Proceedings of

Reflective HCI:
Towards a Critical Technical Practice

A Workshop at CHI 2004

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Program committee:

Paul Dourish, UC Irvine
Janet Finlay, Leeds Metropolitan University
Phoebe Sengers, Cornell University
Peter Wright, University of York

9:00-9:10 Introductions

9:10-10:30 Session 1: Art Practice as HCI, HCI Practice as Arts
Sha Xin Wei and Satinder Gill: Gesture and Response in Field-Based Performance
Pamela Jennings: Distributed Minds | Negotiated Spaces: Social Interfaces for Public Spaces
Michele Chang and Elizabeth Goodman: Learning from a FIASCO: Design in Conversation with Social Science Research
Jan Rae: Keeping Sight of Your Audience: Theorising Theatrical Rehearsal In Support of Educational Software Development, A New Paradigm of practice

10:30 Coffee

11:00-12:00 Session 3: Experience and Interaction
Salvatore Fiore: Oppressive Interactions: Between Expression and Imagination
Matthew Chalmers: Coupling and Heterogeneity in Ubiquitous Computing
John McCarthy: Putting Felt-Life at the Center of HCI

12:00-1:30 Lunch

1:30-2:30 Session 3: Learning from the Literary
Shaleph O'Neill & David Benyon: Semiotics, HCI, and the Avant-Garde
Carl DiSalvo: The Uncanny and the Everyday in the Design of Robots
Mark Blythe and Ann Light: Usable Reflexivity

2:30 Coffee

3:00-4:00 Session 4: The Politics of HCI Practice
Michael Muller: HCI as Translation Work: How Translation Studies can Inform HCI Research and Practice
Kirsten Boehner, Geri Gay, Phoebe Sengers, Timothy Brooke, and Xiaowen Chen: Technologies for Reflection
Laurel Swan and Alex S. Taylor: A Short Note on Design Troubles & Enlisting Critical Reflection

4:00-4:30 Evaluation
Alan Dix: Validity
William Gaver, Andrew Boucher, Sarah Pennington, and Brendan Walker: Evaluating Technologies for Ludic Engagement

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5:30 End

Abstract for CHI 2004 Workshop on Reflective HCI

Gesture and Response in Field-based Performance
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Overview

Ambience and immersive technological environments allow us to explore some basics of human pragmatics that lie beyond linguistics, intentionality and the subject-agency perspectives of human interaction. We focus on gesture and the body in sense-making and propose a discussion drawing on a non-dualist and agent-free account of embodied, material experience. By agent-free we mean an approach that does not presume the subject. Moreover, we deal with the problem of intersubjectivity by studying the human coordination of activity without appealing to a transmission theory of communication. (Harris, 1997)

We achieve this by considering how gesture spans multiple bodies and how aesthetic design works with this and facilitates it. The paper is in two parts, the first part covers movement studies, focusing on gesture and body movement, drawing on the acting and pragmatics, and the second part develops this with the example of the TGarden, a responsive play space for experimental performance augmented by gesturally nuanced computational media.

We ask the following questions: how do people collectively and individually improvise meaningful gestures in a TGarden environment? How can we build environments in which people can become more virtuosic in their performance with continued play? How can people coordinate powerful experiences without appealing to verbal language or to a linguistic representation? In order to sustain such improvisatory but non-random play, TGarden is built explicitly from metaphorical, dense tangible material substrates and field-based rather than object-based or agent-based responses to gesture and movement. These material substrates include live, gesturally parameterized projection video, gesturally modified sound, and image-bearing or sensate fabrics.

Body Moves deals with the pragmatics of meaning where salient body rhythms span more than one body, and are in relation to each other. In extending this work to the responsive media environment of the TGarden, the relation is not limited to the rhythm of one body with another, but of one body with the salient responsive elements in the environment. Learning to master this responsive space is to be skilled in extending one's own body field.

Body Moves - Gesture (Gill)

Body Moves are a form of what we will term metacommunication, which means they serve 'to instruct about or alter the ongoing communicational process' (Scheflen, 1974). Body Moves are rhythmic configurations between persons; a form of rhythmic synchrony (Birdwhistle, 1979). These rhythmic coordinations shape the engagement space they inhabit, and maintain, form and re-form it. Each Body Move is a composite of rhythm of more than one person.

Two kinds of Body Moves, having sequential and parallel structures, have been identified and analysed within the engagement space: sequential Body Moves have the structure of action-reaction motion, whilst Parallel Coordinated Moves have the structure of parallel motion (Gill, Kawamori, Katagiri, Shimojima, 2000; Gill, 2002; Gill and Borchers, 2003). They have different priorities in their functionality. Sequential moves serve to maintain the communication, whilst parallel moves serve to transform the communication. There is a pulsation in the movement from sequential to parallel action that facilitates the process of the building of a common ground or sense-making in the interaction environment. Each person has a body field of engagement, and together, the aggregate of their fields, forms the engagement space. This space is therefore also called, the Body Field of Engagement. It is a variable field and alters with the degrees of comfort and discomfort, expressed in our work as 'contact'.

Within the engagement space, persons cooperate to sustain the space that enables them to remain committed to be together. It necessitates that the membranes of the person's body fields are in contact, the degree of which alters with levels of commitment and nature of attitude. Overlap or mergence of the fields occurs when bodies move in parallel coordinated action, where the overlap is complete for the period of that action. However, this overlap is only meta-communicatively shared, and does not denote a common focus of attention. In fact, in parallel coordinated action, persons are acting autonomously but simultaneously in rhythmic pulsation on different foci of attention, and in doing so they are aware and attending to each other at the same time (Gill and Borchers, 2003, Gill, 2003a, Gill, 2003b). Space is considered as a resonating space.

TGarden (Sha)

When you walk into a TGarden, you choose from a set of sumptuous garments, each with a different unfamiliarity. Some billow around you in clouds of fabric so that you grow three times larger but no heavier. Some add an odd elasticity to your body so you tend to flop as you walk. Some may rip as you walk, or glue to each other or the walls so you must tear yourself free as you disambiguate your body from ambient matter.

You notice that there are no well-defined objects in the room, but as you play in it over time (minutes or days of repeated visits) you learn certain ways of playing that characteristically elicit more or less well defined entities, whether they are acoustic or visual, or perhaps socio-psychological objects. In time you discover people who have invented virtuosic ways of playing and engaging this responsive space, and without a word you are able to learn from their deft action and inaction. As you walk past another body, you leave behind material traces of yourself: shadow, hair, echoes, and air currents. Even if you do not explicitly and actively acknowledge the passerby, your residues intertwine with the other's and conduct material conversations in your wake.

A particular gesture does not always elicit exactly the same sound; it seems as if you are dragging your fingers and limbs across materials like wool or metal sheet or rubber. As your movements couple to the responsive dynamics of the dragged sounds or visual textures, you learn to intentionally "bow" or brush calligraphically through the medium.

Figure 3. Solo epiphany. Ars Electronica, Linz Austria, 2001. Courtesy Sponge.

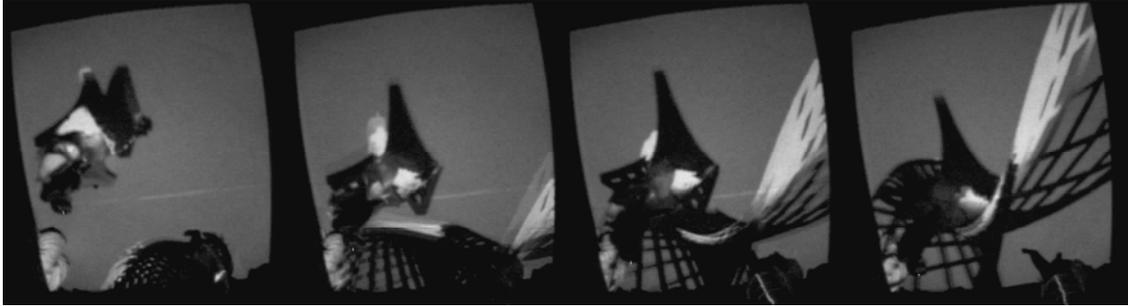Figure 2. Professional dancers in TG2001, V2 Las Palmas, Rotterdam, 2001.

Figure 3. Swapping projected wings upon close encounter

In a TGarden salient rhythms occur within the substrate of the combined activity, indicating particular resonances as body fields move in response to each other.

The TGarden as constructed does not interpret movement presuming intentionality or a model of the ego subject. The salient rhythms are essentially resonances of spontaneous actions and non-symbolic, providing an example of an 'a-linguistic semiology of human performance' (Sha, 2004). We extend the concept of the Body Move based on its essential fields of resonant performance to movement based on fields instead of particular human bodies.   We consider how the players in a TGarden form tacit awareness in overlapping and autonomous space and gauge elements and patterns of connectivity, and through this tacit learning, shape the media space and are concurrently shaped by it.

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Distributed Minds | Negotiated Spaces: social interfaces for public spaces

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ABSTRACT

The *Distributed Minds | Negotiated Spaces: Interactive Tools for Supporting Dialogue in Public Spaces* research project examines 20th century philosophical and pedagogical theories that emphasize the role intersubjectivity plays on supporting discourse between people. The theoretical research will form a foundation of knowledge from which a framework for the design of computer mediated interactive social interfaces will be developed.

Keywords

Social Navigation, Social Interfaces, Social Cartography, Computer Supported Collaborative Play (CSCP), Design Thinking, Meta-Design, convivial tools, symmetry of ignorance, theory of multiliteracies, open work, discourse wranglers.

1. INTRODUCTION

In their paper "An Invitation to Postmodern Social Cartography," Rolland G. Paulson and Martin Liebman introduce the "social cartography" research methodology. This methodology uses "a process composed of a series of transformations by which an individual acquires, codes, stores, recalls, and decodes information about the relative locations and attributes of a set of theoretical phenomena." The results are delivered with the aid of a visual descriptive system, or map, that consists of a collection of knowledge objects that are positioned based on a set of internal rules. This is a tool that enables comparative researchers to enhance the presentation of their findings, particularly when their findings focus on the postmodern diffusion of heterogeneous orientations. The result is a cultural portrait that displays the deep inter-relationships between multi-disciplinary theoretical explanations. [10]

The social cartography for *Distributed Minds | Negotiated Spaces* research project is centered around four social-philosophical concepts; (1) communicative theory of action and the conditions that support intersubjective discourse; (2) social-historicism and its impact on intersubjective experience; (3) pedagogical theories supporting the pursuit of life-long learning; and (4) socially oriented theories for human computer interaction design.

The social interface is a catalyst for the transformation and reinvention of the social and cultural environment. [1] The main goal of the *Distributed Minds | Negotiated Spaces* framework is to develop a method for the design of social interfaces, or "discourse wranglers," whose function is to facilitate discourse, and support the intersubjective contextualization of ideas, assumptions and beliefs among its collaborating users. The "discourse wrangler" is a computer-mediated interface. Its purpose is to provide a catalyst for the transformation of intersubjective experiences and interaction in public spaces.

Intersubjectivity is the dynamic interrelationship of self and other that leads to human consciousness and self-identity. [16] When an individual's *final vocabulary* is challenged, and one's *passing theories*, used to decipher the meaning, implications, intentions and negotiations of each other's words and gestures, are stretched to their limits, one cannot find recourse in extending her beliefs, thoughts, or situated reactions. [14] Habermas defines four claims for the validation of communicative acts that support *passing theories*; intelligibility, truth, sincerity, and normative rightness. To achieve mutual understanding the speaker and the hearer must operate at two levels; that of the intersubjective state in which the speaker and hearer communicate; and the level of a mutually experienced and understood subject of communication. [7]

Vygotsky's constructivist learning theory emphasizes the influential relationship between the inter-psychological social plane and the intra-psychological or inner mental processing plane on all cognitive acts including voluntary attention, logical memory, formation of concepts and the development of volition. [11] Situated cognition and the theory of multiliteracies take on the task of analyzing and creating new methods through which life-long learning in formal and informal educational settings can occur. Situated cognition emphasizes that learning takes place within a socially and culturally informed context that shapes the quality of knowledge and self-efficacy an individual can achieve in her given environment. [11]

The theory of Multiliteracies emphasizes that the process of design thinking is integral to the development of meta-cognitive and meta-linguistic abilities. Available design, design, and re-design are three concepts that describe the incremental level of discourse afforded by tools of design. Available design describes a design process that is mediated by a strict set of rules. An analogy for understanding the limits of available design is the

concept of thinking inside the box, where the designer is not aware of the box structure that restricts his process. Design is the process of using tools for creative expression and representation. The latitude of the design tool defines the depth of creative expression afforded by the tool. Returning to our box metaphor, when engaging in the act of design, one is still working inside the box. However she is now aware of the bounding-box that restricts her design process. Screen-based paint, design layout, and CAD applications fall under the category of design. The concept of re-design involves the transformation of meaning that molds a new meaning from current discourse. Tools developed to support the process of re-design support the concept of the user as constructor. These tools empower the user to transform meaning and effect change in the intersubjective relationships between the self and other through the process of examining, deconstructing and negotiating a new common ground for discourse and learning. To re-design is to think outside of the box. [9]

The theory of Multiliteracies supports the design of convivial tools that enables "users to invest the world with their meaning, to enrich the environment with the fruits of their vision and to use them for the accomplishment of a purpose they have chosen" [8] Convivial systems encourage users to be actively engaged in generating creative extensions to the artifacts used in their practice. The theory of Meta-Design supports the development of new media technologies that are convivial systems. The user interface is no longer driven by a predefined database of information and possible interactions. Rather the Meta-Design system is an open system providing opportunities and affordances that encourage and support debate, discussion and collaborative knowledge construction. [6]

Social navigation is based on the fact that information about others and about other's activities can be beneficial to an individual and her individual activities. Social navigation is not a specific technology, rather it is a series of methods to enhance shared awareness and distributed intelligence in physical or virtual space by supporting transformation and emergence of interactive dynamics between people. Social navigation can be used as a technique to dissect a rhizomic environment -- to map the ephemeral lines of flight that connect its inhabitants. [3] Dourish points out that there are two distinct, yet complementary, definitions of social navigation. It can be considered as an aspect of collaborative work, in which information is shared within a group. Social navigation can also be presented as a way of moving through an information space to exploit the activities and orientations of others in that space as a method of managing one's own spatial activity. [4]

2. THEORY INTO PRACTICE

In the mid-80's and early 90's Computer Supported Co-operative Work (CSCW), investigations on how technology can be optimized to enhance the collaborative work process, emerged as a line of research in the study of human computer interaction. Early experiments in social navigation took the form of recommender systems. During this time social navigation either referred to navigating toward a cluster of people, or navigation based on another person's interaction with an object. From
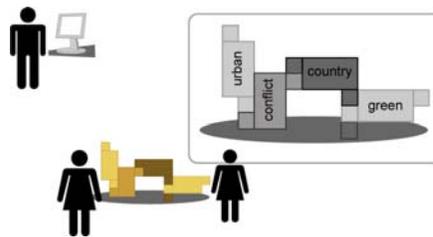
recommender based social navigation systems emerged network-based environments designed to enhance the individuals' discourse-based interactions in a shared virtual space. Examples include collaborative virtual environments (CVE), multi-user dimension environments (MUDs), and newsgroups. These environments inhabit the virtual domain and often work through the same network infrastructure that supports the Internet. The latest generation, of social navigation technologies, integrates both the physical and virtual worlds falling under the broad umbrella of augmented reality. The progress in this field corresponds with the progression and diversification in technological tools used by human computer interaction researchers, designers and artists as they began to incorporate multimedia and multi-modal interaction techniques, such as images, video, animation, machine vision, speech and gesture recognition into their work.

Constructed Narratives is a research project designed to explore methods of practice that is based on the theories articulated earlier in this paper. It will be a block-based construction game similar to the form and function of children's construction toys, but designed for adults. It is being designed for use in public spaces where people have the opportunity to encounter the game and subsequently learn about each other.

The goal of this research project is to develop a framework for the

design of context aware tangible social interfaces that act as "discourse wranglers." A "discourse wrangler" is a computer-mediated interface that serves as a communication bridge between individuals in public spaces. The aim of the "discourse wrangler" is to provide a catalyst by which individuals can come to understand cultural commonalities and differences by providing a means for enriched interactive experiences in public spaces. The system architecture will support context aware tangible user interfaces that adapt their data output based on the context of each unique participant, interaction patterns between participants, and patterns in the emerging block construction.

To construct is to creatively invent one's world by engaging in collaborative decision-making and problem solving. *Constructed Narratives* is an activity where the builders will co-inhabit a constructed world in which they are both the builders and the resource material by which the design manifests itself.

The software architecture and interface, for this project, are being designed to enable future use in applications for human computer interaction domains including; computer supported collaborative learning (CSCL); and design collaboration using techniques for computer supported collaborative work (CSCW). *Constructed Narratives* is an exploration of a new design domain that supports learning and intersubjective experiences through collaborative play – computer supported collaborative play (CSCP.)

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Learning from a FIASCO:
Design in Conversation with Social Science Research

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ABSTRACT
FIASCO is a location-based game that takes place on a website and on street corners. Designed to promote exploration and player reflection on the use of public space, FIASCO extends methods inspired by Situationist urban theory. Tensions between FIASCO as a game in its own right and as a research probe have spurred reflection on game design as a research method.

Author Keywords
Design research, Game design, Iterative design, Reflective design, Situationist theory, User interface design,

ACM Classification Keywords
H.5.2 [Information Interfaces and Presentation]: User Interfaces — evaluation/methodology, prototyping, user-centered design; H.5.1 [Information Interfaces and Presentation]: Multimedia Information Systems — evaluation/methodology; General Terms: Design, Experimentation

INTRODUCTION
Now the city would move like a map you were drawing; now you would begin to live your life like a book you were writing. Called forth by a street or a building, an ensemble of gestures might imply that a different city had to be built or an old one overthrown. [16]

Until the 1980s, New York streets — dangerous, dirty, and derelict as they appeared — were also playgrounds. [15] Street games such as stickball, marbles, hopscotch and jump rope are no longer as acceptable, especially in downtown Manhattan. Instead, private entities have co-opted the public space of the street as a commercial zone. [9] The current boredom of cities is the erasure of neighborhood identity through the pervasive sameness of chain stores. New York children still play in the streets, but the recreational activity of choice is likely to be shopping.

In contemporary America, the park system is the main sponsor of public, physical play. Parks provide necessary green space in cramped cities, but they also regulate and systematize recreation. We play sports on the field; sun ourselves on lawns; run on the official jog path around the reservoir. Just as it allocates zones for work, sleep, and transportation, the city also designates a place for play.

As a response we designed FIASCO, an Internet enabled street game, to encourage "ordinary" New Yorkers to imagine and perform physical responses to an increasingly regulated public sphere. Players stage and document small interventions or 'stunts' on the streets of New York in order to claim turf on a virtual map of the city. By linking game success to the exploration of territory we hope to encourage players to reflect on their relationship with their "turf," and to move beyond habitual haunts into new territories.

FIASCO's response to the cultural implications of city planning and modernization is the product of Situationist and other social critiques of city experience. But the critiques of homogeneity and control can be extended beyond the context of urban planning. Situating a Situationist-inspired game as a research tool blurs the boundaries between the zones of research and design, workplace and playground.

PLAYING GAMES WITH HCI
Design and human-computer interaction research are the inheritors of very different traditions of pedagogy – the studio versus the lab. At times, the gulf between the priorities of the two disciplines has been reduced to one pithy dichotomy: "ease of use" versus "fun of use." Certainly, there has been in HCI a preoccupation with "the values of the workplace: concerns for clarity, efficiency and productivity." [6] But researchers are increasingly moving to more playful explorations with props and theatrical games, as with Iacucci, Kuutti, and Ranta's "magic things" used to support development of mobile devices. [12]

Related work
The graffiti-inspired audio boxes of *Tejp* [13] and the psychologically fraught domestic appliances of the *Placebo Project* [4] deliberately create playful or ambiguous experiences as a means, not only as an end, of research. Because their proper use is left as a question for users, such objects encourage active participation in the construction of meaning through experimentation and play.

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Similarly, open-ended "domestic probes" have been used to "subvert expectations about research" [6]. The designed objects inspired by those probes were then distributed to volunteers to "live with them, make sense of them" to further the research process [7].

More structured play has also been used to fuel design. Jacobs, Polizzi and Andersen use playful, rule-based activities to create artifacts and generate insights that then inform the design of interactive systems [14]. We would argue, however, that their "games" lack one crucial component: a clear winner.

Games and play are related, but not identical, human activities. They can be seen as subsets of each other in different contexts. Games are playful activities, but "play" is one component of games. Zimmerman's definition of games helps us differentiate FIASCO from other projects that use formal or informal play: "A *game* is a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome." [18]. Game design is a reflective practice; designers evaluate games by playing them, make improvements, then play again. Play is a means of iterative game design, not just an end [18].

By using a game, we offer a methodological experiment into how games can motivate inquiry. Like certain traditional research activities, games produce quantifiable results. Yet players control their direction. As with Gaver's work, we propose to let our players decide the game's "proper" methods and use for themselves. Because game motivations, such as competition and fun, drive the inquiry, we hope that it will arrive at unexpected destinations.

Even seemingly arbitrary game rules serve the implicit understanding that the purpose of games is "fun." The word fun encompasses a complicated set of temporally and geographically specific behaviors and assumptions. We were less concerned with "dissecting fun" [1] than we were with employing fun to propel play. Fun is not a problem to be solved; it is not a "quantifiable outcome."

One of our players, a 30-year-old New Yorker, defined fun in the context of city life as "faster, stupider, and more retarded." Not so much anti-intellectual as *a-rational*, this vision of fun rejects the adult norms of patience, politeness, and thoughtfulness. In a world of industry and intellect, it is a *waste of time*. And from that comes its power.

THE SITUATIONIST CRITIQUE

Beginning in the 1950s, a group of artists and intellectuals in France decided that utopian ideologies of urban planning concealed a metropolis of regimentation, empty consumption, and boredom. They called themselves the Situationists. As one 1967 slogan put it, "The guarantee that we will not die of starvation has been purchased with the guarantee that we will die of boredom." [16] They saw the city as a living organism held hostage by capitalism's demands. In wandering the streets according to game-like rules or momentary whims, they sought to revitalize urban experience by constructing new "situations." Situationist artistic interventions employed randomness, absurdity, and satire. Their collaged papers, writings, and dramas were an analogue of their desire to tear the city grid apart to build a better one. The most prominent of these experiments was the *dérive*, or "drift," where individuals abandoned everyday practices in favor of alternate acts dictated by the urban terrain and encounters found therein. [2]

A child of Situationism, psychogeography maps emotional and psychological affect to geographic location [3]. Psychogeographers use chance to interpret places through personal memories, aesthetic affect, and random social encounters. To avoid familiar routes and force exploration, some psychogeographers follow walking algorithms" [20] (ie, "Take the first left. Walk three paces. What color do you see?"). Psychogeography replaces the goal-directed travel of the commute and the aimless wandering of flâneurie with algorithmic tourism. That is, it uses the logic of games to rethink urban mobility and construct new maps.

Recent responses

Attempts to "reclaim the streets" as sites for play have flourished recently, as evidenced by the international Reclaim the Streets movement's slogan of "celebration as direct action; dance as resistance." [9] In America, the Cacophony Society, self-proclaimed "dada clowns rewiring the neural circuits of the community" through "meaningless madness," have branches in several cities [8]. Following McKenzie's theory of performance as at once artistic practice and technological imperative [17], public play can be a source of creative *malfunction*, making alternatives to the norm of efficiency visible.

CREATING A FIASCO

Design Process

Inspired by Situationist methods, our design process for FIASCO traced a virtual dérive through the Internet, art practice, and gaming communities. Using the Google search engine, we assembled large collections of images and phrases associated with urban games and the built environment.

To juxtapose unexpected concepts, we borrowed a creative strategy from the painter Mark Tansey, who finds inspiration for his fictional "history" paintings by spinning a set of interlocking wooden wheels engraved with lists of elements, then responding to the combinations that result [19] We also adopted the approach of Vito Acconci, whose "Following Project" documents a series of games he played with strangers [11]. After picking a stranger at random from crowds in New York, Acconci trailed and photographed the chosen target until the person entered a privately owned space. He then displayed selected photographs. Both Acconci and Tansey use game logic ("spin the wheel three times" or "follow the first stranger you see") to generate unexpected and creatively energizing outcomes.

We also looked at Geocaching, a successful Internet-enabled urban game. The goal of Geocaching is to find and open small boxes ('caches') hidden in public places with the help of Global Positioning Systems (GPS) and a few written clues. The game is not centrally managed; players decide when and where to hide and seek the "caches." Yet a website is a key intermediary, storing the necessary lists of GPS coordinates and providing a space for players to celebrate their adventures in the physical world [10], commiserate with others, and find less experienced players to mentor.

Game Structure

The goal of FIASCO is to dominate a map of New York City. Street corners comprise the gameboard and a web interface serves as the dice. As with Geocaching, players generate stunts on the website whenever they choose. They organize teams and stage actions on the street, then return to the website to claim territory by uploading photographic documentation.

Like Tansey's paintings, game moves in FIASCO ("stunts") are based on combinations of different components – in this case, an object, an action, and a theme. An object can be any item often found in a city, such as coffee cups, newspapers, fire hydrants, street signs, bricks, and asphalt. An action can be any outdoor game such as hopscotch, hide-and-go-seek and tag. A theme is an metropolitan event or situation, such as "happy hour," "vice," "border crossing." It is a wildcard that affects the representation of the other two components. Players incorporate these components as they like, but all must be present in the documentation.

Location is an implicit fourth element. Each stunt is associated with a node, which is the street corner in New York where the stunt took place. Nodes are marked on the virtual map with their owners' tags. Because stunts are always situated within a specific locale, they must be judged *in context*. Behavior that is amusing in a children's park might be less so on a deserted residential street.

Uploading photographs completes the stunt. The entire online community then rates the amusement value of the stunt concept and accompanying photographs. These ratings affect the visibility of the stunt on the site – and the status of the creator. When players battle for control over a node, the stunt with the highest rating takes possession of it – until another challenger comes along.

Implications of trial play

Physical gaming, unlike its virtual counterpart, faces unexpected complications created by specific conditions of time and place. In trials, getting to the site, gathering props, and managing the inevitable audience (ranging from impatient students and rowdy passersby to the police) became hurdles to both our creation of rules and our players' ability to initiate game moves.

Photographs from trial play.
The player on the left won the round.

The unexpected juxtapositions created by dense urban populations create game play that would be impossible in virtual worlds, where the programmers of the game mandate what is possible within its structure. Yet the self-enclosed, artificial world of the game can become a powerful motivation for action. Competition and the structured activity mandated by rules empowers players to perform actions they wouldn't consider otherwise, almost as if the suspended reality of screen gaming extends to the streets. Nevertheless, the consequences of clicking on a virtual map are rooted to specific street corners. Through embodied action, public gestures can promote personal transformation.

By publicly enacting new urban situations, players affect not only themselves, but also bystanders. Even if they leave no mark on the built environment, memorable public performances affect how we understand specific locations; they rezone our mental maps of the city. Even fleeting spectacles help us imagine the public sphere as playground *as well as* workplace, transforming our expectations of both.

GAME AS RESEARCH LENS

Games cannot be simply slotted into the barrage of traditional research methods without altering the power relationships that have underwritten the authority of HCI's representatives as a discipline. FIASCO has become an opportunity for us as researchers and design practitioners to critically approach a condition that researchers have tried to minimize: loss of control.

We will not regulate who plays the game, nor how they play, nor what kind of documentation they provide. Certainly, we can shadow players or perform participant observations. But given the spread of information on the Internet, we will never be sure of the number of players (since not every person who takes part must visit the site) nor the extent of their involvement.

Much of the "system" will necessarily remain opaque revealed only through photographs and brief descriptions contributed to the website. Similar to the Situationists' dérives, these mere traces of player activity create an alternate system for producing insights into the culture they

move within and their role as actors within it. Incomplete perhaps as a data set, yet potentially worthwhile as a research lens.

The workplace and the playground

"Clarity, efficiency, and productivity": like the urban core, HCI too has been seen as a workplace with neatly bounded zones. Traditional HCI practice separates "knowledge-generating" research and "artifact-generating" design [5]. It calls for the evaluation of artifacts and the contexts of their use through carefully regulated methods of inquiry. Ideally, the result is verifiable, transferable data.

FIASCO does not attempt to solve the problems of social coordination and public performance that it presents to players. Instead, we have deliberately built an open-ended system that, like the dérive itself, provides alternate paths for players — and encourages them to create traces of their routes. Aspects of the game such as debating the rules, navigating the map, and creating alliances can shed light on technology use and construction of self in social interactions that increasingly mesh virtual and physical realms.

While we have recruited players for previous trials, there is no guarantee that a full beta test of FIASCO will ever find an audience. We accept that FIASCO may fail *as a game* because of our design choices, which will then fundamentally affect what we observe and how we observe it. If FIASCO succeeds as a game, it will bring forth cheaters, spoilers, and super-players. All are more interested in winning than in being helpful. Games are "for" winning; as far as players are concerned, the production of knowledge is merely a byproduct.

FIASCO exists within a feedback loop in which the game exists not just as a product of research or as finite step in the research process [14], but in dialogue with traditional forms of social inquiry.

CONCLUSION

Games, as Zimmerman points out, catalyze participation in part because they are self-rationalizing. Yet putting control in the hands of disembodied "rules" eventually destabilizes the rule-makers' authority given enough motivation to ignore them. Turning *users* into *players* devolves control of the research process from researcher onto the subject.

The urge to win very predictably stimulates antisocial behavior, over-intensive use of resources, and deliberate dishonesty [18]. When games are well-designed, they are disruptive *because* they are so effective. In a sense, a really good game turns maps for behavior into gameboards. Following the Situationists, we can use FIASCO to reimagine a tradition it moves within – and reflect on a research strategy that is less an *object* of inquiry than an *actor*. Putting failure within the context of game design research allows us to reflect on the control we give up to users: our inability and disinterest in creating a system players cannot game.

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Keeping sight of your audience: theorising theatrical rehearsal in support of educational software development, a new paradigm of practice.

Mainstream educational software development in UK Higher Education (HE) institutions has moved on from the 'blue skies' arena of the early 1990's. Then, pilot projects, research projects, mock-ups and software demonstration models paraded the potential for innovation in education through learning technologies. These partially functioning prototypes, shells, schema, Quick-time explorations, resource libraries and the like, were created by 'early adopters'[1] to advertise the potential implicit within the technology. Towards the mid 90's, when educational software development became a mainstream activity, the significant step change that accompanied the move was the need to fully appreciate the student users' needs. These users were not necessarily impressed with or, more importantly, able to learn from award winning software that had passed the scrutiny of judges based on the metrics of design and innovation. Pedagogic evaluations began to expose student user expectations and frustrations with learning by means of what were then called 'new media'.

The initial aim of those who took part in the early mainstream software development activities in the HE sector was to be in the vanguard of innovative teaching. They had no particular model of development to follow, just a conviction that nascent approaches to teaching with new technology would advance practice. They had recognised and willingly applied themselves to realising the recommendations, benchmarks and technological expectations of Government Committees[2] and the funding bodies for the benefit of future generations of students. During this next phase much was achieved; access to computing in the home, the school and HE increased exponentially and educational software advanced. At the same time however, many mistakes were made and much educational software floundered because it was not 'fit for purpose'[3]. Preece et al. (2002: 203) report that 'unclear objectives and requirements' was the most often cited reason for IT project failure, and we might presume this to be equally true of educational software development projects. Academics, software developers, designers and so forth have to communicate with each other through their discourse-specific knowledge, experience and language, leaving plenty of room for misapprehensions in discussions relating to software requirements and specifications. 'The terminology of software development' in the mid 90's was, according to Jackson, 'mostly in a chaos that correctly reflects the chaotic state of the field' (Jackson, 1995: 194), undoubtedly a contributory factor to these many failures.

At the same time that HE was making mistakes in educational software development (and not necessarily learning from them), students' expectations about the quality of software per se were also being amplified. Special effects in the cinema, games consoles, the web and the easy availability of digital information were among the sources of these raised expectations. Student users of educational software naturally began to expect similar "production values" to those that were available in the main stream of digital media.   The "wow" factor that could be produced by commercial companies anticipating huge returns on their investment was now unwittingly pitted against University software development teams supporting academics on tight budgets.   And educational software emanating from the non-commercial sector was not seen as, or critiqued as, a separate genre but, instead, as the poor relation of commercial software.

Major software production processes for the delivery of robust commercial software were being increasingly articulated into models of working such as the Capability Maturity Model, the Waterfall Model, RAD (Rapid Applications Developments) and so on. However, educational software development in HE was mostly 'shoehorned' into existing working practices and relied on creative conversations between academic subject specialist, designers, software developers and other ICT

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[1] e.g. J.L.Rae, 'Opening Night' and ' Production Snakes and Ladders', Hypercard teaching stacks developed for use on the Nottingham Trent University BA Creative Arts course, presented at Thriving Arts conference, Nottingham, July 1990
[2] e.g. UK National Committee of Inquiry into HE (the Dearing Committee), 1997, at: http://www.leeds.ac.uk/educol/ncihe/docsinde.htm
[3] TLTP (Teaching and Learning Technology Programme) Newsletter No. 1 July 1994 McKendree, J. University of York writes: "As all the TLTP projects are undoubtedly well aware (since this is one reason why TLTP was funded) much of the available computer-based teaching material is just not very good."

support staff to translate the teaching materials into software using processes better suited to print or audio-visual productions. While a few were in a position to work in closely knit teams in 'set aside' accommodation that potentially afforded closer working relationships, others had to conform to the rigors of cross-faculty working practices and the limited, 'costed', availability of key team players. Very few were in a position or had the resource to create new, sustainable and documented working practices that could inform and support other such educational software collaborators even within their own institutions, and even fewer produced conceptual frameworks for developing educational software that encompassed the pre-production phases of development. By and large the joint endeavours of those developing educational software were unified by a sense of unique achievement from largely unrepeatable and undocumented processes.

I suggest that innovation in educational software development cannot continue to support this parochial approach as regards 'processes of development'. It was all very well for pilot projects not to be over concerned with process but scalability and shorter production schedules are real issues now that need to be addressed and cannot neglect the role of process. The pitfalls in the development lifecycle of numerous educational software development projects could have been addressed more easily, or avoided entirely, had sufficient attention been paid to constructing a paradigm of development that was itself fit for purpose. This paper therefore sets out to address this issue and provide an HCI audience with an in-depth appreciation of the theatrical rehearsal process that may inform their involvement with both the theory and practice of educational software development.

This approach has little or nothing in common with the pervasive use of theatre as a simple metaphor in which the stage, actors and spotlights prevail. Instead, it is an exploration of the generic features of 'rehearsal' that places value on them as supporting effective development processes of many kinds, especially where coherence is recognised as crucial to the final outcome. This requires illumination of the people, places, practices and processes of theatrical rehearsal, those features that combine into a systemically user-centred developmental framework which could alternatively be described as a distributed cognitive process (Preece et al., 2002: 133). This process is the means by which the potential for transfer of meaning to the learner is represented throughout the development lifecycle. Applying such a user-centred framework, I suggest that it is possible to recognise the strengths and weaknesses of our current software practices and work towards optimising those practices for the benefit of the user audience.

I begin by suggesting that, often, educational software has been presented to its audience in an under-rehearsed form. That the smoothness and attention to detail that a fully rehearsed product should possess (Tognazzini, 1993) has often been sacrificed to immutable production deadlines. If the creation process has not been completed before the production process begins it follows that this will impact on the finished product and its apparent coherence for an audience. I suggest that users will reap the benefits, in 'fit for purpose' usability terms, of educational software products that have been refined through a systematic and effective pre-production development process.

Theatre and software share the ambition of providing audiences with opportunities to create a range of meanings dependent on the context of reception of the finished product. They may also share, in a generic sense, the opportunities and problems that present themselves as the people, places, practices and processes combine to form a comprehensible gestalt. But first it is necessary to consider conceptually what the core conditions of an effective rehearsal process might be. In order to further this exploration I have posited the generic features of the theatrical rehearsal process, for a more in-depth discussion see (Rae, 2004). These codified examples, which include the people, places, practices and processes involved in developing a theatrical production, are designed to illuminate and characterise the creative development process generally. They are the result of a personal ethnographic interpretation and ongoing research into the relationship between creative development processes in the theatre and educational software development in HE.

Theatre People: Creative Teamwork
The theatre, a long established 'Community of Practice' (Wenger, 1998), works with a commitment to creating community coherence, namely: mutual engagement, joint enterprise, and a shared repertoire as a 'resource for negotiating meaning' (Wenger, 1998: 73-82). Theatre people's working environment is defined by characteristics that sustain the roles, relationships and responsibilities associated with theatrical rehearsal that leads towards coherent amalgamation, in 'performance', of texts, design, sound, staging, lighting, special effects, and so forth. These characteristics include:

(i) Appreciation of the role of a principal exponent, usually the 'director', who is empowered to create, stimulate, share possibilities and make decisions on behalf of the production.
(ii) Intrinsic belief in and encouragement of company values and the sharing of information.
(iii) Promotion and application of a shared language that supports two-way and whole group communications.
(iv) Clear delineation of role boundaries, relationships and responsibilities of *all* contributors.
(v) Appreciation of the complexities of the working environment and the associated needs to recognise problem situations and to take full advantage of new opportunities, through appropriate reflective practice (Schon, 1983).
(vi) Integral feedback mechanisms between individuals and the wider 'company' that promote shared dialogues related to task (Marsick, Bitterman, & van der Veen, 2000).

Theatre Places: Audience Considerations
An interrogation of theatre places reveals an appreciation of the intersection between the 'space' that the performer inhabits and the 'space' that the audience inhabits, including both physical and cognitive considerations of the juncture. These spaces are explored in the theatrical rehearsal process, with full attention being paid to the 'audience's/users' needs'. Matters such as physical usability of the performance (e.g. whether the audience can see and hear the action) are worked out concurrently with the development of the 'message' of the performance. These combined physical and cognitive processes do not necessarily correspond to usability engineering and the broader cognitive HCI considerations explored by, for example, Neilson (1993), Preece (2002), Mamykina et al. (2002) and Shneiderman (2003). It is precisely because of the symbiotic relationship between the practical and the cognitive that the theatrical rehearsal affords user satisfaction. Other audience considerations include:
(i) Awareness of the context for the reception of the production, the venue, because it informs the scale required of the performances (e.g. open air, intimate, local authority, regional, touring, West End, and so on).
(ii) Considerations about who, according to the precise marketing strategy, is likely to inhabit the audience space, and what style of performance will help bridge the gap between performer and audience.

Theatre Practices: Design Considerations
Design in the theatre is systemically linked into every aspect of a developing production. The design underpins the message of the production; if alterations to it are needed to affect this outcome then the rehearsal process provides that opportunity and it is through the participation of theatre company members that the final form of the design takes shape; in production, the design is a reification of the rehearsal process. Further design considerations include:
(i) The need for contrivance, so that your audience sees only what you want it to see (Spool, Scanlon, & Snyder, 1997; Tognazzini, 1993).
(ii) Working with tangible substitute design features (e.g. props, costumes, staging) so that they can be comprehensively incorporated into the finished production or amended effectively.
(iii) Iterative technical integration of the design components.   Where design elements interact with performers they will be rehearsed in the context of the action of the performance and assessed for suitability.
(iv) Theatrical rehearsal is a collaborative design exercise, as explored by Mamykina et al. (2002) a creative process in which all stakeholders, notwithstanding their individual interests, work together for the good of their shared goals.

Theatre Processes: Records, Rationales and Time Scales
Documentation is an essential feature of the creative process; it saves time and lets the collaborators know in detail what decisions were made when an aspect of the production was last worked through. Documented theatre processes include:
(i) The 'book' – sometimes called the 'prompt copy', written up concurrently in the rehearsal room to record decisions progressively and developed eventually into the running order document which guides the performances.
(ii) Schedule of events – a plan which details in overview the schedule for the entire rehearsal period up to and including the technical, dress rehearsals and opening night performance.
(iii) A theatrical production is a project, and as with any efficient process it benefits from being managed. Group decision-making processes particularly benefit from the kind of control, planning and co-ordination that effective project management can afford (Bennatan, 1992).

In Conclusion

As we have seen, the evidence suggests dissatisfaction with the processes that have supported the development of educational software. Interrogation of the strengths and shortcomings of any new paradigm, such as the one I have begun the process of uncovering, can lead to the emergence of important 'new questions' that other paradigms have not prompted us to ask. Current debates in literary theory and learning technologies[4] are bringing to the surface just how issues, elements and processes in, for example, design and performance, design and art, and design and literature can contribute to our understanding of effective educational software design. Through my professional involvement in both theatre and educational software development practices, I would like to think that I am also contributing to that debate.

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OPPRESSIVE INTERACTIONS: BETWEEN EXPRESSION AND IMAGINATION

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INTERACTIONS ARE FIRST OF ALL CONNECTIONS

Language connects people. It helps communicate felt meaning and turns otherwise nondescript occurrences into meaningful experiences. Transformation into meaningfulness is the result of language operating through the actions of a community (Dewey, 1958). In this sense, language helps distinguish humans from other animals. For example, humans can not only feel the heat from a radiator and want to be near it out of pure instinct, as an animal might. Language helps us learn the significance of staying warm from our community, give a name to the source of heat and teach to others what we know. In this sense, a language acts as an instrument to communicate and interact with other people who know how to use it and who share our understanding of the surrounding world.

By creating things like language to connect to other people, we provide a situation for their use and so the imagining, making, using and passing on of shared mechanisms like language, signs and gestures, provide people with a way of connecting with the world around them, communicating values and making or finding meaning. Such connections are extended through the invention, manipulation and use of objects in the world. People first imagine a way of freeing themselves and others from a situation or condition of subjugation, oppression or lack of meaningfulness. New artefacts are created out of this imagination, then used or perceived by others. As, by nature, people are part of and contribute to a social world, these artefacts become shared in use. In this sense, the creator of the artefact aims beyond a selfish existence of building objects for self preservation: as a means to their own ends.

People contribute and use artefacts in a shared world. In this sense, the acts of creating and using an artefact are joined through the possibility to imagine and the interaction which takes place through the artefact. We can see this interaction as being a connection between two sides: on one side the desire to free oneself from the idea that its impossible to avoid certain conditions and at the same time achieve an higher level of richness in life; on the other side, the act of being freed from that condition. The artefact is between, merely the thread which connects creator and subject in shared meaning supported by the existence of the artefact in their lives. When the artefact is a meaningful addition to the lives of the users of it, it frees them from a given condition, just as when fire was discovered many millennia ago. In doing so, early people freed themselves and all the generations of humans to follow, from cold and darkness. Continuing to use fire for heat, cooking and light, later people used their own imagination to adapt it to suit them better, creating heaters and stoves and harnessing the energy of fire for previously unimagined applications. The users of the artefact use their imagination to adapt it and channel it and in doing so, make it more meaningful for their own lives.

Fire has not finished as merely a tool to achieve a prescribed outcome. Instead, it has been developed, changed and understood in new ways. The human who first made sparks to create a fire provided the artefact, but it required other people to use it in a way that freed them from an oppressive situation of cold for the connection to be made to the original creator's vision.

To explain further, one might say that an artwork becomes meaningful at the moment when it is perceived as such by someone other than the artist: a painting that never finds objectified expression on canvas cannot become art. A person may appreciate Van Gough's technical application of paint or feel excited by Bolero, or perhaps be perplexed or angered by the latest art installation of a dissected cow. But these responses alone do not constitute an aesthetic experience. People are unified in the aesthetic experience when it comes to the point of perceiving the artefact in a way that connects them with the act and experience of creation. Art produced only for selfish admiration by the painter or perceived only as a beautiful composition on the wall is arguably not art, not without the two-way interaction of creator and subject through the artefact.

BROKEN CONNECTIONS

When the artefact is technological, an added complexity is introduced to the interaction. Interactions through computers are changing the way we live and connect with life and each other, for good or ill, in part because computers have the appearance of being the real point of interaction. We do not perceive the designer behind the system or interface, to the point that the computer artefacts

actually appear to take on a persona and behaviour of their own, giving the illusion that we are interacting directly with them. Here, the connection with the real is lost.

When a computer crashes or fails in its function, we always blame it as though it were a living entity, too stupid to understand our language of buttons and icons. We direct our attention to the artefact and shun it for its lack of understanding, knowing that another person would have no trouble comprehending. How many times can be heard the chastising voices of "It's temperamental today" or "he's not intelligent enough…he should have understood". The once object has gone from being an inanimate piece of plastic, to an intelligent machine to an apparently living thing, nowadays. As a result, we cannot perceive of or connect to any notion of a designer who created this technological being and we blame it for its poor understanding of our world of inconvenient actions and transactions. Despite this, we are ready to take it with us and adapt ourselves to its quirks and goal directed way of being.

While interactions with technologies are supposed to provide a window onto the potential richness of life, technology can also create new oppressive interactions, forcing humans to adapt to new roles with technological artefacts in their life. To take a case for example, we might question if a computer in a bank, which doesn't understand that a customer simply forgot to pay money into a loan account one month, is a meaningful part of their life if it is unable to function in a way that is helpful and understanding towards them. As a result of the missed payment, the customer takes on a character in the eyes of the system of an irresponsible person. For the customer, this character is far from their true self. In their eyes a payment has simply been missed; an easily rectifiable mistake. But this representation of the customer within the system - a representation believed by the bank's employees - is dehumanising and false. The customer is unable to relate to this distorted digital shadow of him/herself and feels betrayed by a false reality existing only as a strings of bits. Surely the designer did not want to see the customer in this light, as an individual who does not care about paying back money owed or their reputation in the bank. Nonetheless, the customer is depicted as though a character in a fictional story, bearing no semblance to real life. Here again, connections are broken between designer and user and between user and their own life. Further, the connection with the real is broken; the system no longer playing a role, the employee user forced to play a role unconnected to their life and the customer necessarily playing an unexpected role that does not belong to their life.

Scenes of ordinary subjugations become acceptable at the risk of suffocating appreciation of the beauty of interactions among humans. The designer too becomes victim of technological limitations, distanced from the expression of their understanding of life and the human condition. Expression is reduced by loss of contact with the real, with no space for communicative imagination, whilst the imagination of the user is subjugated to impossible interactions. When computers mediate such connections, feelings of oppression and the impossibility of imagining further interactions are a result of designer limitations, where they become a victim of their own oppressed expression. To make matters worse, by this stage, the situation is out of the realm of control of the designer, the figure of whom, does not enter into the conscious life of the user. At this point, the connection between the person who designed the system and the experience of the person it is intended to serve, has been irretrievably cut, as has that between the user and their own life. They have lost trust in the system and probably the bank too and feel that this technology does nothing to make their life better. They feel no connection to or through it and, like the designer, no control over it. All in all, broken connections take us far from the richness of things imagined and experienced in other aspects of our everyday life, only to immerse us in fictional scenes.

Reconnecting to life, would at this point also mean reconnecting the designer to the user.

We cannot ignore the significant place that computers have in everyday life nowadays and it would be incredible to suggest that all these computers should not be meaningful for us, just as long as they are functionally adept. Every person is a unique creative being and brings that uniqueness to the use they make of computers. Yet, for a long time, models and frameworks have considered humans as units of labour, denying any creativity or expression in the use of computers. Perhaps in recognising the limitations of such frameworks, HCI may involve itself in helping structure the meaningful lives of people as they intertwine with technology. After all, computers have not been invented for corporate benefit alone, but primarily as an expression of progress of humankind. The responsibility is also one of continuing that progress to free humans from their own condition.

Highly efficient and usable systems are fundamentally not intended to be entertaining or pleasurable to use: they merely serve a purpose well. Nonetheless, there is no value judgement to be made that these systems cannot be linked with meaningful aesthetic experiences simply because of this. It is only that, if the user is to have an aesthetic experience with a computer, the possibility must

exist for their emotions, actions *and* intellect to be engaged. The new challenge for HCI then is perhaps to find a way of freeing up this interaction, opening up the way for computers to be part of meaningful life experiences and thus reconnecting the designer and the user through the experience.

A CONNECTION WITH THE DESIGNER : THE AESTHETIC EXPERIENCE

The designer is able to exert much influence over the nature of an aesthetic interaction experiences through the very fact that they are essentially connected with the experience of making; "the sensory satisfaction of eye and ear, when aesthetic, is so because it does not stand by itself, but is linked to the activity of which it is the consequence" (Dewey, 1958, p.49). Much like an artist, the designer experiences the artefact whilst in the throws of creating it, building the material for experience through the act of expression. Afterwards, the user is relied upon to use the artefact and contribute to the creating of their own experience, inseparable in essence from that of the designer. On the designer side, the doing and perceiving of what is done are connected and instrumental to one another in creating the artefact, while the user then recreates the artefact, perceiving only through the creation of their own experience. In this sense, an aesthetic experience is the result of involvement by and interaction between the creator and the user, constructed jointly and flowing to a consummation and fulfilment.

We might then reject the idea that computers are the real and absolute point of interaction with the user and consider them instead as means of communication between designer and user, where the aesthetic experience, as constructed at the point of use, connects designer and user. However, talking of aesthetic experiences involving computers necessarily involves recognising the acts of thinking, doing, suffering and perceiving, as well as feeling emotion and applying intellect. In this light, it is easier to see users as people who bring something to the interaction in terms of imagination and even creativity. This relates more closely to the way people interact directly with other people; it would after all be controversial to suggest that people are not active in their interactions with others or that they do not try to connect with what the other is trying to communicate. Applying this active involvement and connectivity to computer-mediated interaction, it becomes useful to talk of the artefact simply linking the designer's imagination and expression with that of the user through aesthetic experiences, where the interplay of emotion, intellect and practice from both sides make up the experiential whole. (Wright and McCarthy, 2004)

Collingwood suggests that "every imaginative experience is a sensuous experience raised to the imaginative level by an act of consciousness; or, every imaginative experience is a sensuous experience together with consciousness of the same. Now the aesthetic experience is an imaginative experience…the only power which can generate it is the power of the experient's consciousness" (Collingwood, 1958, p.306). In this sense, the work of the artist, is one of the kind where the sensuous-emotional activity of painting, forms the basis from which their consciousness generates the aesthetic experience of creating expressed by the painted picture or in the designer's case the technological artefact. It is precisely this externalisation or expression which makes the richness of the aesthetic experience and the connection to the perceiver or user to bring to the artefact their own ideas.

Like the creator, the conscious imagination of the perceiver transmutes ideas into a total imaginative experience, identical or close to that of the creator. This might arguably mean that the designer aims to express, not their own personal emotions, but those which are shared with the audience; after all, it is not the role of the audience to be imposed with struggling to grasp the meaning in an artefact to which they feel no real connection. As such, the connection between designer and audience is an actual part of the aesthetic experience, rather than simply a by-product of it.

Beyond a mere communication between creator and audience, there is an active and conscious collaboration, based on shared meaning. Also, the designer has an audience in mind when moving from imagination to expression. From this perspective, the artefact becomes more than a tool for communication, becoming instead a means for *collaboration* between designer and user. The designer cannot expect to be able to *design* aesthetic experiences for users. They can only put in place certain conditions in the hope of reaching the user and encouraging their collaboration. Similarly, the user cannot expect to have the experience delivered as a part of the computer package and the designer cannot leave it only up to the user to make their own experiences, with the designer concerned only with the functionality of the artefact.

FURTHER CONNECTIONS: ARTEFACTS FOR SHARING A VISION OF THE WORLD

Treating users as mere information processors, the real work of HCI is suppressed by a world of oppressive interactions. In such a world, user and designer become trapped between expression and imagination, both dehumanised by the finite goal of

usability. On one side, we see the user wallowing in selfishness, detached from the richness of life with computers to the utilitarian end of achieving a personal goal. The designer meanwhile is limited to objectivity, unable to connect to the life of the user and contribute to its meaningfulness through their skilled and heartfelt expression in producing the artefact. Understanding well the objective of the user, the designer produces an object to match it and serve it, at the same time satisfied to have met the prescribed business goals. Between user and designer then stands the artefact; each sees it as the final focus of their interactions, each unable and perhaps unwilling to envision a road of collaboration that goes beyond that technological barrier.

In a recent publication, Donald Norman shared with the reader his admiration for his assortment of teapots, a collection of objects of beauty that, on the whole, do not function particularly well. All the same, Norman projects great respect towards these artefacts, naming them and giving them a position of display in his house. Everyday though, he does not normally use any of these splendid pots, preferring instead a very functional and easy to use metal bowl, only occasionally taking down a prized pot to carry out the menial task of tea making. When he does, however, he is undoubtedly aware of how the pot feels different in his hands, the beauty of its appearance and how it requires more work to make tea. He may even think of the designer of the object, admiring the skilled work and wondering at how the creator managed to make an object that so closely matched Norman's idea of what is beauty in a teapot. In this sense, he connects with the designer, sharing with them some felt and imagined idea of beauty expressed through the actual artefact. Using the "everyday" metal bowl is quite a different experience. Norman does not spare a thought for the designer of the metal bowl. He is not invited by the object to consider it in any way other than as an efficient tea-making tool. What is relevant at this point is what the object can do for its user, the creator having long-since diminished into the history of its production. Here two choices exist when making tea: to reflect through using a beautiful object, or simply make tea through using a functional one.

Such points provide reflections on the richness of interactions and hint at an augmented role for users, as people free to excite in a thorough exploration of the artefact and what new richness it may bring to their life. The user is able to decide if the object is going to become part of their own life, with the choice of rejecting it if it seems to bring no new meaning. This would contradict the idea of an artefact as plain, functional and goal directed, encouraging instead a near sensual vision of it

intertwined with and embroiled in everyday life. Users of such artefacts would feel a connection to the designer through its use, recognising on some conscious level, a shared way of seeing the world. Such a vision does not sit comfortably with various recent attempts to incorporate some notion of experience into design.

While some have rushed to join the Experience Design bandwagon, it is perhaps an error to assume an approach of designing and programming experiences for users, ignoring the dimension that they themselves will bring to the experience and the interaction itself. While design of this sort may exemplify good craft, it leaves the designer far away from the consciousness of the user, not even allowing space to their imagination and expression, never looking beyond capabilities to receive stimuli and respond as trained throughout many years of interactions with computers.

A PARADIGM SHIFT

To overcome this limiting view of users and designers, the philosophy of art appears to present fascinating potential as a paradigm for HCI. First and foremost, it may provide a catalyst to help us view the roles of designer and user in a new way, as an alternative to seeing the user as someone who has to accomplish a goal as a Human Information Processor. The power in such an approach may therefore lie in the reconnection with the entity (designer/artist) who frees the user, avoiding the subjugation of the object as a means to an end. In particular, this paradigm may be useful to liberate from fixed ideas of how artefacts *can* be designed. Nonetheless, it is possible to think that such connections between user and designer might be achieved in some particular design cases which, for their very nature, would consider the computer as just a medium, rather than placing it as the focus of interaction. Doing so, we can carefully consider the role of the designer and of the user in a completely new light, free from our own subjugation of looking through the lenses of HCI.

The arts may also be useful to the long-term direction of HCI, in the sense that they encourage the questioning of political and moral issues. Designers need necessarily nowadays to adhere to business strategies and structures and contribute to the meeting of business goals. Reasonable though this may be, it leaves little space for expression and could be said to educate us all towards accepting technology as something out of our control and with little relevance to the reality of human existence in society. It is difficult to think of another sphere of the life where such subjugation would be acceptable.

Computers, after all, are not anymore something that most people find it easy to avoid coming into contact with in their everyday activities. It is likely then to be in the interests of the HCI community to be open minded about what the arts may contribute to their discipline, in the very least by encouraging in students, a sensibility towards and enthusiasm to maintain, the richness of human life with computers. We may also at some point see the development of a fully-fledged philosophy of HCI.

Undoubtedly though, if art is to be taken as a paradigm for HCI, some problems emerge. We would need to understand the full implications of considering the designer in an artist-like role and question at the same time if we can simultaneously continue to look at the designer in a traditional way. To now, the designer, much like the user, has been aided, yet at the same time entrapped by the need to follow strict prescriptive guidelines and create artefacts of measurable success. The inevitable difficulty if an alternative concept of an artist-designer were to seep in, is that the metaphorical equivalent – the artist – is a figure left completely free to imagine and express, who may well be charged with passion or have very strong personal feelings about the design subject. The skill of the artist lies in channelling this imagination through expression and connecting to the audience. Fitting this role to the business world in particular may prove challenging. One would also need to consider what these observations can actually bring to HCI.

Exploring even further the parallel between HCI and the arts, there emerges a much subtler conception of evaluation, linked to meaning, the aesthetics of interactions and the need to define beauty of interaction, suggesting the introduction of new concepts previously undisclosed to HCI. At the same time, we face all the questions about what art is.

These things said, it is perhaps helpful to see that such an avenue of exploration is not quite so radical as it at first seems. People have, after all been practicing Aesthetics in one form or another in HCI whether intentionally or not. Jakob Nielsen, as an example, adopts a formalist perspective to the design of web interfaces, interpreting the reality like a perfect form. Research continues to provide guidelines, in an attempt to offer a level of certainty to designers in accurately supporting the interaction at the interface. The difficulty with such work when applied to certain design cases, is that it deconstructs the artefact to the purely functional domain, imposing pure forms over matter conceived by the designer and leaving no space for expression and imagination. Aesthetics holds some promise as a useful paradigm in this sense: recognising where the connections between people have been broken by technologies and making sure HCI is able to reconnect them.

CONCLUSIONS

Engineering computer artefacts that are joyful, satisfying and easy to use or that provide stimulation on a sensory or visceral level is not the only focus for HCI. Beyond this, there is a great deal of potential to reflect on the meaning of computer use and more importantly, on the aesthetics of interaction through the interface. Taking aesthetics as a paradigm might help explain what makes an interaction beautiful. Most importantly, however, it may enable HCI to go a little further in looking at the imaginative expression of the designer and the user as a serious and worthy aspect of designing and using computers. As such, the position is quite simply that aesthetics represents an interesting paradigm for HCI to pursue in light of:

- Reconnecting the designer to the user,
- Redefining or expanding the scope of the roles of designers and users,
- Enabling interactions as meaningful connections
- Considering what the designer wants to communicate to the user through the artefact,
- The aesthetic experience of using the artefact and the aesthetic experience of the creating,
- Freeing the designer and the user from their own condition and giving space to expression and imagination,

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Coupling and Heterogeneity in Ubiquitous Computing

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ABSTRACT

As mobile computers' processing and communications systems become more powerful, they can support interactive tools such as collaborative virtual environments. Similarly, mixed reality systems use some of the same technologies as 'traditional' collaborative virtual environments and virtual worlds, but they are increasingly coupled and interconnected with other media in a way that we usually associate with ubiquitous computing systems. The context of use of a system, and context as modelled within that system, may consist of a heterogeneous combination of both new and old media. This paper uses theoretical work on the interdependence and interpretation to discuss such coupling among heterogeneous media. Our long–term aim is better understanding of the design and use of such systems, and better design practice consistent with theory and studies of user experience.

UBICOMP & EMBODIED INTERACTION

A recent HCI text [6] drew upon philosophy in discussing the accommodation of new technology by users, and their appropriation of it as they find their own ways to use and understand it. Dourish suggested that everyday human interaction is embodied i.e. is non–rationalising, intersubjective and bodily activity. Traditional approaches to HCI offer many guidelines for system design, but do not take full account of embodiment, according to Dourish. They are not in accord with the activity they aim to support. He raises the issue of embodiment but draws back from offering specific principles and guidelines, favouring instead statements that help sensitise designers to the general issue, e.g. users, not designers, create and communicate meaning and users, not designers, manage coupling. This paper uses similar theory, but tries to move forward with regard to discussion and understanding of accommodation and appropriation, and design guidelines. It focuses on the details of how systems that involve a mix of media, such as ubicomp and mixed reality systems, are designed and used. It centres on the issue of heterogeneity—spatial, temporal and technological—as a catalyst of deeper understanding.

Users of ubiquitous computing (ubicomp), mixed reality (MR) and augmented reality (AR) systems use the artifacts of digital media, such as handheld computers and head-mounted displays, combined with artifacts in more traditional media, such as books, tabletops and buildings. In MR, AR and ubicomp, the distinction between digital media and traditional media is clear if one looks for it, but the idea is that, effectively, one is not aware of it because one focuses on the overall experience: on the task instead of the tools for the task, to put it crudely. The new technology and the seams where it joins to old media are, as Weiser put it [18], "literally visible, effectively invisible". With such interwoven or simultaneous use, the notion of each medium being a space itself becomes problematic, as has been discussed in [3], [10] and [5].

Weiser suggested that even a "glass TTY UI can be ubicomp," if its use is well woven into the fabric of people's collaboration and interaction. This may seem contradictory to the common notion of ubicomp, involving technologies such as location sensors, mobile displays and wireless communication, but Weiser was clear that it was not technology in itself that made for ubicomp. Instead he suggested that we should aim for the accommodation and appropriation of computing into everyday life, so that its use is non–rationalized, intersubjective and interwoven with the other media that we use. In good design, according to Weiser, interaction using heterogeneous media is so tightly coupled in user activity that the obvious differences, boundaries and seams between the parts of a system become less significant than the quality of interaction with the whole. The seams are perceivable—the technology is 'seamful'—but we can call the whole system a single, hybrid object because coupled use of the parts is so unproblematic in users' interaction. In other words, interaction is non–rationalized and seamless, even if the technology is seamful. This approach to design brings to the fore the process of experiencing and understanding how to weave a new system into the other media used in one's everyday life. It emphasises the temporal, spatial and social patterns of use of all the media one has at hand, rather than treating a tool or system as an isolated 'thing in itself'.

The ubicomp design approach relies on the fit and coupling of the system design with the context of use i.e. the full range of tools and media used in everyday communication, activity and interaction, and the social or cultural understandings of their use: "the unit of design should be social people, in their environment, plus your device" [18]. Social people, in their environment, continually mix and couple media in everyday communication—walking, gesturing and pointing while one talks, and referring to places and what people did in them as one writes—and computational media can or should become embedded and embodied in that mix and in that social interaction, and neither superior or inferior to more traditional media.

People design their activity to fit 'our' technologies into the many media that they use in their everyday lives, often

changing or adapting the technology along the way i.e. appropriating it to suit the practices and priorities of their own contexts and communities of use i.e. other, older tools and media, and their use in interaction with other people. Studies of use consistently point out that such accommodation and appropriation are key to the adoption of new technologies. This process has been observed in media spaces [7], email [13], Lotus Notes [15] and workflow technologies [2]. As people do this, the use of the new technology becomes everyday, in the sense that "the most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it" [17].

This notion of disappearance, where a tool is "literally visible, effectively invisible" is from philosophical hermeneutics [9,11]. An old example from Heidegger is the way that a skilled carpenter engaged in his work focuses on the use of the hammer, and how it changes and is combined with other tools and materials, rather than focusing on the hammer in itself. Heidegger called this practically engaged and non–rationalising use 'ready–to–hand', in contrast to the rationalising, objectifying and abstracting activity he categorized as 'present–at–hand'. He saw both modes or categories of use as being set within a circular process of interpretation, in which one influenced by one's understanding and past experience of older tools and media when using any new tool or medium. One's use of the tool in the course of everyday, situated and social interaction, combining the new tool with the heterogeneous others used in everyday life, builds up new experience and understanding—that will affect how one uses and interprets another new tool. In time, this process of accommodation and appropriation lets one focus on the use of the tool, and not on the tool as a thing in itself, thus making the tool 'disappear'.

Influenced by Weiser but also drawing directly from similar philosophical sources, in [11] Dourish similarly called for a move towards design of interactive systems which have a better fit with everyday human activity, understanding and interaction, and with the practically engaged and non–rationalising way that everyday activity takes place. Dourish draws upon Heidegger, as well as Schutz' elucidation of the social or intersubjective element of everyday perception and activity, Merleau–Ponty's discussion of the way that the body, through the interwoven senses, plays a vital role in everyday perception, and Wittgenstein's emphasis on the way that meaning and activity are based on the patterns of use of the heterogeneous mix of media that constitute language: "the meaning of a word is its use in the language".

Weiser and Dourish focus on raising our awareness of embodied interaction, i.e. the interpretation of a system by a user as ready–to–hand. They present traditional HCI design as being based on its opposite, i.e. rationalising, objectifying and abstracting activity, or interpretation by the user as present–at–hand. Dourish discusses the shift between these two categories of interpretation as varying the degree of coupling between the interpreter and the system. As he puts it [11, p. 139], the existence of both

modes is critical to the effective use of technologies. However, Weiser and Dourish both swing from one extreme to the other, focusing almost entirely on design to support embodied or ready–to–hand interaction. They do not fully address the relationship between the two modes. In particular, how does a tool become invisible or ready–to–hand?

Heidegger, and his successors such as Gadamer and Ricoeur, held that situations where a tool becomes present–at–hand may be crucial to the individual's learning and to the differences between individuals. The ongoing 'hermeneutic circle' of interpretation and understanding integrates these two modes, and affords variation in people's understanding as well as consistency in their behaviour. For example, creativity can be considered as the variation of an individual's subjective understanding from his or her prior understanding and from others'. The individual may then be very conscious of his or her own activity, rationalising it and very aware of it, i.e. the system, tool or symbol is present–at–hand. With experience of its use, however, it may become understood and familiar, i.e. more ready–to–hand and embodied. Similarly, as two people perceive one another's use, with each interpreting and reacting to each other, they can achieve intersubjective consistency of behaviour—consistent with each other, but not necessarily with the use expected by the designer. A use or activity that is new and present–at–hand for one of them can thus become learned and ready–to–hand for both. The circular process of interpretation, whereby perception and activity are influenced by understanding, but also feeding into and changing understanding, thus relies on the interplay between ready–to–hand and present–at–hand interpretation.

Embodied interaction, as Dourish and Weiser made clear, is an aspect of human activity that is under–emphasised in HCI. Nevertheless, ready–to–hand embodied interaction and present–at–hand objectification are interdependent—and neither author addresses this. We have to expect that a new technology will be to some degree present–at–hand, no matter how well the designer aims towards embodied or present–at–hand interaction. This is most clearly the case when the technology is new, but two other situations arise that neither Weiser nor Dourish fully address. The first situation is *breakdown*, where the affordances of even the most familiar tool may significantly differ from those of everyday ready–to–hand use e.g. when the head of the carpenter's hammer becomes loose, so that he has to consciously concentrate on using it towards his task. Another example might be the breakdown that occurs with a mobile phone when it loses its network signal: one's attention may turn from a conversation 'through' the phone and its infrastructure to the tool itself. A second situation is where *the task is the tool:* where one can no longer work 'through' the tool in a transparent way because one has chosen to focus on the tool itself. This may occur as an act of conscious learning or analysis, e.g. a novice carpenter taking some time to improve his hammer swing, or a researcher studying how a new mobile technology works in use. Breakdown may have an influence, or overlap with

this case, as one might be working to repair an earlier problem or to try a different tactic of use.

HISTORY AND INTERDEPENDENCE IN MEDIA

Activity continually combines and cuts across different media, building up the temporal patterns of coupling and interweaving that constitute experience and understanding. A person's work or activity may be influenced by a 3D computer graphics display in front of them, and the interactions that such a system affords, but also by books, telephones, hypermedia, furniture, buildings and so forth—and other people's use of all of these media. The context of one artifact, in a particular medium, is the other artifacts and tools in that medium—and also in the other media at hand.

A narrow emphasis on one digital system or 'virtual space' as the paramount resource for activity underrates the interdependence of media. Recent technological developments, such as mobile phones and email, heighten or highlight the interdependence of media or intertextuality already familiar in the use of older media such as written text, maps and cinema, and well–explored in philosophy, semiotics [12, 27] and linguistics [31]. We take the standpoint, then, that activity and language is constituted by all the symbols and all the media one uses, with each symbol interpreted through immediate perception as well as past experience and social interaction.

We can choose to characterise media and treat each one as if it were an isolated individuated entity because of the senses we use in perceiving each one, and also because of our understanding of how to relate and to distinguish examples of each one. The differences between media are usually, then, rather obvious. It is easy to distinguish the spoken word "red" from the written word *red* because of the senses one uses in each case. Despite having the same letters, it is easy to distinguish *tar* from *rat* by looking at the order of letters within each written word. Such simple rules about what one can immediately see, hear, etc. within a word begin to strain and then break when one considers, for example, how we distinguish homonyms such as *rose.* The written word *rose* can mean many things, including a flower and having risen. When spoken, the same syllables can also mean linear structures (rows), about or belonging to fish eggs (roe's), moving in a boat (rows), small deer (roes) and multiple occurrences of the Greek letter (rhos). Saussure [16] established that a word's usage is understood through understanding and experience of patterns of use i.e. of other symbols that generally co–occur with it in use in language—and not just through the perception of the word's syllables or letters. Following Saussure and Wittgenstein [19], any symbol or artifact gains its meaning in this way, including a digital one: its meaning is its use in the language, where language is seem as involving all communicative media.

The notion that context is the other symbols at hand, in all media, becomes progressively more important as we turn from thinking about the differences between media, and the distinction of artifacts or symbols in those media, and focus on the similarities of media and the relatedness of symbols. The meaning or understanding of each symbol is not solely dependent on its form or medium, but also on experience and understanding of how we use each symbol along with other symbols in any or all media. For example, the spoken word "red" and the written word *red* are related because, based on past experience and current context, we can use either of them in the context of rose blooms, fresh blood, the former USSR and so forth. We understand, relate and differentiate symbols through experience of combinations and patterns of use within a culture. We can more clearly see how one's history has an effect on ongoing activity—Gadamer's 'historically effected consciousness'—in weaving media together via the hermeneutic circle.

Overall we suggest that achieving the design goals of ubicomp and embodied interaction may be aided by understanding the interdependence of media, and supporting coupling in our system designs. The next section puts forward some more specific design examples and suggestions, intended to help towards this goal.

COUPLING ACROSS MEDIA & TIME IN DESIGN

A typical 'context–aware' ubicomp system involves the coupling and interdependence of media for an isolated user, and we often seem much keener to couple information to space than vice versa. A museum exhibition might be associated with a set of web pages, so that walking into a room on a particular architect triggers the display of text describing the life and work of that architect. However, reading text about the architect is less likely to trigger display of a map or visualisation of the museum room, and afford access to a structured collection of blueprints, design sketches and building models. We might not be surprised to see images from the museum via a webcam, but it is rare to find video going the other way, from the page reader back to the museum visitor. There are some partial counterexamples, of course, but we suggest that ubicomp systems are generally relatively asocial and asymmetric in terms of their coupling and use of media. Perhaps each medium should be coupled to the other, and part of the context of the other, so each space or text is a peer with others.

In our work we aim to treat digital media more as peers, rather than treating any one space or tool as the primary focus or locus of activity. In our systems such as the Lighthouse system [4] and in ongoing work on a system called *George Square*, users interact with each other through audio links, as well as a number of spatial media. Users present themselves to others as icons on maps, as avatars in VRs and, of course, as people walking through buildings and city streets tracked by GPS. We couple spatial media together, tracking activity in each one and representing it in others, and we link the use of related artifacts in different media, such as using georeferenced web pages to show a location for someone accessing a web page, and to show a web page for a someone moving in a map, VR or city street.

We note that greater symmetry does not mean absolute uniformity and homogeneity across media. Homogeneous

shared resources may aid what Aoki et al. called a "cohesive social experience" [1], but slightly varied resources can serve as individual contributions and spurs to deeper engagement [4]. We suggest three practical situations in which a limited degree of heterogeneity may be useful: when users are in different locations or have different tools available and yet wish a shared experience; when the designer's and the users' interest is in the ambiguous or contradictory [8]; and when users have different past experiences to draw from.

The latter point brings us to the way that ubicomp often focuses on context as based on immediately observable objective features, in a rather present–at–hand way, but context also has temporal and intersubjective features that cross or interrelate media—and that these features are especially important in ready–to–hand use. Again, there are some partial counter-examples in the literature, but we suggest that have a long way to go in making past activity across many media a resource for ongoing or synchronous activity in each medium and with each other. In George Square, we therefore have begun to support asynchronous awareness as well as the synchronous awareness of the Lighthouse system. In a way based on structuralist linguistics, we record user activity over time, so that we can make recommendations of where to go and what to read based on comparing each user's recent activity with the past activity of others. We present each individual's recommendations to each member of his or her group, as an aid to mutual awareness, but recommendations are heterogeneous with regard to users, and with regard to media: they may come from street movement, web activity, map activity or VR activity, or a mixture of the four.

CONCLUSION

This paper has drawn on hermeneutics and semiotics in discussing the way that a narrow design focus on one space or medium as primary may inhibit use and constrain ubicomp design, as everyday activity involves the interweaving and combination of media. Similarly, we raised the issue of the relative lack of historicity of ubicomp systems. As Dourish put it [11], users, not designers, create and communicate meaning, and users, not designers, manage coupling—but designers are involved in this process, and can support it with rich cross-media awareness between users, in both synchronous and asynchronous forms.

By seeing the use of a computer system as one case of the use or interpretation of a symbol, we bring to bear the philosophy of language and interpretation, such as Wittgenstein and Heidegger, and linguistics and semiotics, such as Saussure. Such discourse has already had a significant effect in ubicomp and HCI, most obviously in the work of Mark Weiser but, by raising the critical awareness of the references and assumptions of Weiser and related researchers, we hope to enable future advance in system design in terms of practice, theory, and accord between the two.

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Putting felt-life at the centre of HCI

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Technology as experience

As computers become objects we live with, not just tools for work, the need to explore people's relationships with technology and what these relationships say about our technology and our humanity becomes more apparent. Following a similar impulse, Dewey (1934) re-imagined art as experience, challenging reifications that positioned art as objects held in museums and commending instead a close analysis of what we do to art and what it does to us. Taking his lead, we have tried to re-imagine technology as experience (McCarthy and Wright, 2004), and employing Dewey (1934) and Bakhtin's (1993) analyses of aesthetic experience, we have developed a holistic relational approach to experience with technology. According to this view, experience is constituted by the irreducible relationship between self and object, the concerned, feeling person acting and the materials and tools they use. In this pragmatic approach, experience registers life as lived and felt, something with the potential to be richly integrated and meaningful.

Life as lived and felt is not the 'natural' stuff of scientific or technical practice. The first-person perspective entailed in a felt-life approach to experience does not sit comfortably with the realist ontology, rationalism, and third-person perspective of science. But, as Agre (1997) has argued, such a lack of fit does not reflect a 'natural' order. Rather, critical reflection on the metaphorical processes that create centres and margins raises questions about how and why impersonal cognition should be seen to be 'natural' and felt-life troublesome in technical discourse and practice, especially in the light of the many aspects of people's relationships with technology that become difficult to address under this configuration of centre-margin. For example, an approach to HCI that is centred on cognitive approaches to interaction has difficulty addressing resistance to a technical system that seems to undermine the proposed users' identity, emotional attachment to technological artefacts, relationships with technology and with other people mediated by technology, the kind of tenacity that some people exhibit when faced with an unhelpful system, and the feelings of wonder and surprise at discovering a novel use for a system. It is our contention that addressing these kinds of issues requires a serious effort to reverse the centre-margin relationship such that a commitment to felt-life becomes the generative metaphor at the centre of our discourse and practice.

Putting 'felt-life' at the centre

If it is to be generative, reversing the relationship between centre and margin should not reproduce the same hierarchical relationships that sustained the prior relationship with the constituents of the troublesome margins on top instead. Rather it should result in a wholly different perspective on relationships between people and technology. Putting felt-life at the centre should throw new light on the cognitive and intellectual processes that it moves to the margins. Perception, remembering, and thinking should be seen differently in the context of felt-life than in another context. It should also enable us to see technology differently, as well as the activities and practices that surround technology. The reversal should enable us to make sense of issues such as tenacity, resistance, and enchantment that seemed alien and even incoherent from a rationalist perspective and should raise issues and questions that would not otherwise have been considered, for example questions about what design concepts such as seamlessness and

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transparency mean. Whatever the outcomes, in order to make the reversal in the first place, we need to be clear about what constitutes felt-life.

Our approach to felt-life takes as its starting point the irreducible relationship between self and world, or more tractably the things that constitute that world, and tries to see that relationship in terms of the lives of the people involved. The analysis of felt-life starts with our sensory engagement with a situation, which orients us to the concrete, palpable, and visceral character of experience. It draws attention to things being grasped pre-reflectively as the immediate and vital sense of a situation. One of the ways in which we think about sensory engagement is in terms of feelings, for example, the feelings of excitement, anxiety, satisfaction, and frustration that people experience with technology. Although these feelings are associated with bodily sensations, they never quite belong in the body rather they are qualities of interactions between organisms and things in their environments. Nonetheless, they can be seen as basic forms of knowledge in practice and in experience, such that feeling pain prompts one to withdraw or feeling tired carries a sense of a history of engagement and an expectation of rest.

In contrast with some other species, for people feeling is inevitably intertwined with language, intentions, and values. Combined with language and intention, feelings become more sophisticated forms of knowledge or sense making, partly because of their proliferation and partly because of their association with a person's sense of self. When feelings can be named and ever more complex discriminations made between them, they enable identification and discrimination to take place in experience. Different kinds of pain, anger, or tiredness are experienced and the discriminations made become constitutive of how people see themselves. For example, feeling unfulfilled at work, the warmth of welcome or the coldness of exclusion in a social setting (say in a chat room), undermined by the introduction of a system that cuts against a preferred way of working and relating with colleagues – are personal, intention-rich feelings that colour an experience and how one sees one-self in that experience. Such feelings are constitutive of the emotional-volitional character of all thinking and acting.

Nussbaum (2001) argues that emotion views the world from the perspective of our goals, needs, desires, and values and suggests that emotions are therefore best seen as judgments of value. Emotion is always directed at something or someone: boredom at a film, anger towards a friend who has let you down again, hope in the message of a leader, frustration with obstructive procedures and systems. As Nussbaum clarifies, although emotions are often hot and urgent, they should not be confused with what we think of as animal or uncontrollable urges. This confusion arises from the marginalisation of emotion in rationalist philosophy and cognitive psychology, with emotion being hot and irrational and thought being cool and considered. The alternative we are developing here sees thought and belief as inevitably emotionally toned – simply as a function of them being the thoughts and beliefs of people who are reflectively engaged in what they are doing and thinking. From this perspective, it is not so strange to see nurses' distrust of a hospital information system in terms of how they feel it interferes with their sensually and emotionally-intoned relationship with patients. In this sense, the emotional quality of experience is – like the sensual quality that we described earlier - an understanding or sense making process. We have already seen that the sensual aspect is concerned with the sense or meaning immediately available in a situation. Now we are suggesting that the emotional aspect is concerned with the sense or meaning ascribed to an object or person because of the values, goals, and desires we have.

When felt-life is at the centre, perceiving, attending, and thinking are seen as sensually and emotionally engaged and as unavoidably implicated in the construction of a sense of self and even our own subjectivity. In other words, our responses to technologies – our feelings about them and emotional responses towards them, how we think about them and act with them - tells us something about our selves as individuals and the nature of our human subjectivity or self-awareness. While attention to the construction of a sense of self is common, the construction of

subjectivity or self-awareness is less often addressed in cultural accounts of experience, because of their reluctance to confront the relationship between inner life and external behaviour.

Many socio-cultural accounts of experience treat the construction of self as at the heart of the narratives we create throughout our lives to make sense of our experience (e.g. Bruner, 1990; Benson, 2001). It is an idea that also fits quite easily with practice or activity approaches to experience with technology. However, from a felt-life perspective, an account of self as the narrative centre of experience is insufficient. It is too cognitive an approach to self, underplaying as it does the often-inexpressible feelings that constitute our awareness of our self or our subjectivity. This is an area that a number of authors studying relationships between people and technology have tried to engage (e.g. Coyne, 1999; Dourish, 2001; McCarthy and Wright, 2004), but which none have yet engaged in a fully satisfying manner. A radical approach to the mediation of our subjectivity by technology requires us to linger in the gap between inner life and external behaviour – where our subjectivity or sense of self is created - and we have not yet done that in reflecting on our practices with technology.

Many accounts of relations between technology and people, be they socio-cultural, hermeneutical, or phenomenological, forget that the emergence of language and community among humans did not erase their feelings, desires, needs, and bodily sensations. Accounts of experience that dissolve these riches in discourse or practice miss something important: the embodied vestiges of experience and the moment of possibility that "happens on the cusp between body and speech" (Malone and Friedlander, 2000). From a felt-life perspective, it is in the moment when experience is being expressed, when something inchoate is being shaped, that feeling and expression create each other. Moreover, in that moment, "in the gap that separates inner life and external behaviour" (Zizek, 2000), human subjectivity or self-awareness is created. Putting felt-life at the centre is an attempt to press into these gaps in order to focus our discussions of people and technology on the moments of potentiality in which human subjectivity is created.

Felt-life, technology, and human subjectivity

Putting felt-life at the centre entails looking at cognition, interaction, function, computation – and a host of other familiar concepts - as part of the process of becoming that marks the creation of subjectivity. This re-centring raises questions about technology and people that might be of interest to a workshop on reflective HCI. In the limited space remaining, I would like to draw attention to some examples of the types of questions raised. Here I will focus on three that are closely related and central to our considerations of human subjectivity in people-technology relations.

- *A sense of agency and a sense of self in interaction.*
  The first concerns the sense of agency that a person has in interaction and how this relates to their sense of self or subjectivity. In other work, we have been developing an account of a dialogical sense of agency in the relationship between artist and artwork (e.g. McCarthy, Sullivan, and Wright, submitted). This work is based on Bakhtin's analysis of the agency of author and hero in Dostoevsky's novels and his analogical development of a theory of perception as authorship. It argues that we create an other by orienting towards them as a centre of value. Thus the idea of each of us authoring the other implies a human subjectivity that is at once intersubjective, aesthetic, and ethical and a sense of agency as creating rich dialogue. This approach to agency could be used to reflect on a number of issues and concepts in AI and HCI, for example:
  - How we conceptualise mediated activity, suggesting a dialogical rather than solely functional approach.
  - What sense of agency a bot, an information system, or a character in a computer game can

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have in interaction with people.

- What sense of agency people have in people technology interactions.

- *A sense of what is real in interaction.*
  The second question concerns how and where we construct 'reality' in computer-mediated relationships, people-technology relationships, and in virtual reality. Such questions have already been explored by Coyne (1999) in broadly hermeneutic terms, which are sympathetic to the Lacanian theme of reality residing in the ineffable and antagonistic - the ineffability and antagonism of body and speech, feeling and expression that we referred to earlier. Following Coyne, we can bring felt-life to bear on critical evaluations of people-technology relationships. For example: what does a felt-life specification of the real tell us about technology and humanity? Some of us feel uneasy about virtual relationships, uncomfortable with the idea that people and computers can really have emotional relationships, and confused by some kinds of technological interventions in human life. Having already intimated that something very significant with respect to our subjectivity or sense of self happens between body and speech in a felt-life account: what would a treatment of that moment as defining of our human subjectivity suggest is real in people-technology relations?

- *Interactivity and interpassivity.*
  The third and final question for the moment is an attempt to draw issues from the previous two together in an attempt to provide resources for critically evaluating 'activity' in human computer interaction. The felt-life approach focuses on the moment of uncertainty, constraint, and potential between body and speech, interior life and external expression. Zizek (1999), reflecting on this moment, developed a critical analysis of interactivity and interpassivity in cyberspace. Generalising from his analysis of cyberspace suggests questions about the kind of human being or subjectivity that is promoted in interactions between people and technology. To the extent that activity with and through technology replaces engaged, felt, responsible relating with a substitute that extracts some aspect of relating from fully felt form, it reveals passivity, not agency or activity. For example, our experience is of *one-sided interpassivity* when we engage in an activity without feelings of mutually relating or of *one-sided interactivity* when we get our job done through another agent while remaining passive ourselves. However, we have to be careful to be dialogical in applying these concepts. As we have seen elsewhere (McCarthy and Wright, 2003), culture jamming and strategic consumption point to apparently one sided relationships that in fact involve a subtle, expressive response. One such response occurs when the technology mediating experience facilitates *mutual interactivity* as is the case in episodes of culture jamming, creative use of the technology given, and dialogue. The child who uses her mobile phone to call her father who is 200 miles away acts from feelings to imaginative use of technology.

To return to where we started, I hope that these brief examples of the kinds of questions indicated by and resources provided by a felt-life approach enables demonstrate the value of such an approach for exploring issues that remain marginal when cognition is at the centre. Issues such as those outlined at the start of this paper including: resistance to a technical system that seems to undermine the proposed users' identity, emotional attachment to technological artefacts, relationships with technology and with other people mediated by technology, the kind of tenacity that some people exhibit when faced with an unhelpful system, and the feelings of wonder and surprise at discovering a novel use for a system.

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Semiotics, HCI and the Avant-Garde

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ABSTRACT

Human Computer Interaction (HCI) is a complex and multi faceted area of research that continues to defy description in simple terms. Although the name suggests that HCI is simply the study of human interaction with computers, it belies the diversity and growing number of these interactions within a culture increasingly saturated with computational devices. Our semiotic approach to HCI has brought us to consider HCI from an arts and media perspective that attempts to develop a theory of interaction that is wide ranging enough to encompass new sorts of interaction. In attempting to understand the relationship between the arts and HCI we revisit the development of the computer and the climate within the arts that is associated with it. From here we suggest themes from artistic endeavors that might be useful for generating theory about HCI.

Author Keywords

HCI, Art, Semiotics, interaction

ACM Classification Keywords

HCI

HCI, CRITICAL THEORY AND EMPIRICAL DATA

The work that we are concerned with is the development of a semiotic model of interaction that focuses on interactive systems, which, it is hoped, will be useful for understanding interactions across many aspects of contemporary and emerging digital media. An important factor in the development of this model is the relationship between semiotic theory and empirical work. Traditionally Critical theory requires no empirical data, while HCI in itself is built on traditions that require its use in making claims about how we interact with computers. This tradition however is somewhat cumbersome and in an age where the development of technology far outstrips the pace of the Rhetoric that understands it, theory in HCI finds itself struggling to keep up. In our approach Semiotic theory is the basis of our model while we use empirical evidence from detailed video talk-aloud protocol analysis to support and develop the model in a grounded way [1-3].

SEMIOTICS AND HCI

Semiotics has been used in many different domains to explore the meanings and meaning making processes that occur when people interpret signs. For the most part it is used from a first person perspective to analyze 'texts'. Texts here are considered not just in the literary sense but also from the notion that any group of signs can come together to make up a readable, or interpretable, entity e.g. a news paper article with pictures, an advertising bill board, or a film. Largely it has made its mark in cultural and media studies as a form of critical analysis performed by semiotic experts who analyze these texts to find the different levels of meanings that can be attributed to them. An interesting central theme of semiotics is the notion of the relationship between the authors and the readers of these texts. Semiotic theory has called this relationship into question; undermining notions that meaning resides in texts in themselves and supporting the notion that the reader makes meaning when the text is interpreted.

In relation to HCI research this is an interesting perspective for two reasons. Firstly it treats software interfaces as texts that can be analyzed in search of the meanings that can be attributed to the signs in an interface. This idea can contribute to the notions of communicability and usability of user interfaces [4, 5]. Secondly it treats the whole process of interaction as a semiotic process, where signs are transformed, exchanged and interpreted between the user and the computer [2].

Indeed the history of the development of the computer in relation to this second point is an interesting one. Not least this is because one of the greatest critical repositories of information that documents its development is that of digital art [6]. Moreover, the impetus behind the development of the computer, more specifically the 'multimedia computer' that now sits atop most desktops across the world in both homes and offices, is intrinsically

linked to ideas that were spawned by some of the great avant-garde artists of the 20th Century [7].

COMPUTERS AND THE AVANT-GARDE

A Key link in understanding the relationship between semiotics, the arts and computers is the invention of the 'Hyperlink'. Invented by Ted Nelson the hyperlink was seen as a potential way to write non-linear narratives or texts that were inspired by the likes of William Burroughs who championed the notion of the 'cut-up' novel [7]. As Nelson envisioned it, 'Hyperlinks' would allow discrete portions of text to be linked together into 'Hypertexts' and accessed in a non-sequential fashion that would allow writers to produce work challenging conventional notions about hierarchies and linear reading.

While this may seem somewhat obvious in a world that now takes the notion of the Hyperlink for granted. Understanding the intellectual and artistic climate that surrounded its invention brings new insight into HCI and offers the potential of rediscovering forgotten themes that are again relevant to the development of contemporary digital media criticism. The invention of 'Hypertext' can be traced back from Ted Nelson to Vannevar Bush's 'Memex' machine and ideas championed by Douglas Engelbart in the form of the Arpanet. However, no matter who claims its invention its origins lie in trends within the avant-garde and conceptual art movements of the time.

The likes of John Cage, Robert Rauschenberg, William Burroughs and their associates [7, 8]were all interested in exploring notions of randomness and chance as a tool for making artwork. These employed the idea of the 'cut-up', literally cutting up sections of text, musical scores, sound recordings or images and rearranging them with other elements in a kind of collage. Building the first attempts at new types of non-linear narrative among other things.

These avante-garde artists were also exploring the notion of rule-based systems to create artworks. John Cage, for example, wrote many scores that were simple instructions for performers without writing a single note of music [8]. Allan Kaprow and artists from the Fluxus movement formulated sets of rules as a medium through which anyone could take part in one of their 'happenings' or 'intermedia' events. The Fluxus movement in general contributed, like Cage, to ideas based on scores and instructions that eventually became artworks in their own right [9].

These notions along with a desire within the avant-garde to challenge the relationship of the artist and the viewer that began with the development of audience participation were explored by many critical theorists of the time. Indeed semioticians at this time started to explore various media as sign systems while the avant-garde and the conceptual artist had also become concerned with language as a medium for making art. These artists were also concerned with the blurring of the boundaries between different media and with the blurring of the distinctions between art and life [9].

This blurring of different media is something that has now become a relatively trivial occurrence in the lives of those of us who use computers on a daily basis. Our desktop machines are capable of delivering highly developed multimedia applications or artworks that continue to put the viewer, or in HCI terms, the 'user' at the centre of interpretation and understanding. Contemporary digital media have, in short, turned the concerns of the avant-garde artists of the 60's & 70's into the reality of users in the 21st Century, blurring the boundaries between art, life and media.

Indeed, Alan Kay and Adele Goldberg in their proposal for the 'Dynabook' in 1977 [7]put forward a compelling argument for considering the computer as a medium in it's own right, stating that:

"Devices which variously store, retrieve or manipulate information in the form of messages embedded in a medium have been in existence for thousands of years… The computer, viewed as a medium in itself, can be all other media… moreover this new 'meta medium' is active - it can respond to queries and experiments."

This is perhaps one of the clearest insights into the relationships between artistic and scientific exploration that has pushed forward the development of modern computer systems. More recently, the notion of the database as a source material that is manipulated by users/artists via algorithms and rules (or coded messages) that describe their intentions formally [10]is one of the latest theories of new media that has its roots in this fertile territory.

As Douglas Engelbart put it in 1962 the purpose of the computer is to "augment human intellect" [7]. He envisioned the enhancement of human creative potential through the support of personal association mapping collaborative computer supported work. In other words, as Engelbart saw it, the most important aspect of digital technology is to support the cognitive abilities and creative endeavours of the people who use them. Engelbart became widely considered to be responsible for the invention of the mouse, windows, email and word processing.

OUR PERSPECTIVE

Our concern with Semiotics and HCI as brought us to an understanding of the difficult problem of approaching a critical theory of contemporary digital media from an inherently empirical HCI standpoint. Our exploration of this problem and the different notions that exist in various disciplines related to HCI, have lead us to uncover some intriguing parallels within the history of computing, the avant-garde and critical theory. As HCI practitioners what we are interested in is looking at how people interact with computers. What we have found are a number of themes from within the arts that may or may not prove to be useful in understanding our interactions with contemporary digital media.

1. The expropriation, recombination and recontextualisation of information from one place or form into another. Born from the ideas of Marcel Duchamp's Ready-mades [11] this is now an everyday activity supported by digital media, evident in the use of word processors and digital image manipulating software to name but a few [6].

2. Touching the void – the notion of reaching out into the imagination, into the nothingness of the void and making it tangible, first explored by Yves Klein [12]. This is an interesting starting point for theorising about notions of immersion in virtual environments [13] and ubiquitous computing. What is the material that we work with? Are they representations, simulations or sign sytems? What are the characteristics of contemporary digital media is it material or immaterial?

3. The relationship between chance and rule based systems for making happenings or performances explored by John Cage, Allan Kaprow, Nam Jun Paik, and the Fluxus group of artists [9]. An interesting way of exploring an alternative understanding of what interaction is in relation to art, life and various media.

4. The role of the reader, as explored by semioticians and artists alike [14-17]. This is a potentially rich vein of ideas about interaction, interpretation and the user/designer dichotomy that is central to HCI concerns.

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The Uncanny and The Everyday in the Design of Robots

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ABSTRACT
Working from literary theory, in this position paper I propose The Uncanny as strategy for a critical approach to the design of robots. Using existing robots, I describe how The Uncanny can be used to reveal the underlying issues and implications of robots, particularly as they relate to boundaries and distinctions between the natural and the artificial, the animate and the inanimate, and the human and the nonhuman.

Author Keywords
Design, Design Research, Reflective HCI, Critical Design, Robots, Literary Theory, The Uncanny.

INTRODUCTION
Design often functions to integrate the new into the everyday. Many of the methods of "good design practice", especially within the domain of human-computer interaction, are explicitly structured towards this goal: to make products accessible and accepted. But the everyday can be dangerously banal. When relegated to the periphery of our awareness, we often lose sight of the impact and significance of products. This is of particular concern when dealing with new technological forms and functions. The complexity and allure of these products often shrouds important cultural, social, and ethical issues. This raises interesting questions. 'Should such products become integrated into the everyday so quickly?' And 'What strategies can design employ to thwart the banal and illuminate the issues and implications of new technological forms and functions?'

My interest is in the design of commercial robots. Recently there has been a surge in the development of robots as products for use in offices, public spaces, and the home. As robots become more common it is important to understand how they exist as a unique kind of product. The forms and functions of robots are often explicitly constructed as imitations of living beings. Through these imitations, robots exhibit and are attributed qualities such as emotion, intelligence, and autonomy, and take on roles such as personal assistants and companions. But these qualities and roles have been commonly thought of, and philosophically contested as, being particular to animate entities, not attributable to inert machines.

What is of concern is how these robots are being designed for consumption and use. As robots are transformed from research projects into consumer products, from the extraordinary to the everyday, how can we avoid losing sight of how unusual it is to grant such qualities and roles to them? In this position paper I put forth The Uncanny as a strategy for a critical approach to the design of robots, a strategy that functions to thwart the banal and illuminate the underlying issues and implications of these new technological forms and functions.

BACKGROUND
Examples of inquiries into the role of design in the construction of the everyday can be found in both practice and research. In 2003 The Walker Art Center organized the exhibition "*Strangely Familiar: Design and Everyday Life.*" This exhibition presented over 40 projects that challenge common assumptions about form and function in the practice of graphic, product, and architectural design. Rather than just serving practical ends, the projects in this exhibition exemplify how design can operate as "the measure by which we gauge our encounter with the everyday," offering opportunities for reflection on what we consider to be common [1]. Within the domain of human-computer interaction, researchers have begun to explore how we might approach the design of new technologies and applications as part of a critical technical practice. Notable is the concept of *defamiliarization* described by Bell, Blythe, and Sengers [2]. Following from literary theory and ethnographic practice Bell, et al., define defamiliarization as "a literary device that compels the reader to examine their automated perceptions of that which is so familiar that it seems natural and so unquestionable [2]."

The use of The Uncanny falls within such approaches to a critical interpretation, evaluation, and practice of design, particularly in relation to the everyday. The topic of The Uncanny in literary theory traces back to the essay "Das 'Unheimliche'" by Freud[i] [3]. Freud describes The Uncanny as an experience in which the familiar suddenly becomes strange, resulting in a sense of psychological fear. As such, The Uncanny could be characterized as a manner of defamiliarization that utilizes specific tactics (themes and causes) for specific results. In "Das 'Unheimliche'" Freud explores several themes and causes of The Uncanny. As a demonstration, in this position paper I will focus on one of these:

The Uncanny as the effacement of the distinction between imagination and reality, "as when something we have hitherto regarded as imaginary appears before us in reality or when a symbol takes over the full functions of the thing it symbolizes [3]."

Furthermore, I will emphasize that aspect of The Uncanny that operates in the boundary space between the natural and the artificial, the animate and the inanimate, the human and the nonhuman, causing us question on what basis those distinctions are made. It is my position that this questioning of boundaries and distinctions raised by The Uncanny is central to the design of robots.

There is also a history of the concept of The Uncanny within robotics. Roboticist Mashiro Mori postulated that as a robot appears more humanlike, our acceptance of it increases, until it's level of human-like-ness reaches The Uncanny Valley [4]. The Uncanny Valley is that point where the resemblance between a robot and a human is almost, but not quite, identical, and the tension between this difference/sameness is disturbing. Even though The Uncanny Valley has never been systematically examined, it is perpetuated in the robotics community as a place to be avoided. But perhaps, it is not a place to be avoided. Because The Uncanny causes us to confront basic assumptions central to the design of robots, perhaps it is exactly the place where a critical approach to the design of robots should focus.

TWO EXAMPLES OF THE UNCANNY IN ROBOT DESIGN
As robots are introduced as commercial products their design has become refined and stylized. But this does not necessarily diminish the presence of The Uncanny in their form and function. What follows are two examples of the use of The Uncanny as a critical interpretation and evaluation of the design of robots.

Posy – The Flower Girl Robot
Renowned robot designer Tatsuya Matsui has designed a robot named Posy, made to resemble a flower girl. Posy is technologically sophisticated, yet deliberately frail and

Figure 1. Posy, The Flower Girl Robot.

without any productive functionality (Figure 1). When asked why he designed Posy as he did, Matsui replied

> Today, we are using technology to further an agenda of destruction and violence, which is why — more than ever — we need to rethink its role in our society and make sure that it is only used to better humanity. By creating Posy, I hope to unleash a weapon of peace — a reminder that one small robot's step is a giant leap toward a peaceful and equitable future for all [5].

Sociologist Joan Fujimura has pointed out that for Matsui, the design of robots is not only a technological endeavor, it is an opportunity to re-establish an appreciation of life and re-connect us with what it means to be human [6]. Matsui achieves this through Posy's uncanny design. The robot's neck and arms are thin and child-like. The robot's face is neither the helmet-like head common on so many robots, nor an articulated caricature of human anatomy, but rather mask-like — suggesting that the face of the robot either does not exist, or is hidden beneath the surface. Posy is often pictured in a pink dress clutching a bouquet of flowers to signify her role as a flower girl — a role commonly bestowed upon a special relative in a highly ritualistic activity. Posy's lack of productive functionality is unusual in the domain of robotics research and development; and Posy is not presented as an entertainment robot, such as the Sony Aibo, nor as art. The uncanny-ness of Posy is both the precision of imitation of *what a flower girl is thought to be*, and the design of a robot that embraces much of *what a robot is thought not to be*. As an effacement of the distinction between imagination and reality Posy is a symbol that threatens to take over the full functions of the thing it symbolizes, and the thing it symbolizes is considered to be preciously human. Posy causes us to question on what basis we make distinctions between human nonhuman roles, and the relationship between human qualities and roles and machine forms and functions.

To emphasize the impact of Posy we can compare it to another popular humanoid robot: the Honda ASIMO. The Honda ASIMO is the product of over a dozen years of research resulting in an impressive engineering feat — a truly bi-pedal robot. But unlike Posy, the Honda ASIMO is not uncanny. Its form is what we would expect from a humanoid robot, gracefully geometric with substantial bulk. Its functional capacity and the relationship of its form to its functional capacity is clear, the Honda ASIMO was designed to walk, and its form directly follows this function. Although we may marvel at the technology of the Honda ASIMO, it does not lead us to the questioning of assumptions invoked by the uncanny-ness of Posy.

The Robot Guard Dinosaur and Banryu
At the 2002 Robodex the Tmusk Corporation debuted a robot guard dinosaur designed in collaboration with Sanyo (Figure 2). Equipped with a video camera and controllable with voice commands via a cell phone, a homeowner could

use Banryu to patrol and monitor their home while they were away. The imitation of a dinosaur, or at least our image of a dinosaur, is impressive. The robot appears to have a wrinkled, mottled hide, three horns, and an open mouth filled with pointed teeth. It is strikingly similar to a model of a dinosaur we might find in a science museum.

In a turn of events, the robot guard dinosaur has been re-released with a new form and functionality (Figure 4). The new robot, named Banryu (Japanese for guard dragon) has shed its hide, its mechanisms are now revealed and it is clad in a sort of mecho-tronic armor. Its aesthetics seem to borrow equal parts from the Sony Aibo and The Terminator. Its functionality has been altered even more radically than its form. Banryu was demo-ed as a product to facilitate tele-present shopping experiences. For the 2003 Robodex Banryus were placed in 2 Virgin Megastores in Tokyo and in the Pacifico Yokohama exhibition hall, where Robodex was held. Operators at Robodex remotely controlled the Banryus via cell phones to browse for their favorite cds in the selected Virgin Megastores. Customers at the Virgin Megastores were able to operate the Banryus in the exhibition hall to explore the exhibition.

There is no evidence the design team for either the initial version of the neither robot guard dinosaur nor Banryu explicitly sought to engage The Uncanny, yet both robots do. The choice of a dinosaur/dragon for a form factor is itself uncanny — yet arguably appropriate. There are no dinosaurs on Earth today; they are creatures of the past. Dragons are fictional entities. Most people have only limited knowledge of dinosaurs and dragons. Hollywood and children's books heavily influence the knowledge people do have about these creatures. What better form factor for a robot? Robots are popularly conceived of as creatures of the future, and like dinosaurs and dragons, something that most people have limited knowledge of outside of science fiction. This might explain the toy-like stylizations of the initial robot guard dinosaur, with its pale blue and cream coloring. Likewise with the Banryu, it appears like we might expect a robot dinosaur to appear in 2003, if in fact we had any such expectations.

The uncanny-ness of the robot guard dinosaur is the precision of imitation of *what a dinosaur is thought to be*. The uncanny-ness of both the robot guard dinosaur and Banryu is compounded fact *the referent, the creature the robot seeks to imitate, is itself unreal*. It is impossible to have a dinosaur/dragon guard your home or shop for you because these creatures do not exist. But it is possible to have a robotic versions do those things for you, with your cell phone. The uncanny-ness is in *the seeming impossibility of what is possible*. As an effacement of the distinction between imagination and reality, the robot guard dinosaur and Banryu are things that we had previously regarded as imaginary appearing before us in reality. The robot guard dinosaur and Banryu cause us to question assumptions we hold about reality and imitation and the relationship between the real, the natural, and the artificial.

DESIGNING UNCANNY DOMESTIC ROBOTS

My research engages the animation of technology and the location of subjectivity in artifacts. I am particularly interested in how these effects are achieved and the tactics used to negotiate and manipulate the distinctions and boundaries between people and technologically animated artifacts in relation to agency. One aspect of this research is situated in the design and experience of domestic service robots. I am using robotic vacuums as a platform for my initial design explorations. Robotic vacuums offer opportunities that Posy, the robot guard dinosaur, and Banryu do not. Our responses to those examples are anecdotal and theoretical. Robotic vacuums provide an available and accessible platform to empirically research the same issues and implications raised by those examples.

I am using The Uncanny as both a theoretical and aesthetic device to frame my initial design explorations. What follows is a set of three conceptual propositions for the design of uncanny domestic robots. These propositions seek to leverage The Uncanny to probe the relationship between and the effects of the animation of technology and the location of subjectivity in artifacts.

Figure 2. The Robot Guard Dinosaur

Figure 3. Banryu

Robotic Vacuums That Speak Their Mind
One of the themes of The Uncanny is the revelation of that which was meant to be concealed. Robotic vacuums are marketed as solutions to automating household tasks, reducing the need for human involvement in those tasks. But robotic vacuums require a substantial handholding. For example, it is suggested that they be accompanied the first time they are used in a new environment. These are very needy appliances, but their needs are often concealed by design and reveled only through consequence. Perhaps robotic vacuums should be more direct in expressing their needs. For example the robotic vacuum might speak: "I have never been in this room before, please stay with me while I clean it." Such expressiveness would betray the hidden needs of robotic vacuums, revealing their frailty and dependence upon human guidance.

Homely Homes For Robots, Unhomely Homes for Humans
There is a strong relationship between the home or the homely and The Uncanny. The Uncanny has been conceptualized as that which is unhomely, a house that by design is difficult to inhabit or a house that is haunted. Oftentimes, homes need to be prepared for robotic vacuums to function correctly in them. This preparation may be as simple as removing toys from the floor or as involved as installing virtual walls to mark perimeters between rooms. One could imagine over time the design of the domestic environment being transformed from a space for people to live in to a space for technology to work in. Such a transformation would result in uncanny homes, homes that were unhomley for humans but homely for robots — redefining the artifact as an inhabitant and granting it an unusual form of agency in the home.

Real Appliance Pets
An emerging trend in domestic service robotics is to market them as pets. However these domestic service robots are often pets in name alone. Their forms and materials are what we would expect of robots, geometric shapes and injection molded plastic. They are not given pet-like (or even robotic pet-like) behaviors or expressions. It would relatively simple to transform a robotic vacuum cleaner into a more realistic imitation of a pet. The form could be covered in fur. They could respond to the environment with creature-like sounds and wander around the home when not in operation. They could even require being cared for as pets in order to continue to work properly. These appliance pets would confound the distinctions between functional machines and relational entities. They would play on the effacement between the real and the imaginary as the symbol of a pet takes on the qualities of pet.

CONCLUSION
As discussed in this position paper, The Uncanny is a strategy that can be used for a critical approach to the design of robots. Because The Uncanny deals explicitly with the boundaries between the natural and the artificial, the animate and the inanimate, the human and the nonhuman, it is particularly applicable to robots. It is also applicable in other technological/product domains where these boundary issues are raised. One salient example is the domain of pervasive computing where environments and artifacts are often characterized as "aware" or "smart".

The use of The Uncanny, and other theoretical positions, as a basis for a critical approach to design has benefits beyond tactical application. It serves to provide a theoretical rigor to the interpretation, evaluation, and practice of design. It also provides the opportunity for design to contribute back to development of theory. Such critical/reflective design can be used as interventions into culture that reveal, demonstrate, and interpret social and ethical issues, acting as a sort of performative research and documentation. Such contributions and rigor are necessary if design is to have import and effect outside of itself.

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[i] Following from Freud, the topic of The Uncanny has continued to receive considerable treatment in literary theory, most notably in the works of Cixous and Kristeva. It has also been addressed in architectural theory in the work of Vidler. The works of these authors, and others, are important to the discussion of The Uncanny and design, but cannot be treated in the scope of this position paper.

Usable Reflexivity.

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Human Computer Interaction (HCI), as an applied and interdisciplinary research area, has been said to lack a theoretical basis (eg [Mackay 1998], [Scaife et al 1994]). It has also been seen as based as much upon developments in the technology industries as it is upon any philosophy or methodology. The success of HCI projects is to some extent defined by their release back into the commercial world [Sutcliffe 2000] and part of the goal of many researchers is to work in a way that enables industry to develop "better" computer products and services, where "better" is understood in a performance paradigm [Light, forthcoming]. This can lead to an unquestioning acceptance of business values, an uncritical embrace of natural science as a model for social science, and a technological determinism that sits poorly with reflexive practice. How then can radical HCI studies that draw on cultural studies, critical theory, and phenomenological approaches and practices reach out to commercial culture?

This paper outlines some of the cultural constraints of working with industry, suggests two scenario-based tools that might facilitate a more reflexive design practice and, finally, considers how industry might be persuaded of the value of a more reflexive HCI.

Cultural constraints in working with industry

Commercial practitioners look to HCI researchers to provide solutions: they want succinct information and swift processes that fit in with their constraints and business pressures. Therefore, methods that problematise design may be seen as making the immediate issue more complicated - i.e. worsening the problem, rather than solving it - and may not immediately appeal to industrial teams. In fact, organisations tend to suppress consideration of the politics of design, either through circumstances, such as short development timescales, or through deliberate means, such as what might be considered "groupthink" (cf [Fallows 2000], for example, on Microsoft's military-like organisation).

Another factor to consider is the multidisciplinary nature of much design for digital products and services [Scaife et al 1994, Burns and Vicente 1995], this can sit at odds with the interdisciplinarity of reflexive HCI work [Kim 1995]. Most practitioners will bring to their work the prejudices of their original training, be it in experimental psychology, computer science or graphic design, and so may not be at ease with techniques grounded in different traditions. This is at its most manifest when looking at the extremes: between the opening-up, essentially creative, techniques that produce possibilities (most familiar to design-trained staff), and the narrowing-down, essentially analytic, techniques that produce final versions of a tool. In many commercial projects, the goal is a holistic view of context, people, and technology, especially with the domestication, mobilization and networking of services and products. But there is often still a strong emphasis on the so-called "objective" analytic and evaluative aspects of user research, reflecting the experimental or cognitive grounding of the researcher. Further, industry can still be somewhat dubious as to the value of even relatively traditional HCI methods. Owen Daly Jones, the head of the UK Serco usability labs recently reported that clients are frequently unconvinced of findings from co-operative evaluation studies where only small numbers of users are tested. They demand greater numbers of subjects despite the fact that the usability problems and trends in the initial data are merely confirmed by subsequent tests with more people [Daly Jones 2003].

At what point in the design process, then, might reflexivity be emphasised? Scenario development [Carroll 1996, 2003] usually appears at an early and malleable stage of design and can be made to accommodate more reflexive approaches.

Tools for Reflexive Design

Scenarios are frequently used in HCI to present user research to design teams, either in generating new applications for technologies, or for refining particular designs, but they are seldom reflexive. Standard HCI scenarios have been severely criticized in recent years. At

DIS 2002, Lene Nielsen pointed out that users in scenarios are rarely vivid characters and are very often simple stereotypes, mere functionaries that illustrate the workings of the product being described. Calling for more vivid characterisation, Nielsen argued that it is not possible to predict the goals or actions of users without knowing anything about them. Alan Cooper has shown how the creation of personae can lead to design insight and Nielsen suggested how the techniques of film scriptwriting could enrich scenarios. However creating a vivid and compelling character each time a scenario becomes necessary in the design process is a tall order. The following sections describe two relatively cheap and easy methods for making scenarios that do not rely on stereotypes and unthinkingly reproduce the designer's assumptions.

The Random Scenario-building Method

The Random Scenario-building Method (RSM) uses a combination of three random qualities to start a scenario-building process. Here participants are thrown into a creation process of their own, with minimal information to draw upon. They are encouraged to engage with people as rounded entities, with cultural contexts and social needs, rather than the simplistic versions packaged in much user modelling. Small groups involved in the design process are asked to select two slips of paper per person and one slip per group. The first two slips carry, respectively, an adjective (such as: aged, shopping, limping, drug-pushing) and a role (such as: mother, businessperson, teenager, lover). Together they make up a more or less likely combination: the group may exchange adjectives among themselves to produce a more easily reconcilable bunch of people, though this plays to any tendency to stereotype. The last slip, which is owned by the whole group, is a context (such as: in a supermarket, heavy rain, late at night, after a row with the boss). The group is then charged to make a scenario out of just these materials, supplying other details through invention. The slips provided for selection may be customised to relate to the particular technology being developed, or left as a blue sky exercise to identify needs.

The need to reconcile three elements works to liberate the participants from swift, trite answers. The group nature of the task brings in social elements that might otherwise have been ignored. But the actual roles and adjectives are unimportant – it is the process of engaging with them that is key to taking the participants out of straightforward analytic mode and into a more reflexive and discursive intellectual space. The process serves to connect them to their personal, rather than professional, experience from which to draw examples. It has been used by Light in a consultancy capacity, with engineers to develop greater understanding of town centre usage, as well as in the design of digital artefacts. In its openness and its emphasis on individual and group engagement, it differs from the cognitive and systematic approach of scenario popularizer Carroll, but he too identifies a valuable role for the social [Carroll 1996].

Pastiche Scenarios

Another way of making more rounded scenarios is to draw on fiction as a resource for design. Rather than requiring designers to create fresh characters and situations, pastiche allows the designer to very quickly evoke resonant contexts in which to place a new design or consider user needs. Pastiche is a form of writing that imitates and borrows from other works and styles. It appropriates characters, situations and plot lines often to satirise the original but sometimes simply to place it in a new context. Pastiche scenarios then draw on existing narratives in order to create richer and more resonant descriptions of users and technologies. Such scenarios can be used to explore in an engaging way, the complex social and cultural issues raised by technological innovations. Because the cultural sources drawn upon are rich and resonant, possible interpretations of the scenarios are multiple. Character traits are not answered by product functionality because other authors developed the characters with quite different aims in mind. This creates ambiguity which as Gaver et al [2003] note, can lead to new challenges and insights.

Pastiche scenarios were first developed in relation to the conceptual design of a piece of surveillance technology [Blythe [1] submitted]. This was a directly political subject which necessitated a detailed consideration of possible impacts on civil liberties and privacy. Pastiche scenarios then were made drawing on the Miss Marple detective stories (for an

idealised utopian view of the crime prevention technology) a clockwork orange (for a dystopian view of how the technology might affect those it would be used against) and finally, and perhaps inevitably Orwell's 1984. These scenarios were concerned with conceptual design issues. However the method also proved useful in the implementation stage of another project. Pastiche scenarios were constructed for the Net Neighbours scheme [Blythe [2] submitted] which widens access to online shopping via volunteer telephone intermediaries. Various financial models were represented in a series of pastiches made for users and the computer programmer who was designing the interface for them. Although the pastiche document was rather long it succeed in provoking lively discussion and communicating the dependability issues involved in a humorous and engaging way.

There is an obvious objection to the kinds of scenario developed by RSM and pastiche: they do not address the typical user. Alan Cooper [1999] points out that there is no such thing as a typical user and argues that designs for "personae" can generate more useful scenarios. Djajadiningrat et al [2002] found "extreme users" to be helpful in generating design insights. The typical user is really a convenient fiction and so too is typical use. The synthetic quality of both methods outlined above is a reminder of this, and that designers can shape but not determine, the use of their products. Atypical characters (either random or pastiche) may help designers to position themselves reflexively: to be continually aware that they can only ever create fictitious users and possible uses for their technologies when they are constructing scenarios.

Such approaches to scenario development seek to enlarge the vision and understanding of the participants. Both have novel features that might in themselves prove stimulating to adventurous practitioners. However both involve aspects that are not purely scientific and measurable and run the risk of being dismissed as "silly". Neither method could overcome organizational or internal resistance to participation and so it may be with many of the more radical measures to stimulate reflection. What then is the value of a reflexive HCI?

The Value of a Reflexive HCI

Computing technology now pervades every aspect of our lives: not only as professionals, but as civilians, consumers, students… and, increasingly, digital networks are connecting up these roles. Both ubiquity and connectivity necessitate a more reflexive design process. A more reflexive HCI means a discipline able to respond to these technological changes with more agility, in recognizing and reasoning about the relationships between society, culture and technological development. Indeed, a turn to the subjective, the social, and to a basis in experience may serve to expand the scientific imagination, even as it challenges it. However, there remains an important question of legitimacy, not only in terms of justifying practice to more traditional academics, but also in selling such a turn to industrial and commercial developers. And here we have again to consider the essential pragmatism of this applied discipline.

Morten Hertzum's recent longitudinal field study of how scenarios are actually used by practising software engineers has demonstrated that use is opportunistic rather than systematic [Hertzum 2003]. The development of scenarios, like that of other design artefacts, is likely to cease when other activities yield more immediate results (ibid). The applicability of method, reflexive or otherwise, will vary, then, depending not only on the stage of the design process, but also the work to be done and the tools available. So, in terms of putting reflexivity in the design process, the stress must be on completeness: clearly there is a time and place for creative acts and rich descriptions, and also one for tight analysis to create predictive "rules" and to narrow down options. Successful design will justify the means.

But scepticism in industry - though, in part, individual - is also determined by the culture of production. Time pressure has the effect of making people revert to the safest option and cut stages that deliver uncertain value [De Young 1996]. A culture of blame will make even the bravest adventurer resort to techniques with demonstrable precedent and validity to ensure accountability [Pearn et al 2000]. If, however, more creative processes are valued at a senior level, then staff respond accordingly: in fact, if there is time and budget for experimentation, and a freedom to follow ideas without individualized blame, then creative processes come

generally to be welcomed and the benefits are demonstrable [De Young 1996]. The aim, then, must be to present a usable reflexivity.

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HCI as Translation Work:
How Translation Studies can
Inform HCI Research and Practice

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ABSTRACT
This position paper extends the argument that HCI work is a kind of translation work, in which the HCI worker both transforms and transports knowledge from one culture (e.g., users) to another culture (e.g., software professionals). Based on earlier work with ethnocritical heuristics, I explore how the thousand year history of translation studies may inform our work in HCI. Lessons learned illuminate choices in the following areas: the unit of work, the transformation of information, the construction of "users," and the organizational positioning of the HCI work. I hope to use cultural critique and translation theory to interpret and advance HCI as a hybrid, interdisciplinary endeavor.

INTRODUCTION[1]
Much of the work of HCI involves many aspects of translation. HCI workers often are in the role of *receiving* information or knowledge from their sources, *adding value* to that information by selecting, summarizing, and explaining it, and *delivering* that improved information to their audiences. For example,

- In the HCI practice of **requirements analysis**, the source is often the users, and the recipient is often the development team.

- By contrast, in the HCI practice of **design**, the source is often the development team, and the recipient is often the users.

- Finally, in the HCI practice of **usability evaluation**, the source is again the users, and the recipients are again the development team

The principal activities of translation are transportation and transformation (Maier; 1994; Ortega y Gasset, 1937/1992; Raffel; 1989; Scheiderer, 2001). We receive information from one group, and we *transport* it to another group –

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[*] This position paper extends an argument begun in (Muller, 1999b). Some paragraphs have been copied from that earlier work.

often moving ourselves and the information from one geographical or organizational location to another. We receive information from one group, and we *transform* it so that it will be understandable to another group – often thinking carefully and strategically about how our acts of transformation and transformation may benefit one group, or the other, or preferably both.

Translation has been described as an "impossible necessity" – an act that cannot be done correctly, but that must be done if people who are different from one another are to communicate with one another (Cutter, 1997). As I will attempt to show, this is as true for HCI as it is for other fields. In an earlier work on applying the cultural critique theory of ethnocriticism (Krupat, 1992) to HCI (Muller, 1997, 1999a), I began to explore our own "impossible necessity" of transforming users' information into a form that is palatable to software professionals and others of our colleagues. This problem, which Suchman highlighted as the issue of *representation* (Suchman, 1995), continues to trouble us: We must explain the users' world to our software professional colleagues, but when we do so, we must constantly balance our fidelity to the users (the need to report the users' world as *they* see it) against our fidelity to our software colleagues (the need to present clear conclusions that can immediately be put to use by people who are uninterested in the users' view of their own world).

In this paper, I pursue several themes from that work, focusing on the HCI worker as the person who *goes between worlds* – typically, the world of the users, and the world of the software professionals. Because translators are people who *go between worlds* (), I use insights from the 2000-year history of translation studies as part of my analysis.

TRANSLATORS BETWEEN WORLDS: TO WHAT END?
Translation has a complex history. On the one hand, translation makes different world-views intelligible to one another (e.g., Baker, 1992; Dingwaney and Maier, 1994). In HCI, translation has been described in analogous terms, as a way of bridging between different knowledges

(Williams, 1994; Williams and Begg, 1992).[2] Without translation and translators, differences between groups and peoples can become causes of conflict and destruction. In this view, the translator becomes an agent of communication and explication.

But translation also has a more troubling side. Many students of translation have described the practice as a matter of alteration and even distortion (e.g., Venuti, 1995, 1998). Bassnett and Lefevere (1993) note that

> Translation is, of course, a rewriting of an original text. All rewritings, whatever their intention, reflect a certain ideology and a poetics and as such manipulate literature to function in a given society in a given way. Rewriting is manipulation, undertaken in the service of power… The history of translation is the history also of cultural innovation, of the shaping power of one culture upon another.

Indeed, some writers in the post-colonial or subaltern studies tradition have described translation as one of the weapons of colonialism (e.g., Cheyfitz, 1991; Krupat, 1993), as an act of violence that silences the source for the benefit of the recipient (Venuti, 1998), or as an act of destruction preceding an act of reconstruction (Peden, 1989).

Venuti argues that it is important to recognize *who* is performing the translation, and what the translator's goals and assumptions are (see also Bassnett and Lefevere, 1993). Part of this work is explicitly to position the translator as part of the work of translation – i.e., to avoid the appearance of fluency or transparency, and to make the translator's own role and position *visible* (Venuti, 1995), as "irrevocably mediate" (Dingwaney, 1994). A similar argument was made regarding the positionality of the HCI worker by Plowman et al (1995).

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[2] Translation as I have described it is not a new concept in HCI. Williams has developed a study of practices that are used by a special case of HCI translator – persons who have subject matter expertise in the users' task domain and in HCI, and who can therefore provide interpretive services between users and software professionals (Williams, 1994; Williams and Begg, 1992). A brief electronic search found 38 papers that make reference to translation as a human transformative process in HCI,[2] perhaps most influentially Dix et al. (1998), Mackay (1990), Nielsen (1994b), Norman (n.d.), Rosson and Carroll (1996), Smith (1988), Smith and Mosier (1986), and Star and Griesemer (1989). Thus, in this paper, I am not so much introducing a new topic as attempting to bring rigor to a topic of long-standing but diffuse interest in HCI.

In our own work in HCI, we sometimes face similar problems. The analyst in HCI is often in the role of a work-rationalizer – an expert who attempts to find inefficiencies or redundancies in work, with the goal of making work processes more productive from the perspective of the organization as a whole (e.g., Bailey, 1993). As the participatory design tradition has emphasized, this perspective is more likely to favor executives' workplace perspectives over those of low-status workers (Bjerknes, Ehn, and Kyng, 1987; Greenbaum and Kyng, 1991; Schuler and Namioka, 1993). Similar conclusions have been reached in non-HCI-based studies of low-status workers (e.g., Kramarae, 1988; Rakow, 1988; Rapp, 1993; Wagner, 1993). As the HCI analyst goes between the world of the workers and the world of the executives, they face challenges similar to those faced by translators: *Whose world-view is to be supported? At what cost?*

Similar questions arise when HCI workers move between the world of the workers and the world of software professionals. Software professionals face their own set of challenges, most of which are concerned with being effective in their own work. As Floyd has explained, the perspective of software professionals favors certainty over ambiguity, definitive tests over exploration, uniformity over diversity, and fixity over mutability – despite the fact that human work in complex situations is often characterized by ambiguity, exploration, diversity, and mutability (Floyd, 1987). In order to be useful to software professionals, HCI workers are often called upon to simplify the users' world and world-view – to make the users' complex experiences conform to the language of requirements analysis and software engineering. And in the course of constructing fixed requirements from the ambiguous, exploratory, diverse, and mutable world of the users, HCI workers often have to engage in a process of analysis-followed-by-synthesis that is disturbingly similar to the process of destruction-reconstruction outlined by Peden (1989).

These problems for HCI workers are made more acute by the mediating role that HCI workers often occupy. While we like to say that the users are the experts in their own work, our colleagues in software engineering (and their executives) often require *us* to take on the role of experts. This position puts us on dangerous ground, because we become the only voices for the users, and we are not the users. Our voice then becomes privileged in comparison with the voices of the users.

In a powerfully disturbing essay called "The problem of speaking for others," Alcoff explores some of the ethical and political issues when one non-representative voice is privileged over other voices (Alcoff, 1991). Alcoff outlined three cases in which one person was expected to speak on behalf of others, with three different outcomes – all of which were unsatisfactory or disappointing for various reasons.

The HCI worker is nearly always privileged in the way outlined by Alcoff. The development team chooses the HCI worker as the representative or proxy for the users. Sometimes, the organization designates the HCI worker as the knowledge-owner regarding the users' work. The HCI worker thus has verbal privilege (Rich, 1983/1986) over the users – even though the users know more about their work than the HCI worker (Muller, 1997). The representation constructed by the HCI worker can have profound impact upon the development process and the outcome for the users. These issues return us to the problem of representation (Suchman, 1995), and the impossible necessity (Cutter, 1997) of representing the users to our colleagues.

CHOICES IN HCI TRANSLATION

It may help us to look to the kinds of choices that translators have had to make, over the long history of translation and translation studies. In this position paper, I will briefly describe these choices, with the hope of pursing them at greater length in a longer work.

The Unit of Translation

In some views of HCI and requirements analysis, there is a tradition of reducing complex concepts to simple relationships. Object-oriented analysis, for example, may seek to find nouns and verbs, and to combine them into simple and unambiguous requirements statements. Entity-relationship models work similarly, finding a set of objects and specifying their relationships. Is this a sufficient description of human work?

In practice, translators operate at multiple levels of analysis. While it is easiest to think about translation at the level of words, many theorists of translation have recognized that there are multiple aspects of words, and that words change their meanings depending upon context. Two-hundred years ago, Schopenhauer (1800/1992) argued that

> We will never grasp the spirit of the foreign language if we first translate each word into our own mother tongue and then associate it with its conceptual affinity in that language – which does not always correspond to the concepts of the source language – and the same holds true for entire sentences… A complete mastery of another language has taken place when one is capable of translating not books but oneself into another language.

Paz (1971/1992) referred to word-for-word translation as "a glossary rather than a translation… Without exception, even, when the translator's sole intention is to convey meaning, as in the case of scientific texts, translation implies a transformation of the original…"

If we think about HCI analysis as a kind of translation, we may find useful analogies to the work of linguistic translators. Translators do indeed assemble glossaries, but they also look to the associative meanings of words, and the ways that words are characteristically used (Baker, 1992;

Danks et al., 1997). We may usefully test and interpret our object-oriented analyses, our entity-relationship diagrams, and our specification languages against more macro-level, interpretive, associative representations. We should find agreement among these different levels of analysis – or we should review and revise our more elemental definitions until they no longer conflict with these broader accounts.

Who Moves?

A second major question in translation studies was summarized by Schleiermacher's influential proposition: "Either the translator leaves the writer alone as much as possible and moves the reader toward the writer, or he [sic] leaves the reader alone as much as possible and moves the writer toward the reader" (Schleiermacher, 1813/1992). This is to say, should the translator render the source in the recipients' concepts and world-view, or should the translator require that the recipient work (stretch, learn) to understand – if not the *language* of the source – the *concepts* and world-view of the source? (For discussions, see Benjamin, 1969; Friedrich, 1992; and Krupat, 1992).

This question has had a long and troubling history in translation. Hundreds of years ago, Saint Jerome stated that the translator should approach the source's language in the manner of a conqueror, disposing of the source's language (and, by implication, of the source as well) as any colonizer might dispose of the colonized.[3] As noted earlier, some theorists in the tradition of colonial studies have analyzed translation as part of the subjugation of less powerful peoples.

Let's take several HCI examples. When we perform a requirements analysis, we make many choices about how we will present the users' work to the development team. We choose whether to write about the components of the work, as seen by the users, or the components of software system or data architecture, as seen by the developers (see Floyd, 1987). Now, of course, there is supposed to be a correspondence between these two worlds. However, as HCI analysts have learned repeatedly, the correspondence is seldom perfect, and something is inevitably "lost in translation" (to use a colloquial expression) as the users' world is re-presented in the software developers' domain.

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[3] "The translator considers thought content a prisoner which he translates into his own language with the prerogative a conqueror." And here is Quintilian: "The goal is to surpass the original and, in doing so, to consider the original as a source of inspiration for the creation of new expressions in one's own language…" Quotations are from Friedrich (1965/1992), who appended Nietsche, "Indeed, at that time translation meant to conquer." Nietsche went on to say, "And all this was done with very best conscience as a member of the Roman Empire without realizing that such action constituted theft" (1882/1992).

The result is often a system that misses at least some of its objectives.

Translation scholars have argued that, in some cases, it is important to maintain the "strangeness" of the source culture when presenting (translating) it to the receiving culture (e.g., Bassnett and Lefevere, 1993; Krupat, 1992; Venuti, 1995). If we think of "strangeness" as a presentation of the users' view of their own work, then this heuristic may serve us (and our users) well in working with our software professional colleagues. But then we are asking our colleagues to "move" (in Schleiermacher's proposition) closer to the users' world view. We need new methods for making this movement easier for software professionals. Contextual analysis and contextual design have made strong claims this kind of translation of world-view for software teams (Beyer and Holtzblatt, 1998), without requiring the kinds of heroic immersions that are frequently recommended in participatory design (e.g., Blomberg et al, 1993).

As a second example, consider the act of design. When the development team creates a user interface, they have the choice of presenting the system in their own (developers') language, or in the users' language. We as designers or evaluators have seen many difficult cases when the language was more developer-oriented than user-oriented – in fact, many of Nielsen's heuristics in heuristic evaluation (Nielsen, 1994a) apply to just this sort of failure in translation. A frequent response by designers and developers is to provide additional documentation and training, so as to make the system more intelligible to the users.

But do documents and training make the system more intelligible? They do not, of course, literally affect the system in any way. The target of the documents and the training is to transform the users – in a manner of speaking, to make the users more "intelligible" to the system. Returning to Schleiermacher's conception, documents and training are yet more ways to make the users "move" to the software professionals. By contrast, the methods of participatory design and of contextual analysis and design may be used to "move" the software professionals closer to the users' perspectives.

Thus, Schleiermacher's question has direct relevance for HCI. The answers to his question may be subtle. For example, if the system is being created to support an existing activity or work process, then the *users'* language may be critical. However, if the system is intended to create a new environment or a new way of working, then it may be crucial to *avoid* the users' language if that language would imply old solutions or old ways of working. In Muller (1997), I described this choice as the question of a *reference language* for the HCI analyst's work: That is, whose language would be used to make authoritative claims

about the problem being addressed or solved by the system. I claimed that, like many of the "ethnocritical heuristics" in that paper, there was no generally applicable answer: Rather, the answer depended upon many factors (but the question should be asked). The answer to Schleiermacher's question depends in part on the purpose of the translation, and on the purpose of the system.

Foreign and Domestic Subjects

A third choice in HCI translation emerges when we reconsider the process of *social construction* in translation and in HCI generally. I argued in the preceding subsections that the HCI worker's choices can have a strong influence on the construction of the "foreign subject" – i.e., the person or group that is being described in the translation. Several theorists have also noted that the *choice* of what to translate – in our terms, the choice of what users or workers to study, the choice of which tasks to focus on – also has a subtle constructive effect (see again Venuti, 1995; see also Bachman-Medick, 1996).

We construct a foreign *other* – the user or users – whom we present to our domestic recipients (e.g., the development team). In most work settings – and in HCI as a discipline – certain categories of users or workers appear as obvious subjects for our analyses and our translations. These apparently obvious subjects establish a set of norms of translation choices. For example, we often study knowledge workers in a relatively sympathetic manner (e.g., Kidd, 1994). However, our studies of less privileged or lower-status workers are often less sympathetic, and tend toward different outcomes (for review, see Muller, 1999). When we are able to make choices in whom to study, we may choose to support these established norms of whom to study, or we may choose new and less obvious subjects, leading to new understandings of human work and of the ubiquity of knowledge-work among people in diverse jobs with diverse status levels in their organizations (e.g., Muller et al., 1995).

Where does HCI Translation Occur?

The last choice in HCI translation that I want to raise in this paper is concerned with where translation takes place. At first glance, this choice appears to be a repetition of my earlier question ("who moves?"). I intend something different here. Consider the example of a software development team that works on a project for a specific group or category of users. The HCI work (i.e., the translation) can take place *within* the development team (treating the users as outsiders or *others*), *within* the users' workplace and organization (treating the development team as outsiders or *others*), or at a boundary or frontier *between* the two organizations (encouraging dialogue between the different perspectives of users and developers) (Muller, 1997).

Many HCI methods have been concerned with situating the HCI work at a "good" or even "best" place with respect to these boundaries (e.g., Beyer and Holtzblatt, 1998; Schuler and Namioka, 1993). Translation theory can again aid us in

thinking about these choices. In addition to the Schleiermacher question ("who moves?"), translation theory offers us several concepts of boundary work. Krupat (1992) developed the theory and practice of ethnocriticism, a rich set of concepts and high-level practices toward maintaining cultural awareness on both sides of a boundary or frontier between cultures (or, for HCI, between work practices). Berman (1995) advocated a constant movement back and forth between cultures. Based on the influential cultural critiques of Bhabha (1994), Bachman-Medick (1996) suggested the deliberate construction of a novel, uncategorizable space for communication that could exist *between* the cultures – a "third space" (e.g., Evanoff, 2000) that partakes of some of the attributes of each of its neighboring two cultural spaces. This hybrid third space has the interesting properties of belonging to neither source nor recipient, of containing and fostering multiple perspectives (Krupat, 1992), of allowing all concepts to be questioned and re-evaluated, and of encouraging the formation of new, hybrid concepts. I recently analyzed a large collection of participatory methods (e.g., workshops, story-telling, dramas, photo-documentaries, games, and non-technological prototypes) in terms of their ability to create such a hybrid or third space, focusing on the creation of highly intelligible media that become opportunities for interpretation, explanation, and subsequent representation in support of system design and development (Muller, 2003).

CONCLUSION: REFLECTIVE HCI THROUGH TRANSLATION THEORY

In this position paper, I have applied selected concepts from cultural critique and translation studies to problems in HCI. I have found these concepts useful over the past seven years, in negotiating some of the epistemological, ethical, and political challenges that are a necessary part of HCI research and practice. HCI is, by its nature, a kind of interdiscipline – an evolving, improvisational hybrid space of its own, among more established traditions of software engineering, formal requirements analysis, behavioral science, and social science.

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Technologies for Reflection

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A CALL FOR REFLECTIVE DESIGN

This paper is a proposal for and case study in 'reflective design' as an agent for critical thinking and potential change. Many previous studies have looked at technology as an (unconscious) agent of social change [e.g. 18] and examined the bi-directional influence of people adapting technology and technology adapting people's practices [e.g. 13, 10]. Disciplines of anthropology, sociology, psychology, design and cultural studies, to name but a few, explore how the shape and evolution of technology offers insights into the values, beliefs, and development of people as individuals and societies.

We build on this body of work by designing technology with the primary intention of stimulating reflection on existing practices and perceptions. Social scientists have studied technology as found artifacts reflective of ways of being and doing. Critical technical practice [1], on the other hand, has allowed researchers themselves to reflect on and change these assumptions as a part of technical practice. We are combining these ways of thinking to devise technological devices that encourage both ourselves as researchers *and* our users to reflect on and perhaps to change common perceptions, relationships, or behaviors. We call this approach to technical research, which draws on similar strategies in design [e.g. 4] and the information arts [17], reflective design [6,15].

Reflection is not a natural result of technology design because it tends to encourage reification. This obstacle to change occurs in two important ways. First, computer models tend to require a codified way of defining and instantiating practices. This codification necessitates viewing a practice or construct as something primarily static governed by set rules and options. Secondly, the fact that practices are codified suggests that other alternative practices are not addressed. Features that are implemented often represent unarticulated choices to support some activities at the expense of others. It is in environments where technology is most often employed to reify existing practices where reflective design is most powerful.

DESCRIPTION OF THE DESIGN SPACE

In this case study, we are looking at technology designed for a generally traditional and conservative environment, namely art museums. Art museums in many ways have embraced technology from information kiosks to digital take-home collections of art to virtual museum web sites to audio and video tour guides inside the museum [11,14]. In some art museums, computational devices enter the museum as art itself, such as Simon Penny's Petit Mal at the Otso Contemporary Art Museum or Ken Goldberg's Ouija 200 at the Berkeley Art Museum.

We propose, however, that most applications of technology, whether on the side of art or tool, reify traditional museum practices. Specifically, technology in art museums tends to support the established roles of visitor as novice or passive recipient, the curator or exhibit designer as expert, and the artist as a remote entity communicating through his or her art or the curator's interpretation of this art. Furthermore, when implemented as a tool for art museums, technology is often designed to support the practice of information transfer between curators as expert providers and visitors as novice recipients. This is a valuable communion but suggests a limited view of what the museum experience could be.

We are seeking instead designs that draw the visitor's attention to these practices and the role of technology in them, as well as designs that potentially create space for new practices and perceptions.

TECHNOLOGY FOR CHANGE IN MUSEUMS

A quick look at one of the most recent technology additions to art museums illustrates how technology design tends to perpetuate as opposed to challenge existing practices in museums. Handheld context-aware computers are being explored as an alternative or supplement to the popular audio tour guides many art museums offer. Most of the focus in designing and evaluating these guides has been on usability issues, such as supporting intuitive navigation, providing information just in time, or

customizing personal tours [2].

An advanced version of such guides called the Museum Wearable was developed at the MIT Media Lab [16]. Although this guide challenges the amount and customization of information typically available on a tour, it still supports a model of information transfer and individual, perhaps at the expense of social, experience. The success of the Museum Wearable is measured in part by how accurate the system is at anticipating a visitor's needs or interests. In other words, the emphasis is on making the system more aware of the user's context and using this awareness to present appropriate information.

It is only natural and sensible that technology design for art museums support existing practices. In actuality, many visitors to museums are there to seek information, to learn, to be entertained, etc. We are not suggesting that these practices and the technology to support them are wrong or without value. Instead, we are suggesting the opportunity to provide additional support for alternative practices. One such practice is the communion between visitors -- honoring the social presence of museum spaces -- and reversing the role of the visitor as novice to the visitor as expert or contributor.

In an early study of handheld guides in museums for example, the Cornell HCI Group pushed on the one-way information transfer model by adding a bulletin board for visitor comments and questions [7]. In implementation, however, we found this feature underwhelming in the type of dialogue it generated and the value visitors attributed to it. When analyzing this result, we compared the experience to a similar handheld guide developed for campus tours [1]. In the campus setting, tour participants utilized and enjoyed the ability to leave comments about different areas of campus. In short, similar populations used similar devices for a tour, but in the museum experience the social aspect was far less popular.

Comments from these different studies indicated that one of the reasons people did not leave comments during the art tour was because they underestimated their license or authority to speak about art. In contrast, on the campus tour, students using the guides felt their experiences were valid and important enough to share with others. For the museum environment, simply having a channel for visitor communication and social engagement is not enough. There must first be motivation for and awareness of this potential.

This observation of how deeply embedded existing practices of museums are led us to design devices that would begin by first illuminating the social presence of museums and the individual's mark on this collective space. Our goal is to draw attention to the museum not just as a house of objects but a collection of people dynamically changing the museum experience.

STRATEGIES FOR REFLECTIVE DESIGN

There are several possible strategies for reflective design in museums that would draw visitor attention to elements of the museum experience that are under-represented or over-represented in existing technologies. One possible strategy for reflective design is to violate expectations through destabilization or defamiliarization.

Destabilization is the approach used, for example, in technology value fictions [4]. A technology value fiction employs existing or plausible technology for disturbing or questionable ends. For example, Maywa Denki's Uke-TEL clock [5] consists of a small water basin of swimming fish. A series of sharp spikes, suspended above the basin, release on the hour potentially spearing the fish. Value fictions tend to connect with people already questioning reified values. For audiences who miss the point, at best the value fiction causes discomfort to be examined and perhaps resolved. At worst, the fictions reinforce the values being called into question.

A possible defamiliarization experience with technology in museums might be to use electronic tour guides for presenting questionable, even false, information or information not in the curator's authorial voice. This might serve to draw attention to the role of possible other voices and the amount of trust placed on both the curator as expert and the technology as a deliverer of truth or facts. However, as with the value fictions example, the danger here is that the design intention might resonate with a very limited audience and serve as a source of confusion, alienation, or misinformation.

We have opted instead for a strategy of explicit re-presentation. This strategy starts from the position that there are practices and occurrences that are so habitual we don't even see them anymore. If we re-present these practices in a different way, however, it draws them into sharper relief. People recognize implicitly that the museum is a social place and unconsciously they will use peripheral cues of others' presence (e.g. noise level) to inform and influence their experience in a museum. Visitors may not attend *consciously*, however, to this presence and reflect on the potential for social engagement or recognize the effect of their individual choices on the museum experience as a whole.

If we re-present the presence of people in alternate ways, such as a large visual display of patterns and preferences, this may serve to stimulate reflection both on the museum experience and the role of technology in this experience. One option would be an art installation that draws attention to the presence of others in the museum and the tendency of technology to support individual information transfer experiences. The difficulty of this option is that it maintains to some degree the same museum practice of remote artist communicating a message

through his or her art around which visitors may choose to engage. Instead, we wanted something that would not just draw attention to one particular installation but would pervade or reflect the entire museum experience.

We therefore set out to create something that would have aspects of art, as a commentary open for multiple interpretation, and aspects of a tool, with a level of utility and task-focus. The desire to position the re-representation displays as tool-like was also motivated by the fact that we were working within the constraints of a conservative environment. We could not build something that challenged existing practices outright. Instead, we needed to design something that could both support and build from traditional views and practices of technology in museums.

DESIGN SKETCH

We have worked with curators and museum visitors to identify what type of information about the museum experience is of value and how best to display this information. Simultaneously, we are experimenting with different data collection methods, from tracking visitors' locations and choices via their use of handheld guides to monitoring indicators of presence and activity levels with embedded sensors throughout the museum space. We will describe some preliminary results of the research on displays before outlining our next design for testing.

In an initial user study, we presented two focus groups with several displays about social presence and activities in a generic museum space. The initial idea was that these displays would be projected to visitors on their handhelds as a navigation tool and also projected on a large communal space, such as on a blank wall in the foyer or even the side of the museum building. One focus group consisted of six museum curators and staff. The second focus group consisted of 11 museum visitors.
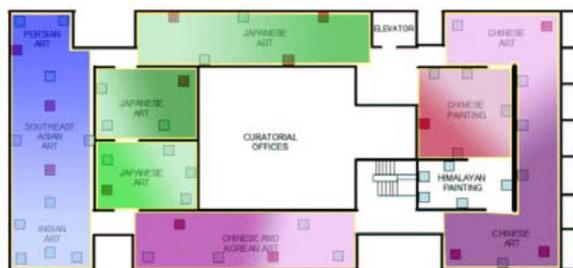

Figure 1: Atmosphere Display

The displays showed visualizations of population (e.g. population density around certain exhibits), popularity (e.g. frequently visited objects), paths (e.g. common paths of different demographics), and affect (e.g. the emotional climate of different gallery wings). The displays ranged in the level of abstraction. For example, some displays would represent individuals in the museum against the backdrop of a museum

floor plan. Other displays depicted the atmosphere of different rooms in the museum like a climate map (see Figure 1). One display tested the concept of emergent art: where visitor patterns and preferences contributed to an aesthetically pleasing impression of visitor experiences. In this way, visitors would not just be viewing art but participating in a creative process as well.

We found in testing these displays that both visitors and curators found the views interesting, informative, and potentially behavior changing, although to various degrees. From a qualitative analysis of participants' comments we will underscore three main lessons for future designs:

Engagement Through Ambiguity. People tended to engage more with the ambiguous displays [8] or displays that lent themselves to user-constructed narratives [12] as opposed to the literal displays that left little room for interpretation.

Finding Self in the Collective. Some of the displays depicted only aggregation and for these participants asked to be able to identify their own place. There was an expressed desire not necessarily to isolate oneself but to be able to see how one's own participation influenced the overall display.

Traces of Expression. People responded enthusiastically to displays that allowed them to leave a mark in the museum, such as the emergent art display or the popularity displays indicating how one's preferences influenced the paths of others.

Context Specific Designs. Our initial displays were designed for a generic museum. We recognize, however, that the displays' interpretive affordability requires resonance with a specific museum context.

Given the lessons described above, we are currently building a new design implementation for the Johnson Museum of Art at Cornell University. We are working with one floor of the Johnson Museum, the Asia Gallery which houses several objects about nature, contemplation, and spirituality. We wanted our designs to therefore resonate with this type of content. Furthermore, the physical space of the museum is also largely influenced by nature as the external corridors consist of wall-to-wall windows looking out over Cayuga lake and the surrounding hills of Ithaca.

After reviewing several possible designs, we ultimately decided to build as a first test a visual display of presence and an auditory display of absence. The auditory display would consist of a series of wireless speakers placed throughout the Asia gallery. The speakers would emit bird sounds emanating from areas of the gallery with the least amount of visitor traffic. As people move into the space where birds are singing (metaphorically), the bird sounds will stop and move elsewhere. In addition to the auditory displays of absence we will

also project displays of presence or popularity represented by a montage of popular exhibits in the museum (see Figure 2). Both the absence and presence information will be drawn from a combination of sensors and use of handheld guides.

Figure 2: Simulated Object Popularity Display

EVALUATION

As we look toward implementing the new design in the Johnson Museum, one of the biggest issues revolves around evaluation. How will we define success? And by what metrics will we measure this? Returning to our objectives of causing reflection on the museum experience and the role of technology beyond information transfer, one possible metric of success would be eliciting people's perceptions of the museum experience before and after the introduction of the display. What or how do people talk about the museum experience without the display? Are the narratives people tell about the museum experience different with the displays? What are people's interpretations and valuations of the displays?

As we explore different methods for answering the questions above, we will look toward combining methods for evaluating a 'tool' such as traditional usability studies and methods for evaluating 'art'. This latter approach is somewhat controversial [9]. What does it mean to evaluate art? To some degree, artists or art historians would argue that art is beyond evaluation – people either get it or they don't. Yet, there are lessons to be learned from performance art, for example, in terms of what characteristics of exhibits tend to engage people versus exhibits that don't command or hold attention and involvement.

CONCLUSION

In critical technical practice as conceived by Agre, critical reflection is dialectically linked with technical research through the researcher's reflection on his or her own work. We are extending critical technical practice to incorporate reflection not only by researchers but also by users. In the process, we are beginning to leverage user reflection to help us understand and refine our own assumptions. Reflective design, therefore, supports both user reflection and our own.

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A Short Note on Design Troubles & Enlisting Critical Reflection

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INTRODUCTION

In this paper, we examine the use of *lists* in mothers' work. Drawing on an ongoing ethnographic study of mothers' work in the home, we reveal how the list is occasioned as a resource to order domestic life. Despite its seemingly mundane character, the list is shown to be one of the assemblage of *socially accountable artifacts* through which the order of the home is routinely accomplished [2]. Specifically, we demonstrate how mothers mobilize lists to organize the multiple and disjointed activities and events involved in home- and child-care; how this organizational work serves to configure the moral order of the home; and how this (re)configuration conceals the considerable demands involved in the 'smooth' running of the home.

Viewed in this light, the use of lists in the home foregrounds a concern that is of direct relevance to both designers and practitioners in HCI. Because artifacts such as lists are immediately implicated in the business of producing social order, designers and practitioners find themselves in a position where they are directly accountable for their participation in building technological alternatives. That is, in designing solutions, designers and practitioners cannot help but have a say in how people order their lives. Using our presented findings as a rhetorical tool, in the latter stages of this paper we examine this concern and question whether HCI is, unavoidably, a 'critical practice', at once caught up in promulgating particular social orders and subjugating others.

STUDYING MOTHERS' WORK

The data presented in this paper are drawn from ongoing interviews and field observations with five mothers from middle- to high-income families in London. The women, all 'full-time' mothers, form a close network of friends. All the mothers have at least two young children, and all have a four to five-year-old child in the same nursery class. The women and families were chosen because the aim was not only to investigate the independent work of mothers in the home, but also to examine if and how women work collectively in the domestic context. Notably, the focus on the middle- to high-income socio-economic group is recognized as one limitation of this study—clearly they are not representative of the large number of women that work in the home. It is hoped that this project will be a part of a growing body of research on this broad topic by investigators in the fields of HCI, CSCW and elsewhere.

Lists in the Home

On close inspection, it would seem that what lists provide is a way for mothers to negotiate a complex and often competing litany of demands. For mothers, the running of the home is achieved through the careful orchestration of the fragmented worlds of family members, activities, events, household chores, etc. Lists offer a means of marshalling these people and things so that they can 'neatly' operate within the established order of the home.

A serious hurdle to what is ostensibly the organizational component of mothers' work is the divide between the demands of childcare and the myriad of other activities that make up domestic life. What is sometimes overlooked, or possibly unapparent to non-parents, is that children do not fully understand the social rules that govern ordinary behavior and/or are not altogether willing to conform to the established social order of home (and adult) life. Thus, there is sometimes an element of chaos that can make the accomplishment of routine tasks and activities a serious challenge. For example, most mothers will think twice about a grocery-shopping trip with a two year old who is near to either a nap or meal time. In this context, lists act as a repository, a means of catching and fielding the various bits and pieces of information that go into the running of the home. They also function as markers, bridging the divide between the 'outside', adult world and the chaotic world of children. This subtle but crucial role of the list and its relationship with the arrangements of home life is what we now turn to.

Form and Content of Lists

All the mothers in the study relied on some type of list, but the forms varied considerably. Anya (six months pregnant and the mother of a son of 4 and daughter of 2), for example, has several legal pads and a diary, which she places strategically within her home, forcing her to walk by them several times a day depending on her activity, to act as constant reminders. Carrie (with a son of 1 and daughter of 4), on the other hand, rarely uses paper and instead relies on calling her home phone from her mobile (cell) phone and leaving herself messages on the answering machine. Kate (eight months pregnant and the mother of two daughters, 2 and 5), scribbles notes down on to the backs of envelopes, which she explains invariably disappear. She finds the act of making lists, however, helps her remember what needs to be done.

As for the content of lists, the ways in which items are recorded and arranged can appear, at first sight, muddled. We find, for instance, that household chores are clumped together with doctor's addresses, reminders for husbands, phone numbers, shopping lists, and arrangements for children's birthday parties. Indeed, it appears to be one big collection of miscellany. There can be method to this apparent disorder however. To examine this further, let us consider the use of notebooks by Amanda, the mother of two girls.

Amanda typically has several notebooks at any given time dedicated to a variety of activities. The determining factors for whether an activity warrants a separate notebook seems to be how much information is being generated on the particular subject. For example, her house is being renovated, and she has a notebook dedicated solely to that project. She also runs the parents association at her daughters' school and is involved in fundraising and has a separate notebook relating to that. However, in the interests of compactness, portability and convenience, she deliberately limits the number of notebooks she has at any one time. Through this use of notebooks, we see a simple means of categorizing or dividing up some of the activities which Amanda engages in as a mother, one that relies on the material features of paper and specifically notebooks [see 7].

In a page from the notebook Amanda carries with her when she is out and about—her daily, catch-all notebook for jotting things down that come to mind during the day—there is a mixture of items, beginning with "Sort out summer clothes" and ending with "read menopause info". Apparent from this list is that the categorization system Amanda uses by having separate notebooks does not apply. Rather than categorizing by activity, she uses a chronological means to group items—items get clumped together on the basis of being important for that day or the moment-in-time in which they are written. Through this we catch a glimpse of how the methods employed to categorize items are open to change and are situationally dependent; categories can be *produced*, if you like, on the fly and to suit the occasion.

Categories and the Moral Order of the Home
In itself, this way in which lists are 'occasioned' for the situation at hand is not news. Numerous other researchers examining systems design have made similar observations [most notably 9]. Specific to mothers' work are the ways in which items are divided (either into separate diaries or sometimes into groups within lists) and how this does a special sort of 'reconfiguration work' through which a *morally implicative order* to home life begins to emerge. In illustration, let us turn to an excerpt taken from a discussion with Anya.

> I tend to have one big page, a column on the left, a column on the right. There's what you might call the kind of financial and administrative stuff, and that's usually the main column, pay x bill, sort out car insurance, the sort of stuff which really matters if you don't do. And then I would probably lower down the page have the kind of 'where are Tom's socks?' I kid you not.

For Anya, we see how the list can be used to classify particular types of tasks and activities. By separating out household finances from mundane chores like finding her son's socks, Anya is quite deliberately carving-up and configuring home life. Dividing the page into columns and rows, she sections out home-work into orderly slices, a broad collection of tasks and activities that get done in the home, grouped and ordered into things that 'really matter' and those less important 'to-be-dones'. The list then serves as a helpful delegation device, configuring home-work and transforming it in to its right and proper order.

Through this prioritization of listed items, a moral order of the home emerges. From Anya's description we hear that socks get placed lower down on the page than "financial and administrative stuff"—a clear reminder of their status. Anya's last four words in the excerpt above, "I kid you not", do quite a bit to show where things stand in this hierarchy and go some way to explaining why. By using this phrase, Anya confirms that she is well aware of what we all know to be true (i.e., common sense)—that socks come after bills and insurance. The list then, in being used to prioritize work, reaffirms the moral character of the things that need to get done in the home.

The Merging of Worlds
The trouble with this reconfiguration and ordering is that it by no means emerges as a natural consequence of combining the various activities, events and people that are a part of home life. On the contrary, the work of mothers does not only demand the coordination of multiple and disjointed activities, but also the fusing of what are, for all intents and purposes, 'worlds' operating in stark opposition to one another. We get a sense of this in a conversation with Claire (mother to children of 8, 4 and 2):

> I find switching between child time and normal time the worst. The days I just do children, and can just slow down… do things the way they do instead of rushing around, getting things done… Sometimes it's better if I just have child time, or just have normal time. I have the least patience when I've had a day when I've been getting things done and then I have to switch back to their time.

Claire invokes a palpable division between the world inhabited by children and that of "normal time"—the world where things get done. We can glean from this that there is no simple fit between the demands of childcare and the rest of domestic life, and that a considerable amount of work is demanded of mothers to coordinate the two. In a sense, we might see lists as a reification of this achievement, embodying the substantial mental thought and physical effort that mothers must put into planning, arranging and pulling off the running of the home and the care of children.

The Hidden Work of Mothers
A final line of reasoning that emerges from the argument we have presented is that through employing the organizational systems and methods we have so far discussed (as well as many others), mothers can obscure the complexity of their own work. That is, by rendering the chaotic worlds

that revolve around family life in the form of lists, mothers conceal the considerable undertaking that is needed in the smooth running of the home. To unpack this possibly controversial point, let us take a look at an excerpt from an interview with Kate.

> Asked whether her husband transfers the content of her written lists to his PDA, Kate replies: "No, not really. Often they're quite domestic lists which I have. If I involve him in the list, it's because I'm expecting him to do something, *effectively.* And which sometimes works quite well, if he's in the mood. Umm, or sometimes it's because I've been asking Nick to do things, certain things, and I've given up and I've decided that I'll have to do them. I mean, on our kitchen table at the moment, there is a humungous list which I wrote when I got bored with cleaning cupboards this morning. I've got a feeling this is going to metamorphose into a bigger list that's got something to do with feeling a baby coming and wanting to make sure that you've done a whole load of filing, paid bills, you know, make sure that everything's up to date and being scared that you'll forget things because I know, if the baby turned up tomorrow, um you know, 90% of my lists would be erased from my brain because I couldn't help it because that's what happens. So you know, thinking actually I need to keep it all down somewhere. It's funny, lists. The world feels better when I have a list, maybe just because I don't have to remember it all but the world feels... the same way the world feels better when the house is tidy and all the toys are in the right place.

What we see in this excerpt is that for Kate, like Anya above, lists are delegated the job of making the world orderly. Kate, of course, is well aware that 'chaos' is an ordinary feature of the home. In composing lists, not only does she make the world feel "better", she tidies up the chaos by putting things in their "right place". However, what she also does is diminish the efforts of her own labor, sanitizing the real messiness of her work behind the supposedly '*natural*' rhythms of home life. This is apparent not only in the carrying out of *her* duties but also in the delegation of work to other family members. In talking of how her lists "come out" to alleviate the stress of having so much to arrange, Kate explains that lists also provide a means of communicating the orderliness of the home to her husband:

> Something often gets put onto a list by the end of the weekend cause nothing's got done and I've got stressed about it. And then, eventually, a list comes out. So generally speaking, the lists come out when I'm with Nick. It's also a way of communicating to him what needs to be done cause he hasn't got a clue.

Describing how a list can be used to delegate "something", presumably some task or activity, Kate reveals that the list is more than a mere itinerary of what must be done, but also serves as an implicit reminder of *who* has got to do *what*. Kate though, in both her excerpts, is doing more than merely describing how lists can be used to assign duties. In her first excerpt, notice how she assigns certain sorts of lists to the "domestic" world and, within the same turn, depicts this world as under her authority. Kate takes possession of lists of the *domestic* variety and places herself in the position of managing who has access to the tasks and activities they refer to. Similarly, in the second excerpt, but in a more emphatic manner, Kate implies it is she, and not Nick, that

has a "clue" on the matters that lists pertain to—on domestic matters.

The point here is not whether Kate is right or wrong in her delegation of domestic-work, nor whether she is right to assign herself as an authority on such matters. What is revealing is that she is quite specifically delegating the right and proper place for this work and that, in this case, it is the list that is mobilized to do this delegation. What is central is that Kate's carving up of the home's activities into manageable lists and her subsequent division of labor to undertake those activities sequentially transform what was once chaos into the taken-for-granted arrangements of the home. By invoking these taken-for-granted arrangements, home life is seen to have always been orderly and, thus, the (mothers') work needed to achieve that order is rendered inconsequential, quite simply *invisible* [see 6].

IMPLICATIONS FOR HCI

Thus far we have built up an impression of how mothers' work is supported, in part, by the use of lists. Through these artifacts, a disparate assemblage of things and people, operating in different renditions of time and place, are transformed into compartmentalized collections of tasks and activities ready to be resolutely crossed out once completed. In essence, what we see is how artifacts become bound up in everyday life, how they interleave with ongoing trajectories to (re)produce, (re)configure and render particular social orderings.

The 'Critical' Artifact

Important for HCI, this reveals that the technological artifacts that are designed to support 'work' are unavoidably '*critical*'. Critical, not in the sense that they articulate explicit commentaries, but rather, through their intended design and immersion in everyday life, they immediately conspire to make the world intelligible under certain terms [1]. For example, one might imagine how organizational tools such as Personal Information Managers (PIMs), designed to carve up time and categorize activities into the discrete worlds of leisure, work, domestic life, etc. (as they often do), enmesh with the routine practices of the home to cement, or in some cases contest, the established order. Through their use, PIMs, in this sense, sanction a moral order that privileges a particular division of labor, etc.

The trouble with HCI is that it has yet to recognize or consider this account of technology. It would seem that the emergence of the HCI project has occurred in such a way that it lacks the analytical resources to reflect on its practice and, as such, has sidestepped any obligation it may have to critically examine or be accountable for technology's role in privileging versions—or even visions—of social order.

From its inception, HCI has been closely aligned with the modernist program, whereby technology has been objectified, reduced, and 'black-boxed' [4, 5]. This essentialist turn has served to isolate social action/order by first creating a division between society and technology and then

authorizing technology's authority. The constructed divide has allowed HCI to comfortably focus on the localized and discrete arrangements of human-computer interaction whilst *camouflaging* the complex ways in which humans and (technological) artifacts intermingle to make the world intelligible (and ordered).

It is our contention that it is this ontology that has been the main stumbling block in recognizing the 'critical' role technology has in the wider social context and consequently incorporating a reflexive position in HCI. The teasing apart of technology from society has left little room for examining how the two interweave to produce social order and, in doing so, has prevented a thorough understanding of the interactions humans have with computers.

Reflexivity in Design

In our opinion, HCI must overcome this position in order to reflect on the inherent critical nature of the artifacts it produces. Not only would this broaden the scope of HCI to restore "authorship and thereby accountability to our relations with artifacts" [8], it would also directly contribute to the understanding of the situated *use* of artifacts and, specifically, how they might be best designed *vis-à-vis* the constituted social/moral order.

Different disciplines, ranging from the arts to the social sciences have been shown to provide various routes through which to achieve this reflection. Whatever the route, a key element of reflection is to contest the division between technology and social life, and, at least in part, to recover the complex interplays between humans and artifacts that serve to produce taken-for-granted social orders. In short, it is to provide a corrective to the modernist view of humans and artifacts as autonomous [8]. The recent designs of public benches presented by the Royal College of Art offer an example of such a corrective [3]. Displaying juxtaposed, digital renditions of older people's handwritten slogans on street-side benches, they contest the ordinary by breathing life into what might be considered a symbol of urban decay. Whereas graffiti is usually a manifestation of youth culture, this legitimizes it as a form of public expression and places the authorship in the hands of a population that is usually disenfranchised in urban life.

To conclude, and consider what this might mean in practical terms, we return to the body of empirical research presented in this paper. By attending to the interplay between people, artifacts and social life, our presented findings reveal a tension between what mothers do to successfully accomplish their work and how their work is made (in)visible. On the one hand, we find mothers coming up with a collection of resources and methods to make their work manageable amongst their mass of interleaving and competing demands. On the other hand, we find mothers 'producing' their work as an unremarkable and seemingly natural feature of home life. This is the stuff of being a 'good' mother, but it also serves to disguise or hide the hard work that goes in to juggling multiple tasks, activities, peo-

ple, times, places, worlds, etc. What is apparent is that there is something of a moral order being preserved here, something that is partially achieved and sustained through the routine use of lists.

As well as providing a practical tool for organizing home life, lists are shown to serve some 'critical' function. They grant a privileged status to the established moral order of the home by contributing to what Maushart [6] and others have referred to as the "invisibility" of women's work, where the caring and home-related activities, performed in large part by women, have been arguably marginalized because they are simply taken for granted.

This raises a specific problem for HCI practitioners and designers that might have been overlooked without the recognition and reflection of the critical role of artifacts. The problem that arises is that the optimization of the organizational work involved in mothering does not do away with the inevitable hard work of running a home and taking care of children, it simply eases the management and integration of the multiple activities. Crucially, it can also mask the hard work itself.

Designers and practitioners who wish to take on the challenge of building technological artifacts in this context are faced with having to reflect on the critical nature of their own solutions. They are confronted with the difficult task of deciding how their solutions might conform to an established moral order that serves to obfuscate the work performed by mothers' in and around the home. In practical terms, they must aim to provide a solution that at one and the same time eases the efforts needed in organizing the arrangements of home life, but that does not conceal the numerous and substantial demands placed on mothers.

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--- validity

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--- dry eyes

Twenty years on from the Ethiopian famine of 1984 the BBC broadcast a documentary. Michael Buerk revisited the people he had interviewed and the places he had visited. The programme also covered the subsequent events, including the Band Aid Christmas record and Live Aid concert.[1]

The scenes from the original footage were harrowing, even knowing that the events took place ago 20 years ago. In 1984 a young woman, Claire Bertschinger, had been in charge of a feeding centre for children at one of the major camps. Each day she would walk down the line of listless shrunken children and babies and select those who would be let inside. She did not choose the weakest. they would be fed for a day and die regardless – a day's food wasted. She chose only those she believed would be saved. A few moments assessment of pitted eyes, parchment skin and stick-like limbs and a choice: life or death.

She too was brought back to Ethiopia. For twenty years she had held the horror of that time, and believed that those she had worked with and those that had been at the camp, would regard her, like the commandant of Auschwitz, a dealer in death. Of course she was greeted with joy and love by all who had known her all those years back; they remembered the life she gave. Twenty years on her healing could begin.

Holding our own work against the lamp of these events is perhaps too revealing, but perhaps Band Aid itself is easier to deal with.

So, let's ask the question "was Band Aid a success?" and see what that tells us about the measures of validity in our own arenas.

--- success

Of course in true deconstructive style, Band Aid itself is not an isolated incident, but is part of this wider unfolding. Bob Geldof was moved by the reporting of Michael Buerk, by the images of death and suffering. He was a pop star, and a fading pop star, but also one who, through character or experience, was able to recognise that.

In the documentary he recalls how he thought that a Christmas record could net seventy two thousand pounds[2] but knew that a Christmas record by him would not be the success it needed to be. In humility uncharacteristic of the industry he went instead to his friends and contacts rather than going alone.

Of course we all know how Band Aid was in fact a great success and netted over eight million pounds with its own chartered boats and lorry conveys taking medical supplies and food to the heart of a war torn and drought stricken country.

Now this is a metric of success or validity that a traditional HCI practitioner would love: £8 million raised with an initial specification target of £72

innocence of snowdrops beneath rain damp trees and gold glow summer misted hills, the sound of laughter in the street outside, ring hollow in those dry eyes

thousand. We might question the professional competency of a designer whose system outperforms expectation by 10,000%, but we can hardly question the success. Hard numbers – yes!

But Band Aid was not just a fund raiser, but also a record and a song, so what about aesthetics? Bob Geldof said it didn't matter whether it was a good song or not, he just wanted it to sell. But would public guilt and a hall of fame as singers been enough on its own to make it a commercial success? Could bad music or bad lyrics have been simply a way of drowning out the silent eyes staring from those news reports? I would guess that unless the tune and the performance had been adequate it would not be the case. It is no good it simply being a good record to buy it needed to be a good record to listen to as well.

Of course, now we are treading the ground of more artistic judgement, or at least popular taste.

Not only were the listeners of Band Aid moved aesthetically but also they were often moved to empathy and action. For one Christmas, Band Aid changed the spirit of the public and, because of this, governments also had to change their policy. The £8 million the record made was magnified many fold in state aid. Perhaps the most major effect of the record was its affect.

… and for Bob Geldof himself, his life was changed forever. While the Boomtown Rats are known by one musical generation, his association with Band Aid and Live Aid cut across age and class.

--- for us

The practical success in raising money was an important criteria of success, but of course that required other forms of success. This is exactly the situation facing those of us in HCI as we consider issues of user experience. Like Band Aid neither purely functional nor purely aesthetic considerations are sufficient to understand the full issues.

Traditional HCI takes its notions of theoretical validity from base disciplines such as psychology and ergonomics. Usability testing and metrics have formalised this in terms of measurable efficiency and effectiveness and research looks towards scientific experimental method. The truth of a design rule and the measure of an interface's value are taken from the external aspects of its behaviour in use.

In contrast, literary and artistic theory looks for its validity in less objective areas. M.H Abrams, in the introduction of *The Mirror and the Lamp*, says "A good critical theory has its own kind of validity. The criterion is not the scientific verifiability of its single propositions, but the scope, precision, and coherence of the insights that it yields into the properties of single works of art and the adequacy with which it accounts for diverse kinds of art."[3]

It is interesting that this focus on insight does not refer at all to the success or quality of the works being studied. However, it is clear that much of the historic study of arts has focused on trying to understand what it is that makes a work 'good' and how to achieve this quality in practice. For example, the study of metre and rhyme can be used both to account for some of the 'quality' of verse and to guide the poet.

hands that fed, turn magazines and open tins of soup, feel velvet moss on autumn walks and gather empty milk bottles at night, but still recall the paper touch and sickly drag of weightless flesh

This tension between the singularity of each work and general rules has been recognised for many years. The classical Roman author of *On the Sublime*, known as Longinus, writes of other contemporary critics "Works of natural genius are spoilt, they believe, are indeed utterly debased, when they are reduced to the bare bones of rules and systems.", and he then goes on to counter this view and produces a work of literary criticism that has been influential for nearly 2000 years![4]

This classical voice sounds strikingly familiar if we consider those advocates of various models and theories of HCI who seek for generalisable knowledge and those who emphasise the more contextual and singular aspects of each interaction and situation.[5]

This has been a problem with 'normal' work-based systems and the design of them. However, it is even more problematic when the systems we design are intended to elicit emotions, to be fun, to yield experiences. These things take their validity from their subjectivity.

John Searle, famous for his Chinese Room Argument, distinguishes two types of subjectivity: epistemic and ontological.[6] A statement such as "I think the Empire State building is 1273 feet tall" is epistemicly subjective - it is a matter of belief. In analysis, science prefers epistemic objectivity – the measured height of the building. However where personal preference, aesthetics, pain or other feelings are the domain of discourse, as in this work, then we have ontological subjectivity - where the subjectivity is the very essence of the thing being studied.

However, the development of certain types of art in the latter half of the 20th century also gives us cause for caution. The subjectivity of experience is transmuted into a critical tradition where the values are aesthetic have no grounding outside the cognoscenti. The role of theoretical critique of human experience should be to explain the felt effects not define what they should be.

--- the real thing

UNIVERSE

↑

WORK

↙ ↘
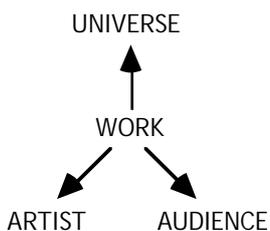
ARTIST   AUDIENCE

To discuss critical theories M.H. Abrams uses a framework that is surprisingly similar to ones we see in HCI. He looks at four elements: the artistic work itself, the artist who produces the work, the audience for whom the work is produced and the 'universe' the people, events and topics that the work is about. Adams uses this to discuss different critical theories which often tend to focus on one or other element.

In HCI we can substitute designer for artist, user for audience, context and domain for universe and the designed system for artistic work. In HCI we also find that different techniques focus on designer, user or context.

The universe is interesting as there are often two things that a work is 'about' – its subject matter and the deeper reasons for its production. Miller's 'The Crucible' is about the witch trials in Salem in 1692 and also 'about' McCarthyism in the 1950s.

When Claire Bertschinger first heard Band Aid over a crackling radio set she thought it was a sick joke, someone making money off the back of those she saw dying around her. It was only later that she realised that it was not only about the famine, but 'about' making money to alleviate it.

the sound of jumbo jet or wagner at full volume cannot drown the silent stare, accepting little when all is lost and ears still hear the sound of those dry eyes

The first 'about' is concerned with the internal nature of the song. The second 'about' is concerned with the why, the external meaning; it is a single utterance within a wider context: the economics of EU grain and butter mountains, the politics of a war over parched land and dying children.[7]

Band Aid's validity was not in measurable profit or felt experience but in this other 'about'. Looking towards this other validity seems equally important as we practice and theorise in HCI.

--- notes

1. *Ethiopia: a Journey with Michael Buerk - This World*. Clifford Betsall (director), Kern O'Conner (editor). BBC2 9pm, Sunday 11th January 2004.
2. I'm not sure where the figure of £72,000 came from, perhaps a previous Christmas record. However, this is figure the target figure that was iterated several times in the programme.
3. M.H Abrams. Chapter 1 *Orientation of critical theories*, from *The Mirror and the Lamp: romantic theory and the critical tradition.* 1953.
4. Longinus *On the Sublime*. In T.S. Dorsch (trans.) *Aristotle Horace Longinus: Classical Literary Criticism*. Penguin Books, 1965
5. This tension is also evident in more recent theory. The concept of iterability is central to the distinction and lack of distinction between spoken word and text in Derrida's writings and followers. Each utterance of a symbol creates a new instantiation which is both the same and different from previous utterances: "the structure of iteration … implies both identity and difference" Jacques Derrida, *Limited Inc.* Evanston, Illinois: Northwestern University Press, 1988, pp. 53. quoted in Section 4.1 *Iterability* of Kevin Halion. *Speech Act Theory and Deconstruction: A Defence of the Distinction between Normal and Parasitic Speech Acts.* PhD Dissertation, McMaster University, 1989
6. J. Searle. *The Mystery of Consciousness*. Granta, London, 1997.
7. On reading a previous draft of this, monica schraefel pointed out that there was an interesting further context in that this was all happening at the time of the British miners stroke. Reflecting on this, although there were not millions of children dying in the UK, there was certainly considerable hardship and hunger amongst the families of miners. Further the causes of the Ethiopian famine were as much to do with the war raging there as the drought, and the famine, by depopulating the rebel territories, was to some extent a tool of war. Similarly in the UK the government sequestered the funds of the miners union cutting stroke pay and thus forcing many to break the strike due to hunger. monica wondered whether in a way it was easier for people to acre about those far away than those on their doorstep. Similarly in preparing this paper I wondered am I, like Claire Bertschinger thought when she heard the Band Aid record, in some way exploiting or trivializing the Ethiopian famine in drawing the analogy between Band Aid and HCI design. Turning this on its head I wonder whether it is more that we can easily as researchers, artists or designers deflect away our own responsibility in the small for our creations by seeing it as unimportant in the large.

Evaluating Technologies for Ludic Engagement

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ABSTRACT

Methods for evaluating workplace systems may be impractical or unsatisfactory when evaluating systems meant to support ludic engagement in other spheres of life. Instead, we suggest that it may be appropriate to use approaches that elicit interpretation of systems from the number of roles relevant to them. We discuss two methods for doing this, *storytelling* and *cultural commentaries*, in the context of two examples of designs for ludic engagement.

INTRODUCTION

As a discipline, HCI has a great deal of experience designing interfaces for the workplace. In this setting, systems are usually considered valuable insofar as they are *useful* and *usable* [9]. This implies, typically, that systems are 'solutions' that should address frequently encountered problems, that they should provide more efficient and effective ways to handle these problems, and that they should be easy to understand and operate.

A number of techniques have been developed within the HCI community that are useful in evaluating the claims of such interfaces. These range from controlled laboratory studies that test specific hypotheses to relatively looser user studies that assess system usability.

Designing for Ludic Engagement

As technologies are increasingly designed for domains outside the workplace, however, it is appropriate for them to emphasise new values. After all, people in non-work settings often act as *Homo Ludens*, engaging with the world as playful creatures [6, 4]. We wander and wonder, explore things out of curiosity, toy with ideas, and act out imaginary dramas with friends. Play, from this point of view, is not just a matter of entertainment or wasting time, but is also a means by which we develop new ideas, find new perspectives, and explore new ethical and aesthetic standpoints.

Systems designed to support ludic values differ significantly in their assumptions, values, and techniques from those developed for the workplace. Rather than being useful and usable, they are rich, ambiguous, and open-ended. Rather than offering clear solutions to common problems, they offer situations for people to appropriate, explore, and interpret. They offer resources for exploration [2], suggest unfamiliar or extreme narratives [1, 8], or provide constrained media [10] or unusual situations [5] for people to explore.

Developing technologies for ludic pursuits raises problems of evaluation, however. Traditional methods are often unsatisfactory for dealing with such systems:

- Because ludic designs are meant to promote *idiosyncratic appropriation*, it is difficult to predict exactly what people will do with them.

- Genuine appropriation is usually the product of *long-term use*, posing challenges for many evaluation methods.

- Such systems often depend on being encountered in people's *everyday environments,* making laboratory studies problematic.

- The *playful engagement* emphasised by ludic designs can easily be inhibited by laboratory assessments.

In sum, many traditional evaluation methods are difficult to apply to designs meant to encourage more open-ended, playful activities.

Assessing appropriation

Even where traditional methods may be applied, the results may seem unsatisfactory. Evaluation has two facets: on the one hand, we want to judge whether a system is a 'success' by some criteria; on the other, we want to better understand the experience of using it. These can be incompatible goals–the summary statistics used to show significant differences in task performance may tell us nothing about the experience of using a system, for instance. Conversely, a rich description of user experiences with a system may not 'prove' its success, since it will invariably reflect interpretation on the part of those producing the description. Nonetheless, such a description may give us the grounds to reach our own conclusions about the success of a system, and moreover can be an invaluable resource in understanding possibilities for redesign and improvement.

In the rest of this paper, we describe two case studies in which we have used people's interpretation to assess the experience and success of prototype systems. Apart from any intrinsic interest in the methods we have used, we believe these case studies are useful as examples of the

role of *co-interpretation* in the evaluation of ludic designs.

USER AS STORY-TELLER: THE DOUBLE DECK DESK

The Double Deck Desk (Dddesk) was a standard-sized office desk at ground level with a raised platform and integrated table about 3.5 meters above the ground ([3]; see Figure 1). Prototype 'Reflection Engine' software projected onto the lower and upper desks allowed people to create 'mindmaps' – words arranged to show patterns and relations among concepts – across the two desks using keywords automatically culled from their existing files. The intention was to combine physical height with software functionality to encourage people to reflect on the fundamental trends and issues emerging from their work.

Figure 1: The Double Deck Desk

For ten days in November 2000, we installed a prototype Dddesk in the atrium of Hewlett Packard's Bristol Research Laboratory (Figure 1). The Dddesk's deployment within Hewlett Packard was more similar to a performance or exhibition than a traditional evaluation. We did not seek to experimentally assess the Dddesk or its software, nor did we try to find volunteers to use it over any significant period of time. Instead, we showed people the Dddesk ourselves, or allowed them to explore it on their own with the aid of a 'users manual' explaining its operation.

Key to our understanding of the Dddesk's reception was the stories that people told about it. This happened spontaneously and continuously: As we constructed it within our studio space, for instance, some of our colleagues complained that it suggested surveillance over our closely packed working environment. Within Hewlett Packard the Dddesk's appearance was initially greeted with bemused speculations about vertical office-sharing, prompted, we learned, by its coincidence with a move to reduce office space. Even the placement of an inflatable space alien in the Dddesk's raised cockpit can be seen as a form of storytelling.

We sought to encourage storytelling as a means of understanding the Dddesk by running an informal contest within Hewlett Packard for the best story about it. Although the response was extremely low, the results were interesting. One story, for instance, described the Dddesk being used in a child's room by parent below and child above. Another saw it being used as a setting in which defence lawyers could practice dominating the opposition. As far as we could tell, nobody spontaneously interpreted the Dddesk according to our

original intentions of providing an opportunity for contemplation and reflection. We began to see the Dddesk not as a value fiction [1] embodying a clear if unusual story about technology, but instead as a *projective object*, engendering many different interpretations.

Note that the stories people told were not about how the Dddesk was *actually* used, but instead speculations about how it *might* be used. Unconstrained by actual experience, people fantasised about the Dddesk, and their fantasies reflected both the Dddesk's attributes (i.e. its height) and their own interests, preoccupations and concerns. Storytelling as used here is thus related to its use in psychotherapy [7], though we are more interested in what stories tell us about our designs and their possible appropriation than we are about the psychological lives of the tellers themselves.

So was the Dddesk a success? It depends on the perspective from which it is interpreted. From the point of view of HCI, it was essentially untested. As an example of speculative design, it failed to embody a clear and unambiguous narrative of use. Seen as a projective object, it was extremely successful in evoking a wide variety of interpretations. In the end, the reader will be the judge.

CULTURAL COMMENTARY: THE KEY TABLE

For about a month in 2003, we gave the Key Table to a London family to live with in their own home. The Key Table (Figure 2) is designed to infer people's emotions from the way they set down their accessories (e.g. keys, change, mobile phone) when they come home. Load sensors supporting the tabletop measure the force with which things are placed on it, and by analogy to the heuristic that slamming doors spell trouble, guess that forceful placements equal emotional upsets. A wirelessly linked picture frame signals the Table's mood estimations, swinging out of kilter to warn other household inhabitants to tread carefully.

The Key Table is an example of using 'extreme narrative' in design, in which a system's narrative of use is purposefully exaggerated. On the whole, we did not believe that the Key Table could accurately reflect people's emotions. Instead we saw it as a somewhat

Figure 2: The Key Table

Figure 3: Filming the Key Table documentary

critical comment on current efforts to achieve 'emotional computing', as well as an invitation for users to find their own narratives. We hoped the Key Table would emphasise the importance of emotional communication in the home and encourage people to think about how they use objects and spaces to express their moods (perhaps to the extent of *purposefully* using the Key Table to express their moods).

As a major part of our evaluation of the Key Table's use, we hired a freelance news cameraman to produce a documentary about the piece (Figure 3). We tried to provide him with only a minimal description of what the Key Table was, our design intentions in developing it, and our more general conceptual interests. We hoped that the documentary he produced would embody his own interpretations of the piece as well as those of the temporary owners, and that by standing back from this process we would gain new understandings of the Drift Table in use.

This approach worked only too well. As the resulting documentary revealed, the family drastically reinterpreted our original suggestion that the table would reveal their moods. Instead, their imaginations were captured by the portrait of a dog that we had placed, almost without thought, in the picture frame. Based on this picture, they anthropomorphised (or perhaps 'caninomorphised') the table as an animated presence in their home. Instead of seeing the table as reflecting their own moods, they saw it as having moods of its own. This ended with them rechristening the table as 'Terrence the Table', playing games with it "just as we do our cats," and dressing the table in unusual materials. Moreover, they were aware of this process. As one member of the household describes: "I've actually started to think of myself as the artist. I don't know if I have the liberty to do that. Too late, I've *taken* the liberty…"

In part, this liberty appeared to come from our use of the filmmaker as a strong and independent commentator on the project. Invited to join us as we delivered and set-up the table, he questioned the family about their initial reactions to the table. It was clear that he did not play a neutral role, but instead reacted to their various statements with encouragement and 'leading' questions. After the set-up, we did not have further contact with the family, except to replace a defunct battery with a power cable, until we came to take the table away. The filmmaker, in contrast, returned to shoot the body of the documentary towards the end of their stewardship, and between this and the various calls needed to set up his visit, had much more contact with the family than we did. We speculate that his presence as somebody who was working with us but not particularly wedded to our original story helped to encourage the family to find their own meaning in the Key Table.

So did we succeed with the Key Table? As with the Ddddesk, it depends on the perspective from which success is to be judged. Seen as an object embodying a narrative about emotional interfaces, our user trial was a failure (though at conferences and workshops, a setting for professional interpretation, the Dddesk has been more successful). Seen as an object lending itself to interpretation and appropriation, on the other hand, it appears to have been very successful. But this was one isolated and seemingly extreme occasion of use, and we are hoping to deploy the Key Table to other households (and with other pictures) to better understand the range of meanings people find for it.

In any case, the use of a documentary filmmaker in understanding the Key Table itself was an extremely valuable part of the project. Not only did it encourage the users themselves to develop their own interpretations of the table, but it added to this the filmmaker's own interpretation. Moreover, the result emphasised the role of our interpretations as designers, not only in our original creation, but in how we perceived the video as evidence about the table's use.

EVALUATION AS INTERPRETATION

What all this suggests is that the use and evaluation of a system meant to encourage ludic engagement may usefully be thought of in terms of interpretation at a number of levels (see Figure 4). Designers, for instance, may interpret the systems they create on their own grounds (e.g. in terms of their technical achievements), in terms of how users may or do use them, or in terms of how onlookers might perceive the result. Similarly, users may approach a system on its own, or in terms of the designers' perceived intentions, or in terms of how they may appear to onlookers.

An important but often overlooked role in this situation is that of onlookers who encounter a system without using it themselves. Onlookers, too, may be important in the interpretation of a system. Friends may comment on whether or not using a system is socially desirable, for instance. Cultural commentators may explain systems in the mass media. CHI reviewers may recommend that reports about systems be accepted or rejected for publication. And so on.

What all this leads to is a view that evaluation of designs meant to lend themselves to appropriation is itself an interpretation. While the designers of a system may themselves may offer a preferred view, their privilege in asserting that view may be debatable. Instead of concentrating on evaluating the monolithic success or failure of a system, then, it may be best to focus on gathering a multitude of interpretations of a given system, and to present them in all their confused richness. This will have the effect of emphasising the role of interpretation in consuming the results of research. This may be uncomfortable, but at worst it may be realistic, and at best may itself be engaging and intriguing.

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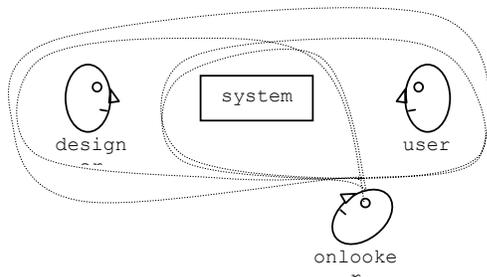
Figure 4: Systems involve interpretation at many levels. The onlooker's perspective is shown here for clarity.