked at the Brazilian coasts, and the natives (Tupi people) proceeded to eat him.

14 Warwick Anderson articulates the main ideas of postcolonial technoscience in a special issue about "Postcolonial Technosicne", SSS journal vol. 32 (5-6). In the introduction he argues that postcolonial technoscience theories might offer a way to understand how "technoscience is implicated in the postcolonial provincializing of 'universal' reason, the description of 'alternative modernities', and the recognition of hybridities, borderland, and in-between conditions".

15 Our approach to robotics and artificial intelligence is inspired by the popularized behavior-based approach, a purely reactive behavior-based method developed in the 90s by Rodney Brooks drawn from the lesson of Artificial Life that rejected symbolic computation and allies with Francisco Valera's theory of "enaction" (an emergent theory of cognitive science that based on embodiment and concrete situatedness).

Programmable Tapes - A Romance with the Material

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Abstract. This paper describes the interactive exhibit Programmable Tapes. The work addresses the area of tension between digital and analog technology by bridging small, fast, programmable integrated circuitry with bulky, obsolete traditional tape players. The tangible machinery of retro tape players drives a microprocessor that was fitted in the transparent case of an audio-tape. The chip executes algorithms (celebrated by a web community as *one-liners* due to their minimal nature) that produce bit patterns feeding a simple coil. The resulting electromagnetic field is in turn picked up by the playback head of the player which outputs the resulting sounds. The instructions carried out by the microprocessor are simple bit operations. The resulting sounds inherent an 8-bit aesthetic. The low-fidelity character of Programmable Tapes is further enhanced by the buzzing and crackling noise introduced by the analog circuitry.

1. INTRODUCTION

It is common practice to start a paper on digital media by stating how omni-present technology is these days and how fast it became and how fast it will become in future. Sometimes this goes by referencing Moore's Law [1] and drawing a curve. And it is true that we are surrounded by technology, that it connects and disconnects us. One might even say that it permeates and pierces us and penetrates the way we act, interact and think. With computers disappearing into walls and clouds it becomes increasingly important that people look into technology, rip it apart and get a grasp of its inner workings and gain what some refer to as *computer literacy*. Alan Kay stated as early as 1984: "Computer literacy is a contact with the activity of computing deep enough to make the computational equivalent of reading and writing fluent and enjoyable. As in all the arts, a romance with the material must be well under way" [2]. How is it possible now, to foster such a romance with the material in case of digital media, namely computers? It was argued that sound could be an appropriate medium to gain creative access to technology [3].

2. MATERIAL

The installation Programmable Tapes is an attempt to connect analog devices with its rather tangible parts and pieces with digital technology in the form of a programmable microcontroller in such a way that it creates a stimulating experience.

Fig. 1. *The basic version of Programmable Tape set up in a traditional tape player.*

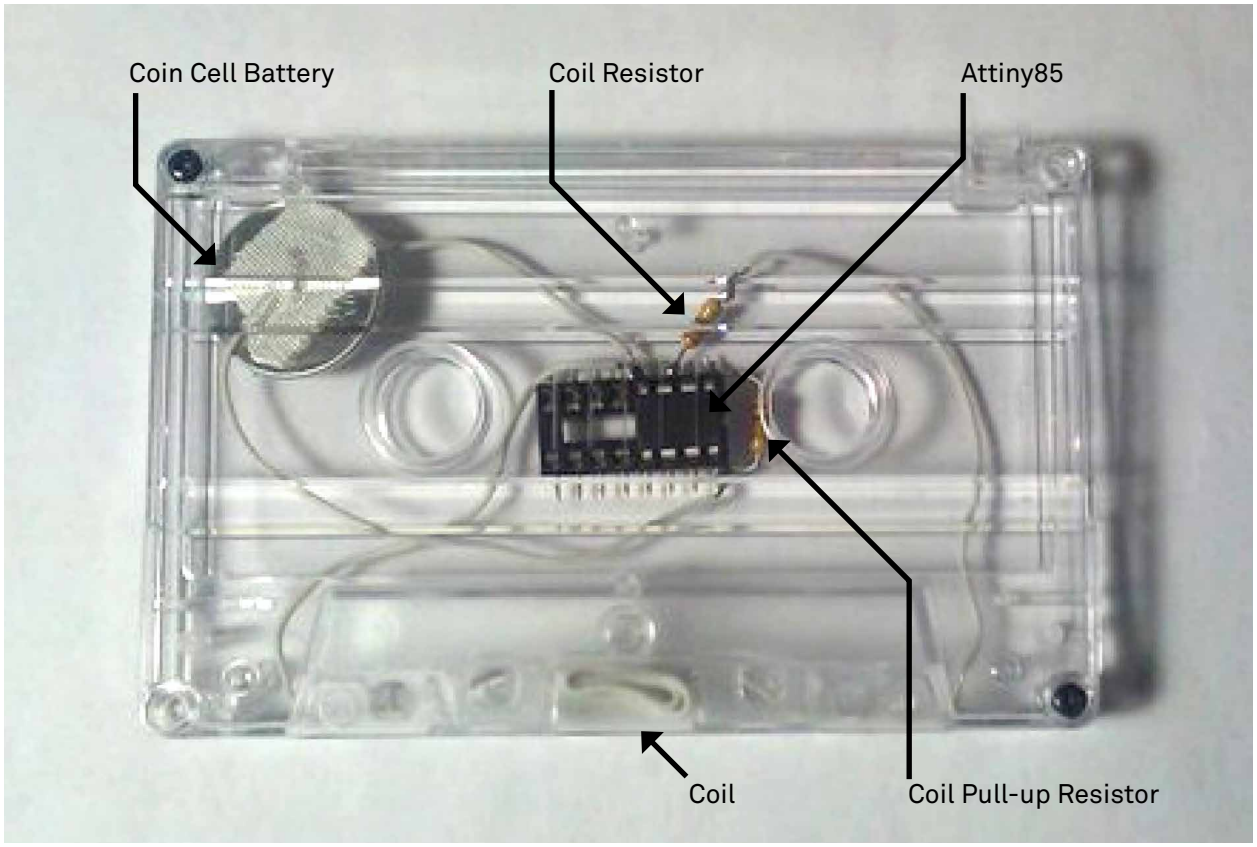

Fig. 2. *The parts of Programmable Tape.*

2.1 SOUND

Sound is the medium of choice for this project as it is a forceful stimulus that is ambient, evocative, and emotional. Frances Dyson describes sound as the *immersive medium par excellence*: "Three-dimensional, interactive, and synesthetic, perceived in the here and now of an embodied space, sound returns to the listener the very same qualities that media mediates: that feeling of being here now, of experiencing oneself as engulfed, enveloped, absorbed, enmeshed, in short, immersed in an environment. Sound surrounds. It's phenomenal characteristics - the fact that it is invisible, intantgible, ephemeral, and vibrational - coordinate with the physiology of the ears, to create a perceptual experience profoundly different from the dominant sense of sight" [4]. The sound of the Programmable Tape installation is based on one-liners as described in [5] inspired by a C64-demo: Only one line of code of bit operations such as shifting with the parameter t is executed in a loop to manipulate a byte and output it to create complex rhythmic and melodic patterns. See [6] as a great source of inspiration.

2.2 HARDWARE

The installation is based on the Attiny85 microcontroller. It is programmable with the Arduino IDE[1] as described here [7]. The microcontroller is fitted in the transparent case of an audiotape as shown in figure 2. In this simple version it is powered by a standard CR2025 coin cell battery. The chip executes the one-line algorithm that produces the bit patterns in a loop. In the installation only one bit is used to toggle one output pin of the microcontroller. The pin is connected in series with a resistor to a simple coil which builds up a magnetic field (well documented [8]). The resulting electromagnetic field is in turn picked up by the playback head of the player which outputs the resulting sounds.

2.3 SOFTWARE

A single pin is used to output the resulting sound.Example of a Computer Program for the Arduino IDE to program the Attiny85 Microcontroller. The variable *data* is fed in the loop with results from a one-liner, in this case an example by *tejeez* as presented in [6].

```
int led = 4;
int count = 10;
int t = 00000000;
byte data = 00000000;
byte mask = 10000000;

void setup(){
     pinMode(led, OUTPUT);
}
void loop(){
     t++;
     data = (t*(t>>5|t>>8))>>(t>>16);
     if(data & mask){
               digitalWrite(led, HIGH);
     } else {
               digitalWrite(led, LOW);
     }
     delayMicroseconds(count);
}
```

3. THE INSTALLATION

The installation of the 9-by-9 array of tape players can either be set up on columns distributed in a room or be assembled to hang on a wall. Participants can operate the tape players as well as explore at one station how to program the tapes using a laptop. They can try out their own algorithmic composition, contributing to the digital/analog chatter ensemble. The tangibility of turntables inspired the scratching culture. The installation Programmable Tapes argues that digital technology can be designed in a similarly graspable way. The emerging sounds can be understood as a call for such open design with digital technology that invites to explore, participate and grasp the nuts and bolts of its inner workings.

4. FUTURE WORK

The simple version of Programmable Tapes as presented in this paper relies on a coin cell battery. The energy required to drive the microprocessors could in future versions be generated by the rotation of the tape player motors: The participants need to charge Programmable Tapes by occasionally fast forwarding or fast rewinding the tape: a homage to linearity of audiotapes and their physical reliance on time and space, as well as their openness and traceability, where speed can be adjusted by placing a finger on the spinning tape wheel. The connection between the mechanical rotation and the chip could be strengthened by enabling the microprocessor with sensors to respond to a change in speed or direction of the rotation with an altered sound.

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ENDNOTES

1 *arduino.cc*

The Acconci Robot

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Abstract *The Acconci Robot* expands upon my previous investigations into performative robotics. This paper details the background, intentions, functionality, responses to the work and future developments.

The Acconci Robot [1] is an interactive robot that follows you unawares. Appearing as a shipping crate of minimal design, the robot is mute and motionless as a viewer approaches. But when the audience member turns away, and starts to leave, the robot begins to follow. If the audience member turns to look back at the robot, it stops in its tracks.

The work draws inspiration from the 1969 performance work, 'Following piece' by Vito Acconci. Acconci's early work developed from an interest in the human body and its relationship to public space. In 'Following Piece', he would select unsuspecting people in the street and follow them until they disappeared into a private place. Acconci carried out this performance every day for a month, documenting each encounter and sending it to a different member of the arts community. Acconci's investigations of the body in public space are re-contextualised in my work within the gallery, re-examining public interaction through human robot interaction. The work draw connections between nineteen sixty's conceptual and performance art and art in the age of interactivity.

The Acconci Robot builds upon my previous investigations into performative robotics detailed in my doctoral research 'An exploration of the uncanny in autonomous artworks' (UWS, 2011) [2]. The research addressed notions of the uncanny, and whether *The Uncanny Valley* (Mori 1970)[3] hypothesis can be used as critical theory. My questions were: Can autonomous artworks help us to understand the nature of the uncanny? And What is the nature of the contemporary response to autonomous artworks? By creating works that explored the notions of the uncanny, the research connected historical theories surrounding the uncanny to the contemporary art gallery, in search of new uncanny moments. Audience members commented on their experiences and the qualities of the works. These responses, critical reviews and my own evaluation, formed the basis of my thesis. The thesis concluded that *The Uncanny Valley* hypothesis should be used as an aesthetic framework, not a limitation and that robotic installations can induce fear by reminding us of our own mortality. Significantly the insight which resulted from the exhibition of the works, came

Fig. 1. ***The Acconci Robot,*** *212, RMIT Gallery, Melbourne. (Photo © RMIT Gallery.)*

from the audience, who asked, "Did the robots respond to me?" This raised my awareness of the misconceptions people have of robots. That people have their own expectations of how robots should interact with humans. This has led me to my current research, titled 'Does The Robot Know I am Here?'

The Acconci Robot explores this concept through recognition of the human as the subject of surveillance, through tracking. To achieve this, a Microsoft Kinect camera [4], was added to my robotic platform allowing the robot to have depth-enabled vision.

The Acconci Robot uses the Kinect in combination with Open Source Computer Vision software (OpenCV) [5] to detect faces, and human figures. The two main behaviours developed for the work are 'Wander for a view' and 'Follow'. 'Wander for a view' is an update of 'Avoid and Wander', a Python [6] script written by Jeremy Apthorp for *The Hosts*: *A Masquerade of Improvising Automatons* 2009 [7]. 'Avoid and Wander' allows the robots to autonomously navigate a space without collision by reading the values of 13 SRF02 ultrasonic range finding sensors [8]. The 'Avoid' section checks if any of the sensors are reporting values less than a threshold value (1m). If they are, it stops and turns in a random direction until the sensors don't report that something is in close proximity. 'Wander' polls the sensors and takes the output from sensors 3 and 9 to control the forward motion of the robots motors.

'Wander for a view' by Dougall Johnson, 2012 utilises the Kinect's depth sensor to look within a given space for an optimal view point. It does so by wandering within the space and looking for a vantage point that is a balance of 5m on both the left and the right sides of the camera aiming for the centre of the space. The program counts the number of pixels on the left and the right separately, it then checks that both numbers are of a decent size and that they are not too different. 'Wander for a view' allows the robot to be in a spacious location, ready to follow the next person and not facing a wall with its back to the audience. The 'Follow' behaviour looks for faces using OpenCV and the vision camera of the Kinect. If a face is

detected it starts tracking using the depth sensor information. The program keeps track of the area where a head is and then inspects the area around the head for facial features.

If there are none, it creates a blob of the human form. A blob is a collection of depth pixels at an adjacent video frame. Each frame is tested to match the last using template matching. This allows the robot to keep track of a person after they have turned away. The limited field of view built-in to the Kinect is a limitation affecting the response time and fluidity of the human robot interaction. For example, in order for the robot to follow a viewer the person needs to look directly into the camera in order for their face to be detected. The viewer must turn around and walk away slowly keeping in line of the robots line of sight. If the viewer walks out of range (*15 degrees) the interaction is lost. For future iterations multiple Kinect cameras or ceiling mounted cameras are possible solutions to this problem (I prefer an embedded approach).

In designing the form I wanted the robot to look like an everyday object, come to life. Originally I was going to make it look like a wardrobe, but then decided I wanted it to look more like something left on the street, like a piece of junk. The final version is a kind of shipping or packing crate. The blank slate appearance enables audiences to project upon the work with their own imagination. For example, it might reference the scene in F.W. Murnau's 1922, 'Nosferatu' [9], where the vampire travels inside a coffin with the soil of his land, complete with rats and plague within the ship. There is some sense that someone could be inside the box, acting as a stalker. Like Facebook we can use technology to track people, and can follow them to a private place, just like Vito Acconci tracked and followed people in the streets more than 40 years ago. The difference now is that surveillance is ever present. Thus the work leads us to question notions of autonomous agency, an important aspect of the increasingly computer mediated times we live in, for example Unmanned Aerial Vehicles (UAVs) and drones.

PERVERTING TECHNOLOGICAL CORRECTNESS

In this cheeky and playful work, I seek to invert the audience expectations of the direct engagement and reciprocal exchange typical of commercial interactive art, by creating a work that only responds when the audience is most disengaged from it. People found interacting with *The Acconci Robot* challenging, as it there is no indication as to what the robot thinking. This complicates my question, (Does The Robot Know I am Here?) as the robot seems to have a life of its own.

When visitors to the gallery see work, it is a performance piece, unable to be totally translated into a simple video clip of the event. The scale and physicality of the work, the inanimate object moving towards you and the experience of the space and the event cannot be duplicated. It's ephemeral; it's a haunting, if you like, of the gallery space by an object that should not move, should not have a "life", but just might, at least for the duration of the exhibition.

The Acconci Robot was commissioned by Experimenta Media Arts, [10] for their touring exhibition, 'Speak to me', Experimenta's 5th International Biennale of Media Art. The work has so far been exhibited at the Royal Melbourne Institute of Technology, 2012 and ISEA2013, Powerhouse Museum, Sydney, Australia.

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Fig. 2. ***The Acconci Robot,*** *212, RMIT Gallery, Melbourne. (Photo © RMIT Gallery.)*

AutoDJ: An Adaptive Music Player Utilizing Computer Vision and Machine Learning

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Abstract. Music players today are typically controlled manually either by the listener or by a facilitator such as a DJ. The advances in music classication over the past decade has provided a vast amount of knowledge which it is possible to tap into for more intelligent music players. This combined with computer vision allows for an ambient intelligent system that provides automatic prediction of audience song preferences based on computer vision data. This paper provides the theoretical grounding along with the design, implementation and test of AutoDJ, an intelligent system to tackle the challenge of automatic DJ'ing.

Keywords: Music player, playlist adaption, computer vision, machine learning.

1. INTRODUCTION

We should consider every day lost on which we have not danced at least once.

- Friedrich Nietzsche

The closely linked subjects of music and dance have been an integral part of human life for a long while and all along technology has continuously been improving the access to music. With the digital options of computers and MP3 players one can store thousands of music tracks in very little physical space and access it instantly. Through the recent advances in streaming media, access to millions of music tracks is now possible and these services can even be accessed from anywhere via one's smartphone. All this means that distribution of music and access to it are to a large extent challenges which are well on their way to being solved.

With the massive amount of music available, a challenge which is as relevant as ever is the choice of which music to listen to. Recent advances have given us systems which provide recommendations by looking at which music one has listened to in the past, which music one's friends are listening to, or by letting the user input a set of preferences. While these systems go a long way towards solving the challenge, most of them still lack the ability to react to the changing moods of a user or any kind of dynamic in the surroundings of where the music is played.

At a party venue the music is an important part of the experience and therefore the right music needs to be played. Figuring out what 'right music' means is a particularly hard problem as it is matter of sensing the atmosphere and finding an answer which fits multiple people. All this can be taken care of by a professional Disc-Jockey(DJ), as the job of a DJ is to make it a fun party and to get people to dance by playing the right music. Hiring a DJ is often not a option due to financial or practical reasons and one therefore has to rely on more manual methods of controlling the music.

This paper documents the development of AutoDJ, an intelligent system with the vision of

automating the selection of music to be played at a venue and thereby make redundant the need of a regular DJ. This is made possible by using computer vision to monitor the party and then applying machine learning to that set of data.

2. PREVIOUS WORK

2.1 MUSIC CONSUMPTION

Seeing how this project deals with music it is relevant to start out with a look at how music is typically consumed. Music listening can either by an entirely manual operation by picking each music track or it can be predefined such as with radio and concerts.

When it comes to predefined sets of music, the most important phenomena is the playlist, a sequence of music tracks with a specific playback order[6]. A playlist can take form as an album, mix tape, radioshow, and other forms depending on which media it is used in. Although a regular CD album may be considered a playlist, the term usually denotes a combination of music from different artists. With the later appearance of radio this was continued with playlists based both around genres and hand-picked by radio hosts [2].

Streaming is becoming very popular due to the instant access to millions of tracks without having to worry about buying them or having the disk space. Popular examples include Pandora[1], Spotify[2], Grooveshark[3] and Last.FM[4], most of which are also able to provide personalized recommendations. Unlike Last.FM and Pandora, Spotify is built around a downloadable client. A key feature of Spotify is that one can share and collaborate on playlists.

One of the places where music is of high importance is in nightclubs and other party venues. One example of how it can be handled is by using color coded mix tapes, each with a different kind of music[9]:

Three colour-coded categories loosely designating when they are supposed to be played "Green" for the daytime, "Yellow" for weekday evening, and "Red" for Friday and Saturday nights. "Green" music is subdued and relaxed background mood music and more "middle of the road". "Yellow" music is slightly more upbeat and "Red" is livelier still.

Many nightclubs employ DJs to control the music selection and playback [2]. One of his most important tasks is to continuously adapt the playlist to suite the audience and it is therefore relevant to look at the basis on which he performs this task. The DJ'ing is about finding an optimal ordering of tracks, the so called process of sequencing [3]. From this paper it is also reported that a typical DJ session lasts between 40 minutes and 6 hours. The DJ'ing is done by operating with the objective of maximizing activity on the dance floor but sometimes also receives special requests to create a special kind of atmosphere which not necessarily involves dancing. When evaluating the reception of a played track a DJ mostly looks at the amount of people dancing and how they dance [2].

2.2 MUSIC PREFERENCE PREDICTION

Systems to predict what a user wants to listen to is named playlist generators and these are commonly able to compose an immutable playlist based on an initial set of input. HP DJ [3] is a system which allows a user to specify a selection of tracks and with optional quantitative criteria. The system analyses the songs to see which ones that provide the best transitions to another track and use this in combination with the user criteria to perform sequencing and mixing. The user providable criteria include being able to specify the desired evolution of the tempo and being able to set specific rules such as "don't play Track A before Track B". There is no real time information used to adapt the playlist.

[1] presents a context-aware music player as an example of their proprietary WhozThat protocol. They have developed a piece of mobile software which works by contiguously scanning the surroundings for a WhozThat music server. On connection the server will retrieve the users' favorite bands via the artists they have liked on Facebook. After this they use Last.FM API to generate a playlist with the most popular tracks for each artist and this playlist is then played.

More advanced playlist generators fall in the category of being able to adapt their playlists on the fly based on real-time input. [10] has looked at how one can automatically generate a playlist based on physiological responses to music when combined with song meta data. Their

system works in real time and relies on collaborative filtering. The idea with the system is that music can be used not only for enjoyment but also for a purpose. They mainly look at how this can help a user in terms of exercising.

Flytrap [5] is a system which is built with the purpose of automatically creating soundtrack to please the majority of people in a room. Each potential user needs to be equipped with a Radio Frequency ID badge which contains his music preferences. These badges are used to detect when whom are in a room and the system then features an algorithm to find a compromise between the two most popular music genres. Flytrap fetches peoples' personal music taste by having software installed on their personal computer, looks at what they usually listen the most to. It has a built-in "DJ Taste" to e.g. never play the same artist twice in a row. While they do succeed in building a working system it appears to require quite a lot both in terms of both hardware and software.

Jukola[9] is a jukebox system which allows people to upload more music over the internet. The sys- tem tries to bridge the gap between bar controlled music on the one hand and then a user controlled jukebox. It gets metadata and album art from freedb.org and amazon.com and allows for voting via handheld platforms. A slightly more updated approach to handheld voting is PartyStrands[8] which allows the user to vote via text messages, this product was only shut down shortly after its inception though.

HP DJ 2[4] builds upon system from [3], of the same author. The new version presented adds to the previous one the addition of floorshow feedback. The feedback comes in form of a wrist-attached custom portable device which features an up-vote and a down-vote button. This allows members of the crowd to signal their pleasure or displeasure with the current song being played. The signal is transmitted over Bluetooth to the HPDJ server which uses the data to alter the playlist.

2.3 SUMMARY

There are plenty of great existing music players such as Winamp or Spotify for which it seems more appropriate to integrate with than to build custom playback component. Lots of research has been done in the area of creating playlists but few systems can shape playlists in real-time according to user input. Of the adaptable systems all seem to require user interaction and cumbersome hardware setup. Based on techniques from ambient intelligence it should be possible to create an adaptable playlist system which can work autonomously.

3. DESIGN AND IMPLEMENTATION

3.1 INTRODUCTION

Based on the research from the previous chapter it is found that a system which is to be useful and novel is to have the following features:

- Automatic real-time adjustment.
- Operate entirely autonomously, i.e. without any interaction (implicit learning).
- Easy setup.
- Run on cheap commodity hardware.
- Work without an existing music library, i.e. needs to use a streaming music library.
- Integrate smoothly with an existing music player.

There are many different goals that one could aim for, but to keep things specific the goal of the system will be to maximize activity on the dance floor. This should be matter of the amount of people dancing but preferably the system should also take into account if the people are actively dancing or just standing and talking. The monitoring should be of the dance oor only and featuring no sensors for the rest of the venue. One could argue that by this decision cuts the opportunity of knowing if 20 people dancing is good (as it would be if there was 20 people in total) or bad (if the venue holds 200 other people not dancing). It is a clear limitation of the program but needed to keep things within a reasonable scope.

The focus is entirely on an adaptive playlist system, that being a system which can make an intelligent choice on the next song to play. Aspects such as mixing, scratching, fading, beat matching, or any other kind of audio manipulation will not be a part of the prototype.

There appear to be three steps in designing a system for automatic DJ'ing: Surveying the party,

building a crowd profile, and finally playing back the music. These steps will shape the structure for the remaining subsections of this chapter.

3.2 STEP 1: ACQUIRING LIVE AUDIENCE PREFERENCES

As found in "Previous Work" there are multiple ways that one can monitor a venue or get input from an audience. The core thing the system needs to sense can be expressed as "How much does the current track help to keep people on the dance floor". The requirement of no interaction rules out any kind of user carried device along with voting stations. The requirement of cheap commodity hardware rules out having to integrate sensors in the floor. Microphone input is ruled out due to a low presumed chance of getting the desired feedback. Smartphones have plenty of movement sensors such as accelerometer, compass, and gyroscope. To get data from these it would require an app to be installed, which would require user work. This kind of manual setup is not within the design goals and a smartphone approach would furthermore require a good amount of bandwidth and battery from the phones.

Computer vision is chosen as this provides essential feedback (dance floor activity) and a laptop with a webcam is commonly available. Most importantly, this kind of input can operate without user interaction and thereby work entirely autonomously.

Quick testing shows that simple motion detection algorithms provide promising results and it is therefore decided that the final implementation should work with that as a base. Both two-frame difference and background modeling are implemented and tested. Testing shows that they work equally great as indicators of motion level and two-frame difference is therefore used.

The webcam used is a Logitech C170[5], a 15eur webcam, which testing shows to be of a sufficient quality. It runs 720p at 25fps.

3.3 STEP 2: SELECTING NEXT TRACK

The system needs to be able to pick the next track as the track that will deliver the most dance oor activity. To be able to make this prediction the system must first have a knowledge base of audience preferences. This can be done by monitoring the venue as previously described and then based on this creating a list of played tracks along with their respective amount of dance floor activity. There are many independent factors such as the intoxication level of the party attendees or the general light level which could in uence the motion level. With these independent factors changing over the course of a party it would make sense to introduce an adjusted motion level which more closely should map the implicit rating of the audience. This is done by having all motion be compared to the average motion over the last 15 minutes and thereby creating a more relative measurement.

To select a track one needs to know properties of any given track and it is found that online meta data sites such as Last.FM and Echonest provide web services with extensive meta data on tracks. The very most suitable appears to be similar tracks as that one already takes into account all the other properties. The amount of tracks one can find as similar via Last.FM differs a lot from track to track but it is usually around a handful. The similar tracks property is generated by Last.FM as a combination of many different methods including both content-based filtering and collaborative filtering which gives it a high degree of accuracy.

The proposed algorithm is to start out by trying to select the top similar hit to the top popular track. If this has already been played recently or is not found it should proceed with alternating between trying the next similar and trying the next popular track. If a song has been played recently it should not be played again for a certain period of time. In case no suitable track can be found for playback, e.g. because of a too little data collected, there is a fallback mechanism which can put on just some music to prevent the system from going entirely mute. As a fallback measure the system will resort to a playlist of the most popular dance tracks in Denmark in case it can not settle on a track to play next.

Having settled on Spotify as the music player it would make sense to also use their APIs for meta data extraction, the Spotify API does however not allow for query of the track similarity and instead the Last.FM api is used for this. Echonest

was also considered, as they are one of the largest music meta data providers, but they do not provide similarity lookup on a track level.

To gain access to the Last.FM web service one needs an API account which is free for non- commercial use. With a such one acquired one needs to pass along an API account key for all requests. The Last.FM API is a web service which is accessed via a HTTP GET lookup and JSON(JavaScript Object Notation) which can then be deserialized [6].

3.4 STEP 3: MUSIC PLAYBACK

The system design goal is for it to be cheap and easy to setup, this means that the user should not bother with assembling a music collection himself and a streaming service should therefore be used. As found in the previous work section, there are multiple streaming radios which are potential products to integrate with in terms of handling the playback component. Pandora, while being the original provider of music recommendation, is today only available to users in the United States, which excludes it from this project. Grooveshark has been accused to right issues and is deemed illegal in Denmark. Last.FM excels in terms of an extensive metadata library but only has a web-based player. Spotify is very popular, has the largest collection and mostly importantly it features a desktop client, which should ease integration from other programs. Spotify will therefore be the choice of music player to integrate with.

The chosen integration was done via a Spotify process running called SpotifyWebHelper.exe which runs in the background as long as Spotify is running. It works by listening on port 4380 and is normally used for the play buttons on Facebook and embedded players on other websites. There is an API running on that port, providing several functions that can be used with either JSON or XML. Using the SpotifyLocal7 framework it is possible to hook up to this API. This way of integrating ensures that even if AutoDJ crashes it is nearly impossible for it to take down Spotify (and thereby the music playing) with it. With the desired music track coming from Last.FM a conversion from the “Artist - Track” naming scheme to Spotify URI is needed. This was handled via the Spotify Search web service, their services take arguments via HTTP get and can return in either JSON or XML.

4. TEST

4.1 METHOD

During implementation many small scale tests were carried out but they were all of technical character and executed outside the intended environment for the system. With a rough prototype implemented it is time to see how well it holds up when presented with a realistic scenario of use. This test should gather data on the overall feasibility of the system and provide input for further revisions.

A user test was conducted at the university Friday bar at Aalborg University Copenhagen. The venue is student driven and holds Friday bars every two to three weeks for all students at the campus. The opening time is from 1500-2200h and usually there is bar managed playlist playing from 1500-1800h and then from 1800h a professional DJ takes over for the remaining hours. The AutoDJ system was on this day running during all hours. The bar manager knew of the system but the rest of the attendees did not know that there would be anything different about the DJ for the event. The setup was placed in a corner of the room next to the dance floor with the webcam at a high table.

Test data are gathered in three ways:

- Quantitative measurements of the dance floor rating and songs being played.
- Interviews with people who have been out dancing.
- Observation.

The benefit of using three different data sources is that one can triangulate between them which helps improve the validity of the results. Questionnaires were considered but it was deemed more likely that party goers would want to be interviewed than wanting to fill out surveys. Interviews furthermore have the benefit of one being able to ask follow up questions in case the subject seems to have misunderstood a question or if other interesting points come up.

The intention with the quantitative part is to get some objective data to compare up against. The goal with the observation is to get a larger understanding of how the quantitative log data and the qualitative interview fit together. The interview part focused on two central questions: Why they had started dancing and why they had stopped dancing. This was noted along with a time stamp, age, gender and any other thoughts they had on the music of the night. For the interviews I presented myself as the DJ and as doing research on "dance culture".

4.2 FINDINGS

A total of 21 people were interviewed, 12 males and 9 females. Aged between the age of 20 and 29 with a mean age of 23,71 (std. dev 2,28). There was around 30-35 people in total at the venue, this number being relatively stable between 1600h and 2200h.

For quantitative evaluation data was logged each second for around 5 hours, for each time stamp and motion level were logged along with which song that was being put on and if the system had was unable to find a suitable next track. Examples of answers to why people entered the dance floor range include "It was a total rad song that came on", "There were hot girls on the dance floor", and "There was a nice hiphop beat going".

Examples of reasons for leaving the dance floor include "Lack of other people dancing", "Was sweating too much", and just plain "Got tired". 13 of the 21 respondents mentioned a music related reason for entering the dance floor and thereby makes music the most prominent parameter in terms of attracting dance floor activity. Only two respondents mentioned a music related reason for leaving the dance floor.

When asked about their thoughts on the music being played there were no significant complaints or comments about the quality of the DJ which leaves the impression that the system was indeed mistaken for providing a real DJ experience.

There were too few people in total at the venue to create a proper atmosphere for dancing. This somewhat changed over the evening though, for the last hour the atmosphere ended up being so good that there were people on the dance floor constantly.

At the end of the Friday Bar the system faced the most criticism when the music had to be turned off. At that point the atmosphere was really good and the system had gotten a good hang of what people wanted to hear meaning that the dancers were facing a very sudden stop in the music. At the end of the party the bar managers requested for the system to be used for the next Friday bar also. It is uncertain how much this is a praise of the music selection or just economic reasoning based on that they had gotten a DJ for free unlike their regular paid DJ.

5. DISCUSSION

The initial idea with the AutoDJ system was to make predictions on what music people would like to hear next when dancing. Already by the word prediction one can see that one is dealing with an area where a clear answer is no straightforward or easy thing to provide. Or maybe it is easier than made out to be, maybe popular tracks are just popular with almost any crowd of party goers and thereby the crowd-adjusting features are less meaningful.

Several of the interview subjects were noticeably intoxicated which had a negative impact on their ability to formulate meaningful answers. Most interview subjects seemed to have interpreted me as also being the DJ of the night, this might have had an unfortunate influence on their willingness to criticize music choices.

Generally the technical parts of the program worked out well. Tracking when it was darker still work ok, there were just lower ratings but due to the relative design of the system this was not an issue. This test did not uncover how the system holds up against a real DJ or a playlist as that would take a proper control scenario. A test for the next iteration of the system would be to alternate every half an hour between having AutoDJ active and just playing a playlist of popular dance tracks.

A conclusion from the test is that the system currently has a clear cold start issue and requires some manual curation to gain an initial knowledge base. To take care of this some kind of starting medley or random selection could be made. Another interesting option would also be

to let people log in somewhere via their Facebook or Spotify profiles and then this could serve as a seed music preference.

Song requests were very much something people seemed to want so it would make sense to integrate in the system. An extension to AutoDJ would be to make use of the wide smartphone availability today and let users request songs through them.

In terms of adaptability the test showed a con ict at the early hours of the test between system wanting people to dance and people not wanting to dance at early hours. This was a natural result of the system only featuring the goal of maximizing dance floor activity. The system could benefit from having settings to give some rough indicators of when it should go for lounge music and when it should go for dance music. Similarly, the final minutes of the test clearly showed that the system needs a cool down feature as the one described in [4].

6. CONCLUSION

This paper has presented the design and implementation of the AutoDJ system. It is an adaptive music player that can adjust the music to be played based on input from computer vision and by using 3rd party web services. The system fulfills a number of design criteria such as being able to operate with commodity hardware and without any kind of user interaction.

The system was tested with users at a party venue which overall delivered satisfactory results. The test showed that the technical parts worked out well and that the system performed the needed task even with many components relying on simple solutions. The users were in general appreciative of the music selection but it is not possible to conclude on exactly how the system compares to a static playlist or to a professional DJ.

This project focused on motion level activity but it would make sense to look at if people counting, facial expressions, dance style, or other features could provide a more accurate picture of the atmosphere of a venue.

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ENDNOTES

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2 *http://spotify.com*
3 *http://grooveshark.com/*
4 *http://last.fm*
5 *http://www.logitech.com/en-gb/product/webcam-c170*
6 The process of converting from a string of characters to data objects.
7 *http://code.google.com/p/spotify-local-api/*

CONDUCTING SOUND, CODING PERFORMANCE

CONDUCTING SOUND, CODING PERFORMANCE

Conductive Music: building DIY drum synths, drawing digital music notation, and designing for urban youth

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Abstract. The Conductive Music project, scheduled to occur in multiple sessions over the 2013-2014 academic year, is a workshop series designed to engage at-risk urban youth in the construction and performance of electronic drum synth instruments based on Makey Makey boards and household items such as kitchenware and fruit. The workshops incorporate software and hardware gained from the Open Source Software communities and techniques from drama and contemporary music notation. These activities impart positive skills through multi-media content delivery for all learning types. The Conductive Music project's goal is to open up the world of electronic music performance to a new generation of young artists and to replace negative social behaviours with creative outlets for expression.

1. CONDUCTIVE MUSIC

Conductive Music is a series of workshops during which electronic components and commonplace objects are transformed into personalised musical instruments. We pitched the tone of the sessions for mainstream school students at risk of exclusion, living in poverty, or those who are refugees and asylum seekers and ESL students. We will be able to reach this specific pool of students thanks to our partners, Newham Music Trust which, as the music hub for the London borough of Newham, has built strong connections with secondary schools and concentrates its efforts with those in deprived areas. Our goal is to boost their personal artistic potential, nurturing self-confidence and self-esteem, by providing creative and technical skills. Coding, instrument design and fabrication, sound design, teamwork, composition and performance will provide essential training for various employment paths and provide an environment where achievement substitutes delinquency or violence, for those at risk [2]. The first portion of this two-day workshop is designed to showcase the possibilities that lie in the technology and objects that surround us, proposing an 'enhanced interface which acts as a liberator, or an augmentation of creative potential' [4]. Kitchenware, food, random objects will be featured, illuminated in a different light through a technological lens (See Figure 1). For the student, a messy room will be transformed into a palette of timbres, which will entice the most uninterested and satisfy the most demanding. The second day will culminate with the showcase performance, an experience which will provide a platform to share, comment and receive feedback among peers. *Conductive Music* will have wider impact as well: expanded outreach of partner institutions such as the aforementioned *Newham Music Trust* (London) and *Art-parkING* (St Petersburg), complementing organisers' current work in the field and providing professional development opportunities for young artists.

Fig. 1. *The edible drum kit, built with Makey Makey, fruit and vegetable.*

We designed *Conductive Music* because our academic research has highlighted a crucial intersection between current practices in multi-media performance and the expansion of open source communities. We, and others of our generation of multi-media performers, have found a wealth of music-making and sharing possibilities in the DIY instrument systems and want to appeal to new, young audiences by developing a *consciousness of kind* [1]. In open source software communities (OSS), this concept identifies a group of collaborators who share a target, a jargon and views on the final product. We want to share these principles with the workshop participants while also encouraging them to teamwork, boost their social interactions and cope with giving and receiving feedback from peers.

2. THE DESIGN OF ACCESSIBLE AND SUSTAINABLE INSTRUMENTS

Conductive Music instruments are based on commonplace objects, from kitchenware to food and toys (anything with a metal or liquid base), that are conductive and thus capable of channelling an electric signal. We decided to work with everyday materials for a variety of reasons. Their ubiquitous availability eased our logistics (they can be found *in situ*) and their low cost makes them affordable and interchangeable. These objects allowed us to demystify the aura that surrounds both conventional acoustic music instruments and expensive electronic ones. While a few might feel comfortable to sit behind a piano, nobody will pull back when given the exciting opportunity to engage with an ice-cube tray that makes sound. We invite new audiences, people that have never been exposed to electronic music before, to re-think the objects with which they are familiar. The instruments we designed are all characterized by an underlying simplicity, some of which are based on solder-free solutions. Whilst soldering is a valuable and transferrable skill taught at our workshop, we understand that some participants might have difficulty with the fabrication. This is why we designed some instruments which can be put together with simple electrical tape, much easier to manage and also much quicker to assemble, considering the restricted workshop timing. For example, we created a water piano by piercing the soft silicon bottoms of an ice-cube tray and connecting it to the board; we also wrapped toy rackets and soft foam balls in tin foil, creating a very basic *Reactable.* While many manual and practical skills are essential to the essential part of the workshop, we tried to stimulate those with different skills by introducing Bare Conductive Ink, with which the students can directly imagine and draw their instruments. For example, we have augmented a snare drum by drawing a

Fig. 2. *The early stages of the augmented snare drum, designed by Enrico Bertelli, drawings by Oriana Lauria.*

breakfast dish on its head (See Figure 2 below). The black outlines of all the shapes are reactive and respond reliably to the bare touch or to conductive sticks (drum brushes).

2.1 CODING AND MIDI MAPPING

Prior to the release of *MakeyMakey,* Bertelli based his augmented kitchenware instruments on *Arduino* boards and the *Ardrumo* software. The knock sensors (piezo) transformed cheese-grates and colanders into velocity responsive MIDI controllers. With the release of *MakeyMakey*, it became possible to bypass strip boards and most electronic components (resistors and diodes). Even though this board could no longer provide velocity data, it added control over the note length, extending the expressive possibilities when playing with synthesizers or other pitched sounds.

In order to exploit the full extension of virtual MIDI keyboard, controlled by the computer keyboard and compatible with most DAWs, we altered the *Makey Makey* code. Luckily, the simplicity of this operation gave us the opportunity to discuss it, together with principles of coding, during the workshop, providing students with insight on this valuable skill. Once inside *Ableton Live!*, each sensor was isolated and sent to a different channel via virtual MIDI ports (IAC). This procedure allows us to isolate the inputs and to treat them independently. Together with digital composer Mr. David Ibbett, Bertelli designed and developed *Scale Shaper,* which 'takes an external MIDI feed to generate a continuous analysis of what pitches are present (factoring out octaves). This information is used to 'shape' the drum kit's MIDI output - incoming notes are adjusted to match the nearest pitch of the current harmony or follow the top/bottom of the chord' (Ibbett, e-mail, 2012). Eventually, the *Scale Shaper*'s output is fed to arpeggiators and chord generators to create modal harmonic contours to the melodic performance. Due to time restrictions, the sound design is kept relatively simple. Young students are encouraged to focus on one instrument only and to focus on their role within the ensemble performance. More advanced ones are shown how to connect multiple instruments and how to create a more organic sound from a single instrument, between percussive, bass and lead sounds.

3. A MULTI-MODAL APPROACH

In order to address the varied learning modes and needs of the students, *Conductive Music* is designed to be a multi-modal learning experience at every stage of the workshops, by implementing multimedia technology and layers of reinforcement through a variety of delivery methods. The use of multimedia to improve student engagement has been extensively studied by educators, and has been shown to improve student confidence and learning outcomes [6]. The *Conductive Music* workshops, by nature, will be led with spoken instruction, but musical examples and sound samples will also provide sonic information connected to the teaching content. The electronic instrument construction process provides an abundance of tactile stimuli and use of fine motor skills. During the instrument construction and sound design stages, the instructors will provide examples on a projector screen, such that students will be able to visually match the instructors' navigation to their own computer screens. These modes of learning -- aural, visual, and tactile/kinaesthetic -- also are addressed during the second half of the *Conductive Music* program, which is focused on musical learning. At the end of the program's first day, a brainstorming session will be targeted to musical composition and the development of a narrative by using creative tools such as the game Rory's *StoryCubes*, as well as improvisation exercises based on drama techniques. Students will co-operate in groups, building short, informal performances based on prompts. These exercises will involve all modes of learning and will draw on the students' ability to construct a narrative arc in an ensemble performance. The students will also participate in a workshop about experimental music notation ("graphic notation"). The notation workshop will introduce the basic principles of graphic notation techniques and will encourage the students to develop systems that not only communicate effectively but also reflect their own creative concepts. These may include the use of colour in music notation, indicating musical gesture through lines, and symbolising performative actions through simple icons. By using simple illustrating techniques in digital software, the students will explore methods of effective and innovative visual communication of musical ideas and performance instructions to other participants. When the student groups' compositional and performance ideas begin to solidify, we will move on to working in loosely structured group rehearsals. A crucial part of musicianship is the ability to work as a team in preparing and honing a performance. Robertson will direct the groups in their rehearsals and foster an environment of teamwork. Though the interactions of rehearsal in an ensemble setting may be uncomfortable at first, they provide another rich environment for learning visually, aurally, and kinaesthetically. [8]. Students who are more confident may take a leading role in their groups, but the group progress will be monitored to ensure that less active members are encouraged to interact and contribute to the musical outcomes.

4. ENGAGEMENT OF URBAN YOUTH

Conductive Music's engagement method relies on *experiential* and *discovery* learning. We preferred this practical workshop setting, as opposed to a standard frontal lesson, based on the feedback from previous experiences (i.e. *Augmented Kitchenware Arduino Workshop* ran at the London Music Hackspace). During the two days, we will present students with questions, incomplete ideas and problems that they will need to solve, under our guidance. The transformation of lifeless electronic components into a personalised instrument comes at a great effort. Therefore, students will have to create structures and solutions [5] based on the newly gathered skills, unable to refer to ready-made procedures, they will have to rely on their personal and their group's resources. Immersed in this teamwork experience, students will learn to value argumentative and technical skills of themselves and others and to collaborate for the common good, the public performance. *Conductive Music* will not only provide students with new skills, but also help them discover and grow confidence in those they already have. Furthermore, we will aim towards the gamification of the musical experience, by putting the groups in competition with each other. Research shows how music students attribute ability and effort to success and

failure, rather than commenting on luck or difficulty [7]. We foresee this experience as a motivation booster and as an invite to cooperate towards the greater good of the group (music ensemble). Eventually, we see *Conductive Music* as a pilot program for music technology, able to generate other workshops as well as regular sessions to be included in secondary schools' curricula. We are currently collaborating, through the Newham Academy of Music, with the East London Science School, to incorporate *Conductive Music* in the syllabus.

5. THE FUTURE OF CONDUCTIVE MUSIC

5.1 TECHNOLOGY IN PERFORMANCE AND DISSEMINATION

The instrumental prototypes creatd during *Conductive Music* will not be limited to our workshop sessions. We have already started performing with the instruments we designed, extending the outreach of the project. For example, an augmented snare drum (*MakeyMakey*-based circuit, *Leap Motion* and *Conductive Ink*) has been presented at the first edition of *Hack the Barbican* (Barbican Centre, London) and *Big and Small* (Tate Britain, London) and will be showcased at the Mariinsky Theatre (St Petersburg) in early November 2013. We are currently planning a series of performances with newly created instruments, which are extended by the incorporation of e-textiles and other wearable technology. We are currently investigating the possibilities of *LilyPads* (a wearable Arduino-based hardware) and the new *Flora*. We will continue to participate in the dissemination of open-source data associated with the *Conductive Music* program and instrument design, through our blog and our partners'.

5.2 WORKSHOP DESIGN AND DELIVERY

The concepts and pacing of the *Conductive Music* workshop program was tested at the Elephant and Castle London Mini Makers Faire in July 2013. This miniature iteration of the program was marketed for all ages as part of the series of ticketed Maker Faire workshops. Running the workshop in a shorter time frame for a wider age range brought the strengths and weaknesses of the program to light and informed a series of revisions that will be implemented in the next scheduled series of *Conductive Music*. These insights included a greater awareness of the importance of multimodal learning in the workshop environment and provision of some pre-fabricated materials for students who may have difficulty during the instrument construction phase.

Conductive Music is scheduled to take place in Newham, London throughout the academic year 2013-2014. We will also be directing *Conductive Music* as part of the 2013 "World of Sound" festival in St. Petersburg Russia, in co-operation with Art-parkING and the Mariinsky Theatre, and has just been presented here in Copenhagen, in collaboration with the *Re:New* conference committee. Through these opportunities, we hope to reach hundreds of urban young people and open up the world of electronic music for them to explore and a universe of art for them to discover.

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The Switch of Carpentry – Memories from a Cassette Tape Recorder

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Abstract. This paper sets out to investigate the relationship between documenting, representing, collecting, structuring and transforming the operational cassette tape recorder into philosophical research material. This is done in an attempt to combine practice-based research with a theoretical background of object oriented ontology and media archaeology, resulting in ways of extracting knowledge from the operational machine itself and transfer this operation very directly into formal academic writing.

1. INTRODUCTION

By posing the question of how the tape recorder represents and understands the world we have the possibility to get closer to the actual physical operational technology itself as an exposition of length, time and magnetism and its way of representing reality. This exposition will happen through an object oriented, ontological perspective paired with a media archaeological approach to the operative cassette tape.

For the scientist the tape recorder was traditionally used to document and record our sounding reality which then could be brought back to the lab for further analysis, focusing on the spoken or auditory content of the tape, as opposed to an investigation of how the tape itself "understands" its surroundings. Later digital technology made the tape recorder obsolete, but the analysis of the world being carried out is still a textual one, focusing solely - or primarily - on the content, making the medium somewhat unimportant. I, on the other hand, propose a different approach, in which the cassette tape recorder is transformed into an object of carpentry.

2. THEORETICAL AND PHILOSOPHICAL BACKGROUND

2.1 Carpentry A central term for philosopher and game designer Ian Bogost, as it is unfolded in his book *Alien Phenomenology* from 2012, is the notion of *carpentry* which is described as the philosophical practice of making things.
As a philosophical lab equipment [1] carpentry becomes a perspective on creative work that poses philosophical questions, as when matter is being used especially for philosophical use [2], executing what could be denoted as applied ontology. This happens because writing is dangerous for philosophy because writing is only one form of being, a comment to the assumption that we relate to the world only through language [1]. At the core of carpentry lies the understanding that philosophy is practice just as much as it is theory, the practice of constructing artefacts as a philosophical practice that is [1]. The term extends the ordinary sense of woodcraft, to include any material, and additionally it lies within Graham Harman's philosophical sense of "the carpentry of things" [1], a term that refers to

"how things fashion one another and the world at large" [1]. But in Bogost's terminology carpentry "entails making things that explain how things make their world" [1], thus enabling not only theory in practice, but more over; practice *as* theory [1].

The term carpentry is unfolded within a larger context of object oriented ontology or philosophy, which originates from the speculative realism of Graham Harman, Ray Brassier, Quentin Meillassoux and Iain Hamilton Grant. At its core a speculative realist is opposed to correlationism - a term used to describe that being exists only as a correlate between mind and world, placing humans at the center [1], [6]. As an example Heidegger claims that objects can exist outside human consciousness, but their begin exist only in human understanding [1]. Thus to be a speculative realist "one must abandon the belief that human access sits at the center of being, organizing and regulating it like an ontological watchmaker" [1], and instead shift focus to include all possible objects, and that all things exists equally thus introducing notions of flat or tiny ontology.

Ultimately this means that when removing humans from the center of the equation more focus is directed towards the various objects that the world consists of, which for Bogost means the investigation of what it is like to be a pixel within a computer game.

3. CASSETTE MEMORIES WORKSHOP

The 3rd and 4th of July at this years Roskilde Festival in Denmark I together with sound artist and researcher Andrew Prior, and researcher Søren Pold conducted a performative workshop in which the audience were invited to participate in the construction of tape loops from old compact cassettes. These loops now formed the basis for several performances by Prior and my self throughout the two days the workshop lasted. These performances, together with interviews of the participants were all documented on cassette tapes.

The workshop was entitled *Cassette Memories* and had two main focuses, the first being what memories we have of the compact cassette medium - as the first childhood medium that brought us our first musical experiences, and the second focusing on how the cassette tape remember us, the object oriented ontological take which unfolds how the rotating capstan and pressure roller pressing against the thin polyester tape coated with chromium oxide, transferring the magnetic domains to the playback head.

Before continuing with the findings from this performative workshop, I will briefly introduce the principles of magnetic recording and the basic functionality of a cassette tape.

3.1 PRINCIPLES OF MAGNETIC RECORDING AND THE BASIC FUNCTIONALITY OF A CASSETTE TAPE RECORDER[1]

In 1820 Hans Christian Ørsted invented electromagnetism, which paved the way for Michael Faraday's experiments with electromagnetic induction in 1831, which ultimately lead to Valdemar Poulsen inventing magnetic recording via his wire-recorder from 1898 [8]. In 1962 Philips invented the compact cassette tape, which was introduced to the European marked in 1963, and performed for almost 30 years as the most used method of recording and reproducing sound.

Material that is capable of being magnetised is referred to as ferrous, and the molecules of such a material are linked together in the form of a crystal structure [3]. Each complete crystal element contains a certain number of molecules, depending on the material. Ferric oxide e.g. which forms the basis of the coating of *Fe* tape has eight molecules per element [3].

The crystal elements can be regarded as domains of randomly oriented magnetic fields, but when the material gets magnetised the domains are swung from their random distributed positions and now the domains line up. The strength of the resulting magnet is determined by the number of domains in alignment. When all the domains are in alignment the material is said to be magnetically saturated, that is, being incapable of accepting further magnetism or producing a greater magnetic field [3].

The basis of which the tape recorder is capable of capturing and reproducing auditory content, is centred around three tape heads - erase, record and playback - each containing an electromagnet having the ability to convert an electrical signal into a magnetic force that can be stored on the passing magnetic tape, and conversely convert the magnetic content of the tape

into electrical current. It should be mentioned that in most compact cassette recorders the record and playback heads are combined into one in order to cut down on the reproduction mechanisms size.

At the erase head a high frequency (approximately 80 to 100 kHz), high amplitude audio signal is sent to the erase electromagnet, thus randomises the magnetic particles on the tape, erasing any previous material on the tape. Music varies in frequency and amplitude, as so does the magnetic field from the record head, thus imprinting a magnetic picture of the audio signal on the tape. When recorded tape scrolls under the playback head, the moving magnetic fields induce a varying current in the head. This voltage produces an electrical representation of the magnetic signal on the tape. This is then passed through an equalisation and amplification circuit so that the recorded music becomes audible at connected speakers.

3.2 CASSETTE LOOP TIME & SOUND ON SOUND RECORDING

As previously mentioned the *Cassette Memories* workshop was documented on tape on various tape machines using various formats of compact cassettes, but one method is important in the context of this paper, namely documenting on loop cassettes using a tape recorder that has been modified so it is possible to disable the erase head, enabling sound on sound loop recording, a method in which layers of sound becomes superimposed upon each other.[2]

The sound on sound button that disables the erase head of the tape recorder reconfigures the cassette machine into an object of carpentry, as it gives us the possibility to display and monitor the cassette tapes state of magnetic saturation, a state that uses all possible resources of the ferrous coating on the tape. A state that shows the true personality of the recording medium and its attempt to capture the complex pulsating sound waves of humans talking, walking, playing music onto the tape which gradually gets more and more saturated forcing the magnetic domains in the same direction, but still leaving room to listen to the contours of the previously recorded material, while new material gets and layered and layered.

When recording for documentation, time is a crucial factor. When did the recording take place? for how long? etc. But also the time of the actual recording is important. When recording on a compact cassette, time is measured in length, the length of tape, which is played back by the tape recorder with the average speed of 4,76 cm/sec. The specific cassette recorder used in the example is the Philips D6260, and according to the service manual (Philips, 1986) the tape speed can vary up to + and - 3%, making the notion of accurate time questionable.

If time is length - or more accurate the execution of length, then the precision of the tape recorder becomes extremely important, which introduces the notion of the operative tape recorder, which to great extend references Wolfgang Ernst's notion of micro-temporality. But things gets even more complex when using a 1 minute continuous loop cassette using sound on sound recording, a method that questions the notion of documented time to an extreme. Time gets transferred into complex states of recorded time, real time, machine time, past time, tape time (which is the execution of tape length), creating a compound of different conceptualisations of time existing as layers on top of each other.

This method of reconfiguring the cassette recorder can of course be claimed to have a clear artistic agenda, and a specific aesthetic expression, but the self made sound on sound switch and the use of loop cassettes also changes the tape recorder's status from a technological object into an object of carpentry, a philosophical lab equipment used to practice philosophy. Layers of sound becomes superimposed upon each other, and furthermore various notions of recorded time gets superimposed upon each other, making the sound on sound loop tape difficult to analyse in a traditional textual manner, forcing us to shift our analysis perspective towards the actual recording technology itself.

These philosophical questions posed by carpentry reveals an alternative reality of the operational tape recorder. A reality that can be claimed - following the thoughts of Wolfgang Ernst - to be in its core un-historical, meaning that the specific function of the machine is in someway outside history, and to some extent

outside human discourse. But not outside the discourse of cassette tape itself, shifting the perspective to the conceptualisation that the technological moment becomes comprised of media, not humans, and this media is not dead, but operating [4]. Thus a merger of object oriented ontology and media archaeology present itself, bringing an awareness to the moment when media themselves become active "archaeologist of knowledge" [5]. From a media archaeological point of view it is only technical media that is able to register physical real signals, and so does the cassette tape not only preserve the memory of human cultural semantics, but also the knowledge of how the cassette recorder stores and operate the magnetic domains of the ferrous coating of the running tape. Knowledge embodied in the operational technology exposed by its use in a artistic performative context, reconfigured into a philosophical practice by the notion of carpentry which enables the exposition of physical material saturation, and questions regarding our understanding of documented time. Perspectives that additionally reflects the use of our current digital technologies for documenting our sounding reality, stressing the importance to pay more attention to the media archaeological moment of the operational machine.

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ENDNOTES

1 The following technical description is based on the following sources: [3], [7], [8], [10], [11]

2 A method resembling the tape experiments of e.g. Terry Riley, Pauline Oliveros and Morton Subotnick in the early 1960s.

Speak - Active Sound-Space and the Performer

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Abstract. Speak is an interactive work for meta-trumpet and active sound space – the assemblage of instrument, computer and physical acoustic environment. A sound-as-medium concept is implemented using an ALife wave model inhabited by an evolving population of sounding-listening agents. The work consists of layers of different wave phenomena, enacted by these agents. Listening within the system is considered important in the encouragement of emergence, as is the redescription of phenomena between different domains. In Speak, communication between three domains – wavespace, performance space and symbol space – produces a complex hybrid dynamical system.

1. INTRODUCTION

Michel Serres has recently reminded us that the founding myth of music – the story of Orpheus – is concerned not with creating or performing, but with listening[1]. In an earlier work he shows how human imagination is predicated on a "sea of noise" to which it is attuned and on which it depends[2]. Much Western music (and even more Western performance) is concerned with isolating itself from not only its inherent and embedding acoustic noise but from the musical-informational noise that produced it. Sound art, to polarize exaggeratedly, would tend to amplify and draw attention to the noise, to the nature of the sea from which music arises. *Speak* is concerned with the passage from one to the other. It attempts to compose through situated processes of human and machine listening, expanding the physical actions of the performer to explore the emergence of structure in the spaces between noise and figure.

Speak relates to a wider theoretical project: the *work-without-content*[3]. This develops ideas from Giorgio Agamben (*The Man without Content*, *The End of the Poem*) to hypothesize that the common currency of listeners in a culture of fragmentation and individualism are the expectant silence - the blank page - and the challenge of structuring it as noise or habit rush in to fill the void. This is different to a Cageian silence, which might emphasize the "musical" by framing it with its negative.

Discussion of music tends to assume a notion of "content", whether melodic-rhythmic figure or abstract *objet sonore*, as if this has some kind of existence beyond the bounds of the experience itself. The "note" is the supreme facilitator of this situation. Notation has played a key part in the evolution of Western music in its plastic role as a means of calculation, representation, instruction and analysis. Recent musicology acknowledges the embodied, situated of musical performance, but tends to remain event-focused, replacing a written text with a recorded text. Sound art, on the other hand, tends to characterize a particular work precisely by its situation and mode of embodiment, of which the resulting sonic surface is a product. I exaggerate to make the point, but the fissure between two discourses

exists: in this year's *Research Excellence Framework* evaluation programme in the UK, music and sound art two fall under entirely different disciplines, performing arts and fine art. They might be distinguished by their modes of performance, by their approaches to structuring time, their degree of figure or abstraction or their plasticity as works. Most important, I would argue, is the relationship between creative intentionality and the musical surface, the sonic reality, that results in any given instantiation.

A model is needed that takes account of all these aspects, therefore. Here we consider a musical work in terms of its dynamics, its starting conditions, constraints and behaviors, and the ways in which it is embodied, distributed and situated. While reverse-engineering the Western canon would be a non-trivial challenge, this conception is as valid for a symphony as for a piece of interactive technological sound art.

In his paper *Against Soundscape*, Tim Ingold argues that sound is not the object but the *medium* of our aural perception[4]. This has significant implications for how we conceive of making music. We do not perceive "notes" but changes in air pressure; notes represent a complex set of acoustical phenomena with some reducible features (steady pitch, onset in quantized time) emanating from a particular individual, instrument and place. Sound is what illuminates the activities of music. We are well attuned to sonic detail: we can pick out one voice from hundreds, after several years and on a bad phone connection; expert violinists can identify individual instruments. Attention to the particular instabilities of these apparently stable phenomena is therefore inbuilt as a cognitive skill. What is needed is a model that can account for such phenomena while making them accessible to conscious creativity, manipulation and reflection. Our concept of the performing environment also has to evolve. The room is full of air in movement, however slightly – full of microsound, of sound potential – just as every action of the performer has sonic implications.

2. A VIRTUAL WAVE MODEL

In *Speak* we therefore adopt a wave-based model implemented using an ALife approach. The work maintains a virtual space parallel to that of the performance, inhabited by a variable and evolving population of agents. These exhibit different kinds of behaviour informed by different rules, constraints and kinds of information. They both initiate and listen to wave activity. They are both sonic beacons and telescopes, identifying, isolating and bringing into the range of human hearing the various phenomena in which they take part. The initial state of an agent consists of its position, amplitude and frequency characteristics (up to eight components). It evolves as other behaviors are acquired through interaction with its virtual and real surroundings. The contribution of every agent to the aggregate movement/sound within the space is calculated at each time step. Their common virtual space has nonlinear properties; in particular, the speed of sound can vary widely, and may itself be modulated by other wave behaviour. Similarly, the degree of attenuation of each signal as it moves through space is variable. In this way the space effectively has material properties.

Speak deals with the moment of emission of an acoustic sound, of its production by the acoustic coupling of a complex human system of vibration and resonance with an instrument: the trumpet in this case. It is concerned with entering the moment of "speaking". Its principal material is the unstable liminal acoustic phenomena that occur at the edge of stability – sounds that would prefer to tend towards resonance, noise or silence. It is a work-without-content in the sense described above: the surface of a particular instantiation is determined by a set of interacting dynamical systems, the actions of the performer, a technological setup – an *assemblage*, in Agamben's terms – and the particular context. Behind these lie an implicit narrative, a rhetorical structure; together they produce an emergent form. The assemblage is based around the *metatrumpet* – the fourth generation of the system. A conventional instrument is equipped with a range of movement and tactile sensors, visual position-sensing, and microphones inside and outside the instrument. It communicates by Bluetooth with a computer running Max/MSP, as interface and audio engine, which in turn communicates with the custom software in C++ via

the OSC protocol. Some processing is devolved to outboard processors. Such a spatial concept may ultimately lend itself to implementation with a technique such as wave field synthesis, but reliance on non-standard installations would compromise the mobility of the work. In the current version, IRCAM's *Spat* is used to dynamically locate sounds.

In a study of the mechanisms of arts based on constant movement – among which he counts both sound and video – Bill Viola provides this comprehensive list of wave phenomena:

- Refraction
- Reflection
- Diffraction
- Interference
- Resonance
- Sympathetic vibration [5]

The layers of the work are the phenomena listed by Viola. Reflection, resonance and sympathetic vibration are all familiar from conventional modes of Western music. They all play a part in our conscious listening, but one might further argue that they are more structurally fundamental to the evolution of Western music itself. Polyphony in its various forms is one of its most characteristic attributes, which can be understood in terms of reflection. Tonality as described by Rameau is effectively a system of resonance; Tartini discusses harmony and tuning in terms of sympathetic vibration. Here, reflection is used to establish a continuum from timbral phenomena – over time-periods too short to individuate or simultaneously, in the frequency domain – to figural or formal levels. Virtual resonant and vibrating objects are created in the course of the work as a product of the combined behaviors of performer and system.

The performer can establish behaviour-transforming objects in the virtual wave-system, analogous to mirrors, lenses, prisms or barriers. Some are created directly, others as the result of analysis of performance system parameters. These may be temporary or evolve into persistent agents with their own behaviours. Refraction is implemented by splitting the incoming sound, whether from the trumpet or the virtual wave-system, into its constituent frequency components. These are then time-shifted independently; they become separate voices that develop their own trajectory. Figure can evolve from non-figural input. The relationship between these components may also be transformed – they can be transposed independently or together – and they may be reunited into a new object. Diffracting objects are also created, around which currently active wave-emitting agents move. They partly reform, the remaining energy being diffused in a "halo". Experiments using Kirchoff diffusion in real time proved impractical in context, but demonstrated the results that might be obtained using far greater computing power. In practice this is implemented using filters.

In any system of more than a single wave, interference is ubiquitous, however slight. To speak of interference as a separate phenomenon is in a sense redundant: degrees of constructive and destructive interference are in evidence at every point in the space. At the same time, this would seem to be the phenomenon of greatest interest, the effect that appears to generate new behaviour or structure. Such emergence is most clearly identified in interaction with the subject, with the listener or observer. Here we must distinguish between two kinds of emergence: weak emergence which is in the ear or eye of the beholder (ripples merging on the surface of water, for example), and strong emergence in which new elements are added to the dynamics of the whole system (wave systems combining such that they form a vortex attractor). The subject has therefore to be present in the system. This also happens to two ways: in the structured relationship between virtual model, acoustic reality and performance described below, and by enabling the agents themselves to be listeners.

This has a wider implication: we do not hear the virtual space as a single abstract entity – how would we choose from what perspective to listen? Rather, we listen from the perspective of agents as they move through the space, sometimes separately, sometimes in polyphony. Interference plays an important part in their development and evolution. At each time-step, a point of maximum interference is calculated

for the entire space. After various experiments, the strategy adopted is to look at the difference between the scalar sum and the vector sum of the contributing waveforms[6]. What we hear is the agents' listening to this point from their own position, taking account of individual factors such as differences in speed of sound. Each agent then calculates their particular contribution to the perceived signal at the point of maximum interference, and moves within the space to maximize this parameter. This naturally produces an endless dance of agents through sequences of pattern, chaos and temporary attractor until other events cause the nature of space or agents is change. Within each group focusing on a particular point of interference, voices/listenings are distinguished by their spatial position, degree of attenuation and Doppler shift. The continuity of this movement allows a micro-polyphony to emerge. As with all the wave phenomena described here, a process of identification, isolation and magnification is necessary; it is not possible simply to amplify the aggregate wave system, and the surrounding noise would defeat the object. The process is akin to capturing wave patterns in water by illuminating and magnifying an area of its surface. We might think of it as a kind of second-order sonification. In the cases of all these phenomena, parameters – including and especially time – are stretched and shifted. They are illuminated in order to bring them into the realm of conscious listening. In this magnified form they are reintroduced from the real acoustic space to the virtual wave system.

Analogous evolution takes place in the frequency domain. Some agents have complex frequency characteristics derived from external input – the trumpet or electronic sound in the acoustic space. The frequency content of individual agents is compared to that of the aggregate signal, internal or "real", and agents adapt their spectra to optimize their contribution according to variable parameters of harmonicity or noisiness. The degree to which an agent is aware of other behaviors in their world is variable; we might describe it as their *sightedness*, after Prusinkiewicz' work in biological morphology[7]. While computationally expensive, it is possible to implement individual memory for agents such that the act over different orders of time; this aspect of behaviour is discussed below. In general, memory is considered to be inherent in the current state of the whole as a dynamical system.

Interference thus becomes the principal structuring and evolutionary wave phenomenon in *Speak*, and listening within the system is vital to its behaviour as a whole. To return to our opening reference, the agents are a band of *Serres' Orpheans*.

3. HYBRID SPACES

One of the musical goals of this work is to realize musical structure over multiple timescales. This dynamically hierarchical dimensionality seems to be an important property of Western art music, for example, and is absent from closed, purely generative systems. The complex modality of human perception of music suggests that this is not merely a product of hierarchically promoting emergent structure within a fixed parametric space. As in the case of interference, perception plays an active role. Emergent structure is not just identified; it affords the ascription of salience, it is redescribed by the subject as having some degree of autonomy and instrumentality. Instead of an elaboration of a previous behaviour or situation, it can be abstracted as a new "essence". As we have suggested, this process can be understood as a changing of domain, a redescription as a different kind of thing. Indeed, we might suggest that such processes are the very drivers of much compositional practice and perhaps of the evolution of Western notation-based art music.

Domain-crossing is already inherent in an assemblage such as that of *Speak*. Exchange between a virtual model and physical performance is not transparent or unmediated; it relies on many modes of conversion, description and mapping. In addition, some internal behaviors are predicated on processes of symbolic representation. In such cases sound (in the performing space or within the system) is subject to categorization of pitch and quantization of frequency, necessary to facilitate processes such as pattern identification and matching or the induction of periodicity. To work in the real world, such operations require a degree of flexibility and deviation that such categorizing makes possible.

In this domain we deal with events: MIDI pitch and quantized rhythm. In relation to the signal streams this is a form of data reduction, but it also corresponds - however loosely – to human perception. Again, a process of listening drives behavioral evolution and emergence within the system. The conceptual architecture of *Speak* is a thus threefold model, combining *wavespace* (the computational model), *performance space* (the physical world) and *symbol space* (the space of description), as shown in fig. 1:

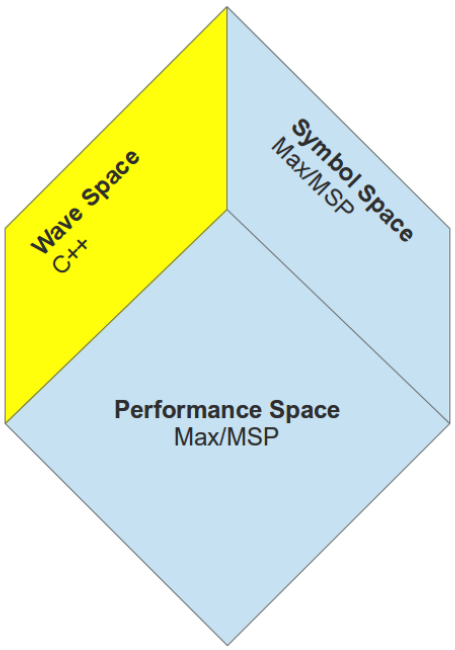

Fig. 1*: geometric representation of the three-space architecture*

The three spaces are in continuous communication, but they do not mirror each other. Rather, their boundaries articulate the dynamical system of the whole; the processes of listening and mediating within and across these boundaries are its driving forces.

4. CONCLUSION

The intention is to present the performer with an active sound space affording a balance of autonomy and plasticity. As with the physical act of producing a sound – *speaking* - that is the seed of the work, the relationship between intentionality and joint behaviour is complex, nonlinear and evolving. The sound is this in perpetual evolution; its development on micro-sound and formal levels is the product of a network of structured links between creation and listening. The performer's role is to explore what Delanda describes as the *space of possibilities* of simulation systems. He distinguishes between the properties, tendencies and capacities of such a system, and suggests that its "historically contingent identity" is defined by their emergence[8]. In his taxonomy, properties are inherent, tendencies reveal the dynamics of stability and capacities may remain potential. Tendencies and capacities do not need to become actual to be real, therefore. Such an analysis offers the performer a model for their relationship with the work. Emergence can be shown to be real, he says, when "emergent entities at that scale can become component parts of a whole at a larger scale."[9] This reflects the quality of evolving hierarchy discussed above. The balance of these qualities is what allows the work to achieve wholeness or not, a property piloted by the performer.

In discussing the state of contemporary art, Agamben also emphasizes the importance of the *potentiality* of the work. He argues for the importance of its "energetic aspect", the "being-at-work of the work" through which the subject can engage in the becoming of its final shape[10]. This work is a complex space that produces a specific surface only in interaction with the subject, internally and from without the system. The performer is looking for gradients within a spatial system the entirety of which is in constant movement: probing, provoking, listening and illuminating. Adopting a spatial model to address what may have appeared incommensurable approaches to making and understanding art has echoes of David Summers' proposal of a real-virtual spaces model for the understanding of different modes of visual art[11]. The active sound space affords this composer and performer a way of conceiving and working with sound that goes some way towards overcoming dichotomies of event and environment, inside and outside time, fixed and open, while retaining a notion of the work as a bounded integral whole.

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THEORIZING MEDIA ARTS

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Operational Blindness in the Twentieth Century: The Emerging Digital Image in Art from Gestalt to Distributed Network

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Abstract. This paper looks for resonances of the present in the past. It interrogates ideas that contemporary theorists claim to be uniquely borne upon 21st-century digital technologies rather than existing within the deeper history of pre-digital technologies. In short, the intention here is to show incarnations of contemporary new media theory in history. While Mark B. N. Hansen claims that "operational blindness," a term referring to mind or consciousness understood as a distributed network rather than a contained entity, is particularly enhanced by if not, simply put, *particular to* 21st-century media, I argue that "operational blindess" exists deeper in time, in the prehistory of the digital image within art that goes back to the thinking of László Moholy-Nagy, Gyorgy Kepes, and Jack Burnham among others.

1. WHAT IS "OPERATIONAL BLINDNESS"?

For at least a century, critics and philosophers have written about the transformations of perception, knowing, the self, and sensorium brought on by image and moving-image technologies. At base, the photographic and film camera extended the human sensorium out into the world, prosthetically enhancing it by laying bare an "unconscious" of the senses, as Walter Benjamin put it, hitherto unnoticed.[1] These technologies marked another push toward what Bernard Stiegler calls "exteriorization," the outward and relational inclination of the individual enhanced by technologies, from writing to the smart phone.[2] With respect to the modern light-image, celluloid pictures and movies did not simply show us our intuition but made them felt. And, in a perverse turn of forces, the manmade techno-image laid bare our metacognition, that is, our proprioceptive knowing beyond knowing through "mind" conceived as rational, static, seated in the cranial cavity, and separate from the phenomenology of the body. Image machines put us closer to our animal-self, which, in the process, reinforced the manmade and constructed nature of concepts such as "consciousness," "mind," and "self." Technologies of light, image, and time reveal "consciousness," "mind," and "self" to be not only manipulations of language and social mores, but also confabulations tweaked and made material by the space-time of machine technologies – both analogue and digital.

Now part of Hansen's larger project *Feed Forward Recording for the Emergent Future*, the concept of "operational blindness" is based on the "technical distribution of cognition and perception" in the understanding of "complex couplings between humans and machines."[3] Building on networked "superject" rather than "subject," i.e. the individual extended out into the future through space-time, Hansen argues that wireless technology and the wireless smart environment divorces the superject from time in a way that "blinds," muffles, or thwarts conventional human consciousness:

When "we" act within such smart environments, our action is coupled with computation agents whose action is not (at least in part) beyond our control, but also largely beyond our

awareness...we can have absolutely no cognitive or perceptual access to the computational processes that inform them *at the moment of their occurrence* – a moment that I shall call their "operational present." This foreclosure of access comprises what I shall refer to as the "operational blindness" of human consciousness.[4]

This blindness is equally a blotting out of consciousness, and its accompanying mind-body dualism and hierarchy of being. According to Hansen's thinking, such sightlessness unfolds as part of the basic functionalism inherent to the experience of the everyday workings of the wireless smart environment, which itself bears an "ineliminable temporal gap."[5] As humans do not perceive this caesura in time that is part of the use and functionality of such technology, operational blindness, viz. a strain of unconscious, intuitive, proprioceptive maneuvering, becomes the norm within smart environments.[6] Hansen underscores the link between this blindness and disindividuation and correlates this shift from gimlet-eyed awareness to the functional unseeing to philosopher of technology Gilbert Simondon's thinking on preindividuation and transindividuation. For Hansen, following from Simondon, the individual does not emerge whole, fully formed ex nihilo, but rather is preceded by and carries within it a fabric of preindividuation, which he also refers to as the "associated milieu."[7] Rather than acting as a fully formed ego-subject, the superject – the individual with potentialities always unfolding into the future – is an ecological being, interconnected to other living beings within an already given milieu. In sum, operational blindness creates a situation propitious for the coming of the superject, over the subject, or what Hansen calls "former concrescent actualities that have become part of the settled world."[8]

2. WHAT REVEALS OPERATIONAL BLINDNESS? 19TH-CENTURY AND 21ST-CENTURY MEDIA

The linchpin of Hansen's argument is 21st-century media. The erasure of conventional human consciousness and transindividual agency arise as a possibility with digital devices and within the smart environments of the 21st century. Hansen tells us, "It is because today's media are able to access – and routinely operate by accessing – dimensions of our experience, of our open and ongoing individuation, that lie beneath the personal or individual level."[9] In particular, it is the manner in which 21st-century media is able to access "quasi-autonomous microagencies," which lie beneath the personal or individual level.[10] We are here brought back to the original machine-mammal dynamism described above with the photograph and film. The machine, in this instance, the most cutting edge digital technologies, put us in touch with our fleshy instinctual automatic self, an example of a quasi-autonomous microagency. High technology makes us viscerally responsive to the world.

It is thus all the more curious that Hansen looks to the late 19th-century chronophotography of Etienne-Jules Marey to situate the "technical distribution of (human) perception and cognition."[11] Marey's images of figures moving in and in between time provide Hansen with evidence of a certain temporal disconnect between human consciousness and lived experience. Marey's "machinic perception" is never actually our very own human perception, but rather a cipher of our missed and lacking perception. The image tell of our operational blindness, which is in turn part of a different, chain-linked distribution of psychic individuation across space-time.

3. HAPTIC UNCONSCIOUS: A PREHISTORY OF THE DIGITAL IMAGE IN ART, 1937-1970

I would like to use Hansen's suggested ambivalence here about the location of operational blindness between past and present technologies as an opportunity to introduce evidence of a parallel idea, what I call the "haptic unconscious," within the 20th century. Like operational blindness, the haptic unconscious privileges experiential, intuitive, and proprioceptive knowing over static consciousness. Philosophically speaking, the haptic unconscious is a monist concept based on the union of mind and body. It refers to the manner in which consciousness and knowing are spread across the body and environment with the aid of technology. Beyond being simply contained in the cranium, mind with technology resides inside and extends outside. It is within one while between many. The theory of the

haptic unconscious emerged in its most inchoate form in 1920s Berlin from the exchange of ideas between Hungarian artist László Moholy-Nagy and the German writer Walter Benjamin. From there, the haptic unconscious developed into the full blown philosophy-cum-heuristics of the light-image in art first taught and espoused by Moholy-Nagy as Director of the New Bauhaus in Chicago, 1937. The idea shifted and evolved during the twentieth century through the work of colleagues, friends, and artists, materializing early on as the "light-image" and later as the digital image within art in the decade of the 1960s. I use the word "light-image" as Moholy-Nagy did while stretching it to include electronic image technologies that have emerged since his death in 1946, i.e. as the term refers broadly to photography, the moving-image of film and today video, light in motion of kinetic art, city lights seen while walking, driving, or aerially while in flight, the light-image of the television and computer screen, and the experiential light image of electronically based performance art.

The light-image in art realizes and embodies this extension of mind in lived time. It is not an omnipresent idea in the 20th century, but part of a very specific passage of knowledge and pedagogy, traceable through the pedagogical writings and work of László Moholy-Nagy, his fellow Hungarian light artist Gyorgy Kepes, MIT professor of urban design Kevin Lynch, scholars of psychology, art, and perception Ernst Gombrich, Rudolf Arnheim, and James J. Gibson, the curatorial experiments and art criticism of Jack Burnham, and the flickering light images of artists working within the realms of Op Art, New Tendencies, the Bell Labs, and Experiments in Art and Technology (E.A.T.). The following key concepts give form to the "haptic unconscious": the distributed light image, biocentrism and the scientific image, Gestalt theory, the image as phenomenological urban experience, psychologies of perception from Gestalt to ecology, and systems aesthetics.

The great energy and possibility of the haptic unconscious is its simultaneous past- and presentness, its historicity and contemporaneity. While the haptic unconscious is derived from the historical documentation and archives of the abovementioned figures in art and psychology, it nonetheless resonates well with contemporary discourses on operational blindness, embodiment, affectivity, and expanded mind. Often connected to theories of new media – the space-time relations between humans, computers, handheld devices, and the Internet – these ideas seem in so many ways to be the contemporary instantiation of Moholy-Nagy's thinking on art, light, and technology from almost a century ago. In final conclusion, this trajectory of light-image development – as pedagogy, world-view, actual technological possibility, or what I call the "haptic unconscious" – reveals both the historicity of operational blindness and, more precisely, the time-worn richness of mind conceived as an ecology of interrelations.

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Remotely Framed: Exploring the Aesthetics of the Live Pixelated Experience

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Abstract. This paper will explore the aesthetics of the pixelated scenes relayed across the globe by streaming webcams. It will examine the mesmerising and transportative powers that these shimmering pixels possess – what is it that makes them so sublime to us, and how does this differ from eighteenth-century albums, nineteenth-century panoramas, magic lanterns, twentieth-century travel guides, television programs and films? It will investigate how our perception of place undergoes a transformation as the line between 'here' and 'there' becomes blurred and suggest that a new digital and vicarious aesthetic has evolved to exist within the wider context of travel imagery.

1. INTRODUCTION

A computer screen in Copenhagen glows with the soft morning light fed from the Blue Mountains in Australia, slowly intensifying as the day begins. This real-time scene could not be more different to the view through the window behind the computer, that of the city's night skyline. These two contrasting windows are at the heart of the telematic transformation of Alberti's conception of the construction of spaces for the vicarious experience of nature, in particular distant and exotic places.

When we look at a scene through a webcam, our perception of place undergoes a transformation as the distinction between 'here' and 'there' is reconfigured – it is as if, in a sense, we are there, even though our bodies remain here. Indeed, the digital wiring of the world effectively collapsed geographical distance, with a virtual map of webcams offering us a chance to connect in real-time with remote, yet carefully framed, landscapes. This compression of time and space has allowed us to become computer-chair tourists, able to embark upon a Grand Tour and witness spectacles of nature while never having to step outside our front door.

2. VICARIOUS TRAVEL

In the twenty-first century we can 'visit' the other side of the world with a click of a mouse. As Guy Debord proclaims, all experience that was once "directly lived" has now become "mere representation [...] simple images become real beings and effective motivations of a hypnotic behaviour". The spectacle makes "one see the world by means of various specialized mediations (it can no longer be grasped directly)"[1]. The experience we have of a place, via the webcam, becomes a substitute for being there; we are offered a simulacrum. While our bodies may be disconnected from this faraway location, our brains are not; as a mesmerising stream of digital images is fed to us in real-time, we experience a sense of being present in two places at once. We undergo a form of telepresence[1], albeit in a limited form since, as Debord describes it, it is generated only through the "privileged" and "mystifiable"[2] sense of vision. Or, as Andrew Utterson observes, "we experience exotic geographies

through a profound metaphorization, revelling not in representation but in evocation, a stream of referents interiorized within the Internet's transcultural, simulatory domain"[3].

3. NATURE AS SPECTACLE

It is not uncommon for city dwellers to harbour a desire to 'reconnect' with nature, and escape the technological noise of the urban environment to the serenity of an unpopulated, faraway landscape. Yet, as several theorists have pointed out, this nature belongs only to the imagination, framed by the images and symbols that art and media have fed to us.[2]

These yearnings to escape city life and experience the authenticity of nature originate in the nineteenth century. The worship of nature – and of the sublime[3] within it – during the Romantic era, together with an aversion towards early industrialisation and rapid urbanisation, pushed the still young genre of landscape further from signs of developed civilisation, searching out a pristine wilderness. These romantic images emerged not only in paintings but also in the newly born medium of photography, appearing in travel albums and magic lantern slides that could viewed in the privacy of one's home or at a public lecture.[4] It is this romantic version of landscape that we have inherited – visual echoes that hark back two hundred years; majestic scenes of our planet's remote and (apparently) pristine places infiltrate our everyday existence. They saturate travel media, appearing on our television screens, billboards, magazines, and, of course, our computers. We are presented with the binary opposite to our own urban environment: a nature/civilization dichotomy featuring the desired 'other' of our own place.

Webcams, presenting sublime, simultaneous[5] views of nature's spectacles, are capable of enchanting us. Framed within our computer screen, they offer us an encounter with a hyper-real vision of nature; at times, they are more capable of evoking the experience of the romantic sublime than one would experience if actually standing upon a shore. Often, like a staffage figure in a Caspar David Friedrich landscape painting, an unsuspecting sightseer may wander into a scene who provides not only a sense of scale but also a point that we can vicariously project ourselves onto. *Lake Rotoiti,* a series of five 2 x 1.5 metres photomedia prints, is based on images I originally gleaned from a webcam directed at the backs of figures gazing upon a sublime scene in New Zealand's South Island. Referring to Friedrich's paintings, Barbara Maria Stafford suggests that figures who turn "their backs on the viewer to gaze" produce an "emotional and cognitive inaccessibility [...] profoundly subversive, thwarting the beholder's natural impulse to simulate the figures' expressions and so comprehend the situation. Uncertainty and ambiguity reign"[4].

The light reflecting into the *Lake Rotoiti* webcam's lens is reconstituted into pixels, which are then formed into blocks of colour by a jpeg compression algorithm[6]. "The underlying aesthetics of current imaging techniques", writes Sean Snyder, "play a role in establishing a *sense* of authenticity. Whether this is true or not, data compression results in the disintegration of image quality, leaving space for interpretation (or over-interpretation)"[5]. To emphasise the images' digital construction and remediation, I reprocess them by further compression.[7] In an unusual contrast of techniques, after this deliberate degradation, the computer is used as a digital darkroom to reference the history of landscape representation; I mimic traditional photographic techniques, such as controlling contrast, burning in the image edges (a common landscape photography practice), and enhancing tones within localised areas. Then, once again, the images are remediated; removed from the screen, they shift from the digital realm to the analogue; output as prints, the original digital features are even further accentuated due to their large scale. When seeing the images from a distance, they first appear as conventional photographic landscapes, but, as one nears, their digital foundation clearly emerges.

4. THE VIRTUAL LANDSCAPE

The history of the immersive, virtual landscape extends from the prehistoric cave paintings of Lascaux and the frescos of ancient Rome through to the panoramas of the nineteenth century, and on to the virtual-reality computer-simulated environments of today.[8] There is a further history that comprises an amalgamation of the

real and the virtual: the Claude glass (the seventeenth and eighteenth-century painters' tool that captured the reflected landscape and transformed it into a tinted picturesque scene[9]), photography, and, of course, present day's webcam. The genealogy of disembodied travel follows a parallel trajectory to both these histories.

During the nineteenth century, the representation of distant lands underwent a major transition, as new inventions allowed the mediated experience to shift in both a spatial and temporal sense. The panorama[10] (at first, briefly named *La Nature à Coup d' Oeil*, "Nature at a glance") was the first form of mass media entertainment. A hugely popular spectacle, it appeared in many of the large cities of Europe, the US, Australia, and New Zealand. Its highly illusionistic, immersive effects offered city dwellers, the majority of whom were unable to afford the pleasures of travel, the opportunity to experience the wonders of the natural world in remote geographical locations, albeit in a remediated manner. Spectators would enter the rotunda building, whose inner wall was covered with a meticulously painted canvas, via a dark tunnel that not only physically but also metaphorically transported them from the outside world into a magical realm. For the panorama, perspective techniques had to be adapted to deal with the curvature of the painting, and spectators, no longer anchored at a fixed point, could walk about the platform and reorient themselves to a view that encircled them.

The contemporary telematic vehicle of vicarious travel, the webcam, did not appear until in 1991, two hundred years after the panorama. The first, the Trojan Room Coffee Cam set up in Cambridge University's Computer Science Department, allowed the researchers to see if a coffee pot in a staff room was full, and therefore, whether or not it was worth making the long journey through the building to get a cup.[11]

A year before the Coffee Cam emerged, Jonathan Crary had already recognised that "most of the historically important functions of the eye are being supplemented by practices in which visual images no longer have any reference to the position of an observer in a 'real' optically perceived world. If images can be said to refer to anything it is to millions of bits of electronic mathematical data. Increasingly, visuality will be situated on a cybernetic and electromagnetic terrain [...] consumed, circulated and exchanged globally"[6]. It did not take many years before the webcam- lens-to-computer distance stretched from just mere metres, within Cambridge University, to thousands of kilometres, reaching over oceans as it grew in tandem with the rapidly expanding Internet. In the ensuing years, webcams swiftly multiplied, their lenses being turned upon both private and public scenes, providing views, among others, into people's homes, onto street corners, and of national park vistas. In effect, they sprung up wherever anybody felt the inclination to install one, a network of mechanical *Cyclopes*, colonising the planet, to peer into just about anywhere.

5. THE AESTHETICS OF BINARY TRANSMISSION

Webcams, such as the one pointed at the glacier Jökulsárlón, Iceland[7], possess a hypnotic quality. This remediated light, reflected from an icy land at the top of the world, is transformed into luminous pixels of serene blues and soft greys that lull us into a kind of reverie. The seductive quality of these glowing pixels can be paralleled with other optical devices born in the nineteenth century that, as Stafford explains, "played a key role in this dialectical process of joining earthly to the unearthly experiences. Specifically, the technologies of projection, magnification, and transparency made it possible to permeate tangible substances with intangible light"[8]. Thomas J. Campanella declares that webcams are "liminal devices [...] because they are only briefly separated from the pulse and hue of life – for a time at least – they are infused with a touch of magic [...] they 'map' reality onto cyberspace, and vice versa"[9]. In the view of Jökulsárlón, movement of the water's swift current and the shifting sunlight is rendered in fluctuating digital blocks formed as the algorithm performs its process of deconstruction and reconstruction, while other areas of the image remain relatively static like the frozen land they depict.

In 2001, Lev Manovich pointed out that for all the enthusiasm surrounding the precision

of digital imaging, it was the aesthetic of compression with its poor image quality that dominated[10]. He predicted that this would change as wider bandwidth and higher definition became more widespread. Now, twelve years later, the volume of global Internet traffic grows exponentially by the day,[12] and the enhanced quality and higher resolution of the relayed, instantaneous image is following in its wake.[13] Unsurprisingly, the push for this greater verisimilitude comes from the realm of commerce as the physical offices of today evolve into the telepresent workstations of tomorrow.[14] However, volume tends to increase with greater access, and consequently, algorithmic compression will continue to be around for some time. Nevertheless, this digital aesthetic may eventually be remembered as a quaint characteristic of our time.

6. FRAMING SPACE AND TIME

Alberti's single-point perspective[11], a method of representing three-dimensional space on a two-dimensional plane, was based upon a framed grid that the painter (and later, the viewer) considered an image as if through a window. Not only a technique, linear perspective was also a concept that rationalised and removed the body from human vision. This paradigm, Crary claims, shifted in the nineteenth century when optical devices, such as the panorama, stereoscopic, magic lanterns and other viewing apparatuses, introduced new means of viewing the world[12]. In the twenty-first century, a computer is capable of having multiple webcam views and perspectives framed upon its screen simultaneously. Although nineteenth-century optical devices and webcams may vary in methods of virtualisation, they all possess mesmerising, transporting powers. All incorporate a hybrid of physical and virtual space, even if the friction that exists between these two spaces manifests itself in different manners. Furthermore, all these devices bring the exterior into the interior, and in doing so, present nature as spectacle. Moreover, they impart to their respective viewers a scopic sense of control, a form of visually tying down an increasingly complex world. Each presents a vicarious experience; they offer the urban dweller a chance to escape their confines, to encounter spectacular scenery, and extend their visual horizons, enabling new ways of perceiving the wider world.

The typical tourist, someone who views "*named* scenes through a *frame*, such as the hotel window, the car windowscreen or the window of the coach", John Urry writes, has now evolved into the post-tourist for whom the authentic experience is not necessarily imperative; they are content to consume places through the frame of the television, video, or Internet "at the flick of a switch"[13]. "Like the window, the screen is at once a surface and a frame", Anne Friedberg states, "a 'virtual window' that changes the materiality of built space, adding new apertures that dramatically alter our conception of space and (even more radically) of time"[14]. Alberti's window is a mode that may well have become outmoded.

My art practice explores this relationship between physical and virtual space, as I endeavour to visualise and spatialise temporality. The installation *Now How Far* comprised a small, darkened room with two monitors diagonally faced each other, displaying a live webcam video-feed[15] of an icy scene in Jökulsárlón. Viewers would enter the space and stand between the two monitors, sandwiched between two mirror images that relayed in real-time from the top to the bottom of the world. A sound, which at first seemed to be of waves breaking upon a shore or perhaps wind swirling through trees, permeated the space. However, on closer attention, one could hear the blips and crackles that revealed it to be a mix of electrical static noise. For this particular work, I chose to use monitors instead of projections in order to explore the manner that these scenes, which reconfigure the here and now, are actually framed within the everyday.

The post-tourist experience that Urry speaks of is that of disembodied travel; only a virtual journey is taken. But can we really call it a journey? There is no duration spent getting from A to B, which is a vital component of the experience of journeying – no equivalent to a road, train or plane trip. As Paul Virilio puts it, today's technology has ushered in a time "whereby everything arrives without having to leave, the nineteenth century's elimination of the journey (that is, of the space interval and of time)

combining with the abolition of *departure* at the end of the twentieth, the journey thereby losing its successive components and being overtaken by *arrival* alone"[15]. When we 'travel' to just outside of the Arctic Circle to gaze upon the azure and white icy scene that the Jökulsárlón webcam frames, we just 'arrive'.

7. CONCLUSION

It is sad to think that viewing a webcam overlooking the Blue Mountains of Australia could ever actually substitute for visiting the place 'in the flesh'. To completely forego the authentic experience, we would not smell the heat of the bush, hear the birds cry, or feel the hot Australian sun upon our skin; instead, we would gaze upon a simulacrum. However, for all this sense of lack, there is still a magic to behold in this experience; it lingers in the simultaneity, the sense of being present in two places at once, and the light reflecting off the scene, remediated and compressed into the glistening pixels and blocks of digital data that flicker upon our computer screens. Gazing out over the mountains, we are witnesses to a new, vicarious digital aesthetic.

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ENDNOTES

1 Oliver Grau explains telepresence as enabling "the user to be present in three different places at the same time: a) in the spatio-temporal location determined by the user's body, b) by the means of teleperception in the simulated, virtual image space [...] and c) by means of teleaction in the place where for example a robot is situated, directed by one's own movement and providing orientation through its sensors." See Grau, O.: History of Telepresence: Automata, Illusion, and Rejecting the Body. In: Goldberg, K. (ed) The Robot in the Garden: Telerobotics and Telepistemology in the Age of the Internet. MIT Press, Cambridge, Mass. (2001) 239. Although some webcams can to be controlled by the viewer for a brief period of time, the majority offer no form of physical interaction.

2 For example, see Schama, S.: Landscape and Memory. A.A. Knopf, New York (1995); Baudrillard, J.: The Animals: Territory and Metamorphoses, Simulacra and Simulations. University of Michigan Press, Ann Arbor (1995) 41; and Cronon, W.: The Trouble with Wilderness: Or, Getting Back to the Wrong Nature. In: Cronon, W. (ed) Uncommon Ground : Rethinking the Human Place in Nature. Norton, New York (1996) 69.

3 For Edmund Burke, a sublime scene evoked terror and awe but required to be experienced at a safe distance. See Burke, E.: A Philosophical Enquiry into the Origin of our Ideas of the Sublime and Beautiful. Oxford University Press, Oxford (2008).

4 Public lectures were an extremely popular form of educational entertainment, and adventurers recounting their tales were common on the lecture circuit. See Theodore Barber, X.: The Roots of Travel Cinema: John L. Stoddard, E. Burton Holmes and the Nineteenth-Century Illustrated Travel Lecture. Film History. March (1993) 68–84.

5 Webcams deliver their images in different ways; some are video streaming while others produce jpegs at consistent intervals, ranging from one second through to hourly or even longer.

6 The jpeg compression algorithm reduces the size of a digital file through a lossy process – digital data is discarded in order to make it faster to transmit over the Internet. Pixels within a particular tonal range are grouped together, which gives a particular 'block' look to the resulting image. Mpeg compression is the moving image equivalent.

7 This emphasising of digital artefacts of compression is a method Thomas Ruff also uses in his series *Jpegs* (2004–07). This series investigates the pervasiveness of digital images within our lives, and the ways in which they are disseminated and are received by us. Russ appropriated the majority of images from the Internet, though some are photographs that he took himself.

8 See Grau, O.: Virtual Art, From Illusion to Immersion. MIT Press, Cambridge, Mass (2003).

9 The Claude glass, also referred to as the black mirror, was a popular device among nineteenth-century tourists that allowed them to convert their views into Romantic landscapes. However, it was looked down upon by the critic John Ruskin who valued a more direct, authentic view. See Maillet, A.: The Claude Glass: Use and Meaning of the Black Mirror in Western Art. Zone Books, New York (2004).

10 The panorama was invented in the late-eighteenth century but it was during the nineteenth century that it really came into its own. For an extensive survey on the subject see Oetterman, S.: The Panorama: History of a Mass Medium. Zone Books, New York (1997).

11 The Trojan Room Coffee Pot Resources website, *http://www.cl.cam.ac.uk/coffee/qsf/*.

12 See Mitchell, S. Spencer, P.: Work-Life Innovation: The Role of Networked Technologies.Cisco IBSG, San Jose (2012) 11.

13 In July 2013, Japan tested 4K television streams over the Internet, see *http://www.bbc.co.uk/news/technology-22872891*.

14 See Duffy, F.: Justifying Place in an Increasing Virtual World. In: Work and the City. Black Dog Publishing, London (2008) 56-59.

15. Wolfgang Staehle and Susan Collins are two artists who have consistently used webcams in their work. Issues of temporality are obviously a major conceptual component when using such a medium, and Staehle was one of the first artists to do so. His 1996 work *Empire 24/7*, an homage to Warhol's film *Empire*, comprised a webcam taking a photograph every four seconds of the top of the Empire State Building, offering a real-time experience that could be accessed via the Internet, albeit only live for a matter of weeks. His most well-known work, however, is *2001,* an installation shown in New York's Postmasters Gallery, consisting of three live webcams views projected on to a wall each. One view showed a medieval monastery in Comburg, Germany, another a TV tower in Berlin, and the last a view of Manhattan's skyline. Intended as a meditation on the nature of time through its synchronised juxtaposition of the slow rituals of faith against the fast pace of present-day commerce and communication technology, *2001* took on a whole new and unforeseen dimension when it inadvertently recorded the fatal events of September 11. The English artist Susan Collins' works *Fenlandia* (2004–06), *Glenadia* (2005–07), and *Seascape* (2009) investigate the relationship between landscape, time and technology. All these projects operated in both an online and gallery location, and consisted of images that were created pixel by pixel, second by second, and day by day over a period of one to two years. Images were formed through the collection of pixels fed from a webcam, from top to bottom and left to right, in horizontal bands, marking visible fluctuations in light and movement throughout the day and archived at two-hour intervals. Photographic prints were also created through screen captures.

Links and Connections: Future's Past

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Abstract. An attempt is made to offer connections and links between computational art, art history, and aesthetic theory, so to provide fertile ground for historical and theoretical development. The concept of "process" is studied as one of the main tools for the production of computational works of art and design, by analyzing and studying works and theories by Eno Henze, Tim Riecke, Federico Diaz, Philippe Galanter, Casey Reas and Kokkugia. A rough draft of history and theory of process in modern art theory in connection to computational art is then proposed through analysis of the works and writings of Viktor Sklovskij, Henri Focillon, Sol LeWitt, Frank Stella, Konrad Wachsmann, among others. In the end computational art and design are revealed to the reader as the last heir of modern and autonomist approach to art.

1. INTRODUCTION

What is generative art? More importantly, what are the connections between computation and aesthetic theory?

Computational art is often described as a scientific kind of art, art critics and artists using genetic and naturalistic metaphors to describe its works.

It's not unusual to hear or read computational works of art described like natural phenomena, given the likeness of the processes, natural and artificial, that generate their final products.

As opposed to the romantic idea of the the unique and suffering genius, the computational artist is described as a researcher whose work is just to give phenomena the possibility to grow while letting all natural processes evolve.

Abstract and algorithmic procedures are described as genetic codes by which the project grows, through computational procedures, to its final definition and presence. In this way "generative" and "computational" are usually thought in relation to how art is produced. This is not a matter of content: the algorithm is the genotype, the final product the phenotype. But if we take off the scientific and genetic jargon applied to generative art and we study it from a disciplinary point of view, we can see a specific subset of a precise art world, as Howard Becker could have called it, emerge [1].

Computational art appears then as an artistic genre in which different artistic disciplines are mixed in an avant-garde manner, each based on the same specific rules, only in slight different ways: artists using computation to produce "installation effects" in sculpture, or "painting effects", and to elaborate subject/object interactions; architects and designers using computation to produce "spatial" and "tactile" effects.

2. PROCESS AS AN ART ABSTRACT MACHINE

Reading Philippe Galanter's definiton of generative art, we comprehend it as referring *"to any art practice where the artist creates a process, such as a set of natural language rules, a computer program, a machine, or other procedural invention, which is then set into motion with some degree of autonomy contributing to or resulting in a completed work of art"* [2].

A key concept in this definition is *process*, proposed by Galanter as a "set of language rules". Process is much more than just a tool to produce the final work of art, it is an *abstract machine*: the set of the self-referential procedures by which the final work of art can be produced. Process is the real object of computational artists and designers: the generating rules are posited in the place of the artist's subjective self-expression.

Thus Casey Reas describes the processes' involvement in generating pieces of art:

"A Process interpretation in software is a kinetic drawing machine with a beginning but no defined end. It proceeds one step at a time, and at each discrete step, every Element modifies itself according to its behaviours. The corresponding visual forms emerge as the Elements change; each adjustment adds to the previously drawn shapes" [3].

Computational artists are constantly focused on solving the dilemma behind the objects, as opposed to creating objects and working on their possible meaning from an authorial point of view.

Dans l'S, à une heure d'affluence. Un type dans les vingt-six ans, chapeau mou avec cordon remplaçant le ruban, cou trop long comme si on lui avait tiré dessus. Les gens descendent. Le type en question s'irrite contre un voisin. Il lui reproche de le bousculer chaque fois qu'il passe quelqu'un. Ton pleurnichard qui se veut méchant. Comme il voit une place libre, se précipite dessus. Deux heures plus tard, je le rencontre cour de Rome, devantla gare Saint-Lazare. Il est avec un camarade qui lui dit : « Tu devrais faire mettre un bouton supplémentaire à ton pardessus. » Il lui montre où (à l'échancrure) et pourquoi.

3. ART WORKS

Many computational artworks can be used to exemplify the importance of process in generative art: Tim Riecke's *"con\texture\de\structure"*, where a drafting machine is used to draw a simple self-referential process so to produce works divested of their unique artistic object status [4]; or Eno Henze's "Red Ambush" where drawings are created by a Perlin noise function so to *"teach the computer to draw like a human"* [5].

Federico Díaz's *"Outside Itself"*, a collateral event of the 2011 Venice art biennale, is an interactive installation assembled by robots responding to human presence thanks to optical sensors.

The robots are mathematically programmed to produce, in a notion of viral growth, a morphing process that keeps replicating over and over again, generating different shapes in relation to the bystanders' movements [6].

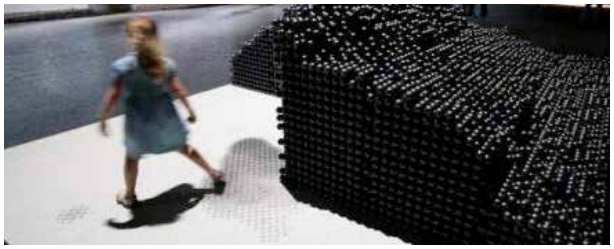

Fig. 1. *Federico Díaz, Outside itself, 2011*

In the work of Kokkugia architectural firm, process-based design is used to generate new spatial effects and investigate the possible emergence of complex spaces, through behavioral design methodologies based on the new potentialities granted by building industry, CNC instruments and robots. [7]

Fig. 2. *Kokkugia, Babiy Yar Memorial, 2010*

Finally, for a better understanding of generative art's process-based discussions, we can consider Casey Reas' series of *"Processes"*. Reas describes "Process 18" as *"A rectangular surface filled with instances of Element 5, each with a different size and gray value. Draw a quadrilateral connecting the endpoints of each pair of Elements that are touching. Increase the opacity of the quadrilateral while the Elements are touching and decrease while they are not"* [8]. This work has then been displayed near to the process' written instructions, the "element 5" diagram, and the the element's definition [9].

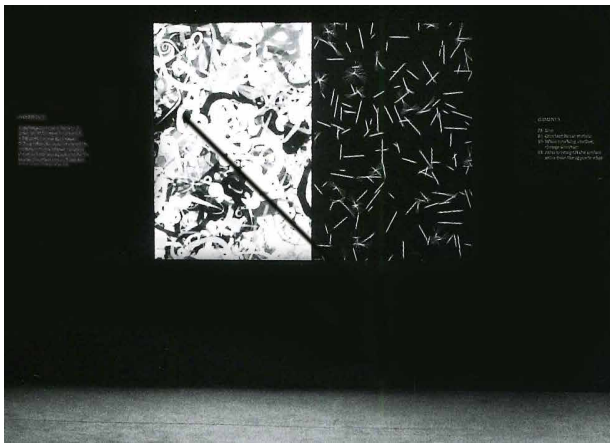

Fig. 3. *Casey Reas, Process 18, 2007*

4. MODERNIST PROCESS

Is the idea of process based art really new and revolutionary?

Actually, the term "process" is constantly present in art history, generally understood as the artist's working method: something similar to what we could call "creative process". Critically, this term has two other possible meanings, deeply related to computational theory.

Tiens ! Midi ! temps de prendre l'autobus ! que de monde ! que de monde ! ce qu'on est serré ! marrant !ce gars-là ! quelle trombine ! et quel cou ! soixante-quinze centimètres ! au moins ! et le galon ! le galon ! je n'avais pas vu ! le galon ! c'est le plus marant ! ça ! le galon ! autour de son chapeau ! Un galon ! marrant ! absolument marrant ! ça y est le voilà qui râle ! le type au galon ! contre un voisin ! qu'est-ce qu'il lui raconte ! l'autre ! lui aurait marché sur les pieds ! ils vont se fche des gifes ! pour sur ! mais non ! mais si ! va h y ! va h y ! mords y l'oeil ! fonce ! cogne ! mince alors ! mais non ! il se dégonfe !le type ! au long cou ! au galon ! c'est sur une place vide qu'il fonce ! oui ! le gars ! eh bien ! vrai ! non ! je ne me trompe pas ! c'est bien lui ! là-bas ! dans la Cour de Rome ! devant la gare Saint-Lazare ! qui se balade en long et en large ! avec un autre type ! et qu'est-ce que l'autre lui raconte ! qu'il devrait ajouter un bouton ! oui ! un bouton à son pardessus ! À son pardessus !

In avant-garde theory, process was intended as one of the concepts concerning the self-referential and autonomous rules generating the final art product's forms, whether or not the work of art was to destabilize the ruling norms. Russian structuralists Victor Šklovskij and Roman Jakobson developed an idea of art as the result of a process. According to Roman Jakobson, language and its learning is an evolving process, in the way we can think about computational language: he posited language as based on several steps, one following the other.

More than Jakobson, Victor Šklovskij proposed a precise and insightful idea about process and about its value in art. In his famous "Art as Technique" - mostly remembered for the quote *"Art is a way of experiencing the artfulness of an object; the object is not important"* [10] - he defined process as an "algebraization" of form where things are replaced by symbols and the artistic objects are given to the eye as a "formula".

We can find an idea of formal process in Henri Focillon as well, in his theory of the evolution of form as a derivation from an *"astonishing fantasy of metamorphosis"* [11] producing self-signifying shapes.

Šklovskij's and Focillon's concepts of process in turn are reflected in Clement Greenberg's idea of a modernist art, resting *"in the use of characteristic methods of a discipline to criticise the discipline itself, not in order to subvert it but in order to entrench it more firmly in its area of competence"* [12]. We can also consider this concept of process as one of the tools to reach a Kantian idea of ideal good taste objectivity, then typical of modern mannerism.

Focusing on artworks, Ellsworth Kelly's grids of color are procedural both in the choosing of colors and in the randomness of recomposing all the squares back together; while Ad Reinhardt's compositions of geometrical shapes and his patterns of different shades of the same color are themselves procedural works of abstract art. The symmetries in Frank Stella's work, used to avoid the artist's unconscious expression, can also be considered as an attempt to realize a more objective and controlled art via geometric abstract processes.

Fig. 4. *Frank Stella, Empress of India, 1965*

5. DESIGN IN PROCESS

It is even possible to find a relation between the use of processes as tools to define a specific area of competence in architecture and the modernist concept of "spatial specificity".

If we look again at Kokkugia's "Babiy Yar Memorial" we understand that the processual procedures are not just translations of "swarm intelligence" systems. The project is produced by a self-generating system where the object-agents keep defining space through continuous interactions between one another. "Process" here is a tool to change and add degrees of complexity to topological space, as in Theo Van Doesburg's idea of a formless and dynamic shape, of a form not simple but complex, a form that wasn't to be a "*fixed aesthetic formal type*" [13].

Kokkugia's research (similar to the one of the majority of computational architects and designers [14]) can be read as the permanence of the Modern idea of a "new architecture" able to represent new technologies and new tools.

Their projects are today's actualization (yet in different shapes) of Konrad Wachsmann's modernist idea that *"New materials, methods, processes, knowledge in the fields of static and dynamics [...] must be accepted. [...] Human and aesthetic ideas will receive new impulses through the uncompromising application of contemporary knowledge and ability."* [15]

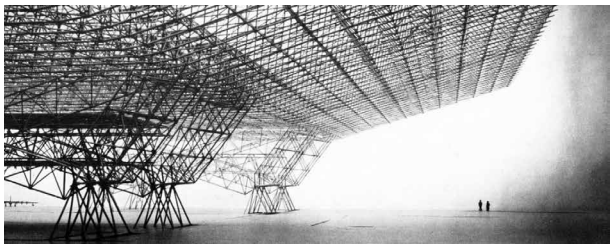

Fig. 5. *Konrad Wachsmann, Hangar for the American Air Force, 1951*

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6. CONCEPTUAL PROCESS

The second meaning of computational process was already present in the work of some of the most famous minimalist and conceptual artists. In their work process is not simply a tool to explore art in itself but a more sophisticated concept to criticize any idealistic concept of art.

Musicians like Philipp Glass or Steve Reich worked on the idea of process. Their music is based on continuous repetition, overlaying, and progressive shading, of simple melodic and rhythmic cells. Theirs is a refusal of the classical conception of music based on symphonies' thematic development. Minimalist music evolves from the concept of static variations: a set of processes is put in place so to obtain a gradual differentiation around a melodic and harmonic core, generating the composition's overall structure.

Minimalist sculptors like Donald Judd and Robert Morris try to overcome creative gesture and subjectivity in art by forced progressions of formal processes, the work of art defined by a series of autonomous systems and norms.

As Robert Morris said: *"[...] chance is accepted and indeterminacy is implied since replacing will result in another configuration. Disengagement with preconceived enduring forms and orders for things is a positive assertion [...]"* [16].

Looking at Judd's stainless steel or mill aluminium cubes, Morris' mirror cubes, or Roman Opalcal's obsessive writing of numbers, we understand how the a priori idea is frozen. These works are enclosed structures obtained by abstract processes. [17]

Fig. 6. *Donald Judd, 100 untitled works in mill aluminum, 1982-86*

In *"Variations of Open Cubes"*, Sol LeWitt builds the 122 possible variations of incomplete

edge cubes with the aim to produce an objective formal work where no expression of the author is to be found [18]. More interestingly he hangs on the wall two-dimensional drawings of the same cubes, in guise of instructions. As today's Casey Reas' "Process 18" installation, Sol LeWitt exposed his "*Variations of Open Cubes*" with the work's "algorithmic instructions".

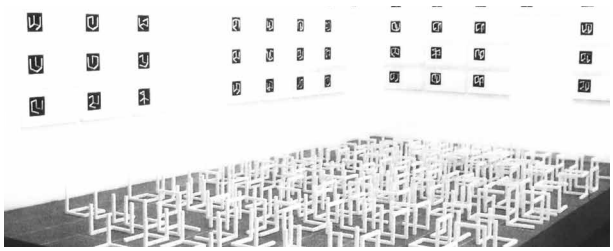

Fig. 7. *Sol LeWitt, 122 Variations of open cubes, 1974*

7. CONCLUSION: HYPER-PROCESSES AND THE MASKS OF MODERNITY

It could be argued that a main difference exists between the modernist project of autonomy and generative art's theoretical background. Computation is a process that can be used to generate installations, paintings, sculptures, buildings, or any other kind of artistic object, without any precise boundary between each discipline. Despite that, by analyzing from an historical point of view the work of Eno Henze, Tim Riecke, Federico Diaz, Kokkugia, and Casey Reas, we can see the minimalist nature of their processes, put in place not to inquiry artistic disciplines' metaphysical presence or to criticize their role in society, but to define the autonomous role and meaning of computation in generative art. In this sense computation and process are generative art's modernist bases.

Computational art can appear now as an hypermodern product of history, the latest form of an old theoretical issue, the brand new mask of modernity. Painting, architecture, design, sculpture are newly asked to examine the role and value of technology in art and to face their limits.

Jour un midi vers, la sur arrière plate-forme un d'de autobus ligne la j'S un aperçus jeune au homme trop cou qui long un portait entouré chapeau un d'tressé galon. Interpella son soudain il prétendant que voisin en exprès de celui-ci faisait sur les lui marcher fois qu'pieds chaque ou descendait il montait des voyageurs. Ailleurs rapidement la il abandonna d'jter sur une discussion pour se place libre. Je le revis devant quelques heures plus tard en grande conversation avec la gare Saint-Lazare disait de faire remonter un camarade qui lui supérieur de son pardessus un peu le bouton.

As in Raymond Queneau's *"exercises of style"* descriptions of the same episode in many different styles, computational art is the new style of what in time we repeatedly refer to with the word "modern". It concerns once again and *in new shapes* the issue of art in relation to its medium and its t*echnical support. Often rhetorically, almost always interestingly.*

[All the french texts are from Raymond Queneau's *Exercices de style*, Folio, ed. 1982 (first published in 1947)]

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Allegorical Procedures Renewed.

An Artist as a Semionaut in the Network-Based Culture

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Abstract. Since contemporary culture is increasingly becoming the navigation culture, replacing the narrative culture, artists are exploring existing content and relating to its overproduction. An artist, as a semionaut, somehow relates to an external framework (conceptual, cultural, or a technological). In this paper, I am going to approach two theoretical frameworks—one by Benjamin Buchloh and another by Nicolas Bourriaud—and confront each with the latest examples of artistic re-practices in the online and the offline world. What was already present in the notion of allegorical procedure may be relevant again within the practice of postproduction. The whole range of artistic re-practices (e.g. remixes, remediations, and re-enactments) leads to a non-linear idea of time. Since the information is of greater importance than the visual representation, there is no centralized knowledge, but rather fragments to navigate between and a constant tension between the updated and the outdated.

1. INTRODUCTION

The continuous process of overwriting content is present in artistic re-practices, such as remixes, re-enactments, and remediations. Can we consider the aforementioned re-practices and others (e.g. looping, which is one of the main features of time-based media) as returning to the same point in a cycle of repetition or even deliberate regression?

More than 30 years ago, Benjamin Buchloh stated, "Each act of appropriation seems to reaffirm precisely those contradictions it set out to eliminate." [1] This is an example of an aporia that seems to be still valid when applied to contemporary net-based art and serves as a starting point for my inquiry. If allegorical procedures, as Benjamin Buchloh understood them, were emblematic for post-modern appropriation, then the recent idea of postproduction, introduced in 2002 by Nicolas Bourriaud, may be a useful approach to contemporary culture[1]. The concept of postproduction, as a very particular cultural model, includes the key persona of a semionaut.

Roughly three decades since the publishing of Benjamin Buchloh's essay in "Artforum" and ten years after the release of the book *Postproduction* by Nicolas Bourriaud, it's time to rethink and compare the ideas since they seem to be inspirational. Therefore, in this paper, I am going to approach two theoretical frameworks—one by Buchloh and another by Bourriaud—and confront each with the latest examples of artistic re-practices in the online and the offline world.

2. GOING BACKWARDS

Benjamin Buchloh' essay entitled, *Allegorical Procedures: Appropriation and Montage in Contemporary Art*, published in "Artforum" in 1982, provides a useful glossary of terms, including "allegorical procedure". While the category of allegory in the arts has a long history, Buchloh mostly refers to montage and its "allegorical methods of confiscation, superimposition, and fragmentation". [2] For the purpose of his essay, Buchloh refers to montage, which is practiced by the Dadaists, and described it in terms of the cultural paradigm shift defined by Walter Benjamin. Since montage was allegorical from its very beginning and numerous artists

using montage were apparently aware of its allegorical nature, Buchloh refers to particular artistic attitudes to outline the general conditions of the allegorical process. The basic allegorical principles—of equal importance—are "appropriation and depletion of meaning, fragmentation and dialectical juxtaposition of fragments, and the systematic separation of signifier and signified". [2] One of the first examples of allegorical procedures, according to Buchloh, is the gesture of Robert Rauschenberg in his *Erased de Kooning Drawing* (1953). As a result, the representation was removed and replaced with information and, as Buchloh notices, "the gesture of erasure shifts the focus of attention to the appropriated historical construct on the one hand, and to the devices of framing and presentation on the other". [2] This is an important point because we can see a process of shifting focus elsewhere, into the external and informational qualities of the contemporary net culture[2]. Buchloh provides an example of applying allegorical procedures in the artistic practice of Sherrie Levine. Her decision to take photographs of existing photographic images places her activity in the conditions of a changed paradigm. As Buchloh argues, "Just as Benjamin had identified devalorization as one of the fundamental principles of allegory, Levine devalues the objects of appropriation by negating the aestheticized commodity status of photographs... in her willful, seemingly random acts of re-photographing and re-presentation, emphatically restating their actual status as multiplied, technically reproduced imagery". [2] In this quotation, we can notice several expressions referring to a practice that is in some way negative, reductive, or regressive. Is it because Sherrie Levine's *modus operandi* was based on the tactics[3] of regression? Was it, rather paradoxically, progress? The gesture of appropriation has become a widely used tactic of postmodern art and, from today's perspective, it already has a rich history. Levine's attitude is based on the withdrawal from progress for the sake of apparent regress, evidently because, at that time, progress was no longer expected. Obviously, the postmodern conditions did not offer a vision of progress anymore. Paradoxically, however, this attitude fostered the further development of the discourse on art associated with imaging, simulacra, authorship, and last, but not least, appropriation as another creative technique.

2.1 ALLEGORICAL PROCEDURES UPDATED

The idea of allegorical procedure was not solely connected with postmodern era. Introduced by Benjamin Buchloh in 1982, it became, in a way, updated almost twenty years later in the critical thoughts of Nicolas Bourriad. In his book, *Postproduction*, Bourriaud explains the notion and presents a useful typology of postproduction-related cultural practices. [3] Since postproduction, as understood by Bourriaud, is neither a regular activity relating to the editing of a raw audiovisual material nor a notion with a "post-" prefix, but rather another form of the creative process. The key issue is "the recourse to *already produced* forms"[4]. [3] It is because contemporary culture increasingly becomes the navigation culture, replacing the narrative culture. However, this navigation takes place in a networked context, i.e. the endless realm of information with its very particular heterarchy that ultimately leads to information overload. In his further explanation of the context, implied by the figure of a semionaut, Bourriaud claims, "navigation... itself becomes the subject of artistic practice". [3] Therefore, an artist, as a semionaut, somehow always relates to the external (be it conceptual or cultural) framework.

Apparently, the theory of postproduction can be expanded to the online realm, especially where the issue of time is in play. An interesting example of such a semionautical practice can be found in the series of performances conducted in Second Life by Eva and Franco Mattes aka 0100101110101101.ORG[5]. Their series *Reenacments* (2007-2010) includes, among others, re-creating important performances from 20th century art. All of the performances were remediated, which means the initial scenario was used as a starting point, yet there were no real, flesh-and-blood performers, but rather their Second Life avatars. Another semionautical activity linking the artistic past, the seemingly real-time present, as well as viewers' time can be noticed in the *1 Year Performance Video (aka SamHsiehUpdate)* by MTAA (M.River & T.Whid

Art Associates) from 2004. This results in a very particular construct, because, as Mark Tribe and Reena Jana notice, "in Hsieh's original work, the burden of the whole process was on the artist. MTAA shifts this burden from artist to viewer". [4] The series of looping videos, resembling the original activity by Tehching Hsieh, questioned the idea of watching the performance in real time. A potential viewer, who would dedicate an entire year of his/her time, actually becomes the performer.

Bourriaud writes that postproduction, in this context, is also based on the blurred boundary between consumption and production since each piece can be a temporary terminal connected to the network elements, such as the narrative element, which extends and reinterprets preceding narratives. Therefore, an intertextual approach is possible or even necessary to read the internal and external meanings of artworks like *Reenactments* or remediated photographs. A famous example is Sherrie Levine's *After Walker Evans* series 1979, which was based on rephotographing documentary photographs by Walker Evans from 1936[6]. Levine's act of appropriation had its intertextual follow-up in the project *AfterSherrieLevine.com* (2001) by Michael Mandiberg. In that project, photographs of Walker Evans' models (e.g. Allie Mae Burroughs) were remediated at least twice and can be distributed in numerous printouts, of which every copy—as Mandiberg ironically suggested—can be an original.

It is important to follow art practice in order to find indications of changes in culture. Bourriaud states, "By refilming a movie shot by shot, we represent something other than what was dealt with in the original work. We show the time that has passed, but above all we manifest a capacity to evolve among signs, to inhabit them". [3] This comment is not only undoubtedly accurate when we consider well-recognized examples like *24 Hour Psycho* (1993) by Douglas Gordon, but also when think of works with opulent meanings, such as *The Clock* (2010) by Christian Marclay. In *The Clock*, the remixed footage, which is 24 hours in duration and is carefully curated in order to synchronize the time in the video with that of real time, makes all the difference and affirms the so-called (paraphrasing Bourriaud) "inhabiting signs." Another example is the project *INSERT DISC* (2012) by Aram Bartholl and Robert Sakrowski. The project is a kind of slightly techno-nostalgic interface, as well as a time capsule, operating in the real world since it offers New Yorkers the possibility to insert a disc into a DVD recorder that is built into a wall. It allows one to see and experience artworks from the nineties within their natural aesthetical context, which is an emulated Mac OS 7.6. The just-off-the-street direct access and the idea of inserting a disc into a brick wall in a particular place sends us back to the desktop computing model of the nineties.

All of the above-mentioned examples could also be analyzed in terms of remixing, as understood by Eduardo Navas. The historical background for remixing can be found in music, which saw the production of numerous "versions" of a song. [5] Since any cultural content can be potentially remixed and since remixing has become a form of cultural prosumption (cultural production and consumption), a function of remixing may add another value to the process of postproduction.

2.2 SEMIONAUTICS: NAVIGATING IN OVERPRODUCTION

Since over a decade ago, Nicolas Bourriaud stated that "overproduction is no longer seen as a problem, but as a cultural ecosystem", [3] the situation is even more complicated. If so, do we still expect any progress after the end of modern *telos* and the depletion of the meaning offered by the postmodern attitude? Do we expect any progress when there is an overwhelming sense that there are too many layers, plots, and meanings? A possible answer can be found both in Buchloh and Bourriaud's thoughts: shifting the attention to that which is external, i.e. the (cultural) framework itself. Of course, this is not a simple update of the conceptual attitude. From the perspective of 2002, Bourriaud refers to the postmodern times, noticing a profound change in the status of the (mass) culture recipient: "The *ecstatic consumer* of the eighties is fading out in favour of an intelligent and potentially subversive consumer: the user of forms". [6] However, we have to notice that today any repetition or appropriation that was a part of the sophisticated game in postmodern art

is not what it used to be in the postmodern context. What was a new territory recognized by postmodern artists (even though the term *new* sounds inadequate in this context) is the obvious and everyday environment in which everyone (be it an artist or any other user) starts from; in other words, they share the same vantage point.

A vivid example, though not very obvious, is present in the works of Ryan Trecartin and Lizzie Fitch. Their works, though accessible on YouTube and having the Internet itself as their primary context, are neither Internet-based works nor are they technological. I am not going to analyze the aesthetic aspect of these movies, but only their general context and concept. The inevitable aesthetics and inner chaos of the constantly updated and re-structured Web culture is reflected in most of the artists' projects. [7] In Trecartin's movies, we can recognize the exaggerated figure of the *ecstatic consumer,* as Bourriaud called the seemingly forgotten persona, coming back once again after a few decades in the cultural context of overproduced user-generated content. Therefore, the semionaut in Trecartin's work is not an internal element, but rather an external element, bringing together parts of the complicated narratives without making them coherent. This lack of cohesion is explained by Patrick Langley in *The Real Internet Is Inside You,* where the author also notices that Trecartin's "films' foundation is textual..." and they reveal "a consistent, if subversive, reassignment of textual symbols". [8] This interpretation of a text-based activity, resulting in a plethora of chaotic images, leads us back to the theory of a semionautical activity.

Since Nicolas Bourriaud defined the figure of a semionaut using the examples of a DJ, a postproduction artist, or any other user (understood as a "Web surfer") [3], the basic semionautical practice is based on the action of navigating, which has a creative side. The result of this navigation questions the familiar meanings and enables the establishment of new relations between existing artwork. This linking practice not only helps to recontextualize the present and the past meanings like samples of a remixing DJ. It also emphasizes the whole process of using them and reveals the theoretical framework.

So, the *culture of use*, as described by Bourriaud, can have, in my opinion, a double meaning. [3] It refers to the heterachical network of users and re-users, as well as to making use of existing cultural content, both the attractive and the forgotten/outdated. Remixing, as well as adapting, existing screenplays often leads to remediation. The paradox is that the more accurate the adaptation of a screenplay is, the more vivid the differences between the original context and its contemporary version are. A series of particularly interesting examples can be found in cases where an object is (re)materialized while the sign comes from the digital imaginarium. This is a kind of a return, in a symbolic sense. As Buchloh notices, quoting Walter Benjamin, "The devaluation of objects in allegory is surpassed in the world of objects itself by the commodity. The emblems return as commodities." [2] This sentence is particularly inspiring when we look at numerous examples of re-materializing virtual images. One such case could be *Untitled* (1993) by Maurizio Cattelan, which was reviewed by Bourriaud and interpreted as an instance of *détournement.* Cattelan had cut a monochrome canvas, which resembled the aesthetics of cut paintings by Lucio Fontana from his *Concetto Spaziale* series. The only difference was that the shape of the cuttings in Cattelan's work was taken from the easily recognizable "Z" sign of Zorro. This sign, associated with popular culture, acted as a kind of *dètournement* practice. Bourriaud notices the difference, writing, "While the laceration of a canvas for Fontana is a symbolic and transgressive act, Cattelan shows us this act... as the gesture of a comic villain." [3]. He also makes a more general remark about this kind of artistic approach: "the formal structure seems familiar, but layers of meaning appear almost insidiously, radically overturning our perception". [3] Cattelan, as a trickster, had an unexpected contemporary continuation in yet another act of *dètournement* by artistic duo Eva and Franco Mattes, A.K.A. 0100101110101101.ORG. In this case, the artists have applied a tactic very similar to the one already used by Maurizio Cattelan. The *Fake Cattelan Sculpture* (2010) is believed to have been inspired by an Internet meme (also known as a Lolcat) that showed an

upset cat inside of birdcage with a yellow bird on the top of it. The caption declared, "EPIC FAIL". As the artists explain, the picture was used as evidence that any given image could actually be assigned to the portfolio of a famous artist in an argument about creativity on the Internet. The search for a random Internet meme resulted in finding the image described above, which seemed to resemble the aesthetics of Cattelan's work. The similarity was even more striking since Cattelan used to include taxidermy animals (like donkeys, horses, or dogs) in his works. As we can read in the article by Eva and Franco Mattes, "We sent the image to a taxidermist and soon we received a box by mail: the 'sculpture!' It still needed an audience". [9] This remark is also significant in this case as this would suggest that an artwork is strongly contextualized by its audience and, generally, by its position in the art world circuit. The meme materialized as an art installation that has been displayed in the Inman Gallery Annex in Houston as a new work by Maurizio Cattelan, arousing interest among viewers and potential collectors[7]. Therefore, Eva and Franco Mattes, acting like art pranksters (as they describe themselves on their website), have remediated the image from the immaterial realm of Internet popular culture to a real gallery object. This transfer was enhanced by the process of institutionalization and a false prestige that is based on the elitist attitude of the audience. To summarize, the 0100101110101101.ORG artists have used the allegorical procedure, but, at the same time, their activity was a form of postproduction.

3. SUMMARY

It seems that contemporary culture with its wikinomic potential functions like a form of data that can be (and possibly should be) processed and reshaped over and over as if the presence of its original form by itself in the cultural circuit was insufficient. This looping process produces numerous versions, to recall the remix-related vocabulary. It also gains cultural value. However, quite often, it does not result in any orderly accumulation of knowledge, but rather information overload. This connectedness, as an effect of endless postproduction, has both a spatial and time-based quality. The aim to describe everything is utopianism, similar to the idea of a one-to-one (1:1) scale map that was depicted by Lewis Carroll[8]. This kind of a "big picture" of the art world is visible in this year's Venice Biennial (55th International Art Exhibition), where the idea of the Encyclopedic Palace, in the exhibition curated by Massimiliano Gioni, was not just about the supremacy of knowledge over visual attractiveness. I suppose that network-based culture, with its externalization of knowledge, overproduction of content, and collective authorship, seems to be a model for contemporary understanding of what the "Encyclopedic Palace" would be today. Since information is of greater importance than the visual representation, there is no centralized "palace," but rather a series of fragments to navigate between and a constant tension between the updated and the outdated.

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ENDNOTES

1 In this paper, I rely on the 2007 edition.

2 The history of this process can be dated back to the artistic meta-practices of conceptual art.

3 I understand the term "tactics" as it was explained in the writings of Michel de Certeau with regards to the difference between tactics and strategies.

4 The emphasis (indicated in italics) was added by Bourriaud.

5 *http://www.0100101110101101.org/home/reenactments/* On the artists' website, there are currently links to five projects. Previously, there was a sixth: *7000 Oaks* by Joseph Beuys.

6 As we can read in the description of Sherrie Levine's work on the website of The Metropolitan Museum of Art: "The series, entitled After Walker Evans, became a landmark of postmodernism, both praised and attacked as a feminist hijacking of patriarchal authority, a critique of the commodification of art, and an elegy on the death of modernism." See: *http://www.metmuseum.org/collections/search-the-collections/267214*

7 Inman Gallery Annex, Houston, *http://www.inmangallery.com/artists/WEASEL/2010_WEASEL_press_updated.pdf*

8 See: Lewis Carroll, *Sylvie and Bruno Concluded*, first published 1887. *http://www.gutenberg.org/ebooks/620*

Corporeal interval: sensory indeterminacy as the poetic bloom of interactive art

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Abstract. The interactivity adds a new sensory level in art. The implementation of artificial sensory systems can enhance what was discussed earlier as a human nature, indeterminacy. In this paper, we will discuss how the indeterminacy inherent in each one of the constituent elements of aesthetic experience is an essential factor in the development of the poetics of interactive art. To this end, the thoughts of Henri Bergson on the indeterminacy of the body are related to the machine's margin of indeterminacy discussed by Gilbert Simondon. This discussion is related to a theoretical and practical research which also includes artistic production. Therefore, the reflection influences the conceptualization of Em3 interactive installation that will help in understanding the ideas developed throughout the text. Finally, the indeterminacy of artist, artwork and observer will delineate individually and collectively the concept of 'Corporeal Interval'.

1. INTRODUCTION

When thinking about interactive art as a new degree of openness of the artwork that follows participatory art, we find a new configuration of sensory in art emerges. In participatory art, the novelty was the possibility of the public to engage physically with the artworks, with a greater use of their bodies. Yet, in interactive art, the implementation of artificial sensor pickup systems can enhance what was discussed earlier as a natural human characteristic: indeterminacy. Aiming at embodying information technology in art, it is necessary to consider the potential contribution of these media having artistic experience as the main goal. In this paper, we will discuss how the indeterminacy inherent to each of the constituent elements of the proposed aesthetic experience is essential in the development of the poetics of interactive art. To this end, the thoughts of Henri Bergson on the indeterminacy of the body are related to the machine's margin of indeterminacy discussed by Gilbert Simondon, with a little help of the black box philosophy by Vilém Flusser and the idea of the body as living media by Hans Belting. This discussion is related to a theoretical and practical research which also includes artistic production. Therefore, the reflection influences the conceptualization of Em3 interactive installation that will help in understanding the ideas developed throughout the text. Finally, the indeterminacy of the observer along with artwork and artist will determine, individually and collectively, the 'Corporeal Interval'.

2. BODY AND INDETERMINACY

The participatory art is a milestone in increasing the value of the observer's body in the artistic experience. Artworks like those of Lygia Clark and Hélio Oiticica (both Brazilians) intend to raise the awareness of the public's bodily perception. The proposal is for the observer to intervene with his own body. When the public get in contact with the artwork, his/her body performs as an expressive element. Artwork and observer will then bond as an art piece. In this process, we can identify three dimensions performed by the body during the artistic experience: plasticity, reception and mediation. Henri Bergson's thought will guide us

through this discussion. His theory begins from assuming that bodies are images, developing his analysis in understanding the body as field of action, which is related to the indeterminacy inherent in their perceptual abilities.

"Consider the system of images which is called the material world. My body is one of them. Around this image is grouped the representation, i.e. its eventual influence on the others. Within it occurs affection, i.e. its actual effort upon itself. Such is indeed the fundamental difference which every one of us naturally makes between an image and a sensation." [1a]

It is worth emphasizing that the philosopher assumes that the presence of this body is itself an image, in which the other images may also create representations upon it. Therefore, from an aesthetic point of view, the body itself, may it be the artist's or the public's body, is a medium, an aesthetic element that inserts itself in the artistic experience together with the artwork, whichever type it may be. Hans Belting will also emphasize this imagery character of the body:

"Their activity is needed in order to practice visual media in the first place. (...) Bodies perform images (of themselves or even against themselves) as much as they perceive outside images. In this double sense, they are a living media that transcend the capacities of their prosthetic media " [2]

That is, before being an observer, every body is an image. The first aspect of the body to be considered in the artistic experience is its plasticity. This plasticity is the image formation process based on sighting of shapes. Every body, whether in the moment of art creation or of reception constitutes an aesthetic object as much as the artwork itself. Belting proceeds stating that the body is an image that is able to perceive external images. Each body as a 'living media', needs to sense the other images in order to interact with them. The perception process results in assimilated information. For Bergson, perception is "unlimited *de jure*" and therefore the body is characterized as a center of indeterminacy. The management of the immense field of involuntary perception will be crucial in establishing the artistic experience for both the artist and the public.

Only after absorbing his surroundings is the individual able todevelop his own aesthetic experince. After the assimilation of information, the observer can connect to the images and perform his/her action, becoming a subject in the experience. So, along with the plasticity and reception capacity, the third role performed by the body in artistic experience is the mediation: the ability to respond to his environment after assimilating perception.

In participatory art, the intersection of the potencials of action and indeterminacy will be crucial for the establishment of the artistic experience. But wouldn't the transformation of these powers in actions be subjected to the process of limitation of the perceptual field and of the capacity of assimilating the surroundings poetically? The conscious form of perception is key to the artistic experience, because without this awareness, the body-image relationship would be limited to action-and-reaction. So the indeterminacy of the body plays vital role in participatory art.

"The degree of independence of which a living being is master, or, as we shall say, the zone of indetermination which surrounds its activity, allows, then, of an a priori estimate of the number and the distance of the things with which it is in relation. Whatever this relation may be, whatever be the inner nature of perception, we can affirm that its amplitude gives the exact measure of the indetermination of the act which is to follow." [1b]

The indetermination influences the three aspects of the body during the artistic experience. These three aspects are plasticity, reception and mediation. In participatory art, this natural indeterminacy in reception is expexted to present itself in the mediation done by each individual and his or her body so that the proposal of integrating the artwork plastically is fulfilled. The same applies to interactive art, which will take the sensory topic to an artificial level. In the next section, we will reflect on how digital media may also imply a level of indeterminacy.

3. MACHINE AND INDETERMINACY

The use of digital media is one of the characteristics of interactive art that allows a constant update of the work in accordance with the interactor's attitude. Digital media is based on a

computing machine capable of storing and processing data. Its peculiarity is the normalization of all content on numeric values, the binary code. Peripherals are attached to the computers to be used as interaction detectors or sensors and the most common are the keyboard and the mouse. In addition, you need software, such as operating system and programs to perform specific functions. We can digitize various types of analog data with it, or even convert digital data in different types. This is why Manovich [3] calls the computer "the metamedia" because it covers a variety of existing media and it also can be used as a tool for developing new media. Therefore, the digital media brings two contributions to art creation: the possibility of scanning data from various analog sensors; and the ability to instantly convert these signals into multiple expressive forms through the programming of machines and data remapping.

If the specificity of digital media is its ability to mimic between visual, audible and textual forms through time, would it have the power to trigger bodily perception in new creative levels? If we are now facing a digital media with this transformation potential, can we transform our self-perception along with them? With this question in mind, we attend to the influence of media on our perception and expression, not forgetting to link this transformation to the fact that we are interacting with machines that includes an artificial sensory system.

The possibility of going beyond human perception, allowing access to sensitivity unknown to us contributes to the interest in artificial sensors. For example, a camera with infrared light, simulates the sense of sight, but is sensitive to a type of light that our eyes are unable to see. The sensitivity of the machines and men operate from different principles. The understanding of sensitive measures by numerical values is not part of human nature. We are unable to see the machine's "feeling" process, we can only interpret its data.

Vilém Flusser attended to what escapes from human intent in the machine coding process. He developed the philosophy of the black box, known as phylosophy of photography. His theory shows his insight into the man-machine relationship, in which he identified a condition of eternal untapped potential. "This is because the "machine-operator" complex is too complicated to be penetrated: it is a black box and what you see is only input and output. When you see the input and output, you see the channel encoder and not the process that goes on inside the black box." [4] Would the black box's inside content be a kind of sensitivity? Would the encoding process result from the machine's perceptual and expressive abilities? The encode process involves the artist's intention, but can he master the machine completely?

For Flusser, creative freedom is presented as a challenge to the machine users. The distinction between the intention and the result of the creative act questions its feeling when this one is brought under the understanding of the internal process of the machine. The artist who chooses to use digital media is subjected to at least two layers of this black box: the sensitiveness of the machine, and software previously installed in the machine, ie the middleware necessary to access the sensor data. Therefore, the artist is charged with the challenge of art and technology creation: to uncover emerging poetic process inherent of machine's complexity.

Gilbert Simondon studied the machine's evolution. He found in the internal development of machines, a process that he called individuation. The term 'individuation' had been used in the context of psychoanalysis by Carl Jung. In this circumstance the term is used to describe the process of acquiring personal awareness of individuality. For Jung, the individuation is primarily related to the rupture of identification with others, when a differentiation of their environment emerges. It is based on the search for a balance and adaptation of the human being to the conditions inside and outside the situation where he/she is.

The Simondon's individuation theory began discussing about the acquisition of autonomy by machines. To this end, the machine would have to acquire a certain "technicality" by achieving a concrete technical object status. This process consists of an increase in the synergy between the internal processes of the machine. To accomplish that, the machine should have a greater

internal coherence, but also an opening the outer world, so that the machine can relate to its environment. In this way, technicality also opens the machine to human intervention, allowing a relationship between them, not in the sense of dependence, but cooperation. The technical objects, little by little, lose their essential artificiality, guarding increasingly similarities with living beings. However, technical objects would never be fully concrete, but point out to the complexity that allows unexpected and non programmable reactions.

"The real perfecting of machines, which we can say raises the level of technicality, has nothing to do with an increase in automatism but, on the contrary, relates to the fact that the functioning of the machine conceals a certain margin of indetermination. It is such a margin that allows for the machine's sensitivity to outside information. (...) A purely automatic machine completely closed in on itself in a predetermined operation could only give summary results. The machine with superior technicality is an open machine, and the ensemble of open machines assumes man as permanent organizer and as a living interpreter of the inter-relationships of machines. " [5]

The machine's autonomy prescribe two factors: a margin of indeterminacy and man as an interpreter of these machines. We can say that Simondon believes that the potential contribution of the machines are in their artificial sensitivity and in its relationship and communication with man. Thus, we can also relate Simondon's and Jung's individuation theory. For both of them, the process of individuation is the result of the individual being (biological or artificial) on its context. It is worthy to note that the process of individuation, for both Simondon and Jung, unveils the possibility of balance in the relationship with the otherness.

We can then return to the question about freedom brought by Flusser, still dealing with the man-machine relationship, but now from the machine point of view. The individuation process is never completely done, ie, the machine never becomes completely autonomous or the black box can never be completely unraveled. This condition prevents human to predict all its multiplicities and effectively understand their internal processes. That is how interaction is formed in art: the artwork needs the interactor in a way that it never is completely autonomous, but never quite revealing.

Could we link the darkness of the box with the machine's indeterminacy? From the human lack of comprehension, the machine's margin of indeterminacy and the game with the apparatus, we can catch a glimpse of what should be a sensitive artwork. This artwork consists of an artistic approach of the machine, that even thought "works" according to the artist's code, shows itself, for both artist-programmer and interactor, as a mysterious black box. The machine is no longer treated as an obedient tool, but performs an aesthetic challenge. It is considered as a sensitive device in its perception abilities. In order to deal with an artwork that has unknown sensitivity, we need to reflect on the artwork point-of-view and its contribution to interactive art.

In this case, the artwork, as well as the artist and interactor, also performs the three dimensions of the body discussed in the first topic - reception, mediation and plasticity. If the artwork has a sensory system, the artistic experience also depends on its skills in these three areas? Obviously we do not intend to outline it as body similar to the human, but the inclusion of this new sensory system in the arts requires a closer look at their peculiarities.

In the case of analog signals, the data digitization can include an adjustment of information in the sensitivity of the sensors and in the processing of raw data yet before it becomes accessible to the machine user. This form of adjustment, in most of the time, is determined by the original function to which the machine was developed. In the analog context, the rejected data are called noise. The noise is seen as an obstacle to the information transmission, it's an unwanted information inherent to the received signal. For Simondon, there must be a balance that sustains the yield of information for the transmission of the message, but is also necessary to keep some background noise to guaranty some energetic information outwork. According to him, the sharp reduction of the noise level affect the process of machine individuation.

"The information is distinguished from

noise because you can assign a certain code to it, a regularity concerning the information. In all cases in which noise can not be reduced directly below a certain level, it operates a reduction in the margin of indeterminacy and unpredictability of information signals." [6]

If interactive art searches this openness to the unpredictable, reducing its margin of indeterminacy would be detrimental to the machine's contribution in the establishment of the artistic experience. The openness balance in the margin of indeterminacy machine is not something quite clear. The artist may be tempted to decrease the indeterminacy, looking for a more stable and intuitive experience for the interactor. For this reason, it is up to the artist to define the measure of the proposal openness to the machine. A balance must be found between the development of a coherent system that is executable and "runs", but still provokes the public perception and allows the machine to surprise the interactor. There is a delineation of the interactor's expected behavior in an interactive artwork, which has always a variable latency from each individual. But the artist also presumes a certain behavior for the code execution in the artwork, which may incur in unplanned reactions as well.

Interactive art, besides being characterized by the dynamics of its relationships, should have its openness towards the expressiveness of the machine. The use of machinery in the artistic sphere can incorporate some functional deviations and the unforeseen dialogue between human and machine. As much confident as the artist is of the artistic and technical aspects of his/her artwork, it is in maintaining the margin of indeterminacy that the he/she may have a real openness to the unexpected. So if the unpredictability is a characteristic of the work of art open to interaction, would the artificial sensory system be a possible contributor to the artistic experience?

4. CORPOREAL INTERVAL IN EM3

Throughout the paper we could see how the indeterminacy is inherent to the three points of the interactive art. Artist, artwork and interactor bring along their individual indeterminacy. However, it is due to the flexible boundaries in the relational space that indeterminacy can emerge in the plural sense as the poetic bloom of interactive art. When we state that the artist should be open to the indeterminacy of the machine, we believe that by doing so, the public is inserted into the expectations game that consists interactive art. The artist creation is merely an intention, a proposal that is submitted to the indeterminacy of the artificial sensory system and the public's reactions. The public, on the other hand, also try to anticipate the artwork behavior and it is up to him to unravel and explore its possibilities by developing his/her perception. Until now, the indeterminacy has been discussed in the context of each of the individual constituents of the artistic experience, from now on, we will discuss its collective and relational aspects, that emerges as an interval resulting from the tension between the indeterminacy degrees of the artist, the public, and the artwork.

"The visual arts refers to the concept of 'interval', which is not the 'emptiness' of west culture, but space. This is the 'in-between space' (...) what matters is the space between objects and not the objects. (...) It is the interval that allows the reading of the heterogeneous (the other) and not the homogeneous (the same)." [7]

The notion of interval arises as a consequence of this indeterminacy as a condition for art. The interactive art will be characterized as an interval for its unstable relational nature. The artistic experience occurs in the juxtaposition between the intention of the artist-programmer, the machine's margin of indeterminacy and the range of (un)expected actions in the dialogue between artist, artwork and public. The artistic proposals that open themselves to the indeterminacy of the three components, appropriate the corporeal interval its greater magnitude.

For better understanding, we will illustrate this from our own creation. Em3 is an interactive installation in which the public can contact the artist's body through the mediation of the artwork. This installation is the final experiment of a theoretical and practice research conducted over two years, that investigated the relationship of bodies mediated by sensors. On the occasion, the Microsoft Kinect 3D camera was used as a sensor due to it's human movement recognition algorithm. The body data obtained through the

Simple OpenNI library in the Processing programming software consists of vectors with positioning and orientation of specific points of the body, such as head, hands, shoulders, knees, etc., but also a confidence level for each one of them, witch we understood as the indeterminacy margin. The installation confronts artist's and interactor's bodies as these scanned data in two projections. The first one presents graphics (lines, circles, squares), generated from the relationship of the two bodies interpreted into shapes and are back projected on an one-way-mirror, so that the interactor can see them along with his/her reflection. The second one is the silhouette of the previously recorded artist's body, which also reflects in the mirror.

The graphics are updated from various parameters into dynamic visualizations styles. The main point is based on the comparing of artist's and interactor's bodies. In order to develop the artwork, a choreography was created and recorded out of poses and movements that the sensor response was different from what we would expect. The similarity or difference between these two bodies would trigger the two main visualization modes. If the installation consider the bodies in similar poses, their skeletons representations would appear, otherwise, we could see their joints moving in space, morphing into a mass as a unshaped collective body. The two bodies are also linked with white lines if they stay close to each other, that is, if the interactor's physical body and the installation's virtual body would occupy the same space. Furthermore, the confidence level of each joint influences on its representation. The bigger the margin of indeterminacy, the greater the occupied area by this point.

The provocation is in the kind of movement made in the artist's choreography. Some of the movements were made in a way that the sensor would not recognize, so that the machine can show new perceptions of our body. Therefore, even if the interactor tried to copy the virtual body, the comparison will not be stable, because the virtual body is not a copy of the human body as the interactor is used to. In fact, the virtual body is subordinated to the perception of artificial sensory system. Thus, the bodies joints are combined precisely because of its heterogeneity, emphasizing the difference of motion of the physical bodies, but also of human and machinic perception.

So in Em3, the dynamics of the relationships established reinforces the interval as a condition to understand the proposal and establish communication between the artwork and the public. The interval is presented as a space-time potential for transformating body paradigms. Starting from the indeterminacy as a principle, the corporeal interval is revealed in interactive art as a potential field of action and relationship. The various dimensions of the interval are embodied in the relationship between artist, work and public, whether as the distance between two points, a temporal break or a silence. In a poetic approach, the interval is more than a way to match and differentiate two bodies. It is a space of tension and exchange between artist, public and machine.

CONCLUSION

By reinforcing this perceptual distinction between interactor and sensitivity of the artwork, we believe that we are increasing the space for dialogue with the machine as an expressive element of the artwork. The combination between artist's, public's and artwork's bodies occurs through different dimensions of space-time into a corporeal interval experience. This experience depends on the way each body engage in transforming the other one, in how he/she/it can amplify their own perception and relationship with the other bodies. As we see this artificial sensory system as an opportunity to make the artwork sensitive, we are embodying the artwork to the corporeal interval and we are considering its sensory system as another agent of the artistic experience.

In fact, it is the artificial sensory system that can provoke new insights of the human body through their simulacrums, promoting the exchange between artist and observer, and positioning itself in between them, as a sensitive artwork mediator. By focusing the points of distinction of this sensitivity to our own, we are embracing the unpredictable and opening ourselves to the contribution of technology to new insights of artistic perception and expression. Therefore, the corporeal interval is outlined by the machine specificity and by its embodiment into the poetic relational space of interactive art.

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MEDIA (DIS)LOCATIONS

MEDIA (DIS)LOCATIONS

A Telematic Approach for Mass Music Ensembles

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Abstract. After several years of development as a research prototype, the Soundjack software package has become established in the international online music community for its capacity to facilitate low-latency online collaborations, as well as network performances between musicians across distributed locations. While past setups involved a maximum of five players, this paper focuses on a use case interconnecting each musician in an orchestra consisting of 60 or more members. In this context the authors describe the technical challenges of IP traffic engineering in peer-to-peer networks, the current server-based implementation and the results of experimental test performances.

1. INTRODUCTION

Due to the unpredictable "best-effort" manner inherent to how conventional IP data is relayed, and the consequent lack of guaranteed packet delivery, the Internet was not originally developed for the purpose of sending real time traffic, as necessary for the transmission of audio data. Packet loss and delay variations typically lead to dropouts in the received audio stream, which result in signal errors, and correspondingly, disturbing noise, clicks and artifacts [6]. In order to overcome these problems, voice-over-IP (VoIP) and video conferencing services work with the principles of large audio frames, large network buffers and packet retransmissions [11]. This implies additional latencies of several hundred milliseconds [11]. Such delays do not represent a problematic figure in the context of normal voice communication, but in the context of distributed live music latencies should not exceed 30 milliseconds in order to achieve adequately realistic performance conditions [4] [8]. At present, even consumer-grade network infrastructure built on ADSL or cable modem technology can meet the delay- and quality-critical requirements of the distributed music domain simply as a result of constantly increasing bandwidth capacities. By consciously avoiding the above-mentioned principles of larger audio frames and audio buffers, two major projects leverage the improving characteristics of modern Internet infrastructure: the Jacktrip software being developed by Chris Chafe et al. [7], and the Soundjack software [3] [14] described in this paper. Both have become the most prominent solutions in the domain of distributed music and share one common core principle, which is the possibility to adjust the soundcard to the lowest latency that the host system will allow to be configured. Consequently, the soundcard generates relatively small chunks of audio samples, which arrive at the system's userspace at predefined intervals. Upon arrival the system sends the data as UDP packets to a desired destination, where the remote user can then freely adjust the size of the so-called network jitter buffer. The lower a sender adjusts the audio chunk size and the lower a receiver adjusts the jitter buffer size, the lower the resulting latency will be. However,

actual configuration depends on overall network stability and must be manually configured by the user. Under ideal network conditions with significant bandwidth and a low amount of additional Internet traffic, the system will introduce a delay of approximately 4 ms. The worse a connection is, and the more additional Internet traffic is sent across the same network path, the described parameters must be adjusted upward accordingly, resulting in an increased typical system latency of 20 ms to 200 ms, or possibly more under extremely adverse conditions [1][12]. The final latency is result of the system latency plus the delays caused by the transmission capacity of each intermediate network component such as routers or switches, and the propagation speed of the respective network media such as fiber optic lines or copper connections [9][10]. Unless a provider offers a dedicated QoS (Quality of Service) scheme users cannot control these network-specific latencies [16]. Further details and a comprehensive analysis of distributed music can be found in [1].

2. GOAL

Building on past research limited to a maximum of four remote performing sites, this paper focuses specifically on the interconnection of larger ensembles such as orchestras. This objective is motivated by a collaboration with the Dresdner Sinfoniker, a German orchestra famous for its unconventional attitude towards musical and technical experiments. In this context, where a classical orchestra could involve upwards of 60 musicians, new requirements emerge with regards to the system's architecture and corresponding network engineering. The following sections will describe the intrinsic challenges, our concept and realization of this new use case in distributed music.

3. PROBLEM

In [13] the authors state an upper latency acceptance threshold for musicians of 30 ms. In [8] this value is slightly adjusted to 25 ms, however, it is noted that a fixed number can only be considered a rough guide value. The actual threshold is actually rather subjective, depending on each individual musician's perception and on the performance speed. In practice, thresholds can vary from as little as 5 ms for delay-sensitive musicians in fast performance situations to 50 ms for delay-insensitive musicians in slow performance situations [8].

Assuming a guide value of 25 ms, and taking into account only the pure propagation delay caused by fiber optic lines, it is plausible that distances of approximately 5000 km could be covered, as illustrated in Figure 1. However, when considering the addition of other real-world delays caused by routing detours, device transmission and system related buffering, we typically encounter a practical maximum distance of approximately 1000 km, which per se prevents performances on an intercontinental scope [1].

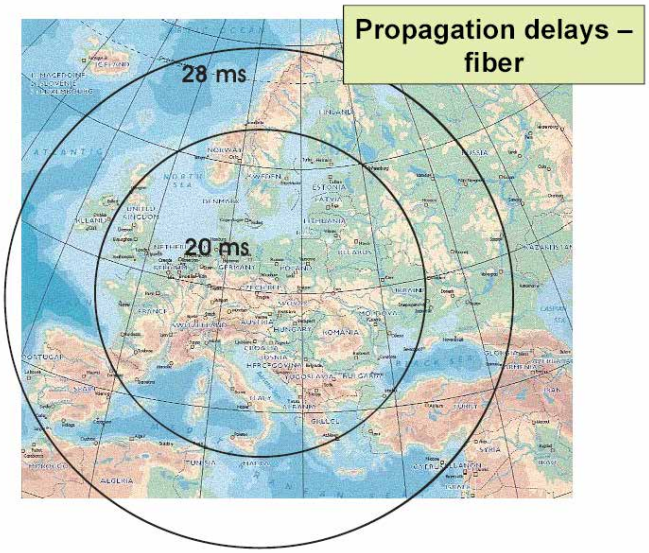

Fig. 1. *Latency caused solely by propagation over fiber-optic lines.*

Many experienced network musicians have an awareness of alternative performance approaches to be applied in situations where excessive latency becomes problematic. By explicitly declaring rhythm and solo sections on each participating end, artificially delaying one's output signal to a certain amount, or by consciously playing ahead of the beat, it is possible to overcome some latency issues. However, such strategies typically lead to a less convenient performance environment and a significantly different instrument feel. It is unclear how far trained classical musicians without a technology background would consider these approaches acceptable.

Furthermore, the goal of interconnecting a whole orchestra in the described manner implies a new problem concerning the network capacity: One uncompressed mono audio stream requires an upload bandwidth of approximately 1 Mbps, although with Soundjack and its corresponding compression algorithm it is possible to reduce this to around 300 kbps [2][15][17]. If each of the 60 musicians require an individual bandwidth of approximately 300 kbps and were to be simultaneously connected to every other musician in a conventional peer-to-peer manner, the corresponding minimum up- and download throughput for each user would be 18 Mbps. This requirement simply cannot be met by most conventional consumer-grade Internet connections. This problem is illustrated in Figure 2.

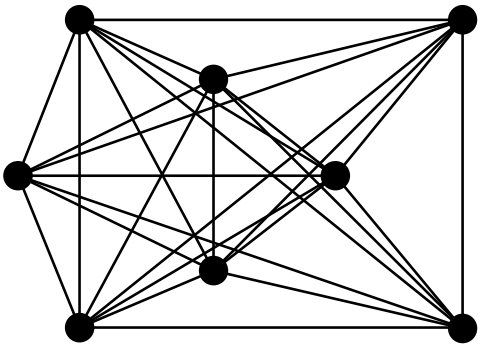

Fig. 2. *Example of a conventional peer-to-peer audio streaming network with eight peers: dots represent a peer; solid lines represent a full-duplex network connection. All peers are directly connected to every other peer, which leads to seven upstreams and seven downstreams for each peer. Using Soundjack in this conventional peer-to-peer manner, a full orchestra setup with 60 peers results in an unacceptably high upload bandwidth requirement of 18 Mbps for each participant's endpoint connection.*

4. CONCEPT AND IMPLEMENTATION

As outlined in the previous chapter, the most significant technical issue is related to bandwidth limitations at each endpoint connection. As a solution, instead of using a peer-to-peer connection scheme, a custom centralized server was developed to receive and mediate all 60 streams, mix them to one single stream and then send it back to each musician. Consequently, the bandwidth requirements for each peer would be reduced to just one inbound and one outbound stream. As with the peer-to-peer variant of Soundjack, the new Soundjack server is also developed in C++. With respect to the current target group and its ambiguous latency requirements, we decided to limit the project's geographic boundaries to Germany for this initial experiment. Furthermore, it was necessary to ensure that each respective stream to the server would not suffer unreasonably from significant routing detours as compared to a direct peer-to-peer route, which necessitated an active search for a suitable central server location. Eventually a partnership with broadband Internet provider Vodafone was established, offering an ideal server location directly within the Vodafone backbone in Frankfurt/Main, with a network capacity of more than 1 Gbps. This setup is depicted in Figure 3.

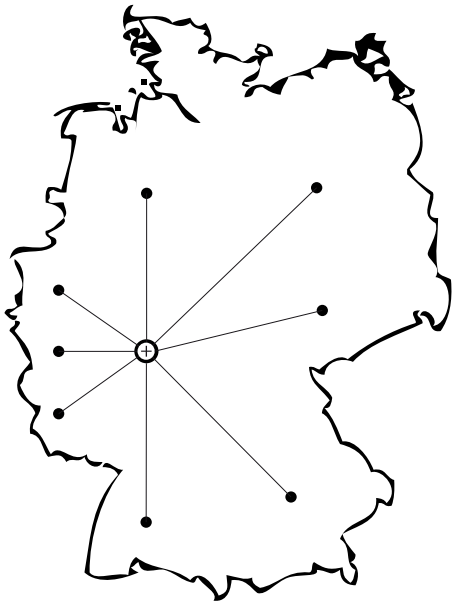

Fig. 3. *Server-based Soundjack Network Topology: Instead of establishing multiple peer-to-peer connections, each respective audio stream is sent to a dedicated, central Soundjack server, which mixes the incoming streams to one single stream and sends it back to each participant: dots represent peers, solid lines represent full-duplex streaming connections. The central dot represents the server located in the Vodafone backbone in Frankfurt/Main.*

Additionally, it was necessary to determine server parameters in terms of buffering, compression and the resulting server-related latency. As described in the previous chapter, it was not clear to what degree the current target group would require 'natural' performance conditions, or could possibly apply alternative interaction

approaches. It was subsequently decided to apply a compromised parameter setup, which strikes a balance that achieves relatively stable network streaming conditions without pushing latencies to new extremes. As such, one audio channel was configured to use a sampling rate of 48 kHz [5], with one single audio buffer with a size of 512 samples [5] to be instantly decompressed and mixed to a final uncompressed one-channel audio stream of about 800 kbps. Resultantly, the sample buffer itself entails a latency of 10.8 ms, while decoding entails an additional 2 ms, which culminates in a final server delay of around 13 ms.

5. EVALUATION

Initially the intention was to establish an extensive test regimen comprising various styles of music, tempi and performance constellations. However, following the first set of experiments, it was decided to significantly narrow the scope of the evaluation scheme. Five test sessions with ten players were conducted, in which each performer was already experienced and confident using Soundjack in the conventional peer-to-peer manner, as well as geographically located within Germany. The evaluation repertoire ranged from Monty Python's "Always Look on the Bright Side of Life" to Bach's "Inventio 1," while also including simple blues schemes and single chord patterns at various speeds. It soon became clear using this server-based scenario that it was not possible to maintain the caliber of musical interaction expected at the professional level. In practice, routing detours and additional server latency exceeded the delay-acceptance threshold of the participating musicians, which led to significant timing problems. Moreover, none of the musicians were willing or able to apply alternative interaction approaches such as self-delay, rhythm/solo separation or consciously playing ahead of the beat, which lead to a non-performable situation and eventual frustration for every participant.

6. CONCLUSIONS AND FUTURE WORK

A dedicated central Soundjack server currently represents the only feasible solution to address the bandwidth issues encountered by remotely distributed large-scale music ensembles. However, the corresponding additional latencies experienced in practice currently exceed the acceptance threshold of the involved musicians and lead to an untenable performance situation. Likewise, the stringent delay-critical demands of the target group of professional classical musicians must be taken into consideration, as a natural and uncompromised performance situation is non-negotiable. Considering these findings, it is imperative to reduce the server-internal latency from the current 20 ms to 5 ms or less. Correspondingly, each musician's individual technical setup must be improved, and performers must be conceptually informed of the persistent issues of bandwidth and latency. Nevertheless, despite a centralized server topology, additional real world server-related latencies and routing detours again reduce acceptable performance distances to 800 km or less.

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TuneMap: an Interactive Geolocated Music Information Browser

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Abstract. TuneMap is an interactive web application that aims to visualize and foster reflection upon the influence of geography on contemporary popular music. Artist and audience related information is displayed on a world map, while a number of interactive controls allow the user to listen to music samples from artists from all over the world. Meaningful data on relationships between artists and listeners, as well as between artists themselves is visualized on the world map. TuneMap uses information gathered from a number of online websites that provide diverse and previously unconnected datasets. In this sense, TuneMap is a "mash-up" web application.

1. INTRODUCTION

There is a close link between geography and human behavior [15]. For instance, latitude and coastal proximity are clearly correlated with economic development [7]. Art, as an expression of the human nature, is not an exception. An obvious example is architecture: one of the main goals behind vernacular architecture was to adapt existing spaces or to create new structures for protection against the elements of nature [13]. As this basic need was satisfied by primitive architecture, these structures evolved and were provided of additional qualities. Other variables (cultural, religious) played important roles in the process, but these newly introduced qualities never diminished the importance the initial – more utilitarian – needs of architecture, which where greatly influenced by geographic location.

While one can presume that music is influenced by geography as well, it is harder to find and interpret any evidence of this. However, the recent availability of powerful Geographic Information Systems (*e.g.* Google Maps, Open Street Maps, Wikimapia, among others), the increasing efforts to open access to information databases [16] [12], and the connectivity provided by Internet, are empowering the general public to gradually leave a passive role and become active actors in the study and generation of geolocated knowledge [5], which sometimes manifests as the creation of interactive *mash-up* applications for data discovery [3]. These advances of information technology can help us to understand, or at least to observe and expand our ideas about the influence that geography might have on contemporary popular music1.

An illustrative approach to this questions was an image posted in the Reddit web page on February 23th of 2012 by user *depo_* [11]:

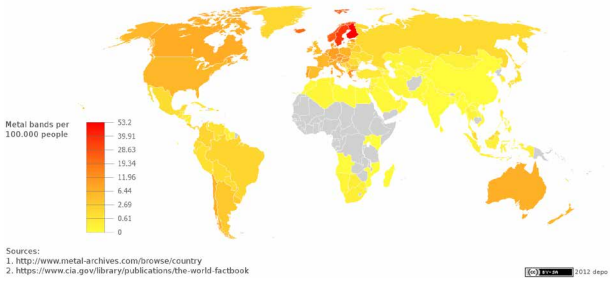

Fig. 1. *Metal bands per 100.000 people, per country, as posted by user depo_ in Reddit on February 23th of 2012.*

This image, though static an limited to one single variable, serves as an inspiration to what could be done with online music databases and geographic information tools. In this specific case, the data was obtained from the *Encyclopaedia Metallum* [6] and the CIA's World Factbook [1]. Interestingly, this data mapping has been done more than once, as the spawned discussion in Reddit testifies.

For the project herein described, we used2 a number of websites that provide diverse datasets in order to develop a mash-up web application, titled *TuneMap*, a tool for the exploration of music-related, geolocated data. TuneMap was initially developed during the Barcelona Music Hack Day in 20123, and it is currently been improved in a number of ways. In next sections I present details of the current state of TuneMap, its development, deployment and use, as well as some thoughts and questions that have appeared during the process.

2. PROJECT DESCRIPTION

TuneMap superimposes interactive music data visualization over a world map. This serves as a starting point for reflection and understanding of how artists, music fans and genres are geographically distributed. This also allows spotting relations between artists, illustrating how musical trends and influences might have travelled across the world.

2.1 INTERFACE DESCRIPTION AND USAGE

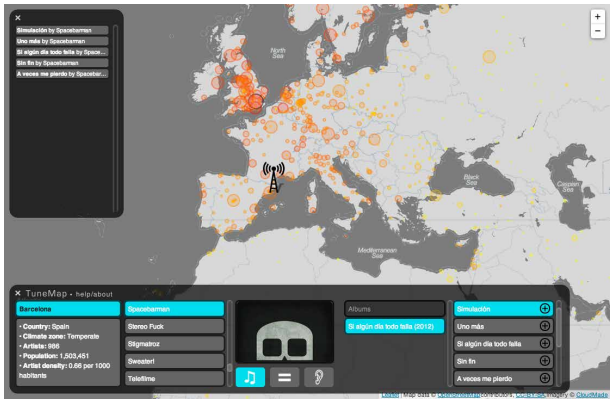

Fig. 2. *TuneMap main interface.*

Map navigation is probably familiar to anybody who has used Google Maps or similar map applications. The map can be clicked-and-dragged around to locate a point of interest, and zooming is done by the zoom ("+", "-") buttons, or using the vertical scrolling on a mouse or touchpad. Cities of the world are marked in the map as colored circles. The radius of each circle is proportional to the amount of bands or artists located in it. Likewise, the circle's color represents the "artist density" – the amount of artists of a city divided by its number of habitants. A lower density is represented with a yellow color, while a higher density is represented in red, with shades of orange for middle values. Some exceptional cities are highlighted with a black circle (see Section 4.2). It's important to mention that, while an initial estimation of the amount of artists per city are stored in a local database, all other data visualized with TuneMap is downloaded dynamically via APIs from music information websites, as explained below.

While the user browses the map, an Information Panel with basic data will appear when hovering the mouse pointer over every city. These data includes the country and climate zone where the city is located, the amount of artists, population and artist density. When a city is selected by clicking on it, the Information Panel will stay in place, and will expand showing a menu with a list of artists from the city. Currently, the 100 most popular artists from the city, as reported from The Echonest, are included in this list. Once an artist is chosen by means of a click, the Information Panel expands again to show the artist's photo (if available) and a Control Panel with buttons for three available functions for displaying further artist information: *Music*, *Similarity* and *Audience*.

Fig. 3. *TuneMap main control panel. The buttons under the artist image (♬, =, 👂) allow to select the Music, Similarity and Audience functions.*

Music: When this function is selected, additional menus are displayed for the user to chose among the artist's albums and songs. A 30 second song preview can then be played or added

to the current *Triplist* (more on this later). This 30 second limit is imposed by the music streaming service (Deezer) due to copyright issues. However, if the user has a Deezer account and she is logged, the whole song will be played.

Similarity: If this function is selected instead, the map will show lines connecting the selected artist's city with other cities with similar artists. The weight of every line is proportional to the number of similar artist in every connected city, as a way to measure the strength of the connection of the artist with the city, at least in musical terms. A menu with the names of the corresponding cities will appear, and the similar artists can be browsed as well. Any artist in this list can be also clicked, restarting the "discovery loop".

The *music network* displayed by the Similarity mode allows aims to represent the relationship of the artist with the rest of the *music world*. For instance, certain artists may be more closely related to other artists in the same country, while in other occasions the related artists are more widely spread. This can help to unveil unknown artistic, geographic and even technological connections, as well as music genre distribution, since frequently similar artist share stylistic features.

Audience: Finally, if the Audience function is chosen, the map will display an *audience network*, *i.e.* a set of lines displaying the main cities of the world that display relevant audience metrics for the selected artist. These metrics include tweets, listens on Myspace and torrent downloads. This audience network may help gauging how each artist's audience is spread around the world.

2.2 THE TRIPLISTS

A *Triplist* is a song playlist constructed while the user explores the TuneMap. Whenever a desired song is located in the corresponding menu, it can be either played immediately or added to the current Triplist. Since every song is associated with the city of origin of the artist who composed it, a Triplist is also associated to a trajectory (a trip) across the world map. As the user adds songs to the current Triplist, the trajectory is drawn on the map.

3. DEVELOPMENT

In this section, I present the main details of how TuneMap was developed, including the technologies used, description of data sources and how the data was obtained.

3.1 TOOLS AND DEPLOYMENT

TuneMap is written in PHP and JavaScript, and MySQL is used for storage. After an initial prototype was working locally, it was deployed under the domain name *tunemap.net*, where it is right now. TuneMap currently keeps a log of the specific artists searched by visitors, but it will eventually log more activity in order to obtain better usage insights. Visitor data is also logged with the help of Google Analytics.

3.2 DATA SOURCES

This subsection describes the resources used for the development of TuneMap, the datasets employed and how they were used and obtained. Two main categories of data were used: music-related and geolocation-related.

Countries and cities: Data about country and city population and location data was obtained from the GeoNames geographical database [8]. The first time a visitor uses TuneMap, country and city data is stored in LocalStorage4 on her browser. This way these data takes less time to load in further uses of the application.

Artists' location and similarity: The Echonest [19] is a music intelligence company that offers an extensive database of descriptors of millions of songs and artists, audio analysis and music remixing tools. They offer a comprehensive API (both free and paid) for browsing their database. We used this API to estimate the number of artists located – or which were founded – in each city.

The Echonest's free API has certain restrictions for the applications that access it in order to avoid verbatim copies of their database. For instance, for certain API methods, the amount of artists for which information can be downloaded is limited to 1000. For further discussion on how this API limitation affects TuneMap, please refer to the section 4.2.

Map data: We opted for using the OpenStreetMap [17] service for the generation of maps, due to its open philosophy. We created

a custom layout for it using CloudMade [2]. For interaction with the map (map overlays and pop-ups) we used the Leaflet [10] Javascript library.

Music: Deezer [4] is a web-based music streaming service. They provide SDKs for accessing their catalog from mobile applications, and APIs for web application access. We used Deezer to find artists' recordings (albums) and songs, as well as for music playback.

Audience data: Data used for this visualization was obtained from the Musicmetric[14] analytics service.

4. DISCUSSION AND FUTURE WORK

In this section I present some descriptive statistical data obtained from studying the TuneMap dataset, as well as some derived thoughts. It is worth noticing that these results cannot be assumed to be 100% complete or accurate, due to the limitations of our data sources (see section 4.2). However, they are representative enough to show some insights on the worldwide distribution of contemporary popular music.

4.1 STATISTICS

At the time of the writing of this paper, The TuneMap artist visualization uses a total of 163,645 artists from 1888 cities located in 182 countries. The countries with the highest number of artists are, from highest to lowest United States, United Kingdom, Germany, Canada and France respectively. Therefore, North America and Europe appear to have the higher number of artists, with Asia in third place. However, given the limitations of the dataset (more details in next section), Asia is probably underrepresented.

The color-coded information on the map clearly reflects this numbers. Cities in North America and Europe are frequently represented by bigger circles, and they tend to appear closer together. They also reach orange to red tonalities more frequently than in other zones, implying a higher artist density. It is worth noticing that these cities are mainly located between the north of the subtropical and the temperate zone5.

On the other hand, most cities with artists in Asia, Africa and South America are more sparsely distributed. They also appear to concentrate in the coastal zones, and usually have a lower artist density.

Finally, towards the south of Africa, South America and in Australia, when absolute latitude value increases reaching again the temperate zone, some cities with higher amount of artists and higher artist density appear again.

An analysis of the relationship between latitude and amount of artists gives interesting results. Leaving aside the frigid zone (which contained only two cities in our dataset), there are significant differences in artist density between zones. A comparison was made using a Mann-Whitney U test (given that the samples don't follow a normal distribution), leading to statistically significant results: countries closer to the Equator (tropics) have a lower median artist density than countries in the subtropical area ($Z = -6.7523$, p-value < 0.01). Similarly, the median of the artist density in the subtropical area is lower than that of the temperate area ($Z = -9.7471$, p-value < 0.01).

It is of course not possible to prove causation from these results, but it is more likely that latitude influences the appearance of artists, and not the other way around. Though the results are not absolute, I hope they invite to reflection.

4.2 LIMITATIONS

Music information websites such as The Echonest sometimes obtain their data by crawling the web, in a similar fashion as what Google does for general Internet search. The huge amounts of complex data gathered this way are frequently redundant, incomplete or might need corrections. Though these websites do a great job organizing such information, any limitations they suffer will affect TuneMap behavior as well.

A more specific limitation is imposed by The Echonest on some of their methods, which cannot be used to obtain information about more that 1000 items. This limits the accuracy of TuneMap's city statistics. For instance, for some cities that have a high number of artists, it was not possible to obtain information from more than 1000 of them. TuneMaps highlights these cities with a black circle, and reports information accordingly (*e.g.* for London, the total of number of artists is reported as more than 1000 and the artist density just as "High").

It is important to take into account the relation between development and Internet access. Even though Internet penetration is constantly increasing, artists living in countries with lower Internet access will certainly have more limited possibilities to publicize their work on the Web. A city for which TuneMap reports a low number of artists might actually have a rich music scene, but it could be limited to a local influence because of a lack of proper Internet access of its inhabitants.

On a similar note, non-western countries are probably underrepresented in many of the sources for TuneMap information. This is in itself a source for reflection. For instance, observing how scarce and spread artists seem to be in a country like China, which is highly populated – and which most likely has a much higher amount of artists than those we know of –, suggests certain isolation from the western world.

It is also worth mentioning that Deezer, the music streaming service used by TuneMap for audio previews, is not available in certain countries. In some cases, visitors might not be able to listen any audio previews at all. At the moment, an optimal TuneMap experience would require a valid Deezer account to have the possibility to play unlimited music. Offering other music streaming services might provide some additional flexibility in this aspect, and this is part of TuneMap's future plans. However, even with no audio playback, TuneMap provides interesting visual insights on the relation between geography and music.

4.3 FUTURE WORK

In this section I present a number of possibilities for further development of TuneMap.

Music genres: Information about genre and other descriptors is available for every band in the TuneMap dataset. This can lead to interesting visualizations, such as the one mentioned in the Introduction of this paper. Certain descriptors might be mapped so as to understand which zones in the world tend to produce certain types of music. For instance, it would be interesting to investigate if parameters such as "danceability" or "aggressiveness", which tend to be related to certain musical genres, are also correlated with latitude or climate of its places of origin.

Temporal data: The data currently displayed and mapped on TuneMap mainly relates to geographic data during present time. I am interested in adding a temporal axis to better understand evolution of popular music and maybe even influence. For instance, if two rock bands are closely related, but one was active during the sixties and the other during the eighties, it is more likely that the first influenced the second than the other way around.

Real-time data: In an increasingly connected world, music consumption seems to be moving from download to streaming [20]. In terms of live music, a number of solutions are starting to appear [18]. Real-time geolocated information about streaming of live events, or about music played in public places, can complement information on music consumption at global level. This idea is aligned with the location feature [9] that Shazam recently launched as a complement for their song recognition application.

Sharing: Finally, in should be eventually possible to share information discovered using TuneMap. This might range between simple Facebook shares and Twitter tweets, to a whole community around the sharing of *Triplists*.

Additional music streaming services: Ideally, a TuneMap visitor should not be restricted to a single music streaming service. In the future there might be a number of services available directly from the application.

5. ACKNOWLEDGEMENTS

The initial prototype of TuneMap was conceived and created by Guillermo Malón, Alberto González and myself as a project for the Barcelona Music Hack Day 2012. This project would have not been possible without this initial team effort.

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[18] Spacebar. *http://www.spacebar.com*
[19] The echonest. *http://the.echonest.com*
[20] The NPD Group. Music file sharing declined significantly in 2012. http://bit.ly/1ecRaaR (February 2012)

ENDNOTES

1 Even though the ideas herein presented apply to any type of music, popular music, as opposed to traditional or art music, is probably better represented.
2 Though this project was initially a team effort, solely the current author continued working on it on subsequent stages of development and for the effect of this publication.
3 http://wiki.musichackday.org/index.php?title=Tunemap
4 *http://www.w3.org/TR/webstorage/*
5 *http://en.wikipedia.org/wiki/Geographical_zone*

Sound Cairns:
Virtual Spaces

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Abstract. I will discuss the ideologies and approaches that form the basis of a series of audio projects that I have worked on over the past 7 years. Each of these uses sound and location as "Sound Cairns". I will explain the details of a "Sound Cairn" by showing examples of my own. The virtual net-based object of the "Sound Cairn" creates questions by stratifying the Cartesian "built" environments through the presented locative media projects.

INTRODUCTION

"Fog everywhere. Fog up the river, where it flows among green aits and meadows; fog down the river, where it rolls defiled among the tiers of shipping and the waterside pollutions of a great (and dirty) city. Fog on the Essex marshes, fog on the Kentish heights. Fog creeping into the cabooses of collier-brigs; fog lying out on the yards, and hovering in the rigging of great ships; ..."[1]

Place, location, and sound are some of the foundations for listening. Each of these elements are different aspects of an experiential moment in time and space, whether we are listening to the flow of water in a stream in the Upper Peninsula of Michigan or a concert in Lincoln Center. These factors create this experience from the constant motion of the sonic "fog" that is draped around us.

In the multi-planar realities of the digital world, each of the planes extends our understanding of the physical environment and as to how we navigate and interpret each place, person, or moment in time. The virtual net-based object of the "Sound Cairn" creates questions by stratifying the Cartesian "built" environments with locative media projects.

This paper discusses the concept of "Sound Cairns" as it relates to the ideologies and approaches underpinning a series of audio projects that I have worked on over the past seven years.

CAIRNS AND SOUND CAIRNS

A cairn is a stand of rocks set on top of each other as either a place marker or a physical memory. They have been used for many reasons and in many cultures throughout history. Just as physical cairns mark places associated with meaningful experience, "sound cairns" use recordings of experience to mark locations. One can either leave a stone by recording their experience or witness the experience of another by listening to the other's recording. These sound cairns have been represented as virtual web based points that users access by mobile devices with Global Positioning Systems (GPS), written descriptions and navigations to that place, or links associated with QR code scan markers.

Cairns arise organically from the experiences of users. In this way, they differ from works limited

to a gallery, because they invite natural, casual participation in their creation. In other words, they are placed "as they happened." Their purpose is not to be seen, but rather to be found.

This difference in the display of the cairn brings meaning and a more poignant transformation in the person discovering and the witnessing the cairn. Cairns are not primarily found on maps; they exist as ghosts of memories placed in space and time, spread out through the physical landscape and, in the case of sound cairns, connected to the Internet.

With the advent of mobile technology, computing has become ubiquitous. The software appliances we use change the way we interface with physical and virtual space daily. We use these devices to navigate visual art, design, technology, architecture, location, and sound. It is on the basis of this multi-modal paradigm that I apply the concept of the sound cairn as an object placed and experienced at a fixed point.

CYBERSPACE AND PHYSICAL SPACE

Within this paradigm, the concept of the sound cairn became formalized as it connected to current topics related to sound in information and communication technology (ICT), specifically as it relates to transcendence in the digital world. With the advent of mobile technology, our digital world is not somewhere other than here; we live in a hybridized state between the World Wide Web and physical space.

These concepts depart sharply from early theories of "cyberspace" introduced by William Gibson[2] and "transmission of place" discussed by Nicolas Negroponte[3]. Each of these discusses the digital world as an alternate plane, that is situated in a place separated from our physical world. Negroponte said that "digital living will include less and less dependence upon being in a specific place at a specific time, and the transmission of place itself will start to become possible." With the sound cairns, in contrast, it is the linkage of locational experience and the sound marker that is important; in other words, it emphasizes the critical experience of "being in a specific place at a specific time."

Creating a way to talk about this hybridization was crucial to understand my creative process. I began to explore the root concepts of creating node points of conversation with technology. The importance in sharing this theoretical concept of the sound cairn is to create a more formal relationship with these moments of sound and the attempt to create "fixed points" where the delineating lines of the physical and digital world hybridize into new definitions of public space and digital art.

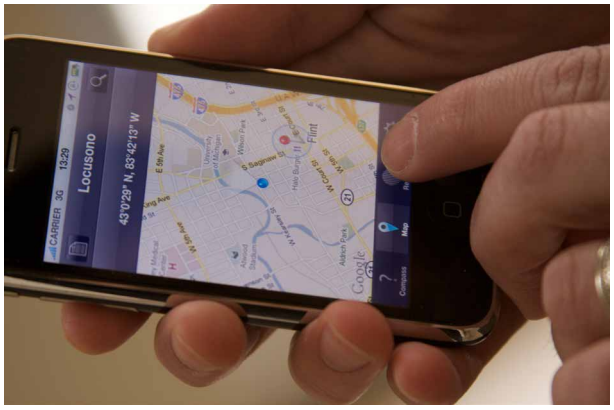

Fig. 1 *Prototype mobile design for the Locusono locative media application*

The mobile design project Locusono allows one to share stories, events, and histories from their physical location. By linking a GPS location to an audio recording created by the user, Locusono weaves both together into a new immersive experience, using sound to engage people through listening and participation. People will be able to hear stories, sounds, and conversations made by other participants and also make their own recording(s) that will record their GPS location so that someone could then find it later. This is a new way to think about creative engagement and building pathways through asynchronous connections.

When the user records the story, it is uploaded to a web server where it can be accessed by anyone. These stories can then be heard at the recorded location with a mobile device or through a desktop web application.

The effect of this project was to think of the sound cairns as technologically defined locations linked with GPS. The sound cairns in this project could be found at their location coordinates as soon as the segment was recorded and continuously after that. By allowing users to record their own segment, Locusono creates a network of cairns that become the voices of the community.

URBANtells

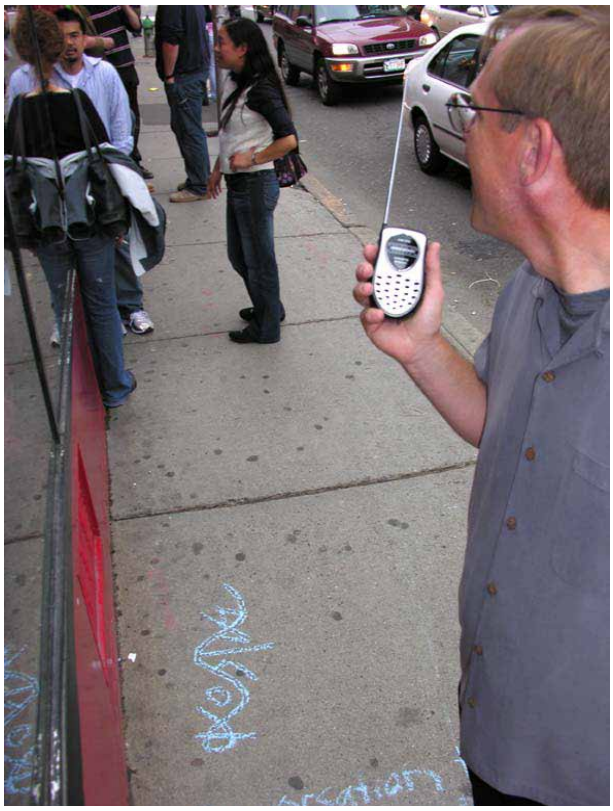

Fig.2. Participant listening to sounds from the URBANtells Cambridge, MA project. Art

With James Rouvelle and Steve Bradley, I co-created URBANtraces, a neighborhood radio project that used low-power FM transmitters broadcasting at 87.7 FM. The transmitters were located at various sites, including homes, shops, and art spaces, in a transitional neighborhood in Baltimore, Maryland. The broadcasts were available 24 hours a day, seven days a week in August 2008.

Using an FM radio, participants listened to stories, sounds, and other sonic art forms created by participants who live or work in the Station North Arts District and Greenmount West area of Baltimore. As they walked, the radio would receive the audio recordings as the participant entered the radius of each radio transmitter.

Projects created with URBANtells focused on giving a new meaning to urban areas. For this reason, people, including technologically-naïve people or those with limited access to technology, had to be able to easily engage with project; this led to the use of AM radios, which provided a familiar and accessible entry point for participants.

Since radios were used in these projects, the participants' impressions were different from the projects that employed smartphones. As a person walked the street with a portable radio, they weaved in and out of radio static and the pre-recorded segments. We did not tell the audience the locations of the transmitters: they had to seek them out in a general area. We wanted people to hear the recordings as the walked the street and discover them as if they were using a divining rod to draw them out of the landscape.

THE PAVEMENT

Fig 3. The Pavement, Grand Rapids (2012) and Washington D.C. (2013)

"The Pavement" was a temporary public art project where, at specific locations, I have made chalk markings with stencils or installed ground stickers that could be scanned using a smartphone application. The scanned code then accessed an audio file to be played on a smartphone.

These audio files were content from Jane Jacob's book *Death and the Life of Great American Cities* (1992). The short section clearly and frankly describes "sidewalks" as they relate to human use of the city. When one listens to these audio recordings out in the streets after scanning the QR code to access them, one hears the words of Jacobs while being immersed in the reality of their present location. Placing these recordings this way magnifies the meaning of the reading.

"The Pavement" is an experiment in using sound cairns for fixed social commentary. Each of the segments that could be scanned in different locations around Washington, DC and Grand Rapids, MI were placed in on busy sidewalks where they could be found easily. I see each of the recorded segments[4] as very evocative and by placing the QR indicators on the sidewalk, it

not only created a sound cairn when someone scanned the QR code; the resulting audio also instilled a new impression of that particular area of the street upon hearing Jacob's writings and seeing the architecture of the immediate area.

CONCLUSIONS

Each of these projects demonstrates different facets of the sound cairn concept. Each situates sound objects in space. The sound cairns may or may not have physical presence themselves, but they are directly connected to a physical location through the Internet.

By link sound and technology to physical spaces, sound cairns create monuments, caches, node points, or other markers to change and interpret our surroundings and create a new fabric built of peoples' voices and the sounds around them. If we were to step into the future, sound cairns could exist for long periods of time, being visited again and again, always playing the same sound, witnessing the same experience. These audio markers would stand like a stone in the landscape, to be found and lost time and time again.

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2 Gibson, W. (1984). *Neuromancer*. New York: Ace Books.

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4 You may hear and read the segments that were used in "The Pavement" by going to *http://www.joereinsel.org/the_pavement*

Data Sculpture

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Abstract. Stephen Cartwright is an artist and self-tracker. Every hour since noon on June 21, 1999 he has recorded the exact latitude, longitude and elevation of his position on the earth with a handheld GPS (global positioning system) receiver. Cartwright creates multi-dimensional maps and objects from the collected data and offers a unique perspective of one person's transit through life. His works exists at the confluence of science and art, where hard data intersects with the intangible complexities of human experience.

1. INTRODUCTION

My work exists at the confluence of science and art, where hard data intersects with the intangible complexities of human experience. Some artists paint likenesses of themselves as a means of understanding who they are in a complex world, but along with a few other contemporary artists, I document and present recorded data. Data is the underlying topography of our lives and this type of work reinforces the fact that it is nearly impossible to have an accurate idea about anything simply by perception or recollection—you need data.

I use my comprehensive record of personal data to study my intersection with the geographic and cultural systems in which we are immersed. My data expands incrementally, and it may take years of diligent recording in order to discern the patterns within the data and form a more complete picture. I will continue collecting personal information indefinitely, maintaining my current data projects and embarking on new ventures.

2. DOCUMENTING LOCATION

My Latitude and Longitude Project records my exact position and elevation every hour using a hand held Global Positioning System (GPS) receiver. I started this iteration of the project on June 21, 1999 and have continued it uninterrupted ever since. The database grows by 24 entries a day, 8,760 entries a year, and now contains more than 130,000 documented locations of my body in space and time. It is too much data to be understood by looking at a sea of digits in a spreadsheet, but the amassed information from this and other databases form the foundation of my sculpture.

The conscious action of documenting my position heightens my awareness of place, geography, landscape, and routine. An hourly alarm on my watch reminds me to pull out my GPS and record my position. I transcribe information from my GPS onto log sheets denoting the latitude, longitude and elevation for each hour. Making a recording on the hour inserts some objectivity into the system—precisely linking a specific time with a specific place. It does not matter where I am. I could be a few feet out the door, on the other side of town or in another country; when

my watch beeps I take a recording. Points along the way are recorded with the same importance as final destinations. This makes for a much richer data set that, over time, more accurately illustrates my life.

From my GPS location data I create maps in a three-dimensional drawing program. They grow ever more intricate: hour by hour, point by point. It is difficult to render the entire history of my location in a scale that simultaneously shows movements on a very local level (movements of several yards to city blocks) and movements on a larger scale (miles, states, countries). However, working in a digital environment allows maps that contain all of the detail in a single drawing, and a change of zoom can exhibit macro and micro scales. The maps document my position in three-dimensional space (latitude, longitude, and elevation) but can also be formatted to illustrate my position in time. To view my position over time, latitude and longitude remain on the X- and Y- axes but I replace the elevation information with time for the Z-axis. With this method it is possible to see the routine nature of modern life. Repeated trips back and forth to work are interrupted at weekends, and if I am lucky, longer travels away from home.

My maps depict my exact location at one hour with a straight line connecting it to the next and thus I proceed through space connecting point to point. Of course, during any hour, many twists and turns deviating from that straight line may occur that are not recorded. But the project is more about the aggregate of the movements than the specific paths that I follow. Little details are lost or afforded undue attention, but over time a trend-line that best fits the data can be discerned. The trend-line helps reveal the big picture within varied minutiae and mountains of data. The data leads to works that are not subject to my unreliable memory. Sub-consciously we remember things filtered through layer upon layer of pre-dispositions and recollections of past experiences. Recording data forces me to see things how they really are not how I would like to perceive them.

My usual mapping methods create a very accurate rendering of my movements. Much is gained by mapping with such precision, but some essential elements are lost. Over the course of a year, I may repeat certain trips between two points hundreds of times. In computer space, all of those trips line up perfectly, so that from a top view they essentially read as a single line or trip. I have generally made maps of my movements using standard computer prints, but I now find it imprecise to record a life that moves point to point and then display it raster by raster.

3. CAPTURING LIGHT

My recent piece XY Plotter changed my visualization practice. In the sculpture an RGB LED is programmed to move in a precise pattern and I record the moving LED in long exposure photographs. XY Plotter images based on my latitude and longitude data show accumulated movements over time in a single print. In images from the XY Plotter repeated excursions along the same track or between two points make a groove in space-time. Points where I spend a lot of time light up and become prominent, while others that I visit infrequently fade. The bright colored LED light in the images burns my track into the undefined blackness of the background. At the focal points the color is so bright from the length of time in that area that they become over-exposed. This way of imaging highlights patterns and routines, and suggests the probability and potential of my whereabouts at any given time. With this piece I can capture some of the intangible wake left by my trajectory—the invisible history of my life.

A complication of digital sculpture could be the question of what constitutes the actual artwork; is it the machine or the product of the machine? Roxy Paine was asked a similar question in an interview with Tod Williams and Billie Tsien, he says that the products taken away from the machine should “be compelling, so that even if you had no knowledge of how they were made, they’d still be fascinating objects.” But he goes on to say that “knowing how they were made enriches the objects.” The product and the machine should strike some kind of balance. In the case of the XY Plotter the machine is a requirement. Similar images could be made in an all-digital environment, but the essence of the images is that they are made over time, capturing a moving object. The data was recorded in the same way—point by point over time. The logic

between the machine, data, and product should have some correlation. Random pairings of information and output will confuse the viewer and detract from a deeper connection with the work. In the best instances there will be enough correlation between data, machine and product to allow open readings that continue to be informed by the original source material.

Sabrina Raaf's piece (2004-2006) is a sculpture that uses data to determine its actions. The piece is a small robot that creeps around the perimeter of the gallery. While it moves along the wall a sensor measures the level of CO2 in the room. The robot responds to the level of CO2 by drawing a grass-like line in green ink on the wall; the height of the lines grow with increased CO2 levels. In an exhibition of the work, the robot may take several circuits around the room and cover the bases of the walls with overlapping layers of "grass." She explains that the number of people breathing in the exhibition space effects how the machine draws. More people exhaling CO2 cause the robot to draw taller blades of grass. She calls the relationship of audience to artwork "cross-metabolic," and considers the artwork, art venue and art audience to be interdependent. She says: "My machine's grass growing is a dynamic, emergent behavior in which humans participate involuntarily." She continues that the piece "makes the people in the space more sensitive to their environment and its conditions." This is a feature in many digital or data-based sculptures, the ability to change the awareness of the viewer. This mindfulness of the body in space can happen with traditional static artworks, but becomes more acute when the machine-sculpture is creating its output based on real data. Viewers that can see the how the input affects the output will have a better understanding of the data. Translator II: Grower also provides a sort of external memory through its drawn record of the CO2 levels in the room, allowing the viewer to experience the present and the past simultaneously.

4. ABSTRACTING INFORMATION

Many of my sculptures and installation pieces derived from my data encompass all the information in an abstracted form. To create my work I increasingly turn to three-dimensional virtual modeling and digital fabrication technologies. Laser cutting, CNC routing and rapid prototyping offer unparalleled accuracy and mesh logically and conceptually with my practice of data gathering. There are many decisions to be made in the creation of digital sculpture but data is the prime determiner for the form of the sculpture. Choices about scale, color, material, and style can all be adjusted within the framework of the original data to modify the form and focus of the final piece, but the data is fixed. The system and the data have a fractal-like quality; any set of my data could be viewed from multiple levels of focus to alter the look of the resulting sculpture.

Tangent to the Latitude and Longitude Project, I collect data on many elements of my daily life every day, including: mileage (walking, running, cycling, driving, bus, train, plane), local conditions (sunrise/set time, temperature, wind speed, precipitation), spending, books read, films watched and sleep times. The data sets are varied and growing; and each set spawns new inquiries, recordings and artworks. As the number of different data sets grows, correlations and causalities between the diverse recorded activities become apparent and illustrate the intricate systems and interconnections of life.

My piece Range is a good example of the process I use to convert data into a piece of art. The piece is made from my daily recordings of my running mileage. It all starts with my feet striking the pavement on a run and recording the mileage. From there, I plot out the data in a spreadsheet or a more complex drawing program. Distance is on the vertical axis, and days unfold along the horizontal axis. In the case of Range, the initial plot of running mileage created an organic line rising and falling in irregular undulations through the course of the year. As multiple years of this information were plotted together, the illusion of a mountain range came into focus, with multiple ridgelines overlapping and coming in and out of view. For the final piece I made translucent blue acrylic panels cut into the shapes made by the original plot lines from the running data. These panels were then fitted onto a mechanical structure that moves each panel independently in a wave motion side-to-side. Although most

of the running was done in the flat Midwestern United States, the data reminded me of a different landscape. The staid land of Illinois became an unsettled upheaval of earth, shifting tectonic plates, or the rolling sea. Only after working with the information to create art, could I see the potential of the data.

In my next works, Mesh 1 and Mesh 2 I let the data become more dimensional by expanding the ridgelines to create a full topography. In virtual space, I spread the two-dimensional plot lines apart, and modeled a triangular mesh surface between them. The surface is realized by connecting the plot line for each year together with a series of triangular facets. From one direction, the contours of this virtual landscape depict mileage over the course of each year. From the other direction, it compares mileage on the same date, year to year. For these pieces I looked at running and cycling mileage, and translated virtual models into built landscapes made out of translucent colored plastic. Physical experience of the data allows for a more expansive reading. Each triangular plane in the sculptures is easy to see and reflects its inspiration from early digital, three-dimensional rendering. The coarseness of the rendering also reflects our inability to comprehend fine detail over large areas. The simplified faceted surface of the landscape is a metaphor for the underlying systems that define our seemingly chaotic world.

In my work, diagrams become real objects. They are landscapes of my own invention driven by data, but they are fictional landscapes that exist simultaneously with real spaces. Even though these pieces are about moving through the landscape, the rolling hills on my mesh landscapes depict how I live as much as they reflect where I live. The surface becomes varied, because the routine of modern life is fluid, flexible, and acted on by forces beyond our control.

Artist Andy Holtin is also concerned with notions of real and invented landscapes. In his piece We All Need a Creation Myth, 2.0 he investigates forms that suggest landscapes. In the piece, blue chalk powder is released through a sifter onto a moving shelf. Both the sifter and the shelf operate irregularly resulting in the creation of various sizes of overlapping piles of chalk. Holtin used a programmable microcontroller to operate the sifter and shelf. The programming contained various sub-routines that would deposit chalk in a randomized sequence of landscape-like heaps. In Holtin's case the source data that directed the machine wasn't an actual landscape or some other statistical determinant, it was his ephemeral recollection of the representation of landscape. He found these notions of what a representation of landscape looks like to be innate and reinforced by our experience. In an interview with Rachel Sitkin he says he has made: "...landscapes that look nothing like any real mountain range that you've ever seen, in color or in shape or in anything, but there is something about the basic logic that is compelling in spite of the things that don't make sense." Therefore, even randomized piles of chalk elicit imagery of mountain scenery. The most compelling feature of Holtin's data-driven landscapes are that they are the result of time data, rather than spatial. The length of time dust falls on the shelf relative to the length of time that the shelf is still determines the form, and since they are just piles of dust they are impermanent. This temporal determiner poetically recreates the upheaval and erosion of real landscapes, a process that takes eons and no human can adequately comprehend.

5. DYNAMIC OBJECTS

With much of my previous work, the sculptures were static, but the data was dynamic and growing. To address this, my new kinetic sculptures are activated by data files that control their movement. By integrating motors and microcontrollers, I can update the data in the work or change its reference data completely. The same piece can change form based on the data that is used as input or can cycle through more data than is reasonable to fit on a static piece. It is therefore possible, to make a piece that involves vast amounts of data but doesn't become overwhelming or make us lose perspective.

One of my latest pieces, Kinetic Mesh, is an articulating brass grid, 12 segments wide and six segments deep. It looks like multiple lines of a line graph pulled apart in space. The vertices create the skeleton of a landscape and the

interconnecting mesh fills out the topography. The gleaming brass mesh-work in the piece creates a floating landscape above the visible mechanics, reflecting the idea that so much that appears beautiful, free-form, and organic is built upon a foundation of rules and data. The piece moves in pulses, as each new input of data drives the deformable grid-work into an ever-changing landscape. Virtually any sized data set can be displayed on the sculpture by cycling through rows of data, creating a constantly refreshing, undulating surface.

Kinetic Mesh can recreate existing topographies, but more importantly, it can illustrate fictional spaces depending on the input data. With this sculpture, I can visualize how any recorded aspect of my life relates with any other by using them as separate fields of input. In their correlations, beautiful landscapes can emerge. The data scrolls across the surface and reminds us that we live in an undulating topography of information. By visualizing varied self-recorded information the underlying contours of my history become apparent.

Unlike standard data visualization, my work does not to simply re-present information; it creates something new. The specifics of the collected information may not be precisely discernable, but they operate in conjunction with sensory experience and allow multiple entries and associations in each piece. Working with data reveals the hidden topography of life, a landscape that exists somewhere between reality and fiction.

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Motion Structures: Aesthetics of Spatial and Temporal Transformations

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Abstract. Time-based media such as video and film often depict visual images one after another: the same visual space is erased continuously. Alternative ways of interacting with the same sequence of frames have already been explored: as a grid of frames; as a flattened image averaging a set of frames based on a particular visual feature (e.g., maximum or minimum brightness); and more recently 3D explorations. In this contribution, we introduce an experimental approach to explore and interact with time-based media. We aim at studying spatial-temporal transformations represented as a 3D object and at contributing to the ongoing research on 3D forms and shapes. We present three recent productions created from video artworks. In the end, we reflect on potential uses of our productions.

1. INTRODUCTION

Time-based media such as video and film often depict visual images one after another, which means the same visual space is erased continuously: one frame replaces the previous one. Alternative ways of interacting with the same production have already been explored. For example, by decomposing a film or video into an image sequence we can process and reorganize those images according to the properties of 2D and 3D spaces, either physical or electronic. In this article, our intention is to contribute to the ongoing research on artistic 3D forms and shapes.

Historically speaking, the depiction of time in static images and sculptures has always attracted visual artists. In the early 20th century, with the influence of Einstein's Theory of Relativity, artists strived to go beyond the 2D canvas and the 3D object in pursuit of an extra-dimension. In this context, 4D has been understood as the representation of at least two concepts: time and multi-dimensionality. The aesthetics associated with 4D have been related to the examination of non-Euclidean forms and geometric shapes as qualities for abstraction, as a symbol of liberation, as a rupture with material supports, and as the interpretation of multiple and higher states of consciousness [9].

In recent years, new kinds of projects have emerged, taking advantage of developments in image processing, computer graphics, information visualization, and media art. Through these projects, it seems the exchange of properties and processes among domains has been a motor for creativity in the quest of alternative ways to see and interact with media.

The domain of time-based media such as film, video, and multimedia, has witnessed an expansion of techniques and technologies that were previously used mainly in other contexts: video segmentation (as in photography), video traces (as in slit-scan photography), video annotation (as in text), video summarization (or video abstraction) (as in summaries of documents), video cubism and video cubes (as in data visualization), and media visualization (including techniques such as montage, slice, and image plots) (as in scientific imagery).

Moreover, the use of 3D techniques and

technologies has also been a relevant domain. Today '3D' easily appears as prefix for at least the following fields: views, data representation, data description, spatial interaction, modeling, visualization, user interface, model retrieval, capturing, printing, volume rendering. The importance of studying and using 3D structures is related to the intention to achieve or facilitate: multivariate analysis, immersion, interactivity, representation of larger volumes of information, visual analytics, visual interfaces (commonly for VR, AR, and games), representation of hyperspace, depiction of mathematical models.

As developments continue, domains expand and interact. In humanities and social sciences, for example, the most evident progresses can be appreciated among the digital humanities community. The arts posses, on the other hand, a rich tradition on digital art, cybernetic art, electronic art, hypertext literature, virtual art and, media art that comes with an extensive catalog of artworks that have been created since the beginning. Thus, celebrated art projects such as 'The Invisible Shape of Things Past' by Art+Com (1997) [1] and 'Field-Works' by Masaki Fujihata (2000) [5] consider an image sequences as an array of individual objects (video frames in these cases) that could be organized on the Z-axis (depth) according to the position of the camera that recorded them. Another case is the 'Liquid Time Series' by Camille Utterback (2000-2002) [14], which combines aesthetics of video traces and the physical movement of participants. More recently, artists create and make available the software and programming code used to produced a piece. In such cases, it seems that the artwork is also the software and, perhaps more important, the different operations available to perform on some type of media. Consider the forthcoming interactive documentary 'CLOUDS' by James George and Jonathan Minard, which was created with the RGBD Toolkit (where D stands for depth). While the film was crowd-funded, the software can be downloaded for free from the creators website [6].

2. INTRODUCING MOTION STRUCTURES

In this article we introduce an approach to explore and interact with time-based media, such as film, video, and motion graphics, in a different way. Our approach is based on the idea of representing spatial and temporal transformations of an animated sequence. Our intention is to contribute to the ongoing research on artistic 3D forms and shapes. In a similar way as noted above, we consider time-based media as a series of images (or an image sequence). From this perspective, we are interested on representing the shape of spatial and temporal transformations that occur within the visual space of the frame. The final outcome thus traces those transformations in the form of a digital object. We call our approach 'motion structures'.

From a technical point of view, we build on top of the open-source software ImageJ (developed by Wayne Rasband at the National Institute of Mental Health, Maryland) [10], which is mainly used for scientific imagery practices. Basically, we have created an ImageJ macro script that performs a series of operations that take as input a folder containing an image sequence. The script then automatically converts the images into 8-bit format, subtracts background, and finally runs the 3D viewer. From the 3D Viewer it is possible to save the result as static image, as 360-degree rotation movie, and to export it as a mesh surface.

Our first steps into motion structures initiated in late 2011. At that time we were interested on representing the shape of CGI visual effects sequences, starting with the Paris fold-over sequence from the film 'Inception' (Nolan, 2010) [12] and moving towards a fragment from the 'Game of Thrones' TV series main title sequence [13]. For the latter, we discovered an intrinsic invitation to go deeper in the interaction with a motion structure and to 3D print it as a physical piece.

Motion structures have also fostered some reflections about the relationship of a medium to its support. It seems that the possibilities to interact with a medium are determined by the software containing it. So, our macro script could be seen not only a small piece of software that allows converting an image sequence into a 3D object, but more important the operations and processes behind this process. At another level, we are also using motion structures to study visual features and what has been called in visual semiotics 'plastic signs' [8]. Besides recognizable figures

within an image, there are always plastic properties such as colors, textures, and forms. Most of the time we do not attend plastic properties because they are difficult to cope and analyze, as opposed to recognizable figures such as faces, parts of the human body, animals, objects, etc. From this context, as it has been noted for scientific imagery, some processes allow for seeing the invisible (or unnoticed): spatial-temporal patterns, visual features, and software operations.

In the rest of this article we will focus on the aesthetics of spatial and temporal transformations. For this occasion, our selected image sequences come from seminal video artworks by Charles Csuri, Peter Weibel, and Bill Viola. In the end, we believe motion structures share some principles with what has been called a 'sculpturalization of images' or video sculptures [11], which are objects produced out of existent moving pictures, but which also have artistic values (rhetorical and aesthetical) on their own, mainly because they alter the viewers' expectations of traditional time and space depiction.

3. MOTION STRUCTURES OF VIDEO ARTWORKS

The introduction of video and animation technologies for recording, processing, and playing back moving pictures opened a wide range of possibilities for artists to explore and experiment on the aesthetics of space and time. Contrary to cinema, video was more accessible, malleable, and portable. It was also easier and faster to watch and project the recorded movie. Finally, the look and size of technological image was based on lines, reproduced at a different pace than film.

The following pictures show the motion structure generated from three different video artworks.

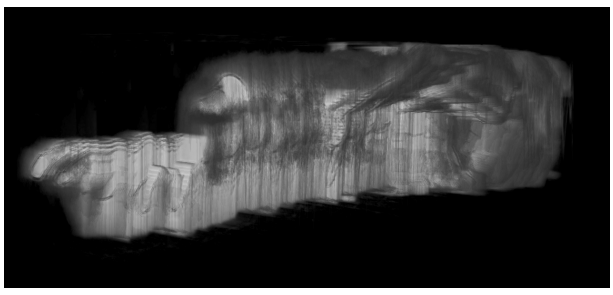

Fig. 1. *Motion structure generated from Charles Csuri's "Hummingbird" (1967). 02:10 minutes, 1295 frames. This is a forward angle perspective captured from ImageJ 3D Viewer [3].*

Fig. 2. *Motion structure generated from Peter Weibel's "Endless Sandwich" (1969). 00:38 seconds, 378 frames. This is a forward angle perspective captured from ImageJ 3D Viewer [16].*

Fig. 3. *Motion structure generated from Peter Weibel's "Endless Sandwich" (1969). 00:38 seconds, 378 frames. The object was exported as mesh surface in OBJ format and then opened in MeshLab. This is a perspective inside the object.*

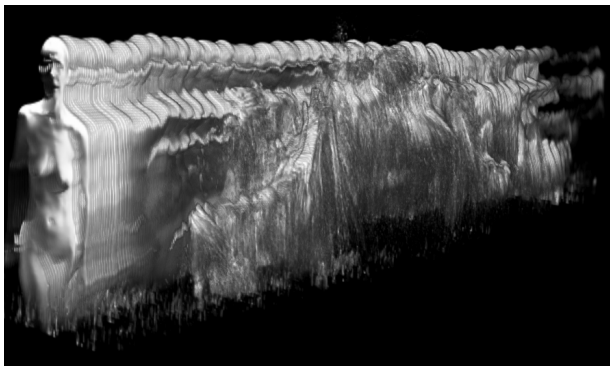

Fig. 4. *Motion structure of Bill Viola's "Acceptance" (2008). 02:03 minutes, equivalent to 1231 frames. This is a reverse angle perspective captured from ImageJ 3D Viewer, which means the first figure to the left is the last frame shown in the original video [15].*

3.1 OVERALL OBSERVATIONS

The representation of these seminal video artworks as motion structures allows seeing patterns of spatial and temporal transformations. The main rhetorical turn comes from a rupture of the traditional way of interacting with time-based media (i.e. one frame after another in the same visual space). The contemplative character of these artworks is then represented as a single object that depicts a rhythm that goes from simplicity towards complexity. At the beginning of the animated sequence we observe fewer elements that evolve in time, increase in number, and occupy more space of the frame surface. This is also perceived in the form of scaling shapes that change in scale along the Z-axis.

Some reflections from the aesthetical front involve the fundamental question: why transforming a video into an object? Recent research on visual epistemology recalls the difficulties of exploring new ways of seeing things. Following the idea of what has been called 'aesthetic provocations' [4], we take into account the aesthetic approach interested on the aesthetic experience over functionality. That is, to put it simply, to focus on design instead of function. Aesthetic provocations are also a mechanism to "augment our understanding of the encoded material" through the discovery of hidden patterns; to take a look at the way the work was produced. This would require the eye to give importance to abstractness because sometimes the aesthetic production engages with non-rational systems of thought.

In our case, the video is not anymore a motion picture but an object. Aesthetics of contemplation changes to aesthetics of exploration, holding, weighting, orbiting, destructing, or decorating. It seems the fascination and invitation to 3D print a motion structure is related with the current turn of a 'culture of craft', that prefers physical presence to electronic, touch over sight, poor media over rich media [2]. As the authors propose, is that a revolt against the screen culture? Or is a motion structure an 'iconoclastic delight', irreverent enough to destruct and decompose master pieces of video art or cinema [7]?

Video art has been in itself a rhetorical movement against traditional representation of moving images. Artists working with video explored the plasticity of the video image. The aesthetics of video art has also influenced other media such as film, multimedia, and websites. We observe this influence in special visual effects, in hybrid media (media made out of different media), and media art installations. The study of transformations of space and time within the boundaries of a frame is also an endeavor to put attention on plastic properties and invisible elements of visual media. Motion structures of video artworks are a second-degree anesthetization of the shape of time and space.

4. CONCLUSIONS

We have introduced 'motion structures' as an approach to explore and interact with time-based media in a different way. We were interested on the aesthetics of spatial and temporal transformations occurring within the visual space of the frame. A motion structure implies to decompose an animated sequence into individual frames in order to perform software operations that will convert the image sequence into a virtual 3D object.

In this article we have shown three motion structures generated from seminal video artists, namely Bill Viola, Peter Weibel, and Charles Csuri. In the end, we reflect on the aesthetical values of motion structures. Because video art has been in itself a rhetorical movement against traditional representation of moving images, motion structures could be seen as a second-degree anesthetization of the shape of time and space. For the selected artworks, they all are contemplative and occur in a single shot without any cuts. The motion structure captures well the traces of movement and the rhythm of the transformations.

Our understanding of aesthetics is related to the idea of 'aesthetic provocations'. We try to use our approach not only for the sketch of visual artworks and design, but also to contribute to a visual and software epistemology by taking into account plastic properties and software operations in a reflexive manner.

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GESTURES IN INTERAC-TION

GESTURES IN INTERACTION

Redesigning the Way We Listen: Curating Responsive Sound Interfaces in Transdisciplinary Domains

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Abstract. The following describes a research project-in-progress based on the idea to use curatorial practice as methodology for investigating responsive sound interfaces. Sound art is a transdisciplinary practice. As such, it creates new domains that may be used for redesign-purposes. Not only do experiences of sound alter; the way we listen to sound is transforming as well. This paper analyse and discuss two responsive sound interfaces and claim that transdisciplinarity generates a redesign of the way we listen to and use sound.

1. INTRODUCTION

The thoughts and questions presented in this paper began with a vague curatorial idea, first derived back in 2004, inspired by a text by Peter Weibel in the Ars Electronica Catalogue that year [9]. Weibel describes and analyses the "transdisciplinary practices", which are reconfiguring the domains of the contemporary avant-garde. What was particularly inspiring, apart from the fundamental contextual challenges of 'transdisciplinarity', was the notion and cognitive status of these new and reconfigured domains. I was curious about how this could be used to create responsive sound interfaces that were not 'just' another part of the experience-industry, but could instigate a redesign of the way we listen.

This paper focuses on the reconfiguration of sound domains by discussing two cases, The Audiobar by Mogens Jacobsen and the Poex Tape by Martin Luckmann, and it will be my argument that, in a transdisciplinary field of sound practice, it is possible to operate in a new domain of sound interfaces and listening methodologies.

2. CURATING TRANSDISCIPLINARY DOMAINS

Two concepts have to be introduced first: Transdisciplinary practice as defined by Peter Weibel, and 'curating'. Curating in the following indicate a research methodology for designing user interfaces to art based on the reflected study and analysis of transdisciplinary practices and domains.

Peter Weibel suggests "a transdisciplinary mapping of competences is taking place in the fields of art." He continues:

'[...] The redistribution of competence ... is precisely the progressive status of the contemporary avant-garde: [...] its protagonists attempt to undertake new comparisons and redistributions of competence, and to make the transition from the formal level to the level of practice [...] Extension of competence is the latest phase in the expansion of the concept of art. Art expands from the object to the practice and its practice expands from its field of work into new domains....' [11]

What Peter Weibel is formulating here, I would claim, is a framework for understanding

contemporary art practice that involves more than aesthetic and formalistic research. There is much more at stake as the competences of art and art institutions are being redistributed. In fact, I would claim that Weibel marks out a general condition: Habitual and conventional domains of knowledge and art are shattered and renegotiated, and in their place new domains are configured.

We are faced with the question of formulating qualitatively new phenomena and inventing concepts and strategies in-between theory and practice. The construction of new domains is based on highly different competences that are actually working together, in a dynamic exchange of solutions and differences.

3. SOUND + ART

I consider sound art to be a transdisciplinary art practice. As such, it is an ideal case for investigating the active domains of artistic practice within the comprehensive field of 'sound art', which has had a century or more to develop and mature.

One certain sign of the transdisciplinarity of the field is that it remains undefined and uncategorized as discipline or 'genre'. However, even though it has not been univocally defined academically, instead it is the artists, and their practice especially, that gives the field an identity (and 'a local habitation and a name'). The Swedish curator Teddy Hultberg also witnesses this:

'Sound art is the universal term for a field that is not clearly defined but in which artists, composers and even poets, on their own or in collaboration, try to test and expand the limits of artistic-musical creation. Under the umbrella term Sound Art, or such variants as audio art, ARS ARCUSTICA, we find sound installation, soundscape, text-sound composition, poésie sonore, EAM, live-electronics and multislide as well as performance and actions in which the acoustic element is essential.' [2]

It is interesting to observe that it is no longer than a decade ago that the transcisciplinary status of sound art was often considered as a 'problem'. In dealing with such a vast field, it was often argued, there was the danger of ending up with incomprehensible discussions of categories. In his text, Hultberg recognizes the crossover effect of sound art as an essential one, but at the same time he perceives the transdisciplinarity of sound art as a threatening breaking-down of the domains of art-critique:

'It is evident that today's artists and musicians often do not stick to one medium of expression but work across the traditional genres. And the genres, in our electronic era, become increasingly diffuse, threatening finally to make the constant discussion of crossover art incomprehensible.' [2]

However, as I am claiming in this paper, the transdisciplinary situation does not only serve as a confusion of matters; it is also serve as a way to open up a discussion about important categories of sound art; as well as it creates a focus on how we 'design' the way we listen – as a bodily act based on interaction.

Sound art in particular seems to be the phenomenon expressing this transdisciplinary exploration of the foundation of language and cultural consciousness in constant change. The American sound artist Brandon LaBelle sees this as an 'invasion' of the public space:

'Sound overwhelms its own limits, refracting across social space – it seeps through the cracks and disturbs another's sleep, violates demographic borders, spills over. In other words, sound interferes... In this way, sound is never a private affair, rather it invades public space, occurs within a multiplicity, as a multiplicity.' [3]

Imagine then, that the works of the electronic arts, media art and sound art has a kind of new paradigmatic character; imagine that they indicate a completely new domain of cultural production and knowledge.

For a number of specifically interesting artists transdisciplinarity emphasizes a new awareness of producing works based on the media and materials at hand – it is first, and foremost, describing an artistic practice. Ways of producing, innovatively and differently, that are very different than the accepted domains of art-categories and genres.

4. GENERATING NEW DOMAINS

An example of this would be the transformative explorations by the Futurists into the 'psychological space' of the modern man signals a new way of operating and producing relational

patterns of meaning. It is running counter to the Positivistic paradigm that flourished round about the same time but it also differ in a number of important ways to the historicisms of humanistic academic traditions. Today the experiments of the Futurists remain an enigma to the more disciplined scientific traditions exactly because, I will argue, it describes a new domain for the first time: the domain of sound art. Moreover, it does so in a manner that includes an element of modern psychology into the artistic practice: They replicate actual experienced sounds with instruments that they build themselves and this is precisely what differentiate them from the representational paradigm of classical art (one that modern art inherits). Instead of representing an abstract element of the world to a public they produce a technology (an instrument) whereby the public may themselves experience and compare with their own subjective pre-experience of being in a modern city (and living a modern life). [6] [7]

Thus, from the outset, and even before the advent of electronic media, transdisciplinary art practices within sound art represents an alternative way of producing art that differs completely from the formalistic and autonomy-defined domains of specific genres and art categories.

Moreoever, it opens up for the possibility of generating new ways of listening. In the rest of this paper I will present two different sound interfaces that work exactly with this premise of redesigning the way we listen and discover sound: The Audiobar and The Poex Tape.

5. AUDIOBAR

The 'Audiobar' (or 'Hørbar' in Danish, which has the double meaning of 'making things audible' and the concrete reference to the physical bar) is a responsive environment designed by Mogens Jacobsen[1] for exploring a huge collection of sound art. The Hørbar was part of the Media Art Platform project, which was documented in a publication discussing the domain of digital archiving, however the Audiobar particularly should be discussed within the context of a responsive sound art audience. [8]

The audience interacts with the sound art pieces in the collection using a tangible interface: By placing bottles on the bar. The bar

Figure 1. The bottles are placed on the Audiobar – the interaction begins. Photo by Morten Søndergaard

consists of a central table and 260 bottles placed on shelves around the bar, and 260 bottles with colorful labels.

The entire collection was indexed and described according to 12 pairs of emotional parameters. This was done by listening to all the tracks (more than 1600 of them) and 'fit' them within the system of description. The labels indicate a 'game of categories', which on one hand, and not without irony and humor, points away from the heavy, historicized categories habitually used in Art Museums; on the other hand, it works within an 'embodied' relation to the sound art pieces via associations to the act of experiencing sound – and how we may describe those experiences (which is hard to do when operating 'outside' the symbolic and iconic representational paradigm as argued above). Therefore, the curatorial methodology of MAP and Audiobar places the audience inside a new domain where their own associations and experiences serve as initiators – I use the word can-openers – for witnessing this extraordinary, amazing thing called sound art... and find that they grabble with a little bit of complexity, and having fun at the same time.

The action begins when a visitor places one or more bottles on the table. The light below the semi-transparent table changes colour from green to bright blue. After less than a second audio begins to play and the table is lit by white light. If other visitor places additional bottles, the table blinks again. And a track is selected that fits the combination of bottles. If all bottles are removed, the table returns to its silent state with a green illumination.

Fig. 2. *Playing with domains: The bottle-labels. Photo by Mogens Jacobsen*

At first, the bar activates the listening-senses of the audience by subjecting them to the 'unprepared' listening of the sound art pieces that are played-back to them after the placing of the bottles. Then the audience is being drawn into a critical position that may even bring about curiosity, asking questions like: How and when was this piece made? Why does it sound like that? Who made it? Why is it more noise than silence?

The curatorial methodology used in Audiobar brings for the first time an audience into a position where you are challenged and gently pushed towards activating your cognitive faculties through an expanded sensing process involving listening and touching the bottles. Everybody may now interact with sound art and have a opinion about it. In the Audiobar, it becomes a collective situation to make sense of the new domain of sound art.

6. POEX TAPE – INTERFACING THE UNHEARD AVANT-GARDE

Because of the invention of technologies that makes it possible, in still new ways, to 'liberate' sound from its source, sound became the first technologically emerged material that mediated (a) new art; as such, sound art should be considered the first media art practice. Sound is immaterial and sound art practices are fugitive / ephemeral. They are time-based, often playing with the perception of presence and space, and it is nothing within the art-category without being experienced.

Thus, sound art practices, as most media art practices, become 'unheard' (of) in archives. It flies beneath the radar of cultural memory and knowledge like a sub-mediated parallel history.

It is from this unheard status of experimental media art that the POEX Tape project finds it momentum: Not only in giving the unheard a voice, but also in addressing some fundamental issues concerning the way new transdisciplinary domains are renegotiated across disciplines and boundaries of competences.

The interface, in effect, is the visual representations of the sound waves of the works in the archive as they are playing. You are able to listen in real time, but also to scroll through a piece – and hearing the sound of fast forward or rewind while you are browsing. In this way, the POEX TAPE interface becomes an investigative instrument where the audience may discover unheard avant-gardes in their own way – and have a very private listening experience.

Fig. 3. *The Finished Installation at ZKM, Karlsruhe.*

The content of POEX tape are recovered sound art pieces or sound documents from the POEX65 event. They turned out to be five sources, mainly – thus structured in the interface in five streams, or sound waves, representing the status of avant-garde sound art in December 1965: Experiments beyond Jazz, Electronics, Art (Fluxus), Poetry, and Beat. To structure this material, and meta-date it, we created the POEX app, an piece of application software designed to bridge the archive meta-structure of the CHAOS platform and the interface. The meta-dating and structuring of the sound material is de-facto the visual output of the interface – and the textual pop-up with information about tracks and artists etc. that the interactive listening creates on the screen is also controlled by the POEX app.

To create an interface to unheard material,

one has to ask - what is an unheard avant-garde? Of course, the answer may be tautological: no one has ever heard of the unheard avant-garde, as it were.

The purpose, then, is to define the methodologies to reactivate, on a curatorial level, the field of the 'unheard avant-gardes' (if it indeed is one field) – what are the categories? How do we describe them? Do they manifest themselves into (new) paradigms? And what would be best practice for meta-dating and documenting the field? Furthermore, these questions also point towards a more fundamental problematic regarding the definition and function of 'art' in a mediated cultural context and environment.

By creating a tangible user interface, the POEX Tape allows the users/audience to navigate an uncovered collection of unheard avant-garde sound art from the 1965 event in Copenhagen, called POEX65. At the time of the POEX65 exhibition the main recording technology was the reel-to-reel recorder. Artist such as Else Marie Pade used the recorder both as a recording device and as an instrument. This widely used technology became the main inspiration for the interface of the POEX Tape. We wanted to make an interactive interface to the archive of unheard avant-garde of POEX65 by playing a design-critical game with audiovisual representation. With the reel-to-reel recorder inspiration we created an environment that allowed the audience to interact visually with the sound art archive.

This is the curatorial and conceptual focal point in the reworking and presentation of the Unheard Avant-gardes in Scandinavia at the exhibition Sound Art – Sound as Medium for Fine Art at ZKM in Karlsruhe (running from March 16 2012 to January 8 2013). Focus is on sound in every aspect and on many levels, including sound as noise, as document, and as medium for artistic practices.

9. CURATORIAL METHODOLOGY

The curatorial methodology operating behind both Audiobar and POEX tape is conceptually structured around a metaphor implying a blend of cognitive, embodied interaction and semantic web. Furthermore, it is a metaphor describing an attempt of curating a new cognitive semantics of sound interfaces.

The *POEX tape* Project builds upon the assumption that media art produces a 'submedialer raum' in archives). [11]

Furthermore, it builds on the knowledge and experience of LARM - a major infrastructure combining research in and access to sound and media art archives in Denmark – and, specifically, the Unheard Avantgarde research and exhibition project (Head of Research: Morten Søndergaard).

However, the focus of *POEX tape* is on trying to achieve a transdisciplinary exchange between the syntax of coding systems and listening. For achieving this, a new cognitive semantics for sound archiving was made operational which presents a rather different perspective than the LARM infrastructure project: That of a curating process (selecting, developing, qualifying, and leading an art-process towards an exhibition framing) – and that of developing a cognitive semantics for that process. The project is thus to be concluded with an exhibition at ZKM which took place in 2012. An important part of this project was to investigation of an interactive design for co-re-active sound archives conducted through and across the clouds of tagged data from many different sources and countries.

In this regard, the curatorial methodology is moving beyond the concept of 'cloud computing'. [4]

Cloud computing is a concept for next generation Internet where data is organized in a different manner, than is the case in the current www setup. The speed and growth of the Internet means we are drifting away from taxonomy and the search-oriented architecture gives us new possibilities in crowd sourcing and collaboration. The innovative idea of Cloud computing is that everything on the future www is 'miscellaneous', yet traceable in tagged contexts. [4]

Emergent technologies like *Echonest* and others, gives us a opportunity to 'trace' sequence and identify 'hidden' content in large amount of sound data. On the other hand, some of the mechanisms of emergence are organizational and collaborative, rather than purely technical. [5]

An interface to an infrastructure of sound is dependent on the development of alternative methods and modalities for 'seeing' and 'touching' acoustic temporality and its (natural and cultural) contexts. In other words, we need to curate a new cognitive semantics for sound interfaces.

10. SUMMING UP: DOMAINS UNDER TRANSFORMATION...

The redesign and reconfiguration of the domains of experience and sound in the Audiobar and POEX tape is based on the assumption that future use of computers should not just mirror our relation with the physical world, but should also evoke different kinds of experiences that augment people's perspectives on the world. Thus, the transdisciplinary methodology at play in the design of the interface of Audiobar and POEX Tape, I would claim, formulate a new domain for sound interfaces and points towards a complete redesign of the way we listen to and use sound.

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The Device in Interactive Art: Interactivity, Gesture and Sense

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Abstract. This paper explores the specificity of Interactive Art focusing on the concept of device, present in Philosophy and other arts, from the perspective of Giorgio Agamben in dialogue with the notion of gesture from the author Vilém Flusser. Taking this theoretical approach, we examine the modes of articulation of an Interactive Art work and the different ways of creating sense that are expressed in the public's behavior. Through the analysis of two interactive works of the artist Rafael Lozano Hemmer, we explore the nature of gestures in interaction and the factors that prompt them as part of the device created in the work of art.

1. INTRODUCTION

"With a piece of paper and the twenty six letters of the alphabet, you may write both Don Quixote and a History test in primary school."

— Arlindo Machado

Given contemporary works of art that make use of technology (be it digital, electronic or even analog), the emergence of an artistic practice distinguished by the construction of an unfinished, potential configuration has become evident; its evolution is determined by contact with the public, who is invited to an interaction that is not just interpretative anymore (the secret dialogue in which every work engages its audience) but deliberately material. The act of sculpting a shape during the interaction could be, under some circumstances that we will analyze later, as revealing for the audience as for the author of the artwork. Brazilian theorist Arlindo Machado outlines this situation as follows:

"Instead of having one finished 'work', you only have its elements and exchange rules defined by a combinatorial algorithm. Now the 'work' is created exclusively in the act of reading and, in each of those acts, it assumes a different form, even though this is eventually determined by the potential the algorithm allows." (Machado, 2009).

Many artists working in the field of interactive art often make reference to this characteristic when defining their artworks. Prolific artist Rafael Lozano Hemmer states:

"The idea is for the artwork to be an incomplete platform and to let the integration with the audience interpret and highlight it in some way. In the case of interactivity, one of the main functions is the creation of situations that are beyond the artist's control. For me, this is essential. That is, I cannot prescribe the artwork, I do not want to identify what the ending will be, how it will look, what people will and will not do." (Lozano Hemmer, 2012).

Interactivity is usually associated with two ideas and values in relation to the public: freedom regarding possibilities of action and

the rule of co-authorship, given that the audience, through its participation, determines the final form of the work, which is no longer a finite object but an event, a situation, an open process. However, while these descriptions manage to identify inherent features of interactive art, they prove to be too general to pinpoint the differences various works present in their evolution (the characteristics that artists associate with their own work, though far from creating a particular genre, may be applied, to a great extent, to many other interactive artworks); furthermore, establishing the final result indetermination as a feature of this type of platforms per se, associated to an apparent unpredictability of the public's actions, leaves wide areas of uncertainty, failing to interrogate the specific ways they manifest that indetermination in a particular work.

2. DEVICES & APPARATUS

"A device is like a ball of yarn, a multilineal ensemble... to untangle the lines of a device is to draw a map, to chart and explore unknown territory."

— Gilles Deleuze

The concept of *apparatus* constitutes a valuable tool for understanding what is missing in general descriptions of Interactive Art. The breadth and accuracy of this concept will reveal the multiple ways of creating discourses, opening new areas of reflection in order to transcend the dichotomy between a *closed work* and an *open work*, between a univocal work and a participative one. Giorgio Agamben provides the following definition:

"I shall call an apparatus literally anything that has in some way the capacity to capture, orient, determine, intercept, model, control, or secure the gestures, behaviors, opinions or discourses of living beings. Not only, therefore, prisons, madhouses, the panopticon, schools, confession, factories, disciplines, juridical measures and so forth (whose connection with power is in a certain sense evident), but also the pen, writing, literature, philosophy, agriculture, cigarettes, navigation, computers, cellular telephones and -why not- language itself, which is perhaps the most ancient of apparatuses -one in which thousands and thousands of years ago a primate inadvertently let himself be captured, probably without realizing the consequences that he was about to face."

In turn, André Parente, when analyzing the cinematographic device, quotes Michel Foucault characterization of this concept, for whom:

"a device has three levels of agency: 1) the heterogeneous set of discourses, architectural forms, propositions, knowledge and power strategies, subjective dispositions and cultural biases, etc.; 2) the nature of the connection among those elements, and 3) the episteme or discursive formation in a broad sense, resulting from the connections among the elements.

Today, the notion of device is usually associated, initially, with the technological field. If we search Wikipedia, we get references to storage devices, direct access devices and others. And the interactive art argot, particularly in the *hardware* field, is full of similar descriptions: input devices, output devices, ambient devices, infrared devices, etc. This observation is relevant because it reveals that, in the collective imaginary, devices are conceived mostly as objects, as technological apparatus. These notions can also be tracked in the field of artistic productions with *new media*, even when they are referred to as artworks. For this reason, in many cases, what is said about an interactive work, by the author or the audience, primarily makes reference to the elements that form its material side (the technological resources it is made of) or even procedural factors (how it is made in relation to the techniques used).

These dimensions seem to fall, though partially, within the first level of agency established by Foucault; however, there are two subsequent levels, which are essential for the emergence of a particular device.

We will analyze two artworks, "*Body movies*" (2001) and "*Under scan*" (2005), which belong to the same work series (Relational Architecture) from the same author: Rafael Lozano Hemmer. Both artworks are built of very similar elements, apart from some differences. The mechanism for both is the projection of people portraits

(with a fixed or mobile image), a strong light that conceals those images, and the public's participation through the use of their own shadows as interfaces. Each individual, when coming between the light source and the projection plane, can see the images in the shadowed area, which constitutes a representation of their own body, a mask and, at the same time, an avatar.

These common elements will allow us to observe to what extent the experience is defined by its mere inclusion in the artwork, and if there are other factors, beyond the elements used, that establish differences in the evolution of participation.

BODY MOVIES

In the video that documents this work,[1] we can see passers-by stop in front of a big screen, project their shadows of various sizes and make the projected images visible. When a person decides to emulate the posture of the portrait being discovered, there is even a brief illusion of movement. In one of the scenes, two elderly women are revealed and one of them seems to raise her arm in a victorious gesture; for a moment, her body produces the illusion of movement ("movies"). An adequate coincidence between the scale of the shadow of the person's moving arm and the one of the projected image creates an effect of merger as a consequence of the transference of the body movement to the image sphere.

But along these behaviors expected by the artwork there is an overlapping level of interactivity in which people play with their shadow, no longer as an interface and mask for the fictional world of the portraits but as a convenient resource for shadow puppetry, creating different situations in combination. The possibility of changing the scale by modifying the distance in relation to the light source seems to stimulate the imagination of the public, who tries various dramatic situations based on the asymmetry of the projected shadows.

This dimension that was not contemplated in the objectives of the artwork, however, takes place in actual experience.

UNDER SCAN

In the video that documents the work[2] passers-by can be seen wondering around the interactive surface and stopping in front of a video portrait when it is disclosed by their shadow. In this case, we can see that the movement belongs to the image, and that the interaction participant becomes a spectator whose body stays mostly at rest and looking down. When the performance ends, or if people lose interest in staying still, they continue walking in some direction, and the video/character stops the action. In this version we can see that there are no shadow puppets, that interactivity tends to be more individual (or, if socialized, takes place in small groups), that the experience seems to have a more intimate and atomized character.

3. THE GESTURE OF INTERACTING

"The limitations we face today are no longer technological."

— Jim Campbell

According to Agamben's definition, a device has the capacity to influence gestures, behaviors, opinions and discourses. In Interactive Art, gestures and behaviors hold a hierarchical position; the public comes into contact with the artwork by moving their body and performing a set of actions in response to the situations presented by the artwork. When we speak of body and gesture, we refer to an inseparable binomial. But is a body movement a gesture in itself? Philosopher Vilem Flusser tells us that:

"A gesture is such because it represents something, because it is only intended to give sense to something. [...] *If someone pokes me in the arm, I move it... there will be a causal concatenation between pain and movement and a physiological theory to explain that concatenation.* [...] *This sort of movement will not be a 'gesture' according to the proposed definition any time the observer can provide an adequate explanation. However, I may also raise my arm in a specific manner when someone pokes me; but this time there will not be a flawless concatenation of causes and effects between pain and movement.*

A kind of wedge is inserted into the concatenation, a codification that gives the movement a specific structure so that, for those who know the code, the movement adequately communicates the 'meaning' of pain. My action represents pain, it is a symbol; and pain is its meaning." (Flusser, 1994)

The wedge converting movement in gesture implies a code. A code that is fed from two sources; firstly, the cultural heritage that the interaction participants have and that guide their movements introducing a certain intention; secondly, the particular code that the work proposes and that people apprehend *in situ* through what they observe, experiment, deduce.

In the case of *Body Movies*, the additional, unexpected layer in the artwork is connected to *extradiegetic* experiences: the ancestral experience of forming images using shadows. In addition, the behaviors of the audience are not casual, unpredictable or mere physiological reflexes; the recurring situations created from the scale difference between shadows let us discern a symbolic universe oriented towards movement. When a person decides to take somebody else's head and move it, he understands before or at the same time he is making the gesture that in order to do it: his hand must be larger and the shadow of his body must necessarily grow to break the dimensional symmetry with the body of the other person, so that he may simulate manipulating the other person as a puppet. Thus, his coming nearer to the light source has a purpose, he is searching for symbols that are already rooted in his cultural heritage, the association between the big and strong, and the small and weak. This behavior may take place because of the intentions dwelling within the people who interact, but fundamentally because of the arrangement of elements in space, specifically, the light on the ground and parallel to the projection plane.

If these two people were placed at the artwork *Under Scan* and if they tried to perform the same action, they would not find it easy. Since the projector is placed up high in an axle that is perpendicular to the floor plane (which is also the projection plane), people would only be able to reproduce a scale of similar variability in the shadows if they were able to transcend the gravity law or fly by themselves.

4. THE GESTURE OF ARRAGING

"If we are given a sufficiently virtual representation of freedom and personal autonomy within a limiting structure, we lose awareness of the artifice; we are unaware that we have adopted a belief system and its attendant simplifications."

— David Rokeby

At this point we can start to discern that the arrangement and the articulation among all the heterogeneous elements that form a work generate significant differences in behaviors, which means they become signifiers that produce meanings. This is the second dimension that Foucault makes reference to: "*the nature of the connection among those elements*." It is evident that the nature of the connection is defined at a stage before the individual's participation and is the result of specific settings of the artwork configuration, whether they originated as movements intended by the artist or evolved by chance.

Arlindo Machado develops a brilliant analysis about Plato's *Allegory of the Cave*, where light and shadow also happen to play a central role:

"... This fire is strategically placed behind and above the prisoners' heads, since Plato knew too well that, if it had been placed somewhere else, the light source would have caused the spectators to be projected on the screen, which would have revealed the device. And given that the effectiveness of the illusion depends, mainly, on hiding the technology that creates it, Plato places a 'small wall' between the prisoners and the 'operators' of the projective mechanism, taking care to protect operators from the prisoners' indiscretion." (Machado, 2009)

Plato builds a device, on the philosophical plane, that assumes in this allegory the form of a particular situation: a space, heterogeneous elements, and subtle arrangements which affect the nature of what is perceived. The *critical sense intended to install horror in the reason of the senses* (Machado, 2009) needs specific material arrangements and connections for the

conceptual construct not to collapse. And this is the third point mentioned by Agamben when quoting Foucault: "*the episteme or discursive formation in a broad sense, resulting from the connections among the elements*" (Agamben, 2009).

David Rokeby, a Canadian interactive artist, makes some observations related to this discipline which may be understood through the lens of the concepts we have developed:

"It is a mistake to conclude that by presenting a variety of perspectives, the artist is being objective and disinterested. Through selection of the specific points of views offered, how they are linked together, and the design of the method of navigation, the artist holds significant expressive power which is enhanced by this apparent objectivity. This is analogous to the situation encountered in hypertext databases which presume to completely cross-reference the information that they contain. The system of cross referencing used remains a powerful expression of the ideas of the creator, emphasizing certain kinds of relationships while effectively discouraging others. Creating such structures is similar to designing the infra-structure of a community or society; it charges the space politically. At the same time, such a structure is comforting because in limiting the options available at any one time, it assists the interactor in deciding how to proceed. It gives one a coherent structure within which and against which one may establish an identity." (Rokeby, 2005)

5. CONCLUSIONS

The potential of an interactive artwork not only lies in the combinatory variables of the supporting computer code, but also in the potential of its conception as a device. Connectivity –an operation associated with communication protocols- acquires a new sense when interpreted in relation to other structural aspects of an artwork. Ultimately, it is the arrangement of and connection among the elements forming an artwork that condition and model the audience's sphere of action.

In this sense, absolute freedom of action for the audience would be an illusion, less real than the field of possibilities implicitly suggested by the device.

Unpredictability is an intrinsic feature of many phenomena, beyond the artistic and algorithmic plane; unexpected events are part of life and this does not turn all spontaneous manifestations into aesthetical experiences.

We may conclude that some areas of unpredictability take place within the expressive sphere of the artwork, as a result of the relationship between the device and the audience; and other unexpected and surprising events silently disclose unexplored territories outside the expressive scope of the artwork.

The limits that let us determine when a user is within or outside the artwork become invisible if we only consider the material aspects of the work. The outline of experience is the result of an intangible fabric of connections between the instances of the artwork and the discursive formations created. Only by considering all these aspects in combination may we provide a true sense to the concepts of unpredictability and freedom in an interactive work.

This semantic fabric is where the new media artists' intentions ultimately sculpt the shape of their work and the poetics of their language.

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Sensing sites: Contemporary media art installation by Turner, Lyons and Sagar as cross-modal sensory experimentation and multimodal interaction

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Abstract. What are the perceptual elements at play in sensate sites? As a new media curator, I work with artists creating and staging multisensory media environments largely in Aotearoa / New Zealand. These installations contain complex interactivity and participatory requirements that activate simulated synaesthetic and kinesthetic properties. Works by Raewyn Turner, Marcia Lyons and Mark Sagar will be examined from the perspective of enactive cognition, cross-modal sensing and multimodal interactivity. In essence, these 'black box' installations experimentally engage with our sensory perception requiring a high level of embodied cognition. The resultant machinic sensor 'mapped' spaces define the territory in which the conditions of perception, and the resultant physical, social, emotional and cultural reactions, occur. The body of the viewer becomes the site where meaning is enacted and becomes a traceable event in and of itself.

Over the last 27 years as a curator of new media, video, film, photographic, interactive and live performance projects I have become increasingly challenged and intrigued by the perceptual and sensory experiences contained within many of these multisensory artistic projects. After working in a variety of roles within public art institutions, I took over leading the Moving Image Centre (MIC Toi Rerehiko) for sixteen years. This organization profiled creative media, interdisciplinary arts and live performance and encouraged playful enquiry processes, intercultural engagement and cross-disciplinary collaboration. Many projects combined the integration of creative research and development in emergent technologies with hybrid artistic practices. Exhibition platforms began to adapt to network generated live performance, scalable screen-based media art, embracing cross-pollinating disciplines (theatrical, festival, documentary amongst many others).

Increasingly, many of these works contained complex interactivity and participatory requirements that brought in to play simulated synaesthetic and kinesthetic elements in real time that required a reassessment of the base properties of aesthetic experience. These works cannot be perceived by simple observation. The process for experiencing and understanding is exploratory and one of sensual discovery. Sustained engagement often reveals further layers and meanings of the work. The method of creation also began to fundamentally change, frequently requiring trans-disciplinary teams and a high degree of risk and experimentation in the development and staging. Concurrently, increasing demands were set for the audience in terms of conceptual and participatory involvement. This consistent need for curatorial adaptation to an evolving array of practices sparked the question: What are the perceptual elements at play in sensing multisensory sites?

Environmental and perceptual real-time conditions, within new media installation, are contributing to our understanding of embodied cognition. Chris Salter explains: 'Perception is increasingly seen as *co-structuration* – a simultaneous coupling of body, brain, and the lived spaces in which the body finds itself.' [7] It is *in the act* of freely crossing and negotiating

disciplinary boundaries when assessing these artistic multisensory environments that the practice becomes more deeply considered.

Caroline Jones observes that these works mark 'a shift from aesthetic experience to the aesthetics of experience' and subsequently ' the work of the artist includes and transforms the art-goer who is engaged and embodied'. [2] It is within the real time experience of these environments that it is often reported that the participatory viewer has an increased awareness of their own sensory perception through all forms and degrees of sensing. Jones goes on to clarify: 'What the aesthetics of experience leads me to claim is that the activities occurring in this space of fluid negotiation can be called the work of art, where work is a verb rather than a noun.' [5] This becomes further complicated with the introduction of virtual and interactive technologies where the experience moves from in-situ to a relationship with remote conditions as in the case of real-time networks with other sites or live engagement with data from internet based sources. These multisensory environments can be reframed as experimental laboratories for a re-contextualisation of both our understanding of our body, its sensing properties and interconnectedness with large-scale dynamic environmental, political, social and virtual conditions. Salter describes the enactive view as: '... perception is not representation but action – a direct projection of the body into the environment and an ongoing "probing" of that environment with the sensor and motor capabilities of the active body.' [7]

In recent years, I have curated a number of artists who have diverse multi-sensory practices, whose focus has led to manifold insights into a range of perceptual audience experiences. In particular, I will briefly look at specific works produced by Marcia Lyons, Raewyn Turner and Mark Sagar and their various trans-disciplinary collaborative teams involving artists, scientists and engineers. All of the works covered in this paper were staged in environments commonly called "black box" conditions. The viewer's movements, and physical space of interaction, were mapped and monitored by the art environment through a combination of sensors, cameras and software. This mapped space therefore defines the territory in which the conditions of perception and the resultant physical, social, emotional and cultural reactions occur. The immediate physical conditions of these works locate the interactivity initially in the black box location, however each examined work also contain elements in which it is then possible to connect to remote micro or macro locations. The body of the viewer becomes the site where meaning is enacted and becomes a traceable event in and of itself. Sabine Flach expands: 'It is always the *entire body* which perceives and is perceived.' [3]

Fig. 1. *Lyons, Open Limit, 5 channel live network, interactive sound, Bluetooth, MIC Toi Rerehiko, AKL, NZ, 2010*

In 2010 Marcia Lyons exhibited the interactive media art installation *Open Limit* [Fig. 1] at the MIC gallery. *Open Limit* belonged to an ongoing series by Lyons entitled *Sensory Broadcasting* which sought to explore interactivity, perception and live-feed technologies. This installation provided an immersive physical, interactive and sonic environment that connected to live webcasts and was driven by the gaming platform Unity 3D. The viewer, first dressed in a lab coat with a tracking marker on the back, entered what appeared to be a globular weather condition "on standby", consisting visually of two projected live video feeds and a real-time triggered revolving sound environment. As the viewer's movements were tracked various sonic and visual reactions occurred causing planet like forms to emerge. When participants intuitively moved to the shape of the terrain tagging system, sensors "unlocked" live webcasts for global site locations: New York City, Antarctica, Bombay, Iceland or Russia. The specific webcast interacted with was defined by the terrain map that acted as the marker on the

back of the lab coat. Participants on the street outside the gallery were invited to pair their Bluetooth cell phone to the live terrain sound by receiving direct snippets of sound to carry and share from their cells.

Marcia Lyons (US) elaborates: 'Within a dynamic sense of standing -in, -with or -among remote and local energies, I invite viewers to access a living presence within their own improvisational moves. Remote frequencies become a kind of character study, suggesting a porosity, awaiting entry and passage, as well as the 'wide open,' as an endless metaphor for field.'[2] 'I'm interested in how these limits disappear and how perception is determinate.' [3] Lyons' project is a visual, emotional weather-like system - a tai-chi-like - movement or an 'encircling game' process where viewer's become competitive without knowing in the underlying gaming software environment. She worked with programmer Roy Davies on the gaming platform interface and interactivity, and with other scientists regarding locasting frequencies. She explains: 'I seek out experts in the field - scientists, engineers, programmers, whoever is accessible to consult on projects. ... Over the past two years I've been working with scientists in the field to understand imperceptible frequencies emanating from the planet. The work at MIC came out of a series of investigations where live data and viewer 'creative interference' intermix to create a third, in-between, portal. The work is like weather on 'standby' waiting to be 'moved'.' [12] Dynamic interfacing of the local individual and the global virtual in this piece exemplifies a kinesthetic (somatic) environment through sound and vision.

Also in 2010, Raewyn Turner (NZ) in collaboration with Diane Burgoyne (CAN) exhibited the two installations *Re-Sense* [Fig.2] and *Flap* [Fig.3]. The artists' state: 'both works are explorations of the olfactory sense and its place in our landscapes and in our everyday lives. These works grew out of a notion that, like the bandwidths of light and sound that are beyond unaided human perception, many olfactory signals presented to our senses remain mainly beyond comprehension.' [13] Their process began with an experimental sensory investigation. 'Our initial inquiry centred around whether we could consider the landscape as a map of smell and sound?' [13]

Re-Sense occupied one gallery and consisted of two screens showing samples of video palettes of 'green' sourced from New Zealand and Canada. Each territory's representative green screen was paired with a tonal frequency generator that created sound. Working with the artists, Louise Crouch, a commercial perfumer, created scents that matched synaesthetically the colour/sound palettes. Polymer plastic beads were embedded with fragrance, housed in a glass sculptural form and placed on top of an embedded speaker. Scents were activated and released by sound vibration. As Mark Amery, a local art critic observed; 'The effect is, as the artists' intended totally synesthetic, which is to say it creates impressions through stimulating the senses. ... The effect is disorientating and all encompassing, as if entering an abstract painting in which life forms have been reduced to their base coordinates and rhythms.' [1]

Fig. 2. *Turner and Burgoyne, Re-Sense, 2 channel video, scent, electronics, interactive sound, MIC Toi Rerehiko, AKL, NZ, 2010*

Fig. 3. *Turner and Burgoyne, Flap, Jars, socks, glass, electronics, interactive sound, MIC Toi Rerehiko, AKL, NZ, 2010*

In the neighbouring gallery, Turner and Burgoyne installed *FLAP*. *FLAP* is an installation that utilised white socks that had been given to various voluntary members of the public, who wore them for several days and then redeposited them in to a glass jar. These "specimens" were encased in preserving jars, reflecting on the notion of preservation. The jars were installed lining the wall of the gallery like a scientific experiment. As the viewer came in close proximity to a jar, the lid was triggered, lifting to release the sock's odour.

The installation encapsulated the intimate environment of our domestic lives focusing on one object – the sock. The artists' expand on this effect as an affect: 'It asks us to think about the smells that we take for granted in our homes and provides us with a multi-sensory re-visioning of the very humble sock.' [8] *FLAP*, in contrast to Lyons' experiment, explored non-directive tactile senses; where the participator/audience, not the artist/author, is in control. A sense of smell is individual and the artist becomes the enabler in the activity of recognizing subliminal stimulation.

Turner has collaborated with a variety of artists from industrial chemists, commercial perfumers through to architects and symphony orchestras. Her work is centred on the synaesthetic exploration of our senses. Her working process often sees a mapping of coordinates between senses designing cross-sensory stimulation. For instance in 2002 when designing the orchestral concert series for the deaf, *Four Senses Concerts,* Turner designed colour palettes and light states that were composed in reaction to the sound composition and were activated through improvisation. 'The canvas of the whole orchestra was composed using saturated colours to achieve high degrees of retinal stimulation, brightness and afterimage.' [9]

As described by the artist: 'The concerts for the deaf, *Four Senses* in 1999 and 2002, inquire into the sensory worlds of the blind/deaf, of hearing, of breathing in and of visualizing the world. The projects were an experiment with creating simulated synaesthesia and the imaginative 'vision' of association triggered by sensory factors. It is possible that one dedicated sense could be used for other sensory perceptions, e.g. the shape of sound, the colour of smell.' [10] 'The translations form a methodology in which one medium has been related to another. The correspondences established between sound/silence and colour/light/dark are creating systems and structures as a way of negotiating reflective and subjective connections between sensory experiences.' [9]

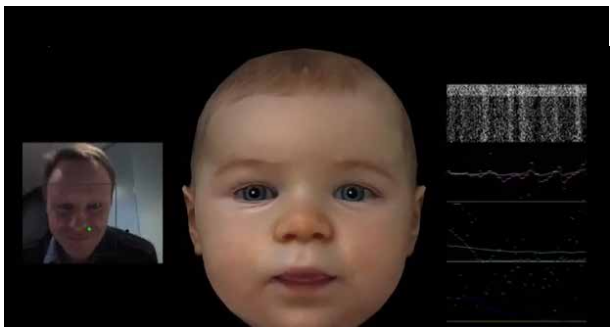

Fig. 4. *Sagar, M with Laboratory for Animate Technologies, Auckland Bioengineering Institute, Baby X (snapshot), autonomous animation, 2013.*

Over the last couple of years, Mark Sagar and his collaborative team at the Laboratory for Animate Technologies at the Auckland Bioengineering Institute at University of Auckland have been building a computational model of the human brain and face. Working with research teams at the Centre for Brain Research, these computational models contain current neuroscientific understandings. Having come from the animation, film and entertainment industries Sagar's research interest is largely in the area of developing a universal system for mapping faces. In his work analyzing the muscular facial control system, including morphology, anatomy and biomechanical modeling, he began investigating the emotions and neurobehaviours driving character expression. This led, in turn, to the current project to create a neurobehavioural computational model with emergent behaviours.

This neurobehavioural computational model has been publicly displayed in the foyer of a public building recently and is destined for public display in a national art museum over the coming year. When installed, this work *Baby X* [Fig.4], is essentially an interactive media art installation, containing both scientific and artistic elements. When viewers first enter the usual "black box" environment they see a large screen on which the face of an animated child is projected. The

child follows the actions and movements of the viewer displaying realistic responsive behaviours such as smiling, crying, confusion and abandonment. The computational model is capable of these responsive behaviours through a variety of camera-based sensor tracking systems aimed at monitoring eye and individual body movement. The characterization is modeled on that of a six-month old baby, based on Sagar's own child. Along with the facial expressions that mimic emotional states, it is possible to navigate internally seeing representations from the muscular anatomy down to the neuronal, cellular and neurochemical levels in a live neural network linked to the autonomous behaviour. It is possible to follow the stimuli through the responsive neural pathways and through this simulation gain greater understandings of neural networks.

In a recent public installation, *Baby X* was vigorously engaged with and there was found to be a high degree of emotional responsiveness on behalf of both character and audience. Participants generally reflected feelings of empathy and sensing a relationship between themselves and the baby. The system is undergoing further experimental extension introducing an interesting dialogue between human sensing and machinic sensing. The computation model is capable of networking with other systems such as environmental, wireless, independent audio-visual sources, intelligent architecture and other robotic systems. Within this context the computational model can be perceived as actor, control system and collaborator.

Sabine Flach asserts 'However, body images as image scenarios are ... always characterized by a fundamental oscillation between *nature* and *culture*, *imagination* and *imago*, *facticity* and *fictionality*, between *habitus, habitat and heredity* ... and between *intentionality and non-intentionality*. This oscillation is key to understanding the connection between expression and emotion.' [4] Within Sagar's work there is the additional sensory oscillation between virtual and real, artificially intelligent and human. Along with increased audience multimodal sensitivity there is an increase in emotion and feeling sensitivity when interacting with the animated child. Triggering empathy, in particular, increases the degree of viewer participatory awareness. Due to the virtual age of the animated child, this interaction does not involve language but rather pre-verbal multi-sensory intuition bringing in to play a dialogue between motion and emotion. As Flach goes on to say: 'The feeling of sympathy allows the viewer to empathize with what is shown, and this empathy, in turn, is a deep process-oriented feeling that adapts to the expression of emotion as a bodily process.'[4] Finally this work brings in to play the deeper oscillation in this work that is between character representation, neurobiological representation and embodied cognition.

This paper is entitled *Sensing Sites* invoking both the human and machinic sensing presence within these multisensory virtual and local media sites. It also acknowledges the connection between physical site of that sensing in terms of external and bodily siting and the incessant oscillation between these elements when aesthetically experiencing the works. Alvo Noe, in his book Varieties of Presence, sets out: 'Experience, in the large, and in the small, is complex and manifold; it is always an encounter with hidden complexity. Experience is fractal in this sense. Perceptual experience extends to the hidden.' [6]

Each of the works by Lyons, Turner and Sagar, stage embodied sites that contain complex, transparent participatory engagement. They are locative merging of body and environment both virtual and real that trigger a form of experiencing that incorporates elements of synaesthetic and kinaesthetic sensual real-time exploration in order to reveal meaning. Within each, the black box environments are mapped out and the participatory audience member marked for tracking and interactivity. This brings into activation a complex interplay of site-absorption and "felt" understanding.

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ENDNOTES

1 Observations, contained in this paper Sensing Sites, form the basis of a Doctorate within the College of Fine Arts, University of New South Wales and the National Institute of Creative Industries, University of Auckland. The creative practice component includes formation of a trans-disciplinary research group and staging exhibitions and symposia from 2014 to 2016. I acknowledge the support of the University of New South Wales and the College of Fine Arts.

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Mapping and Meaning: Embodied Metaphors and Non–localized Structures in Performance System Design

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Abstract. This paper explores the application of gestural structures and embodied *image schemas* in the design of control mappings and interpretative layers for a spatial music performance system. In doing so, it advances a design that maps structural features derived from musical performance gestures to various aspects of spatial and timbral sound processing. An analysis of a system by one of the co-authors will be undertaken, in addition to discussion of wider implications for performance system designs based upon these theoretical perspectives. The importance of image schemas in such a model is their potential utility in contributing to the development of richer, yet coherent, mappings that go beyond simpler localized transduction–based models to encompass a variety of less localized output modalities.

1. INTRODUCTION: TIGHT AND LOOSE COUPLING AND SIMPLE AND COMPLEX MAPPINGS

Digital signal processing (DSP) techniques may extend the musical palette of the instrumental performer beyond the conventional, permitting the creation of novel and intricate sound structures. However, musicians may experience difficulty in attaining the same level of intimate performance control (*control intimacy*) within *hyper–instrumental*[1] practice as may be found with conventional instruments [1, p.399]. Control intimacy is sometimes equated with what might be termed the *tight coupling* of input to output. For example, it is notable that the formative priorities of the digital musical instrument (DMI) and performance systems design field have frequently centered upon streamlining source–cause relationships via reliability of transduction, low latency and simple mapping strategies. However, if parameters are individuated to facilitate such tight coupling, the resulting complexity may undermine control intimacy. Conversely, if such parameters are cross–coupled[2] in a complex fashion, the nature of the mapping may not be immediately apparent, impeding the system's learnability at early stages of engagement [4], [5]. Furthermore, the act of defining larger–scale musical structures may be more difficult in a system employing tight parametric coupling and low–latency response, resulting in an atomistic bias.

A solution may be embodied in the application of established instrumental performance practices to hyper–instrument design. Rather than completely decoupling instrumental causal relationships through technological augmentation, exploiting existing structures embedded within instruments and their established performance practice is suggested. Norman [6, p.23] proposed the use of *natural mappings* in interaction design, based upon familiar structures, as a means of facilitating engagement with complex systems. This foregrounding of "natural" source–cause relationships is based upon Gibson's [7] *ecological psychology* and its concept of *affordances*. In Norman's [6, p.9] usage, "affordance" describes the perception of interaction possibilities through sensory perception and experimental interaction. However, this usage

also encompasses cultural affordances and constraints [6, pp.23,85], providing a useful basis for the examination of conventional instruments as providers of control data.

We therefore argue that in more complex *loose–coupling* cases (for which causal results of actions are less localized) it may be preferable to exploit the structure of established musical gestures rather than to substantially alter the physical instrument. Data from *figurative gestures* [8, p.78]––emergent contours and trajectories from the music's pitch materials––may provide a useful source of control structures for the interpretative mapping layer of a performance system; c.f. [5, p.189]. Furthermore, embodied *image schemas* [9, pp.105–110], [10, pp.136–50]––theoretical cognitive structures based on patterns of sensorimotor activity or engagement (i.e. affordances)––could provide a clear and coherent mapping between local performance gesture and wider parametric control.

2. EMBODIED IMAGE SCHEMAS AND CONTEMPORARY MUSICAL MATERIALS

We argue that the presented approach may only be viable if the musical structures of the relevant practice can be clearly related to obvious and familiar affordances, similar in structure to the individual performative gesture. Johnson [10, p.29] has advanced an embodied model of music based on a metaphor of *moving time*: our understanding of time being informed by our experience of spatial movement, embodying the passage of objects past a stationary observer. Johnson's [10, p.248] *moving music metaphor* describes music's temporal progression based on physical movement. This metaphor comprises multiple mappings from a source domain of physical action embodying spatial aspects (e.g. paths of motion, cessation of motion, location of observer) to temporal structures and implications (respectively: musical gestural contours, points of rest/stability/"cadence" and a sense of musical immediacy, i.e. "presence"/"the present"). Johnson [10, p.254] further expands on this by advancing a *music as moving force metaphor* to describe causes of musical motion, embodying analogues of physical forces in cause/effect and tension/release structures.[3] Support for musical applications can be found in a survey and analysis of embodied metaphors in musicians' analytical language [11], which also contains further commentary on potential usage in music software interface design.

This ecological/embodied categorization of musical experience may therefore prove useful in the development of hyper–instrumental practices that exploit figurative gestural structures––particularly those concerned with gravitational attraction and inertial analogies––as the syntax of control mappings dictating larger–scale sonic structures. Johnson's account focuses on common practice Western music (he does not specifically treat the expanded textural and spatial palette of contemporary music).
A strikingly similar discourse can be found in Smalley's [12] *spectromorphology*, which outlines salient structures in electroacoustic/acousmatic music in a broadly ecologically–based fashion. The basic (physical) sound–producing act/gesture is described as being parsed via its various acoustic components (such as envelope and spectral characteristics), which are seen as providing *source bonding information* about cause and effect [12, p.110].[4] These (physical) gestural archetypes are therefore presented as frameworks upon which to elaborate larger–scale compositional structures through embodiments of typical causality.

Smalley's theories are based on three distinct gestural orders [12, p.112]:

(1) The "raw" output of the sounding object, through its use via more obvious affordances and source–identification associations.
(2) "Instrumentalisation": performance gestures upon musical instruments or interactions with other objects influenced by the intersection between physical affordances and the cultural conventions of musical performance practice.
(3) "Gestural surrogacy": non–localized figurative gestures, whereby the gesture is "inferred or imagined in the music."

The latter two categories are of most concern in terms of extending immediate performance gestures to non–localized responses.

One such potential mapping can be found in Smalley's discussion of envelope components of *onsets*, *continuants* and *terminations* [12, p.115], which advances a series of ecological/embodied associations suggestive of connections between localized gestures and the macro–structural level (see fig. 1).

onsets	**continuants**	**terminations**
departure	*passage*	*arrival*
emergence	*transition*	*disappearance*
anacrusis	*prolongation*	*closure*
attack	*maintenance*	*release*
upbeat	*statement*	*resolution*
downbeat		*plane*

Fig. 1. *Table of ecological meanings and potential musical functions associated with envelope/gestural phases; after Smalley [12, p.115]*

For the present purposes, it is significant that Smalley [12, pp.122–4], [13] also advances a model of gestural inter–relations exhibiting spatial as well as temporal implications. Such an approach could be seen as connecting the musical structures at output with more localized gestures through the medium of image schemas, enhancing the clarity of causal relationships based on the familiarity of these mappings from one modality to another. The practical application of such an approach to hyper–instrument design may see structures derived from figurative gestures applied to the trajectories and amplitudes of spatial movements.

3. PERFORMANCE SPACE FRAMES: ORGANIZING SOUNDS AND SCHEMAS

This section will theorize the potential application of image schemas to performative gesture and control relationships in spatial music performance. Smalley further develops his concept of spectromorphological gestures into the spatial domain [13], highlighting the intricate spatiotemporal relationships found in our surrounding natural environment. His account of space–form encompasses groupings (or *containers*[5]) of individual spatial gestures,[6] whereby space is the primary articulatory dimension, served by time [13, pp.55–56]. This account of relationships between localized spatial gestures and larger–scale[7] space–form may usefully inform the design of a spatial music system employing looser coupling.

In terms of such larger–scale (figurative) connections between his spatially–based materials, Smalley's ecological schemas include embodied gravitational (i.e. moving force) relational metaphors [13, pp.45–8]; c.f. [10]. A pitch–based hyper–instrumental spatial music practice could easily exploit higher–level abstractions of relations between materials, such as *tonal pitch space*[8] [13, p.46], in its spatial mapping to acoustic space, reifying aspects of the musical gesture's schematic structures in physical–performative space. This suggests the potentially fruitful development of *gestural narratives* between the pitch–based musical gesture and its ecological context.

Before attending to the design of the performance system, one may find it useful to consider the general form (and functional association) of descriptive organizational categories from within which we can make our schema–based mapping strategies manifest within a physical performance space. Emmerson [14, pp.97–101] has proposed an analysis of the spatial structure of live electronic music performance within different *space frames*; regions of the performance space/environment with distinct functional associations of *local* (a foregrounded and localized area of clearly–perceived events) and *field* (a more diffuse ambient context for local events).

These frames deal with the interrelationships between performer, instrument and the wider sonic environment, and we argue that their implicit ecological/embodied basis may provide a crucial perspective on potential gestural relationships between them. Furthermore, the *local/field* distinction is analogous to our own tight/loose coupling distinction. The tightly–coupled results of the performer's interaction with the physical instrument may be observed and heard as assigned to the *local* frame; the more loosely–coupled response of a performance system may be assigned to *field*.[9] Fundamentally, Emmerson's space frame typology suggests a causal–spatial syntax for the relationships between a hyper–instrument's local and field responses, informing a spatialization model which considers

performative implications of space rather than treating it as just another formal–structural output domain. The presented space frames are not mutually exclusive and may overlap, providing intersecting spaces for the interactions between primitive and complex metaphors (reflecting the structure of an interpretative layer of mappings based on loose gestural coupling). By adopting such a design approach, a performer–technologist has an accessible means of elucidating a rich variety of gestural roles and source–cause relationships along the *loose–tight* continuum.

4. EXPLANATION OF EMBODIED/ECOLOGICAL CONCEPTS WITHIN THE *PD2LIVE* SPATIAL MUSIC PERFORMANCE SYSTEM

Through the use of mappings based on ecological/embodied models, one may reify figurative movements from musical gestures within the physical/*real* performance space. This section will discuss the application of embodied and ecological concepts within a nascent spatial music performance system: *Pd2Live*[10] [15]. The system parses a multichannel audio feed from an electric guitar on a channel–per–string basis,[11] extracting pitch and amplitude data from each channel. The data is further parsed into pitch–class (relative to a user–specified tonal center) to obtain pitch–class distance and continuous melodic contour, in addition to temporal information (average note inter–onset time). On its most fundamental level of spatial control, *Pd2Live* extracts and applies pitch contour data directly to ambisonic spatialization parameters for the purpose of spatial music performance.

The primary performative/figurative gestures can thus be easily mapped to spatiotemporal processes based on gestural structures, articulated as a local/field delineation between the tightly–coupled output (more based upon the instrument's "raw" output) and the more loosely–coupled responses of the performance system.[12] This basic control mapping allows the performer to develop narratives between pitch–space schemas and the physical performance space in local and field frames.

4.1 RATE MAPPINGS

In addition to the basic metaphorical "equivalence" between pitch contour and spatial trajectory, the system embodies a mapping from *rate* of input note–gestures (average note inter–onset) to a number of analogous output domains. The mapping of a guitar picking/plucking action may be informed by Johnson's identification of qualitative dimensions of movement [10, pp.21–4],[13] namely *tension* (embodying effort/amount of activity). In this case, the rate of the note articulation may be taken as mapping to "activity density." Following this qualitative association, in our first example of the system [15, performance_tests.mov, 2'17"],[14] increasing *rate–effort* is mapped to granular *density* (rate of new granular events), in addition to an increase in the rate of progression of other timbral processes.[15] The rate mappings thus develop a narrative between the structure and qualities of the performative gesture and the structure of the output domain.[16]

4.2 MELODIC CONTOUR MAPPINGS AND THE MOVING TIME METAPHOR

This strategy applies the spatial attributes of figurative gestural schemas (melodic contour shape and trajectory) as a method of dynamically spatializing audio events within the field frame, exploiting Johnson's moving time and, more specifically moving music metaphors [10, p.254]. Incoming audio data is parsed into pitch classes, from which a pitch–class contour (from 0 to 11) is created and then scaled to provide directional (azimuth) data for an ambisonic spatialization process (i.e. to 0 to 360 degrees), providing a relative directional mapping based on the melodic contour.

Our next example [15, basic_control.mov, 6'42"][17] comprises a chromatic figure whose contour is mapped to ambisonic azimuth position in such a fashion. Furthermore, the ambisonic distance parameter is mapped based on Lerdahl's [16] *basic (tonal) space* model, whereby tones close to the specified tonal centre (e.g. triadic/diatonic tones) are mapped towards the centre of the spatial array, whereas chromatically–offset tones are assigned to peripheral locations (increased distance factor), providing a centre/periphery schema which is compatible with Emmerson's space frame distinctions.

4.3 MAPPING MELODIC SYNTAX TO MORE COMPLEX LOOSELY–COUPLED BEHAVIORS

In addition to the contour data, computed pitch–class profiles form the basis of a more sophisticated melodic syntax model, based on Lerdahl's tonal pitch–space schemas and processes [16], [17]. Lerdahl's integration of dynamic forces, including gravitation,[18] and a *centre–periphery* schema could also be viewed from the embodied perspective of *moving music* and *music as moving force* metaphors[19] (in spite of cognitive models providing the basis for his theory [17], [18]).

Following this lead, dynamic melodic syntax data (such as attraction and inertia) from [16], [17], were mapped to in–kind parameters of a *boids* flocking algorithm controlling dynamic spatialization [19], [20, p.206], [15, pp.156–162]. Melodic syntax choices thus directly modified multiple behavioral parameters of each boid, relative to a specified center point within a two–dimensional Cartesian space. In application [15, melodic_model.mov, 14'09],[20] tonal force models are applied to the flocking parameters of the boids, articulating a general mapping from an *inertia–to–attraction continuum* to a *diffusion–to–central–localization continuum*. The combination of the boids algorithm and the melodic pitch space model proved to be a usefully responsive ambisonic spatialization performance tool (which embodies space frame distinctions), establishing an intuitively accessible loose coupling between musical and ecological schemas, highlighting the embodied musical forces already implied by Lerdahl's model.

5. CONCLUSIONS

Theories of embodied cognition propose that higher–level abstractions are based upon more primitive, ecologically–based structures. If one considers higher–level musical structures to be so defined, a useful approach to performance system design may be to structurally embed such metaphors within mappings. Gestures and image schemas may therefore provide an intuitive and coherent basis upon which to integrate, organize and combine these source structures into different (interacting) domains, advancing clear dialogues within and between complex multidimensional/multiparametric structures.

Embodied/ecological perspectives on musical structure in Johnson [10] and Smalley [12], [13] have informed our proposal of mappings that are based upon structural and qualitative aspects of performance gestures, transposed to more loosely–coupled temporal and spatial domains. Furthermore, an examination of functional/ecological distinctions between space frames [14] indicates how looser relationships between localized performance gestures and a hyper–instrument's response may contribute to coherence for the performer and, potentially, the observer. In conclusion, we have discussed the contribution of gestural structures to the coherence of loosely–coupled mappings for a spatial music performance system. In future work, we are planning to investigate the wider aesthetic implications of complex embodied mapping syntaxes.

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ENDNOTES

1 A hyper–instrument is typically an existing acoustic or semi–acoustic instrument that has been technologically augmented to allow the performer a more expressive role in sonic transformations, whilst maintaining the instrument's original character [2, p.47], [3, p.249].

2 Cross–coupling mapping strategies connect a single input modality to multiple output modalities. Hunt and Kirk [4] note that such complex mapping strategies may facilitate the successful control of more complex outputs, such that more expert users may prefer mapping strategies which are not simply *one–to–one* (with a large number of discrete parameters). We argue that such an approach is more likely to be successful if the structure of the mapping is based on a familiar structure; c.f. [5].

3 As Johnson states, "musical forces are conceived as acting on listeners to move them from one state–location to another along some path of metaphorical motion" [10, p.254].

4 "The natural tendency to relate sounds to [...] causes, and to relate sounds to each other because they appear to have shared or associated origins" [12, p.110].

5 *Container schemas* are one of the most fundamental image schema structures identified by Lakoff and Johnson, allowing for the organizational delineation of elements (grouping), but also describing relational processes taking place between different containers [10, p.21].

6 These individual spatial gestures are termed, somewhat confusingly, *spatial forms*, to distinguish them from the larger–scale structure embodied by space–form [13, p.56].

7 Introduced through environmentally–based examples [13, pp.35–38].

8 "The subdivision of spectral space into incremental steps that are deployed in intervallic combinations – a sub–category of spectral space" [13, p.56]. Smalley notes that the spatial associations of spectral gestures may imply their subjection to gravitational analogies [13, p.46]. See also [16]

for a cognitively–based theory of tonal relations which encompasses gravitation.

9 This is strikingly similar to Smalley's delineation of *gestural* (local–performative) or *arena* spaces [13, p.41].

10 *Pd2Live* Pure Data patches are available for download from Graham's personal website: *http://rickygraham.com/research*

11 More information on the Graham/Harding *Septar* multichannel audio board may be found on Graham's personal website: *http://rickygraham.com/research*

12 Thus supporting an intuitive ecological/embodied clarity in the system's operation.

13 "It is not just the structures of movements that matter; it is, even more, the qualities of movements that constitute our bodily understanding of motion" [10, p.27]. Johnson's [10, pp.21–4] other qualitative dimensions of movement are *linearity* (coherence of path of movement), *amplitude* and *projection* (transient movement/sudden acceleration versus more gradual rate–changes).

14 Available at: *http://youtu.be/8YBLM2Ja6Uo?t=2m27s*

15 E.g. grain spread and high–pass/low–pass filtering; the schematic/hierarchical organization of these processes is based upon a tonal model [16, pp.47–18] that differentiates between chromatic, diatonic and triadic functional levels.

16 Further rate–based mappings were later integrated within pitch–based gravitational/attractional models.

17 Available at: *http://youtu.be/TFyO1xa4l14?t=6m42s*

18 Lerdahl's melodic attraction process is explicitly based on a gravitational inverse–square law [16, p.163].

19 Therefore, the system's formal processes––based on Lerdahl's [16], [17] *linear completion* (relative closure), *melodic attraction*, *attractional asymmetry*, *tendency* and *implicative denial* (extrapolation)––embody an ecological familiarity in their force–based and centre–periphery dynamics.

20 Available at: *http://youtu.be/r3W2G_QTsiw?t=14m9s*

FRAMING MEDIA

FRAMING MEDIA

Curating Media and Digital Art in an Age of New Hybrid Forms

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Abstract. This presentation will consist not only in describing the ways in which a multidisciplinary media arts organisation operates, but also in underscoring the various possible hybrid avenues that can be taken with respect to programming and to our artist in residence activities. This will enable me to better illustrate my approach to curating with respect to the Re-New festival, where aesthetic issues in media arts also demonstrate a diversity of paths and modes of expression. The principal connection here is the question of technology and its most recent advances, brought to light by a history of artistic practices. A variety of examples of recent productions at *Daïmôn* will illustrate my remarks.

Daïmôn has an unusual mandate, unique in Quebec and without any real equivalent elsewhere in Canada. Its strength is undoubtedly tied to its past and the fact that it is the product of an encounter between a community of independent filmmakers in the Outaouais region in southern Quebec – literally steps from the country's capital, to which it is connected by four bridges – and a community of photographers with a very strong presence in the Ottawa-Gatineau region. This encounter first took form with the establishment of a "cine-photography" institution in Ottawa in the late 1930s, for at that time the National Film Board of Canada was endowed with a photography department. When the NFB moved to Montreal, it left this photography service behind, along with a sizeable photography collection, which led to the founding of a Canadian Museum of Contemporary Photography, now a part of the National Gallery of Canada. This made it possible for a community of photographers to endure, and today a certain number of them continue to experiment with analogue photography. Some of them are even are even passionately devoted to it, at a time when this practice is more artisanal than ever. But this also opens up a range of possibilities, for the field is no longer governed by conventions or by the academicism which was previously a major factor, first of all because the region, like most capital cities, is essentially conservative by nature. It's not by chance that a photographer such as Yousuf Karsh, the paragon of neo-classicism, had a studio in downtown Ottawa for practically his entire working life.

Daïmôn was thus born of an encounter between photography and independent cinema. Under the impetus of these artists, Daïmôn was clearly a part of a movement that blossomed in Canada in the 1970s: the non-profit artist-run centre. Today Daïmôn has some sixty members, an eight-person board of directors and five employees. Most of our funding comes from federal and provincial government arts councils and, to a much lesser extent, from the municipal government. While in the beginning photography and moving images were behind the founding of Daïmôn – which means "benevolent spirit" in ancient Greek, forming part also of Platonic

philosophy (see *The Symposium*) – what is at stake here is more precisely the encounter between the two media, and today between an even broader range of media.

All of which is to say that Daïmôn is a place par excellence for montage, where we hope an encounter between media is little more possible than elsewhere – and I would say a little more still if this encounter is by chance or of a new kind. This is precisely what I am going to speak to you about today. But let's look at history a little longer in order to see which definition of historical and aesthetic space Daïmôn is a part of. The expression "media art" gradually took hold in the 1990s to define art which uses video, electronics or more broadly music that could be described as electro-acoustic, without being limited to it, or that is also known as sound art. Today in Quebec this terminology has been abandoned by the Conseil des arts du Québec [Quebec arts council], perhaps among other reasons because it encompassed too many phenomena and because video in particular enjoys a massive presence in contemporary art galleries, proof positive of the breaking down of disciplinary categories.

This category has split into the digital arts on the one side and film and video on the other. But Daïmôn brings together more than digital art and media art. What we do, rather, is build bridges. It is, most of all, a production centre, where artists are encouraged to use a range of technologies and to cross from one production space to another while making their work. I should point out that our space is divided into four distinct production areas: the digital printing room, the editing suite, the production and exhibition studio and the darkroom. Rather than a mere encounter of media, this creates an interrelation of technologies.

This, in particular, is what we wish to encourage at Daïmôn: photography that blends analogue with Final Cut editing software; an approach to sound which employs sensors connected to cameras, making it possible to record movement; live projection performances using 16mm film accompanied by a synthesiser . . . the list could become long. As the artistic programmer, when I help select an artist in residence on our jury, just as I choose events for the year-round programming in our Studio, I seek out projects which will inquire into the role of these technologies, not only to explore their possibilities but also, sometimes, to critique them. In order to develop a meaningful discourse, one must first master the technology and then show what is involved in its use. In other words: what perception of history does the technology bring? Which sensibility, attached to a medium (for example photography), is thereupon displaced or transformed? Photographers who use digital technology or traditional film during their residencies at Daïmôn do so as a conscious choice and this indicates extensive knowledge of their medium.

With respect to the educational work to be done amongst the public, this cannot be limited to the mere description of our residencies on our web site. Our educational mandate develops over a number of events and programs. With respect to the analogue/digital relation, the programming we developed with the artist Sabrina Ratté is emblematic of the basic questions at stake. Sabrina Ratté is an artist who salvages old video synthesisers and manipulates them to create an original discourse, which enters into dialogue with the inventive music composed by her companion Roger Tellier-Craig, himself inspired by old synthetic sounds which he transforms and amalgamates with recent applications. This encounter between image and music employs the specificity of the synthesiser and, among other things, its undulating operation. The work of these artists is marked by a memory of technology, and in this sense it seemed logical to present a program which spoke to this memory, by introducing people to the work of Sabrina Ratté's predecessors in this not yet well-enough known field. We have thus shown Lillian Schwartz's *UFO's*, famous for being one of the very first videos made with an IBM computer, in 1972. The program unfolded chronologically, beginning with a work by John Whitney shown in 16mm. Whitney used the first scanners to create a film that anticipated three-dimensional experimentation with depth of field through the creation of unprecedented forms which would later fascinate Stanley Kubrick. Alongside these films were works which blended the recording of a performance with video art in its own right, documenting the establishment of a tradition situated

between video performance and audio-electronic performance.

We see a large part of our work within a kind of genealogy of this performance element. One of the emblematic examples is the group Jerusalem in My Heart, in that it not only works on both electronic sound and images, but also in that on each occasion these images are shown in a peculiar manner, with the projection screen hung overhead. This screen, in interaction with the audience, can move about the room as the event takes place. Obviously, this requires that the presentation be adapted to each venue in which it is held. This is an essential point in defining the work of these artists, who presented their work in a Copenhagen jazz club just the day before yesterday.

The question of the space in which a work is presented is thus essential, and at Daïmôn it is a part of the event-driven aspect of our programming. In this sense, our approach is based on three elements: 1) a historical perspective on technology; 2) the conditions of the live performance, the event; and 3) the hybrid quality of the forms of expression, which in our view is inherent to the art we promote. All these aspects converge in the notion of community, a concept that has been a major focus of federal and provincial cultural policy in recent years. This does not mean to say that we are proceeding in the same direction, consensually, but rather how we position ourselves with respect to this powerful trend. I would say that Daïmôn's approach in terms of programming and public access simply takes into account what several thinkers in Quebec call "digital culture".

Milad Doueihi, a philosopher at Université Laval, even seeks to define the terms of this culture in a way that resembles an idealistic philanthropy. His book *Pour un humanisme numérique* (Seuil, 2010) examines the forms of expression on the Internet which are changing our representation of the world. In the view of this vision, our representation of the world depends on its reception, according to a logical inversion which returns Jauss to his grave, along with all reception theorists in general.

Obviously, there exists an opposite manner of reacting to today's new paradigms, that of virulently criticising them, but we can also consider the fact that while we are not in a world governed by our idea of it, there is at least a way of connecting our minds, today, to this world in a way that literally changes the mind's make-up, just as its stimuli have changed. Our audience literally lives with its eyes cast upon a variety of media – screens that reach a speed never attained by the most complex multimedia installation. In this context, artists working in video, contemporary photography and sound art are simply extending their practices by letting this fact show through a little. Our task is to help them make clear the meaning and scope of their work.

For Doueihi, the question of the digital is, first of all, a question of conversion or, if one prefers, of transfer: it is always a case of transferring one world to another. Or rather, of transferring a world to a platform. In this sense, digital technology is not simply unthinkable without analogue technology; it can only be conceived of "with" analogue technology. On this point Doueihi hits hard, carefully avoiding critique of such a state of affairs. His tone is neutral, and in this sense he is the exact opposite of Guy Debord, who anticipated this situation and formulated an implacable critique of it from the outset. In contrast, Doueihi takes refuge in approaching his topic through a mimetic style of writing. Because for him, the digital is most of all a hosting structure, a globalising expanse at whose centre lies the Internet. He in turn welcomes the digital without passing judgement on it.

On the question of friendship, for example, he believes that in the digital era this has passed from the private to the public realm. The social media are the structure in which friendship is now seen. From a philosophical point of view, we might thus say that Daïmôn is also a hosting structure whose distinctive approach consists in giving meaning to a technological component (the digital) whose scope appears impossible to circumscribe, until such time as an artist seizes hold of it, thereby responding to our wish, our editorial line. I imagine that the equivalent in the social media would be the intrusion of an experienced hacker.

What we wish to encourage through our programming and residencies, in the end, is for artists to take into account the effects of

technology on our perception and view of normal life – on what the poet Alain Jouffroy calls the externet. This necessarily means that not all sound and video artists we host have mastered the technology, because our approach is close to contemporary art, where technology is sometimes seen as a toy. This fact sometimes also leads to the creation of works with a poor understanding of their medium, thereby yielding a kind of anecdotal result.

The ultimate example of a form of technical mastery framing a new artistic discourse can be seen in all its complexity already in the cinema of Antonioni, who calls into question the narrative power of his art form by leaving a crime concealed in the frame of his image. Everything that is shown always conceals something else, and Antonioni's power lies in tackling head-on this machine for looking, the cinema, in an attempt to define the new meaning it conceals, like the new stories it can look at. To find the body, Antonioni explains, we must used a mixture of techniques. If we decompose movement, if we blow up a still image, an answer may appear. In *Blow Out*, De Palma later showed that sound too can be used to compose a narrative differently, based on the same plot. In the end, and most often in a non-narrative context, Daïmôn is simply continuing to illustrate such postulates for its residencies and programming.

Speaker's biography: Guillaume Lafleur is Director and Artistic Director of the arts centre *Daïmôn* (Gatineau, Canada). He holds a doctorate in literature and film from the Université de Montréal (2007). He is the author of more than fifty articles in the field of media art, and in particular cinema, for publications in Canada, the United States, France and Poland. Since 2009 he has curated and programmed some fifty events in the media and digital arts.

Little Red Riding Hood: The other side of the story

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Abstract. This paper wishes to present three virtual art ecologies that were created in 2013 in the metaverse of Second Life, involving a re-interpretation of the folk tale Little Red Riding Hood (LRRH). The tale of LRRH has many layers of complexity that are open to many varied interpretations, some of which were tackled by the participating artists and will be discussed in this text. Beyond presenting the work itself, this paper also wishes to discuss a theoretical framework regarding storytelling, especially as it relates to today's information society, and it's offshoots, online virtual worlds.

1. INTRODUCTION

In early 2013 storyteller and virtual world resident Heidi Dahlsveen/Mimesis Monday curated a themed exhibit in the metaverse of Second Life® by inviting three virtual artists to stage their interpretations of the age-old fairy tale Little Red Riding Hood (henceforth referred to as LRRH) by creating installations that would also be in the nature of art ecologies in that the building would take into account the geography as well as the climate of the virtual land upon which they were placed. The artists were expected to re-tell the story from their own novel point of view, in effect bringing to the fore what, for them, would be the other side of the tale of LRRH.

The completed installations were open to all Second Life avatars who could take in the work by walking through the ecologies at their own pace, by following paths that they decided upon themselves; thereby also creating their own tales through the non-linearity of what they encountered. Indeed, a second objective of the undertaking was to add yet another layer to 'the other side of the story' by encouraging visitors to add their own interpretations to those of the three artists by engaging in their own storytelling sessions and creative work that further enhanced the project.

2. THE PROGRESSION OF LITTLE RED RIDING HOOD

In what follows we want to discuss how a narrative can be told through an installation in a virtual world and how a meeting between oral tradition and the virtual world creates reflection.

There are not too many individuals in western cultures who, as children, did not encounter the tale of LRRH. Some of us remember the story as that of a little girl who was frustrated over not having blonde curls, some of us remember her as a sweet young person who went to visit her ailing grandmother in the forest, while others were traumatized over the killing of the wolf. Indeed the wolf, and the fate that befalls him, is a forceful component of the tale and the encounter between the girl and the wolf are likely to affect us on many levels – some conscious, others sub-conscious.

According to Jack Zipes the development of the written story of LRRH is in itself a brutal history in that it is a male creation and projection. Not women, but men – Charles Perrault and the Brothers Grimm – gave birth to our common conception of LRRH as we know the tale today [1]. Zipes points at the existence of an earlier oral narrative in French culture that Perrault very likely based his story about the girl and the wolf upon. Perrault's great artistic achievement consisted in his appropriating folk motifs, imbuing them with a different ideological content, and stylizing the elements of the plot in such a way that they would be more acceptable to his upper-class audiences, consisting both of children and adults. [2] Thus, it is of no surprise that his literary narrative marks a slow stagnation of the motifs in the story, given that his task was to adapt stories for an aristocratic audience.

What is of note is that there are great moral differences between the oral and the literary story developed first by Perrault and later the Brothers Grimm. In the story that we all know as LRRH today, the protagonist is portrayed as a helpless little girl who encounters a dangerous world when she decides to go out alone, refusing to heed the advice of adults. And, unsurprisingly, in the version of the Grimm Brothers, it is an adult male who helps her out of her debacle, when the hunter jumps to her rescue and kills the wolf. Ergo, in the written manifestation of the tale LRRH is depicted as a young woman who is ultimately dependent on men to move on. Indeed the manner in which the wolf is disposed of forms the crux of the difference between the written and the oral versions of tale since in the oral version of the tale LRRH takes matters into her own hands and escapes the wolf through her own devices, with no outside help whatsoever. Therefore, the oral story depicts a strong young woman who is about to become an adult and who through her own efforts and ingenuity can get out of any situation, whereas the written version casts LRRH in a role of dependency due to her gender. That the essence of a tale can have changed and stagnated to this extent due to a specific era's moral considerations, and that it can still be conveyed as a children's story today is disturbing when viewed in this context.

3. THE THREE INSTALLATIONS

The tale of LRRH has many layers of complexity that are open to many varied interpretations. The three outcomes of the project reflected this diversity: Soror Nishi's output can be related to a wider concern that addresses the very landscape on which many folk tales are played out – the fantastical setting/flora of the enchanted forest of the tale itself. Cherry Manga and Alpha Auer however chose to take a look at some of the confrontational aspects of the story: While Cherry Manga situated these within the sexual encounters/conflicts that are to be found in the oral version of the tale; Alpha Auer examined a conflict between human and beast, namely humanity's brutality towards the wolf situated as 'the other.'

Fig. 1. *Alpha Auer, Second Life, 2013. (Photograph courtesy of the artist). Alpha Auer's interpretation of the tale placed the wolf at center-stage, as the martyr and LRRH as the human villain who did not baulk at killing creatures that she deemed to be the 'other,' when it suited the advancement of her own interests. Accordingly, the visual elements of Auer's art ecology was dark, dense, confusing and mournful.*

Fig. 2. *Cherry Manga, Second Life, 2013. (Photograph courtesy of the artist). The sequential scenes which Cherry Manga created interpreted the oral tradition of the tale from a novel vantage point.*

Both Alpha Auer and Cherry Manga utilized three dimensional humanoid or hybrid animal/human models that were meant to provide visual clues to the unfolding of the tale. In Alpha Auer's case these figurines were not placed in such a way that they would provide exit and entry points. There was no clear beginning or ending, instead visitors entered the story at a juncture where it was already at its peak point or even at a point of no return. Consequently it was entirely up to the visitors to construct a story around a central stage that showed an impaled and dying wolf who was being mourned by his family. Further figurines that depicted a number of rather scary LRRHs were scattered around the dark forest in a manner that was meant to accost and unsettle the wandering visitor. Since Auer's story was not a story in the truest sense of word, but instead centered upon the visualization of a general concept of human cruelty to animals, that took its symbolism from the tale of LRRH, this non-linear setup worked well in her case.

Conversely, Cherry Manga's installation was comprised of four sequential scenes that followed the plot of the French oral tradition in which the young girl initially fools/tricks the wolf through sexual overtures, after which she sleeps with him and then murders him; thus, taking her fate into her own hands. In Manga's installation the three dimensional figurines were used to stage tableaux in which the encounter between girl and wolf, leading to a dance and sexual intercourse were depicted, all of which led to a murder tableaux which symbolized the emancipation of LRRH.

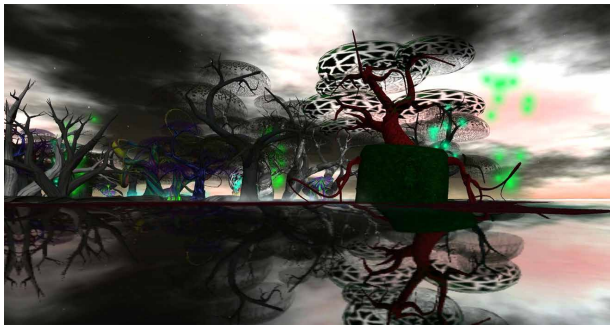

Fig. 3. *Soror Nishi, Second Life, 2013. (Photograph courtesy of the artist). Rather than delve upon the specifics of the tale Soror Nishi chose to look at the environment, the 'Enchanted Forest,' in which the story unfolded.*

The third artist, Soror Nishi, followed a distinctive course by focusing not directly on the tale itself, but instead upon the backdrop against which the tale was set. While Alpha Auer, too, devoted much of her building to the creation of a dark and ominous forest in which her story unfolded, Nishi placed the 'Enchanted Forest' at the very center of her artistic investigation, considering the flora of the woods almost as protagonists in their own right.

Residing particularly in the realm of Germanic folk traditions, the 'Enchanted Forest' is contradictory in its very essence - both a temple of holiness, as well as the abode of darkness, of evil and of danger. For some thinkers it stood as a model of immortality and regeneration; for others it perfectly illustrated the Darwinian struggle for survival. The forest has formed the context for heroic quests, a place where life had to be wrenched from the dark, foreboding wood with bravery and effort. [3] *"It is in the forest that fairy-tale characters often lose their way and then find themselves again as their life's purpose becomes clear since the fairy tale forest has the power to change hearts and destinies,"* [4] and *"menacing brambles and undergrowth through which the heroes have to pass could symbolize a deep-rooted psychological past that has to be cut through,"* [5] as is also evidenced in Max Ernst imaginations of the forest from a Dadaist and surrealist perspective, bringing forth paintings such as "Pataphysical Forest," "Great Forest" and "Last Forest."

Just as Max Ernst did not attempt to paint his forests by depicting biologically correct fauna, Soror Nishi and Alpha Auer also constructed their forests out of plants that were based upon their subconscious imaginings. Nishi says that Virtual Worlds present her with an opportunity to experience a subconscious dream world while conscious. According to Nishi *"the computer screen has more in common with stained glass than with photography or film and the extensive attempts some make to populate this new world with 'realistic' copies of the Old World show a colonial tendency to ignore the native culture and superimpose a pre-formed visual style on this new medium. This may be due to a fear of the new, or simply a lack of courage. Hopefully, Time will eradicate this anachronistic tendency."*[1]

4. CONSTRUCTING NARRATIVE IN A VIRTUAL WORLD

There is a similarity between the oral tradition of storytelling and a narrative installation in the virtual world, and this resides in the meeting of the story with a pre-informed audience who nevertheless fully expected to hear the tale being re-told in a novel and unexpected manner. This is evidenced in the work of Parry and Lord who researched the bards in the former Yugoslavia, looking for clues to the code for understanding the Homeric epics. [6] Through this study they attained an understanding of how the oral tradition of storytelling operated before the written language became dominant. Within this tradition the listeners or community already knew the material that was to be told. Therefore the storyteller's art consisted of how to compose a story in the here and now, in a novel way, for the current audience. In such a context it appears to be evident that following a linear structure in which events succeed one another will not work. Accordingly, the storyteller does not start at the beginning of the story, but perhaps in the middle, as is also the case in the Homeric epic of "the Iliad," which does not commence at the actual beginning of the event – the divine party on Mount Olympus – but instead starts with the wrath of Achilles, an event that actually happens much later in the epic.

Narrative installations in a virtual world appear to work in a similar way in that visitors can wander in and out of the installations without following a linear direction, entering the story from any point of its unfolding, or indeed at a point of no return; as has already been previously discussed.

What is equally significant however is that when we enter a narrative virtual world installation, we seem to inevitably enter something that will create an experience which lays the foundations for storytelling and retelling. An excellent example to this phenomenon has been provided by the avatar Saveme Oh who improvised extensively in Cherry Manga's installation of LRRH. Her progression was documented by the avatar Marmaduke Arado, through snapshots that were subsequently published on Oh's blog. When these shots were placed in a specific order which was accompanied by Oh's personal text, it was seen that she had brought forth an entirely new tale which emerged out of the original material that had been provided by Cherry Manga.[2]

All of this can also be related to Walter Benjamin, according to whom storytelling gives us "*the ability to exchange experiences*". [7] In this context it is also noteworthy that Benjamin saw how an excess of information might create poor conditions for storytelling since a story has its basis in sensory involvements and when a story is being told, these are converted into the listener's experience:

Every morning brings us the news of the globe, and yet we are poor in noteworthy stories. This is because no event any longer comes to us without already being shot through with explanation. In other words, by now almost nothing that happens benefits storytelling; almost everything benefits information. Actually, it is half the art of storytelling to keep a story free from explanation as one reproduces it. [8]

It is precisely due to this dependency on uniquely individual experiences that stories have a long life because this constant regeneration of experience posits that stories are meant to be perpetually retold. Thus, a story can only be based upon experience and not information, since information alone does not provide us with the prerequisites of perpetually rebuilding experience. In the case of LRRH it was things such as the choice of which protagonists to foreground, their depictions and attire, as well as the depiction of the environment in which they were placed, and finally the very non-linearity of the user's actions within this environment, that were expected to build the unique, perpetually re-generated visitor experience.

What is also important for a story is its ultimate dependency on a plot, which can also be defined as a deliberate design that helps to make a point with a story. According to Kieran Egan this resides upon a binary concept [9], whereby a story is always developed in relation to a conflict or a tension. The story sorts and structures its content by this tension; a well known circumstance through which binary opposites such as good/evil, greedy/generous, and ugly/beautiful make up the backbones of folk tales. In our project the plot, and its underlying tension of binary

opposites, was revealed in the title of the project, through the sentence which proclaimed that what the visitor was about to encounter was 'the other side of the story.' By this foreknowledge the needed tension was created even before a visit to the installations.

For Roland Barthes a story is not just a chain of events, but an intricate system of units and rules, consisting of a series of levels that together create meaning. In accordance with these units and rules the story can be divided into three levels: Level of functions, level of actions and level of narration. When it comes to the work discussed it may be beneficial to take a closer look at the level of function, which is the smallest narrative meaning-making unit, the essence of which it is to plant a seed that is harvested later in the story. Such functions can be divided into two categories: Cardinal functions that are open ended and lead to alternative consequences, in effect making the story a risky place to be; and catalyzer functions that are chronological and logical, and which therefore provide safe and luxurious places to be within the tale. To paraphrase Barthes: *"The catalyzer has a constant function which is [that] it maintains the contact between narrator and addressee."* [10]

Relating these Barthesian definitions to the artwork it can be established that Cherry Manga's approach involves the active usage of catalyzer functions whereas both Alpha Auer's and Soror Nishi's work incorporated cardinal functions: Although the four scenes that Cherry Manga created were placed on the land in a non-linear fashion, nevertheless the very fact that there were four of them and that they narrated progressive parts of the tale made it easy for visitors to follow the plot and the story's development since ultimately there was no room for doubt as to which scene followed which.

Alpha Auer's installation, on the other hand, was charged with cardinal functions since the installation featured only one central scene that was the apogee of a series of confusing events. The cardinal feature was emphasized by the fact that it was unclear as to who was the protagonist of the scene: Was it LRRH sneaking away, the mourning wolf family or the sacrificed wolf? Such key questions inevitably left the progression of the plot very much up to the visitor. The same can also be said of Soror Nishi's enchanted forest which presented a dilemma that stemmed from the very absence of protagonists around which a pre-determined sequence of events, or a plot could be constructed; again very much leaving the visitors to their own devices when it came to a satisfactory resolution of the tale.

5. CONCLUSION

One of the wistful charms of virtual output is its transience: The three installations were open to visitors throughout Spring 2013, and were visited by many avatars who took advantage of them to generate their own creative output, based upon what they encountered. In this regard, to judge by the amount of work generated by others, the project has turned out to be a success. In early summer however, the installations were removed, to make place for a novel project of Mimesis Monday's. The three artists and the curator of the project are continuing their creative explorations in the metaverse.

Creating narrative environments in virtual worlds remains on the agenda of all of them since this is a subject that begs for much further investigation, both from a practice based, as well as a theoretical standpoint. Indeed the utilization of virtual worlds for storytelling purposes may turn out to be one of the main usages of these environments, given how easily spoken/textual content can be transformed into, as well as supplemented by, visuality and sound within them; potentially emerging as the three dimensional, virtual continuation of the historically well founded tradition of the illustrated non-textual story book. A further, parallel development may also be the provision of a platform that can revive the oral tradition of storytelling based upon experience, further enriched by the visual/audio content that are intrinsic features of these worlds.

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The Ambivalence between Distance and Intimacy: Active Contemplation and Connection in David Rosenberg's and Glen Neath's *Ring*

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Abstract. Drawing from Jacques Rancière's principle of aesthetic distance in *The Emancipated Spectator*, I apply the idea of contemplation as an active mode of spectatorship to a field research I have conducted in London in the spring of 2013. I engaged with audiences of a pitch-black performance in afterward conversations and correspondences to explore our collective experience of this disorientating, technology mediated performance. While compiling our exchanges, I try to sustain the idea that spectators were oscillating between distance and intimacy during the performance.

1. ENGAGING AUDIENCES IN IMMERSIVE PERFORMANCES

Immersive performances are often associated with audience responsive frameworks that promote the idea that audience participation needs to be enacted or verbalized. Spectators are navigating through an enclosed environment that is seemingly affording opportunities to enter in relation with the performance (the or site, the performers and/or the technology). They may play with the set or with objects, converse with the performers or perform actions, wander freely across different spaces, etc.; all of which are creating the impression that spectators are exerting a certain control over this environment and over their experience, therefore engaging with the performance. In many instances, however, responsive frameworks have proven to be close-ended and manipulative, prescribing behaviours rather than fostering genuine exchanges between the performance and the spectators. Unspoken rules guide the spectators towards certain reactions and towards speaking about particular topics. As soon as spectators attempt to cross the boundaries of the frame previously set by the creators, the fictional world of the performance and the real world inevitably collide and immersion is temporarily or permanently unsuccessful.

Audience responsive frameworks do not necessarily foster the engagement of audiences with the performance and dissension occurs under many aspects, notably by spectators performing against their will, hence without conviction. Moreover, engagement could be considered as something that thrives mainly after the performance, in the rich exchanges happening between spectators among themselves and between spectators and artists. During those exchanges, spectators and performers take fully control of their own experience, by returning to it and by framing the way that they will keep its memory. They are therefore able to engage with the posterity of the performance, unfolding it by debating on its impact on society and securing its relative afterlife, at least among a circle of people who have attended or who know someone who has attended the performance.

2. AESTHETIC DISTANCE AND CONTEMPLATION

Immersive performances that are not audience responsive can provide more introspective experiences, during which audience members can develop their private responses to the performance without feeling the pressure of having to perform those publicly. Immersion needs a transition time to pass from one world to another, as well as it demands a mental space to process the experience. A contemplative mode of spectatorship can facilitate the unfolding of one's experience, allowing for moments of complete immersion as much as moments of withdrawal, which are happening at different times for each individual.

In *Le spectateur* émancipé *[The Emancipated Spectator]* (2008), French philosopher Jacques Rancière questions the drive to make spectators 'do something' and challenges what he considers the fallacy of the opposition between active and passive spectatorship. For him, there is no form of passivity in spectatorship as he points out that reception itself is an activity of translation demanding an effort of perception and appropriation. According to Rancière, the highest form of empowerment lies in each spectator's private world:

The collective power shared by spectators does not stem from the fact that they are members of a collective body or from some specific form of interactivity. It is the power each of them has to translate what she perceives in her own way, to link it to the unique intellectual adventure that makes her similar to all the rest in as much as this adventure is not like any other. [1]

Collective empowerment in spectatorship is for Rancière a matter of individual agency. To engage with the performance, each spectator needs to be given opportunities to produce his/her own mode of perceiving and connecting with the event. For Rancière, this is only achievable through what he terms as the principle of aesthetic distance:

[A]esthetic distance, which does not consist in the ecstatic contemplation of the beautiful and thereby work mischievously to conceal the social underpinnings of art and dispense with concrete action in the 'outside' world. Instead it was first used to refer to the suspension of a determinable relation between the artist's intention, a performance in some place reserved for art, and the spectator's gaze and state of the community. This is, after all, what critique means: separation. [2]

For Rancière, the concept of aesthetic distance is key to the spectator's emancipation: this distance provides a space that enables for each spectator's idiomatic mode of perception to develop a creative and critical response to the artwork. To be contemplative is not to become passive, but rather it is to take a critical distance from the performance to become able to process the event. Through the principle of aesthetic distance, Rancière re-establishes contemplation as a mode of critical engagement.

Although Rancière strongly associates contemplation with the spectator's gaze and vision, contemplation could be considered as a state of mental distance towards an artwork or event, therefore addressing the whole sensorium. It provides a model for a creative and critical mode of engagement with art, breaking with the widely spread binaries of activity and passivity or empowerment and alienation.

3. CONTEMPLATION AND CONNECTION: DISTANCE AND INTIMACY

Spectatorial agency could hence be considered as the audience's capacity to engage creatively and critically in the reception of a performance. Contemplation provides a model for this type of engagement during a performance, but may as well be a reflective and introspective state for spectators returning to the performance in memory. Moreover, spectatorial distance or contemplation is not constant and happens intermittently throughout and after the performance, allowing for moments of deeper connection with the here and now of the performance.

Those moments of connection are maybe the most difficult to seize. They seem to be produced through a heightened state of attention towards the presence of performers and/or of other spectators, therefore connecting with the actuality of the performance. They generally do not happen at the same time for everyone, although reports on moments when a whole auditorium seemed mysteriously all connected

are pervasive in audience and theatre studies. Connection seems to create a level of intimacy between participants of a performance, blurring the distance between them and producing confusing affects, because those affects are shared collectively. Performances that are very successful at creating those levels of intimacy are often also successful at fostering a contemplative return on the spectator's experience in afterward conversations. Spectators are hence constantly oscillating between those moments of connection and others of contemplation during the performance, creating ambivalence between distance and intimacy in their experience of the performance.

In order to better understand the process of this ambivalence, I have undertaken a field research with audiences of immersive and site-specific performances. Immersive and site-specific contexts are generally providing a high potential for intimacy and connection, but are more rarely regarded as contemplative experiences. Nonetheless, distance is inherent to spectatorship even if only experienced briefly and immersion, whether it is in a found site or in a constructed environment, can provide a rich type of contemplative experiences. While being immersed in certain sites or environments, spectators may encounter the ideal contexts to withdraw in their own thoughts, become introspective and explore their own modes of perceiving the performance, according that the framework of the performance allows for so. Immersive performances that play with the blurred frontiers of reality and fiction are usually more successful at creating those moments of contemplation, because they constantly demand that spectators take distance to re-evaluate the limits of the fictional world and reflect upon their own perceptions.

4. DAVID ROSENBERG'S AND GLEN NEATH'S *RING*

In March 2013 in London (UK), I have attended David Rosenberg's and Glen Neath's *Ring*, a pitch-black performance that worked with binaural recording. The audience was immersed in complete darkness for 50 minutes, listening to a three-dimensional recording that completely blurred the distinctions between the real space in which we were sitting and the imagined spaces that were suggested by the narratives coming from the headphones. Although the performance did not require spectators to perform any action or speech, it nevertheless fostered a very complex form of individual participation through contemplation and connection. I was able to evaluate a certain range of audience members' experiences of *Ring* by using a methodology of audience research that I had first developed at Concordia University for my own work as a site-specific artist. I engaged with audiences in afterward conversations and correspondences, organizing group discussions and sending open-ended questionnaires, in an attempt to facilitate for the spectators and for myself a reflexive and introspective return to the memory of the performance.

The audience completely filled the Council Chamber at the Battersea Art Centre, where rows of seats were arranged in two halves facing each other. In the middle, where the facing seats were meeting, a lone performer walking with a crutch was pacing from side to side the length of the room. We were handed a pair of headphones just before entering the room and were told to put them on as soon as we sat on a chair. The rhythm of the walk of the injured performer resonated in our covered ears along with the humming of the audience settling in their seats; it seemed like the headphones were transmitting the live sounds of the room. The performer introduced himself as a host, or guide "leading proceedings", and asked all audience members to stand up and go sit next to people they did not know. Once the shuffling of the room was over, the performer warned us about the intensity of the darkness to come. He then ran a darkness test for about a minute, after which people could leave if they felt too uncomfortable under this unusual and absolute deprivation of light. Sometimes, spectators left after the test, other times, they stood up right in the middle of the ongoing performance and, following the performer's instructions, lifted their hand and yelled "help" to have a staff member help them exit the darkened room. The immersion was beyond most people's life experience of darkness.

When darkness came back for good, falling

slowly upon the audience, the live transmission of the room's noises imperceptibly switched to a recording. In the headphones, the recorded voice of the performer, whom we could still hear walking with a crutch, told the audience that we would soon have to rearrange our chairs into a circle. Although this action seemed highly impossible given the size of the audience, we then heard some people siting next to us moving, after the performer had told them to. Those actions were only taking place in the headphones, but thanks to binaural recording, the auditory illusion gave such a sense of spatial orientation that the fictional, non-existing audience members shifting their chairs became extremely tangible. Most spectators were generally confused about whether or not people were actually moving around them. Very cleverly, just as some spectators might have started to try to move their chair, the performer's voice came to whisper in our ear not to move. The technology was so acute that many spectators reported to have felt his breath on their necks.

Not every spectator discovered that the headphones had switched to a recording. Some remained convinced that some events were occurring live, others that there was more than one recording and/or that the one they were hearing was singular. Even for those who unveiled the trick from the beginning, spatial disorientation was still effective. Spectators had to constantly reorient themselves with their embodied memory of the room to contrast with the one suggested by the headphones. Having to sit next to strangers certainly added to the confusion, in addition to enabling the existence of the fictional audience members.

The located voices of the characters and their movements in the recording reshaped the room where we were, by pretending that we were sitting in a circle. The performance space became flexible: for some spectator the room had shrank because the size of the group in the recorded narrative was smaller than the real audience. Moreover, we had been cast in a character known of other characters in that fictional group and the intimacy suggested by the narrative might have contributed in creating a feeling of proximity. For other spectators the room had extended, because of darkness opening onto an infinite space. For myself, it felt like the room had two dimensions: the real space in which we were siting and the fictional space of the narrative, both worlds flickering in my perceptual orientation in space. I even lifted my headphones once or twice to ground myself back into the Council Chamber, in an attempt to reconnect with the 'real' world.

From a technology mediated spatial disorientation, the narrative went to a suggestive description of spaces, with the characters describing nightmarish hotel room and seashore memories. For many, this was a frustrating switch, as they would have preferred to carry on experiencing the mediated disorientation in darkness. But, as I noticed for myself, what was the most frustrating was to feel forced to imagine those spaces. Even if I did not want to leave the darkened room where characters were sitting in a circle, I had to project myself into the hotel room, because the suggestive power of the description was stronger than my will. The seashore seemed to have produced an even stronger displacement than the hotel room, since in a country like the United Kingdom, spectators hold very vivid memories of the sea.

Darkness became the site of an infinite range of projections, from frightening experiences to exhilaration and eroticism. Had you experienced a traumatizing event involving darkness, the performance could become unbearable. In contrast, the whisperings in the dark to the spectators' necks connoted intimacy, if not erotic proximity. For many spectators, this experience of darkness was of pure excitement, a mix of fear and glee that got compared in group discussions to an amusement park ride. The parallel between a ride and this performance informs about the eeriness of the spatial disorientation produced by binaural technology, especially given the fact that spectators sat straight on their chairs for almost an hour.

The completely darkened space had the potential to remind of deathtraps, of sinking into dark waters or, in contrast, of resting in a nurturing, calming void. The evocative power of darkness has enabled spectators to adapt the space according to their own personal projections or desires. Those who preferred an introspective experience would therefore withdraw into their own thoughts and reflect upon their relation to darkness, whereas

those who sought for connections felt very involved in their relation with the characters surrounding them. Darkness enhanced the performance's flexibility to accommodate each spectator's idiomatic modes of perceiving the experience.

For instance, one spectator was convinced during the whole performance that she was the only one hearing this particular narrative in the headphones. She felt like she had a privileged relationship with Michael, the main character with a crutch, and reported being extremely disappointed when discovering at the end that the recording was standard for everyone. She felt strongly cheated, but then related this feeling to personal experiences in relationships. Darkness, in this case, contributed in enhancing the potential intimacy between the performer and this spectator, strengthening the connection that the spectator was already seeking for. Darkness provided a space in which she could project her desire for a deeper encounter.

Another spectator recounts that she really looked forward to the performance because she wanted to ponder on her experience of darkness:

I think it's very rare I'm in complete darkness, especially in London and UK in general where we are always surrounded by strangers and light/light pollution. Even in smaller towns I never feel I am in darkness – because then there are stars. So this darkness is something I have only experienced in staged situations actually. I found it exciting, and want to experience it more, in a meditative way. [3]

She further adds that the experience was soothing for her. The performance provided an unusual context of sight deprivation within which she could more easily withdraw from everyday life and explore a metaphysical space. Darkness, as an unlimited, unbounded space, has a strong power to provoke meditative contemplation. Moreover, spectators who experienced a more distant, contemplative state were generally more critical of the performance's narratives in their answers to the questionnaire, expressing a wish for more complexity and originality in the stories.

The performance's narratives were open-ended and very suggestive and the immersion in darkness contributed to enhance this evocative quality of the text. It was not following a straight conducting line but played instead with the idea of taking the spectators on a twisted dreamlike journey, where they would encounter their own projected fantasies. From the beginning of the performance, the voice of Michael encouraged the audience to start exploring the potential of darkness: "The dark though is never really empty, is it? It can be full of unprompted images. Perhaps for some of you it can seem almost tangible, like a thick curtain, which can feel suffocating." [4]

Many spectators reported to have felt oppressed in the dark, one literally wrote that she was suffocating and I wonder how much those words pronounced by the guide-character might have directly influenced her reaction. Moreover, darkness seems to heighten the receptivity of some spectators, to a point where some of them might let their own personal narrative take over the performance's narratives.

One spectator was so intensively immersed in the final sequence at the beach that his memory of this moment actually transformed the narrative from the script of the performance. At the end of the performance, Michael's voice asks us to imagine that we're on a deserted beach. On a jetty, a little girl is playing. In a worrying attempt to make sure she is okay, our character scares the child and she falls into the water. We fail to save her because we twist a knee on a broken plank on the jetty and the little girl disappears into the deep water. This spectator got so involved into this nightmarish narrative that he believed our character deliberately pushed the child into the sea and reported on being horrified with guilt from fictionally committing this act. During one group discussion, we all debated on whether or not our character was pushing the little girl at the end, as this spectator was so utterly convinced that this was in the actual script. After meeting with the author and reading his script, I could confirm that this murderous ending was only coming from this particular spectator's creative and receptive mind.

More generally, I believe that spectators were oscillating during the performance between a state of contemplation and one of seeking for connections with the performers, the performance and/or the other spectators. The ambiguity of the real presence of audience members

confronted to the auditory illusion of the physical presence of fictional characters contributed to this oscillation. Darkness had the power to immerse the audience deeply into their experience of the environment, while the limits of this fictional world colliding with memories of the real theatre space has introduced a distance in the experience. Hence, darkness brought flexibility to the performance, allowing spectators to navigate from contemplation to connection, distance to intimacy, according to the variability of their perceptions and of their creative and/or critical response.

5. ENGAGING THE AUDIENCE/ ENGAGING *WITH* THE AUDIENCE

The spectatorial experience of *Ring*, which did not require spectators to perform any action or speech, enlightened the complexity of the exchanges happening between the spectators and the performance by underscoring their occasional resistance to the narrative, their withdrawal in contemplation, their private creative responses and a certain level of complicity and intimacy.

Immersive environments that are not audience responsive may foster a rich contemplative distance that engages spectators in producing a reflexive and critical response, as long as the framework of those environments allows for flexibility. Engaging the audience simply requires providing an environment that is sufficiently suggestive and open-ended for spectators to find a space where their own creative and critical mind can perform.

The strongest form of engagement might as well simply happen after the performance, in the way that the memory of this event gets carried away. Spectators spreading the word, debating in cafés and bars after the performance, writing about it on blogs, critics and scholar publishing reviews and papers, etc.: those are very dedicated ways to engage with spectatorship. I have attempted during my fieldwork in London to explore different ways of encountering audiences in order to produce a research that is inclusive of a variety of voices while facilitating a collective contemplative return to our memory of *Ring*.

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Postdigital Art: building appropriable information apparatuses

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Abstract. The interface is leaving the desktop, making it possible to access information everywhere and in everything, through the developing systems of ambient informatics and ubiquitous computing. This new interaction paradigm is being debated: it increases our collective intelligence but at the same time can be a perfect accomplishment of the Control Society. The aesthetics of matters-of-concern replaces representation for the tracking of the process that gives form to our reality in each moment, while Postdigital Art produces works capable of merging virtual and physical spaces. Both these related fields show and articulate the complex informational system embedded in our reality making it appropriable and subject to profanation. This visualization operation displaces the capacities of the system of ubiquitous computing, from perfect control to an increasing capacity of individuals to intervene and perform in their environment by interacting with it.

1. INTRODUCTION

"*The digital moment has passed…the interface is disappearing, or certainly migrating, from a cabled, box-bound environment to a wireless multi-sensory, multimodal mobile form*" [1].

The interface – the space of encounter and translation between the machine and human codes- is migrating beyond the screen to all our physical space, embedded in the objects and surfaces of our daily environment. This has been accomplished by different research fields – Augmented Reality, Ubiquitous Computing and Ambient Informatics, Context-Aware Computing, Physical Computing and Tangible Media- that merge the world of information and the world of things, resulting in a new situation or set of circumstances that Adam Greenfield designates with the neologism *Everyware* [2]. *Everyware* is not only a new system or set of technologies but a new interaction paradigm. In this information is not only delivered from everywhere and at any time but from all things, and always provided in a manner appropriate to our location and context. This new paradigm is becoming materialized in an increasingly pervasive environment populated by networked smart objects capable of gathering, retrieving and processing information. The imperceptible and omnipresent *Smart Dust* that Derrick de Kerckhove [3] cites has proliferated from our bodies –wearable computing- and intelligent buildings to the public space.

This ubiquitous technology is becoming a new Apparatus, as defined by Giorgio Agamben, based on his interpretation of Foucault's use of the term [4]. An apparatus is anything that has in some sense the capacity to capture, orientate, determine, intercept, model, control or secure the gestures, behaviors, opinions or discourses of living beings. This is a strategic relation maintained by the power, supporting, and supported by, of certain types of knowledge and extended between heterogeneous elements with which we access our world. This Apparatus can redefine our concepts of space and time, identity and otherness, citizenship and society.

The *Smart Dust* is one of the resources of the Augmented Mind, being able to sensorize our environment, increasing the potential of the shared and disseminated intelligence detached

from humans, thus increasing our knowledge and our agency in the world.

Nevertheless, at the same time these intelligent devices, able to retrieve, process data and store it on networked databases, are leading to a highly relational and fuzzy system that can be blended in our daily routines in an imperceptible way.

Ubiquitous Computing was first proposed by Mark Weiser [5] as a calm technology, able to blur itself in the environment. Projected for assisting us in our daily tasks and reducing the information overload that characterizes the networked society, Ubiquitous Computing has to increase our efficiency anticipating our behaviour while vanishing into the background. Following this logic the Apparatus becomes a seamless network. Attached to our physical space it produces responsive environments where we are unconsciously engaged. In these spaces we are not really users but new data sets integrated into the system. By not being users in these systems, we cannot acknowledge them from a *minority status* [6], that is, as a tool that requires us.

The systems of this new Apparatus are constructed following the logic of modularity that characterizes Internet. They are assembled from multiple components, resulting in an emergent whole that cannot be deduced by the addition of its parts. Due to this characteristic neither can it be acknowledged from a *majority status* [6], from the point of view of the rational and systematic knowledge that the engineer holds.

This lack of perception can lead to a situation where our will and agency are substituted by algorithmic processes with the result of a loss of liberty and confidence in our capabilities. At the same time, as it is not subjected to our experience, the Apparatus cannot produce the negotiation between the human being and the systems integrating it, the subjectivation; a process where a relation is established that makes appropriation possible.

The Apparatus can become a perfect accomplishment of the Control Society defined by Deleuze [7]. Not only because of its large capacity to gather data about individuals allowing the tracking of anybody and extending surveillance power beyond all time and all open space, but also because of its power of homogenization. Control Society substitutes the detention of nomadism that characterizes the Disciplinary Society for an absolute deterritorialization. The space becomes homogeneous and subject to a continuous movement of coding and recoding, without any stable set of capacities that can be appropriated by individuals to form an identity and an agency.

What is under discussion here is how Aesthetics can make the Apparatus appropriable and deliver it again for the common use. For this it is necessary, on the one hand, to make it acknowledgeable with the inclusion of aesthetic qualities in the intelligent devices that produce and transport the data. And, on other hand, it is necessary to develop visualization strategies that inform the dataspace to turn its functional qualities into matters of expression that enable their functions to change into new ones. It becomes necessary to make room for new ways of thinking and visualising the processes that generate the apparatus and which can make it possible to relate them to aesthetics and politics and to redefine our relation with them. The Aesthetics of matters-of-concern make it possible to return the apparatus to the collective action. At the same time Postdigital Art and its ability to create works where digital and virtual space interact, will make the apparatus appropriable, liberating its use and returning it to the commons.

2. AESTHETICS OF MATTERS OF CONCERN, CARTOGRAPHY OF THE APPARATUS

The Apparatus, the power that sustains it and the society that it produces, are not a virtual and pre-existent whole, but they have to be composed and maintained in a process that includes actors - human and non-human- and mediations. The movement that assembles the social from multiple heterogeneous elements, groups and agencies always generates traceable data. The Actor Network Theory [8] provides us with the methodology for tracking this movement, considering both, the actors and the networks that engage them, at the same time. Nowadays the digital media producing the technological Apparatus has increased the capacity to track different events.

The Apparatus has been developed with different technologies related to the digitalization

and the Internet. The Net, able to link different contents and people and transporting information across geographic boundaries evolved from the hypertext to the web 2.0 or web as a social platform. The web as a platform of services is participative, improving itself with the contributions of its users that are collected in databases. Later the semantic web and the use of metadata have enabled the linkage between different databases improving the capacity to create the knowledge of the Collective Intelligence. It increased with data, not only coming from the interactions of users with the net but also from the networked smart objects that make up ubiquitous computing. This system, while at the same time producing the Apparatus formed under the *Everyware* paradigm, has also produced an ever-increasing datascape, allowing the tracking of increasingly more events. This technological evolution has constituted a material environment capable of underlining the associations composing our reality, thus visualizing the actual virtuality.

Latour proposed the *Oligopticon* as a media to track and inform the different systems of relations performing our reality. It is able to navigate the datascape following the deambulation of a chosen reference and drawing the net of actors and mediations giving and maintaining its existence. The *Oligopticon* can map the different actors' nets that compose our territories, the multiple assemblages or modes of existence shaping our behaviour across the space or giving meaning to our lives. The *Oligopticon* is a really narrow vision of a fully connected whole, a trace resulting from the tracking of all the linkages that make an actor behave, not being able to contain any element from outside this net. *Oligopticon* is the opposite of *Panopticon*, due to the fact that it does not allow an exterior detached from the trajectories described by the actors; it cannot see everything, but has a really good insight from its limited view. Not being able to show the world as a whole it presents the space as a multiverse, containing multiple modes of existence where after the superposition of different *Oligopticons* an uninformed remainder is always left over; the *Plasma*.

The generalized use of social networks and the proliferation of networked devices have exponentially increased the quantity of geolocalized data. It has led to a new cartography based on an interactive map that tracks data from the physical world in real time. The web project *we are data* by Watchdogs shows the multiplicity of devices gathering data from the urban space, from surveillance cameras to geolocalized tweets. The data deluge produced by these devices has proportioned new traceable events enabling the superposition of new *Oligopticons* by different sciences as city planning, sociology, economics and so on. In addition to the *Oligopticons*, proposed in the work *"Paris: invisible City"* [9], that shows static urban structures such as water, electricity, telephony, traffic, meteorology, geography and town planning, we can now apply it to show the dynamic use of the space and structures by the citizens by means of tracking transport tickets with an RFDI pin, or the data sent from smart phones or GPS cars, for example. The project *Real Time Rome* developed by the Senseable City Lab from MIT on 2006 is based on an interactive map with all the *Oligopticons* created in a city. This work in progress has also been developed in Copenhagen (2008) and Singapore (2010) showing the increasing complexity of our urban space and the big variety of human and non-human actors operating in it. These actors' networks can determine our mobility across the space changing our insight of it as shown in the project, from the same lab, *Trains of Data* (2011), an interactive visualization of the changing topology of France according the accessibility to different cities by the SNCF's public trains. With a similar goal the project by Benediky Grob and Bertrand Clerc, *Metrography- London tube map to large scale collective mental map,* shows the changes produced on the topology of London by the use of the tube.

Another use of *Oligopticon* is the tracking of a daily use object. This shows how non-human agents become actors able to compose a net. The projects *Trash Track* (Senseable City Lab, 2009) and *BackTalk* (Senseable City Lab, 2011) insert small, smart, location aware tags to different refuse products and obsolete technologies, tracking the trajectories of these objects across different nets. The local net of the removal-chain and the global net extend between different countries and groups of people due to the

reuse of the obsolete technological devices in under developed countries. These *Oligopticons* rematerialize the territory not as a limited and administered geographic space, but as a list containing all the agents and mediations that we are engaged with at a specific time.

Finally the *Oligopticon* can show in which events and conversations we are engaged, which nets we adhere to form our subjectivity, downloading the capacities that allow us to interpret our environment within a Collective Intelligence. Some examples are the *Urban Mobs*, a project by Faber Nobel and Orange showing the phone calls realized during different mass events as the 2008 European Final in Spain and the 2008 Music Festival in France. Or the *Newk-Twitter Conversations* project by Santiago Ortiz, visualizing the conversations in the social network Twitter.

Oligopticons allow visualizing the ontology of the Actor-Rhizome, it means, our world as a composition process across the movements and linkages of different actors, and substituting the Aesthetics of matters-of-fact for the Aesthetics of matters-of-concern [10]. The Aesthetics of matters-of-fact shows a world populated by individualized objects that can be represented mimetically. It is the aesthetics implied in the representation and the construction of objectivity; the product of a historical process of codification and a staging of what has been closed into a black box. Opposed to the Aesthetics of matters-of-concern, the black box of these objects opens to show them as projects. It presents things as reunions, moving in all directions and spilling over its boundaries, unveiling the fragile grid that gives existence to them. More than simply being there the things of concern have to be liked, appreciated, mounted, experienced and proved.

The Aesthetics of matters-of-concern informs us of a new relation with our world and our technology. The world is not a consistent whole, but the product of a collective process of composition that assembles heterogeneous elements. It is the product of a process where things reach their existence and endurance taking part in different nets of events and mediations. Emancipation is not a detachment of our technological determinants, but the conscious decision to be well-attached. It involves knowing the mediations that we have to be linked to in order to take part in the collective project to compose our world and our subjectivity.

3. POSTDIGITAL ART, PROFANATION OF THE APPARATUS

Postdigital Art explores the dominant paradigm of the digital era, *Everyware*, reconsidering the relations between the technologies that materialize it and the humans. To attain this goal it proposes the interplay between the different systems, modes of existence and experience of our reality. The works produced under this paradigm are capable of merging the physical space with the datascape, visualizing and rematerializing the data space and returning it to the physical space. The data space and the technological system that produces it both appear as actors implied on the composition of our world, both become subjects of experience capable of releasing it for its appropriation.

Between the artworks developed under this goal we can find different ways to inform and reconsider this relation.

Firstly, there are numerous art projects and social applications that bring to the general public the tools for constituting their personal *Oligopticons*, making their movements and experiences visible and sharable across the space. At this way the devices used on the systems producing *Everyware*, mainly GPS tracking and data bases are appropriated to follow and share the constitution of our own territories. Producing our own data we can rematerialize our engagement on the composition of our collective space. In this line we can quote *Liquidata*, a tangible interface, developed at the *University of Applied Sciences in Potsdam*, which allows downloading and visualizing on a map the data gathered in our smart phones during our walkabouts across the city. Our information on the map can be assembled with the data by other users.

Secondly, there are projects that materialize the different data fluxes around us in public space, by means of interactive installations and architectonic structures. In this case ubiquitous technologies are appropriated in an unexpected manner, giving place to an aesthetic experience of not perceivable realities that we are engaged

in each moment as communication resources, energy consumerism, atmospheric conditions, traffic and so on. Among them feature the project by Tima Arnall, Jorn Knutsen and Einar Sneve Martinussen, *Immaterials: Light paining Wifi.* It consists of a four-metre-long stick equipped with lights that measures the Wifi signal, changing the number of lights turned on according the signal strength. Conducted across space and captured in long exposure pictures it draws this communication net in space. The project *Every One Every Day* by the Kuuki group consists of a 27cubic-metre cube –the quantity of CO2 produced and released in the atmosphere daily by the city of New South Wales in Australia- situated in the public space. It changes its colours according to the variations of the city's energy demand in real time. The work *Flux,* by Stefane Perraud, sited on the Gare de L'Est in Paris, attaches interactive lights activated by the variations on the flux of passengers to the rose window of this building. Finally the installation *Signal to Noise* by Lab[au], is an information panel with rotating split flaps, associated to an algorithm that tracks different radio signals looking for an understandable world to be reproduced on the panel.

Finally, we find projects more related to the internet of things and digital fabrication that appropriates the smart objects by the *Everyware*. Among them feature projects that bring to the citizens open source and affordable devices to sensorize and collect data from the environment. We can mention, among others, the *Copenhagen Wheel* (Senseable City Lab, MIT, 2009) or the *Data Driven Citizens Kit* (MediaLab Prado, Madrid, 2012). The goal of these projects, more related to citizens' science than art, is to engage the citizens in the recollection of data. Allowing them to know and participate actively on the improvement of ecology and quality of life of their environment.

Finally, concerned with the digital fabrication and dissemination of 3D printing we find the production of tangible data shaped in different kinds of objects. An appropriation that metaphorically rematerializes unadvertised *Oligopticons* engaging us, in daily use or wearable objects that we can effectively adhere. In this line: Trevor Hogan uses the data produced by the Ireish public debt to create vessels, and Mitchell Whitelaw uses weather data to produce a bracelet that shows the variations in the climatology of the city of Canberra. Finally the *Emoto Data Sculpture* produced by Studio Nand, Moritz Stefaner and Drew Hemmet uses the data collected by the application *Emoto*. This application gathered and visualized the communications concerning the London Olympic Games; the archive of this data has been materialized in a complex interactive sculpture showing different communication patterns.

All these projects not only materialize the datascape around us making it visible, acknowledgeable and a subject for experience, but also constitute Profanations of the Everyware apparatus. Profanation "*is the counter-apparatus that restores to common use what sacrifice has separated and divided*" [4]. Agamben uses this term to denominate the operation that returns to common use what has been confiscated by any form of power. This operation starts with the possibility of perceiving and understanding the apparatus, to subjectivate it establishing a relation where it is interiorized, allowing its use outside the genetic inscription on a specific sphere. Liberating the apparatus from its obliged submission to a finality it becomes a pure medium and can be returned to the praxis [11]. In this way the interactivity and capacity to track the nets that shape our territories, inherent to the apparatus of ubiquitous computing can be liberated to the potentiality of play. Playing is a praxis not subjugated to any utility, a free movement capable of establishing new connections between different systems, linking them with new anthropological, biological, spiritual, aesthetic and other contents. A creative praxis may also connect with the *Plasma*, the not yet informed reality remaining in the net interstices, thus leading to new processes to compose our reality.

4. CONCLUSION: APPARATUS AND THE COMPOSITION OF THE COMMON WORLD

Apparatus are not mere accidents in which humans are caught by chance, but are rather rooted in the very process of humanization. The apparatus is the set of rules, processes and instruments with which human beings construct

their common world. The ubiquitous technological systems created under the paradigm of *Everyware* produce a new relation between humans and their technological media. They are not merely tools that we can switch off or walk away from, but a new component disseminated and integrated in an imperceptible way in our environment. It creates a new context where we are unaware of being engaged and monitored, starting a set of processes that takes part in our daily routines and our decision process. The capacity to produce and store data, tracking our behaviours and decisions, and following and linking it to other stored data about us, make these systems able to predict our behaviours and anticipate our needs and desires, becoming a barely controllable system.

The *Oligopticon* and the works of Postdigital Art give form to the data that makes this system perceptible and the processes where it is engaged. They build appropriable information apparatuses addressed to rematerialize the virtual through the operation of visualization and appropriation that returns Collective Intelligence and its large potential for increasing knowledge, to the management of humans. At this way we become aware of the new environment producing *Everyware* and can take part to the process of composition of our territories and subjectivity creating a common world.

The Aesthetics of matters-of-concern shows things as a result of a collective project with which we are engaged. Showing things as affecting us Aesthetics is no more concerned with Representation but with a process politically engaged and able to identify the best components to compose our world.

Politics is the process of gradually composing a common world. The free play of art liberates the medium as a field of human agency and thinking. In this way the Apparatus and its technological systems can be intervened in and appropriated for political experimentation. Able to connect different realities between them and with the not yet informed reality, the *Plasma*, it produce new ways of being and bring novelty to the dynamic equilibrium of the complex living and cultural systems.

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TARRYING WITH NATURE

TARRYING WITH NATURE

Human-cyanobacteria interaction: an interkingdom communication system centered on the stimulation, analysis and interpretation of physiological processes at the cellular and animal level

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Abstract. The interplay between animals and bacteria stands as a key process to recognize the structure of ecosystems and the way in which different organisms coexist. A potential approach to appreciate these relationships is the elaboration of inter-kingdom interaction systems. Heliotropika is a hybrid installation that creates an interface between people and cyanobacteria. The project integrates the photosynthetic activity of these microorganisms, the dynamics of environmental light and the bioelectrical activity of the participants. Using microscopic observation, cell culture and computer vision, this work renders the photosynthetic activity of cyanobacteria in the form of an organic structure. It also produces dynamic geometries of solar energy by analyzing environmental data. Simultaneously, this work transforms the activity of the nervous system of each participant into "light" to stimulate the cells. As a result, visitors and cyanobacteria influence each other giving subsistence to a dynamic feedback system.

1. INTRODUCTION

Although animals and bacteria have different lifestyles and belong to widely separated kingdoms, they are fundamentally linked in an organic way. The interplay between them stands as a key process to recognize the structure of ecosystems and the ways in which different organisms coexist. Understanding these connections, thus, can provide important insights into larger questions about life, from the foundations of symbiotic rules to how microorganisms facilitated the origin of animals [1-3].

A potential method to appreciate these relationships between animals and bacteria is the development of inter-kingdom interaction systems. By making connections between separated species, such systems emerge as means to visualize patterns of coexistence and explore innovate interfaces centered on microcellular activity. They also surface as approaches to look at the aesthetics of biological processes and the future interplay among organisms [4-7].

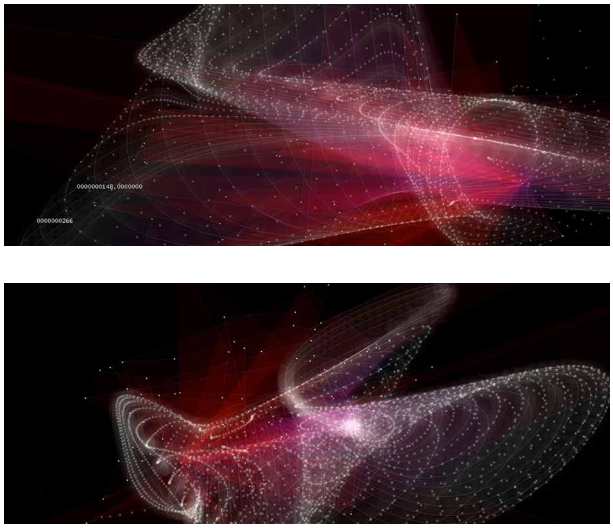

Fig. 1. *Data visualizations of the phototactic motility of cyanobacteria under the stimulus of human bioelectrical activity. Through microscopic observation (Olympus 1X71, CCD camera), cell culture (Pseudanabaena, BG-11 media), and applications for processing data into computer graphics (OpenGL/ computer vision), a three-dimensional structure renders the dynamics of microbial phototaxis influenced by human electrodermal reactions (GRS) in a variety of geometrical shapes.*

Heliotropika is an artistic project that departs from these possibilities focusing on the interactions between microbes, humans and light energy. This project creates an interface between people and cyanobacteria. It is hybrid installation that integrates the photosynthetic activity of these microorganisms, the dynamics of environmental light and the bioelectrical activity of the participants (Fig. 1-5).

2. ON CYANOBACTERIA, LIGHT ENERGY AND OXYGEN

The ability of cyanobacteria to convert light into chemical energy, photosynthesis, established a substantial evolutionary advantage to living organisms. It has been the main driving factor of the oxygen cycle on earth, which is responsible for the present day atmosphere and life, as we know it today.

Before the appearance of cyanobacteria, the composition of the primary atmospheres was very different. They contained large quantities of ammonia, methane, water, vapor, carbon dioxide and nitrogen, as well as other gases; but there was not any oxygen. Hence, their chemistry was inappropriate for organic life.

At some point in time, 2800 millions of years ago, ancestors of cyanobacteria elaborated a system of internal membranes that allowed them to create photosynthesis. They began to use the rays of the sun to split water molecules into its protons and electrons to obtain energy.

Part of the fascination of this phenomena, and source of its evolutionary value, is precisely the involuntarily production of free oxygen as the waste product of the reaction. Although each cyanobacterium only generates a minute amount of oxygen, the combined metabolism of many of these cells over a vast period of time gradually shaped the oxygenic atmosphere.

While in principle, aerobic organisms use oxygen to obtain energy, the fact is that almost all animals, most fungi, and several bacteria are forced aerobes. From an energetic point of view, being a forced aerobe is advantageous for we have more energy than say an archaea, which is an anaerobic organism, but it also means that we depend on oxygen completely. Our organisms as well as our brains cannot be sustained without it for long.

3. HUMAN-CYANOBACTERIA INTERACTION

Owing to the significance of photosynthesis and the aesthetic potential of cyanobacteria, the aim of this research was to integrate media and biological technologies to explore an interface centered on the relation between these microorganism and humans.

The process of creation of this interaction ranged from identifying strategies for visualizing environmental and biological information in real-time, developing means to work with cyanobacteria, and creating applications as aesthetic tools.

3.1 ENVIRONMENTAL LIGHT AS DYNAMIC GEOMETRY

For bacteria and many other microorganisms, the properties of light and its variations represent dramatic events, which may harm or induce important biological process. Photosensitive proteins and circadian rhythms, for instance, are believed to have originated in the earliest cyanobacteria, with the purpose of protecting the replicating of DNA from high ultraviolet radiation during the daytime [8-9].

On animals, beyond vision, light detected by non-visual cells regulates our biological clock, influencing our patterns of sleep and activity. Our skin also, by sensing ultra-violet light, informs our body of the intensity of sunlight, and induces skin cells to synthesize melanin. In this way, outside our awareness, light affects almost every aspect of our life.

Inspired by these facts, the first idea of project was to analyze the daylight activity using sensors as eyes, in an attempt to register all the subtle variations of light energy and use this information to render it as dynamic geometry.

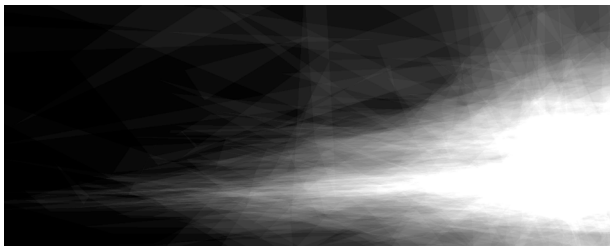

Fig. 2. *Visualizations of environmental light as dynamic geometry. 3 units with sensitive light sensors (LDR) register the ambient light variations on the roof of the exhibition. An application for processing light information into computer graphics (C++, OpenGL) is used to generate these visualizations.*

The first part of this project, thus, takes place outside the exhibition place where environmental light is examined. On the roof of the exhibition units, in which sensitive sensors (LDR) are fixed, register instantly and continuously the on-going changes and irradiation of ambient light. The analyzing program (C++, OpenGL) reconstructs geometry, generating and modifying its coordinates according to the daylight's dynamics. This information is processed in real time leading to the evolution of intricate geometries (Fig. 2).

3.2 CYANOBACTERIA CELL CULTURE

Among the bacterial world, filamentous cyanobacterium *Pseudoanabaena* are well known for their interesting motility. They lack flagella to propel themselves but can move about by gliding along surfaces. This enables them of a waving motion capable of producing complex pattern formations. *Pseudoanabaena* were chosen for this project due to these reasons but also to analyze their active phototropism, which is the tendency that keeps organism following the light in order to get nutrition.

At the laboratory for molecular cell network and biomedia art in Waseda University (Tokyo-Japan), the cells are carefully grown under controlled conditions. Petri dishes that have a thin layer of agar-based medium (BG 11) are used for this purpose. Once the petri dishes with the medium are inoculated with cyanobacteria, they are incubated at 37 degrees Celsius. With this microbial culture method it is possible to let them reproduce under optimal circumstances.

Using microscopic observation (Olympus 1X71, CCD camera moticam 5500, computer Intel mac) and samples from the incubator, a live video of the cells is shown at the exhibition.

3.3 HUMAN BIOELECTRICAL ACTIVITY TRANSFORMED INTO "LIGHT"

Visitors in the gallery are invited induce changes in the activity of the cells through their own bioelectrical activity. On his hand the participant wears sensors that measure the electrical conductance of the skin (GSR), which reflect the activity of the nervous system (Fig. 3).

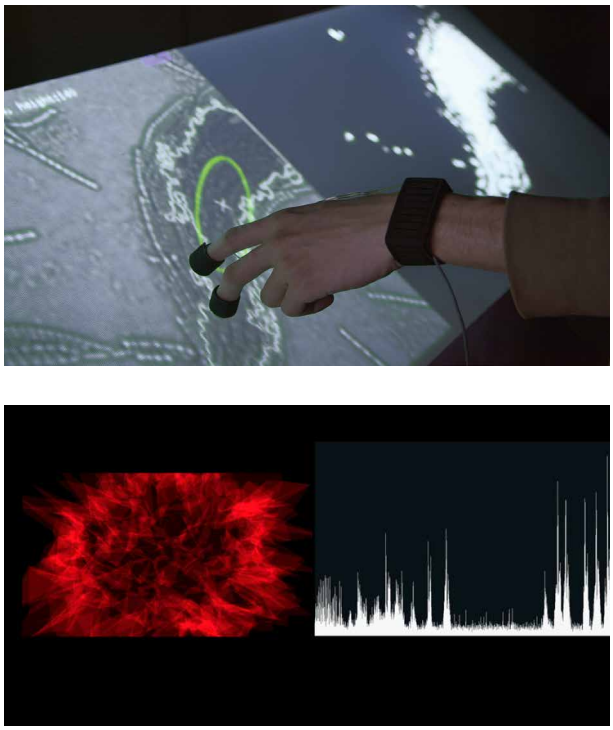

Fig. 3. *Human bioelectrical activity transformed into light. 1_Sensors for galvanic skin response (GRS) measure the bioelectrical activity of the visitor. 2_The people's reactions are transformed into a digital composition that changes its color and shape.*

The sensors register oscillations of electrodermal reactions at a variety of frequencies which have characteristic ranges associated with different emotional states. These reactions are encoded with a device that transforms analog voltage signals into digital messages for processing. The device sends out the information to the computer using Bluetooth wireless transmission allowing 10 meters of signal.

Then this information is transformed and visualized as a digital composition. If the

participant is alert or excited there is a faster range of oscillations, which produces intricate spatial distributions and intense colors. In this way, the more engaged the visitor the more complex and colorful the form of this composition.

Simultaneously, cyanobacteria are exposed to these variations. Through a micro-projector, which is close to the petri dish in the microscope's stage, the digital composition is used as light to stimulate cyanobacteria. The cells sense the intensity, direction, color and duration of this light source and use the information to regulate their growth. Thus, depending on the intensity and color of the visitor's reactions cyanobacteria generate different patterns of colonization, such as a comet-like formation, a bundle or a disk (Fig 4).

3.4 THE PHOTOTACTIC MOTILITY OF CYANOBACTERIA AS AN ORGANIC STRUCTURE

The behavior of the cells and its response to human influences is also analyzed in real-time. The video obtained through the microscope shows us the directional growth of the cells, which is determined by the micro-projector as a light source. This response to light stimulus is analyzed using the video and an application for computer vision (CV). The program works according to the following dynamics: spatial location, cell density, and speed (Fig. 4).

Subsequently, the data acquired by the optical calculation is used in a program for computer graphics (C++, OpenGL) to create a three-dimensional structure (Fig.1). This program renders the changes in the phototactic motility of cyanobacteria in a variety of organic shapes. Thus, the structure generates different types of behavior, which may result in a composition that is comparatively complex or simple depending on the cellular activity.

The project, thus, integrates the photosynthetic activity of the cyanobacteria, the dynamics of environmental light and the bioelectrical responses of the participants. As a result, the visitors and the cyanobacteria influence each other giving subsistence to a dynamic feedback system (Fig 5).

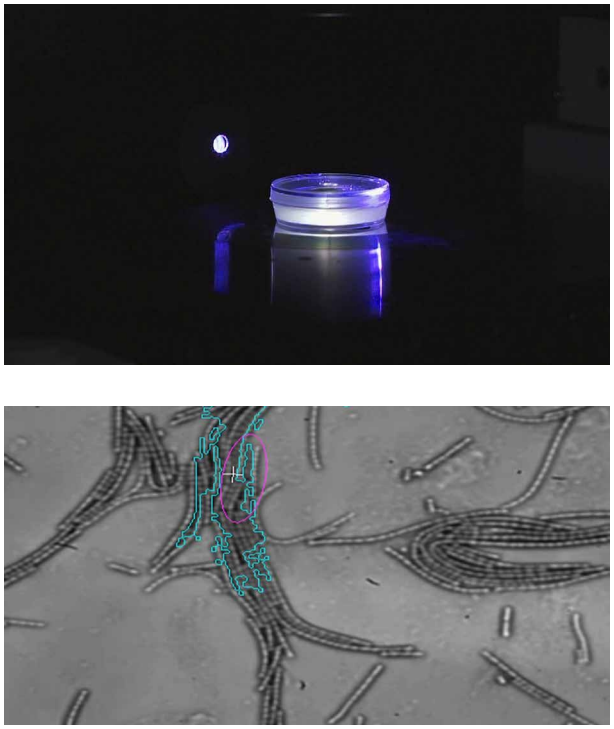

Fig. 4. *Real-time analysis of the phototactic motility of cyanobacteria. 1_Petri dish with cyanobacteria and the micro-projector in the microscope's stage. 2_Image showing the spatial location, cell density and speed of the cells.*

4. CONCLUSIONS

This project as a whole presents a hybrid system developed for exploring interfaces centered on cellular activity. Algorithms and applications for image processing have made it possible to analyze the photactic behavior of filamentous cyanobacterium *Pseudoanabaena* from a video in real time. This analysis and its data visualization enable the construction of a complex digital structure that develops by the continuous adaptation process of the cyanobacteria to human influences.

This work suggests that there exists a certain interaction among cyanobacteria, which would affect positively feedback to collective cell motility. The optical calculation (CV) reveals that the velocity of *Pseudoanabaena* collective movement depends on the cell motility. By switching among the patterns, the cells might chose the most adaptive form to match the specific conditions of the external environment. Hence, positive-feedback mechanisms allow cells to adapt to changes rapidly and efficiently.

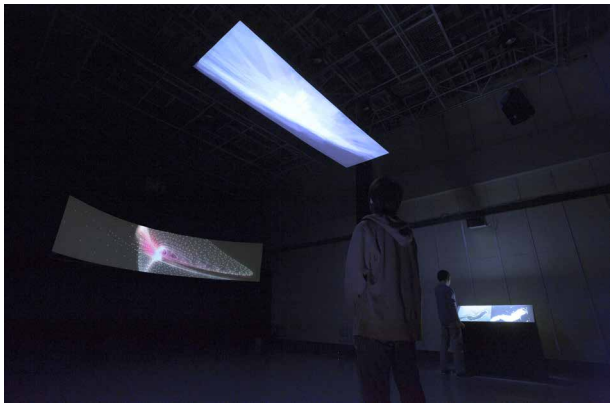

Fig. 5. *General view of the installation. "Hakase Katei Exhibition" TAU, Art Museum. March 21. Tokyo, Japan. 2011.*

On the other hand, this hybrid system shows that biological and new media technologies can be used to dynamically alter and analyze the activity of a population of cyanobacteria. The system, thus, points to a path for potential interfacing between humans and living cells (Fig. 5).

Finally, through practical applications and visualizations, this work wants to look at the aesthetic relationship to biological processes and the subsequent implications for the developments of new forms of communication. In this way, this project questions the possibility of an interkingdom interaction system that could provide insight into the patterns orchestrating the coexistence of organic life.

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Expanded Cinema as "Universe-in-a-Box"; *The Book of Luna* and the Neo-Baroque Poetics of Space

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Abstract. Metabook.1: The Book of Luna investigates a neo-Baroque poetics of space through an interactive, expanded cinema experience that takes the form of a reactive "personal theater" reminiscent of 17th century cabinets of curiosity. The Book of Luna narrates a poetic essay about the Moon's place in the historical imagination that unfolds across a series of nested spaces, namely a box with multiple compartments that contain miniature projections on curved surfaces, Pepper's Ghost illusory visual effects, and interactive, electro-mechanical devices. The Book of Luna treats the Moon as a poetic concept and as a concrete, navigable place, effectively presenting a topological metaphor that superimposes a fictional with a topological space. Through its exploratory poetics and personal architecture, The Book of Luna draws a contemporary connection between the cabinet of curiosity and Gilles Deleuze's analysis of the Baroque as the folding of the imaginary.

In *The Poetics of Space*, Gaston Bachelard traces a profound homology between our perception of space, our way of being-at-space, and poetic thought: "the great function of poetry is to give us back the situations of our dreams. The house, the bedroom, the garret in which we were alone, furnished the framework for an interminable dream, one that poetry alone, through the creation of a poetic work, could succeed in achieving completely"[1]. Spaces are psychological resonating chambers, exterior sanctuaries for our interior states, in much the same way that poetry is a sensate linguistic structure for expressing daydreams. To apprehend space as poetic text entails following the a-logic of the daydream – accompanying the peregrinations of a mobile mind as it pulls in many signifying threads, pictures and words.

MetaBook.1: The Book of Luna investigates this poetics of space by creating a polymedia experience with dynamic content through a reactive "personal theater". This theater combines the experiential qualities of text, interactive devices, and cinema. *The Book of Luna* narrates a poetic essay about the Moon's place in the historical imagination, unfolding across a series of nested spaces. The piece takes the form of a box with multiple compartments containing miniature projections on curved surfaces, Pepper's Ghost illusory visual effects, and interactive electro-mechanical devices. In the spirit of Bachelard's daydreams, *The Book of Luna* treats the Moon as a poetic concept and as a concrete, navigable place, effectively presenting a topological metaphor that superimposes a fictional with a selenographical space. The result is an immersive experience combining the dynamic recombinant possibilities of the digital database with the analog intuitiveness of the Baroque cabinet of curiosities and the perceptual engagement of cinema. In this work, the idea of structural montage transposes the linear-sequential progression of the narrative, one scene after the next, into a non-linear presentation of the "scenes" using spatial distribution. Physical space and form are used as a supplement to sequentiality in the construction of a poetic narrative.

Within the cabinet, a three-dimensional model of the Moon is layered with the stunning

film recordings made from orbit of the Moon's surface by the Apollo and Kaguya/Selene missions, as well as with archival space-flight footage, and animated fantasy characters from the lunar stories to form a 3D collage. The orbital footage is manipulated to simulate the optical quality of Galileo's original telescope from 1609, drawing attention to those surface textures and irregularities that were a revolutionary discovery made possible by one of the great inventions of Baroque science, the telescope. In our cabinet, a fish-eye lens and image mapping techniques based on fulldome planetaria are used to create a 3D model composite of the Moon that is projected into a translucent glass globe, creating a luminous orb (Fig. 1).

Fig. 1. *MetaBook.1: The Book of Luna, multimedia object, prototype. © Clea T. Waite & Lauren Fenton 2013.*

This assemblage reflects the Moon's own history as a palimpsest of humanity's philosophical and literary imagination. The nature of love, madness, the unknown and our capacity for the sublime are amongst the intellectual passions that have crystallized around this mysterious object. There are as many perspectives of the Moon—poems, fantasies, myths, and scientific data — from the beginnings of culture to the Space Age and the memories of the Cold-War generation—as there are craters on its surface. Recipient of prayers, myths, and dreams since the beginning of human consciousness, it inspires love poems and lunacy, influences natural phenomena such as the tides and provokes the supernatural imagination. In the work, both the scrollable text and the audio component of the animation clips remix selenological aphorisms, musings, and observations from some of the philosophers, poets and scientists after whom the Moon's craters were named: Ariosto, Aristotle, Aristarchus of Samos, Copernicus, Cyrano de Bergerac, Leonardo da Vinci, Galileo, Kepler, Lucian of Samosata, Plutarch, Ptolemy, Jules Verne, and H.G. Wells. *The Book of Luna* further allows the reader to visit these craters' geography by manipulating the projected 3D map of the Moon with a joystick.

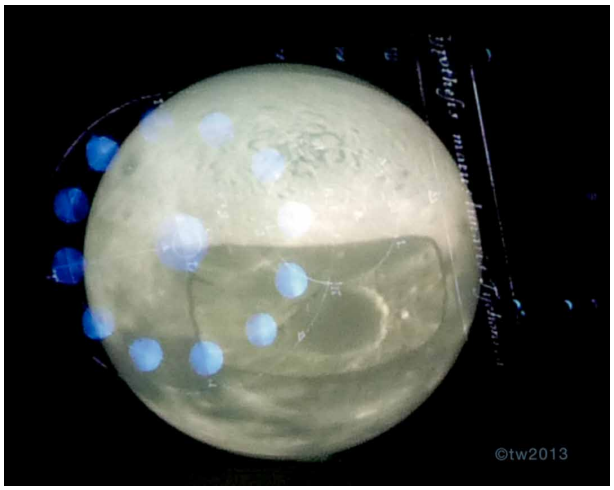

Fig. 2. *MetaBook.1: The Book of Luna, detail of Pepper's Ghost illusion over globe projection. © Clea T. Waite & Lauren Fenton 2013.*

Selecting a crater unlocks more cinematic material in the form of animations of the moon's surface, haunting voices and sound effects, as well as translucent, animated "ghosts" that hover over the globe, an effect called "Pepper's Ghost" (popularized by theme park attractions such as Disneyland's Haunted Mansion). This effect is achieved by placing a monitor in a hidden compartment and a half-silvered mirror between the globe and the viewer. The animated contents displayed on the monitor are reflected in the mirror, causing a holographic-like effect that creates the impression that that the animated images are moving through the surface globe, and generally making it impossible to distinguish between background and foreground, projected material and solid objects (Fig. 2).

The reader is free to navigate between the craters projected on the globe or to read from a poetic text projected in another compartment of the cabinet. This text can be scrolled through with a rotating knob. When selected, portions

of the text transform and fly across the virtual "page", taking the reader to the corresponding crater on the globe. Miniature monitors and lunar memorabilia housed in smaller compartments of *The Book of Luna* cabinet complete the experience of *The Book of Luna*, adding to the cells of storytelling that play out across the complete cine-object. The text featured in *The Book of Luna* is a non-linear, cut-up poem combining quotations from the lunar philosophers with original writings. The text is interactively navigable, allowing the reader to select and combine her own trajectory through the material. When selected, portions of the text transform and fly across the "page", taking the reader to the corresponding crater on the globe. In a *MetaBook*, the reader chooses which pages to engage with and how. The somatic traversal of an architectural space is transposed and compressed into an intimate, personal space of navigation within the cabinet and the written word becomes a voice, another actor, in the film's unfolding.

The back-and-forth between the text, globe, the "ghosts" and the digital and material memorabilia enacts the larger metaphor of the lunar orbit, both as a literary device and as a distinctive model for interface design. The aim of this design is to allow the user to intuitively explore content, to 'float' through a story and through different media, launching her on a reading journey that draws her ever more deeply into an imaginative space.

Our use of multiple projections to create a cinematic architecture was inspired by the rich history of theatrical lighting effects from the Baroque age onward known as magic lantern shows or fantasmagorias. The most spectacular of the descendants of these stage illusions is perhaps the Pepper's Ghost, invented by John Pepper and Henry Dircks in 1863 (Fig. 3). The original magic lantern, a Baroque device that employed mirrors, lenses and a light source to project the reflections of painted images, was invented by Christiaan Huygens in the 1650s and its entertaining effects were described by the polymath Athanasius Kircher in his treatise *Ars Magna Lucis et Umbrae*. Commonly associated with developments from the camera oscura to photography, the history of cinema is also intimately intertwined the formal legacy of the magic lantern and its related practices of spectacular attractions. While the camera oscura and later, photography, pursued a goal of mimetic fidelity, magic lantern media explored the novel types of affect that could be produced and the perceptual possibilities that could be uncovered through the ingenious use of mechanisms of illusion. The most famous of these Baroque visual mechanisms are the optical translations/transformations of anamorphosis and proto-cinematic trompe-l'oeil.

Anamorphosis is a technique by which an image is distorted in such a way that requires the spectator to position herself from a specific angle relative to the picture in order to restore the image's proper perspective. Trompe l'oeil consists of creating the impression of dimensionality through forced perspective, allowing painters to artificially extend and modify architectural interiors through painted domes, frames and recesses. These perceptual tricks are used extensively in contemporary media and now include stereoscopic images, the mapping of projections onto three-dimensional spaces such as buildings, as well as immersive environments like domes and "4D" amusement park rides that employ kinetic and even olfactory subterfuges. Through these technologies of perception, the "anamorphic gaze"[2] creates a fundamentally different reality than linear perspective, one that, as Gilles Deleuze explains, points out "not a variation of truth according to the subject, but the condition in which the truth of a variation appears to the subject"[3]. In this context, the Baroque illusion is not a falsehood that robs the subject of an authentic world, but rather unfolds and extends the world's material complexity: an artifactual exploration of the multiple points of views of objects for whom the subject is never but one among many objects. The media technologies deployed in *MetaBook*.1: *The Book of Luna* specifically adopt this Baroque poetics of effect and affect that, carried into cinematic practice, become newly relevant in the context of expanded cinema.

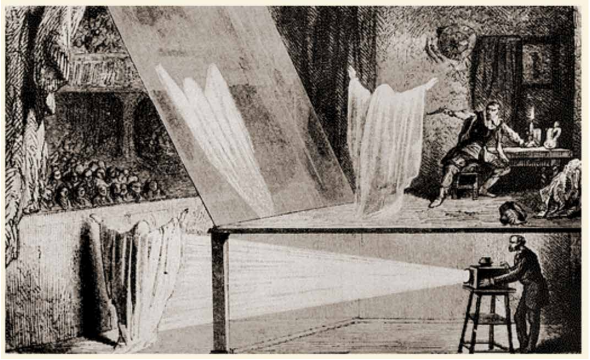

Fig. 3. *the original Pepper's Ghost theatrical illusion, invented by John Pepper and Henry Dircks in 1863. ("Illusion d'Optique - Les Spectres" from Du Magasin Pittoresque, 1869)*

In discussing the relationship between wonder and new technology at the turn of the last century, Tom Gunning, a scholar of what he dubs "the cinema of attractions", returns to Victor Shklovsky's notion of estrangement as the aesthetic's capacity to deliver the spectator from the "automatism of perception"[4] that characterized modern life. Gunning argues that although automatism is the reaction that tends to set itself in place when a technology becomes habitual, new technology, like successful art, is greeted with a sense of wonder, a feeling of joyful estrangement: "a discourse of wonder draws our attention to new technology, not simply as a tool, but as a spectacle, less as something that performs a useful task than as something that astounds us by performing in a way that seems unlikely or magical"[4]. The thrill of perceptual immersion phases into curiosity, into a desire to investigate further, to simultaneously unveil the mechanism and to revel in its indecipherability. Reflecting on the sense of cosmological awe provoked by the 16th century discoveries in astronomy and the Baroque literary fantasies that were written in their wake, Angela Ndalianis further elaborates on wonder as an affect that is both aesthetic and scientific in nature, enticing the subject "into a problem-solving experience"[5]. Philip Fisher retraces the roots of wonder to a feeling both of interrogation, "the power to put in question", and of exclamation, "the admiration, delight in the qualities of a thing"[6]. Ndalianis and Gunning are referring to discourses that surrounded technology during the Baroque and late 19th century period respectively, times when scientific and technological innovations were being put on display in particularly spectacular fashion. 16th century telescopes and microscopes were designed as much to be exquisite toy furniture as instruments, while orreries, elaborate mechanized models of the solar system, were exhibited by traveling amateur scientists in fashionable salons. Wonder, which "allows re-enchantment through aesthetic de-familiarization"[4], was a response to the opening up of previously unexplored perceptual and conceptual domains, a reaction of the subject when confronted with scientific and technological phenomena whose material affordances were unprecedented and astonishing.

In the encyclopedic catalogue that accompanied the Getty Museum's 2001 exhibition of techno-artistic artifacts, *Devices of Wonder: From the World in a Box to Images on a Screen*, Barbara Stafford evokes an entire lineage of "gadget-furniture", objects for the home like perspective boxes and toy theatres that functioned as "sociopoetic kits", simple machines that enfolded platforms for the imagination within their imbricate space: "objects, too, are not eternally fixed within their utilitarian or commodity function but, like the dynamic consciousness itself, are seen to be metamorphic and performative"[7]. This metamorphic property of objects extended to even the mundane surfaces that populated everyday life, reflective surfaces such as the porcelain of a tea set, the iridescent bulbousness of bubble-blowing, or the play of light in the mirrors hung across a bourgeois interior. The texture and sensual affordances of the domesticated, engineered, crafted material operated on the consciousness in a technological fashion that exceeded the utility of furniture, recalling instead the logic of the machine with its programmed series of physical transformations. Like the 18th century Claude glass, a distorting lens through which strollers could view landscapes in the same high-contrast, golden light that bathed the picturesque paintings of Claude Lorrain, these domestic toys functioned as distillers of consciousness, opening up the possibility of an alternatively embodied subjectivity that could reveal new avenues to empirical knowledge: "...self-coherence emerged in the activation of such devices. The reflective toy-as-instrument

is a perceptual and cognitive focusing tool"[7]. Nor was this reorientation of the sensorial apparatus limited to vision only – crafted at a human-scale, these toys were objects and boxes that were designed to be handled, explored and manipulated.

Wunderkammers, literally "wonder-chambers", but more commonly known as cabinets of curiosities, developed this epistemological aesthetics to a great degree of sophistication during their heyday in the 17th and 18th centuries. The *Wunderkammers* were ornate pieces of furniture – sometimes, entire rooms – that were used by the wealthy as systems for organizing facts and artifacts and are the precursors to the travel documentary and the natural history museum (Fig. 4). As elaborately crafted spaces, they were devoted to the imaginative juxtaposition of various curios with evocative sensorial and/or figurative properties. These different objects were often placed within nested compartments, creating in the owner's mind a receding chain of sensuous and symbolic associations. This "system of the labyrinth"[8], to quote art historian Henri Focillon, assimilates the visual layout of the labyrinth to the tactile delectability of the objects housed within the cabinet, so that the Wunderkammer as a whole evokes a vast imaginary play-room whose extensive proportions are folded into the comparatively diminutive physical space of the piece of furniture itself. One modern exemplar of the poetics of space at work in the cabinets of curiosities is the artwork of Joseph Cornell who created exquisite collages of found objects that he placed in various boxes. These compositions hinged on the manner in which the meanings of each object ricochet off of each other, creating a immersive and powerfully evocative web of material signifiers.

Fig. 4. *Trompe l'oeil painting of a cabinet of curiosity by Domenico Remps, 1690s, Opificio delle Pietre Dure, Florence*

The motif of nesting fantastical spaces within smaller facades is an inheritance of the Baroque. According to Deleuze, the Baroque's tendency towards a minute examination of the textures and folds of matter – as much at work in the experience of the *Wunderkammer* as it is in the still life paintings of 17th century Dutch masters – obeys a Russian-doll logic of miniaturization that unlocks proportionally infinite spiritual and imaginary realms. "Matter thus offers an infinitely porous, spongy, or cavernous texture without emptiness, caverns endlessly contained in other caverns: no matter how small, each body contains a world pierced with irregular passages"[3]. According to Deleuze, this Baroque logic is exemplified by the figure of the fold. The fold pleats the material surface of objects with the sensate/sentient skin of the subject, making it impossible to demarcate, on an epistemological level, where the texture of the world ends and the texture of affect begins. Baroque objects, in their hyperbolic outpouring of "informing form"[2], their density of sensorial information, reveal that both materiality and perception are recursive structures, folds within folds that are essentially coextensive with each other. As such, there is no privileged viewpoint that can allow us to circumscribe a world in its entirety when worlds are bundled up within one another ad infinitum and we ourselves are wrapped up in them. The Baroque treatment of form emerges then as an epistemological mechanism that consists in "following a fold up to the following fold"[3]. The more our perception unfolds the object before us, laying out its inexhaustible

wealth of detail for our consumption, the more we fold ourselves into it, until the object seems to balloon, to grow beyond us into a world in which we are then enclosed and which becomes our stage.

Through its exploratory poetics and personal architecture, *The Book of Luna* draws a contemporary connection between the17th century media of cabinets of curiosity and Gilles Deleuze's analysis of the Baroque as the folding of imaginary space. *The Book of Luna* re-invents expanded cinema according to a neo-baroque logic of serial miniaturization while extending the concept of cinematic montage beyond the "juxtaposition of cells"[9] to the juxtaposition of evocative materialities. This recombinant assemblage of tangible surfaces that are also narrative units points us back to the origin of media and the book, a platform we metaphorically allude to in our title. As an ancient interface, the book also reconnects with the non-linearity of contemporary digital media. Skipping across imaginary spaces and moments in time is as simple as flipping through its pages. In *MetaBook.1: The Book of Luna*, the medial space of immersion is re-internalized, just as literature has always immersed the mind of the reader. As a multimedia book, the *MetaBook* articulates how immersive formats and an active form of spectatorship can impact upon the compositional flow of a piece. Motivating movement and focus through interface design becomes an element of composition and meaning in which the attention of the viewer composes the flow of information. By mapping its geographical topic, the Moon, to the architectural structure of a cinema-installation, *The Book of Luna* addresses the challenge of Baroque media, to create an external form that functions as an extension of the work's internal logic. In the context of expanded cinema, this means unpacking or unfolding the narrative in a spatial dimension. As a Baroque artifact that brings together illusion and science, aesthetics and apparatus, *The Book of Luna* investigates new metaphors that arise from experimenting with new technologies as epistemological mechanisms within an artistic framework, and the effect of these innovative formal elements on meaning, creative process, and viewer reception.

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NANO Lab: exploring artistic interfaces with natural/ organic elements in telematics environments

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Abstract. Can a telematic system provide an experience in art? The question emerged again during the last three years, resulting from research on computer art, science, and telematic systems developed by artists Guto Nóbrega and Malu Fragoso at NANO Lab (UFRJ-Brazil). The idea of a "Telematic Embrace", introduced by artist Roy Ascott in 2003, is constantly reviewed with technological development through artistic projects that explore processes of creating artificial interfaces which in some way are connected with natural and organic elements, experimenting on possible hybridization, interaction, presence and context in telematic environments. We believe that telematic situation enhances the vitality of an aesthetic experience and that this experience provides a renewed state of consciousness. The idea of a plant or insect-machine-human interaction definitely enhances our capacity of perception. In this paper, the presentation of artistic practical, experimental and technologic procedures are in focus, together with research strategies applied at NANO.

1. INTRODUCTION

NANO Lab (Nucleus of Art and New Organisms) was created in 2010, at the Graduate Program in Visual Arts (PPGAV) at the Federal University of Rio de Janeiro (UFRJ), by Carlos Augusto (Guto) Nóbrega and is coordinated together with Maria Luiza (Malu) Fragoso. Projects are sponsored with undergraduate student grants from CNPq[1], direct funds from FAPERJ[2], which also support most of our events together with CAPES[3]. As it is summarized in the abstract above, our artistic projects explore processes of creating artificial interfaces, which in some way are connected with natural and organic elements, experimenting on possible hybridization, interaction, or presence in telematic environments. One of the most impressive sensations observed from artistic telematics performances is the state of incomprehension of the presented complexity. However, if we believe that telematic situation enhances the vitality of an aesthetic experience, then this experience must allow the telematics environment to infiltrate the work of art. Maybe this is an aspect of what Roy Ascott[4] refers to as cyberception.

Projects engaged at NANO Lab have the premise of believing in building *a trans-linguistic cultural geographic telematics communication* system. We believe that the idea of a plant or insect-machine-human interaction definitely enhances our capacity of perception. Not only we can visualize the interaction (accessible feedback) but the experience provides, to all involved, a renewed state of consciousness. One in which the human end of the system is more generous and open to understanding life and nature, a premise from the origins of art. Artists from different fields (visual arts, dance, music, theatre, etc.) are emerging into a trans-disciplinary methodology of research, in which mechanical, electronic and computer systems are merging into hybrid systems, not only physically, but also aesthetically, providing innovated forms of perceiving and expressing reality. Sometimes, in the process of creating fields of experimentation, art, science and technology become so close in this process of investigation that it's almost impossible to distinguish between them. In our projects, artistic practical, experimental and technologic procedures are in focus, but also an approach to the subject relating artistic practices and science

research in collaboration with other research groups and laboratories. We constantly discuss research strategies between artistic and scientific methodologies and are searching for a trans-disciplinary knowledge.

2. RECENT PROJECTS

In 2011, NANO was invited to collaborate in two research projects: *Laboratorium Mapa D2*, proposed by Ivani Santana, from Federal University of Bahia (UFBA); and, *Ecotelemedia*, proposed by Kjell Yngve Petersen, from IT University of Copenhagen, Denmark. Both had in common the development of collaborative process based on telematic systems to create artistic performances. In 2012, it was possible to observe and apply strategies based on trans-disciplinary methodologies to stimulate the practice of collaboration and communication between artists, researchers and institutions. This year, we can affirm that although we are just at the beginning of long and intense process of creation – and we mean artistically and scientifically – results are beginning to emerge and NANO group is growing and producing new projects with renewed approaches, such as BOT_ANIC, S.H.A.S.T., ECOBOT, Telebiosfera, among others, which can be accessed at *www.nano.eba.ufrj.br*.

Laboratorium Mapa D2 was the first project developed with NANO that focused on an artistic event, sponsored by the Ministry of Culture. It promoted a consortium that gathered different research groups from Brazilian universities such as Telemedia (at Catholic University of Rio de Janeiro), GP Poética (at Federal University of Bahia), Computação (at Federal University of Bahia), LPCA & Grupo de Pesquisa Computacional (at Federal University of Ceará), and LAVID (at Federal University of Paraíba). All groups were organized into audio-visual connectivity in real time based on Arthron, a platform developed by LAVID (Federal University of Paraíba). Arthron is a sytem that facilitates artistic performances that apply multimedia representations combining virtual and real spaces in real time. The main objective of *Laboratorium Mapa D2*'s lab consortium was to experiment and explore the potential Arthron for the creation of artistic projects. During almost one year, twenty virtual meetings were attended by the groups, four Open Labs were organized with the participation of the public (on line and of line), three workshops on telematic structure and creative processes were offered, one preliminary exhibit was held. A final exhibit by the title *Frágil* was held December 1st at the Museum of Modern Art in Rio de Janeiro, during the event "Desafios da Arte em Rede" (Net Art Challenges), a preview of Digital Culture International Festival of Rio de Janeiro, organized by Brazilian Ministry of Culture.

Under the supervision of Guto Nóbrega, NANO worked specifically on the construction a robotic interface named as H.A., with local and remote interaction with performers and public, proposed as interface between all agents of the project. H.A. standing for *Anthropophagic Hyperorganism*[5], was not built to be a robot, but a mechanism that captures images, movements, actions as data, devours this information and reproduces it inside it's body as renewed images and sounds. It may also expand this output to the net. H.A. is composed of a head with monocular artificial vision, a neck that moves in four directions, a body built of translucent material that expands and contracts like a breathing lung actionable by external and internal stimulus. The interface is also built with movement sensors in mapping environments and interactions, Internet protocol for connectivity and video streaming input and output devices. An Arduino with frequency radio transmitter receives the transmission of sound variations through the web and sends it to a wearable interface, which outputs data through four micro-motors. During the exhibition, the motors were located at four different points of a dancer's body. This complex connection allowed dancers to feel the sound intensity of the environment directly over their bodies creating a synergetic experience. Data was flowing between dancers, public, internet, robot in a constant feedback system.

Ecotelemedia (2011) was an international endeavour of a collaborative research net called *The aesthetics of global connectivity: exploring design strategies and networked technologies of distributed sites through artistic processes* proposed by Kjell Yngve Petersen from IT University of Copenhagen. It lasted the hole year of 2011

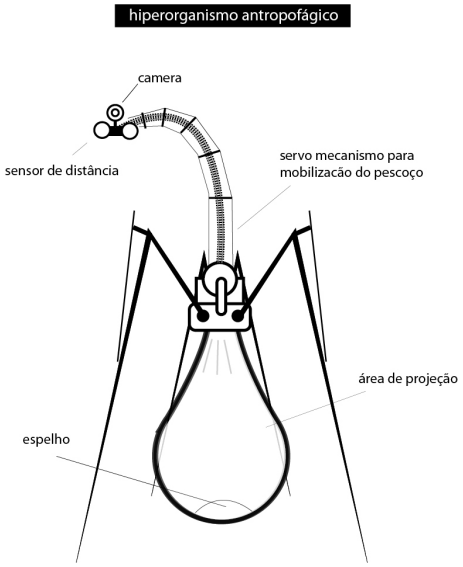

Fig.1 *shows a schematic drawing of H.A.'s project.*

and was coordinated by Petersen, Guto Nóbrega, from NANO (Brazil), and Kenneth Fields, from Central Conservatory of Music in Beijing (China). In April, each of the coordinators invited other collaborators from their research institutions to attend a meeting held at NANO lab in Brazil. A symposium on *Telemediations: exploring aesthetic paradigms in hybrid ecology* was held, together with workshops on methodological approaches and open labs. The main objective of *Ecotelemedia* was to establish some methodology for artistic research, focusing on an aesthetic paradigms resultant from telematic environments. Emphasis was on experimentation with natural and artificial systems based on collaborative experience through visual and acoustic performances aiming an emerging ecology.

An optimized telematic system was planned in order to connect multiple actors (humans, plants, machines) in a relatively coherent way during a specific time period for the performance. NANO's proposal was to create sounds from a hybrid organism, composed of a plant and a computer system programed to transform the variation of electric conductivity on plant leafs. An interface was developed in which three plants worked as organic sensors creating three different channels of data used on the process of creating sound. The connection occurred between Brazil (NANO and Ivani Santana from Bahia), Annika B. Lewis (Washington – USA), and our partners in Copenhagen and Beijing. We can affirm that one of the main coherence factors was the sound feedback created by the digital arrangement of multiple data sources sent to computer stations using *Pure Data.* Other data was shared through OSC protocols, and audio connection between Brazil, China and Denmark done by *Jack Trip*. Data sources were: accelerometers from iPads and iPods used by two performers; two hybrid systems with plant and GSR (Brazil and Denmark), each of them with three plants; and a Cilia digital controller. Between 5th and 9th of September an intensive laboratory workshop was held at IT University of Copenhagen that resulted on the first public *Ecotelemedia* event, in which all participants were sharing the same location. On October 25th the performance occurred through telematic environment.

Bot_anic (2013) is a hybrid plant/robot derived from the work "Breathing" (2009)[6]. In this project we apply the same process of monitoring sensitive plants based on a meter galvanic responses adapted not on one leaf but two separate leaves. This new circuit allows monitoring changes and differences in conductance from the separate leaves, which give us the possibility to create a "sense" of direction to the movement of a small robot carrying the plants. Altogether the project consists of three steps: assembling a motor *shield* (electronic circuit) for Arduino to control two low power DC motors; assembling a *shield* for monitoring conductivity on leafs; assembling a robotic structure to carry the plant. The bridge between the plant and the robot is an interface circuit for reading custom galvanic response, adapted to measure variations from electrical resistance on the surface of plant leaves. When the electrical conductivity of the plant varies, the bridge becomes unbalanced generating an output which is amplified and applied to the analogue input of an Arduino microcontroller for analysis and data processing will act in the remaining stages of the system.

S.H.A.S.T. – housing system for homeless bees (2013)[7] is an on going experimental project that continues our research on interactive multimedia installations and combines aspects of performing urban interventions in dialog with native Brazilian traditional culture. This specific project, under supervision of Malu Fragoso, explores a few myths about bees, some found in

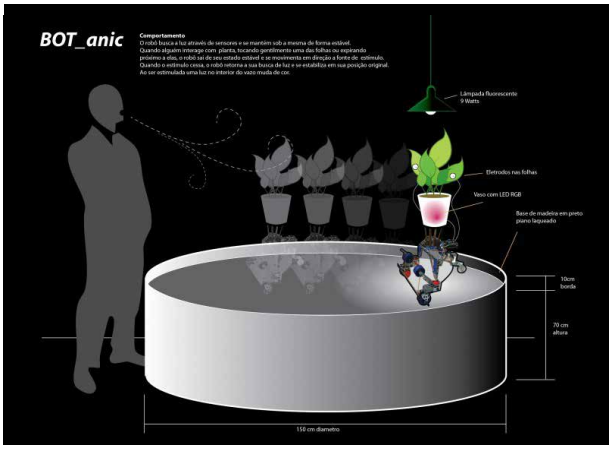

Fig.2 *shows a schematic drawing of BOT_ANIC's project, 2013.*

indigenous Kaimbé nation, some based on practices in apiaries with native and African bees. The installation is developed at NANO, based on our concepts of hybrid organisms and hybrid natures but we propose these concepts within urban contemporary contexts. We explore the idea of collective intelligence and social organization based on scientific research into the concept of "Emergency", well illustrated by Steven Johnson (2000) in his book "Emergency - The integrated life among ants, brains, cities and software".

The project involves the production of three modules, or three objects, interconnected by internet composing a *telematic triptic*. The modules are located at different points: one in the apiary, a real hive with active bees, monitored in different ways so that the data can be transmitted in a variety of formats to a server which receives and distributes the collected data; a second at a specific urban area, previously cheeked for the presence of bees, constantly under surveillance, prepared to attract bees that may or may not be housed in the module; the third one is the expository module installed at art spaces, build as an observatory station where the presence of the other two modules emerge and integrate the art work with exhibition area and the public in a *hyper hybrid ecology*.

Telebiosfera (2013) is a project focused on the construction of a hybrid environment (composed of natural and artificial elements) that proposes a telematic experience based on bio-communication between different ecosystems at different locations. Two small gardens, named *Telebiosferas*, are telematically in dialog, transmitting in real time data and images from/to each ecosystem. The public may experience this dialog through images and sounds which will compose a remote simulation of the distant environment by temperature, light, humidity, etc.). The main interactive interface between both environments is a plant and an artificial organism that captures the vegetable galvanic impulse. Robotics and artificial vision are necessary for this system, which it objective is to allow the public to became an agent within the system. We explore the notions of presence, nature, connectivity, experience, hybridization among others present at contemporary art discourses. The was is being developed in collaboration with the Plants Molecular Biology Laboratory at Federal University of Rio de Janeiro supervised by professor Adriana Hemerly.

3. METHODOLOGICAL STRATEGIES

Interdisciplinary methodology is a common problem and challenge for artist researchers in educational institutions. Artistic approach to technology and science has adopted interdisciplinary strategies and is evolving towards transdisciplinary knowledge constructions. Scientific fields of research are restless about such approaches and collaborative projects rarely accept artistic premises. Since transdisciplinirary knowledge is fundamental for our investigative processes, NANO has developed specific strategies in order to stimulate collaborative proposal and initiatives. We have adopted a constructive conception where art and science, aligned with technology, bring together concepts and models to propose the construction of associative, approximate, empiric knowledge under aesthetic values. We invest interdisciplinary processes that require collaborative actions between research groups and laboratorial spaces which already experimenting with the interaction between art and technology in different fields of scientific research. In the other hand, living in the countryside and experimenting with the rich and diverse nature of our country were aspects that have influenced our group towards the construction of hybrid ecosystems, hyperorganic bodies, and hybrid natures. Intimacy and "naturality" acquired while immersed in natural environments, artistic practice within these environments, favour's intense intuitive creative processes.

The development of methodological strategies for collaborative practices between artist's researchers is fundamental for our work. In this sense we have created along the last two years the following strategies, which are in part responsible for the out come of this years projects listed above:

Laboratorial Integrative System – Adequate to visualize experiments; group's working place, where processes can be shared on practical basis; local reference for external partners; space for systematization and organization of theoretical and practical research for better efficiency and productivity.

Academic Integrative System – Creation of the series *Transdisciplinary Dialogs*, that promotes and articulates between research groups, professionals and institutions that have recognized achievements in their specific areas of cultural and academic research activities eligible for collaborations with NANO projects. Events that open a space for the emergence of new ideas stimulated by meetings and conversations open to the public participation. The objective is the constitution of a didactic data base in DVD format, such as interviews, plus textual and imagery post at NANO homepage. Also the creation of the Series *SET –Transdisciplinary Exploratory Seminar* - an open seminar focused on the presentation of on going research projects, favouring experience exchange and the out coming of new projects.

Artistic and Cultural Integrative System – promote, organize and participate in collaborative projects, local or remote, exhibitions and shows, residencies and performances, with the support of commissions, prizes, and institutional grants from galleries, government offices and university's funding's. NANO created the event *Hiperorgânicos*, on it's fourth edition 2013, that unites in one week activities most of our experimental interests and methodology.

4. CONCLUSIONS

NANO invests in artistic research and poetic production with focus on aesthetic issues that integrate contemporary art, design, science and technology targeted for a *re-invented aesthesis*. We are interested in processes of awareness, which are made possible by the expression of phenomenon in coherent poetic systems. We assume that the "work" of contemporary art happens, it does not mean to represent, it is the action itself, and that the contemporary artist is a mediator who reveals processes and creates conditions for the works to happen. We agree to the fact that technology and computerized telecommunications are an irreversible influence on contemporary artistic production, this practice is a significant factor for social transformation[8].

Artists from different fields (visual arts, dance, music, theatre, etc.) are adopting mechanical, electronic, and computer systems and merging into hybrid systems, not only physically, but also aesthetically, providing innovated forms of perceiving and expressing reality. Sometimes, in the process of creating fields of experimentation, art, science and technology become so close in this process of investigation that it's almost impossible to distinguish between each area of research. If scientific experience used to counter play common experience, immediate tautological conclusions and definitions, contemporary technology, with the velocity of computer mathematical operations transformed in forms, sound and sensations, led immediate experiences to the status of key elements in scientific research, nowadays constructed on social based investigations.

According to Boaventura Souza Santos[9], in post-modern society all scientific knowledge seeks common sense constructs. All knowledge is based on self-knowledge, and it must be recognized as local and total. Scientific environments are adopting humanistic conceptions from social sciences as "catalyst" agent towards the fusion between natural sciences and social sciences, situating the person as author and subject of the world, centre of knowledge, but differently from humanistic tradition, places what we define as nature in the centre of the person.

Although science representatives have engaged in understanding social sciences and artistic processes of creation and knowledge construct, there is still an enormous distance between those methodologies. The experimentations described above pointed the need of larger budgets in art laboratories, maybe by exposing this specific artistic production and obtaining financial support from scientific institutions. In his sense, artist should invest in methodological

discussions with a variety of partners from the large spectacle of technological development and scientific research. Infinity of technological tools is available today for artistic experimentation but, differently from technical tool, technology demands methods and knowledge that is unfamiliar to the artist. Thinking a methodological model for the above projects was our biggest challenge.

Projects engaged by NANO have the premise of believing in building a trans-linguistic cultural geographic telematic communication system. Experiences revealed the sensation of being at the edge of mysteries and revelations. Collective presence "really" happens, it is not a projection of our minds, and, for some moments, we can feel that it is flowing and growing.

Looking back at the overall experiences of the last two year's work at NANO, we can affirm that telematic systems are unquestionably effective in collaborative processes. Subjectivity arises proportionally with the artist's improvisation over technical difficulties. It is an error to create strong expectations based on traditional artistic experiences. Openness to unthinkable sensitive and aesthetic experiences is fundamental. Proportionally, we seem to be in a stage of development in which some part of this effort is some what frustrating, but in all project's experiences there are moments in which the system (and we mean: human-machine-computers-plants-places-time system) provides an immersion in which a sublime state of the art can be felt. We believe that telematics can provide an experience in art. Our next question is: how can hybrid organisms (human-plant-animal-machine) enhance the vitality of an aesthetic experience in telematics?

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ENDNOTES

1 CNPq - National Council of Scientific and Technological Development www.cnpq.br

2 FAPERJ - Carlos Chagas Filho Foundation for Research Support of the State of Rio de Janeiro www.faperj.br

3 CAPES – MEC - Coordination of Improvement of Higher Level at the National Ministry of Education www.capes.gov.br

4 ASCOTT, Roy. *Telematic Embrace. Visionary Theories of Art, Technology, and Consciousness.* Las Angeles: University of California Press, 2003.

5 NOBREGA, Carlos A. da. *Art, Technology, Coherence, Connectedness, and the Integrative Field.* Saarbrücken, Germany: LAP Lambert Academic Publishing, 2010.

6 Art project developed at the end of the Guto Nobrega's PhD in which a plant has its electrophysiological monitored process (electrical conductivity of leaves) and applied in a robotic system for producing motion and lights. *http://cargocollective.com/gutonobrega/filter/artwork/Breathing*

7 S.H.A.S.T. is developed as part of the activities of Malu Fragoso's post-doctorate studies at the School of Communication and the Art at the University of São Paulo - USP, under the guidance of artist and researcher Gilberto Prado in collaboration with the Group Digital Poetics.

8 FRAGOSO, Maria Luiza. *>=4D. Arte Computacional no Brasil.* Brasília: Programa de Pós-Graduação em Arte da Universidade de Brasília, 2005

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IN COL-
LABORA-
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IN COLLABORATION

Speculative Culture: Design Fiction in Participative Innovation Labs

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Abstract. This article introduces new opportunities and responsibilities for curators in a culture of innovation and speculation about the future. Two approaches to curatorial practice are discussed, both positioning artists in collaborative innovation labs. The first one, developed at Creativity & Cognition Studios, applies user-centered methodologies from HCI to the evaluation of interactive art. The second one engages participants in future oriented prototyping workshops inspired by design fiction. An argument is advanced that curators could have a role in mediating the dynamics of a rapid technological change to the public and orchestrate ways to allow more voices in discourses and practices of innovation.

1. INTRODUCTION

The study of complex systems [1, 2, 3] represents a shift and a sort of awakening in our scientific thinking. Until the XVIII Century the dominant vision for an understanding of reality was that of linking interpretations to what could be observed in the past, reducing complex phenomena to simple principles and emphasizing cause-effect dynamics in the natural world [4]. This determined our inability to grasp the long-term consequences of human interaction with the environment. The explosion of innovation has, since the Industrial Revolution, dramatically increased the volume of such interaction, whose unanticipated effects are now threatening us in the shape of overpopulation, pollution, resources shortage [5]. The consequently emerging relevance of the notions of risk, hazard and uncertainty is now nurturing the development of a new paradigm that look at the possible behaviors of interacting elements that cannot be put under observation in the present. Its seeds can already be spotted in the current fortune of the term and the mechanisms of 'speculation' in contemporary culture. Academic inquiry has recently embraced the colonization of two territories where by definition the only achievements can be hypotheses:

1) The exploration of reality from the point of view of non-human objects and temporalities (Speculative Realism, New Materialism, Actor-Network-Theory)[1];
2) The exploration of the future or alternative presents (Future Studies, Critical and Speculative Design, Innovation Studies)[2].

The establishment of a Speculative Culture (SC) can be seen as an answer to the contradictions that Sander van der Leeuw recognizes in our approach to innovation, which is considered at the same time the solution of the global challenges we are now facing, and its main cause [ibid.]. Since innovation has become imperative for today's competitive economies, and is shaping society according to the new products and services constantly introduced to the marketplace, the issue of sustainability is no longer deferrable. According to van der Leeuw, innovation can only become sustainable if supported by

a new way of thinking informed by a generative perspective and a deeper investigation of the impact of the present on the future [6].

Besides issues of sustainability, discourses around innovation have recently introduced a new focus on creativity. Its impact on a rapid technological change has been acknowledged in a series of innovation policy initiatives incorporating the arts into their programs [7]. This paper considers the correlation between creativity and innovation, and the recognition that our society is fundamentally dependent on innovation [5], as a set of challenges and opportunities for curatorial practice. A proposal is advanced that curating in the age of SC should facilitate in the public forms of familiarity and criticality towards technological change.

The fact that the exhibition is no longer the first and only concern for the curator is now commonplace [8]. Workshops, residencies, talks, seminars, publications, field trips, community services are just a few of the most common formats included in the lexicon of curatorial practice in the last decades. This evolution in the ways the arts can be presented to the public is also a transformation of places and modes of production. The arts are moving away from the dichotomy studio-museum, towards more distributed, hybrid situations where curators orchestrate encounters between artistic practice, publics and different forms of knowledge.

As a paradigmatic establishment of this time, the lab is a space where SC, technological innovation, creativity and public engagement interact according to a logic of open research [9]. While the proliferation of future-oriented labs (such as Changeist or the Near Future Laboratory)[3] is symptomatic of a strengthening of the relationship between research, industry and society, artistic and cultural practices are caught in a process of adaptation and assimilation of a future-making drive which is also redefining the meaning of public engagement.

This paper discusses two approaches to curatorial practice positioning artists in labs. The first one applies user-centered methodologies from Human Computer Interaction (HCI) to the evaluation of interactive art and has been developed by Creativity and Cognition Studios (CCS). The second one involves participants in performance-based and collaborative innovation oriented activities within the framework of Design Fiction (DF) [10, 11]. A comparison of the different roles assigned to the public and the nature of engagement allowed by the two approaches suggests a redefinition of art practice as world-making, acting on the double level of symbolic representation and contingencies in the socio-technical reality.

2. TWO APPROACHES: LIVING LABS AND DESIGN FICTION

2.1 LIVING LABS FOR INTERACTIVE ART

The history of the intersections across art, science and technology can be outlined through a sequence of manifestations of the laboratory, from media centers supporting experimentation with emerging technologies, to partnerships between artists and enterprises, to studio-labs, media-labs, hack-labs and maker spaces [12, 13]. The Living Lab (LL) is a recent chapter in this development, and the reason it is of particular interest in this study is its emphasis on a user-centered approach which inspired new ways of engaging the public with technological innovation first, and with interactive art subsequently. LLs are research ecosystems that migrate the activities of a lab into real-life settings, in order to design technologies that better respond to human needs and behaviors [14]. This happened in the context of research on smart cities and smart homes that required a deep and unbiased understanding of users' reactions to innovation. Consequently, when the LL was born it was about a change of setting for research, and also about human-machine interaction. When addressing the challenges of making and exhibiting interactive art, Ernst Edmonds and his team at CCS identified in the human-centered approach to HCI a set of theoretical and methodological tools to gain insights on audience experience [15]. This approach has been implemented in a gallery environment, Beta_Space [16] with a curatorial program focused on the exhibition of interactive artworks at the prototyping stage and on the involvement of the audience in their evaluation.

The CCS adaptation of the concept of the LL to curatorial practice is in many ways a rigorous

one. By exhibiting prototypes the researchers transferred the laboratory into the gallery, hence creating a convergence of functionalities with production, research and exhibition happening in the same space. In this context the studio (where the work is produced) and the gallery can be seen as the usual environments for the artwork, and the research functionality as the implementation that generates a LL. Additionally, the exclusive focus on interactive art reinforces the parallelism with the original LL, as the inquiry on audience experience was still essentially concentrated on the interaction between human and technology [17] rather than other elements (conceptual or thematic for instance) of the work.

In her doctoral thesis [18], developed alongside her practice-based research as curator at Beta_Space, Lizzie Muller analyses extensively her reflective curatorial practice supported by HCI methodologies. The first job for the curator is that to frame for the audience the value of the prototype as part of a conversation with the artist. Additionally, its role often overlaps with the evaluator's one, managing opportunities and methodologies to get sense of audience feedback and communicate it to the artist. Finally, the curator collaborates with the artist in considering the different layers and complexities of audience experience to eventually modify the work in response to the evaluation. The goal is to reduce the gap between artists ideal and audience real version of the artwork [19]. The range of solutions that can be adopted following the evaluation constitutes a blurred area at the intersection of artist and curator responsibilities. They concern both directly the work and the conditions of its presentation, and might involve technical and practical issues, as well as an alteration of the pattern or sequence of actions and reactions performed by the interactional system [17]. Even if maintaining the traditional role of orchestrating the encounter between audience and artistic object, the curator acquires two new areas of intervention: ethnography and collaborative practices. An ethnographic attitude helps him to understand audience experience, collecting information that could feed into the evaluation of the artwork. Furthermore, it is the curator responsibility to facilitate the collaboration between artists, researchers, engineers and audience.

2.3. FUTURE-MAKING LABS

If the CCS drew from the experiences of lab and innovation culture especially a human and experience-centric attitude to curatorial practice, the second approach I am going to outline in this paper is much more focused on the idea of encouraging people to not just evaluate but lead the creative process. This suggestion is being developed in a series of workshops where participants are involved in collaborative design exercises supported by a narrative and performative framework. The goal is to engage people in envisioning and influencing their everyday life in possible futures. The approach is heavily inspired by DF, an experimental, speculative design methodology based on the adoption of fictional scenarios and storytelling techniques to gain insight into the relationship between emerging technologies and social practices in possible futures and stimulate critical thinking on the consequences and the reception of potentially innovative devices. For instance, the premise for one of the workshops (titled Project ICE: Isolated, Confined, Extreme Environments) was the imaginary threat of a possible global pandemic and the consequent need to determine design requirements for a high security, rapid deployment, life sciences laboratory for remote polar environments. Participants were invited to assume the perspectives of representatives of a consortium of corporate and governmental stakeholders who would operate the research facility and to produce prototypes of systems, products or services to support a small crew of scientists and technicians to live and work on site long-term without direct outside support or contact [20].

Partially drawing on the notion of workshop as artwork [21] the intention is to consider both the entire process and the ensemble of prototypes created by the workshop participants as artistic outcomes. This statement is supported by three factors: 1) the design exercise takes the form of a performance with all participants acting according to a fictional role; 2) the scenario, including props, images, ambient features and narrative can be considered as an installation in itself; 3) the prototypes are intended as forms of creative critique and commentary on issues of technological innovation, social practices,

the interactions between political powers and research, and so forth. There is a fourth factor that is suggested here and that goes under the notion of art as a world-making activity. The expression world-making is commonly associated with Nelson Goodman's interpretation of the relationship between real and fictional worlds [22]. The practice itself of world-making is quintessentially future-oriented, as Goodman made the Heideggerian notion of projection into the future at the core of his theories. Every world is created taking existing realities (either factual or fictional) as a starting point and projecting new predicates on them. The visual arts, literature and other forms of cultural expressions all construct parallel worlds with their own specific rules and behaviors. Among these creative disciplines, design maintains a special status because of its power to bridge possible and existing worlds. The essence of design is in fact that of connecting ideas and projections with accepted practices and habits. In contrast with contemporary art, design is perceived as a project directly and operationally affecting people's lives. As observed by Bleecker, DF is a conflation of design, facts and fictions [10]. The prototypes, ideas and critiques developed during the workshops are intended to have an impact beyond the art world, on small or big portions of real life. They are vectors of change conceived to affect specific situations of use. The point I am making here is that the future-making approach extends on a double level of symbolic and contingent existence, or, in other words, it is at the same time artistic and research practice[4].

The job of the curator within a DF context encompasses a complex range of responsibilities, including: to draft a fictional scenario; identify collaborators and specialists to guide participants through the design process; invite and select participants with the goal of assembling the most effective cross-disciplinary team; to identify and make clear to all partners (especially the participants) rewards and potential outcomes; procure props (objects to support the narrative); perform a fictional role; document the workshop. The need of making rewards (learning outcomes, experiences, entertainment, social benefits...) explicit is related to the fact that the workshop demands a high level of engagement to its participants, in terms of intellectual contribution, skilled work, focus and time investment. The degree of engagement required, and the specificity of the subject, cannot appeal to a large general public. Rather, the curator needs to construct its public [23] around a shared concern. Its role tends to shift from that of arranging the encounter between artistic object and audience, to that of staging an encounter between visions, approaches and ideas. Additionally, rather than introducing knowledge to the public, he will extrapolate knowledge from the public.

2.3 A COMPARISON

In this section, I am going to specify further differences between the two approaches outlined above in order to identify the respective advantages, weaknesses and implications. Despite a common interest in the transformation of human experience through technology, significant points of contrast concern the nature of public engagement. While the LL methodology aims at ameliorating or customising existing interactional systems, in future-making labs the attention shifts to the design of completely new devices or services. Additionally, at Beta_Space viewers could gather a deeper understanding of the scientific and technological dimension of the artwork. By contrast, the future-making workshops involve participants in an actively creative exercise whose outcomes are unknown before the beginning of the event, hence allowing for a stronger sense of collective ownership.

The idea of exhibition as laboratory is not new[5] but it is modulated here in two rather opposite ways. A *laboratorium* could be a place where work or activities are shown or a place where the public is invited to work. The first one is closer to the CCS LL, where artists and technologists work in a public setting, thus exhibiting their labor and revealing the cognitive and manufacturing process behind the final outcome. The second interpretation relates to the future-making lab, where the public is at work and is invited to act in a performance and conceptually and manually produce a creative outcome. A relevant point of contact, however, is represented by the idea of curating cross-disciplinary partnerships: in

both cases part of the curator responsibility is to arrange cooperative work between different actors (artists, engineers, researchers, performers, designers, artists, writers...).

3. CURATING INNOVATION

I have identified four fundamental motivations for a curator to develop a practice around the concept of innovation lab:

1) *Artists are often seen as innovators.* The arts are frequently incorporated in innovation policy documents, suggesting the creation of multidisciplinary labs where artists collaborate in techno-scientific research and development [7]. Serendipitous elements and unconventional perspectives are valued as factors facilitating innovation [24].
2) *Artists often make use of emerging technologies and contribute to their understanding, implementation and popularization*. They choose to do so for reasons of visibility, promotion, newness, to learn new skills, but also to perform a role of critical consciousness over the rapid technological change affecting society.
3) *We live in a society of innovation.* Innovation is considered an imperative to survive in the current hyper-competitive economic system. Historical accounts acknowledge a transition from a demand-driven approach to innovation, to one of innovation for innovation sake [5].
4) The cuts to culture and education contribute to a *shrinking of the traditional charitable model of supporting the arts* for their intrinsic value (public or private patronage). Thus artists need to work more closely in partnership with the worlds of research and production to find new sources of financial support.

In a nutshell, curators need to engage with the new role of the artist on one side, and with a global change in the socio-economic system on the other. If innovation is the core aspiration and driver of growth for our society, then we require somebody to mediate its mechanisms to the public and acknowledge its role in contemporary culture. Other methods have already been explored to allow more voices in discourses around technological innovation. For instance, Anne Light adopts techniques from performance art to stimulate a discussion in people marginalized from this kind of debate. Light suggests that people do not need to learn technicalities to express their position about the future, but rather a space to prepare their own narratives [25]. Future-making labs are environments where innovation can be aligned with societal needs, and where people can express visions, fears and criticisms towards an increasingly pervasive technological future.

4. CONCLUSIONS

This paper pinpoints the emergence of speculation as a key attitude in our culture, and acknowledges the development of new interactions between art and innovation. The main motivation for this study was to suggest how curatorial practice might respond to an increasingly future-oriented cultural context. Two possible approaches have been identified, both based on the notion of the laboratory as a paradigmatic space for cross-disciplinary collaboration and research. The concept of LL has been applied by CCS to include audience experience in the evaluation of interactive art. By contrast, future-making workshops inspired by DF are proposed as temporary and participatory innovation labs. The choice of DF is embedded in its potential in creating convergences between creativity and innovation, the representational and the contingent level of everyday life, briefly fictions and facts.

The paper claims a new set of responsibilities for the curator in preparing the public to deal with change. Its tasks should now include the promotion of meaningful participation in a culture of innovation and speculation. The space of the lab can become a site for creating familiarity with the dynamics of designing new tools and behaviors, providing the opportunity to take decisions for the future or a vocabulary to discuss about it. If the dialogue between science and humanities is declared paramount for innovation, then the operational forms and spaces of their reciprocity should not only be recommended by policy documents and incorporated by R&D departments, but also pursued independently

at the scale of curatorial practice, where the distance from the public can be reduced, and its viewpoints listened to.

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ENDNOTES

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2 See for example: Adam, B., & Groves, C.: *Future matters: Action, knowledge, ethics* (Vol. 3). Brill (2007); Auger, J.: Speculative design: crafting the speculation. *Digital Creativity*, (ahead-of-print), 1-25 (2013); Dunne, A.: *Hertzian tales*. London: MIT press (2009).

3 *http://changeist.com/*; *http://nearfuturelaboratory.com/*

4 In a slightly different way to what is generally intended as practice-based research.

5 Hans Ulrich Obrist's *Laboratorium* is a case in point, and a number of examples can be found in the field of bio-art (for instance the recent Laboratory Life at Brighton Lighthouse, led by Andy Gracie). Early proposals for a museum as laboratory, such as that advanced in 20s by Alexander Dorner, can be also acknowledged.

Media Arts Roles in Art-Science Collaborations

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Abstract. Media arts projects are intrinsically engaged with the connections between culture and technology. The relatively new introduction of the term "art-science" is used to designate projects that aim to combine creative thinking and scientific rigor by incorporating media artists into scientific investigations. Despite the success that some Art-Science projects have had, it is not always clear what roles are effective for media artists to play in these collaborations. This paper surveys different approaches taken by media artists when negotiating the design, engineering, policy, and aesthetic issues that arise in interdisciplinary projects.

1. INTRODUCTION

Media arts practitioners are positioned at the crossroads of technology and culture, with hybrid expertise in the use of new technologies and art production. Many academic, scientific, and governmental organizations recognize the importance of interdisciplinary collaboration, or "art-science" projects, that include experts from a variety of disciplines, including engineers, designers, scientists, as well as media artists. These collaborations are exciting because they open up new vistas for media artists, including: opportunities to work with emerging media that might not otherwise be directly available; access to resources and funding not normally as readily available to art practitioners; and a greater influence in affecting projects that may have far-reaching effects on research practice and policy. Interdisciplinary art-science collaborations often make use of some of the skills of the media arts practitioner, such as knowledge of multimedia technologies and design methodologies, but at the same time either de-value or de-emphasize other aspects, such as the use of aesthetic production as a vehicle to tease out cultural issues and mediate between disciplines. Thinking of the media artist largely, for instance, as a software engineer, or expecting the media artist to be primarily involved with secondary aspects of the project, such as public outreach, in effect limits the possibilities for the media artist to have a more integrated role. Similarly, media arts practitioners who see their role primarily as challengers, provokers, and questioners risk positioning themselves as outsiders not directly influencing interdisciplinary research.

This paper explores both the justification of introducing media arts into interdisciplinary projects and also some of the ways that media artists work when engaged in collaborative projects. It is important to accurately characterize the actual, day-to-day contributions of media artists so that they are better equipped to make useful contributions and to explain their role in these projects; either to themselves, to collaborators, or to external agencies such as grant foundations or galleries. In particular, the value of the art-producing aspect of media arts is often misunderstood, simplified, and marginalized.

Some unifying threads that tie much of the literature together is an aim toward a *meta* awareness, a focus on process being as important as results, and a desire to make progress, not only in research, but also in the way research is done. Phrases like "meta-design," "meta-critical," and "meta-knowledge" occur in much of the writing by and about media artists. While these phrases have precise meanings in the contexts they are introduced, they more generally point toward new thinking about how research is conducted and about the importance of including thinking about the meaning and effectiveness of design, evaluation, and knowing.

2. BACKGROUND

Works of media artist tend to be evaluated either in terms of cultural or pragmatic utility. Media arts is often regarded in generalist terms that describe its societal contribution in creating products of cultural enrichment, tools for promoting innovation, or providing the means by which to think critically about the ethical ramifications of technology. Media arts is also characterized as having the potential ability to aid in the solving of specific scientific and engineering problems, especially those having to do with creative representations of, interacting with, and reasoning about data. There is a struggle to articulate concerns regarding the tension between artistic outlooks and technical engagement, as well as to define the role and methods of the media artist within both art and research contexts.

The importance of media arts as an art form is often explained in a similar manner as other arts-- they imbue society with vibrancy and culture. Jennifer Craik, for instance, addresses this in Re-Visioning Arts and Cultural Policy [1], exploring the reference to "cultural vitality" as a prevalent justification for the governmental funding of media arts. More specifically, Martha Nussbaum, in her book, "Not for Profit: Why Democracy Needs the Humanities," sees a correlation between creativity and democratic principles, exploring how necessary ingredients for a robust society, such as the ability to empathize with others, to see problems from multiple perspectives, and to think critically and ask questions, are effectively learned through a strong arts curriculum [2]. The artist and researcher Pamela Jennings also describes the societal benefits of media arts: "The new media arts express a risk-taking and subversive attitude, ultimately seeking cultural acts through which to provide society with entry points for change" [3]. Seen in these ways, media arts practice as a whole is a humanistic endeavor that makes science more accessible and increases public engagement with issues surrounding technological innovation.

At the same time, many research initiatives point to changes in the landscape of STEM (science, technology, engineering, and mathematics) research that indicate that new ways of thinking creatively and collaboratively are becoming increasingly important for various practical reasons. A study released by The Conference Board in 2008, "Ready to Innovate," explores the relationship between creativity and innovation, and argues for the importance of instilling creativity via education in order to foster a globally-competitive workforce [4]. A recent report released by The President's Committee on Arts and Humanities specifically outlines recommendations to facilitate the promotion of arts education, including an emphasis on integrating art practice with other subjects, which seems to improve overall academic involvement and to encourage innovative thinking [5]. John Maeda also describes the need for integrating the arts into government-backed STEM initiatives so that they are recognized as being "part of the same pool of knowledge." More hyperbolically, he explains that because art is needed to help foster innovation it is therefore is "vital to national security" [6]. Specifically, the STEM to STEAM Initiative (championed by Maeda and others) presents a series of case studies involving experiments in early education and corporate collaborations in creating and packaging "design-centered and human-focused products" [7].

Other authors more concretely examine contemporary needs that require creativity and innovation and explore how the media arts (or creative aspects of computer engineering) specifically can be effective. For instance, Roger Malina outlines increasingly problematic issues in contemporary scientific practice and hopes that art-science collaboration may lead new

techniques and methodologies for approaching them. In a book review published in Leonardo, he explains that a primary motivation for the "art-science movement" is the "epistemological inversion" that has occurred due the exponential increase in data that is available whereby the sciences have become "data rich and meaning poor" [8]. Moreover, the type of data has changed-- Instead of having "snapshots" of data, we have temporal "streams," or complex "data systems." This leads to a "crisis in representation." Science is largely conducted through data analysis and not through empirically sensing the world, and, because there are no obvious ways to represent probabilistic, fleeting, or otherwise unintuitive data, this necessitates the attention of the artistic sensibility that is skilled at thinking about issues of representation, or what he calls "re-sensing": "use of visualization and sonification technologies from computer science are a rich terrain of art-science practice and should be viewed as projects in translation" [9]. Moreover, this "deluge" of data creates potential "blind spots"-- areas and interpretations that are ignored because the amount of data exceeds our ability to analyze it. Finally, he advocates for the importance of art-science collaboration because the solutions to complex, global issues require diverse skill sets and the involvement of experts from multiple disciplines. Interestingly, Malina disagrees with the idea of a transdisciplinary merging of art and science, but instead imagines a "shared language" that "entails shared ontologies and eventually connected epistemologies" that "contribute to creativity and innovation." However, the process of building this shared language involves a perpetual negotiation between different perspectives, a process of "trade and barter and not assimilation" [9].

Media artists also continue to develop tools and platforms that foster creative ways of representing and interacting with data. In a 2007 essay, Ben Shneiderman describes the need for tools that enable researchers to come to new understanding or to make discoveries. These tools involve the various stages of research, from the "early stages of gathering information, hypothesis generations, and initial production through the later stages of refinement, validation, and dissemination" [10]. Specific examples of tasks that creativity support tools facilitate include: the rapid generation of multiple alternatives, the freedom to explore implications of alternatives, and the option to revert to earlier stages. Linda Candy sees the media artist as especially well situated to develop new creativity support tools. She explains that media arts projects present a way to "harness" the various "complex social, organizational, and cultural factors" that are required for innovation. Candy thinks of the artist as a "power user" that pushes the boundary existing frameworks and tools in order to discover new forms of expression [11]. Zafer Bilda also examines media arts installations as proving grounds for techniques that are helpful for understanding how different forms of interaction promote increased engagement and creativity [12]. Pamela Jennings further extends the idea of creativity support tool as a framework for pervasive computing. She explores ways in which media artists more expansively consider creativity support tools to be "distributed structures that mutually reinforce both individual and social creativity." She recognizes that any tool is part of "a socio-technical architecture deeply interwoven with the physical environment and social fabric of local communities" and calls for a more "pervasive" outlook on creativity when "investigating and promoting situated and distributed aspects of creativity, particularly in relation to temporal, spatial and conceptual distribution across multiple interaction spaces" [3].

Edward Shanken, in "Artists in Industry and the Academy: Collaborative Research, Interdisciplinary Scholarship and the Creation and Interpretation of Hybrid Forms," explores the gap between the perceived importance of media arts engagement with science and technology and lack of clear methodologies for conducting interdisciplinary projects [13]. He writes that "despite the general recognition that there are substantial challenges to collaboration across disciplines, there is scant metacritical research that studies best practices, working methods, and contextual supports and hinderances." Moreover, there is confusion about the end goals of interdisciplinary projects, especially when it does not lead to a typical artistic or scientific

outcome: "one must wonder about the epistemological and ontological status of these hybrid forms. What exactly are they? What new knowledge do they produce or enable? What is their function in the world?" Shanken is concerned that if there are no clear practices or results to evaluate, then artists and researchers will not have the incentive to "facilitate the creation of new forms of invention, knowledge and meaning." On the other hand, there are exemplary projects that might serve as case studies, and certain individual artists are successful at functioning within interdisciplinary contexts. But it is less clear exactly how and why they are able to function as "catalysts." That is, it is not always clear what specific methods were used in these projects and what specific roles media artists take on in order to help make them successful.

3. THE ROLE OF THE MEDIA ARTIST IN INTERDISCIPLINARY COLLABORATION

The discipline of media arts includes a wide range of practices, with a wide variety of roles available to different media artists. A number of media artists and scholars have articulated different emphases along a range of artistic and technical focal points. Paul Fishwick introduces the idea of "aesthetic computing" in which media artists think of themselves as primary researchers into elegant representations and algorithms [14]. Alex McLean and Geraint Wiggins introduce the idea of "bricolage" programming, where artisitic constraints lead to engineering solutions that are effective in domains outside of arts communities [15]. JoAnn Kuchera-Morin also sees a role for aesthetics in computer science research. In "Using the Creative Process to Map N Dimensions: Quantum Information at Your Fingertips," she envisions the role of the computer scientist as similar to that of a composer [16]. Lev Manovich, in his article, "Post-Media Aesthetics" envisions a new role for media arts as creators of "information interfaces" that influence societal "information behaviors" [17]. And Rita Raley's "Tacital Media" explores how one role of media artists as finding provocative, but not necessarily outright revolutionary, ways to promote changes in thinking [18]. Nonetheless, in the literature describing the roles of media arts practitioners a few general categories emerge, especially in the context of participating in interdisciplinary projects. These roles include diverse activities such as: managing public outreach, leading interdisciplinary teams, organizing politically-charged events, building software tools, as well as making art objects or installations. In this section we look at some ethnographic "post-mortems" by media artists evaluating projects they were involved in.

In the essay, "Art and Science Research: Active Contexts and Discourses," Jill Scott and Daniel Bisig describe their experiences during recent collaborative interdisciplinary projects and raise questions regarding the effective role of the media artist. They conclude that media artists who work in collaborative contexts with scientists are provided with the materials to conduct "critical analysis in the public realm" and believe that through these collaborations media artists can "perhaps even conduct social change." For them, the primary motivation for bringing together media artists and scientists or engineers is so that the activities of researchers can be better explained and presented to the public. That is, the skill set of media artists positions them to be effective mediators between the academy and the public, and to construct effective, educational public outreach campaigns. Internally to the collaborative project, the media artist, as an artist and simply as an enthusiastic outsider, is also able to: challenge disciplinary hierarchies to promote new insights, to critically examine the prevailing tacit methodologies, to point out that knowledge is situated in culture and socially constructed, and to raise ethical cons.

These examinations also discuss how artistic methodologies may promote creative thinking and how creating non-hierarchical research centers may help foster sharing and communication. However, the authors think that it is the media artist's general outlook that is useful to the collaboration, rather than a particular set of skills. Because artists have skills at finding unique visual metaphors, are not afraid to say what they think, and because are concerned with artistry of communication, they envision media artists as the "main players for interpreting scientific research" to a general public who find

science "ethically suspect." They introduce the idea of the media artist as an activist who is able to mediate between the world of research and various public works: "some artists can assist local communities in a move toward sustainable developments, others can look for ways to raise public awareness" [19].

Media artists often choose to be insiders, or even leaders, with a role that is more fundamentally integrated with the scientists and engineers. The artist George Legrady presents a series of articles that examine his own work both as the leader of a team of interdisciplinary researchers and also as an educator investigating methods for fostering creativity in interdisciplinary projects. An article co-authored with Brigitte Steinheider, "Interdisciplinary Collaboration in Digital Media Arts: A Psychological Perspective on the Production Process," contextualizes the process of creating a complex multimedia installation both in terms of the final artistic output and in terms of the collaborative work needed to create the installation [20]. The piece, Pocketful of Memories, applies information technologies and self-organizing algorithms in order to conduct a public cultural exploration of everyday objects [21]. In particular, Steinheider and Legrady examine some of the practical considerations of working with a diverse team of computer scientists, designers, and artists. While the project resulted in a series of successful installations, various problems arouse during the both the design and installation phases of creating the piece.

They explore the tension between production and experimentation; getting things done versus remaining open to new possibilities. From the artist's perspective, flexibility is necessary in order to maintain creativity and to make sure that the final project has aesthetic integrity, despite the potential to cause some amount of disappointment (if plans need to change or people need to leave or work on different tasks) and inefficiency (as work that does not end up fitting the final project must be re-done). However, identifying issues with "communication, coordination, and knowledge-sharing" may make it easier to collaborate. In particular, they emphasize the importance of knowledge-sharing. All participants in the project need to have a "meta-knowledge" that allows them to connect "the different areas of needed expertise as they relate to the project that has brought them together."

Another article by George Legrady explores difficulties that arise when media artists and engineers attempt to collaborate in a more integrated manner, sharing in leadership of a project. In "Perspectives on Collaborative Research and Education in Media Arts," Legrady describes co-leading an innovative graduate-level course with an engineering professor. The course included students from different fields who were tasked with working together on conceiving and creating novel interdisciplinary projects. In observing the development of these interdisciplinary projects, the course leaders noticed different roles that tend to be played by the artist and engineering members of the projects. For instance, artists focus on "cultural aspects of media," look for various kinds of "subtext," and are comfortable with noisy data while, on the other hand, engineers are interested in "problem-solving opportunities," are more comfortable with "purer signals," and seek reliable, measurable collections of data.

Artists are by nature "generalists" who incorporate a "wide spectrum of sources" to come up with a unique approach that cannot be reduced or replicated without dissolving "essential qualities." Ultimately, Legrady concludes these differences in approach are someone detrimental to engineering goals and that there is not necessarily an immediate benefit when including artists in specific, existing research problems. However, he also believes that the artist's insight may "have an impact down the road by opening up new vistas" [22]. In his article "Expectations of Scientists Towards Interdisciplinary and Transdisciplinary Research," Marc Antrop also explores some complications inherent in finding a joint language between participants from different domains working on solving interdisciplinary problems. He believes that interdisciplinarity is actually "an attempt to re-introduce lost skills" that disappeared due to the narrowing of disciplinary focus. In particular, he finds that communication with quantitative scientists is difficult because they do not recognize that research can be "holistic, dynamic, and multi-scale" [23]. He

envisions a "global theoretical basis" for "a common language understandable and meaningful" to all participants in interdisciplinary projects.

These sample case studies present different perspectives characteristic of recent writings describing roles of media artists, as artists, when working in collaborative projects. A variety of different configurations of collaborations and different tactics for operating in these configurations are still being explored. Although a goal may be to have integrated teams of artists and researchers, no "best practices" has been identified that completely effective. However, some important issues are acknowledged, such as the need for clearer communication and knowledge-sharing. The concept of "meta-knowledge" is especially interesting, as it encapsulates the importance of having each participant be aware of the roles of the other participants as well as the overall methods and goals of the project. Since the media artist is positioned in between art and technology, their role in facilitating this meta-knowledge may be important for successful interdisciplinary projects involving multiple participants.

3. CONCLUSION

It remains an important challenge to find adequate ways of describing the functions of media artists so that their work is not presented solely as public-outreach, as beautification, or as an educational or community-building activity, but rather as something that may have specific importance to research in and of itself. In conclusion, we summarize the roles of media artists in terms of four overlapping activities-- generation, augmentation, provocation, and mediation-- that may provide a useful way to articulate the broader importance of media arts in interdisciplinary collaboration.

- Media artists function as *generators* of research agendas, in which art exploration leads to and help define the contours of interesting research problems or applications of research.

- Media artists function as *augmenters* of research, enhancing the representation, interaction, tool-building, or narrative components of the research in order to make it both more effective and more accessible.
- Media artists function as *provokers*, questioning assumptions and introducing alternative perspectives and interpretations.

- Media artists function as *mediators*, creating systems that bridge perspectives and languages, and promote knowledge-sharing between different disciplines and communities.

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Transgenic Swimming Pools: Testing Bodies in Art and Science Experimentation

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Abstract. Through a reading of Avital Ronell's "test" and Karen Barad's "intra-action," this paper proposes the figure of "pooling" for understanding the implications of the experimental process in Art and Science. In this paper we explore two outcomes of scientific testing on bodies, a patent for transgenic fish and a report on the declassified U.S. government reports of radiation experiments unknowingly conducted on medical patients. Re-configurations and transformations of products, waste, contamination, and the limits of tracking and measurement contribute to a process through which value is assigned and patterns may emerge into fields of vision and understanding.

1. CONTAMINANTS

The line or trait that seemed to separate the two bodies of interpretation is affected straightaway by an essential disruption that, for the time being, I shall let you name or qualify in any way you care to: as internal division of the trait, impurity, corruption, contamination, decomposition, per- version, deformation, even cancerization, generous proliferation, or de- generescence.— The law of genre, Jacques Derrida, translated by Avital Ronell [1]

The investment in boundary-defining and questioning boundary limits determines practices across disciplines and institutional settings, a testing process that uncontainably radiates and permeates across public and private domains. Some types of scrutiny are deconstructive: this process of dismantling knowledge fabrications ought to be repeated, although many thinkers have already successfully deconstructed assumed knowledges, whether formulated in laboratories or within historical trajectories. Another, perhaps more speculative approach, might impose temporary boundaries around different lines of inquiry, allowing each to contaminate the other in order to see what results. This experimental process openly recognizes the fleeting nature of knowledge construction, without claims to be founding permanent methodologies – a 'snapshot' capturing a momentary configuration. In this way, this paper draws on the work of Avital Ronell and Karen Barad in a process that we describe as 'pooling.' By acknowledging a 'new materialist' investment in the discovery of new epistemological configurations engaging with science, we place Ronell's "test"[2] and Barad's "intra-action"[3] in dialogue with each other in order to better understand a contemporary situation in which we find ourselves immersed within technological frameworks.

Ronell interrogates testing as an ubiquitous modality that temporarily manifests spatially, touching down from time to time at a 'test site'[2]. Intra-action is used by Barad instead of the commonly used term interaction to signal the process from which scientific phenomena and knowledge emerge. Intra-action is not the interplay of stable bounded entities, instead it signifies materialization through relational knots [3]

[4] and assumes that distinct bounded agencies do not precede this 'relating' but rather emerge through their intra-actions. [3] Barad's discussion of the phenomena and intra-actions of the experimental apparatus might frame experimentation as a process of 'pooling,' a contact zone in continuous motion.

To their thinking we add a couple of examples to the mix. Grappling with the outcomes of two sites of testing—a patent for "transgenic fish and the uses there of"[5] and a study based on declassified U.S. government reports of radiation experiments unknowingly conducted on medical patients—we engage with the process of experimentation as an immersive situation in which all parties find themselves implicated, even those readers and others who contemplate the studies after the fact. The discussion that follows concentrates on two focal points or locational 'pools' of analysis: the arena in which testing operates, and testing as it intersects with bodies. Through an analysis of the textual outcomes of two examples of scientific experimentation, we identify pools of material interferences, sites with ephemeral boundaries experienced through evaporations, contamination and escape.

2. ART AND SCIENCE EXPERIMENTATION

Art and Science both pursue their methodological paths through processes of experimentation. Each system requires coherent research techniques, although in order to reach undiscovered terrain (rather than replicating standardized results already produced) the experimentation must allow for the unexpected. Interestingly, a delicate balance is sought in the experimental system whereby the elements of surprise must stay within the field, else the results might slip past detection and remain unknown. Hans-Jorg Rheinberger's study of protein synthesis describes the experimental system as: "fluid enough to allow for unprecedented events, but stable enough to allow them to be recognized," a fluctuating arrangement that edges towards destabilization in order to produce results [6]. Ronell points out that permission for this blindness in the scientific process may be borrowing from a history of artistic practice, held within a methodology of open inquiry, an appeal to an unknown source of insight that may be granted at a moment's notice through what is almost a type of gambling game [2].

Ronell's analysis of Nietzsche's Gay Science describes Art as an 'experimental engine' that might potentially critique science, or more disconcertingly, may train our eyes for science, serving as a type of societal inoculation against its potential dangers. "Art introduces a vitality capable of hosing down the strictures of morality. The necessarily subversive force of art and play challenges the stability of morality as we know it, and, when in concert with science, repels those recodifications slavishly beholden to moralistic descriptions"[2]. Ronell points out that both Art and Science share the terrain of the experimental *écriture*, an inscription apparatus that breaks apart strict divisions between "object and inscription, or representation and inscription" [2]. The authoritative voice of science combines with the ability of the experimental process to perhaps dangerously slip between model and matter; to write upon and reframe and convincingly reshape our understandings of the world.

3. TESTING

The permutations of a technologically defined society are interrogated by Ronell through the ubiquitous, disseminated and inescapable process of testing—associated with a culture of laboratories whose experimental proceedings operate "within a system of probabilities"[2]. Long since diffused throughout daily life, laboratory proceedings include the defining of objects and the on-going investigation and verification of the constitution of evidence. One way that testing shapes how we understand the world can also be described through Don Ihde's "phenomenological materialism," [7] a way of scientific seeing through instrumentation, or the way in which science "perceives its worlds." Once instruments are developed, the "vision" that they convey is disseminated outside of the specialised field and disseminated widely throughout society, permanently altering understandings of the world. He refers to the invention of the telescope through which the surface of the moon moved more closely into vision. The moon will never look the same—neither when we gaze

upwards towards the sky, nor when we imagine it in our mind's eye.

Everything is put to the test within our technologically-infused society; filtered through an incessantly applied modality in which we create ontological determinations. Testing is not bound by science, nor any other disciplinary field; rather, it forms a widely dispersed arena for relating to others and the world around us. As a modality rather than a space, testing is difficult to "pin down."

Ronell Refers to Hans-Jorg Rheinberger's study of the scientific object, in which he identifies the unfixedness of the scientific object by preferring to call it an *epistemic thing*. "Even where the scientific object exhibits elements of a physical structure – a chemical reaction, a biological function whose elucidation is at the center of the investigative effort – its nature is elusive"[2]. As Rheinberger describes, during the process of experimentation and scientific investigation, the scientific object begins to manifest as epistemic thing, one that is always "yet in the process of becoming materially defined."[2]. The experimental process here could be considered a "grammatology of laboratory writing"[8] that includes not only plutonium, human products, fish and brine shrimp eggs, but also a writing framed by "decisions, traces that are there and not there, legible and illegible at once"[8] in which everything is immersed within a process of trialing and testing, including our own bodies and actions. Just as the scientists in the lab engage with laboratory writing in which they themselves are implicated other manifestations and tests extend outside of this particular institutional setting and boundlessly permeate all aspects of life.

3.1 INTRA-ACTIONS AND POOLING

In her "agential realist" framework Barad uses the example of quantum physics from Bohr to suggest that in order to give an "unambiguous account of proper quantum phenomena" experiments, we must also include a description of all relevant features of the experimental arrangement [3] For Barad, interrogating the details of the experiment (the phenomena) is not merely a way to document the process in order to evidence the relationship between the observer and observed or insure results of measurement. It is the elaboration that "phenomena are the ontological inseparability of agentially intra-acting components" [3]. Intra-action is not restricted to human actions, nor is it distributed across nonhuman and human forms, instead what is at stake is the iterative reconfigurings of materiality - or what Barad describes as the "permanent marks from experimental conditions left on bodies" [9] such as the spot on the photographic plate caused by the impact of the electron. As Noreen Giffney and Myra Hird explain: "Specific intra-actions produce, perform and enact a changeable being, a materiality in continual change". [10]

An experiment is iterative intra-actions of the practices and processes (phenomena), such as condensation, contamination, translation and transformation. The intra-active process of translation is described by Barad as a specific material arrangements. This can be further understood through examining the intra-actions of ionizing radiation:

"Ionizing radiation, by definition, "ionizes," that is, it pushes an electron out of its orbit around an atomic nucleus, causing the formation of electrical charges on atoms or molecules. If this electron comes from the DNA itself or from a neighboring molecule and directly strikes and disrupts the DNA molecule, the effect is called *direct action.* This initial ionization takes place very quickly, in about 0.000000000000001 of a second. However, today it is estimated that about two-thirds of the damage caused by x rays is due to *indirect action*. This occurs when the liberated electron does not directly strike the DNA, but instead strikes an ordinary water molecule. This ionizes the water molecule, eventually producing what is known as a *free radical.* A free radical reacts very strongly with other molecules as it seeks to restore a stable configuration of electrons. A free radical may drift about up to 10,000,000,000 times longer than the time needed for the initial ionization (this is still a very short time, about 0.00001 of a second), increasing the chance of it disrupting the crucial DNA molecule." [11]

By bringing attention to the materializations of the experiment we do not take a neovitalist approach that takes every-thing to be living but

instead suggest it is necessary to ask after ways in which particular experiments "come to matter for particular purposes of particular kinds of flourishing for particular beings"[12]. As plutonium enters bodies, as proteins are produced in petri dishes, these experiments have material effect upon our bodies (humans and nonhuman) that may possibly manifest on lab material or worker. Derrida describes contamination as a sort of participation without belonging [1]. Participation may also create patterns, which Barad describes as material-discursive interferences –composition, decomposition, incorporation, transformation –or what we term 'pooling'.

As a stream's hydrological flow structure alternates from areas of relatively shallow to deeper water, riffle-pool sequences take place. 'Pooling' occurs in several ways, such as water falling from a waterfall digging deep into a river bed. In other words, we can understand pooling as a type of space-time mattering [3], a material arrangement. Referencing hydrology, 'pooling' is a process of material interference; pool-riffles do not happen only underwater but as rocks, sands and water reconfigure, they re-arrange the channel of the river itself. It might be possible to provide definite measurements for the way water diffracts or moves through bodies, for example through field surveys, measuring loading, or channel and gradient morphology, yet the operations of water movement, like the experimental process, continually push at the boundaries and produce results through factors that may likely not be seen initially, may be overlooked or fall outside of what earlier studies have recognized. 'Pooling' in this invocation is an experimental process of intra-actions in which participation is "not simply produced nor simply productive" [13]. It is a "condensation of traces of multiple practices of engagement".[3] Instead 'pooling' is a process of "becoming-together-apart" [3] of continuous sedimentations and erosions. As forces and bodies entangle in the experimental pools, lab writings materialize "as knots of relations involving humans, non humans and physical entanglements of matter and meaning" [16].

4. TRANSGENIC FISH AND THE USE THEREOF

The transgenic green fluorescent protein (GFP) madaca, is a scientific product designed to signal the estrogenic, endocrine disruptors in chemicals, environmental water samples, food stuffs, pharmaceuticals and other commodities [5].

The transgenic fish can be of various freshwater, brackish water, or saltwater (marine water) species of fish, including, without limitation, fish of the Oryzias species and the Danio species. Fish in the Oryzias genus belong to the Adrianichthyidae family and include, for example, Oryzias melastigma (alternative name Oryzias dancena) (Marine or brackish medaka), Oryzias latipes (Japanese medaka), Oryzias celebensis, Oryzias marmoratus, Oryzias matanensis, Oryzias nigrimas (black buntingi), Oryzias orthognathus (buntingi), and Oryzias profundicola. Fish in the Danio genus belong to the Cyprinidae family and include, for example, Danio rerio (zebra fish), Danio albolineatus, Danio abolineatus, Danio choprae, Danio dangila, Danio erythromicron, Danio feegradei, Danio kerri, Danio kyathit, Danio margaritatus, Danio meghalayensis, Danio nigrofasciatus, and Danio roseus."[5]

When the GFP madaca is exposed to endocrine disruptors, it produces flourescent proteins, a signal, an afterglow from pools of developmental toxicology, developmental biology, genetics, chemical reactions, endocrine functions and pollution.

"This method involves exposing transgenic fish to a liquid medium to be tested (i.e., to be tested for the presence of an estrogenic substance. After this exposing step, the method then involves determining whether or not the transgenic fish exhibits an observable mark produced by the induced expression of the reporter gene (contained in the transgenic fish)." [5]

Through a process of intra-action, the GFP madaca emerges from geographically far flung sites of material interference, such as the transference of estrogenic substances in the blood stream pooling into breast milk or endocrine disrupters in water pooling into the flesh of striped dolphins in Japan.[14] . Through processes of contamination, exposure, regeneration, selection, transduction, the GFP madaca produces and is

produced by observable marks, intensities of flourescent illuminance.

5. HUMAN PRODUCTS

The word experiment is rarely used in biomedical research, "other terms, not necessarily synonymous—such as *clinical study, clinical investigation, quasi experiment,* and *case control study*—are all used"[11]. The Human Radiation Experiments Report, based on de-classified U.S. documents, tentatively critiques activities carried out by universities, governmental, and military organizations between the years 1944-1974 who conducted radiation experiments on medical patients, prisoners and other citizens without their consent. By Cabinet directive in 1994, federal agencies located records of human radiation experiments and compiled a database of records for approximately 4,000 human radiation experiments [11]. Detailed within the report is the encoded title "HP," standing for "Human Product," that labeled the medical records of uninformed patients injected with radioactive materials at the University of Rochester in New York; inserting the process of ionizing radiation into the bodies of human products.

"A fast neutron will bypass orbiting electrons and occasionally crash directly into an atomic nucleus, knocking out large particles such as alpha particles, protons, or larger fragments of the nucleus. . . . The particles created will themselves then set about ionizing nearby electrons. A slow neutron will not have the energy to knock out large particles when it strikes a nucleus. Instead, the neutron and the nucleus will bounce off each other, like billiard balls. In so doing, the neutron will slow down, and the nucleus will gain speed. . . . All of these collisions and ionizations take place very quickly, in less than a second." [11]

Tracking scientific data proves difficult when it is performed without consent on living human products. It wasn't possible to restrict these scientific objects of study to a laboratory, a hospital, or even a geographical region for the years required to track long-term results. A trail of documents describe the case of Mr. Albert Stevens in Berkeley, California, chosen for a plutonium study, his excreta collected daily for nearly a year, but only accomplished through a series of economic proposals including placements on the doctor's payroll and free nursing home care to prevent him from moving.

Some of the immediate known effects of radiation exposure contrast sharply with the long-term unknowns: "It takes much longer for the biological effects to become apparent. If the damage is sufficient to kill the cell, the effect may become noticeable in hours or days. Cell 'death' can be of two types" [11]. The cell either no longer performs its function, or "reproductive death" occurs when a cell can no longer reproduce. "The effect of the radiation may not be to kill the cell, but to alter its DNA code in a way that leaves the cell alive but with an error in the DNA blueprint. The effect of this *mutation* will depend on the nature of the error and when it is read. Since this is a random process, such effects are now called *stochastic.* Two important stochastic effects of radiation are cancer, . . . and heritable changes, which result from mutations in germ cells (eggs and sperm)" [11]. The self-perpetuating experimental process easily exceeds the methods for tracking and tracing the results.

6. MATERIAL INTERFERENCES

"irregular trajectories such as a paper-bill in swirling wind, illustrate the tradeoffs between truth and meaning. To the extent one can give a definite interpretation to F=ma in these circumstances (in which gravitation is the only force for which there is a well-defined force function), the equation so interpreted is falsified, but it makes much more sense to say that it lacks any definite interpretation here. There is no determinate application of the concept of force in these circumstances." [15].

Drawing together Barad's intra-action and Ronell's testing, we have arrived at pooling as a type of 'test-site' for the experimental process. Pooling, like diffraction, is of and produces interference patterns that "re-order bodies," enacts "perpetual worldings" and recognises "their embeddedness in patterns of intra-action." [15].

One way that these "worldings" manifest is through an economy of waste, as the gaze affixed to the process of experimentation re-assigns value. If Ronell's test-site more generally

refers to a temporary spatial manifestation of a process of testing, the term itself commonly references a place of military experimentation, where the results of atomic bombs and other explosive devices are measured. These sites for experimentation are selected in part because they are considered remote; where the unknown results of the experiment are unlikely to prove destructive. The value assigned to the Nevada desert terrain or to the homes and communities based on the Bikini Islands, for example, indicate an economy of waste assigned to the process of experimentation. What is considered remote or overlooked allows for the playful and potentially damaging results of experimentation and re-assigns value to what might be considered "waste." What is considered a wasteful site is transformed into a site of military value as the waste that remains after experimentation can itself be measured.

Like Ronell's test-site, pooling as a site of experimentation implies that preservation is not the mode of operation. Rather, experimentation in pooling can only occur in sites where unforeseen transformations will not disrupt pre-existing valuable economies, or where the immediate effects of the experiment are not widely or immediately noticed. So genetic alterations that are likely to disperse outside of a field of study, such as transgenic fish entering the ecosystem, or mutations first introduced on human products, can be enacted as part of the experimental process as long as they remain relatively unnoticed.

But pooling through intra-action also implies patterning; the closely interrelated relationship between movement, mathematics and visualization associated with physics and the computer algorithms that simulate their configurations. Our intra-active reading of Barad and Ronell therefore brings patterning to the test-site as part of experimentation. Returning to the example of testing atomic blasts, predictive calculations were compared with the movements and measurements captured during the tests, helping to establish more precise calculations for the effects of dropping bombs in other locations in the future.

Barad's intra-action as the process through which things manifest also emphasizes, however, the very lack of predictability that is additionally enacted through scientific experimentation, in the truly transformative and unknown aspects that form the basis of the experimental process itself. Instead of creating an account of performativity from the a posteriori characteristics of a 'final' patent, transgenic fish, plutonium injection, faeces sample, or bell curve chart, an intra-active analysis demands that we engage with their configurations and their ever-emerging re-configurations. If these environmentally-dispersed orderings and logics cannot yet be witnessed, or a mapping and flow between morphing pools cannot quite be animated, a scientific worldview would at least suggest such a real-time visualization might be attempted.

The process of experimentation, however, also insists that unknowns emerge alongside patterns that may be predicted.

ACKNOWLEDGEMENTS

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The End & the Beginning of Everything

Shane Mecklenburger

Abstract. Supernovae are cosmic crucibles that produce and distribute the heavy elements necessary for life as we know it. Using computer-simulated supernova explosions as raw material, T*he End & the Beginning of Everything* interprets astronomy research symbolically in relation to two phenomena: the application of supernova research to simulated thermonuclear weapons testing, and the 18th Century Romantic notion of the sublime. Accelerating technologies are amplifying scientists' ability to model, observe and manipulate the physical world, expanding our understanding of life and the universe. Even when intentions are to safeguard, such developments can potentially place life as we know it at risk. *The End & the Beginning of Everything* critically explores the implications of these developments through a creative collaboration between the Departments of Art and Astronomy at The Ohio State University, the University of Chicago Department of Astrophysics, the Advanced Computing Center for the Arts and Design, and Chicago's Adler Planetarium.

THE END & THE BEGINNING

Supernovae are among the most spectacular events in the observable universe. They outshine entire galaxies and are critical to the formation of planets, stars and life as we know it. The heavy elements that compose our solar system were created and distributed by supernovae. [1] Most everything we are—carbon, calcium, iron, oxygen— originated in a supernova event.

In June 2012 I began a creative collaboration with the FLASH Center for Computational Science at the University of Chicago, which produces 3D simulations of supernova explosions from very large datasets at Argonne National Labs. FLASH Center's simulations improve our understanding of how supernovae occur. Models of thermonuclear-powered supernovae have led to discoveries and insights about such explosions, helping astronomers use these events as "cosmological yardsticks" to determine the properties (and hopefully eventually understand) dark energy. For example, supernovae were key to the measurements that confirmed dark energy's role in the accelerating expansion of the universe, an observation that earned a Nobel Prize in 2011.[2]

In addition to offering cosmological insights, FLASH Center's research on thermonuclear dynamics driving supernovae assists in understanding better how to do the kind of computer simulations needed to simulate nuclear weapons, helping the U.S. to move from using live nuclear tests to using computer simulations to assure the reliability and safety of the nation's nuclear weapons stockpile. Funding for FLASH center comes from the U.S. Department of Energy (DOE) Office of Advanced Simulation and Computing (ASC) Academic Strategic Alliance Program (ASAP) within the National Nuclear Security Administration (NNSA). The NNSA was established by the U.S. Congress in 2000 as a separately organized agency within the U.S. Department of Energy, responsible for the management and security of the nation's nuclear weapons, nuclear nonproliferation, and naval reactor programs. The NNSA came about as part of the shift from funding live tests of the nation's nuclear weapons to funding computer simulations of the weapons instead.

Funding for such simulations began in 1995

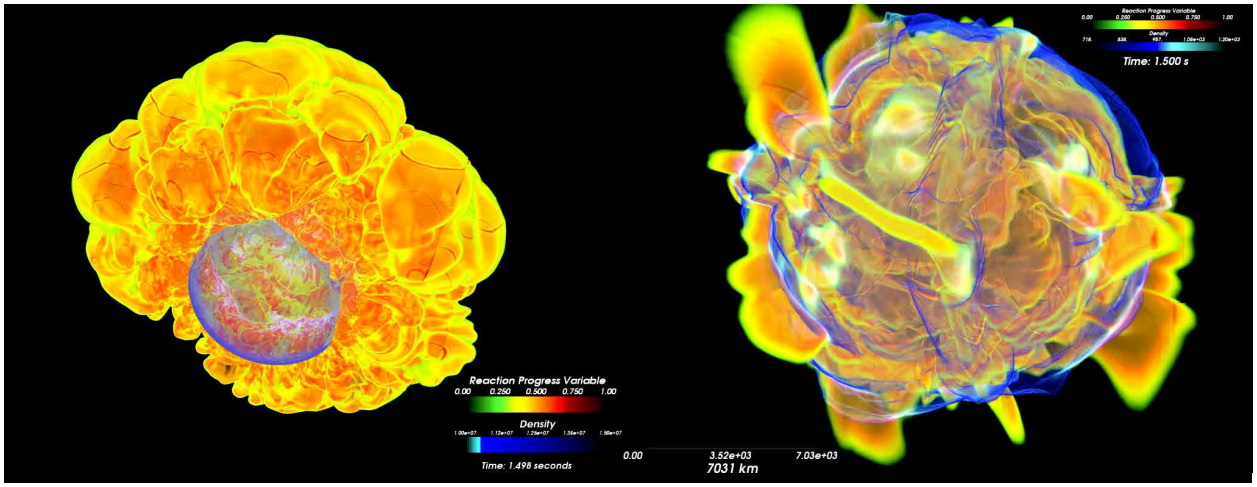

Fig. 1. *Type 1A Supernova White Dwarf Deflagration simulations (video stills), courtesy of the FLASH Center for Computational Science.*

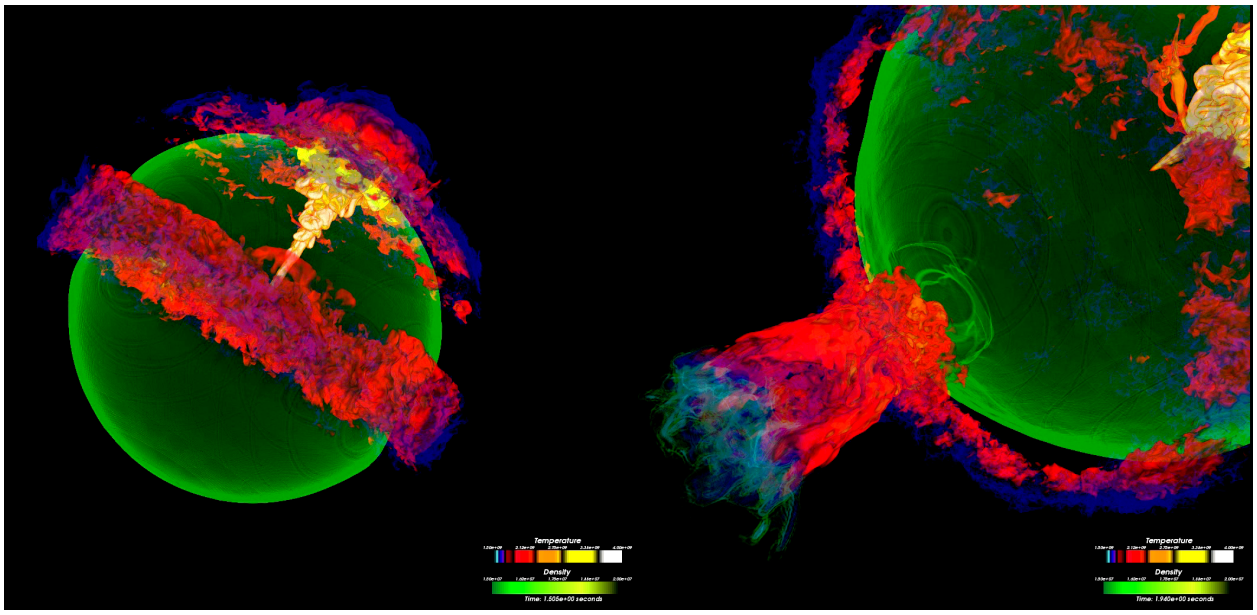

Fig. 2. *Type 1A Supernova White Dwarf Deflagration simulations (video stills), courtesy of the FLASH Center for Computational Science.*

in response to the 1995 Nuclear Test Ban Treaty (which the U.S. has adhered to, but never signed). The decision to adhere to the Nuclear Test Ban Treaty was driven as much by the dissolution of the Soviet Union as by accelerating advances in computational processing power; by 1995, complex computer-simulated weapon tests had become feasible enough to potentially to safely replace real-world nuclear testing. In this way, there were very immediate real-world applications for studies of the thermonuclear processes driving distant supernovae.

The End & the Beginning of Everything is a project addressing this constellation of developments via creative collaboration between The Ohio State University Departments of Art and Astronomy, the University of Chicago Department of Astrophysics, Chicago's Adler Planetarium and the OSU Advanced Computing Center for the Arts & Design. Accelerating technologies are amplifying astronomers' ability to model and observe, expanding our understanding of life and the universe. *The End & the Beginning of Everything* symbolically explores the implications of this research and its practical applications through a series of artworks and a mentorship program made possible by a Battelle Endowment for Technology & Human Affairs.

THE SUBLIME

In FLASH supernova visualizations, these profound moments of annihilation and creation are represented in blossoming embryonic shapes and rich layered color. To my eye, the visualizations are, in a word, sublime— in the 18th Century Romantic sense of the term. The Romantics set out to depict the irrational power of nature in a critique of Enlightenment ideals and approaching industrialization that emerged from them. Human reason and aspirations became insignificant when confronted with the overwhelming forces of nature. Romantic artwork gave rise to a new description of beauty known as the sublime, which described a specific aesthetic response resulting from the awe and terror inspired by natural phenomena beyond human reckoning or influence.

Today's accelerating technological momentum has brought new relevance to the sublime experience. Everyday contemporary perceptions of science and technology— as inevitable and overwhelmingly powerful forces beyond our control or comprehension— is increasingly analogous to how the Romantics once viewed nature. As Richard Coyne and others have pointed out, the prevailing popular response to technology is often analogous to how Romantics once responded to nature, leading to what's been described as the "techno-sublime" or "technoromanticism".[3] [4] [5] As seductive and beautiful as these technological phenomena have become, the prevailing technoromanic turn is extremely problematic, as it often results in the abdication of individual agency to the power of technological and scientific systems. Indeed, it has never been more clear that "TECHNOLOGY," as artist Jenny Holzer asserts, "WILL MAKE OR BREAK US".[6]

SPLIT INFINITY

Since June 2012 I've worked closely with FLASH Center visualization expert Brad Gallagher to create a series of cross-section "slices" of a computer-simulated 3D supernova model that is "frozen" in time. These supernova models are generated from extremely large "big data" sets from international astronomical observations and high-energy density physics simulations processed by massively parallel "supercomputer" facilities at Argonne National Labs. I'm using these "supernova data slices" as references to reconstruct this frozen explosion as a sculptural object, using a technique I developed to construct dimensional forms entirely from acrylic paint. Once the solid "paint explosion" is dry, it is sliced into a series of cross-sections, revealing multi-colored layers of its interior. Each slice is similar to its neighbor and slightly different, like cels of an animation, and these slices will be wall-mounted for exhibition.

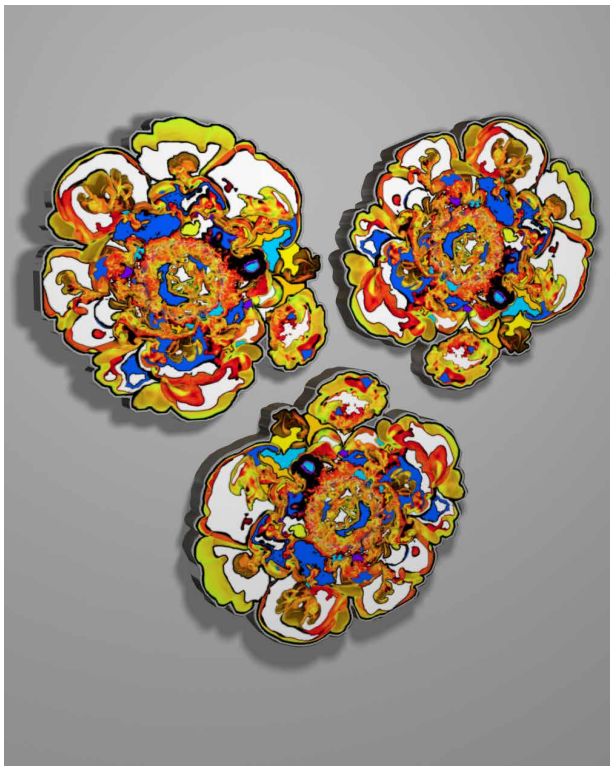

Fig. 3. *A pre-visualization of Split Infinity, paint slices derived from supernova explosion datasets (detail), courtesy of the artist.*

BITING THROUGH

As a gesture, the cross-section splits open an otherwise pristine and opaque object to reveal its disorderly internal "organs". The slices are visually reminiscent of natural systems like storm weather patterns, as well as biological systems like MRI or CT scans of the human body. Cutting-through is a gesture of purposeful and deliberate domination, intended to reveal a concealed— and often disordered— interior. The action of the cut directly addresses the onion-like nature of the datasets I'm using as raw material, both in terms of their structure and also in terms of the social, political and historical forces from which they emerged. For me, the cut also makes reference to the I-Ching symbol Shih Ho, which

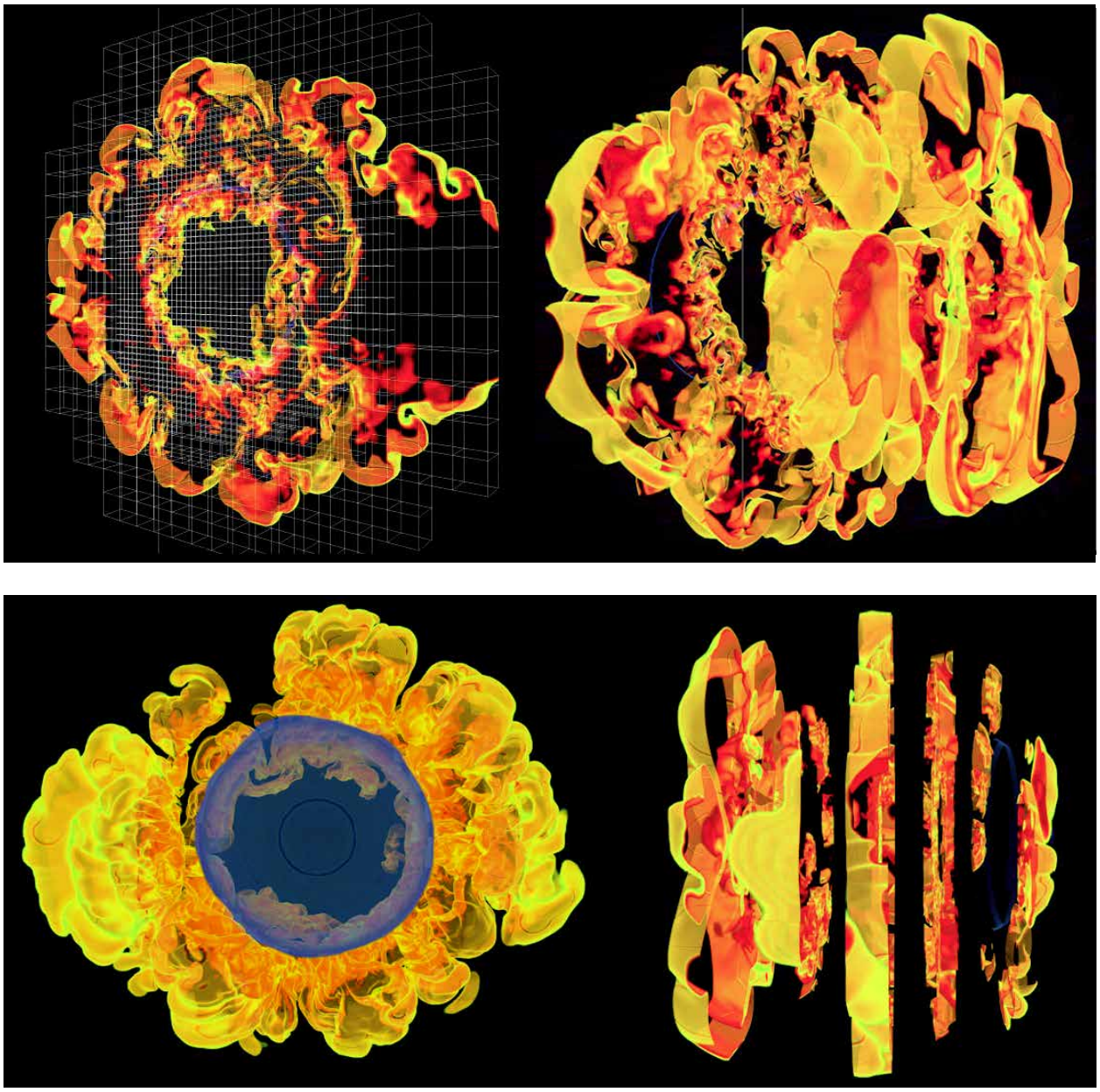

Fig. 4. *Cross-section slices of Type 1A Supernova White Dwarf Deflagration simulations (video stills), courtesy of the artist.*

represents "biting through", indicating how "obstacles are forcibly removed in nature. Energetic biting through overcomes the obstacle that prevents joining of the lips; the storm with its thunder and lightning overcomes the disturbing tension in nature." [7]

CAULDRONS

I've also been working with Brad Gallagher and FLASH Center to produce a series of multi-channel video artworks. Each video is a pastiche of various nuclear thermodynamic simulations unfolding slowly over several minutes. The result will be an array of slow-motion *Cauldrons* on large-format plasma display screens arranged on the floor facing upwards. *Cauldrons* refer to the creative practices of cooking and magic, the historic cultural position of the cauldron as a symbol of the womb, and the unimaginable heat of these cosmic crucibles. The explosion is also symbolic for me of our blooming technological expansion and its dramatic consequences.

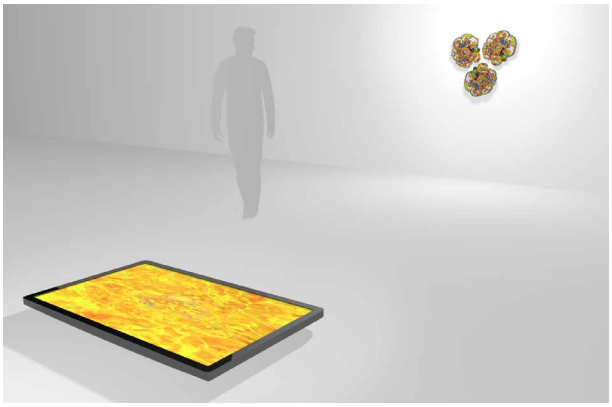

Fig. 5. *A pre-visualization of a Cualdron video display alongside Split Infinity paint slices (installation view), courtesy of the artist.*

MELTDOWNS

The literally "conflicted" nature of the project's raw material and subject matter have called for special attentiveness to any breakages or unexpected results as we work with the simulation data set. So-called "glitches" emerging from our manipulations are important elements to be preserved and apparent in the finished works. Simulations are, after all, a reminder of the limits and imperfections of human understanding, since a model, no matter how detailed, is incapable of approximating reality. Our supernova dataset is extreme in this regard, as a mixture of distant observations and theoretical models. And even if close observation were possible, the reality of it would annihilate us instantly. Thus it's important for me to preserve the limitations of our model and its digital nature, which are marvelously revealed when the system breaks down.

MENTORSHIP

My creative partnership with astronomers at FLASH Center will also be used as a model for a student mentorship program in which students in the OSU program in Art & Technology within the Department of Art are paired with researchers in the OSU Department of Astronomy. Based on what they learn, students create artworks inspired by current astronomy research. This semester-long creative partnership takes place as part my *Experimental 3D Animation* course, in which students learn to use 3D animation software to produce video art. Production and final output of students' high-definition video artworks is facilitated by computational animation rendering resources provided by OSU's Advanced Computing Center for the Arts & Design. Chicago's Adler Planetarium will exhibit the results of this collaboration in their Definiti Space Theater in 2014, using their skydome projection system.

The project challenges students and the public to attend to the humbling discoveries and consequences of technological and scientific endeavors by recasting astronomical revelations as symbolic of both our origins and our limitations. *The End & the Beginning of Everything* addresses the gulf between our understanding of natural events and the events themselves— as well as the lay-public's increasingly precarious relationship to science— by creating a space to critically reflect on both the wonders and implications of technological developments for human culture and society.

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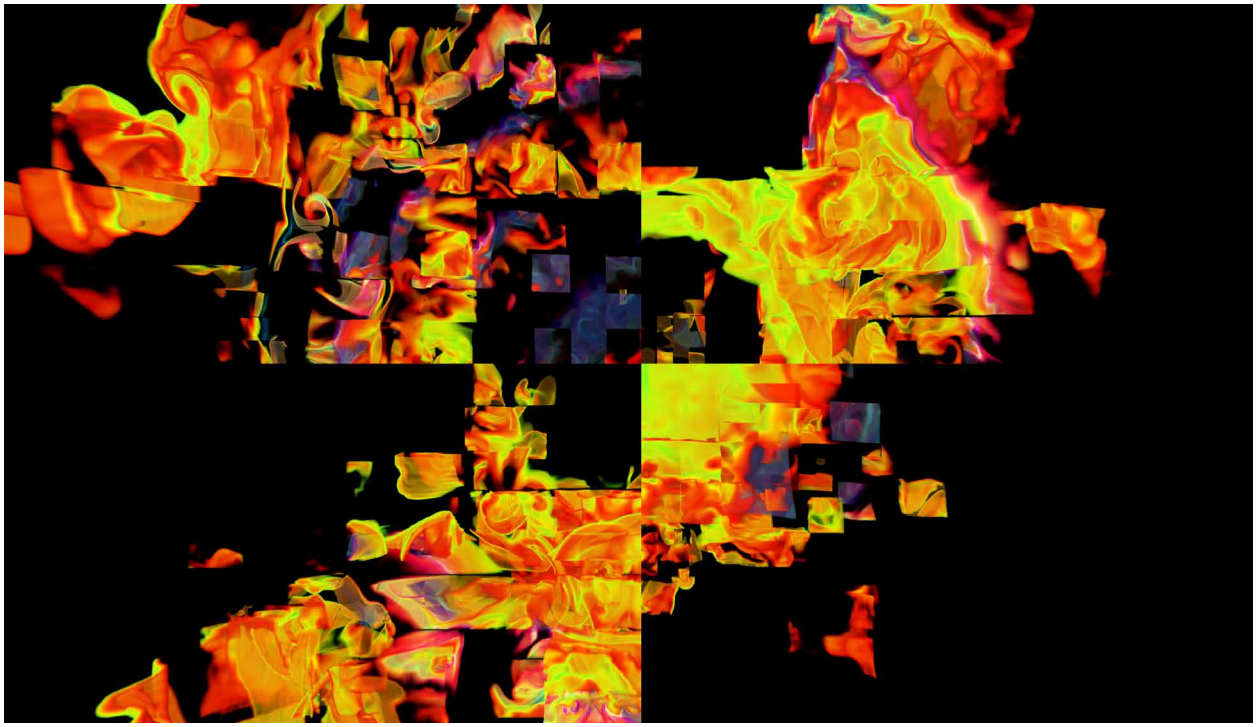

Fig. 6. *An unexpected breakage which occurred during supernova dataset manipulation, courtesy of the artist.*

DATA SPACE, DATA NARRA-TIVES

DATA SPACE, DATA NARRATIVES

DATA SPACE, DATA NARRATIVES

Double-Meaning: Interactive Animations with Simultaneous Global and Local Narrative

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Abstract. In this paper we introduce a series of interactive animations that are able to present "double meaning"-- that is, they simultaneously present two levels of narrative. We describe our strategy for creating these animations is based on an analysis/synthesis approach, similar in some ways to techniques utilized for audio processing effects. Data resulting from the analysis of a real world image (or video) is used to generate a non-photorealistic version of the input where the synthesis elements, instead of being pixels, squares or brush strokes, are rather visual entities with identifiable shape and behavior. The paper is illustrated with examples that show the narrative possibilities of this strategy for animations and real-time installations.

1. INTRODUCTION

Visual art can be perceived at different levels. Paintings for instance, can be examined up-close in order to appreciate the texture, style, technique, or the individual elements that conform the picture. A global view, on the other hand, usually gives information about the intention, subject matter, and the interrelation of the different parts of the picture. Many artists in the past have used different scales of information to create images that contain both a global narrative as well as a micro-narrative at a local scale. For instance, the XVI-century painter Giuseppe Arcimboldo mixed figures of fruit and vegetables to create portraits with double meanings.

The global subject matter in his work is always a human face, but at a local level the constitutive elements also have a separate identity of their own. More recently, Dalí also explored the possibilities of images containing a double meaning in paintings such as "The Mysterious Lip that Appeared on the Back of My Nurse" and "The Great Paranoiac." [1]. Some contemporary artists have also become specialists in the creation of images with multiple levels of narrative (e.g., Sandro Del-Prete, Octavio Ocampo, Istvan Orosz, Andre Martins de Barros, Oleg Shuplyak). For example, Vic Muniz chooses to use unusual materials, such as chocolate or garbage, to embed an additional layer of meaning into his pieces [2]. Kenneth Knowlton and Robert Silvers have investigated the computer-assisted generation of images containing multiple levels [3].

The latter has created the "Photomosaic Process," a technique in which a larger image is composed from a set of smaller images, where there is (usually) a relation between the smaller images and the larger image. This technique has been extended to video, but with less success, as it difficult to find appropriate video clips with a local narrative that relates to the global narrative of the larger video [4]. A related problem involves controlling the synthesis of natural scenes. For instance, Prusinkiewicz and Mech [5] explored the generation of botanic structures with external environmental constraints; other work explores the creation of flocks of birds and butterflies with the capability to align in predefined shapes ([6] and [7]).

In this paper we describe three different alternatives for the creation of *double-meaning animations*, computer-generated animations that have a global and a local narrative. These different approaches can be used in interactive and fixed media arts installations, and are each appropriate for different artistic effects. The first one uses a direct substitution of synthesis elements by concrete entities. The second one uses a generative approach. And the third one is based on the direct detection of the synthesis elements. A major issue that arises when creating double-meaning animations is *temporal coherence*. Temporal coherence is lost when frames are analyzed independently because the parameters of objects in adjacent frames can change abruptly. Moreover, the number of synthesis objects can be totally different in consecutive frames. This rapid appearing and disappearing of objects destroys the effect of motion at the local level, which can disturb the intended aesthetics of the artwork. These three techniques, described below, can each be used to create animations that maintain temporal coherence.

2. DIRECT SUBSTITUTION

A direct alternative to creating scenes that are meaningful at the local and at the global scale is to replace abstract synthesis objects with well-known elements. The following example illustrates the whole process.

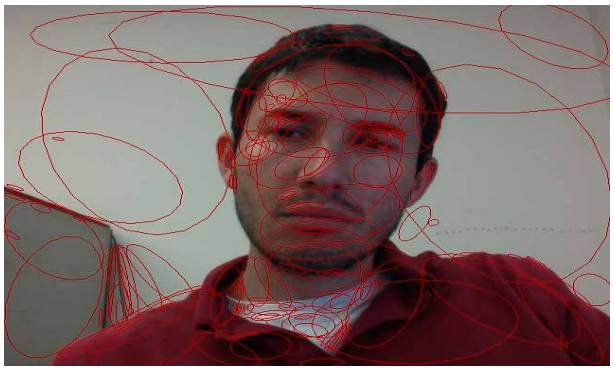

Figure 1. *Ellipses fitted to the connected components of different gray-levels of the input image.*

EXAMPLE 1. GRAY REGIONS TO BAGUETTES.

- The input RGB image is passed through an analysis stage. In this stage the image is separated in few gray levels. Ellipses are fitted to the connected components of each gray plane (Figure 1). The output of this analysis stage is a list of six-dimensional elements (ellipses with gray value).
- The list of elements of the analysis stage can be used to re-draw the input image (Figure 2).
- To guarantee temporal coherence the detected elements are not drawn directly, but used as attractors for the elements drawn in the previous frame.

Figure 2. *Input image re-drawn from the ellipses' parameters.*

- Instead of drawing abstract elements the parameters can be used to transform real-life object textures. Figure 3 shows an Arcimboldo-like image created by the ellipses parameters to manipulate baguette textures.

Figure 3. *Substitution of the ellipses by baguettes.*

EXAMPLE 2. ANT THEATER

The image created is more believable if the synthesis objects are entities that we are used to seeing move in groups, such as schools of fish or flocks of birds. The rules for the synthesis can be combined with rules that simulate swarming behavior [8]. Figure 4 shows a frame from the real-time installation, "Ant Theater." The points of the output of a Shi-Tomasi corner detection [9] are used as attractors. The points are then replaced by "ant" textures. The orientation of the velocity vector from the time-coherent algorithm is used to guarantee that the ants are aligned to their direction of movement. The walking cycle of each ant can be simplified to six different leg positions that alternate while the virtual creature is moving.

Figure 4. *The output of a Shi-Tomasi corner detection algorithm after substituting the detected points by ants.*

3. GENERATIVE APPROACH

An alternative for the generation of cross-synthetic images is to use the detected elements as a "seed" for a generative algorithm. This generative algorithm should create a known structure while keeping the global image identifiable. In the interactive piece "Herbaceous," [10] points with a more positive error value from a dithering algorithm are used as the terminal nodes of a tree. The steps for creating the tree are:

1. Get a black and-white dithering version of the input with the Floyd-Steinberg algorithm [11].
2. Use a predefined number of dark pixels as the objects/targets for the temporal coherence algorithm described in the example 1.
3. Divide the space in horizontal regions and find the horizontal centroid of each region, then recalculate regions. (Figure 5).

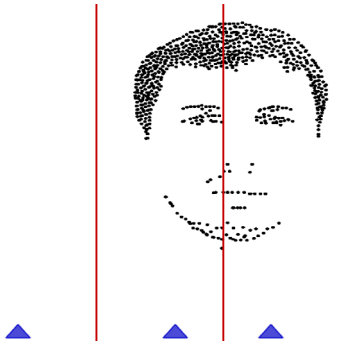

Figure 5. *Dividing the horizontal space and finding the centroid of each region.*

4. Repeat until convergence.
5. Build a tree for each region starting from the nodes (dark points) to the trunk (centroid) using the particle system of plant modeling described by Rodkaew [12]. (Figure 6).

Figure 6. *Drawing trees from the points to the horizontal centroid.*

4. DIRECT DETECTION

More complicated synthesis elements cannot simply substitute basic primitive shapes like points, circles or ellipses. Thus, algorithms for the detection of the target virtual creatures in specific positions must be used. Before the detection, it has to be defined how much variation the synthesis element is allowed to have. Can the elements change position, orientation, scale and/or state? All of these constrains define a model for the synthesis element, and dictate what to look for during the analysis stage. Depending on the specific circumstances, standard techniques for template matching can be used (moments, Fourier descriptors, correlation, etc.) [13]. As an example, Figure 7 shows different states of a human silhouette used as the input of a template matching algorithm. Different translations and rotations of each silhouette

are matched against a target image and the representation error is fed back to the algorithm. Figure 9 shows a frame of an animation obtained with this technique. In this example, temporal coherence was accomplished by matching synthesis elements frame to frame using a combinatorial optimization algorithm [14].

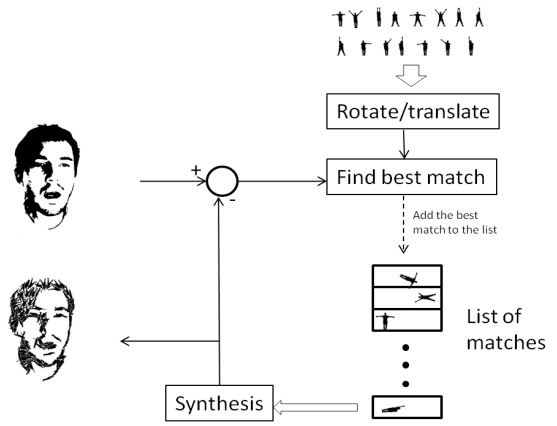

Figure 7. *Direct detection using template matching.*

Figure 8. *A frame from an animation created using direct detection.*

5. NARRATIVE POSSIBILITIES

These double-meaning animations are analogous to cross-synthesis, a technique of mixing two signals that is commonly used in the audio domain. But the video domain presents us with possibilities that go beyond the mixing of two signals. Artworks with multiple coexisting narratives can be created using the strategies presented in the previous sections. Real-time installations like "Herbaceous"[10] or "Ant Theater" show that it is possible to create two simultaneous realities: A mirror that reflects the observer and a window to a different world (the trees or the group of ants, respectively). These techniques have also been used for the composition of short animations than have been exhibited in international festivals. "Background Singer," [15] a short animation that has been presented at different international events[1], uses the juxtaposition of global and local information to present two parallel stories. The global subject matter is a frontal human face, exploiting the extraordinary ability of human viewers to perceive faces. The local subject matter consists of human silhouettes adopting different positions in order to recreate the global human face (Figure 8).

6. CONCLUSION

Three methods for the creation of double-meaning animation sequences were described in this paper, each useful for particular artistic situations. The first one, *direct substitution*, is straightforward to implement using our target-based algorithm to ensure temporal coherence. Since abstract elements are usually simple shapes, this approach is limited to elements with very simple behaviors. The natural motion of living creatures imposes some new conditions on the algorithms. Most creatures move with their body oriented towards the direction of displacement, but will assume a totally different position while at rest. Depending on the specific naturalistic movement being modeled, new artifacts can appear, and the algorithms have to be modified to mitigate these artifacts. Our second method, using a *generative approach*, allows us to create more structured objects, but these new objects do not necessarily maintain temporal coherence as effectively. Our third technique, *direct detection*, attempts to find the object of interest on the input sequence and then matches and interpolates those detections in between frames, but currently is not suitable for real time. A more detailed technical description of those techniques can be found in our previous works ([16] and [17]).

We will continue to expand upon these techniques and to explore their use in creative projects.

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ENDNOTES

1 RABISCUITS - Bienal de Arte Experimental 2013; EFF Portland 2013 - Experimental Film Festival. Portland 2013; Experiments in Cinema v8.53 – Albuquerque NM 2013; Speechless Film Festival, Mankato MN 2013; VAFA 2012 - Video Art for All, International Video Art Festival. Macau 2012.

Art in the age of imaging data: mediated_moments and plasma_flow

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Abstract. This paper sets out to examine the creative practice of Australian media artist Brad Miller and his collaborators Ian McArthur and Adam Hinshaw who together have created and exhibited a series of interactive data visualisations in Australia and China. Specifically this paper will examine the installations *mediated_moments* and *plasma_flow* both exhibited during the GeoCity Smart City International Information Design Exhibition at the China Millennium Monument Museum of Digital Art (CMoDA) during Beijing Design Week (BJDW) in 2012. These two installations used very different approaches to interrogating and visualising data and will be considered in relationship to a number of installations preceding this exhibition.

1. INTRODUCTION

"We live in a software culture—that is, a culture where the production, distribution and reception of most content is mediated by software." [1]

Brad Miller's (hereafter referred to as BM): creative practice is defined by an interest in: software as central to the structural and interactive dimensions of new media installations (*mediated_moments* and *plasma_flow*); memory as mediated by technology (*augment_me*); and data ecologies that can be transformed into subjects of contemplation (*data_shadows* and *le_temps*). His work encompasses the autobiographical and photographic, the visually abstract and scientific, crowd sourced urban and natural imagery and curated thematics.

There is a significant difference between Miller theoretical and scholarly interest in software—its historical, technological, economic and social role in society and culture and what he does with it in making art.

BM: The starting point for me, in this paper, is a series of denials about what my creative work—the interactive media installations I construct—are not. And it's because I'm acutely aware, in academia, of an expectation that artists who work with software should engage with arguments about the ideological uses and implications of software within the work. I do none of that. In the contemporary world, software is the fundamental tool at work in all our technological interactions and integral to how we create and navigate identity and relationships as private individuals and consumers. How could I not be interested in it as an artist? The issues around software must be scrutinized as all tools of power must, but again, that is not the subject of my installations under discussion.

"Key to understanding the power of software—software as power—is its very ambiguous thingliness, for it grounds software's attractiveness as a way to map —to understand and conceptualize—how power operates in a world filled with things we cannot fully understand, even though these things are marked by, and driven by, rules that should be understandable, that are based on understandability."[2]

BM: I agree with Chun that key to understanding "software as power is its ambiguous

Fig. 1. *augment_me, Artspace, Sydney 2009.*
Image credit: Brad Miller

thingliness" that best describes why software is desirable, and apposite, to my artistic practice. I use tracking devices, manipulate my own photographs and other peoples that are publically available via creative commons [3] but I do not map likes and dislikes or secretly collect information on users for commercial purposes. Nor do I analyse, within my creative work, that process or the corporate hierarchy sitting above the collection and selling of personal data, nor the new technological world order that accompanies the trade of private information in exchange for free use.

He also has no interest in conceptually exploring within the installations, the historical origins of computers and software that emerged out of the military industrial complex, and the gender inflected narrative that accompanies that history. Software is no longer identified as a woman given directions by the master male programmer and it's no longer the late 1940s [4].

As an artist, there is the personal, emotional and psychological aspect to Miller's work, and his connection and comfort with the primarily visual and technological terrain of new media art and social media arises not only from his interest in contemporary realities but also, in part, from his dyslexia. He's more comfortable with software as a language because:

BM: Code is, for me, the underlying grammar of the visual and aural interactive lexicon—it's an enabling mechanism, a way to invisibly and poetically structure the aesthetic and kinetic flow of images and sound to create an interactive responsive environment within which the work is viewed. My intention is not to tell people how to interpret or experience the work. Some see a story, some a pattern, some a documenting in real time, some cause and effect (i.e. the way the imagery moves with the viewer), some miss it entirely.

The grandness of scale and context of viewing is also key to understanding how people view and interact with Miller's work. *plasma_flow* was exhibited in 2012 at Vivid, in Sydney, a festival attended by over a million people and one of Sydney's most popular public cultural events. A modified version of *plasma_flow* was featured, alongside *mediated_moments* in the GeoCity SmartCity Exhibition during Beijing Design Week (BJDW) 2012. People attending these events usually go to experience something other, and they do so collectively. When what is being exhibited involves art and design that uses software, the experience is not a utilitarian or teleological one. It isn't the singular person/personal computer/smart phone experience of emailing, buying, roaming the Internet, or frequenting Facebook and Twitter. Through the sensors in Miller's installations that track the movement of the viewer, and invite them to interact consciously or not, they may discover that they can affect and change the movement and shape of what they're looking at, but the content is not their own. As with any artwork, the offer is there to observe, reflect, enjoy, be moved or walk on by.

2. AUGMENT_ME

The Interactive Media Platform (IMP) on which *mediated_moments* and *plasma_flow* are based, came originally from *augment_me* (2008), an installation that took several years to develop. It was also the start of Miller's long collaboration with software developer Adam Hinshaw. In retrospect, it is clear that *augment_me* was both a mapping of what digital photography as the ultimate expression in real time, disposable autobiography was to become, and an expression of Miller's artistic relationship to technology. At the time he began the project in the early 2000s (before the emergence of Facebook and Flickr) he had a vision of what it might be, but it took the development of the software to give him a way forward.

BM: To get a sense of where this work began for me, I go back to 2000 when I bought my first digital camera at an airport on my way to China. With a background in sculpture that used computers, software (now redundant because of operating systems that no longer read the software) and appropriated televisual imagery, I hadn't used or focused on photography or original images; I bought the camera to document my travels in China without artistic intent. On my returned to Sydney, I photographed compulsively and like others engaged in life logging, my camera went everywhere with me. I was storing thousands of photos on a hard drive with the intention of creating a database and using them, not as individual photographs but to create a narrative about our relationship to this new digital technology.

Facebook and Flickr didn't come into being until 2004-2005 and Instagram (2010) was a distant photo-sharing dream. In theory, digital cameras changed nothing – a photograph continues to capture a moment, an event, a person in time; what the new cameras and networked technology was in the process of changing was the mediation of memory, identity, and how we relate to each other via software and technology. Because photographs can be uploaded in real time, distributed, downloaded, copied, manipulated, annotated (tagged) and shared—*how* photographs are used has been altered.

BM: Around 2005, with Adam Hinshaw, we began to sketch up software using Macromedia Director that allowed us to present hundreds of photographs running like a single mock 35mm filmstrip. It was also interactive by means of a mouse—we used the relative cursor position to push the images on screen left or right.

Running parallel with the nascent development of what was to become *augment_me*, was a fundamental change in attitudes to copyright via the emergence of Creative Commons.

BM: Going forward I saw a huge database on Flickr of 4 billion images and growing. Most of them were publically accessible. There had been a shift away from photographs being personal, private and owned towards them being seen as public, accessible and shared. By uploading the photographs that comprised *augment_me*, we also had to create a tagging protocol so we could arrange compositions and work out how the images ran within the horizontal strips. We developed a semantically relevant coding structure—some to do with images, some to do with interaction, some to do with sound, some to do with the network—and at the same time we had to solve how the images would be rendered across multiple projectors.

In terms of the tagging, Miller used place names and localities such as 'Sydney' and 'Wharf Bay' and then sub categories such as 'Interior' and 'Exterior', 'Night and Day', 'Artificial light' and 'Natural light' and camera angles such as 'Wide' or 'Close'. If people were in a shot, he would identify is as it as 'Portrait' or 'Incidental'. This allowed for the search function to gather together specific images and clusters of images. Patterns emerged, patterns that defined the content and allowed greater control over the content as it excuted.

In early 2008, Miller and Hinshaw mocked up the first version of *augment_me* on a computer with multiple screens; in 2009, the first public version was exhibited at Artspace in Sydney, Australia (Fig. 1). Miller's other collaborator was media artist Ian Andrews. *augment_me* used continuous, extremely wide format projection, a responsive granular synthesis soundscape using multi-channel audio and video tracking (the interface between the media and the audience is through this tracking system). The horizontal strips moved according to the movement of the viewer, picked up by sensors overhead in the exhibition space. Lizzie Muller, in reviewing

the work, wrote: "The ultimate promise is that the flow of data may restore the flow of life when it is temporarily halted. Biological death becomes a small death, data becomes the through line that joins old subject to new". [5]

The original photographs used in *augment_me* were Millers' and the work could be was autobiographical. To Miller, *augment_me* was a "memory machine of sorts" but the idea of the content being data appealed. He realised that for viewers coming cold to the work who didn't make the intimate connections he made, the structure and interactivity of *augment_me* resonated with the interest in "data" that had emerged with the digital technologies and online photo libraries.

"I came to see the photos less as mementos significant only to me and more as fragments caught in a digital stasis which when rearranged could throw up new meanings and associations—not only for me but for others and how they think about their own mediation of memories."[6]

3. SONIFICATION

The sonification of the *augment_me* platform has formed a collaborative focus in the ongoing development pathway. In 2010 Ian McArthur approached Miller asking him to consider becoming involved in RARE EARTH an experimental project with artist Richard Goodwin in Shanghai. RARE EARTH was an open studioLAB encouraging art and design students from China and Australia to collaborate using Shanghai as a laboratory for investigating ideas for the future of cities, immersive interactive environments, and cross-cultural co-creation. Miller's IMP was integral to RARE EARTH as a means to document, facilitate and exhibit the studioLAB process and outcomes. During this intensive process McArthur and students began to experiment with using field recordings captured during various research trips in downtown Shanghai.

The process of sonification has evolved throughout the development of *plasma_flow*, *mediated_moments* and a new work *#capillary (2013)* in an increasingly subtle adaptation using the sound patches (granular synthesis) originally by Derek Holzer and further modified by Ian Andrews. The flow of data in these works creates spatialised audio environments constructed from fragments of digital noise, field recordings and McArthur's original audio compositions. These are processed, segmented and reassembled into new configurations, and responsive juxtapositions.

Created with a granular synthesis system - a basic sound synthesis method that operates on the micro sound time scale, all the works described in this paper use sound samples that when deployed in this technological configuration create a live/living responsive soundscape. "Like static, the soundtrack turns the viewer into a bar on the radio dial. Through our movements we tune in the flow of time and data. The signal drops in and out of the noise." [7]

Sonically *plasma_flow* and *mediated_moments* explore the possibilities of software and generative synthesis in ways that "...invite the audience to interact with dynamic audiovisual configurations" [8]. As the user navigates the audiovisual 'surface' a feedback loop is established between them and the system that permits them to traverse, "...the possibility-space of an open work, and thereby to discover their own potential as actors". [9] The transmutability of the digital data flowing through the system creates for the user(s) an experience that is immersive and enveloping, at times soothing, at times disorientating depending on the position of the viewer and the compositions in play.

4. DATA ABSTRACTIONS: *PLASMA_FLOW*

plasma_flow was an incremental evolution in software from previous iterations of the IMP and crucially in response to the previously mentioned essay where Lizzie Muller writes:

"Miller's work reconfigures the relationship between the artist, audience and artwork, creating a complex system of data flow in which the audience's actions have a shaping effect". [10]

BM: On reflection, and in conversation with my collaborators Ian McArthur and Adam Hinshaw, I researched mechanisms that could support or allow for further abstractions of data, moving away from the personal images, towards a more global engagement with images and data. As a result *plasma_flow* (see Fig. 2.) uses the MSAFluid library [11] a publicly licensed Processing for solving and displaying real-time 2D fluid simulations based on Navier-Stokes

equations [12]. These equations and how they are applied within this context is beyond the scope of this paper but many simplifications and approximations have been introduced into the algorithm to reduce computational load and render speeds[13]. *plasma_flow* uses the IMP framework developed for *augment_me*

Working again with Adam Hinshaw, we developed a methodical approach to revealing the underlying key attributes/parameters (Fluid, Vectors and Particles) of the MSAfluids library with a custom Graphic User Interface (GUI), allowing access in real-time. Each of these key attributes were represented in the GUI panels by toggle buttons and control sliders.

plasma_flow's graphic parameters were developed through a series of iterative refinements, balancing visual clarity and the perceived smoothness of how the graphical elements flowed. The IMP inputs can be modeled to allow performative adjustment of the various parameters over time. We use a spiral development model [14] supporting a responsive iterative approach, initiating a set of known parameters, and progressive refinement. As such *plasma_flow* now consists of a series of 22 compositions, each comprising a unique set of parameters that typically run for 2.5 minutes continuously.

5. *MEDIATED_MOMENTS* AND *PLASMA_FLOW* AT BEIJING DESIGN WEEK

In 2012 Miller, McArthur, Hinshaw, and Shanghai-based social media specialist Paul Adams collaborated with Yang Lei, Deputy Director and Chief Curator at Beijing's China Millennium Monument Museum of Digital Art (CMoDA) to create two spectacular large-scale responsive data visualisations for the GeoCity SmartCity Exhibition during Beijing Design Week. The two installations, *mediated_moments* and *plasma_flow* both point towards data flows gathered from social media - using publicly accessible data to draw out relationships related to mobility in Beijing. Although responding to curatorial thematics was a new experience for Miller, it was not unwelcome. The 'Smart City' [15] rhetoric was perceived as a challenge not to be didactic, and the works created respond to this in a way that allows viewers to engage in a co-shaping of these data flows.

mediated_moments advanced the move away from the personal to engage with non-privately tagged visual content on Flickr to reveal folksonomies and visual patterns by combining query terms such as: bicycles, telephone and traffic, with other terms such as places names and localities. These searches, conducted in Mandarin and English, leveraged the multi-channel visual and audio capacities of IMP to render thousands of publicly accessible digital images in patterns depicting information systems, communications, transport and the built environment of Beijing. During this development cycle an initial version of a attribution mechanism was developed with the intention of displaying all the user names of contributors. Unfortunately, full public implementation was not available until *#capillary (2013).*

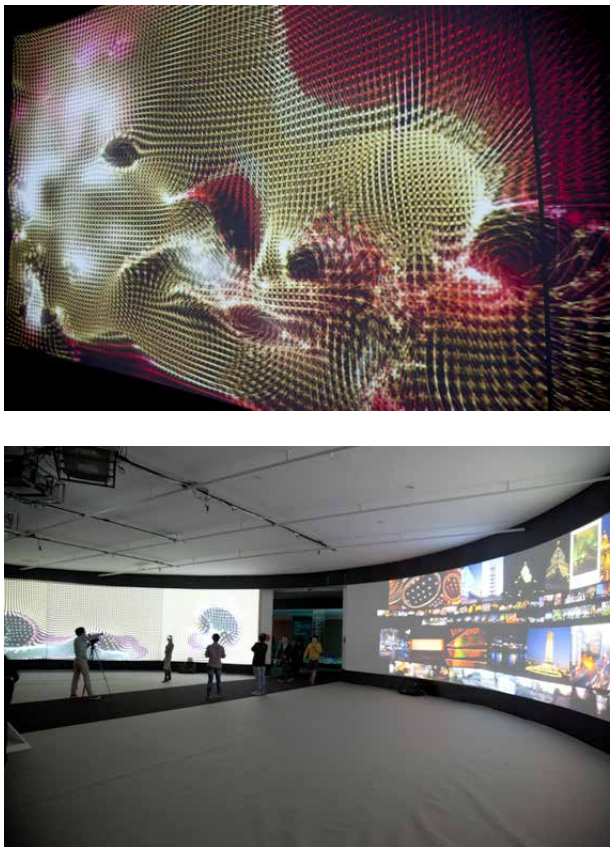

Fig. 2. *plasma_flow (left) and the works plasma_flow and mediated_moments (right) as exhibited at CMoDA during Beijing Design Week in 2012. Image credit: Brad Miller*

The iteration of *plasma_flow* created for exhibition at CMoDA employed autonomous robot blobs drawing out the geo-relationship between two recent and consecutive interactions defined by location and/or subject web metadata scraped

[16] from the Chinese micro-blogging service Weibo within the Beijing area. The blobs are animated between two points and this is transposed to the *plasma_flow* space from the coordinates of tweets that have this geo-location data. The duration of the movement is based on the time in between the two tweets. Yang Lei observed that in this context, *plasma_flow* creates a "magic mirror" [17] to augment both physical mobility (locative audience movement) and the online social media traffic generated by Weibo.

The emergence of *mediated_moments* and *plasma_flow* allude to the scalable potential of urban media to merge into the urban social fabric. Yang, Miller and McArthur argue **[18]** that the IMP behind *mediated_moments* leverages the ubiquity and ambient potential of social media and can be developed and further utilised as a platform for mapping and visualising the 'unconscious' thinking/intelligence of individuals, communities of interest and other stakeholders as users whose collective inputs can be 'projected' onto a mixed-reality urban canvas.

5. CONCLUSION

In conclusion, this paper examines the centrality of software in Brad Miller's artistic practice and that of his collaborators. The IMP that was created in augment_me to structure a highly personal art work and narrative has became the thing that could be developed further to foster and support Millers' evolving interest in new content and cultural and aesthetic collaborations that have nothing to do with the original art work; the platform has a life of it's own, beyond the personal photographic time series that was augment_me. Over time, the IMP has become more sophisticated, more refined and faster; it continues to grow as a live, developing tool for for presenting all kinds of data flows and ideas.

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Interactive Artwork in Enhanced Narrative Form: "Magic Monkey Flies"

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Abstract. Interactivity has changed artwork through audience participation. Narrative supports audience participation and immersion in interactive artwork. In our previous work, we created a framework for interactive art in narrative form and produced an interactive artwork named "Magic Monkey" based on this framework. In this research we propose an enhanced narrative form in interactive artwork, through analysis of the theory of interactive narrative and games. Finally we create a scenario design for "Magic Monkey Flies" based on enhanced narrative form and discuss the new form and design of artwork.

1. INTRODUCTION

1.1 STUDY AIM

In this research, we revised our previous framework and proposed an enhanced narrative framework for interactive art through interactive research. Based on this framework, we proposed the "Magic Monkey Flies" basic design.

The subgoals are as follows:

1) to study interactive narrative and interactive games;
2) to revise the previous framework based on this research and develop a new framework for enhanced narrative;
3) based on this new framework, to create a scenario design for artwork and application for graphic and technical design;
4) to discuss interactive artwork in an enhanced narrative form.

1.2 BACKGROUND AND MOTIVATION

Interactivity based on digital technology has changed as a concept and feature of artwork. The most important change this has prompted is audience participation in artwork content. The audience becomes the co-creator with the author. The role of the audience is to serve as a trigger to operate the artwork. Therefore the aesthetics of artwork are changed by these developments from observation and thinking to participation and activity [1]. As activity by the audience is represented, artwork is created by the audience's sense and cognition. Complex multi-media technology provides a great deal of variety through these factors. The researcher considers new approaches for production of interactive artwork by these technical factors and activities [1][2].

Based on digital technologies, interactive artwork represents the audience's five senses through their activities. The technical and graphic design of an interactive installation is complicated and varied. Before implementing an art piece, a scenario provides a foundation for the realization of the artwork.

Through the advances of technology, interactive art will develop two features in the future—magnificent scenes in real time and digital storytelling by narrative. First, interactive

art will show magnificent scenes in real time. In augmented reality (AR), virtual reality (VR), and 3D applications the audience experiences spectacular scenes through digital technology. With content related to a virtual or digital human, the audience will enjoy the interactive situation. Second, interactive artwork offers digital storytelling by narrative. The short, spontaneous, or unplanned art may move to long and complex narrative forms. Through the chain of scene after scene, the audience experiences a real situation and becomes the main character of the art. As in a digital game, the user experiences an interactive situation [3][4] similar to or beyond reality through the interactive narrative.

Three motivations for a new framework in interactive artwork are as follows:

1) A basic concept to serve as the framework is needed to create the prototype for interactive artwork. Through basic design factors, the author will produce interactive artwork based on the research theory for development of interactive artwork.
2) Narrative in interactive artwork is a new concept in digital art. To accomplish this, the researcher proposes a framework and prototype.
3) In previous research, we proposed a basic framework and prototype. We will revise these through output of user tests and feedback from an exhibition.

Few research have proposed new concepts for interactive art, focused on technical devices and programming for new narrative aesthetic [1] [6]. Use of a narrative for a new aesthetic is a new method arising out of these trends.

1.3 PREVIOUS WORK—INTERACTIVE ARTWORK IN NARRATIVE FORMS

In our first research, we analyzed narrative in interactive artwork through a theory of interactive narrative and artwork [5]. Interactive artworks are classified with three categories: poetic style, mixed style, or narrative style perspective. Based on these categories, the research proposed a framework for interactive artwork in narrative forms.

Limitations of this research included the relationship and identification of audience and character. This research is based on traditional theories of narrative; however, interactive narrative is more complicated in implementation. Moreover, narrative form simplifies the embodiment of interactive artwork.

Based on our previous framework, the second research project resulted in a scenario design and a prototype of Magic Monkey [6]. This research proposed the basic design for Magic Monkey—scenario design, graphic design, and technical design.

In this artwork, Magic Monkey (the audience) performed music by touching raindrops from leaves to escape from the jungle while helping stray people. In this narrative, people were deeply moved by Magic Monkey's music and finally escaped from the jungle with Magic Monkey (or they did not). Through user tests before the work was exhibited in a gallery three times, we evaluated interactive art in narrative forms.

A limitation of this research was that it did not consider evaluation of the process of audience immersion by development of narrative. The enhanced immersion for interactive artwork in narrative form is assessed in a different way than narrative and information. Moreover, the research did not suggest a climax and ending for the audience mission and did not define an entire narrative by interactivity.

Fig. 1. *Exhibition of Magic Monkey*

1.4 RESEARCH FOCUS

In this research, we focused on enhanced narrative form and scenario design of Magic Monkey. These elements are basic factors for the prototype and implementation of design. Through the narrative in interactive art, audience participation and reaction to the installation are reinforced.

Factor	Narrative	Interactive art in narrative forms
Main objective	The character wants to be or do to something	The audience wants to be or to do something
Main action	The action of the character	Interactive actions of the audience
Obstacle/conflict (competition)	Obstacles and conflict overcome by the character's actions	Obstacles and conflict overcome by audience actions - First/second/third obstacle
Development	Development of the narrative through conflict by the character in phases	Development of a narrative through conflict by the audience - First/second/third development —attempt to overcome the crisis
Climax and ending	Climax and ending brought about by the character's actions and choices	The climax is the peak period of conflict in the narrative as developed by the audience action The ending results from the audience's choices

Table 1. Previous Framework for Interactive Art in Narrative Form [5]

2. ENHANCED NARRATIVE FORMS

2.1 PREVIOUS FORM

In our previous work, we constructed the framework for interactive artwork in narrative form [5]. The following table displays the narrative form of interactive art in contrast with the previous narrative.

2.2 THEORY OF INTERACTIVE NARRATIVE AND INTERACTIVE GAMES

Through the previous interactive narrative theories, we extracted factors making an enhanced narrative form. The new form enhances narrative factors through three viewpoints: character view, narrative view, and aesthetics view based on a revision of Edmond's research [7][8][9].

The interactive game narrative focuses on mission, character, and outcome for the user [3][4][10]. In particular, user identification with and immersion in the character are the core point of games. Moreover, narrative development through user reward and punishment are main factors in a game narrative. These factors provide users with immersion and enhanced participation in the game scenario.

2.3 ENHANCED NARRATIVE FORM

Character-based factors are objective, characteristic, visual, action, and identification. Plot-based factors are conflict, development, reward and punishment, climax, and ending.

Basic Factors	Previous Narrative Form	Enhanced Narrative Form
Character-based	Main objective	Super-objective Scene objective
	Main action	Character's characteristics
		Character's visual
		Audience action
		Identification
Plot-based	Obstacle/conflict (competition)	Obstacles/competitor
	Development	Development
		Reward and punishment
	Climax and ending	Climax including sudden drop
		Ending

Table 2. Enhanced Narrative Form

Factor	Structure of Narrative
Main objective	Magic Monkey (audience) wants to be a man Magic Monkey (audience) helps a man to escape from the jungle
Main action	Magic Monkey (audience) calls the butterflies by the audience's action
Obstacle/conflict (competition)	A weak and unhealthy body
Development	If Magic Monkey (audience) does not move as much as it can, the butterflies do not come to it. Much movement occurs using its entire body
Climax and ending	Magic Monkey flies to the sky with the butterflies or it does not

Table 3. Structure of the Previous Design

Basic Factors	Enhanced Narrative Form	Scenario Design
Character-based	Super-objective Scene objective	Super-objective is that Magic Monkey (audience) wants to be a man and helps a man to escape from the jungle Objective in this chapter is that Magic Monkey (audience) wants to fly away supported by butterflies
	Character's Characteristic	Audience characteristics reflect Magic Monkey characteristics
	Character's Visual	1) Audience changes into Magic Monkey 2) Image of Magic Monkey is different from size of audience
	Audience Action	Shaking audience body—arms, legs, head, and entire body
	Identification	Identification before mission by audience action
Plot-based	Obstacles/competitor	1) Audience self-restriction 2) Audience identification
	Development	1) Butterflies come 2) Butterflies attach to Magic Monkey's body 3) Magic Monkey flies by the attachment of flying butterflies 4) Magic Monkey flies higher with more butterflies
	Reward and punishment	1) Increasing or decreasing quantity of butterflies 2) Changing color of butterfly
	Climax including sudden drop	1) Magic Monkey flies to the highest peak point 2) Sudden drop is down to earth by reducing movement
	Ending	1) Video on screen of stray man escaping from jungle 2) Scene about Magic Monkey's success escaping from jungle

Table 4. Magic Monkey Flies Scenario Design Based on Enhanced Narrative Form

2.4 DISCUSSION

The new form requires the following discussions:

1) Is audience participation in interactive artwork more reinforced by the enhanced narrative form than by the previous narrative form?
2) Is audience immersion in interactive content reinforced by the enhanced narrative form?
3) Does implementation have restrictions for embodiment of artwork due to the narrative form?
4) How can the enhanced narrative form be evaluated?
5) Does the enhanced narrative form provide aesthetics for the audience experience of interactive art?

To address these points of discussion, we propose the interactive artwork in enhanced narrative form, "Magic Monkey Flies."

3. SCENARIO DESIGN: ARTWORK APPLICATION OF ENHANCED NARRATIVE FORM "MAGIC MONKEY FLIES"

3.1 BASIC DESIGN

Based on our enhanced framework, we propose a design prototype of an interactive artwork, "Magic Monkey Flies," which is the second in the Magic Monkey series.

In this narrative, Magic Monkey wants to be a man. He helps a distressed man in the jungle. To realize his dream, Magic Monkey finds a cave for the human to rest and plays music by touching raindrops, which are falling heavily.

Magic Monkey then flies to the sky with butterflies. In the artwork, Magic Monkey calls the butterflies by shaking his body, and then, with the butterflies, flies into the sky to teach the distressed human. The audience enjoys the interactive performance required to call the butterflies and flies into the sky by proxy onscreen as well.

3.2 SCENARIO DESIGN

We produced the scenario design of Magic Monkey Flies based on enhanced narrative form.

3.3 APPLICATION

In graphic design, we drew the images to enhance audience participation and aesthetic experience. Graphics in scenes are affected by the environment and whether the attitude of the audience is for or against the situation. Graphic design in Magic Monkey Flies reflects the narrative as follows:

1) Embodiment of the jungle in narrative
2) Visualization of butterflies' image and movement, reflecting the process of the narrative
3) Expressing the relationship of Magic Monkey and the butterflies
4) Realization, with Magic Monkey flying in the sky
5) Climax and ending scene emphasize escaping reality

Fig. 2. Graphic Design of Magic Monkey Flies

In technical design, we implement the openFrameworks programming system through the Kinect, which allows the scene in which the audience as Magic Monkey moves to call the butterflies to fly into the sky. This represents an enhanced narrative arc with ten steps and audience activities for real-time interaction. The system diagram focuses on two stages: the butterflies' movement through audience activity and Magic Monkey's flight into the sky by increasing the number of butterflies attached to its body.

Fig. 3. Recognition of Movement of Audience as Magic Monkey

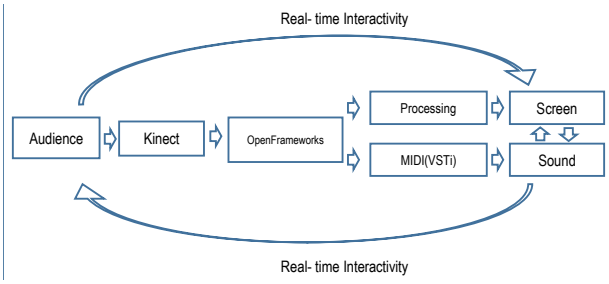

Fig. 4. System Diagram of Magic Monkey Flies

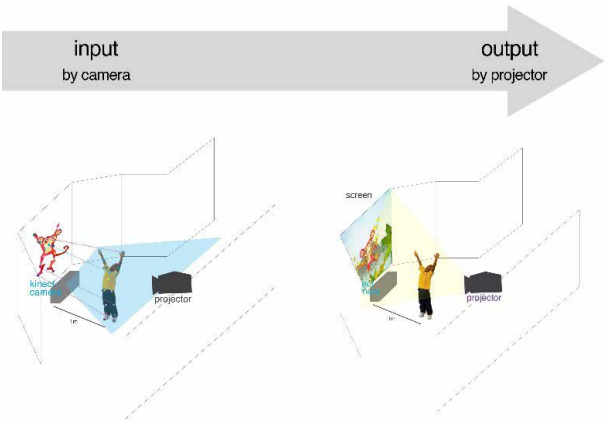

Fig. 5. Scene Environment of Magic Monkey Flies

3.4 DISCUSSION

The subject of the art in such cases is play and pleasure and the works engage the audience in playful behaviors. The aesthetic results, of course, may be important in other respects. Art is many-layered and we certainly must not assume that the significance of playful art is limited to play itself [7][8].

The aesthetic for Magic Monkey Flies requires discussion of the following points:

1) Is Magic Monkey Flies more reinforced by the enhanced narrative form than by the previous narrative form from the perspective of audience participation?
2) Is Magic Monkey Flies reinforced by audience immersion in its interactive content?
3) Does Magic Monkey Flies have restrictions in the embodiment of artwork from the viewpoint of implementation due to its narrative form?
4) Is Magic Monkey Flies available for evaluation of the enhanced narrative form?
5) Does Magic Monkey Flies support aesthetics for the audience experience of interactive art in the enhanced narrative form?

These points of discussion will contribute to the development of interactive artwork contents and aesthetics.

4. CONCLUSION

4.1 SUMMARY

In summary, we propose a framework for interactive art in enhanced narrative form and basic design focused on scenario design. This artwork, "Magic Monkey Flies," is about human dreams for flying into the sky realized through interactive art. Interactive artwork in narrative form supported an audience experience concerning new aesthetics. Not only does the artwork consider the desire to fly; we give aesthetic meaning to the artwork through enhanced narrative.

4.2 LIMITATIONS AND FUTURE WORK

The limitation of this study is the lack of a user test to develop the framework. User testing would support predictions of the audience activities.

Future work will include implementation of the artwork "Magic Monkey Flies." Through the realization of an entire artwork, we will find aesthetics for interactive artwork in enhanced narrative form. We will develop a standard assessment method and evaluate this artwork. Researchers who seek to create interactive artwork in narrative form will confirm the structure of this research.

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Semantic Mass

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Abstract. The creation of artworks based on masses of visually similar material has been a key idea in the art of the last century. However, in recent years a new kind of mass-based artwork has arisen, in which the similarities are based on the meaning of or connotations of the ob- jects being displayed. In this paper we explore this idea, which we term semantic mass, and give a number of examples of works that use this idea.

1. SYNTACTIC MASS

For the purposes of this paper, we define mass as a constellation of ideas around three main concepts. The first is an idea of scale, as demonstrated through large, undecorated constructions, such as works of brutalist architecture. The second feature is undecorated repetition, as found both temporally and spatially in works of music and art from the twentieth century onwards. The final feature is the use of formal arrangement of objects.

Works of art involving mass have played an important part in the develop- ing modernist aesthetic through the last century. One aspect of this is works that re ect or comment upon notions of industrial mass-production. For exam- ple, Market by Michael Landy (consisting of stacks of crates and commercial display equipment) and Rachel Whiteread's *Embankment* (consisting of an arrangement of identical polyethylene casts of the inside of cardboard boxes) use mass-produced objects as an artistic raw material. By contrast, Ai Weiwei's 2010 work *Sunflower Seeds*, which consists of many millions of hand-produced porcelain sunflower seeds made by a large number of workers, comments on the human role in mass production.

Secondly, there is the use of mass to suggest unboundedness. Consider a piece such as Sol LeWitt's *123454321*, which consists of a number of cubes built from breeze blocks (Figure 1). Pieces such as this suggest a process, one which could in theory be repeated on any desired scale. A single example of a stage in a process has the potential to suggest to the viewer the whole, potentially infinite, process.

A third aspect of mass is that of drawing attention to small details. This is notable in so-called minimalist or systems music, where music is built from repeated patterns and systematic changes to those patterns. These patterns set up a focus on small musical components, and small changes can have a strong impact those same changes, in the context of a traditional musical structure, would pass by without any salience in the listener.

Fig. 1. *Sol LeWitt, 123454321, breeze blocks and cement, 1993. Photograph by Sheila Ellen (Creative Commons CC-BY-2.0 Licence)*

We can see all of these as examples of *syntactic mass*. That is, the objects that are massed (breeze blocks, musical chords, porcelain seeds) are massed because they look similar to each other. The aesthetic power of the works comes from the number and arrangement of objects that seen/heard by the viewer/listener as being similar.

2. SEMANTIC MASS

By contrast to these works, a new kind of mass has arisen in some recent works of art. We will term this alternative way of forming mass-based works *semantic mass*. By contrast to works based on syntactic mass, these works display large numbers of similar objects in a formal arrangement, but the idea of similarity draws on some aspect of the meaning of, or some connotation of, the image displayed.

For example, Hong Hao's *Long March in Panjiayuan* series (Figure 2) consist of photographs of large collections of tourist tchotchkes on the theme of Mao Tse- Tung. This has impact because of the visual coherence of the material used|e.g. the colour palette – as well as the kitsch value of the objects themselves.

More central to the mass aesthetic are the more raw presentations of areas of activity. Ellie Harrisons pieces Eat 22 (http://www.eat22.com), consisting of a photograph of every meal that she consumed during a year, and Tea Blog (http://www.teablog.net), a record of the thoughts that she had whilst whenever she drank a cup of tea over the course of two years, are good examples. These pieces engage with day-to-day life rather than being about areas of life that are traditionally seen as deep and important aspects of life, and as such question our notions of whether the things traditionally seen as significant are as significant as day-to-day activity. There is a kind of autistic aesthetic emerging here. '

Fig. 2. *Hong Hao, Long March in Panjiayuan A, C-type print, 2004. Photograph by the author.*

Another example is Jennifer Mills's work What's in a name? (Figure 3), which consists of a large number of paintings based on web image searches for her name. This "transcoding" [5] into a diferent medium adds depth to this work. Another example of work based on collections based on name is Dave Gorman's comedy routine/TV series/book *Are You Dave Gorman?* [2], in which the comedian tracks down and interviews a large number of people who share his name. Interestingly, this was created at a very specific time in internet history where rudimentary social networking tools enabled this search to be somewhat internet- facilitated, but without the ready availability of search tools which would mean that the list of people could be drawn up instantly. There is a conviviality to these works which is absent from other works that collect together images of people based on visual similarity, for example in some of the works of Spencer Tunick or Santiago Sierra.

Fig. 3. *Jennifer Mills, What's in a Name? (detail), watercolour, 2009{11. Photograph by the author.*

The work by Mills points towards the use of technology in the creation of such works. Internet search technologies offer a wealth of possibility for artistic creation [4], allowing the instant creation of works of semantic mass from a search term. This provokes thought about how such things are used as artistic tools. Traditionally, one of the key aims of an artistic tool has been to facilitate the artists expression, and a key part of the training in artistic tool use is to gain a mastery of the way in which the tool converts the artist's ideas into marks on the page (or whatever).

Internet search is a rather different kind of artistic tool, in that it "pushes back" at the artist in a way that traditional artistic tools do not. Rowe [6] has argued that there is a continuum in the way in which interactive music technologies can be developed, from one-way technologies where a human makes a well-defined sound by making an action, through to fully two-way interactive systems where the interaction is more-or-less the same as interacting with another human player (an example of the latter being George Lewis's *Voyager*, a computer program that "listens" to music being improvised and constructs its own lines of music that draw on, but which are not naively reactive to, those created by human players, and which is able to introduce its own musical material).

Artworks based that use complex networks of technologies such as web-based image search provoke interesting questions about the role of the computer (in- deed, the worldwide network of computers [3]) in the creative process. In an artwork such as that of Mills, the computer would seem to be playing a much larger role in the creative process than the paintbrush.

An example which illustrates this argument is given by the author's 2011 piece *Blank*. This consists of nine printed panels, each of which contains a number of search results for the word "blank" on Google image search. A typical panel from the piece can be seen in Figure 4. Most of the images returned by the search consist of various empty templates and outlines – map outlines, frames, blank pages, blank forms, blank music paper, etc. However, in panel 7 (Figure 5, the collection of images includes an image of several bullets. This is an arresting image in the middle of images that are otherwise very neutral and empty, and clearly comes from the use of the word "blank" to suggest a particular kind of gun cartridge.

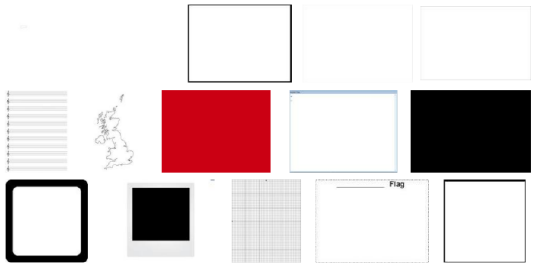

Fig. 4. *Colin Johnson, Blank (Panel 1), inkjet print, 2011.*

A human artist who had included this in a collection such as this would have been seen as making a creative contribution – they had chosen to play on the two meanings of the word "blank", and to create a particular aesthetic effect by contrasting a single use of blank-as-bullets with the otherwise neutral images. However, in this case, this choice was "automatic". Where does the creativity lie here? With the Google search system? With the collective of people who had put the various original images on the web? With the person who decided that the results from this particular search were worth displaying as an artwork? With some collective network effect of all of them?

There is a connection here to the idea of ostensive creativity explored by Goldsmith [1], who makes the point that one way to be creative is to point things out in the world. This idea of semantic mass, whether carried out by a manual collecting process or by an automated internet search, has a flavour of this way of being creative.

Fig. 5. Colin Johnson, Blank (Panel 7), inkjet print, 2011.

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