MAKE A BABY

TOUCH MEDIATED GROUP INTERACTIVITY

INTRODUCTION

A property of the skin that allows for the transfer of electrical signals, in particular audio signals, was selected as ideal material for the construction of a group interaction. The design of the interaction evolved as a critique of hierarchical tendencies in both performance and installation art, adopting the model of distributed network computing as its allegorical structure. This paper will discuss briefly several antecedents in art and music, as well as areas of research related to the use of touch as a means of transferring data. More attention will be paid to the ways in which a group improvisation can be designed in relation to the goals of a distributed network, namely scalability (allowing for members of the group to join or leave at any time, or to participate more or less directly with other members), transparency (maintaining equal immediacy between gestural contact and end result for all users), and the diffusion of instructions as well as data across the group. Following from this is an evaluation of how the design can account for the socially dynamic structures that arise from technologically assisted group interaction--i.e. sharing, open communication, and parallel education. Aside from these macro scale considerations, the design was particularly concerned with creating a system for multimedia expression that operated on the minute level of skin against skin, making full use of the range of communicative expression and sensation this mode of

interaction suggests. Executions of this group interaction occurred in modified versions on March 24th, April 8th, and April 22nd, 2005. A discussion of these versions is included.

INTENTION

"We're tired of trees. We should stop believing in trees, roots, and radicles. They've made us suffer too much . . . Nothing is beautiful or loving or political aside from underground stems and aerial roots, adventitious roots and rhizomes." [Deleuze p. 15]

Does a performance mediated by touch naturally lend itself to the forms of a rhizome, of anarchy, of Quaker theology, of distributed networks? For a technology centered on transference, the creation of networks seems a natural step. Given that it is the inherent potential of networks organized as multiplicities—e.g. in parallel—to outperform hierarchical structures in certain tasks [Flynn 1972], what are the implications for social structure mediated by such technology? The intention underlying the environmental design of a group improvisation to be called *Make a Baby* was to identify, focus, and build on the potential of technology to facilitate group interaction. The ideal conditions of this environment, as established through the course of its design, were as follows:

- the environment should be able to evolve without external or hierarchical mediation. There should be no initial instructions, no decided beginning, and no decided end.
- 2. Cooperation and co-learning between participants should be implicitly encouraged. To facilitate this, the mechanism should be easy to demonstrate on a person-to-person level. In other words, one should be able to explain the mechanism while it is running and being used, without detracting from its effect. The mechanism should not require any previous skill or knowledge, but should promote shared understanding through interaction.

- 3. Scalability (adding more participants) should be a desired aspect, but the mechanism should maintain functionality on a point-to-point level. The environment should be able to expand and contract in size (number of participants) extremely rapidly and gracefully. As a corollary to this condition, the size of the network (number of active user nodes) should be explicitly evident through the music (or video, etc.) created.
- 4. Each node of the network should have the same potential effect on the entire system, which relates back to (1). Following from this, the activity of any one node should be most apparent when interacting directly with another node, but should also have noticeable effect when incorporated into an extended network. This condition relates to the technological definition of "transparency", in which the mediating apparatus between user gesture and remote event is collapsed.

1 GROUPS

"One can imagine an audience environment where the audience becomes the sole activator and responds to itself." Robert Watts [as quoted in Buchloh and Rodenbeck 1999]

Allan Kaprow, pioneer of fluxus-related "happenings" in the late fifties, in seeking to undue the influence of Jackson Pollock's performative explorations of the ego-id relationship, extended John Cage's experiments in chance composition out beyond the stage and into the audience [Kelley p. 8]. Although Kaprow's experience as a student of Cage had a discernible impact on his work, his reading of John Dewey is more easily applied to a performed experience:

"... The process continues until a mutual adaptation of the self and object emerges and that particular experience comes to a close, ... interaction of the two constitutes the total experience that is had, and the close which completes it is the institution of a felt harmony . . . the scope and content of the relations measure the significant content of an experience" [Dewey 1934].

This desire to specifically measure and translate relationships between individuals, groups, and objects led Kaprow away from public performance towards the more intimate shared experiences of later work such as *Time Pieces*, in which couples—serving as performers, participants, and audience all in one—exchanged pulse rates, breathed air, etc. in privacy, discussing and recording their own experiences [Kelley p. 187]. How can technology be used to facilitate not only the measuring of relationships but also the intimacy of a shared experience? In creative group improvisation, interface design should consider both transparency and sensitivity for the sake of collective experience [Blaine and Fels 2003]. In social science, adaptive structuration theory provides criteria by which the use of technology in mediating social structures can be described and evaluated [Desanctis and Poole 1994]. These criteria fall under the more descriptive term *spirit*, used to describe the intent of an environment's design, as experienced from within a group.

2 TOUCH

"It is also possible to think of certain anatomical parts—in particular the hand—as unitary organs where action on the world and perception of it are no longer divorced and discussed separately." [Rovan and Hayward 2000].

Investigation into the particulars of cutaneous sensation—especially concerning its high sensitivity to temporal resolution—suggests that the full potential for communication across the skin has yet to be realized by technological means [Geldard 1960]. Multimedia artists have explored the sense of touch not only as a means of heightening individual experience within an environment [Möller 1997], but also with the intention of

creating a non-hierarchical network by privileging the points of connection over the actions of the individual. Examples of the latter have provided exceptional models of form, and were taken into heavy consideration as the design of Make a Baby evolved. Sonic Meditations XV "Zina's Circle" by Pauline Oliveros explores the propagation of a signal through a group without technological mediation. Participants in the meditation pass a pulse between themselves by squeezing hands, accompanying each transmission with a vocal sound¹. From the Yellow Castle by Gerald Shapiro and Bill Patterson reinforced proprioceptive feedback (awareness of one's body as informed by its environment) through the sonification of touch between participants [Shapiro and Patterson 1971]. In Erkki Kurenniemi's DIMI-S synthesizer (1972), was designed for group participation—sound was generated by up to four players touching conductive handles and one another. The timbre produced by the DIMI-S varied in relation to resistance between handles, and at each point of skin contact between players, a notably similar technique to the method used here [Ojanen and Suominen 2005]. Recent research into the feasibility of "personal area networks"—the storage and transmission of data through the human body—suggests that the possibilities for touch communication as mediated by digital technology are limitless and imminent [Zimmerman 1996, Williams et al 2004].

3 TECHNIQUE

NB What follows here is an attempt to describe the observed properties of signal transfer across skin, as applied in this project. Had the project germinated from a known physical phenomenon rather than accident, followed by trial and error, the mechanism might be more directly explainable. Sincerest appreciation is due to Bill Patterson for his helpful analysis!

What was initially observed was the interruption or modification of a circuit by bridging the connection between signal and ground with skin. Subtly adjusting the skin's contact with signal and ground electrodes produced somewhat unpredictable modifications of the circuit. The effect produced by these adjustments was a change in resistance at three points—between the surface of the skin and each electrode, and between the surface of the skin and the internal environment of the human body (depending as often as not on skin moisture). For the design of this project, this simple interrupted circuit was expanded to allow for measurable contact between multiple bodies. A series of circuits at different frequencies was created, sharing a common ground (through the computer's audio interface). Users maintaining contact with individual circuits at fixed frequencies could then establish complex resistor networks on the fly by making skin contact with one another. The number of actively changeable points of resistance in the network increased as more users were introduced to the circuit. **Figure 1** illustrates how such a network would be described for contact between two users.





Equivalent Circuit of Two People Bridging a Pair of DACs to the Inputs of Two ADCs

The first subscript (1,2) is the person, and the second is what they touch (S – their source, I – their input and 1,2 the other person). Resistors R_{11} and R_{22} represent the resistance of our insides [Patterson, 2005].

The measurement of changes across this resistor network enables the translation of gestures and contacts between differently charged bodies and environmental objects into usable control data. This data can in turn be used to produce an illustrative reflection, of any specific body's interactions and connections with other bodies. Two beneficial properties can be inferred from this. Firstly, subtle changes in the impedance between bodies—the range between slight brushing contact with hair or fingernails to fully clasping palms together or touching one's lips or teeth etc.—can be tracked as changes in return signal amplitude and scaled for use as control information. Secondly, contact between any member of a group of individuals carrying discrete signals can be measured independently and used to build a map of the group's interactions.

4 REALIZATION

A software application was created in the MaxMSP programming environment to provide the necessary superstructure for the performance. The application consisted of three basic subdivisions--(1) the transmission/reception of control signals, (2) the analysis of the resulting streams, and (3) the conversion of the analyzed stream into something else. Maintaining modularity in the design was a primary concern, such that each subdivision could be modified or replaced without rendering the other areas obsolete, and such that the functional use of analyzed stream data could be adapted to any purpose. For the initial execution of this project, analyzed data was used to control

the parameters of a simple sound and image synthesizer. **Figure 2** shows a layout of the hardware used in the performance on April 8th 2005. Two computers ran slightly modified versions of the same application, executing each of the above criteria and converting analyzed stream data into sound, which was output in dual stereo. A third computer, dedicated to video, ran a scaled down version of the application designed to receive analyzed stream data from each of the other computers rather than execute the first two criteria.

A revised version, existing as a self-contained installation, was included as part of the 2005 Boston Cyberarts Festival². For this version, a single computer interpreted data from four circuits that had been incorporated into a textile surface. Images of the installation version have been included in the accompanying documentation.



diagram of the hardware setup used in the performance environment

FIGURE 2 diagram of the hardware setup used in the performance environment

4.1 TRANSMISSION / RECEPTION

The user interface for this performance consisted of eight terminals fabricated out of 9v battery connectors, with each of the two leads fixed to 10 foot lengths of shielded 2-wire cable [**figure 3**].



One lead acted as a receiver, the other provided the transmitted signal, each connected to a corresponding input or output channel of the digital-analog converter. The terminals were designed to be easily held between the thumb and index finger so as to cover both leads completely. An alternating current circuit (audio line-level) was established at one of eight fixed frequencies when held firmly. In this way, users were able to transmit a specific frequency that served as a signature, while simultaneously monitoring a complex signal determined by the combined frequency signatures of those sharing a common touch circuit.

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Figure 4 (above) shows the area of the software application designed to transmit and receive the control signals on any one input/output channel. Between the two computers, eight cosine waves with fixed frequencies ranging from 17000 Hz to 20500 Hz at 500 Hz intervals were output on individual channels through two MOTU 828 mkII firewire audio interfaces. The signal data from each oscillator was algorithmically filtered prior to output to remove any potential noise or overtones caused by overmodulation. Signal data from each channel's input was similarly filtered in order to isolate and identify the presence of signal amplitude at any of the seven other frequencies. The presence of frequencies other than the original would indicate the capacitive coupling between the channel being monitored and any of the other discrete circuits--i.e. the completion of a circuit by touch between two or more people. Amplitude information from each of these seven monitoring channels thereby served as the raw control data from the performers--describing the presence of touch circuits, as well as temporal changes in conductivity within these circuits.

4.2 ANALYSIS

Amplitude information at each frequency was monitored using simple envelope followers (a running average of the signal value taken at 15 ms intervals). Data from each envelope follower was smoothed, filtered to remove a noise floor, and normalized to a range of 0.-1.. By comparing these running averages, a map of any group of users connected by contact upon one another's skin could be established. Furthermore, as connections were made and broken within these groups, or even between individuals, a finely detailed analysis of the degree of contact being made could be tracked, recorded, and translated. Additional analysis was applied to determine consistency of contact between any pair or group of users.

4.3 SOUND/IMAGE SYNTHESIS

In accordance with the analyses conducted on each channel, certain actions within the group took on a greater level of transparency. Considering that it was easier to measure the sizes and identities of groups, length of contact between two or more users, and subtle variations in the quality of contact between users, it naturally followed that these actions could be more closely mapped to sound or image, and thereby operate on the level of synesthetic feedback. Sound and image design served several purposes: to collapse the mediating mechanism by providing a satisfying sense of control, to encourage a variety of touch activities by providing a responsive range of activated characteristics, and most obviously to add to the sense of purposeful shared experience. For the April 8th version of this piece, the sound and image design were as follows: A simple software synthesizer was built to oscillate sawtooth and sine waveforms according to a set of predetermined frequencies (a mode). Each point of connection

between users translated directly into a tunable oscillator. Changes in the tuning, according to the mode, were produced by different ways of touching. This provided a very satisfactory and precise way to "play" on one another's skin. Alterations to the timbre and composition of the synthesized tones were implemented in accordance with length of contact between any specific users, as well as changes in the sizes of groups connected through touch. For the video, control data from each computer was converted from an array of float data to a complex frequency signal with different frequencies representing each user, and stepped levels in amplitude representing the number of touch connections each maintained. These signals were sent as audio to the third computer, where the stream was analyzed and to monitor the number of touch connections for each user. A pattern was projected above the performance space, with each user being represented by parallel bands of color. As the number of connections any specific user maintained increased or decreased, the color of the bands changed in response.

5 DISCUSSION

In reviewing video footage from each of the group improvisations, it becomes immediately apparent how much people were talking to each other. Reiterated instructions, demonstrations, invitations to join suggest that the environment's design was successful in encouraging communication between participants! Moreover, the balance between an immediately comprehensible effect (we touch each other, a sound is made) and the opacity of the mediation between these points seemed to demand speculation, discussion, and exploration. In this way, a specific awareness of *kinetic melody*—the usually subconscious knowledge of one's physical motions as an extension

of conscious intent—became the material of communication between participants, creating a sense of the communal experience that penetrated normal social awareness of one's body.

"No particular empathy is required, merely the innate knowledge of my own body as existing in the world." [Josipovici p. 7]

Without the need for specific instructions, a group of novice users approached the interface as a group, encouraging and educating one another. The group maintained a high degree of scalability as users entered or left the role of active participation. There was an audience, as much as there were performers, but each seemed to occupy a plane of consistency that reduced the threshold between them to subtle fluctuations in the will to participate. This can be partly attributed to one property of the touch transfer that allows signals to be mediated through the skin of those not directly contacting the electrodes, encouraging the experimental extension of participation outside of the realm of active engagement. Deleuze uses the metaphor of a body without organs—conversely, organs themselves refusing to be contained as an organism—to describe this plane of consistency:

"A body without organs is made in such a way that it can be occupied, populated only by intensities, . . . organs appear and function here only as pure intensities. The organ changes when it crosses a threshold, when it changes gradient." [Deleuze p. 153]

Make a Baby sought to include this potential for active change intrinsically at each level of interaction, from interpersonal touch to the temporal extent of the performance itself. Over the course of the April 8th performance (the longest, at roughly six hours), groups would coalesce and disperse in self-organized patterns that transcended any instruction or guidance between individuals, suggesting instead a natural structuration process as naturally observed in flocks, swarms, herds, and other collectives [Blackwell and Young

2004]

Finally, adaptive structuration theory describes the *spirit* of a technologically mediated group interaction using the following criteria, with the aim of not only designing better systems, but also determining whether the presence of technology is in fact an aid to the group experience: the type of decision process promoted, evolution of a leadership structure versus equal participation, system efficiency, how the system handles and resolves conflicts, and the overall atmosphere of the interaction [Desanctis and Poole 1994]. Using these criteria, the performances of *Make a Baby* can be said to have used technological mediation to enrich the group experience—on a point-to-point level, on the level of sub-groupings, and on the level of the group experience as a whole.

6 IMPROVEMENTS

A revision of this project that uses a bank of CMOS 555 chip oscillators in conjunction with an FFT based analysis of the signal input stream is in development, in order to eliminate the need for a multi-channel audio device, as well as provide for maximum scalability. Other improvements that could be undertaken in the near future not only offer ways of reducing the technology required, but also seek to refine the social feedback mechanism central to its success. Furthermore, bringing the beneficial aspects of these interactions to new applications and new audiences promises a better understanding of group interactivity. Some ideas:

- The creation of a suite of different sound creation modules, designed to encourage different behavior patterns through synesthetic feedback, or the mapping of control data to functions other than sound or image.
- Encoding of other information onto the audio signal to allow the transfer of

complex data, as in the concept of "personal area networks" [Zimmerman 1996].

- Using wireless contacts to reduce restrictions on movement, as well as the excessive presence of technology.
- Adapted versions of the improvisation for specialized groups-- young children, the elderly, persons with disabilities, or those for whom touch therapy is an aid to wellness. For these groups, direct interactions with technology--as well as interactions with one another---are either in a developmental state, or extended such that transparency is lost. The seamless integration of interpersonal contact with creativity and shared learning inherent to this project could inspire a broader understanding of technological mediation, introduce transparency (especially in the case of those for whom standard human-computer interfaces can provide neither agency nor warmth).

A NOTE ON THE ENCLOSED DOCUMENTATION

The contents of the enclosed DVD are as follows:

- video footage from a performance on March 24th 2005 at the Asterisk Gallery, Brooklyn, NY
- 2) video footage from a performance on April 8th 2005 at May-N-Kevin 4ever, Providence, RI
- 3) still photographs from the April 8th performance arranged as a slideshow
- still photographs from an installation version of the piece, April 22nd 2005 at the Vertex Building, Cambridge MA (featured as part of the 2005 Boston Cyberarts Festival
- 5) A PDF version of this paper
- 6) A version of the software used in the piece, for the MaxMSP programming environment (downloadable from www.cycling74.com)

NOTES

¹ "Zina's Circle" has been adapted for 2-5 year olds by music educators, a tribute to its

simple effectiveness! [cf.

http://:www.deeplistening.org:pipermail:deep-l:2002-August:003413.html (viewed 4/29/05)]

² The installation version of *Make A Baby*, created in collaboration with textile artist Muffy Brandt, was included as a part of *MEME@Cyberarts*, April 22nd-May 8th 2005, at the Vertex Building, Space 2, 675 West Kendall St., Cambridge MA. For more information on the Boston Cyberarts Festival, visit <u>www.bostoncyberarts.org</u>.

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