

Creating Socio-Technical Systems By Design Thinking

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Sociotechnical systems perceive the interaction between actors and technical systems central. The definition of technical systems is here broader, including procedures and actors' knowledge. The theory says that the setting in which sociotechnical systems exists is mainly a workplace. It is about interrelatedness of social and technical systems in a particular context.

"In the twenty-first century the technology revolution will move into the everyday, the small and the invisible. The impact of technology will increase ten-fold as it is imbedded in the fabric of everyday life. As technology becomes more imbedded and invisible, it calms our lives by removing annoyances while keeping us connected with what is truly important. This imbedding, this invisibility, this radical ease-of-use requires radical innovations in our connectivity infrastructure." – Mark Weiser [22]

We are now talking on everyday life and not only on workplaces and organizations anymore. Imbedded and invisible technology is overall, not only in organizations. Studying sociotechnical systems nowadays needs to put users – not only workers – at the point of attention. This is what we do in this position paper.

We not only show how to design for users we also involve them in the design process. *User participation* has been explored and further developed in computer science for a very long time [4]. Participation in this sense can be applied in other disciplines. One way to do so is to consider the principles of participation. Principles help to define how participation can be defined and kept throughout a process as well as the nature and content of outcomes. For sustainability, it is necessary to think in terms of a coherent vision for change that encompasses three development areas: infrastructure, organization, and qualification. Besides being a mutual learning process, active genuine user participation increases the potential of visions produced by a project and then of the systems to be used according to their intentions. The principle of firsthand experience is realized especially during the in-depth analysis phase of a project. It builds on the proposition that to understand any phenomenon one needs to experience it firsthand. This can be done by observation, shadowing, in situ interviews, and thinking-aloud experiments, followed by systematic analysis and presentation of the gathered information. Finally, anchoring vision involves informing target group about the project's goals, visions, and plans.

Besides ethnographic qualitative methods (like participatory

observations, in-depth open interviews, data analysis) several innovative methods have been established in participatory IT design, partly stemming from other disciplines: cultural probes (to understand the cultural context of users) [12], provocative requisites (to achieve provocation, ambiguity, inspiration in context) [8], design games (as a playful way to gain design ideas) [2] [19], narrative posters (to tell the whole story on one sheet) [20], design workshops (to be creative and explore ideas in a team) [17], technology probes (to get a hint about real life interaction) [10]. These methods can be applied to facilitate participatory explorative design by involving users, also in other disciplines. They at the same time guarantee that solutions developed fit to users' skills, environments, and requirements.

Besides involving users in design processes we believe that *design thinking* is a very helpful approach to design sociotechnical systems. "Design thinking is a human-centered approach to innovation that draws from the designer's toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success." (Tim Brown, president and CEO of IDEO, <http://www.ideo.com/about/>).

In our Multidisciplinary Design Group we have created and established our own version of design thinking as an iterative approach to enable design among designers, students, and companies for a decade now. Our user-centered approach uses several methods: The very first idea, literature review, expert interviews, video analysis, cultural probes, provocative props, design games, scenarios, narrative posters, design workshops - for idea generation and systems design, sketches, wireframes, (video) mockups, technology probes, prototyping, design of product and corporate identity (<http://media.tuwien.ac.at/designthinking/>).

The design process we have established so far is iterative and user-centered by supporting creativity and innovation. Seen from actor network theory point of view [6], intermediaries created by applying design thinking impact the setting in which they evolve so they influence the design process as such. Being part of the network, intermediaries are related to activities or actors. Activity theory [9] "focuses on practice, which obviates the need to distinguish 'applied' from 'pure' science – understanding everyday practice in the real world is the very objective of scientific practice. ... The object of activity theory is to understand the unity of consciousness and activity." [18]. If we take design thinking as an approach seriously and apply (all) its methods thoroughly throughout the design process we can easily follow the goal of understanding of the everyday practice and its actors. This would lead us furthermore to design of systems that consider the context of use, user experiences, and the needed technology support.

Our objective in design of systems is being innovative and improving user experience [15] [21]. We think this can be done only by understanding the actors, their use context, and by user participation.

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ECCE'2014, September 1, 2014, Vienna, Austria.

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Compared to the principles of sociotechnical design [7] – by oversteering the context of organizations and by moving it to the context of users in general, as claimed above – we found out that design thinking is in line with the principles of sociotechnical systems, especially with the ones that are related to processes: compatibility, minimal critical specification, design and human values, and incompleteness.

Design thinking facilitates a process, which is compatible with its objectives. For instance, if the design objective is a playful system, the process needs to be playful by facilitating playful working and playful intermediaries. If the objective is high degree of usability, the process must be open for users and their evaluation of single design artifacts.

The principle of minimal critical specification says that no more should be specified than is absolutely essential. This means the design process must be kept open and flexible as long as possible. Options should be not closed, each design decision is challenged, and alternatives are always been offered. Design thinking supports this principle completely.

Design must put human values to the center. Design thinking offers a complete model to design, which makes designing sociotechnical systems possible. The goal is to improve the quality of users' life.

Finally, design is a reiterative process. As soon as design (intermediaries) is implemented, its consequences indicate the need for redesign. "The multifunctional, multilevel, multidisciplinary team required for design is needed for its evaluation and review." [7, p.791]. This is exactly how design thinking sees the design process.

We succeeded in several projects by considering design thinking as a holistic approach to design sociotechnical systems. Nevertheless, our development of design thinking methods and processes are ongoing and reiterative.

REFERENCES

- [1] Bogner, A. 2009. *Interviewing experts*. Palgrave Macmillan, Basingstoke.
- [2] Brandt, E., 2006. "Designing Exploratory Design Games: A Framework for Participation in Participatory Design?" *Proceedings of the Ninth Conference on Participatory Design: Expanding Boundaries in Design, PDC '06, Volume 1*.
- [3] Bodker S., 2000. "Scenarios in user-centered design – setting the stage for reflection and action", University of Aarhus, Department of Computer Science, Denmark.
- [4] Bodker, K., Kensing, F. and Simonsen, J., 2004. *Participatory IT Design. Designing for Business and Workplace Realities*. Cambridge: The MIT Press.
- [5] Buxton, B., 2007. *Sketching User Experiences, Getting the design right and the right design*, Morgan Kaufmann, Amsterdam.
- [6] Callon, M. 1987. "Society in the Making: The Study of Technology as a Tool for Sociological Analysis." in *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*, edited by Wiebe Bijker et al. London: MIT Press, pp. 83–103.
- [7] Cherns, A., 1976. "The principles of sociotechnical design". In: *Human Relations*. Vol 29(8), pp.783-792.
- [8] Dahley, A., Wisneski, C. and Ishii, H., 1998. "Water Lamp and Pinwheels: Ambient Projection of Digital Information into Architectural Space", CHI'98, April 18-23.
- [9] Engeström, Y., Miettinen, R., and Punamäki, R-L. 1999. *Perspectives on Activity Theory*. Cambridge University Press.
- [10] Fitton, D., Cheverst, K., Rouncefield, M. and Crabtree, A., 2004. "Probing Technology with Technology Probes", *Equator Workshop on Record and Replay Technologies*, London.
- [11] Franke, F., Klein, A., and Schüller-Zwierlein, A. 2010. *Schlüsselkompetenzen: Literatur recherchieren in Bibliotheken und Internet*. Metzler, Stuttgart.
- [12] Gaver, W. et al., 2004. "Cultural Probes and the Value of Uncertainty", *Interactions – Funology Copyright Association for Computing Machinery*, London.
- [13] Gaver W., Beaver J., and Benford B. 2003. "Ambiguity as a Resource for Design", *International Conference on Human Interaction, CHI, USA*.
- [14] Heath Ch., Hindmarsh, J., and Luff, P., 2010. *Video in qualitative research*. Los Angeles, California, Sage Publications.
- [15] ISO FDIS 9241-210, 2009. *Ergonomics of human system interaction - Part 210: Human-centered design for interactive systems (formerly known as 13407)*. International Organization for Standardization (ISO). jithin dev.
- [16] Kissmann, U.T. (ed.), 2009. *Video Interaction Analysis*. Frankfurt/M. et.al.
- [17] Lipp, U. and Will, H., 2008. *Das große Workshop-Buch*. Beltz, 8. Auflage, Weinheim.
- [18] Nardi, B., 1995. *Context and Consciousness: Activity Theory and Human-Computer Interaction*. MIT Press.
- [19] Pedersen, J. and Buur, J., 2000. "Games and Movies - Towards Innovative Co-Design with Users", *CoDesigning*.
- [20] Sandelowski, M., 1991. "Telling Stories: Narrative Approaches in Qualitative Research", *Journal of Nursing Scholarship*, Vol. 23, Nr. 3.
- [21] Tellioglu, H., Ehrenstrasser, L., and Spreicer, W., 2012. "Multimodality in Design of Tangible Systems", *Journal ICOM Special Issue on AAL, i-com, 11/3, November*, DOI: 10.1524/icom.2012.0033, pp.19-23.
- [22] Weiser, M. and Brown, J. S., 1996. "Designing Calm Technology", *PowerGrid Journal*, v 1.01, <http://powergrid.electriciti.com>, July.