Human Work Interaction Design: An Overview

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Abstract. In this paper, we review research in the emerging practice and research field of Human Work Interaction Design (HWID). We present a HWID framework, and a sample of 54 HWID related papers from workshops, conferences and journals from the period 2009–2014. We group the papers into six topical groups, and then attempt to map these groups to the framework to find research gaps for future research. We find that the groups of papers cover all areas of the framework well for a variety of work and leisure domains. The area in strongest need for more research papers is the development of the holistic framework itself. Furthermore, much focus has been on studying design sketching or implemented systems-in-use, while little attention has been paid to mature design (prototypes) or early implementation (content templates). In conclusion, we recommend an update to the framework so that it can be also useful for research in prototyping and early organizational implementation.

Keywords: Human work interaction design · User experience · Literature review

1 Introduction

The boundaries and work processes for how people work and interact are suffering changes due to the very fast emergence of new information technologies. To address this comprehensive problem, the Human Work Interaction Design Working Group (HWID) was established in September 2005 under the auspices of IFIP, the International Federation for Information Processing (Campos, Clemmensen, Abdelnour-Nocera, Katre, Lopes, Ørngreen, 2012). In this paper, we provide an overview of recent research related to HWID. Our focus is on identifying research gaps for future research.

Today, HWID is a comprehensive framework that aims at establishing relationships between extensive empirical work-domain studies and HCI design. It builds on the tradition of cognitive work analysis (Ørngreen, Mark-Pejtersen, Clemmensen 2008). In order to provide an easy understandable version of the framework that is applicable across domains, Clemmensen (2011) developed a revised HWID framework (Fig. 1). In recent workshops and scientific meetings, it has been discussed that the current mission should involve empowering users by designing smarter workplaces. HWID is currently positioned as a modern, lightweight version of Cognitive Work Analysis (CWA).
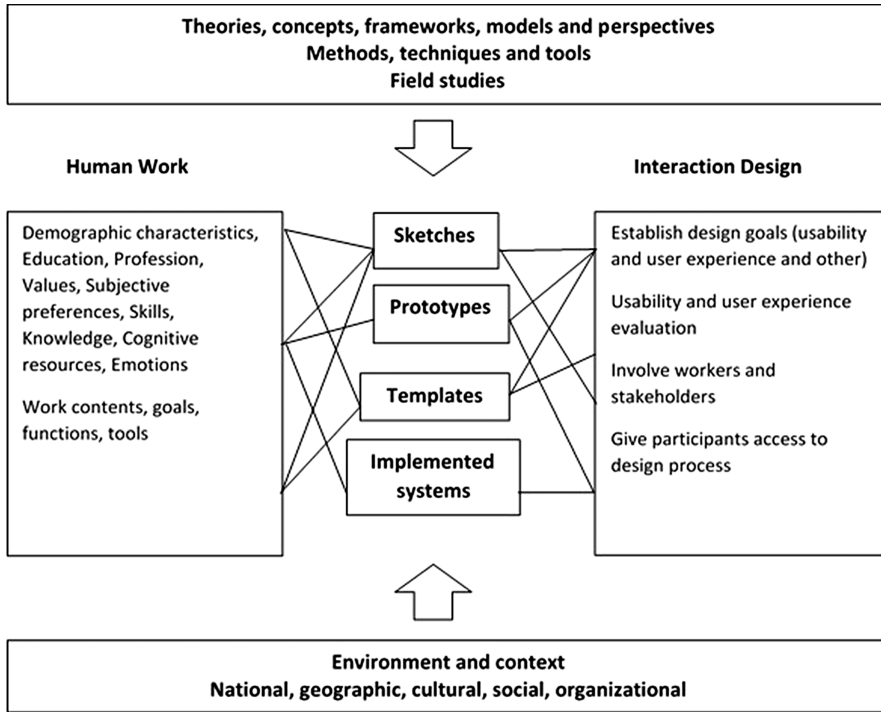
Fig. 1. Human Work Interaction Design framework (Clemmensen, 2011)

The characteristics of humans and work domain contents and the interaction during their tasks and decision activities, individually or in collaboration, are the base of this framework.

The top box illustrates the theories used, the left is the analysis of users' work and life, in the middle column the artefacts, and to the right the design of interactive information technologies. The box at the bottom indicates that environmental contexts, such as national, cultural, social and organizational factors, impact the way in which users interact with computers in their work and life. The lines connecting the left-right boxes illustrate the various relations between empirical work analysis and interaction design activities and products, which are the focus of HWID research.

For the early years of HWID research (2005–2008), Ørngreen et al. (2008) reviewed the theory and empirical evidence behind attempts to combine empirical work studies and interaction design. Since then, the research in this area has grown significantly, making the case for an updated survey and review. In this context, we reviewed and selected 54 research papers about HWID from workshops, conferences and journals from 2009 until 2014. This analysis has resulted in the identification of six groups of papers (see the Appendix for a list of the papers), which reflect diverse topics relating problems that the researchers perceive to be the major concerns and challenges in HWID. It is always a challenge to provide a sound overview of any research field. In this case,

our literature review was quite broad and includes papers that do not cite or refer specifically to HWID, but are potentially important to HWID.

2 Exploring UX and Designs for Smart Places in Work Environments

The first group of research papers takes as the starting point the empirical analysis of human work and its relation to IT artefacts (the left side to center column of Fig. 1).

Understanding UX of Smart Workplaces. To design successful human-centered technologies for smart workplaces, Meerbeek et al. (2014) did a case study of automatic window blinds to acquire a better understanding of the current behavior of office occupants with respect to the control of daylight entrance. They used mixed methods to investigate the effect of user-controlled and system-controlled (automatic) changes of exterior venetian blinds on occupants' experience of the blinds' system and their satisfaction with the indoor climate, including lighting, noise, and temperature. They found that people's work habits tended to overrule artefact settings.

Smart and Pervasive Technologies. There are very few reports on how pervasive and smart characters of information and communication technologies shape the quality of the life, working and user experience of telecommuters. Law and Abdelnour-Nocera (2014) discussed, from different design and cultural perspectives, including emerging economies like India, the nature of sociotechnical gaps in telecommuting and the implications of these for the quality of work and quality of life teleworkers.

Identifying User Experience Goals. Clemmensen and Barlow (2013) used an interpretive phenomenological approach to find user experience goals in complex work systems such us an interactive climate management with growers and crop consultants. They presented a model of the essence of the emotional user experience with examples of how to capture the user experience in work contexts and with a qualitative methodology. In order to measure the identified emotions in other contexts than climate management or other climate management situation than greenhouses they suggested that futures research aim to develop work context sensitive user experience scales.

Ergonomic and Motivating Workplaces. Designing a platform for ergonomic and motivating workplaces, especially targeted at older employees, was the vision of Bobeth et al. (2014). The authors designed a smart and flexible work environment to support a prolonged, productive and satisfactory involvement of older employees in working life. Offering a range of assistive tools and services, both for the office and the home environment, was a goal driven by bottom-up insights into the work realities and contexts for this type of users.

Viz Reporter *in vivo*. Studying mobile journalism in the context of the professional news organization TV2 in Norway, Guribye et al. (2014) show in this paper through ethnographic inquires into the work practice of these journalists, how the adoption of a mobile application called Viz Reporter can be accomplished in practice. The authors

identify design implications not only for the usability of the product but also for the ways in which journalists themselves can take part in configuring their digital habitats.

UX in a Work Context. To capture the user experience of the smart workplace, Yadav and Clemmensen (2014) present an approach discussing a pilot experiment where they integrate multiple data-streams of user experience, such us physiological, behavioral, and environmental and IT processes, in a work setting to give us a holistic view in user experiences due to Internet of Things. Their experiment provides one basic framework to new experiences in the future.

ICT Design and Evaluation for Trans-mediated Workplaces. Traditionally human work analysis is focused on user goals, user requirements, tasks and procedures, human factors, cognitive and physical processes and contexts. Abdelnour-Nocera et al. (2013) show a formal initiative at a European level to harmonize HWID as a substantive discipline supporting the interaction of workers through technology, at a time in which concepts of workers and workplace are changing significantly.

Evaluate the Work Environment of Future Work. Sandblad (2013) developed a checklist for analysis into aspects such us physical, psychosocial and cognitive work in order to prevent possible negative work environment consequences. It is not enough to simply introduce information technologies systems that support the organization's current work practice but also is important to use the full potential of the new technology to improve the organization, work practices and work environment. Developing this checklist based on the Demand-Control-Support model, Sandblad present a research approach with a focus on the work environment aspects.

Studying Contextual Interaction. In order to derive inspirations for designing future interactions Murer et al. (2014) provides an approach using industrial companies' habit to showcase their products as well as production facilities. Their strategy approaching extensive tours "behind the scenes" that are augmented with ad-hoc staging of contextual interactions, allows to study human work interaction in domains and facilities usually hard to access in research.

Workplaces for Creative Writers. Gonçalves and Campos (2014) describe an analysis based on HWID framework to make a simple analysis for a complex domain such as creative writing. The authors describe an analysis of connections between human work and interaction design from a creative writing support perspective.

Mind the Gap. Arguing there is a gap between the technological artifact produced and the social requirements that govern how well the system will fit in the organization, Lind et al. (2013) in this work in progress paper, present a framework – SOT (Social, Organizational and Technical) – to analyze the deployment of information systems (IT) from a sociotechnical perspective. The authors propose the concept of inertia to reflect the relative and varying ability of either of SOT aspects to adjust with respect to the other two. They believe that the sociotechnical gap is a result of the collective inability of these aspects to reach a middle ground within an organization.

Cognitive Work Analysis. Burns (2012) highlights the importance of cognitive work analysis (CWA) and their recent work focused on adapting CWA to face the new challenges and provides a solution that fits a truly social technical system in this paper.

Usage of Different Work Analysis Methods. Campos and Noronha (2012) describe and elaborate around the usage of different work analysis methods in a complex, real world work domain: collaborative review of large-scale 3D engineering models. They concluded that hierarchical task analysis was not effective in obtaining a clear, common vision about the work domain.

3   Improved Qualities in Health and Support in Work Design

The second group of papers are strong on work analysis in particular organizational contexts (right to bottom of Fig. 1).

How to Improve the Interaction Quality of Psychologists and Patients. Serra et al. (2014) look at the gap in the research about "computerized psychology". They present a work in progress project that consist on the development of an application that will support and facilitate the interaction among psychologists and patients. By interviewing several psychologists after and during the prototype evaluation phases, they showed that with the use of therapeutic writing could bring results for the clinical heath of patients.

Using Well-being Data. The advent of new technologies is changing the way people work. Valtonen et al. (2014), describe a new way to think about how we work. They propose the study of well-being from employees that are feeling overwhelmed and exhausted to design new ways of work and work environment to support productivity and well-being.

Designing a Health-care Worker-Centred System. Silvestre et al. (2013) report prototypes around personal schedules, games and personal digital artifact management that investigates different ways of looking at long-term health care based on multiple user-centred design iterations with the chronic mental care hospital staff. They established this approach as promising for improving overall care for the residents in long-term care.

Challenges in Applying a Participatory Approach. Scandurra et al. (2013) recommend increasing the use of "health informaticians" with usability and human work interaction design expertise within national and local eHealth development. In this paper, they present the experiences of applying a participatory approach in a nation-wide project. They considered that eHealth development is a challenging and complex activity, and best-practice methods from HCI related with HWID can support the business development within health and social care.

Usability Heuristics and Quality Indicators. Medical errors and cost the life of a patient can be caused by complexity in the user interface, features and functionalities of ventilator systems. Katre et al. (2009) presents a study about heuristic evaluation of three touch screen based ventilator systems manufactured by three different companies.

Evolving a specialized set of heuristics combined with objectively defined usability indicators for the usability evaluation of touch screen based ventilator systems was performed by four different usability evaluators to ensure the reliability of heuristics proposed. Findings on several observations in ventilators systems shows that the interface design of touch screen ventilator needs significant design enhancements.

The Influence of Mood Feedback. Sonderegger et al. (2013) offer experiences that examine the influence of mood feedback on different outcomes of teamwork in two different collaborative work environments. The authors present a new collaborative communication environment, using an avatar, which provides visual feedback of each team member's emotional state to support teamwork.

Do Usability Professionals Think about User Experience? Clemmensen et al. (2013) investigates how usability professional's thinking about system use is different from other stakeholder groups with different nationalities, in particular system developers and end users. The paper shows results that indicate usability professional focus on emotion-related aspects of system use, while users focus more on context in terms of utility and degree of usage.

Work and Speech Interactions Among Staff. Care services are often provided by the devoted efforts of care staff at long-term care facilities. Chino et al., (2012) observed bathing assistance, night shift operations, and handover tasks at a private elderly care home for eight days. The authors found that staff members are always speaking during the task, remote communication is rare, about 75 % of staff utterances are spoken residents, utterance targets are frequently switch, and about 17 % of utterances contain at least one personal name.

Usability Model for Medical User Interface. Bhutkar et al. (2012), in this paper used a usability model for medical user interfaces, especially for ventilator in Intensive Care Unit (ICU). They proposed this based on Norman's action-oriented seven-step model to capture a related medical context. This comprehensive model brings related medical context into human work analysis in terms of vital medical elements such us medical user, user interface, ICU environment and time required. The authors suggested that usability professionals for improved results could use this model as a template with medical user interfaces effectively.

4 Supporting Human Collaborative Work and Cognitive Strategies in a Global World

The third group of papers is strong on the environment and context, as they focus on the global world (bottom of Fig. 1).

Transnational Teams' Impacts. Global organizations can choose to configure and structure their teams in a wide variety of ways. Haines et al. (2013) found important to understand the implications of various transnational team configurations. The authors conducted a research in a large multinational technology company and they found that the development of social capital is impacted by whether a person is in their home context

or transplanted and their expectations based on that context. They highlight factors in the creation of social capital as well as some mechanisms that may mitigate cultural difference.

Supporting Human Collaborative Works. Chino et al. (2013) proposed in their paper an application model to support human collaborative works. The model is designed based in a real field study at an elderly care facility in Japan and a virtual field experiment on the collaborative words utilizing a voice communication systems for human workers of what they called "action oriented intellectual services" that works in distributed work fields. To improve the interaction design among the system and the human workers, the authors suggest to use the data accumulated in the system itself to support the human work analysis.

Collegial Collaboration for Safety. Jansson et al. (2013) present a model for verbal probing procedures that is used to assess situation awareness in dynamic decision contexts – colleagues explore each other's cognitive strategies. In this paper the authors shows the results from a cognitive field studies using a method developed for knowledge elicitation in applied contexts and reviewed from previous studies – *collegial verbalization*. They purposed to evaluate whether the knowledge elicitation procedure can be used as a basis for exploring how colleagues can learn from each other, using studies that will take place at an intensive care unit.

Distributed Scientific Group Collaboration. Li et al. (2012) explored in this paper the collaborative practices, particularly information sharing, in scientific collaboration between different groups and over the distance of physical containment barriers in a biosecurity laboratory. Their findings contribute to the design of collaboration platform for this type of environment that can resolve common communications issues over distance.

An Integrated Communication and Collaboration Platform. In this paper, Müller-Tomfelde et al. (2011) present the design process, the technical solution and the early user experience of a collaboration platform, which integrates life-size video conferencing, and group interactions on a large shared workspace to support distributed scientific collaborations. This platform was developed to support the diagnostics and research scientists in an animal health laboratory to work collaboratively across a physical containment barrier.

Usability Testing in Three Countries. Triangulating how companies perform usability tests, Clemmensen (2009) in this paper reported and compared three ethnographic interviews studies in Mumbay, Beijing and Copenhagen. This study, using structural and contrast questions do a taxonomic and paradigm analysis, indicates that a typical or standard usability test across countries had some clear similarities.

5   HCI and Usability Research in Educational, Cultural and Public

The fourth group of papers focus on the global context's relation to usability and interaction design (bottom to right side of the Fig. 1).

Usability in a Cultural Context. The aspect of culture in design of user interfaces and interactive products is an issue important that Clemmensen et al. (2009) tries to underline in this paper. To understand the differences in how people with different backgrounds respond to directions and test methodologies, they focused on presenting and discussed the aim context, challenges, results, and impact of the Cultural usability named as CultUsab. This was a project with four-year international research effort from 2006 to 2009, supported by a grant from the Danish Research Councils for Independent Research in Culture and Communication.

Usability Research in Indian Educational Institutions. In this paper Yammiyavar (2009) traces briefly the evolution of human work interaction in educational institutions in India. The author highlights through samples of research work done the urgency for training more researchers in the field of emerging area such us HCI and the great potential in this country.

Usability Evaluation of State Government Portals. Katre and Gupta (2011) present in this paper a usability evaluation of 28 state government web portals of India. This evaluation was based on 79 parameters grouped under 7 broad categories such as accessibility, navigation, visual design, information content, interactivity, ownership and branding. The expert usability evaluation presented in this paper highlights the lack of human work analysis in the design of the state web portals.

A Rapid Ethnographical Study. Righi et al. (2011) conducted a rapid ethnographical study aimed at understanding attitudes of older people towards e-government related activities and Information and Communication Technologies. The authors presented initial results derived from their study and discussed a potential scenario for supporting information sharing and promoting a more active and dynamic participation of older people in their neighborhood. Their findings suggested that a variety of inclusive aspects, such as socialization, face-to-face contact, or mutual support impact the use and adoption of e-services by older people.

Narrative Interaction. Authors such as Schreder et al. (2011) suggested that narrative interaction could be used as a design possibility for human-machine interfaces in public information systems. They considered that using storytelling and narration for the graphical presentation of information in self-service technologies enables customers to draw on their everyday experiences. This paper presents a case study of a train ticket purchase process with a story structure that demonstrates the concept of narrative interaction.

Designing Accessible Public Information Systems. Campos (2011) presents in this paper a design approach towards the development of a fully interactive tourism information office. The author considered that public information was facing unique design challenges arising from the need to a diverse range of users, such as tourists, senior users, passers-by, children and teenagers. He concluded arguing that human work interaction design can be a solid, useful approach to better support the diversity of public information systems' users.

Success within User Centred Design. Hamilton et al. (2011) considered that E-Government websites and other online channels had the potential to empower citizens by making Government services more accessible and convenient to use. They examined three recurring challenges to applying User Centred Design (UCD) in the public sector and then described a successful service design project that overcame these challenges. Their experience in relation to UCD practitioners, was developed in the United Kingdom Government domain, and usability techniques were not being been sufficiently embedded in e-Government projects.

E-Government and Public Information Systems. Clemmensen (2011) outlines a revised version of the general HWID framework with a focus on what connects empirical work analysis and interaction design. Presenting a case study of the Danish government one-for-all authentication system NemID that has been briefly analyzed using ethnomethodology, work domain/task analysis, and the HWID approach for comparison. The author concluded that there were benefits in studying how human work analysis and interaction design in concrete cases are related and connected.

Cultural Elicitation in HCI. In Information and Communication Technologies (ICT) design many different approaches for techniques and frameworks are offered to eliciting culture and context in this field. Camara et al. (2009) in this paper argue that designers need to locally identify context and culture aspects and further explain their implications through the design process and at the global level.

Usability and Culture. Kurosu (2009) in this paper outlined the conceptual framework of the Artifact Development Analysis (ADA) and its relationship to the usability engineering. The author proposed to focus on the extent where the usability can provide the core satisfaction and also summarized the guideline on how the artifact should be designed.

Culture and Human-Computer Interaction. The interest in the correlation between culture aspects and Human-Computer-Interaction had grown significantly during the years. Clemmensen and Roese (2009), propose in this paper a review of current practice in how cultural HCI issues were studied, and analyzed problems with the measures and interpretation of their study. They found that Hofstede's cultural dimensions had been the dominating model of culture, participants had been picked because they could speak English, and most studies had been large scale quantitative studies.

'Adaptation' in Children. Deshpande et al. (2012) in this paper describe an exploration of how children adapt their interactions with different graphical user interfaces (GUIs) in carried task situations. They could observe that a GUI is rich in features facilities user adaptations in coping with differences in task complexities.

Library Usability in Higher Education. Based in UK university libraries, Wiles et al. (2012) in this study aims to find out how and to what extent user experience forms parts of university library policy, and how it can effectively be incorporated into it. The authors show that the creation of a library user experience policy begins with the identification of the social-technical gap between experiences and expectations.

6   Exploring Scenarios to Create Design Ideas

The fifth group of papers focus the relations between interaction design and artefacts (left side to center column of Fig. 1).

Using Storytelling to Create Design Ideas. Madsen and Nielsen (2009) in this paper explore the persona-scenarios method by investigating how the method can support project participants in generating shared understandings and design ideas. They contributed with guidelines that delineate (a) what a design-oriented persona-scenario should consist of product and (b) how to produce in order to generate and validate as many, new, and shared understandings and design ideas as possible.

Personas in Cross-Cultural Projects. To communicate data about users and to create a shared perception of them, Nielsen (2009) considered the method Personas in this experience using 16 participants in 9 different countries. The author asked participants to return a photo that resembled the persona and for them to explained their choice. Results in this analysis shows that there is a difference between the participants with professional experiences and those without.

A Game-Like Interactive Questionnaire. Dai and Paasch (2012) describe in this paper the use of a questionnaire to facilitate a photovoltaic (PV) application research, which led by University of Southern Denmark and with collaboration between local companies to popularize PV technology in both residential and the industrial markets.

Using Lego Mindstorms for Sensor-Intensive Prototype. In this paper, Pedersen and Clemmensen (2012) describe a design science framework for the use of interactive, sensor-intensive prototypes to develop interactive greenhouse climate management systems. This study provides a reference platform for combining micro information systems and human-computer interaction in design science research into environmental sustainability research.

UCD Guerrilla Tactics. Ericksson and Swartling (2012) in this paper present a case study within Sweden's military defense organizations, concerning the introduction of user-centred design (UCD). This paper describes the guerrilla tactics, how it was applied in this case study and factors that should be considered when using it.

Feedback in a Training Simulator. This paper aims to understand the importance of early work analysis in a real context during the design of such a simulator. Druzhinina and Hvannberg (2012) showed results that there were several significant differences.

7   Applications and Evaluations

The sixth group of papers focus on the IT artefacts as part of a holistic HWID context (center column and whole Fig. 1).

A Materiality-Centered Approach. To assess materiality from a user and artifact perspective, Fuchsberger et al. (2014) described an approach that puts the user and the

artifact equally in the center of attention using a materiality-centered data analysis. Their approach allows identifying material attributes of actors that are less obvious.

Empirical Evaluation of Complex System Interfaces. Garg and Govil (2012) in this paper starts discussing two cognitive science paradigms and then present third approach related to interaction with the world as known as embodied cognition. They focused their analyze in work settings with the help of cognitive work analysis and human work interaction design approaches.

Natural Interactions. Proença and Guerra (2012) in this paper present a system for the development of new human-machine interfaces focused on static gestures recognition of human hands. Results shows that it is possible to interact with a machine naturally and intuitively through hand gestures without requiring support material such as gloves or markers.

Focus on Computing Practices. Franssila and Okkonen (2012) present a work in progress paper to considered the utility of current theoretical and methodological human computer interaction and work analysis in understating and supporting knowledge workers. They focused in the design efforts, instead of technical artifacts, into the observation, understanding and development of computing practices.

Mobile Probing and Probes. Duvaa et al. (2012) highlight in this paper the mobile probing as a method developed for learning about digital work situation and as an approach to discover new grounds.

Support of Multimodal. Velhinho and Lopes (2012) present a work in progress to evaluate frameworks used by business enterprises and to state the advantages and disadvantages in their use.

Safety Critical Social-technical System. This paper, authored by Amaldi and Smoker, (2012), used the UK service organization for Air Traffic Management Domain called NATS (National Air Traffic Service) as a case study to illustrate an example of an organization currently undertaking critical self-reflection about automation policy or lack of such.

8 Discussion and Conclusion

Figure 2 shows a mapping of the different groups of paper topics on top of the HWID framework: (**I**) Exploring UX and Designs for Smart Places in Work Environments; (**II**) Improved Qualities in Health and Support in Work Design; (**III**) Supporting Human Collaborative Work and Cognitive Strategies in a Global World; (**IV**) HCI and Usability Research in Educational, Cultural and Public; (**V**) Exploring Scenarios to Create Design Ideas; (**VI**) Applications and Evaluations. These are the groups that correspond to the previous sections. For instance, Group I (Exploring UX and Designs for Smart Places in Work Environments) is depicted on the middle left side of the Fig. 2 since this is where the HWID framework depicts the empirical analysis of human work and its relation to IT artifacts. The same applies to all of the other groups.
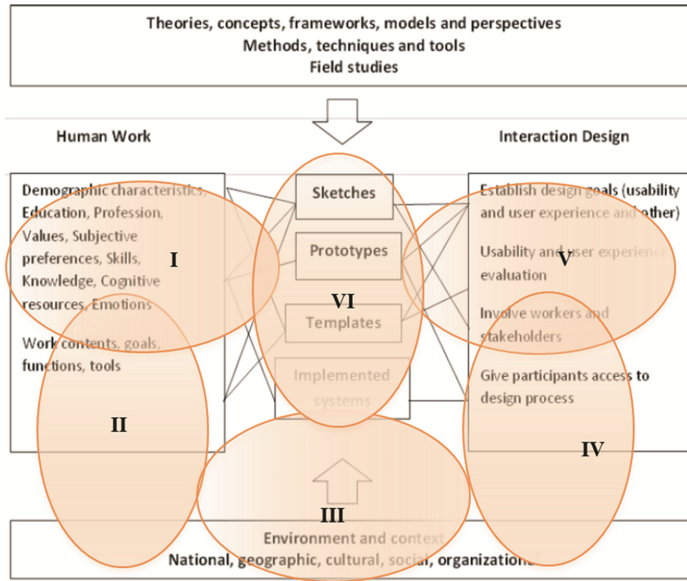
Fig. 2. Mapping groups of HWID papers to the HWID framework

It is obvious, from the analysis of missing bubble in the top of the framework's figure that one research gap is the need for better theories, concepts, frameworks, models and perspectives on HWID.

We do have theoretical work for different aspects of HWID, e.g. Burn's (2012) paper on social aspect of work analysis, but we need more papers that account for HWID as a holistic phenomenon that covers both work analysis and interaction design.

Second, we need more research on methods, techniques and tools, including field studies, for doing HWID research. Clemmensen (2011) suggested a specific way to use a combination of the HWID framework and grounded theory with digital qualitative analysis software (such as Atlas.ti), and we need more HWID-specific methods.

Third, Fig. 2 also indicates that we need more work explicitly dedicated to the relations (the lines in the framework figure), though we have the research papers represented by bobble I and V, and also earlier work on sketching for human work (Campos et al. 2006).

Fourth, when distributing the papers into the HWID framework, see Fig. 3, we can see that most of the papers are about human work and less about interaction design, and also, that there has been more studies of very early phases in system development (sketches) or, at the other end, late phases (studying implemented systems). There has been few studies of late prototypes or early stages of implementation (content templates for use).

Fifth, the work in this field has just started, and during the period that we analyzed, we had 38 empirical papers and 16 theoretical papers in order to explore concepts for the emerging area in HWID. Table 1 shows the number of papers per year we selected for the last six years, and the country of researchers. More
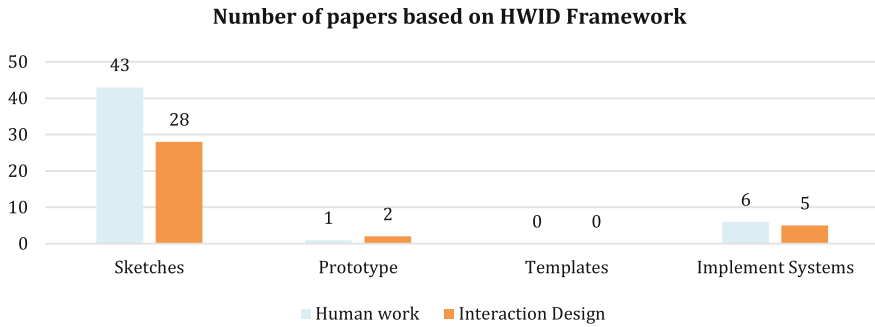
Number of papers based on HWID Framework

Fig. 3. Number of papers based on HWID Framework

researchers from more countries should be involved in this research, as human work and interaction designs may have many forms.

Table 1. Country of researchers and Number of papers per year

Year	Country of researchers	Number of papers
2009	*Denmark, India, Japan, UK.*	*9*
2011	*Australia, Austria, Denmark, India, Portugal, Spain, UK.*	*7*
2012	*Australia, Canada, Denmark, Finland, Iceland, India, Japan, Portugal, Sweden, UK.*	*17*
2013	*Brazil, Canada, China, Denmark, Germany, Japan, Sweden, Switzerland, USA, UK.*	*11*
2014	*Austria, Denmark, Finland, Germany, Greece, India, Netherlands, Norway, Portugal, UK.*	*10*

In summary, we believe that the papers presented in this review illustrates that researchers have developed the understanding of the HWID notion by experiencing and testing the contextualization of the concepts and framework, either empirical or theoretically. This is a good basis for future research in this area and focus on new challenging topics such a smart workplaces.

Appendix – the 54 Papers Included in the Review

1.1 Theme I: Exploring UX and Designs for Smart Places in Work Environments

Abdelnour-Nocera, J., Barricelli, B., Clemmensen, T., (2013) ICT Design and evaluation for trans-mediated workplaces: towards a common framework in human work interaction design. Workshop at INTERACT 2013, Cape Town, South Africa.

Bobeth, J., Gattol, V., Meyer, I., Müller, S., Soldatos, J., Egger, S., Busch, M., Tscheligli, M., (2014). Platform for Ergonomic and Motivating ICT-based Age-Friendly Workplaces. Workshop HWID, NordiCHI, Helsinki, Finland.

Burns, C. (2012) Cognitive Work Analysis: New Dimensions. Working Conference HWID, Copenhagen, Denmark. HWID 2012, IFIP AICT 407, pp. 1–11, 2013.

Campos, P., Noronha, H. (2012) On the Usage of Different Work Analysis Methods for Collaborative Review of Large Scale 3D CAD Models. Working Conference HWID, Copenhagen, Denmark. HWID 2012, IFIP AICT 407, pp. 12–21, 2013.

Clemmensen, T., Barlow, S. (2013) Identifying user experience goals for interactive climate management business systems. Workshop at INTERACT 2013, Cape Town, South Africa.

Gonçalves, F., Campos, P. (2014) Towards Pervasive and Inspiring Workplaces for Creative Writers: Simple Interactions for a Complex Domain. Workshop HWID, NordiCHI, Helsinki, Finland.

Guribye, F., Nyre, L., Torvund, E. (2014) Viz Reporter *in vivo – Design Implications for Mobile Journalism Beyond the Professional Newsroom.* Workshop HWID, NordiCHI, Helsinki, Finland.

Law, E., Abdelnour-Nocera, J., (2014) Towards a sociotechnical understanding of smart and pervasive technologies used by high-managed and low-managed teleworkers, NordiCHI, Helsinki, Finland.

Lind, T., Cajander, Å., (2013) Mind the Gap -Towards a Framework for Analysing the Deployment of IT Systems from a Sociotechnical Perspective. Workshop at INTERACT 2013, Cape Town, South Africa.

Meerbeek, B., Loenen, E. (2014). Understanding User Experience of Smart Workplaces: mixed methods. Workshop HWID, NordiCHI, Helsinki, Finland.

Murer, M., Tscheligi, M., Fuchsberger, V., (2014) Staged Inquiries: Studying Contextual Interaction through Industrial Showcasing. Workshop HWID, NordiCHI, Helsinki, Finland.

Sandblad, B., (2013) Using a vision seminar process to evaluate the work environment of future work. Workshop at INTERACT 2013, Cape Town, South Africa.

Yadav, M., Clemmensen, T., (2014) Multiple Data Stream measurement of UX in a work context. Workshop HWID NordiCHI, Helsinki, Finland.

1.2   Theme II: Improved Qualities in Health and Support in Work Design

Bhutkar, G., Katre, D., Ray, G., Deshmukh, S., (2012), Usability Model for Medical User Interface of Ventilator System in Intensive Care Unit. Working Conference HWID, Copenhagen, Denmark. HWID 2012, IFIP AICT 407, pp. 46–64, 2013.

Clemmensen, T., Hertzum, M., Yang, J., Chen, Y., (2013). Do Usability Professionals Think about User Experience in the Same Way as Users and Developers Do? Workshop at INTERACT 2013 Cape Town, South Africa.

Chino, T., Torri, K., Uchihira, N., Hirabayashi, Y. (2012) Work and Speech Interactions among Staff at an Elderly Care Facility. Third IFIP WG 13.6 Working Conference, HWID, Copenhagen, Denmark.

Katre, D., Bhutkar, G., Karmarkar, S., (2009) Usability Heuristics and Quality Indicators for the Usability Evaluation of Touch Screen Ventilator Systems. HWID 2009, IFIP AICT 316, pp. 83–97, 2010.

Scandurra, I., Åhlfeldt, R., Persson, A., Hägglund, M., (2013) Challenges in Applying a Participatory Approach in a Nation-wide Project-The Case of 'Usability of Swedish eHealth Systems 2013'. Workshop at INTERACT 2013, Cape Town, South Africa.

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