

Between Bodies: using Experience Modeling to Create Gestural Protocols for Physiological Data Transfer

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ABSTRACT

In this paper, we describe the use of experience modeling to create gestural protocols for physiological data transfer. This design method has been applied to the development of a wearable computing public art installation called *whisper*.

A series of user-experience workshops were designed with the goal of developing an interaction model for the public installation. These workshops modeled intimacy, social navigation and playful exchange, using performance methods to create gestural protocols.

Workshop participants generated movement vocabularies by negotiating permission and control of their own physiological data. Gesture was utilized as an expressive indicator of intentionality, extension of body image, permission, control, exchange and play.

We illustrate through video, gestural analysis, and experimental feedback, how the workshops provided an experience model for the interaction, wearable garment design, and body-to-body network protocol used in the public art installation, and how performance methodologies can contribute to the area of interaction design.

Author Keywords

gestural protocols, performance methods, choreography, wearable computing, intentionality, improvisation, first person methodologies, physiological computing, play, experience prototyping, public art, informance design, bodystorming, somatics, experience design, social navigation

ACM Classification Keywords

H.5.2. User Interfaces, User-Centered Design, Prototyping

1. INTRODUCTION

The title *Between Bodies* is a metaphor that provides our framework for experience modeling. Our work in designing and testing experience models borrows methodology from the performance practices of Theater [4], Dance [3], and the field of Somatics [12], expanding work in the area of user-centered design, experience design, and participatory design. Our premise is that

performance, as a practice-based research domain, contains a longstanding history of constructing experience models. Many participatory design perspectives omit the bodily experiences of participants. Performance-based experience methodologies can contribute to exploring our bodies' physical responses in the growing area of interface design for ubiquitous, wearable and affective computing. We explore embodied cognition and interaction as a reflective process that is simultaneously inter-body and intra-body. This research provides a case-study for a model of designing embodied interaction.

1.1 Artistic Aim

One of the major themes of the installation *whisper* is the notion of 'paying attention' to one's self, and using this sense of self to connect to, and exchange with another. This requires an ability to transfer this 'sense of self' to another person. Designing expressive interactions that afford intimacy, privacy, affect as well as connection are the goals of interaction. How can a system create a willingness, a trust, the 'suspension of disbelief' needed to enter into an exchange of information that is otherwise private and 'unknown'? To explore these questions of access to experience we turned to performance methodologies. For example, techniques for extending our bodily awareness through attention to breath and movement are common to performance methodologies found in theatre and dance. Techniques in these domains build both intra-body and inter-body knowledge by focusing on our *perception* of our own physical data. This includes having access to, and agency over our own breathing, our own heart, our own thoughts, and our own body state. In the installation this is afforded through the use of measuring physiological data as a representation of one's self, and in effecting how this data is displayed, exchanged, and shared.

1.2 The Outcome: A Wearable Public Installation

We developed an interaction model for the public art installation through a series of experience workshops outlined in this paper. *whisper* is a real-time interactive public art piece, based on small wearable physiological sensors, micro-controllers, and wireless network transmission, embedded in evocative and playful garments worn by the participants. *whisper* is an acronym for [wearable, handheld, intimate, sensory, physiological, expressive, response system]. Focusing on body state represented through participants' breath and heart rate, *whisper* aims to monitor physical data patterns of the body, mapping heart and breath physiological data onto linked and networked devices worn within a specially designed garment. *whisper* collects breath and heart rate data from the bodies of participants, and through visualisation and sonification techniques, enables participants to interact, interconnect, and interpret their own and other participants internal data in playful and responsive ways.

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Figure 1. *whisper* garment and gestural interaction DEAF03 Festival

The wearable installation is the outcome and testing ground for an experience modeling methodology described here. *whisper* has been exhibited at DEAF03, the Dutch Electronic Arts Festival, in the public lobby of the Schouwburg Theatre, in Rotterdam in February and March 2003, at Future Physical's Respond festival, in Cambridge, UK in March and April 2003, and at the e-culture fair at the Amsterdam Paradiso in October 2003. Up to six participants are able to listen to and affect their own body-state represented by their physiological data (breath and heart-rate). They are also able to connect to and exchange their physiological data with other participants in the interaction space through gestural interactions which enable connecting, listening, exchanging, giving and receiving.

2. BACKGROUND

During our design workshops, gesture was utilized as an expressive indicator of intentionality and body state. We modeled our workshop methods on performance techniques that provide a link between embodied interaction, activity theory, user-centered and participatory design, and situated cognition. Within HCI, gesture/movement design analysis is an under-theorized area, and a need exists to explore richer methods to create gestural interaction. Our work attempts to bridge this gap, and specific examples are described throughout the paper.

2.1 Workshopping Experience through Gesture

The workshops were modeled using a range of performance techniques such as improvisation, props, phantom partners, prosthetic devices, ritual space, and placebo objects. We used attention modeling that incorporated listening, sending attention and touching; imagining and visualization; focus on somatic attributes such as breath, heartbeat, stillness, slow motion movement; journaling using hand-writing and drawing; social navigation using gesture and touch to express permission, trust, exchange, and feeling; and costumes and props to express physical extension, connection and group identity. The goal of the workshops was to model experience that could be replicated, re-enacted, and re-played in the context of a public art installation using wearable computing technology. The design goal of the public art space was that it could be simultaneously intimate, playful, and social, while developing a level of awareness of our selves.

We illustrate our process through video, gestural analysis, and experimental feedback. Gestural protocols created and imagined by the workshop participants during playful engagement became the basis for: body to body network protocol; the wearable garment design, including the selection of connection points, placement of wearable computers, sensors, wiring paths, and visual display systems; and for the mechanisms of gestural connection, intention and data sharing that was used in the public art installation.

2.2 Performance Methodologies as Experience Models

There is a common ground that exists between the domains of HCI and performance practice. We refer to this shared ground as first person methodologies: techniques and protocols that articulate models of experience. We posit that it is precisely the differing frames of reference between the domains that can reveal an under-theorized area of practice. For example, the need to have models of interaction and the experience of the 'user'/performer' can be seen to be one such shared starting point that is framed through differing methodological strategies. How are these models of interaction conceived, constructed, and integrated within a design process? What are the underlying assumptions that differ between these domains?

We explore interaction as a space of lived experience and enactment, as something that is simultaneously *between bodies* and *within-bodies*. Specifically, human-computer interaction, as it is defined by *human* experience in which action and meaning are inseparable. We explore human interaction as a model for developing relational human computer interaction systems.

One of our contributions to this shared domain of developing models of experience, is that in our work, the 'bridge' is being built from the side of performance practices, rather than from the side of HCI. This brings with it new vocabularies, techniques, with an emphasis on building knowledge *within* the experience of the body, an area well defined within Performance and Somatics.

Dourish [9] lays a strong argument for a foundation in HCI that validates the notion of an embodied interaction. The need to augment abstract reasoning and objective meaning with practical action and everyday experience is central to this approach. Dourish notes that his contribution is foundational, rather than methodological, which opens opportunities for methodological modeling and testing as a critical next step in the development of this area.

Suchman's [28] ethnographic research, which views all activity as situated and embodied, and her interest in purposeful, intentional activity, alongside Nardi's [18] work in constructing a "theory of practice" within HCI based on the development of activity theory and intimacy between human and machine constructed through intense relational concentration, provide strong bridging links to our work.

2.3 Gestural Movement Vocabulary

What are the properties of a gestural movement vocabulary? In Activity Theory, Nardi [18] illustrates the notion of a "function organ" – a transforming bond with an artifact. A photograph depicts a child listening intently to the radio, the expression of intense concentration suggests the creation of a relation between body and object. In dance and theatre the gesture itself can also become a "function organ", an artifact that creates or enacts a transforming bond between the participant and their own movement. In this way, we think of the gesture *itself* as a function organ: an artifact that creates affordances for interaction.

The design of specific gestures that can become enactors is a notion common to theatre and dance practice. We follow with examples from performance practice that support this notion. Richard Schechner [22] uses the term *Restoration of Behavior*, to describe gesture as "material". Restored Behavior is organized as sequences of events, scripted actions, or scored movements. He refers to these as strips of behavior, and states that a restored behavior, although "originating from a process, used in the process of rehearsal to make a new process, or performance, the strips of

behavior are not themselves process but things, items, *material*". This concept of gesture as source 'material' for designing interaction models is central to our work explicated in this paper.

Augusto Boal [4] in *Games for Actors and Non-Actors*, states that "bodily movement is a thought, and a thought expresses itself in corporeal form". Boal's *arsenal of theatre* can be used to re-enact, or re-materialize the body state that accesses or indexes that thought, or "thought-unity". Grotowski refers to an acting score as a script for designing *point of contact* or connection [23]. In Interaction Design this is the equivalent of interaction schemas, which are navigated in order to construct the instantiation of the interactive experience. Grotowski speaks to the necessity of scripting gestural sequences in order to construct connection schema: "what is an acting score? The acting score is the elements of contact. To take and give the reactions and impulses of contact. If you fix these, then you will have fixed all the context of your associations. Without a fixed score a work of mature art cannot exist" [23].

We suggest using gesture as a "function organ", as a mechanism that can assist in defining properties for a scripted interaction score. These gestural function organs have the goal of paralleling processes to construct Grotowski's concept of mature art: works of "mature interaction".

3. PRIOR WORK IN DESIGNING EXPERIENCE

What do we mean by experience modeling? By bridging domains of performance practice with interaction design and HCI, we are focusing on an area of enacted cognition: the *enactment* of descriptors, or schemas for movement.

3.1 From Experience To Experience modelling

Previous research in the use of exploring experience/ performance methods within the HCI community has occurred in the domain of user-centered and participatory design [10][14]. This has included: *experience prototyping* that fosters an 'empathetic' and 'embodiment' approach to user-centered and scenario-based design [5]; Interval Research's exploration of *informance*: informative performance and *bodystorming*: physically situated brainstorming, *repping*: re-enacting everyday people's performances, and explorations of how Low-tech solutions can create a design environment that focuses on the design question rather than the tools and techniques [6][21]. Salvador and Howells [20] shifted the focus group methods to something they called Focus Troupe: a method of using drama to create common context for new product concept end-user evaluations. Simsarian [26] has explored the use of role-play in extending the richness of the design process. In the *Faraway* project, Andersen, Jacobs, and Polazzi [1] explored story telling and 'suspension of disbelief' within a context of game and play in a design context.

3.2 Building Experience within Performance Practices

In order to provide a context for the techniques we use in our workshops, we introduce an overview of some of the work that has been explored in the performance domain related to constructing models of experience. This discussion is by no means complete, but suggests a range of models that can be borrowed in order to define experience methodologies. For example, Dance Analysis and Somatics specifically construct systematic articulated movement models directly from the *experience* of the moving body. We are interested in applying these models in our work with interactive systems.

Somatics is a term coined by Thomas Hanna in 1976 [12] to label a field that was beginning to develop mind/body integration disciplines using the body as experienced from within. Somatics can be defined as the *experience from within the lived body*, and is an example of first-person methodologies. It includes practices such as Laban Effort-Shape Analysis, Feldenkrais and Alexander technique. From the Somatics perspective, knowledge is constructed *through* the experience of the body [12][13], and requires that experience be directed or focused through *awareness*. Somatics differentiates between conditioning and learning. In these terms, experience alone is not a pre-cursor to knowledge acquisition, since experience alone could result merely in conditioning, or in accessing conditioned responses. In Somatics this would be termed "somatic amnesia". However, when experience is specifically directed through the focus of attention, knowledge acquisition takes place which can be referred to as "somatic learning", an activity expanding the range of what Hanna [12] terms volitional attention. In our workshops, we specifically using methods to direct and access attention, (what we termed earlier as *attention modeling*). Attention modeling enables us to create affordances to access specific body states that increase awareness. In our workshops, we were interested in creating repeatable, enactable, embodied states that could be used in interaction design. While Csikszentmihalyi [7] suggests that human experience operates within a limited field of attention, other movement systems within Somatics consider attention to be a *generative* attribute of awareness that can be augmented, increased through a process of somatic learning [12], or conversely, limited or atrophied through a process of somatic amnesia.

Rudolf Laban's movement analysis systems [15][19], and the work of other researchers such as Bartenieff [2] and Blom and Chaplin [3], are examples of physical methods to create gestural typologies based in experiential practices of dance [24][25]. These systems model a range of qualities and modes of movement. Laban and Bartenieff's work creates a systematic description of qualitative change in movement. Blom and Chaplin create a set of exercises that explore choreographic techniques for movement generation. We use aspects of these typologies for gestural mapping and modeling qualitative movement characteristics such as intentionality, interest, attention and body state. They present experience models for the classification of aspects of movement, and define a means to approach gestural and choreographic protocols.

Participatory design, experience design, performance, theater, dance and somatics share a common focus in modeling or representing human experience. These domains also share the ability to articulate and explore engaging experience through movement, emotional response, sensorial qualities, and temporal/dynamic qualities of experience and of movement.

4. EXPERIENCE WORKSHOP DESIGN

To develop an interaction model for our installation, a series of workshops were designed. The workshops modeled participant experience of non-verbal expressive gesture that shared and communicated physiological data. At the beginning of our workshop process we included four categories of physiological data: breath, heart rate, galvanic skin response (GSR) and brain signals. The workshop exploration utilized choreographic methodologies in order to create gestural movement vocabularies.



Figure 2. Experience Modeling *connection* and *extension*

In the context of this work, workshops are a formal, scripted experience in which a specific physical experiential concept is explored, tested and documented for the purpose of developing an interaction model. The term workshop is borrowed from its performance context, where a script or form is ‘acted out’, ‘acted through’, and explored with the intention of testing, developing and iterating a theatrical model. This theatrical model also becomes the foundation for the interaction | technological model: the model that provides a basis for the development of the interaction through the technology. As with the theatrical model, the interaction | technological model, includes a set of experience concepts such as intention, gesture, direction of focus or attention, relationship, rhythm, body-state, and use of, and attitude to space. This model creates a formal container for experience that includes a physical as well as technological description, and is a process that enables an evaluation, assessment and analysis of the formal relational elements that operate successfully or unsuccessfully in the construction of that experience.

4.1 Workshop Design: First come First Play

We made use of a series of workshops in order to investigate and prototype the representation of experience for the forthcoming installation. The workshops were designed in the following manner: Each workshop had up to 12 participants with a maximum duration of about 45 minutes. Participants were students and employees at Simon Fraser University and participation in the workshops was assigned on a *first come first play* basis. Invitations were e-mailed to the University School community each week, with a simple subject line such as “invitation to listen”, where <listen> is the title of the workshop. Contextual or conceptual information was purposefully left out of the e-mail exchange and workshop formats, creating an affective, metaphoric, yet ambiguous framework [11] for the invitations. The workshops took place once a week over 5 weeks. Each workshop was divided into two components or exercises that encompassed an overall theme represented by the name of the workshop. Each exercise was based on clearly stated tasks represented by the theme. For example, the exercises in the <listen> workshop were *listen inside* and *listen outside*.

The facilitation of the workshop followed a designed script, and attention was paid to using everyday non-specialized language.

The themes/names of the workshops were *listen*, *between*, *mutate*, *extend* and *phase*. After each segment of a workshop the participant was asked to write their experiences on a single card which included two to three simple open ended questions. Participants were given time to write, note or draw their experiences in long-hand written “journaling” form. The workshops were conducted in a ‘blank’ circular space delineated with ‘theater black’ curtains. The workshops were videotaped and photographed throughout.

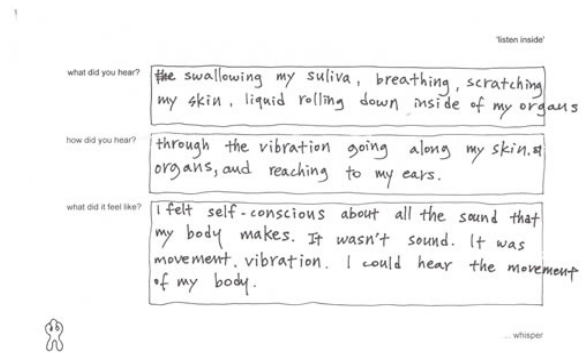


Figure 3. response card example

In the following section we describe a selection of workshop experiences.

4. 1. 1. workshop <listen>

themes: listening/awareness/body-data/self to self

One of the major themes of *whisper* is the notion of ‘paying attention’ to one’s self. As the installation centers on measuring physiological data as a representation of one’s own self, data that we are not normally aware of in our day to day life, the first series of experiences and experience questions relate to how we perceive and deal with shifting attention to our own data, to having access to, and agency over our own heart beat, our own breathing, our own thoughts, our own body.

This experience was initially prototyped in the workshop exercise called <listen>. The participants were asked to walk around until they found a place for themselves in the space. They were asked not to speak. A facilitator then gave each of them a pair of earplugs and they were then left alone with themselves with no further instructions for about 15 minutes. At the end the earplugs were collected and each participant was handed a card (see fig. 3). The card asked the questions: What did you hear? How did you hear? What did it feel like?

In the space of experience, this is the simplest of experiments. By depriving the body of its external hearing we become aware of the internal sound that is otherwise drowned out by the louder external sounds. We are removed from our own ears, but not from our hearing. In performance, artists like Pauline Oliveros and Augusto Boal have created practices such as “deep listening”, and “listening to what we hear”, which probe and access these very same questions of experience. The responses to the question on the cards: What did you hear? focus on this. Responses indicated the participants’ discovery of the internal soundscape.

‘Heartbeat; earplugs as they settle, breath, slapping sounds from others in the room; humming noise; myself; contact with my own body’

This seems to trigger strong emotions ranging from slight unease to feelings of fear or elation in the answers to the question: What did it feel like?

'I felt self-consciousness about all the sound that body makes; it wasn't sound; it was movement, vibration. I could hear the movement of my body'

'Pain, shifting between past and present; fear / calm'

'Normal, I'm alive; Invigorating - breath going in and out with "normal" rhythm, and changing properties'

Some workshop participants were able to shift their internal awareness to recognize that listening occurs not only through the ears, but also through the bones, the resonant cavities of vibration in the body, that the body is a metaphor for listening, and that, what is heard, is not only sound, but movement, vibration, feeling, and sensation.

4.1.2. workshop <between>

themes: awareness/attention/sending/receiving/self to other
The ability to transfer data to another person and the willingness to enter into an exchange of information that is otherwise private and 'unknown' is the other main theme for whisper. In order for such a transfer to work, the participant needs to engage or invite trust not only to the other, but also to the 'listening' self.

In order to investigate the invisible transfer of personal data, and the trust of the self, we created a workshop experience we called <between>.

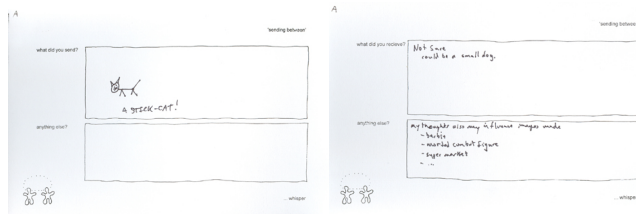


Figure 4. sending and receiving invisible signals

At the beginning of the workshop, the participants were asked to find a space for themselves and begin to move in slow motion, as slowly as possible. They were then left to move very slowly for 10 minutes without speaking.

In Dance practices such as Butoh, this technique is utilized to enable the body to shift its attention to an immersive state in relation to its environment, what Csikszentmihalyi would term 'flow', where attention is intensified, and sensory details are sharpened.

The workshop participants were then asked to pair up, with one person selecting the role of *the sender*, and the other selecting the role of *the receiver*. The sender was asked to silently create an image for two minutes, and then send the image to the receiver, while the receiver was asked to simply pay attention to 'listen' for what image 'came to mind'. At the end each participant was handed a card with the questions: What did you send? What did you receive?

What did you send? *"A stick cat!"*

What did you receive? *"Not sure, could be a small dog"*

4.1.3. workshop <extend>

themes: transfer/sharing/play/self to other

As stated in the previous workshop, transferring private, internal and personal data to another person requires a willingness to enter into a private exchange of information. The participant needs to invite trust with the other, and also engage in a level of agency as to whom, and where, this exchange takes place.

We wanted to continue to investigate these issues of privacy and trust using physical objects that could mediate the interaction through physical gesture. We created a workshop experience we called <extend>, which augmented the invisible data with a non-digital amplification device. The participants were given ordinary medical stethoscopes and a small booklet with ten identical pages. On each page there was space to write or draw and each page had the questions: Where you listening? What did you hear?

'I felt like I was inside myself the pounding amplified my perception of myself, yet my breathing made me feel close'

'My friend stood up and tried to hear my heart, it was hard, I heard my heart, I heard low voice'

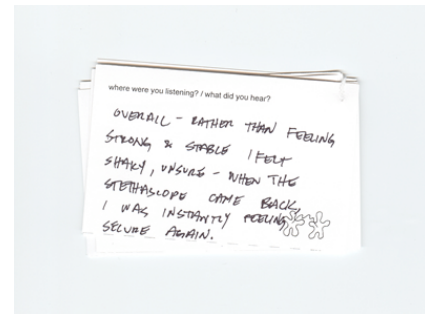


Figure 5. Response Card Sharing Physiological Data

By introducing the stethoscopes we gave access to another type of body data. More importantly, we introduced the possibility of sharing this data with someone else. The design of the stethoscope with a 'listening' end and a 'probing' end allows for the data to be shared by either probing someone in order to investigate their data, or giving someone the earpiece to offer them a particular sound. The latter gesture of offering inverts the interaction model of probing or surveillance, to an interaction which invites and affords intimacy, trust, and peer connection.

4.1.4. workshop <mutate>

themes: permission/control/exchange/touch/islands/snaps

By introducing the possibilities for sharing we immediately encounter notions of permission, surveillance and thresholds of privacy. The following workshop introduced Galvanic Skin Response [GSR] data, and investigated thresholds of boundary, agency, and control.

In the first exercise of the workshop the participants were given white men's shirts that were attached by simple sewing [basting] into pairs at various locations such as the seam of the sleeves, the back shoulder seam, and the seam at the cuffs. Each shirt pair set had a unique contact seam; no two pairs were connected identically.



Figure 6. Exploring Transfer | Play | self to other

The participants were instructed to put on the shirts and button them up. This is a difficult task that requires the pairs to cooperate, both physically and socially, but it also dictates a close proximity between the participants. A series of movement related tasks followed. As in each workshop experience, following the experience, participants were given cards to fill out. An example of the challenges in allowing this proximity is present in an answer to the question: How did you change?

'I wouldn't have gotten that close/intimate under normal circumstances'

In the second half of the workshop the participants were grouped again in pairs and given primitive boards that measure GSR. The boards were constructed in such a way that one of the participants is wearing the sensors [simple metal points of two fingers] and the other has the output [a red LED] pinned on the shirt and connected to the board with a long wire. As the GSR goes up or down the red light brightens or dims. The participants were also given small booklets asking the question: What did you feel?

'As an observer, a recorder, an instigator, responsible'

Here we see an example of one type of response to this particular sharing situation. The first responder classifies him/her self as the passive observer of the other, but since the output of the GSR is closely related to emotional excitement this observer, also feels involved and responsible. By taking responsibility for the output you also take responsibility for the object of your observation.

'I do not know, Dennis is not showing me my output, I will attempt to limit my input to nil, to avoid detection'

This is an example of another group of responses. The observed party feels exposed by the observer not allowing access to the output data and as a consequence the observed participant will deliberately try and influence the result. In this way the observed party changes the rules of engagement and turns what was a probing of emotional personal data into a game.



Figure 7. Extension | Creating One Larger Body

4.1.5. workshop <phase>

themes: extension/body image/creating one larger body

By creating gestural protocols that facilitate sharing and exchange there is a potential blurring of the boundaries between the participants as well as between what is inside and what is outside.

The next exercise is investigating this blur, as we asked participants to put on men's shirts again. This time the shirts were given sticky Velcro patches to apply connection points anywhere they wished. The participants were then encouraged to experiment with moving as each pair of shirts have different possibilities for movement and control. The cards asked the questions: How did you extend yourself? How did you move?

How did you move?: *'Held hands with someone other than my husband; became silly; enjoyed the unusual and unknown; became aware of another's movement'*

How did you move?: *'I found myself thinking of our 'body' as a complete unit - it just had this other piece I wasn't controlling; the attached arm felt very unusual once I got complete control back'*

How did you move?: *'I was no longer just myself, I had to extend myself to become a part of a whole; as a whole we had to work together; when we failed it was almost disappointing because we were apart'*

Here we see several examples of body extension. It is interesting to see the apparent disappointment when the appropriated body gets separated or the combined body fails to complete a movement task.

4.2. Workshop Results: Experience to Gestural Protocol

During our design workshops, gesture was utilized as an expressive indicator of intentionality, body state, extension of body image, permission, control, exchange and play. The workshops were modeled using a broad range of performance techniques. Improvisation was used in all five workshops, improvising both movement and stillness. Stethoscopes, ear-plugs, blindfolds, heart monitors, GSR sensors were used as props. Men's White Shirts became phantom partners, prosthetic devices and placebo objects. The simple 'black box' curtained circle became a ritual space. We modeled the use of physical attention that incorporated listening, 'sending' invisible messages, and touching to connect one's self to another. We used imagining and visualization to explore movement vocabulary. We focused on somatic attributes such as breath, stillness, and slow motion movement. Journaling in both hand-writing and drawing was used as a method of documenting, archiving and expressing. The workshop participants integrated social navigation using gesture to express permission, trust, exchange, and feeling. And the white shirts as costumes along with various props, modeled and expressed physical extension, connection and group identity. The design of the stethoscope with a 'listening' end and a 'probing' end allowed some participants to invert the normalized medical surveillance 'probing' model of listening in favour of giving someone their earpiece to offer them a particular sound.

The workshops contained a broad range of experience results that enabled us to construct gestural protocols within the installation. We continually came back to the main theme found within the workshops, and the artistic aim of the installation: that 'paying attention' to one's self enables a re-direction of attention with a greater access to optimal experience [7]. The workshops responses illustrated that the body can become a metaphor for listening, and that what is heard, is not only sound, but movement, vibration, feeling, sensation, and the self. We discovered that some workshop participants were able to shift their internal awareness to recognize that listening occurs not only through the ears, but also through the bones, the resonant cavities of vibration in the body.



Figure 8. Gestural Interaction in the Installation

In Theatre and Dance practices such as Noh and Butoh, the slow motion technique used in the <between> workshop enables the body to shift its attention to an immersive state in relation to its environment, where attention is intensified, and sensory details are sharpened.

Augusto Boal [4] terms these types of experiential exercise *de-specialization*. He states that in our every day lives “the senses suffer. And we start to feel very little of what we touch, to listen to very little of what we hear, and to see very little of what we look at. We feel, listen and see according to our specialty. The adaptation is [both] atrophy and hypertrophy. In order for the body to be able to send out and receive all possible messages, it has to be re-harmonized [through] exercises and games that focus on *de-specialization*.” Our workshop series are related in form and function to Boal’s *arsenal of theater series of listening to what we hear*, exercises of the 4th series: *rhythm of respiration*, and 5th series: *internal rhythms*.

The workshops met their goal of modeling experience that could be replicated, re-enacted, and re-played in the context of a public art installation using wearable computing technology, where the public art space was simultaneously intimate, playful, and social. As a consequence we selected a subset of successful gestural interactions to be specifically modeled within the installation.

5. DESIGN CONSEQUENCES

The workshops were the basis of the concept design, interaction model, and development of the *whisper* installation. The workshops made it possible to probe and investigate the underlying interaction issues early on in the hardware and software development process. A significant design outcome from this process was the importance for each body to physically control access to their privacy, and allow shared play of their own body data. This was enacted in the installation by the Gestural Protocols discovered during the workshops, where costumes or white shirts expressed physical connection and extension of the body through ‘sticky’ connection points.

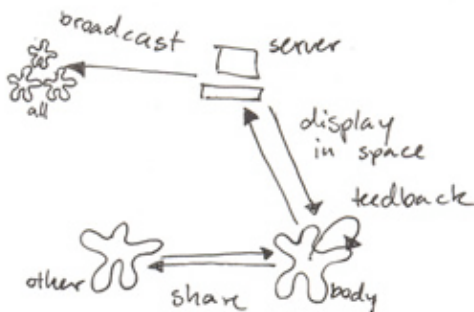


Figure 9. State Spaces: Self to Self | Self to Other

In the workshops these connections were ‘sewn’ together, or explored through Velcro fabric swatches that enables participants to play with connection placement. These connection points were engaged through ‘feel’ or ‘touch’ rather than through a visual symbol or natural language interface.

As a consequence of this workshop exploration we designed a tactile interface to the wearable garment. This consists of a set of wired clothing snaps attached to the right hand fingers of the participant and a series of tactile ‘islands’ placed in various positions on the wearable device. These islands are small id chips wired up to matching sets of snaps. By touching the snaps of an island with the finger-snaps the participant can choose and mix between the different sets of body data coming from his or her own body. In order to access data you have to negotiate physical and social interaction of touching someone.



Figure 10. Garment Design | Snaps | Connection

The islands are made from different textures to allow the participants to navigate the data through touch and feel.

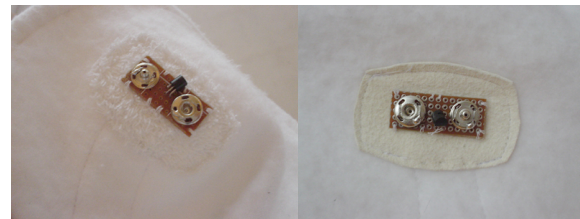


Figure 11. Snap Islands “Textural” Recognition

6. CONCLUSIONS

Our work in designing and testing experience models has illustrated that we can augment experience design with first person performance methodologies found in Theatre, Dance and Somatics. The differing frames of reference between the domains of HCI and performance practice reveal an under-theorized area of practice, which can be explored through experience modeling. We have explored embodied interaction as a reflective process that is simultaneously inter-body and intra-body. In addition, we have provided a case-study for a model of designing embodied interaction. We have applied the use of gesture as a “function organ” [18], as a mechanism that can assist in defining properties for an interaction score that Grotowski [23] describes as scripts, or *points of contact*. The experience with the installation illustrates that participants can learn to shift their own threshold of attention, awareness and body-state through the interaction affordances created within the gestures and embedded within the garment. They participate in “becoming expert” users of their own physiological data, and in playfully engaging with an emerging co-operative and physically and emotionally negotiated body state and collective system state. Social navigation is created through

the participants' perceived internal body data flow [through the fingers, or connection snaps] and represented through the actual data flow [through the server]. As such the installation is also its own experience workshop, and is a starting point to continue to explore methodologies of experience modelling.

7. FUTURE WORK

As an installation, *whisper* was an initial exploration of modeling experience through gestural protocols that led to the design of an interaction language facilitated by wearable garments. The *whisper* hardware remained relatively low level due to bandwidth and memory constraints, physiological data patterns were explored directly through server-side visualization, without the development of context aware intelligent devices. Mapping more complex data relationships to body state and intention were not explored or modeled in this work. *whisper* illustrated that participants could become playfully engaged even in simple feedback loops of "attending to" their heart rate and breath, and sharing that data with other in the space. *whisper* also pointed to next steps in research: exploring mapping and 'meaning' in data patterns across participants body state, extending types of physiological data [brain waves, GSR, temperature], types of output actuators [vibration, local sound, local motor memory], as well as building an intelligent model of interaction which includes memory, resonance and meaning in the devices themselves. Perhaps most importantly, we are interested in continuing explore workshops that model experience by bridging first person methodologies used in performance practice with those of interaction design.

ACKNOWLEDGMENTS

We thank members of the research team: S. Kozel., R. Lovell, N. Jaffe, S. Mah, J. Erkku, Stock, J. Tolmie, A. Kerne, L. Sonami, C. Baker, co-producers: V2-Lab, A. Nigten, Future Physical, G. Boddington, L. Muller, and our funding support: the Canada Council for the Arts, Daniel Langlois Fondation, BC Arts Council, CANARIE, Inc, BC Advanced Systems Institute (ASI), School of Interactive Arts, Interactivity Lab, Simon Fraser University, and T. Calvert.

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