The form of HWID theory

Torkil Clemmensen
Copenhagen Business School
`Tc.itm@cbs.dk`

Abstract. The aim of activities within the Human-Computer Interaction (HCI) area named Human Work Interaction Design (HWID) is to establish relationships between empirical work-domain studies and recent developments in interaction design. Recent areas of research within HWID include design sketches for work, usability in context, work analysis for HCI, and integration of work analysis and interaction design methods for pervasive and smart workplaces. Across these areas, the question emerges what form of theory may HWID research produce? The aim with this paper is to investigate the requirements of different research purposes to a common framework. We take the position that we should approach HWID with a lightweight, medium-level framework that is useful to guide the application of other theories to study the relation between work analysis and interaction design. We analyse the requirements to theory found in research presented at a recent working conference, and find that a frequent form of HWID theory may be a combination of a HCI theory, domain-specific theory and theorizing on the relation between empirical work analysis and interaction design. At the end of the paper, we propose some constraints for further development of a HWID framework.

1 Introduction

The aim of activities within the Human-Computer Interaction (HCI) area named Human Work Interaction Design (HWID) is to establish relationships between empirical work-domain studies and recent developments in interaction design. Recent areas of research within HWID include design sketches for work [1], usability in context [2], work analysis for HCI [3], and integration of work analysis and interaction design methods for pervasive and smart workplaces [4]. Across these areas, the question emerges what forms of theory may HWID produce? The aim with this paper is to investigate the requirements of different research purposes to a common framework. We take the position that we should approach HWID as a lightweight, medium-level framework that is useful to guide the application of more mature theories to study the relation between work analysis and interaction design. Thus, the form of HWID theory will often be a combination of a HCI theory combined with domain-specific theory and focused on the relation between empirical work analysis and interaction design.

The background for doing HWID is that increasingly work environments are challenging for research and design (see the cfp for this workshop). Furthermore, pervasive and smart technologies have pushed work-place configuration beyond linear logic and physical boundaries. As a result, workers' experience of and access to technology is increasingly pervasive, and their agency constantly reconfigured.

While this in certain areas of work is not new (e.g., technology mediation and decision support in air traffic control), more recent developments in other domains such as healthcare (e.g., Augmented Reality in Computer Aided Surgery) have raised challenging issues for HCI researchers and practitioners. The question that such research addresses is how to improve the quality of workers' experience and outputs. The answer to this question will help support professionals, academia, national labs, and industry engaged in human work analysis and interaction design for the workplace. The answer includes developing tools, procedures, and professional competencies for designing human-centred technologies for pervasive and smart workplaces [4].

However, to generate knowledge requires more than results and tools. How to generate knowledge addressing the design of interactive artefacts for challenging workplaces and work environments is a question of theory. The general question of how to theorize about the relations between empirical work analysis and interaction design is the concern of this position paper. In the remaining part of the paper, we analyse the requirements to HWID theory in the different papers from a recent research event (HWID2015). We discuss our findings briefly and indicate some constraints for further theory development. At the workshop, we hope to engage the audience in a discussion about how theories can be adapted, developed, and applied within the research area, and to identify suggestions for further development of the HWID framework.

2 User requirements analysis

Based on the papers, reviews of the papers, and discussions of the paper presentations at the recent HWID2015 working conference, we aimed at identifying the users' (i.e., the researchers') requirements to HWID theory (what theory should be able to do, the form it should have, and what kind of research it would support, etc.). Below we list and explain the requirements that we identified:

1. *Connect Human Work (HW) and Interaction Design (ID)*
2. *Useful for interventions in practical, real-world domains*
3. *Close to an HCI concept, e.g. UX*
4. *Explains aspect of real-world phenomena*
5. *Specify the outcome state of system use*
6. *Deal with context in precise and dynamic way*
7. *Multilevel, take organizational aspects into account*
8. *Describe a work domain*
9. *Well-known and proven (cited)*
10. *Socio-technical in the widest sense*
11. *Useful for domain analysis, eliciting tacit knowledge*

12. Can connect a series of domain specific theories
13. Useful to generalize findings to similar domains

   1. Connect HW and ID. One requirement to HWID theory is that it can be used to give an overview of research in the field. Frederica Gonçalves, Pedro Campos and Torkil Clemmensen [4] use a HWID framework to present a literature review of 54 papers from HWID workshops, conferences and journals from the period 2009-2014. The paper ends up asking why there is a gap in terms of overall HWID theory development? Questions unanswered in the paper includes if some of the research touch on this partially? Or is HWID theory an integration of theory on three kinds: work analyses, interaction design, and IT artefacts?

   2. Useful for interventions in practical, real-world domains. Ørngreen [4], in her paper on reflections on design-based research in online educational and competence development projects, is concerned with the usefulness of HWID theory for interventions. She integrates a literature review with her personal experiences in the field to understand the research and practice domain. It turned out from the discussion at the conference that to make her analysis and HWID theory development practically useful, it would be good to have a graphical overview of the different studies presented and how they were related.

   3. Close to an HCI concept. A third requirement to HWID theory is that it is associated closely with existing HCI concepts or theory, and in this way can contribute to the body of knowledge in HCI. Daniela Wurhofer, Verena Fuchsberger, Thomas Meneweger, Christiane Moser and Manfred Tscheligi [4], in their paper on insights from UX research in the factory on what to consider in interaction design, connect HWID analysis to the HCI concept of UX. Based on recent research (from the last five years), they provide a discussion on the interplay between user, system and context in a factory environment by pointing out relevant UX factors and influences on the workers' experiences. What emerge as a finding is a list of many factors, user experiences and influences, which potentially could be useful for rewriting HCI textbooks on UX.

   4. Explains aspect of real-world phenomena. This requirement for HWID theory concerns the need to be able to explain interesting aspects of the real-world phenomena studied. Maria Ianeva, Stephanie Faure, Jennifer Theveniot, François Ribeyron, Gilles Cordon and Claude Gartisier [4] take an industry perspective on pervasive technologies for smart workplaces and in particular a workplace efficiency solution for office design and building management from an occupier's perspective. They focus on how to increase workplace efficiency in the long-term, and contextualize a contemporary concept (Activity Based Workplace) in a living-lab setting (a company's new HQ). They partially explain the success and failures of the implementation studied. Questions to this research include if the specific

technological solution for monitoring spaces' occupancy bias the results, and for how long (temporal length) such a study should continue.

5. *Specify outcome state of system use.* This requirement for HWID theory concerns the need for being able to specify the (ideal) outcome state of the analysis and design. Valentin Gattol, Jan Bobeth, Kathrin Röderer, Sebastian Egger and Manfred Tscheligi [4], in their paper on bottom-up insights that leads to design ideas in a case of designing office environments for elderly computer workers, aim to design a smart work environment for this target group. Different research methods were employed including interview, an ideation workshop, and an online survey. Questions raised during discussion concerned what the target situation was for the studied user group. Thus, without supporting theory about human work, it is hard to say what it means to be "old" in contemporary societies (this could include less tech-savvy, myopic vision, back pain, poor fine motor control, memory drop outs, etc.), as well as what kind of interaction design will be useful (e.g., why would a "smart" work environment be considered relevant? How about conventional solutions such as digital reminders and task lists?)

6. *Deal with context in precise and dynamic way.* Väätäjä [4], in her attempt to characterize the context of use in mobile work, provides synthesized findings from twelve cases studies, and derives a model to be used when designing and evaluating systems for mobile work. One question that emerged during discussions of this study was if mobile work context as in this study is best described as a mixture of the context as container (precise description) and context as activity (dynamic description)?

7. *Multilevel, take organizational aspects into account.* This requirement for HWID theory concerns the need to take organizational aspects into account. Petra Bjorndal, Elina Eriksson and Henrik Artman [4], in their attempt to make sense of user-centered perspectives in large technology-intensive companies by looking at relationships rather than transactions, find that theory needs to be multilevel. They studied service design in four IT companies and concluded that studying single human-computer interaction in a work context (transactions) was far from sufficient to appreciate and design services (relationships) in the organizations.

8. *Describe a work domain.* This requirement for HWID theory concerns the need to describe a work domain. Jose Abdelnour-Nocera, Samia Oussena and Catherine Burns [4], in their study of the Smart University and how to support students' context awareness, created a set of design guidelines, based on the insights from a cognitive work analysis (CWA). As HWID stems from CWA, this is a classic example of HWID analysis (though only in the direction of work analysis towards interaction design). However, the pro and cons of limiting the analysis of relations between work analysis and interaction design to the form of cognitive work analysis (i.e. CWA table) is a topic for future research.

9. *Well-known.* A HWID theory needs to build on the well-known and simple. Åsa Cajander, Marta Larusdottir, Elina Eriksson and Gerolf Nauwerck [4], in their study of IT-based administrative work, brought life into the HWID analysis by developing a concept of "contextual personas". They motivate this in the convergence of interaction design and pervasive workplaces. The main new thing that they introduce to the persona are the statements about control, demand, and support in the work and life of the persona, based on the theory of healthy work by Karasek and Theorell. A question for further development of the concept is how distinct contextual personas are when compared to task and use scenarios?

10. *Socio-technical in the widest sense.* This requirement for HWID theory concerns the needs for dealing with the wider context of use including societal values. Arminda Guerra Lopes [4], in her study of the work and workplaces in social solidarity institutions with the aim to address organization agility and innovation, found that she needed to study the goals and history of the Portuguese social security system. This included that she studied the societal values related to life as an older person. This study uses multiple theories to address the HWID relations and develops a prototype for integration of information related to care services. It provides a clear requirement to the HWID framework to be an organizing framework for multiple theories on many aspects of the context of use.

11. *Useful for domain analysis, eliciting tacit knowledge.* This requirement for HWID theory concerns the need for doing domain analysis and eliciting tacit knowledge. Samantha Quercioli and Paola Amaldi [4], in their grounded theory study of perspectives on automation amongst aviation industry stakeholders, learned that systems are far too complex for people to understand. Hence the main target for the domain analysis emerges as trying to identify what half-baked knowledge that human actors need to have about non-human actors in order to avoid or recover from unsafe situations with aircrafts. It turned out in the discussions at the working conference that in this case human work and interaction design were clearly mutually constitutive.

12. C*onnect a series of domain specific theories.* This requirement for HWID theory concerns the need for connecting several domain specific theories. Judith Molka-Danielsen, Mikhail Fominykh, David Swapp and Anthony Steed [4], in their design of a virtual learning environment to teach space syntax from the user's perspective, created an artefact by combining insights from several domain-specific theories. The theories were a 'threshold' concept from didactics, 'line of sight' from architecture, Virtual Learning Environments (VLE) theory, and more.

13. *Useful to generalize findings to similar domains.* This requirement for HWID theory concerns the need to make results useful for other similar domains as the one studied. Stefano Valtolina, Barbara Rita Barricelli, Davide Gadia, Matilde Marzullo, Claudia Piazzi and Andrea Garzulino [4] integrates multiple

studies of co-design of cloud services for archaeological practice, and identify two problems in current archaeological practice: 1) how to integrate and create useful knowledge from a richness of documentation, and 2) how to facilitate collaboration among various domain experts. They adopt a semiotic approach in combination with tool design to do the HWID. Future research may map the relations between the two theories in order to generalize to other domains and other archaeological sites.

3 Discussion & conclusion

In this position paper, we have illustrated that a frequent form of HWID theory is as a meta framework that serves to focus discussion on Human Work (HW) and Interaction Design (ID) relations in wide contexts. In the light of the user requirement analysis presented above, it appears that one of HWID's main heritages from cognitive work analysis (CWA) is the need to adapt, combine, and develop a mix of theories in order to understand the relations between HW and ID on multiple levels. Further development of the HWID framework may make it a better tool for mapping the combinations of multiple other theories onto the relations between HW and ID. In addition, the IT artefacts, e.g. contextual personas by Cajander et al (see above) or the threshold artefacts by Moltke (see above), may be examples of hybrid work analysis and interaction design artefacts coming out of HWID. Finally, the HWID theory should reflect that artefacts may be 'packed' with values from both HW and from ID (see Lopes, above).

References

[1] Clemmensen, T., Campos, P., Ørngreen, R., Pejtersen, A. M. and Wong, W., (Eds). Human Work Interaction Design - Designing for Human Work. First IFIP WG 13.6 Conference, HWID2006, February 13-15, 2006, Madeira, Portugal. Revised Selected Papers. Springer, 2006.
[2] Katre, D., Orngreen, R., Yammiyavar, P. and Clemmensen, T., (Eds). Human Work Interaction Design: Usability in Social, Cultural and Organizational Contexts: Second IFIP WG 13.6 Conference, HWID2009, Pune, India, October 7-8, 2009, Revised Selected Papers. Springer, 2010.
[3] Campos, P., Clemmensen, T., Abdelnour-Nocera, J., Katre, D., Lopes, A. and Ørngreen, R., (Eds). Human Work Interaction Design. Work Analysis and HCI: Third IFIP 13.6 Working Conference, HWID2012, Copenhagen, Denmark, December 5-6, 2012, Revised Selected Papers. Springer, 2013.
[4] Abdelnour-Nocera, J., Clemmensen, T., Campos, P., Lopes, A. and Barricelli, B., (Eds). Human Work Interaction Design for Pervasive and Smart Workplaces. HWID2015, London, June 25-26, 2015. (In preparation).