TIME DESIGN FOR BUILDING TRUST IN COMMUNITIES OF SYSTEMS AND PEOPLE

Caroline Nevejan[a] and Frances Brazier[b]

Multi-Actor Systems, Faculty of Technology, Management and Policy,
Delft University of Technology, Jaffalaan 5, 2628 GA Delft, The Netherlands
Email: [a]*C.I.M.nevejan@tudelft.nl,* [b]*F.M.Brazier@tudelft.nl*

Multi-agent system (MAS) design focuses primarily on design of functionality, structure and (emergent) behaviour. Very little research focuses on the design of interaction between MASs and human users (multi-actor systems), and in particular on the design of trust. Based on the YUPTA framework and exploratory research, this paper argues, that temporal engagement between human beings and multi-agent systems must be explicitly designed and implemented for trust in multi-actor systems, including MAS, to be acquired.

Keywords: Time, Design, Trust, Multi-Actor Systems, Rhythm, Synchronization.

1. INTRODUCTION

Multi-agent systems (MAS) are most often designed for a purpose, to perform one or more tasks, to achieve one or more goals for human users. For example, MASs designed to support smart energy grids, financial and mobility infrastructures, focus primarily on their functionality, structure and (emergent) behaviour. Within collaborative systems design, current paradigms presuppose delegation or transition of mandate of tasks to human users or automated systems.

In interaction between 'communities of people and systems', however, *participation* is crucial [1]. Participation extends the notions of delegation and mandating task performance, requiring social interaction and the possibility to negotiate within communities-of-practice. In future Smart Energy Grids, designed to reduce energy consumption, and balance (and stabilize) energy production and consumption, negotiation between prosumers (consumer-producers) is essential. Decentralised monitoring information provided by the Grid will make it possible for prosumers (e.g. neighbours), to locally adapt their behaviour to each other. Trust, responsibility and liability are major issues.

Participation in a community-of-practice presupposes the ability to negotiate and to accept responsibility and liability. Participants are witness to each other; they accept responsibility for what happens next [5]. Communication is crucial to witnessing and negotiating truth and trust. The capacity to recognize spatiotemporal trajectories of other members of the community-of-practice is a condition sine qua non [2]for communication to take place in such 'communities of practice'. Recognition and negotiation are time sensitive both for users and owners of agents. The fundamental values for MAS design autonomy, transparency, identify-ability and traceability [3] are equally time sensitive.

Witnessed presence is the topic of exploratory research in 2008/2009 on which this paper is based: exploratory research to which 24 experts (professionals in ICT and design, artists and system engineers) worldwide have contributed [4]. These experts reflect on the notion of witnessed presence and trust in relation to daily professional practice. All of these experts share a concern to create trustworthy structures of communication coming from computer science, design, business, art, architecture, theatre, journalism and social science. The YUTPA framework [5] in which the relation between presence and trust is defined by four dimensions: time, place, action and relation provided the frame of reference.

Section 2 discusses the theoretical foundation of these concepts. Section 3 presents the results of the exploratory study. By elaborating issues of time design — duration of engagement, synchronizing performance and integrating rhythm — the conclusion is drawn that time design is crucial for trustworthy collaboration in 'communities of systems and people'. On the basis of these results, Section 4 discusses implications of time design for agents and autonomous distributed systems.

2. WITNESSED PRESENCE AND YUPTA: TIME, PLACE, ACTION AND RELATION

For centuries sharing time and place has been a prerequisite to social interaction and witnessing. It still is. However, in today's personal and professional reality of millions of people sharing is no longer necessarily related to the same physical time and place. In emerging 'communities of systems and people' sharing and witnessing are still very fundamental. Witnessing is essential to establishing trust. Unlike perception and observation, witnessing is defined by the possibility to act upon what is perceived or observed. It is a concept that refers to participation in interaction. The process of witnessing and being witnessed deeply influences the performance of presence and the establishment of trust [5]. Trust, in turn, is necessary for fruitful interaction within communities of systems and people.

The performative nature of presence is important; people enact their being [6]. A distinction can be made between witnessing and being witnessed. Sensorial perceptions, cognitive understanding and knowledge, feelings and emotions all contribute to a certain input for other human beings to perceive. Witnessing refers to accepting responsibility for perception and as a result accepting responsibility for what happens next [7], being response-able and address-able [8]. Response-ability refers to the ability to respond to a person's testimony and taking responsibility for the evolving interaction. Address-ability refers to the possibility to address a person's contribution during social interaction. Witnessing between human beings relies not only on response-ability and address-ability but also transparency of subject position [8]. 'Subject position' refers to the knowledge and power of the people involved in relation to the 'trueness' of their testimonies.

This paper describes witnessing in 'communities of systems and people' as specific configurations (unities) of the four dimensions of the YUTPA framework. In these four dimensions response-ability, address-ability and transparency of subject position, materialize. YUTPA (acronym for 'being with You in Unity of Time, Place and Action'), as mentioned above has been designed to further understanding of the trade-offs between the performance of presence and the establishment of trust [5].

The four dimensions: Time, Place, Action and Relation, are depicted in Figure 1. Tuning these four dimensions in relation to one another determines the extent to which trust can emerge. The exploratory study focuses on designing systems for interaction and on the dynamics of each of the four dimensions for design. This paper focuses specifically on the dimension of time and agency, and its relation to the other dimensions of place, action and relation, with respect to trust.
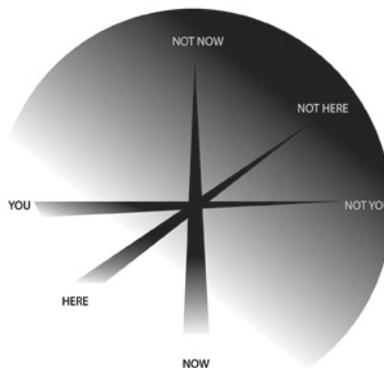

Figure 1. The YUTPA framework defines in four dimensions the relation between presence and a sustainable relationship defined by trust. The black and white parts of the sphere present the possibility to act (Do/not Do).

3.   TIME IS BEHOLDER OF TRUST

Current research focuses on social interaction between human beings and technology in professional practice. Interviews with 20 ICT and Design professionals in the Netherlands, the United Kingdom and India, and 4 artists in the Netherlands provide the basis for the insights presented in this paper. References to excerpts of these interviews are used in the text below to illustrate the importance of time in new social structures.

The emergence of online realities has changed the concepts of space, of speed, of connection, of impact, considerably. Several experts report on the fact that place is no longer the determining factor for trust; time has become the beholder of trust when people do not share place [9]. Emerging online realities are constructed through series of transactions and interactions online. File transfer (a transaction) or a message (interaction) in a social network confirms that a system or a human being is 'alive'.

A shared notion of time between systems and people is essential for communication and for the construction of the sense of reality in the merging on-and offline worlds. Interactions/transactions are the basis for existence in the merging on-and offline line time/space configurations [10]. Trust can more specifically be related to a track record of sharing information, of committing and delivering, of clarity — making intentions explicit, and of reputation over time [11]. Trust emerges online in the social web of institutions and people [10]. In the last few decades 'digital witnessing' has emerged as a factor of significance in the establishment of reputation and authenticity of human beings and systems involved.

This section first reports on the results of a qualitative exploratory study in which YUPTA was used to analyze new social structures in collaboration between human beings in merging new realities. This study clearly shows that integrity, capability, intentionality and reputation are time sensitive. Duration, synchronization, rhythm and moments of transformation, influence these values. The following paragraphs address these aspects. These results are then discussed in the context of communities of multi-agent systems and human beings.

3.1.   Duration of engagement

Duration is a word that refers to a period of time. Duration is a quality that defines how cultures and communities emerge, exist and fade away. Engagement is sustained interaction, in which an intensity of dialogue shapes trust and authenticity as well [9]. Duration of engagement influences experience of witnessed presence.

Human beings and technology have fundamental different scales, speed and formats of time. When dealing with technology human behaviour is guided by a presupposition of a stable physical environment including sequential experience of time and causality [12]. Human beings become habituated to systems over time, acquire competences in specifying need, become capable in using and manipulating them, creating their own regularity, their own engagement. Human beings decide when to be engaged and when not, when to join into engagement and when to leave.

Degrees and intensities of engagement emerge from time spent in focused attention and in witnessed presence. Too much engagement, as happens in India where people work 24/7 in the 'Global Service Delivery Model', in which they are monitored in every action they do, is counterproductive and results in a 'low trust' dynamic for human beings involved [13].

In distance and disembodied communication confidence needs to be placed in engagement [9]. Unless and until a certain degree of concreteness has been assigned to engagement it does not have any value or meaning. To negotiate this trust, people segregate and compartmentalize [8]. Trusting a software agent, a multi-agent system or a human being in merging realities with respect to one domain of expertise does not imply trust in the same party in another domain.

One of the interesting concepts that emerged during the interviews is the idea that authentic presence of multi-agent systems, i.e. autonomous systems, mandates the ability for multi-agent systems to influence their own well-being and survival in merging realities. As part of merging realities a multi-agent system should be capable of gaining or losing authenticity. They should be able to organize their own destruction [10].

Human beings structure collaborative action and emphasize moments of transformation [14]. They stand still by transitions between activities, channelling their feelings and emotions. This aspect needs to be considered in time design in merging realities in which human beings interact with multi-agent systems: the need for lingering time for transformational processes that human beings need, may need to be orchestrated. Duration of engagement, including the design of moments of transformation, may therefore be a requirement for sustainable communities of multi-agent systems and human beings to emerge.

When designing '**duration of engagement**' between systems and people, a number of aspects need to be considered: initiation of engagement, formats and structures for interaction while engaged, moments of transformation in crisis and celebration that affect the engagement and termination of engagement. All participants need to be aware of the status of engagement.

3.2. Synchronizing performance

Tuning of presence between people in real life and in merging realities is crucial to trust. To be able to communicate people have to 'synchronize', tune their presence towards each other, to establish common ground between them. Sensations, emotions and feelings have to be acknowledged in this process for interaction and exchange of information to take place [15]. The body is fundamental to tuning performance of presence, but often human beings do not realize they are tuning with their body. Physical tuning encompasses tacit knowledge [16]. Much of this information is currently lost in merging realities.

Technology deeply influences how people witness each other and experience each other's presence. In mediated communication sensations and the sharing of feelings and emotions in distance and disembodied circumstances has limited potential. The grounds for trust change. Handshakes, for example, a very important type of tuning in human relationships, need to acquire a different presence. Presence of information on the will to agree, does not suffice, it does not represent the complex dynamics behind the moment of tuning/synchronization. Note that handshakes are also common in technological systems playing the same role: digital handshakes, however, are most often not perceivable.

The potential to influence social structures through acting in 'communities of systems and people' in merging realities, referred to as 'presence as agency', is time dependent [17]. In most business environments, for example, there is a clear need to orchestrate on- and offline presence and absence. Clients, managers and workers in different places interact via phone, Internet, an email, with shared data sources. Synchronization is a requirement for trust within such environments [18]. Frequent interaction supports acquisition and maintenance of trust between co-workers. Data can also support the acquisition and maintenance of trust: data may be the result of witnessing or refer to witnessing and contribute to the understanding of current witnessing. Data themselves, however do not witness.

Sensations, emotions and more complex feelings are crucial indicators for human beings to steer towards their well-being and survival [19]. The amount of time needed to react to a new situation may vary considerably depending on state of mind, predicament, availability, time needed to react, etc. Time design must take this into account. Note that this also holds for timing between agents: time constraints on acting may influence the quality of the result (e.g. in Just-in-Time environments). Note also that in some situations in new merging realities human beings can purposefully tune their own presence having learned from the history of the community, following interaction and deciding how to pitch their own presence [10]. Human beings can choose to remain anonymous, as may other participants (albeit agents or other human participants). Synchronizing presence in such contexts requires specific design for developing trust in which momentum and effective transaction is crucial.

When designing '**synchronization of performance**' tuning of different presences needs to be facilitated. High granularity in interaction benefits synchronization, just as rapid interaction. Tuning presence for human beings happens on all levels of consciousness and includes cognitive, physical and emotional understanding. Synchronization presupposes a shared domain between human beings, systems and agents. It is 'presence as agency' that is synchronized. This study suggests that when agency is synchronized, human beings can accept responsibility and liability for and towards systems and agents with which they interact.

3.3. Integrating rhythm

This section defines rhythm as a source for collaboration in 'communities of systems and people'. 'Communities of systems and people' produce rhythms that can be observed and therefore can be designed. Because rhythm is like a heartbeat, because it somehow generates energy and engagement 'for free', because it has the capacity to relate complex things to simple things, it is a very powerful tool to influence how participants experience participation in 'communities of systems and people'.

Rhythm contributes to the experience of duration and enables synchronization. Sustainable rhythms create viability in survival. Such rhythms emerge from the body centre and are transposed to the environment in which the body is present [20]. Such a centre is necessary for any community to exist. A robust structure in time, which rhythm provides, is necessary to provide in-between spaces in which experience and meaning can emerge [21]. The not pre-determinant nature of these spaces is exactly why they generate creativity and experience, which is how meaning evolves. Not determining what happens next is part of the essence of having agency.

Physical environments can be analyzed by focusing on the rhythms they produce. Buildings have rhythms of use, so do streets and cities [22]. Architecture and music are very close and some people are more sensitive to musical rhythms and others more to visual rhythms. Both are compositions to which human beings can be sensitive or not and if so, experience is fundamentally different [23]. In 'communities of systems and people' distinct orchestration of rhythm contributes to recognizing spatiotemporal trajectories between systems and people.

The design of '**Integrating rhythm**' is necessary for sustained interaction between human beings and systems/agents to emerge and to be maintained. Rhythm provides a robust structure to which both human beings and systems/agents can connect. Sharing rhythm enables both duration of engagement and synchronization of performance to be sustained. When sharing rhythm with human beings, systems and agents gain trust.

4. IMPLICATIONS OF TIME DESIGN FOR MERGING REALITIES

The above research on the design of trust in human collaboration in merging realities indicates the need to design time explicitly. This holds for all distributed systems. Each individual system has its/his/her own clock. As a result, interaction between systems (human or automated) is asynchronous unless otherwise designed. Different methods for synchronicity between systems have been designed and are deployed.

A typical domain for which this is needed is that of auctions: rounds need to be well defined in time for systems to be able to participate. Human participants need to be able to assess the capabilities, integrity, reputation and intentions of all other participants: they need to decide/judge which systems and agents they trust and which they don't trust. They need to know how responsibilities are distributed. Meaningful interaction with automated systems, including multi-agent systems, not only requires some knowledge of the owners of systems and agents, it also requires time design to be distinct.

Systems designed to include human participants, albeit owners of agents involved or other human participant, need to be include time in their interface design. Such interface design must consider the time human beings need to reason and to react. All participants must be identifiable and addressable. Time design must include explicit consideration of the three components defined above: durations of engagement, synchronisation and rhythm.

Duration of Engagement: systems and agents should be designed to inform their owners and other human participants of their state either periodically, on request or in specific situations, depending on the application. Moments of transformation are part of duration of engagement for human beings and system/agents need to integrate this in their design. Human owners cannot take responsibility for their participation in systems or use of agents if they are not informed or capable of being informed. In interaction, over time, systems and agents may adapt to the characteristics of other systems, agents or human participants. Design must include the implications over time.

Synchronisation: Multi-actor systems need to tune/synchronise their activities with human participants, they need to decide which information is needed/relevant when. Timeliness needs to be

defined and has to meet synchronization procedures required. This holds for systems, individual agents and groups of agents.

Rhythm: is the result of duration and synchronization: it defines the expectations of all participants with respect to interaction over time, structuring time, determining the degrees of trust users place in their collaborative environment. Systems and agents need to participate in a shared rhythm that is perceivable to human users involved.

This paper argues that new forms of time design are needed for emerging systems: systems in which human beings participate. Existing solutions do not address this aspect. If human beings are to trust multi-actor systems, systems (including MAS) need to be designed to this purpose.

5. CONCLUSION

Time is an important aspect of interaction; it is one of the beholders of trust. This paper addresses the importance of time design for collaboration in multi-actor systems. Autonomous systems and multi-agent systems need to be designed to make time considerations explicit. Human clocks, system clocks and agent clocks differ, human time and system time differ: these differences need to be addressed in their interaction.

The three elements of time design encountered in on-going qualitative research: (1) duration of engagement, (2) synchronization of performance and (3) rhythm, are key to collaboration between human beings in merging realities. This paper argues that the same three elements also pertain to multi-actor systems design. Future research will explore (1) how awareness of status of engagement can be designed, (2) how synchronization of moments of agency between systems and people can facilitate acceptance of responsibility and liability, (3) how opportunities for orchestration of rhythm can be identified and designed.

As described in Section 2, witnessing is fundamental for social structures between human beings. True witnessing between human beings includes response-ability, address-ability and transparency of subject positions [7]. When systems participate in communities of people the question is whether they can match these three criteria. Systems design values of autonomy, transparency, identifiability and traceability [3] provide transparency of subject positions and address-ability if designed appropriately. However, response-ability refers to human subjectivity: the ability of human beings to take the position of response. Response includes feelings and emotions and the responsibility for these feelings and emotions. Systems and agents cannot fulfill these requirements. If rhythm in synchronization of performance of agency is well designed, duration of engagement is well structured, and moments of transformation are well marked, it may very well be that response-ability is not a characteristic that is required of systems and agents once they participate in human communities. Human beings remain to be responsible for offering response to one another.

REFERENCES & ESSENTIAL BIBLIOGRAPHY

1. Brazier, F. M. T. and van der Veer, Gerrit. (2009). Interactive distributed and networked autonomous systems: delegation or participation, in: Proceedings of the Human Interaction with Intelligent & Networked Systems Workshop (HINNS 2009).
2. Kuhn, Thomas S. 2000. *The road since structure, philosophical essays, 1970–1993, with an autobiographical interview*. Editors. James Conant and John Haugeland. Chicago: The University of Chicago Press.
3. Brazier, F. M. T., Oskamp, A., Prins, J. E. J., Schellekens, M. H. M. and Wijngaards, N. J. E., 2004. *Law-Abiding & Integrity on the Internet: a Case for Agents*, in: AI & Law, Volume 12, Number 1-2, pp. 5–37.
4. Witnessed presence and Systems Engineering is an Ongoing Exploratory Qualitative Study into the Relation Between Presence Design and Emerging Trust. Source material is available at www.systemsdesign.tbm.tudelft.nl/witness.
5. Nevejan Caroline. 2009. Witnessed presence and the YUTPA framework. In PsychNology Journal 'Ethics in Presence and Social Presence Technology', volume 7 (1). www.psychnology.org.
6. Butler, Judith. 1993. *Bodies that Matter, on discursive limits of "sex*. New York: Routledge.
7. Nevejan C. 2007. Presence and the Design of Trust. PhD diss. University of Amsterdam.
8. Oliver, Kelly. 2001. Witnessing, beyond recognition. University of Minnesota Press, Mineapolis/London.
9. Hazra, Abhishek. 2008. Witnessed presence and Systems Engineering, interviews by Caroline Nevejan. http://www.systemsdesign.tbm.tudelft.nl/witness.

10. Abraham, Sunil. 2008. Witnessed Presence and Systems Engineering, Interviews by Caroline Nevejan. http://www.systemsdesign.tbm.tudelft.nl/witness.
11. Kaul, Priya. 2008. Witnessed Presence and Systems Engineering, Interviews by Caroline Nevejan. http://www.systemsdesign.tbm.tudelft.nl/witness.
12. Sood, Aditya Dev. 2008. Witnessed Presence and Systems Engineering, Interviews by Caroline Nevejan. http://www.systemsdesign.tbm.tudelft.nl/witness.
13. Upadhya, Carol. 2008. Witnessed Presence and Systems Engineering, Interviews by Caroline Nevejan. http://www.systemsdesign.tbm.tudelft.nl/witness.
14. Solomon, Debra. 2009. Contribution Witnessed Presence and Systems Engineering. To be published at http://www.being-here.net.
15. Vlies, Inge, van der. 2008. Witnessed Presence and Systems Engineering, Interviews by Caroline Nevejan. http://www.systemsdesign.tbm.tudelft.nl/witness.
16. Gill, Satinder. 2010. Witnessed Presence and Systems Engineering, Interviews by Caroline Nevejan. http://www.systemsdesign.tbm.tudelft.nl/witness.
17. Giddens, Anthony. 1984. *The Constitution of Society, Outline of the Theory of Structuration*. Cambridge: Polity Press.
18. Wilson, Rebekah. 2008. Witnessed Presence and Systems Engineering, Interviews by Caroline Nevejan. http://www.systemsdesign.tbm.tudelft.nl/witness.
19. Damasio, Antonio. 2004. *Looking for Spinoza, Joy, Sorrow and the Feeling Brain*. London: Vintage, Random House.
20. Panghaal, Jogi. 2009. Witnessed Presence and Systems Engineering, Interviews by Caroline Nevejan. http://www.systemsdesign.tbm.tudelft.nl/witness.
21. Feigl, Zoro. 2009. Witnessed Presence and Systems Engineering, Interviews by Caroline Nevejan. http://www.systemsdesign.tbm.tudelft.nl/witness.
22. Lefebvre, Henri, Elden, S., Moore, G. 2004. Rhythmanalysis: Space, Time and Everyday Life. Conitnuum, New York. Orginally published as Elements de rythmanalyse, Editions Syllepse, Paris 1992.
23. Jansma, Rein. 2009. Witnessed Presence and Systems Engineering, Interviews by Caroline Nevejan. http://www.systemsdesign.tbm.tudelft.nl/witness.

APPENDIX

Interviews can be found at http://www.systemsdesign.tbm.tudelft.nl/witness. For convenience short descriptions of the participant are given below.

Sunil Abraham is director Policy of the Centre for Internet and Society is a Bangalore based social entrepreneur and Free Software advocate. He founded Mahiti in 1998, which employs more than 50 engineers today. Between June 2004 and June 2007, Abraham managed the International Open Source Network a project of United Nations Development Program's Asia-Pacific Development Information Program serving 42 countries in the Asia-Pacific region.

Zoro Feigl is a young successful Dutch artist, who makes sculptural works that are often associated with mechanical nature. Feigl's 'Active Sculpting Machines' are dealing with issues of space and movement and they provoke an immediate bodily response from the viewer. Stimulating a concentrated experience, they create frameworks for relation and association. Zoro Feigl's complete works are presented at: http://www.zorofeigl.nl.

Satinder Gill is based with the Centre for Music and Science, University of Cambridge, and collaborator with the Topological Media Lab at Concordia University, Canada. She is associate Editor of the International Journal, AI & Society: Knowledge, Culture and Communication (Springer). Gill received her PhD on 'Dialogue and Tacit Knowledge for Knowledge Transfer' in Experimental Psychology, 1995, with the University of Cambridge, UK. She has been a Research Scientist with NTT's Communication Science Laboratories (CSL) and ATR (Kyoto) in Japan (1997–1999), held a Joint position with CKIR, Finland and CSLI (Centre for the Study of Language and Information) Stanford University (2000–2003), and was a Senior Research Fellow at Middlesex University, London, UK (2004–2009). She is editor of the book, 'Cognition, Communication, and Interaction: Transdisciplinary Perspectives on Interactive Technology, published in 2007 (Springer).

Abhishek Hazra is a visual artist based in Bangalore. His work explores the intersections between technology and culture through the narrative device of a 'visual fable'. He is interested in the social

history of scientific practices, and his current, ongoing project attempts to explore the history of science research in colonial India. Hazra works with animated shorts and digital slideshows that often integrate textual fragments drawn from fictional scenarios. He is also interested in the way in which the languages of science journalism and information visualisation participate in the complex dynamics of 'knowledge dissemination' and 'translation'.

Rein Jansma is architect of many public buildings and mobility throughout the Netherlands, Dubai, Georgia and more. Around 1990, together with Moshe Zwarts, Rein Jansma founded Zwarts & Jansma architects. They build soccer stadiums, railway stations, bridges, tunnels and other mobility infrastructure. In 1992 Zwarts & Jansma created the Dutch Pavilion on the world expo in Seville.

Priya Kaul is psychologist and a practicing therapist in Bangalore, India. She is a consultant with CWSolution, a firm that facilitates workshops on leadership development, cross-cultural awareness and professional skills. Kaul has over 10 years experience with business development.

Jogi Panghaal is an independent designer, teacher and researcher in India, a leader whose work focuses on the shift from product to service design, inspired by traditional craftsmanship and traditional artisan communities, co-founder of Life Tools Panghaal has played an important role in Doors of Perception. Panghaal graduated in Product Design from the National Institute of Design (NID) in Ahmedabad, India in 1977. Mr. Panghaal has been a visiting teacher at National Institute of Design in India, ID, at Les Ateliers Paris, at the School of Planning and Architecture, Delhi and at the Gerrit Rietveld Academy in Amsterdam.

Debra Solomon (US/NL) creates experiential interventions aimed at breaking down the barriers between art and viewer. In 2004 Debra Solomon (US/NL) began publishing her independent research on culiblog.org on food, food culture, and the culture that grows our food. Her work has been shown at the PS1 New York; Kunsthal, Rotterdam; V2_Organisation Rotterdam; the Stedelijk Museum, Amsterdam; the OffenesKultuurHaus Linz. She has lectured widely, including UCP Berkeley and the International Astronautics Federation Congress.

Dr. Aditya Dev Sood is the Founder and CEO of the Center for Knowledge Societies in Bangalore and Delhi, where he directs design and innovation projects involving peer-to-peer networks, interactive services and interface design, as well as product design. With foundational training in Architecture and Critical Theory from the University of Michigan, he is a former Fulbright Scholar with doctorates in Socio-Cultural Anthropology and Sanskrit Philology from the University of Chicago.

Carol Upadhya is associate professor at the National Institute of Advanced Studies in Bangalore. She has widely published and also made three ethnographic films 'Coding Culture: Bangalore's Software Industry' in collaboration with Gautam Sonti (NIAS-IDPAD project 2006). With A R Vasavi she edited the revealing study "'In an Outpost of the Global Economy: Work and Workers in India's Information Technology Industry" (New Delhi: Routledge, 2008).

Prof. Dr. I.C. (Inge) van der Vlies is professor of Constitutional Law and Art and Law at the University of Amsterdam. She has served as part-time judge to the higher court in Amsterdam. Her present research focuses on the relationship of art and laws. Within this ambit issues like cultural diversity, cultural identity, freedom of expression and the character of ownership of cultural good are important. She has widely published on a variety of perspectives on legislation, including international developmental perspectives.

Rebekah Wilson obtained a degree in Composition at Victoria University of Wellington, New Zealand in 1996. Working as an independent composer, electronic musician, installation artist and filmmaker Rebekah Wilson has performed and lectured in many venues and festivals. Earlier this century she held the position of Artistic Co-Director at STEIM (Studio for Electronic and Instrumental Music), where she curated and participated in international festivals, workshops and education programs for live electronic and instrumental music, installations and film. Since 2004 she is the co-founder and director of technology for an international software development company, Source-Elements, delivering high-fidelity real-time audio delivery over IP.