

Lisa Jevbratt

Title *Pulse (working title)*

Genre Distributed installation, software, visualization/sonification.

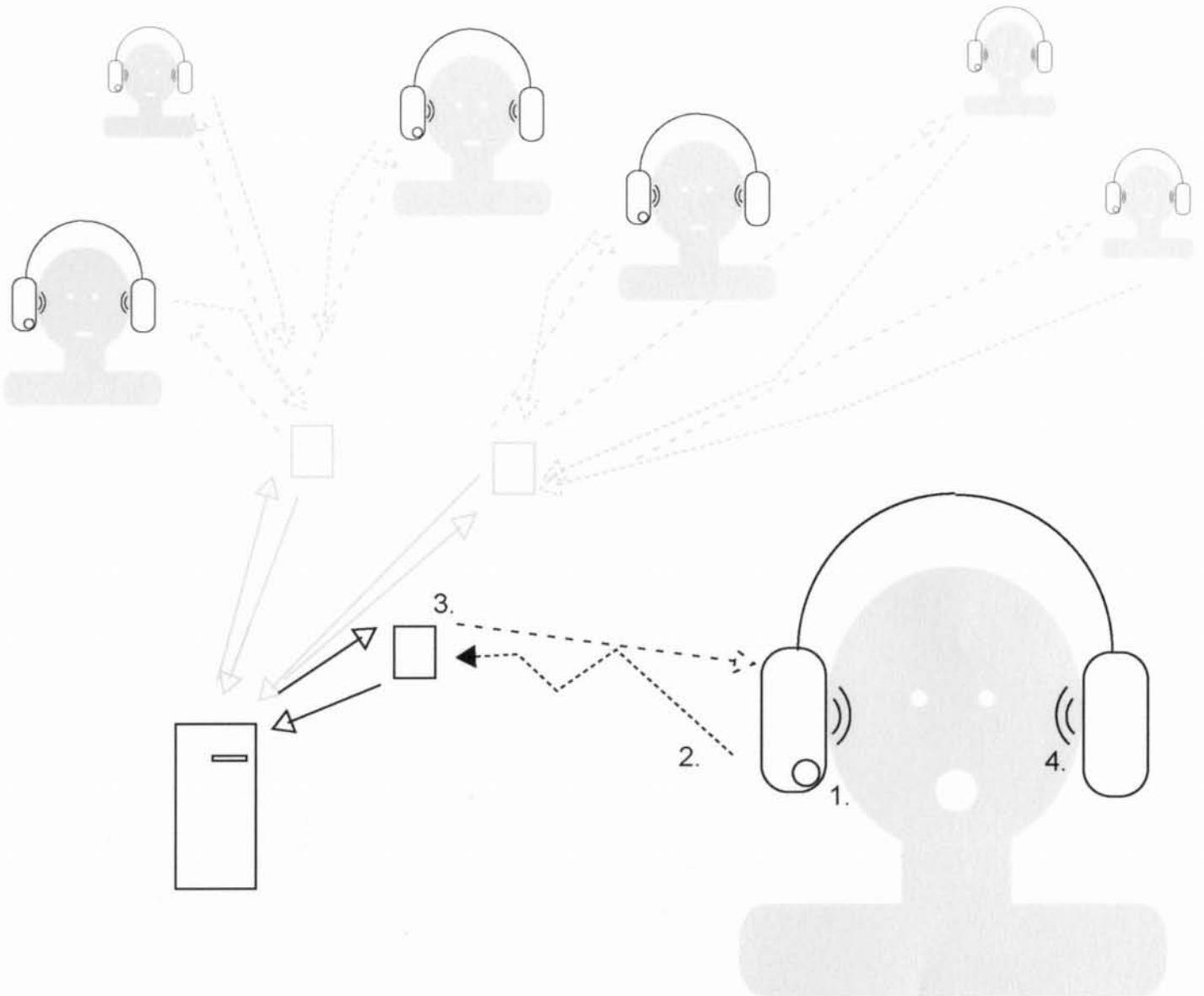
Applicant's Role in Production Idea; system, network and hardware design; programming; direction of production.

Production Format Hardware components, network, installation, software development

Brief Project Description

Pulse is a distributed collective biofeedback system that aims to synchronize the heartbeats of its participants. By mapping our lowest common denominator, our heartbeat, this project aims to create a direct experience of us as one collective entity, one body. The project is intended for a new media art conference/festival setting. The pulse rate is continuously collected from people who choose to participate using a wearable device (optimally a ubiquitous device such as an ipod or cell phone). The pulse rate is transmitted via a wireless network to a computer. The computer calculates the average pulse rate and transmits it to the participants as a single beat sound played in the same device that recorded and transmitted the heartbeat. The participants' heartbeat rates might at times converge due to a synchronizing effect of the playback sound. In addition all heartbeats of all participants will be visualized and sonified in a minimalist fashion in an installation. The subjects explored with the project range from psychoacoustics and biofeedback to the relationship between the individual and the collective and synchronization.

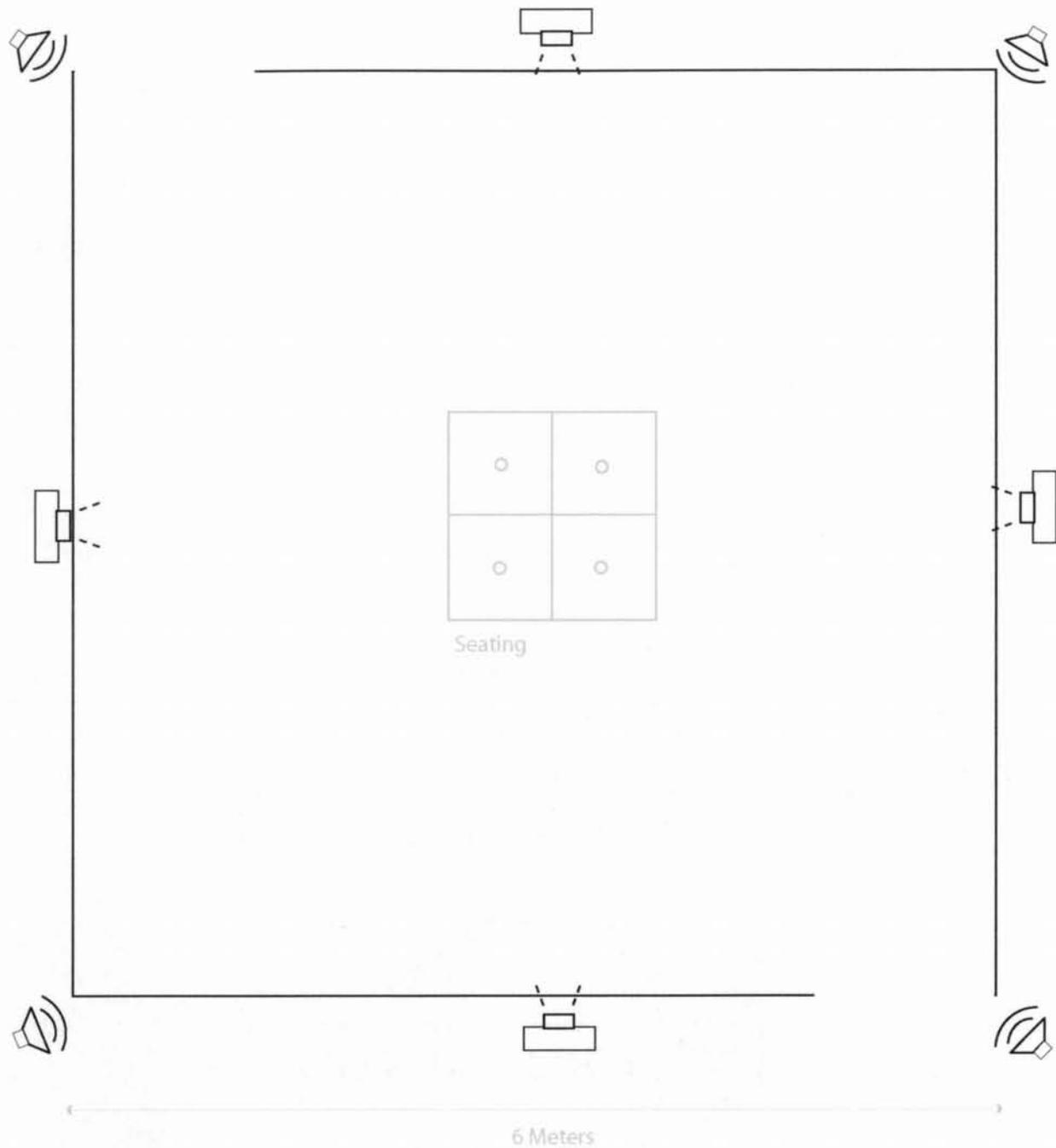
Distributed Collective Biofeedback Loop



Continuous Loop:

1. Collecting hearbeat rates using electrodes or earlobe sensor.
2. Transmitt to central computer via wireless network nodes and the Internet.
3. Single beat composit rhythm sent to device via wireless network and/or radio waves.
4. Rythm is countinously playing in the device.
5. Repeat

Installation floor plan:



 Projectors: ceiling monted, full wall projection.

 Loudspeakers: ceiling monted, 3D sound.

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Title *Infome Imager Lite*

Year 2002 to 2005

Technical

Original Format	Format Submitted for Viewing	Preferred OS
<input type="checkbox"/> Software	<input type="checkbox"/> Software	<input type="checkbox"/> Windows
<input checked="" type="checkbox"/> Web	<input checked="" type="checkbox"/> Web	<input checked="" type="checkbox"/> Mac
<input type="checkbox"/> Installation	<input type="checkbox"/> VHS	<input type="checkbox"/> Unix
<input type="checkbox"/> Other	<input type="checkbox"/> CD Other	<input type="checkbox"/> Other

Web Information (answer only if sample work is in Web format)

- URL http://jevbratt.com/infome_imager/lite/
- Browser requirement(s) Safari, Explorer, Javascript has to be enabled
- Plug-in requirement(s) _____
- This sample requires broadband connection (fast Internet connection)
- A local copy of the sample work has been included with the application

Special Information for Viewing:

First click on “Infome Manifestations” to view visualizations made by other users. To view a specific visualization click on its image icon. Then create your own crawler/visualization by clicking on “new crawler” in the manifestation listing side frame or on the index page, or by clicking on “CLONE” or “RE-VISUALIZE” in the bottom of a visualization window. To print a visualization click ‘PRINT PREVIEW’ in the bottom of a visualization window.

Images on CD (in folder ‘Sample_Images/Imager_(also_www)’):

(The CD does not contain the site since it needs a server to run.)

Images from *Infome Imager Lite Workshop* installation in at Techno Sublime at the University Art Museum, Boulder, Co. Winter 2005:

1_Boulder_05_1.jpg, 2_Boulder_05_2.jpg, 3_Boulder_05_3.jpg, 4_Boulder_05_4.jpg,

Visualizations (print previews) created with the software:

5_ID435_#0.jpg, 6_ID505_0_#0.jpg, 7_ID518_#0.jpg, 8_ID282_#10.jpg, 9_ID334_#5.jpg, 10_ID411_#2.jpg, 11_ID544_#0.jpg

Description of Work

The 'Infome Imager Lite' website allows the user to create "crawlers" (software robots, which could be thought of as automated Web browsers) that gather data from the Web, and it provides methods for visualizing the collected data. Some of the functionality of the 'Infome Imager Lite' crawler is similar to the crawlers search engines such as Google use, but with some significant differences. The search engine crawler collects data about the intended content of a page, the actual words, in an effort to index the Web according to the "meaning", the semantics, of Web pages. The 'Infome Imager Lite' crawler collects "behind the scenes" data such as the length of a page, when a page was created, what network the page resides on, the colors used in a page and other design elements of a page etc. It glances down into the subconscious of the Web in hopes to reveal its inherent structure, in order to create new understandings of its technical and social functionalities. Another difference lies in the way the data is presented to the user. The search engine uses algorithms to sort the data according to one theory or another, in order to present the user with pages containing a few selected links each. The user is not allowed to see the actual data, but a subset of it, selected and sorted by a computer. The result of an 'Infome Imager Lite' "search" is an image with all collected data, potentially a vast amount of information, presented in a way in which the human brain, not the computer, is put to work on what it does so well - creating intuitive understandings of large quantities of information. (In the text "System Esthetics", 1968, the writer, art curator and critic Jack Burnham, borrowed the term 'esthetic decision-making' from the economist J. K. Galbraith to describe this process.)

The *Infome Imager* interface allows the user to manipulate the crawler's behavior in several ways. The user decides where it should begin crawling; it could for example start on a Web page specified by the user, a page resulting from a search on a search engine, or on a random Web page. The crawler can be set to either visit a page once or every time it encounters a link to it. The data resulting from many revisits will create repetitive patterns in the visualization, revealing the linkage structure of the Web sites, while data resulting from single visits will generate distinct data. The user also sets how many pages the crawler should visit. The activity and the result of the

crawler can be monitored on the Web site. The visualizations created by the crawling process functions as an interface linking to all the sites the crawler visited.

The 'Infome Imager Lite' Web site can be seen as a form of distributed computing such as the seti@home project. However, while seti@home is using people's computers in a collective search for intelligence in the universe 'Infome Imager Lite' is using people themselves, or more precisely their aesthetic sensibilities, to collectively find occurrences of identity in the environment/organism created by the HTTP protocol. The collective environment was enhanced further in a Workshop installation of 'Infome Imager Lite' exhibited in 'Techno Sublime' at the UC Boulder Art Museum in February/March 2005. There the audience sat down together, creating and printing visualizations and hanging them on the walls adjacent to the computers. The audience shared their findings with others in physical space and with people who did not wish to engage with a computer. By taking the visualizations outside the computer, to the museum wall and people's offices or living rooms, more time can be used in interpreting the imagery. The images can be seen and interpreted at more random times while doing other things, while eating breakfast or talking on the phone. This allow people's 'esthetic decision-making' processes more time and context to develop and hopefully a larger understanding of the environment, the Web, can emerge collectively.

'Infome Imager Lite' is a continuation of a software created for the project "Mapping the Web Infome", which was a net art endeavor developed as a part of the exhibition LifeLike at New Langton Arts Gallery in San Francisco (June/July 2001). The exhibition consisted of works exploring life-like processes in various media. As the network curator I tried to find work that would explore and acknowledge the Web as a living organism. When I realized how difficult it was to find that kind of art-projects, I decided to develop software that would enable investigation of the Web as a complex entity, a living organism created by language and protocols, and to invite a number of artists whose work and methods seemed relevant and who would enjoy producing a project with the software. I invited the artists Geri Wittig, Lev Manovich, Kevin & Jennifer McCoy, Giuseppe Prisco, Brett Stalbaum, Jan Ekenberg, Ron Goldin, Arijana Kajfes, Kazunori Takahashi and Marc Bohlen. The projects created with the software ranged from textual and

systemic investigations to more visual expressions of the web-infome. The crawlers and mappings that were generated were different from each other in purpose and intent but were joined conceptually by the possibilities and limitations of the software.

Mapping the Web Infome Web site: http://jevbratt.com/mapping_the_web_infome/

For more descriptions and texts about the 'Infome Imager Lite', see the Infome Imager project Web site.

Exhibition History:

Infome Imager Lite Workshop (the installation with printing capabilities)

2005/02 Techno Sublime University Art Museum (Curated by Lisa Tamiris Becker),
Boulder, Colorado

The *Infome Imager Lite* software/Website

2005/07 SYNC, Athens, Greece.

2004/06 VAERK 04 Changing Territories, Denmark

2004/05 Video festival Narave/Natures Ljubljana, Slovenia

2004/04 Ciberart Bilbao, Bilbao, Spain

2002/09 Mapping Transitions University Art Museum (Curated by Christiane Paul and Mark America), Boulder, Colorado.

Mapping The Web Infome

2001/06 LifeLike, New Langton Arts Gallery in San Francisco CA

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Title 1:1(2) and Migration

Year 1999/2002 and 2005

Technical Information

Original Format	Format Submitted for Viewing	Preferred OS
<input type="checkbox"/> Software	<input type="checkbox"/> Software	<input type="checkbox"/> Windows
<input checked="" type="checkbox"/> Web	<input checked="" type="checkbox"/> Web	<input checked="" type="checkbox"/> Mac
<input type="checkbox"/> Installation	<input type="checkbox"/> VHS	<input type="checkbox"/> Unix
<input type="checkbox"/> Other	<input type="checkbox"/> CD Other	<input type="checkbox"/> Other

Web Information (answer only if sample work is in Web format)

- URL http://jevbratt.com/1_to_1/
- Browser requirement(s) Explorer, Javascript and cookies have to be enabled.
- Plug-in requirement(s) _____
- This sample requires broadband connection (fast Internet connection)
- A local copy of the sample work has been included with the application

Special Information for Viewing:

There are five different interfaces, explore them by clicking on their links from the front page. Each interface has a help/description page which is accessed by going to the interface and clicking on the “?” link on the bottom of the page. Start by looking at Interface Hierarchical. It shows the database in the cleanest way, as a directory structure. Then look at Every, it shows all the addresses in the database in one image. Then look at the Migration interface and, if time allows, the 2005 update of that interface at:

http://jevbratt.com/1_to_1/3/migration/

Images on CD (in folder ‘Sample_Images/1_to_1_(also_www)’):

(The CD does not contain the site since it needs a server to run.)

Images from ‘Database Imaginary’ at Banff Centre for the Arts in Canada. An image from the ‘Every’ interface was exhibited as a billboard size print: 1_Banff_1.jpg, 2_Banff_2.jpg, 3_Banff_3.jpg
The image that was printed: 4_every_ip.gif

Two images from the Migration project (an extension of the interface Migration in 1:1.)
5_migration_#1.jpg, 6_migration_#2_detail.jpg

Description of Work

1:1, created in 1999, consisted of a database that would eventually contain the addresses of every Web site in the world and interfaces through which to view and use the database. Crawlers (software robots, which could be thought of as automated Web-browsers) were sent out on the Internet to determine whether there was a Web site at a specific IP address. If a site existed, whether it was accessible to the public or not, the address was stored in the database. When the project was first created, approximately two percent of the IP-addresses were searched and 186,100 sites were included in the database. In the fall of 2001, the search was started again. The initial idea was to continuously search the IP space to eventually have covered the whole spectrum. But since the Web had changed drastically since 1999, it seemed more interesting to search the same areas again to be able to make comparisons between the Web in 1999 and 2001. The update of the project was called *1:1(2)* and it is the version that is accessible now. Five interfaces (*Hierarchical, Every, Random, Excursion, Migration*) visualize the databases and provide means of using the database to access and navigate the Web. The first four interfaces show the two databases in parallel. The fifth interface, *Migration*, reveals in one image how the Web "moved" over the years. The database was updated once more in 2004, and the *Migration* interface was updated to include the new database and expanded into a project in itself. Link to the *Migration* project:
http://jevbratt.com/1_to_1/3/migration/

When navigating the Web through the databases, via the five interfaces, one experiences a very different Web than when navigating it with the "road maps" provided by search engines and portals. Instead of advertisements, pornography, and pictures of people's pets, this Web is an abundance of inaccessible information, undeveloped sites and cryptic messages intended for someone else. Search-engines and portals deliver only a thin slice of the Web to us, not the high-resolution image we sometimes think they do. The interfaces/visualizations are not maps of the Web but are, in some sense, the Web. They are super-realistic and yet function in ways images could not function in any other environment or time. They are a new kind of image of the Web, and they are a new kind of image.

For the specifics about each interface, click on the “?” link in the bottom left corner of each interface.

Exhibition history:

Migration

2005/01 Hypertemporality, University of Richmond Museums, Richmond, Virginia

1:1(2) Web site and billboard print of one of the Every visualization

2004/11 Database Imaginary, Banff Centre for the Arts, Canada.

1:1(2)

2002/03 Hotspot, Gotland, Sweden,

2002/02 The Whitney Biennial, The Whitney Museum of American Art, NY.

1:1

2001 Nordic Interactive Conference, Copenhagen, Denmark

2001 The Pamplona Video festival of Navarra, Pamplona, Spain

2000 The Altoids Curiously Strong Collection (Various locations: New Museum, NY, The Lab, San Francisco and other locations)

2000 Transmediale, Berlin, Germany

2000 Art Entertainment Network, Walker Art Center Minneapolis

1999 New Langton Arts Bay Area Award Show, San Francisco CA

Award Nomination:

2001 Webby award.

Collection:

2000 Altoids Curiously Strong Art Collection. (Collection donated to The New Museum, NY)

The project is discussed in several books, among them The Atlas of Cyberspace by Dodge and Kitchin, 2001, Digital Art by Christiane Paul, 2003 and Internet Art by Rachel Greene , 2003.

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Title *The Voice*

Year 2005/2006

Technical Information

Original Format	Format Submitted for Viewing	Preferred OS
<input type="checkbox"/> Software	<input type="checkbox"/> Software	<input type="checkbox"/> Windows
<input checked="" type="checkbox"/> Web	<input type="checkbox"/> Web	<input checked="" type="checkbox"/> Mac
<input type="checkbox"/> Installation	<input type="checkbox"/> VHS	<input type="checkbox"/> Unix
<input type="checkbox"/> Other	<input type="checkbox"/> CD Other	<input type="checkbox"/> Other

Web Information (answer only if sample work is in Web format)

- URL _____
- Browser requirement(s) _____
- Plug-in requirement(s) _____
- This sample requires broadband connection (fast Internet connection)
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Special Information for Screening:

The sample consists of screenshots of the site in progress. The design of the visualization and other features are not yet finalized. (The site will be premiered the winter of 2006) The images are in jpg format and can be viewed in a browser or any other jpg capable software.

Screenshots of visualization only:

- 1_voice_screen_1.jpg
- 2_voice_screen_2.jpg
- 3_voice_screen_3.jpg

Screenshots of visualization with legend and search window from the site open:

- 4_voice_screen_legend.jpg

Screenshots of the archive page simultaneously showing visualizations from six weeks:

- 5_voice_screen_archive.jpg

A printout of the whole image generated. The whole image might be used as a poster for the arts council:

- 6_voice_large.jpg

Description of Work

The Voice is commissioned by The Swedish National Public Art Council (Statens Konstråd) and it is a public art project for their network/website. The project is in progress and will be finalized Winter 2006. The Art Council is an interesting institution to work with because of their position of power within the Swedish arts community. It is a government body responsible to the Ministry of Education, Research and Culture whose primary function is to commission permanent, site-specific contemporary works of art and to purchase art for placement in government premises. This project is their first attempt to work with an Internet art project as site-specific, public artwork.

The Voice visualizes the words the users of the Art Council website are searching for on the site and in search engines in order to find the site, and a comparison of these words with the word usage at the office of the Art Council (for example words written in emails and read by the office staff on web pages). The visualization consists of the last two thousand words searched for, displayed in different font sizes/colors, with different border sizes/colors, reflecting how many times it has been searched for, when it was searched for, how much it has been mentioned in the internal communication and how much it is used on the Internet in general. Each word links to the pages on the server that contains the search-word, the visualization thus functions an alternate interface to the Art Council website. The visualization is updated daily and each new "image" is saved in an archive accessible by the user.

The project is an attempt to create an image of 'the voice' - the collective identity and inexplicit consensus - of a group of people. The group in question consists of the employees of The Art Council and the public who are interested in the doings of The Art Council, for example artists seeking funding from them and the corporations and organizations that use their services. The project visualizes the individual's relationship to the community and the relation between one group who has resources and one who wants access to those resources. It has the potential of revealing patterns of nepotism and the emergence of new jargon and idioms.

I have been working in the field of software and Internet-based art since I came to the US from Sweden in 1994 for graduate school. My projects have typically consisted of software that collects data from, and is concerned with, the use and functionality of the Web, Internet and e-mail communication.

Data visualization is often a major aspect of the projects. When working with visualization, I want to stay away from two common (and in my view, problematic) strategies. First, many information visualizations created by artists use data to “paint”. In those, the correlation between the data and the visual elements is too arbitrary. My software generates visualizations that aim to be direct imprints, indexical traces – rubbings - of the data. Typically each visual element has a one to one correlation to what it represents, the positioning, color and shape of the visual elements have one graspable function which allows the complexity and information in the data itself to emerge (potentially revealing cultural implications and assumptions hidden in the system producing the data). The second strategy is more commonly seen in the scientific community. There the data is used without allowing it to express itself at all; i.e. the system of representation is not arbitrary enough. Much visualization in that category is merely illustrations of preconceived models. I am interested in creating visualizations that let us experience something we did not know, visualizations that are not representations of reality, but that are reality. To approach that goal I have avoided simulation, metaphorical language and 3D representations. I want the visualizations to be objects for interpretation, not interpretations. They should be experienced, not be a discussion about experience.

From very early on in my work with networks and computers, I have been interested in the collective aspect of the Internet, how it allows us to experience and map, us, humans, on a community/species level. Several of my projects are concerned with the totality of the Internet and in specific the part of the Internet defined by the HTTP protocol, the Web. In all my projects there is an interest in the patterns and synchronicities that seem to emerge in collective entities such as the Web. The projects explore the idea of us finding something unexpected, something that shows signs of an awareness hidden within these collective entities, an awareness that does not look like anything, until something emerges slowly, drawing attention to itself, revealing itself, letting us know it has meaning.

Several of my projects explore unintended expressions of the entities/systems they work with. The *Infome Imager* maps “unintentional” information about web pages, such as when a web page was written, 1:1 maps the assignment of the Internet space, a seemingly arbitrary assignment, which, when analyzed, reveal hidden, culturally significant, assumptions and facts. *Syncro Mail - Unconscious Collective* generated and mailed random messages from the user to a person the user selected to receive the message. It explored the relationship between the intentionality of the act of sending, and the un-intentionality of the information that is being sent. The project proposed here, *Pulse*, creates a feedback loop and a visualization/sonification of an autonomic bodily function, a function that are not under conscious control. Examples from various fields show that the strategy of mapping unintentional aspects of a system might tell us more about it than looking for acts done with intention. In art history, the “Morelli method” hypothesize that in order to identify the authorship of a painting, say a portrait, one should focus on the parts made with least intention such as the earlobes or fingers of its subject, not its eyes or mouth, which are painted with intention, and which typically reveal more about the school the painting was made within, than about the specific artist painting it. Biologists have found that the most well connected molecules (the ones that perform the most work) in an organism are the same in many various species. The ones that set us apart are the least connected molecules, the ones using the least effort.

My general formal strategy is to let form to follow function. The primary aesthetic decision happens on the system level, and the visual appearance follows the operation of the system and the functionality of its interface. Colors and shapes are rarely defined on the surface but are indicators of some systemic fact. I consider every detail in an interface to be part of the project, to carry an important semantic. The result of this method is a fairly minimalist semantic “design” whose poetry is based more in absence than presence even when the project presents enormous quantities of data. With a long education in traditional contemporary art, the process I use is in some sense a non-digital traditional artistic/creative process. I immerse myself in my medium and let it “talk back”. Programming is my actual medium; writing code is the bulk of the work. My ideas are, in part, formed in, and as a result of, the coding.

Pulse is a distributed collective biofeedback system that aims to synchronize the heartbeats of its participants. Networked computer technologies have brought focus to issues of the relationships between the individual and the collective, between specific cultures and us as a species. These technologies allow us to record, in minute detail, the activities of each and every individual and they allow us to create experiences of the totality, the species level, of that data. By mapping the lowest common denominator, our heartbeat, this project aims to create a direct experience of us as one collective entity, one body. The project is intended for a new media art conference/festival setting. The pulse rate is continuously collected from people who choose to participate using a wearable device. The pulse rate is transmitted via a wireless network to a computer. The computer calculates the average pulse rate and transmits it to the participants as a single beat sound played in the same device that recorded the heartbeat. The participants' heartbeat rates might at times converge due to a synchronizing effect of the playback sound. In addition all heartbeats of all participants will be visualized and sonified in a minimalist fashion in an installation.

The project is in a fairly early research state and the details of the project are in development. The specifics in this proposal should to some extent be seen as a point of departure.

Functionality

Wearable devices equipped with pulse sensor (either earlobe sensors, or electrodes that measure the electrical impulse in the heart) are used to record the heartbeats of the participants. Using a wireless network, the recorded heartbeat is transmitted from the device to a central computer. There, all the heartbeats from the participants are averaged into one beat. The beat is sent back to the participants' devices as a drum-like sound via radio waves or the wireless network. The sound will be designed to be as effective as possible for influencing, and ultimately synchronizing, the participants' heartbeats. The heartbeats are sampled at even intervals, or whenever the participant is near a node in the network. In an optimal version of the project the participants should be able to move around a large area, such as the downtown of a city. In a more limited version, using a smaller wireless network, the participants could move around in an

exhibition/conference space.

In addition to being used in the biofeedback loop, the heartbeat rhythms are fed into an installation. There, all current heartbeat frequencies of all participants are represented as a polyrhythmic sound experience. Each of the frequencies is represented as one rhythm, and by overlaying all the different rhythms, complex rhythmic patterns appear. A drum-like sound will be used to represent each heart beat frequency because of its potential of generating a rich, evocative and yet minimal sound image. The visual aspect of the installation consists of a visualization of all the current heartbeat frequencies projected on all four walls of a cubic room. Each heartbeat frequency at any given time is visualized as a grid. All grids representing all participants are overlaid to compose one image. The grids will create moiré patterns as a result of thicker lines produced when the lines in two (or more) grids nearly overlap. The moiré patterns that occur will reveal the combined frequencies of the different heartbeats. As the participants' heartbeat frequencies are continuously updated the moiré image is changing. The result is an animation changing at varying speeds depending on when the data is updated. The four projections of the 'animation' are wall sized to create an immersive experience. In the middle of the room there is a square cushioned bench for seating.

The aesthetics of the installation, both in terms of sound, visuals and functionality, is minimal in order to let the complexity of the overlapping rhythms to manifest. As in all my projects that have a visualization component I am not interested in "painting with data". I want to create a direct experience of the data, with as little interference from preconceived forms as possible. The grid structure is an interesting way of visualizing rhythmic patterns. In a very direct way the moiré pattern is a measurement of disorder in the system, and if/when the order increases by having the participants heartbeats synchronize the moiré patterns will disappear and a single grid appears.

Context

Several interesting areas of research relate to the project, and a deeper study of those will continue to inform the design and contextualization of it. Synchronization has become one of the interdisciplinary research interests of our time. Researchers in fields from mathematics and biology to psychology and spiritual practices investigate the synchronization of fireflies, the coupling of oscillating heart-cells and the entrainment of mind and body rhythms. Biofeedback is

now an accessible and popularized method for wellbeing. The ubiquitous wristwatch heart rate monitors are used to enhance physical exercise and there has been a steady increase in stress relieving biofeedback consumer products, such as games driven by skin conductivity. Another area of interest is psychoacoustics, the study of how sounds affect the human brain. In shamanic practices the steady beat of a drum is used as sonic driving enabling the shaman to reach trance states necessary for their healing work. While these areas are all new for me, my work with the Internet in has led me to a more generalized interest of networks and distributed systems and to the relationship between the individual agent in a network and the communities, bodies or organisms they collectively form.

Feasibility statement

The project is complex and involves technologies I have not before been working with. I have therefore assembled a group of students skilled in networks, sensors, sound etc. to work with me on the project. In order to ensure that the project will be finalized, I imagine various outcomes possible. The wearable input/output device should ultimately be a ubiquitous device such as an Ipod or cell phone but it might be difficult to get that to work with the current state of the technologies. To use a custom made device will therefore be the first solution and when/if I pods gets equipped with wireless capabilities and radio receivers, or cell phones with good sound capabilities and radio receivers, they could be used instead.

Use of Work

The project is intended to be shown in a large-scale symposium/conference setting. It will be proposed for ISEA 2006 in San Jose and other venues. Potentially the project could become more ubiquitous in the future, accessible via the Web and peoples own ipods/cellphones, without a centralized installation component.

Fellowship Use/Budget Narrative

The funding will be used to acquire the necessary hardware, for payment of assistants and for working time.

Pulse – Budget

Lisa Jevbratt

(The project is in an early state and the details of the technologies to use are still being researched.)

Hardware:	
Parts for wearable heart rate monitor and sound playing devices (amount of devices produced depend on cost of parts): radio equipped headphones, sensors, bluetooth wireless transmitters, misc. electronics.	\$12 000
Bluetooth network parts.	\$5 000
Projectors and loudspeakers for installation.	\$6 000
Labor:	
Student assistants (programming, sound design, networking, hardware configuration, hardware production etc): \$15*500(hours)	\$7 500
Labor of artist	\$4 500
Sum:	\$35 000