Affective Systems
seminar 11 November, 15:00- 17:30

Tentative program outline
Agenda
15:00-15:15 Short introduction by moderator Gerd Ruebenstrunk.
15:15-15:45 Presentation by Phoebe Sengers.
15:45-16:15 Presentation by Angelika Oei and Rene Verouden.
16:15-16:45 Presentation by Owen Holland.
16:45-17:15 Presentation by Michelle Teran and Jeff Mann.
17:15-18:00 General discussion and closing remarks.

The seminar aims to give an idea of the state of the art in affective systems by presenting both theoretical and experimental results from different disciplines, and by having a moderated discussion with the authors/creators and the audience about the assumptions, ambitions and approaches that underpin the work.

Researchers and experimenters in various disciplines are trying to equip machines with some understanding of subtext and context of interaction, rather than only literal commands and feedback. This requires the machine to be able to perceive and reason about emotional cues in human interaction, as in intonation, facial expression and body language, and to form expectations of how its own behavior might affect the human. Conversely, given an adequate internal representation for that purpose, machines could perhaps be made to express emotions in and of themselves. Would such efforts really help improve the quality of human-machine interaction? And could similar techniques be applied in other areas, such as simulation experiments in the social sciences, or synthetic character and narrative generation in the interactive arts?

Phoebe Sengers

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Phoebe Sengers is a computer scientist and a cultural theorist. Her work practice is one of reflective design. Sengers is a faculty member in the new Information Science program at Cornell, part of the Faculty of Computing and Information, with a joint appointment with Science & Technology Studies. From 1999-2001, she did research in agents, avatars, virtual environments, and computer graphics in the Media Arts Research Studies group at the GMD Institute for Media Communication in Bonn, Germany. She has been active in the Narrative Intelligence research community. In 1998-1999, Phoebe was a Fulbright Guest Researcher at the Center for Art and Media Technology (ZKM) in Karlsruhe, Germany.

EXPERIENCE AS INTERPRETATION

[This is an abridged version of a paper by Phoebe Sengers, Kirsten Boehner, Geri Gay, Joseph "Jofish" Kaye, Michael Mateas, Bill Gaver, and Kristina Höök]

Dealing with complexities of change

As Wright & McCarthy [1] argue, theories, categories, and models of human experience used in Human-Computer Interaction (HCI) by necessity abstract from users' lived experiences, often inadvertently losing the details that make them rich, relevant and personally meaningful. They point out, for example, that, while we can speak of and program for an abstract category of frustration, the user's actual lived experience of frustration with a two-timing lover will in many essential details differ markedly from frustration because a software package has crashed again - and these are precisely the kinds of details that make up rich and meaningful experiences for people. While formal models can offer useful guidelines, we can be seduced into confusing formal model for lived experience.

Affective computing is one area in which HCI has already developed approaches for allowing computers to address a wider range of human experence. Picard [2] and colleagues in intelligent systems research argue that models divorcing reason, a computational construct, and emotion, a seemingly non-computational construct, are untenable and ineffective, not only because cognitive science is demonstrating that reason itself has an emotional component [3], but also because emotion is an essential part of human experience of computing, and must therefore be considered in HCI.

Much of the work in affective computing focuses on ways in which computers can become aware of and reason about human emotional states (e.g. [2, 4, 5, 6]). These theories often are subject to Wright & McCarthy's critique of formal HCI approaches to experience, by abstracting away from people's lived experiences, focusing instead on emotion as an abstract informational unit. In communication between computers and people, emotion is encoded , transmitted, and decoded.

A possible alternative approach to affective computing draws on the numerous challenges and revisions of the delivery-based communication models that propose a counter view of communication as one where meaning is co-constructed. The communication of emotion may be portrayed not as a discrete state being transferred between sender and receiver but as a process of coordinating meaning. Based on this insight, in our own work we seek primarily not to identify emotional states but to draw the user's attention to the indicators and subsequent inferences made about emotions. Rather than creating a black box system that senses indicators and uses refined algorithms to present the resulting emotion or to pronounce the perceived emotion back to the user, in our work, designers draw the user into the sensing and inference process. Processes of detection and inference about experiences are, then,

collaborative between user and system. We strive to make the user critically aware of what indicators are available for interpretation, how these indicators are interpreted, and the resulting effects of this interpretation.

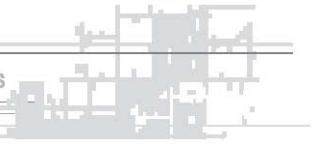
By focusing on emotion as experience, we are able to fish with a wider net in the sea of human experience. While current affective computing is necessarily based on formal models of emotions such as that of Ortony, Clore, and Collins [5], in our work, we are also address fuzzier and more ambiguous human-related emotion-like experiences such as 'moods' or 'vibes.' At the same time, shifting to a constructed, interpretive notion of emotion leads to a set of new research questions around emotions or moods in social relationships. How do groups of users experience one another's moods or a collective mood? What role can interactive systems play in helping groups or pairs of users in coordinating senses of each other's emotions?

Experience as interpretation

User experience, in this model, cannot be understood without reference to interpretation. We understand user interpretation as the process by which people use meaning-making to make experiences real for them in their own lives. In particular, we are interested in how users create experiences of complex technical systems. User interpretation is currently of interest in the user experience community, since analyzing how users come to understand and relate to technical systems can allow them to be built more effectively. It is also a topic of discussion in the critical design community, which asks a different set of questions: what messages are implicit in our designs? How do users reappropriate and alter the meaning of technologies? What are our social responsibilities as designers with respect to how users come to interpret and respond to our designs? (e.g. [7, 8]). Finally, it is an important topic in Science & Technology Studies, which seeks to understand and document the interpretive flexibility of technologies, or the ways in which users reappropriate and give new meanings and definitions to technology in practice (e.g. [9]). We are interested in all of these issues, and particularly in developing a dialogue around interpretation between these communities. We are particularly interested in extending ideas from these literatures to systems with some AI capabilities, where the system is itself also engaging in some kind of interpretation of the user's behavior and/or generating complex behavior that needs to be dynamically interpreted.

The fundamental conundrum of design for interpretation on which all these communities agree is that, while technologies can suggest different interpretations, a particular interpretation is never guaranteed - it always depends on the context in which the technology is being interpreted and the often unexpected uses to which it is put. Gaver, Beaver & Benford [10] have suggested that a process of "co-interpretation" between designer, system, and user is perhaps the best way to understand how meaning occurs. In all these communities, there are serious theoretical and empirical questions around whether and to what extent meanings can be built into objects and how that might affect design practice in general and in HCI. If we consider users to be flexibly coming up with their own interpretations, it becomes difficult to imagine how designers can create systems that reliably engage particularly kinds of experiences in somewhat foreseeable ways.

At the same time, considering user interpretation in the design process opens up new possibilities for adapting literary strategies to design practices to stimulate new interpretations of and experiences around systems. Gaver, Beaver, & Benford [10] argue, for example, that we can and should design ambiguity explicitly into systems, for example to allow users to project their own meanings onto them. Exagerration can be used to raise issues around the underlying meaning of technology or simply to explore the design space. Defamiliarization, or taking objects out of context to assign new meaning to them, is another useful literary strategy for opening up the design space.



Similar possibilities arise from the use of Artificial Intelligence techniques that themselves actively interpret patterns of human activity and generate responses as a function of these interpretations. Such ambient intelligences are able to actively participate in human contexts, not by attempting to completely and formally model the context, but rather by participating in the context as a non-human subject engaged in the shared construction of meaning. Such systems become an "alien presence" which, through its idiosyncratic interpretations and responses, open unusual viewpoints onto everyday human activity, providing opportunities for contemplation..

References

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Angelika Oei and R.A. Verouden

Angelika Oei (1959) created more than 30 dance and theatre performances since 1983. Her early small scale performances in museums were followed by larger scale productions: (among others): Oidan Skroeba (87), aliud (91), Kepler's Kamer (93), Every Night (96), Tomi (1997/99), Rewind (2000) and several solo-works. Works have been shown in Europe, North-and South-America, Canada and North-Africa. She created dance films with Clara van Gool: Courzand (93) and the internationally awarded Bitings and other effects...(95).
The collaboration with sculptor R.A.Verouden started in 1988 resulting in large scale scenography for dance performances and, recently, video-and theater-installations: Tomi (1999) Philomela (2000), Vienna (2001/02).

René Verouden (1959) has been working as a sculptor since 1983, with exhibitions and commissions in the Netherlands: coloured steel sculptures with a complex spatial structure. His work is in private, corporate and institutional collections. After teaming up with Angelika Oei he moved into scenography and design of multimedia solutions and interaction for theatre.
Together they develop works that combine new technologies and live arts. Recent works explicitely research live action as part of pre-programmed environments.

KURORT

A new performance/ interactive media/ installation work by choreographer Angelika Oei and interactive media artist R.A. Verouden, KURORT will be made in collaboration with V2_Lab in Rotterdam and co-produced by the Produktiehuis Rotterdamse Schouwburg.

The health spa phenomenon known as 'Kurort' traditionally offers visitors the possibility for mental / physical relaxation and recuperation in a sensual healing environment. In this interactive technology augmented version of 'Kurort', Oei and Verouden propose to create a space for relaxing the mind and recuperating memory. KURORT will be a collection of interconnected spaces that the visitor can browse and explore; each space is designed for a unique interactive experience. KURORT will also have a 'mind of its own'; a synthetic identity called Lizzie that will reside in the complex digital system. Lizzie will sense the presence of each visitor and is designed to analyze the information she receives to communicate (more than simply react) in a unique way with each visitor through alternation of the environment (i.e. light and temperature), sound, projected image and dynamic tactile objects.

KURORT will be structured using various theatrical and choreographic methods for composition, methods of envisioning derived of visual arts and scenographic construction, generation of narratives and meaning, energizing space and shaping time. Creating the technology for generating the interactive communication experience is complex. Therefore the work will be developed in a series of modular prototypes that will test various aspects of the system, simulating some elements of the machine interaction where necessary. While drawing on ideas from the traditional performing arts, KURORT will not create a traditional performance situation, but will manifest a new form of 'virtual' art based on generating individualized unique experiences for each visitor. This will involve the extensive technological knowledge and facilities of V2_Lab; but will also engage collaborators from the fields of cognitive science, architecture, music composition, etc. to work together towards the success of the project. A residence at the The Banff Center for the Arts in Canada is planned.

Objectives
To develop a ground breaking installation that successfully integrates interactive sensor, tracking and computer technology in innovative ways in the creation of a 'virtual' environment and a synthetic identity that is able to communicate and express in forms of subjective human experience, such as thinking, feeling and mood.

Through this project the artists strive for increased awareness amongst arts practitioners, new media technology artists, engeneers and scientific researchers of the potential for close collaborations. Through a wide distribution a strong addition to the critical discourse in this area will hopefully be achieved.

Target Group
Main target group for the installation will be audiences for art and theatre and new audiences including visitors drawn to new technology and the interactive digital media arts. It is also anticipated that the project will attract scientists interested in studying new forms of social behavior in interactive environments.

Kurort Prototype - Angelika Oei and Rene A. Verouden.

Owen Holland

http://cswww.essex.ac.uk/staff/holland.htm

Owen Holland, Professor and Head of Research in the Department of Computer Science at Essex University, UK, has over 15 years of experience in biologically inspired robotics and computation. He has been working in the area of machine consciousness since 2000, first at the California Institute of Technology, and later at the legendary Starlab. He was one of the organisers of the first international workshop on the subject (http://www.swartzneuro.org/banbury_e.asp) and edited a recent collection of papers on the theme (Machine Consciousness, Imprint Academic, 2003). He is the principal investigator for the first major project in the area, 'Machine Consciousness through Internal Modelling'), funded with £491,000 from the UK Engineering and Physical Sciences Research Council. (For more information on machine consciousness, see http://www.machineconsciousness.org).

EDITORIAL INTRODUCTION: MACHINE CONSCIOUSNESS

[This is an abridged version of the article in Journal of Consciousness Studies, 10, No. 4-5, 2003, pp.1-6. Exeter, UK: Imprint Academic]

In May 2001, the Swartz Foundation sponsored a workshop called 'Can a machine be conscious?' at the Banbury Center in Long Island(http://www.swartzneuro.org/banbury_2001.cfm). Around twenty psychologists, computer scientists, philosophers, physicists, neuroscientists, engineers, and industrialists spent three days in a mixture of short presentations and long and lively discussions. At the end, Christof Koch, the chair, asked for a show of hands to indicate who would now answer 'Yes' to the question forming the workshop theme. To everyone's astonishment, all hands but one were raised. We had not asked the question at the beginning, and so we did not know if any minds had changed during the workshop, but I think we all realized the significance of this near-unanimous vote: the idea of machine consciousness had progressed from being an interesting philosophical diversion to a real possibility.

Later that year, the editors of the *Journal of Consciousness Studies* agreed that the topic would be suitable for a special issue of the journal, and submissions were invited from some of the Banbury workshop participants, and from others interested in the subject. I am grateful to all of the contributors for their co-operation and collaboration in bringing this collection together, and to the referees for the care with which they undertook their task. Special thanks go to Joseph Goguen, editor-in-chief of the *JCS*, and to managing editor Anthony Freeman for his patience and assistance throughout the project.

Igor Aleksander has spent several years engineering artificial neural systems to investigate and demonstrate various aspects of visual consciousness, particularly those involving imagination and imagery. One consequence is that he probably spent more time than anyone else discussing and defending the notion that a machine might posses at least some of the attributes of consciousness. In their contribution to this collection, he and **Barry Dunmall** do not present a new neural model, but instead propose an axiomatic framework within which the structural and functional components of conscious systems, natural or artificial, can be identified and tested. They note: 'We deem this to be useful if there is ever to be clarity in answering questions about whether this or the other organism is or is not conscious.' They emphasize that their approach 'is meant to be open-ended', so that others can contribute 'further axiomatic clarifications'. Their current systems, embedded in robots, satisfy only three of their five axioms, and are therefore non-conscious, but within their formalism they are now able to ask: '[G]iven the development or evolution of the remaining two axiomatic mechanisms, what arguments could be used to deny them consciousness?'

Almost all the engineers and computer scientists involved in machine consciousness take a more or less conventional computational or neurally inspired approach, concentrating on the functions associated with cognitive processing. **Susan Blackmore**'s paper should give them pause: she suggests that our distinctively human consciousness centred on an experiencing self is an illusion created by the memes which have shaped our minds, and that the primary requirement for a machine to 'think it was conscious' is the ability to host memes — that is, to possess a capacity for imitation. This is usually low down on the list of cognitive abilities considered for implementation in artifacts (though there are signs that this is changing — see [1]). Put bluntly, Blackmore appears to be saying not just that we might have missed something, but that we might have missed almost everything that matters. In support of her case she advances a wide variety of arguments, ranging from robotic experiments to evidence from meditation; she also identifies some key unanswered questions, asking in particular 'whether artificial meme machines can ever transcend the illusion of self consciousness'.

In his paper on his new project, CyberChild, **Rodney Cotterill** brings together a number of approaches to the problem of machine consciousness. His chosen method is the computer simulation of the brain, body, and environment of a very young infant; the architecture of the child's brain is a closed neural system; and the strategy is developmental and interactive, in that the child must signal its needs to the experimenter — for example, by crying appropriately — and the experimenter must respond. Cotterill is very open minded: although he has a well developed theory of consciousness, he makes it clear that his current project is broadly investigative, 'searching for the neural correlates of consciousness through computer simulation' rather than explicitly testing any single narrow hypothesis. CyberChild possesses not only a simulated brain and body, but also a simulated metabolism; learning to deal with the contingencies presented by its environment is a matter of life and death, and by implication the approach emphasizes the functional links of emergent consciousness to the well-being of the organism. Although the simulation is necessarily much less complex than the reality it is intended to mimic — as Cotterill puts it, 'In CyberChild, one sees the nervous system pared down to its essentials' — the resultant simplicity offers the advantage that 'If evidence of conscious behaviour does emerge... one could be reasonably optimistic that its neural correlates will be detectable.' The work seen in close focus is rooted in biology, but Cotterill expresses the hope that success will constitute 'a step toward realizing the long-cherished dream of creating *Homo siliciens*: consciousness in a computer'.

[...] Like Cotterill, **Owen Holland** and **Rod Goodman** do not start with consciousness, but hope to end up with it at some future time. And like Blackmore they emphasize a single mechanism — internal modelling — as the possible underpinning of consciousness. (Internal modelling is not imitation, but the two notions are close enough to give food for thought.) Their approach is rooted in robotics; their claim is that a robot able to deal intelligently with the complexities of the real world will have to engage in planning, and that this requirement will inevitably demand the creation of an internal model not just of the world, but of many aspects of the embodied agent itself. They speculate that such an internal agent-model may give rise to some consciousness-like phenomena. Their strategy, like Cotterill's, is developmental, but rather than allowing an entity to modify and extend its own capabilities, they propose to re-engineer the robot themselves, adding and changing whatever is necessary

to deal with the progressively more difficult environmental contingencies to which they intend to expose it. Like Aleksander and Dunmall, their starting point is a robot that they claim is definitely not conscious; from there, as they remark, 'The only way is up.'
[...] **Luc Steels** offers a view of a key feature of consciousness — the inner voice — from the perspective of research into the acquisition and use of language by artificial agents. He expresses his methodological stance as follows: '[W]hatever consciousness "really" is, some of the behaviours often associated with having consciousness can be unravelled, and their information processing foundations understood.' He describes how a community of agents can readily arrive at a shared lexicon by engaging in a robotic 'language game', but how 'the emergence of grammar has turned out to be much more difficult'. This problem was solved by the introduction of a particular information processing strategy — a re-entrant mapping, when output from the language production system is fed back into the language interpretation system. He describes how this enabled the acquisition of a form of grammar by the members of a suitable programmed agent community. However, this re-entrant system [...] also has the potential for enabling a range of entirely new processes, including an inner voice that could provide the foundation for the construction and testing of a self-model. Although such a self-model 'is not to be identified with consciousness', he argues that it is part of the conscious experience, and so the development of language in the way he describes 'may have played a crucial role in the origins of consciousness'. Although he is optimistic about the future progress of robotics in capturing some of the information processing aspects of consciousness, he leaves the question of producing first person experience open.
[...] It is now fourteen years since the publication of Leonard Angel's book *How to Build a Conscious Machine* [2] — perhaps the first serious consideration of making a practical assault on the problem of machine consciousness. The book has worn well — some might take this as an indication that progress has been slow. However, it is interesting to note some of the differences between it and Pentti Haikonen's recent book *The Cognitive Approach to Conscious Machines* [3]. Angel, a university-based philosopher interested in artificial intelligence, wrote from a philosophically influenced perspective; his main concern was to shed light on 'the traditional mind/body problem'. Haikonen is an engineer working for a major technology company; his text contains system block diagrams, signal flow diagrams, and visual subsystem diagrams, and his preface mentions that he is already working on 'neuron group microchip development for the eventual implementation' of his machines. This gradual shift from the armchair to the laboratory and the workshop can also be seen, I believe, in the present collection. We cannot yet know how fast and how far the enterprise will progress, and how much light it will be able to shed on the nature of consciousness itself, but it seems beyond doubt that machine consciousness can now take its place as a valid subject area within the broad sweep of consciousness studies.

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Michelle Teran, Jeff Mann

http://lftk.waag.org

Michelle Teran (1966) is a media artist, hacker of social code and public space working in a networked live art practice. She became involved in media arts after studying art history, theatre, cultural theory, painting and drawing at Hospicio Cabanas in Guadalajara (1986-87), Instituto de las Bellas Artes, San Miguel de Allende (1987), and the Ontario College of Art (1988-1993). She uses live media in performances and installations that address issues such as social networks, intimacy over distance, telepresence and the interplay between (media) spaces. She utilizes video from webcams, streams, wireless networks and cameras, on-line collaborative communication environments, combined with physical objects and gestures, materials used to create performative interventions. Recent projects include Life: a user's manual, a series of public performances and online mappings that examine the hidden stories captured by private wireless CCTV streams and how they intersect with the visible world around us. With her collaborator Jeff Mann, she is currently working on LiveForm:Telekinetics, developing connected social, participatory environments using streamed media, sensor-based and kinetic objects. LiveForm:Telekinetics is a commission by Waag Society for Old and New Media with BEAP (Perth) and Melkweg (Amsterdam) partners.

Jeff Mann is a creator of electro-kinetic art using electronics, sound, video, computer, and telecommunications media, with a primary focus on interactive installation works and research interests in digital interface to real-world environments. Previously a long-standing and active member of the Board of Directors of InterAccess, Canada's premiere artist-run Electronic Media Arts Centre, he is also founder and coordinator of Toronto's Art & Robotics Group art and technology collective. Since graduating with honours from the Ontario College of Art in 1987, he has exhibited and performed internationally, received several grants, awards, and artist residencies for his work, operated a private gallery of electric art, and spoken on issues in art and technology, in lectures, print, and on radio and television.
Mann resides in Toronto and recently in Europe, where he works as an independent electronic media artist and as freelance producer, instructor, and artistic and technical consultant to various organizations and individual artists. He has extensive technical and teaching experience and has been employed exclusively in the educational/non-profit arts sector since 1985: at the Music Gallery and Art Metropole; as Media Production faculty member of the Ontario College of Art, the International Academy of Design, and Ryerson University; as technical manager of Trinity Square Video, as network-art specialist at both the Banff Centre and at InterAccess, and recently as digital video technical consultant at Charles Street Video and electronics lab coordinator at InterAccess.

LIVEFORM: TELEKINETICS
Experiments in Connected Social Spaces

The Waag Society for Old and New Media has in 2004 commissioned Canadian artists Jeff Mann and Michelle Teran to produce and present the second iteration of the LiveForm:Telekinetics Project. LF:TK involves the creation of a series of site-specific

installation/performance works connecting hybrid physical/virtual spaces using streaming media and networked kinetic objects. The commission is part of the Connected! project of Waag Society, a two-year programme of performances, lectures, workshops, installations, and emergent events exploring collaborative networked media and live art.

The LiveForm:Telekinetics project is envisioned as a laboratory that examines the intertwining of social networks and social spaces with their technological counterparts. As a work of art, it challenges and expands the notion of performance, the relationship of the artist and audience, production and exhibition, and ideas of locale and presence.

The LF:TK laboratory and test-kitchen descends on the Theatrum Anatomicum from 6 until 19 December. The lab develops recipes and menus for networked social spaces, where ordinary physical objects come to life as both kinetic art and telecommunication interfaces. Local cafés, hotel lobbys, and apartment parties are transformed into a series of transgeographical temporary performance zones, and connected live via wireless Internet to counterpart locations in the Netherlands and Canada.

Digital networks extend communication across distance and time. How might they influence the forms of our daily social interaction? Sharing a meal, a walk in the park, weddings, sports, or cafés - these are the kind of social activities and rituals we associate with meaningful relationships and lasting friendships. But the typewriter keypad and computer screen are artifacts of a business machine that seem out of place here. What if the interface allowed for body language, gesture, and physicality? What if you could go out for dinner and dancing with friends, even though you're a thousand kilometers away?

Within our urban environments there is a recent phenomenon of wireless Internet access points, found within typical social environments like the local café, sidewalk, public square, hotel lobby, office and private home. These "hotspots" represent convergences between technological and social networks. The wireless access point is a portal, providing the possibility of multi-situated presence, while at the same time placed within a fixed physical location, a social environment rich with familiar objects, rituals and codes of behaviour.

LF:TK takes a playful approach in examining the ways we might inhabit and subvert such a hybrid environment. Furniture, decorations, cutlery, bric-a-brac and cultural debris are reconstructed as networked interfaces - conduits for video, audio and kinetic data flows that populate surfaces and tables within everyday social spaces. Each object provides a simple function (transmitting a sound, image, kinetic motion, etc.) yet when combined with others helps build a complex arrangement of movement and gesture. Imagine a shared creation, a social ritual, a dance through objects, a table that is played.

The LF:TK project addresses the following aesthetic and conceptual issues:

- To what extent is it necessary or desirable to establish direct and overt communications channels between the connected spaces, such as face-to-face videoconferencing or text messaging? What is the qualitative and experiential difference between connections based on language exchanges, and those based on more ephemeral senses of presence, such as fleeting shadows, murmurs, and shards of overheard conversations?

- Which individual qualities of gesture, movement, visual and sonic representations, language and body-language, are most important for people to recognize respond to the "live" presence of others within their environment, and to distinguish that sense from random kinetic events such as wind blowing in trees or the mechanical movement of machines?

- What roles do people play in these spaces? How can traditional ideas of performer and audience, provider and consumer, player and spectator, be modified to investigate a spectrum of varying shades of intentionality and engagement? What new forms and mutations of social interaction, entertainment, or play might arise?

- How can new forms of augmented interactivity and trans-local telepresence be implemented in such a way as to enhance social value without detracting or distracting from that which has already evolved?