Bringing Gender into Technology:
A Case Study in User-Interface-Design and the Perspective of Gender Experts

Brigitte Ratzer[1], Astrid Weisse[2], Barbara Weixelbaumer[2], Nicole Mirnig[2], Manfred Tscheligi[2], David Raneburger[1], Roman Popp[1], Jürgen Falb[1]

[1]Vienna University of Technology, Austria
[2]University of Salzburg, Austria

ABSTRACT
Including gender knowledge in SET (Science, Engineering and Technology) research is apparently an emerging field of action. This is mainly supported by the growing number of European funding agencies that ask for explicit statements on gender aspects in research proposals. This paper describes interactions, problems, and strategies developed in research projects where an external gender expert introduces gender knowledge to a SET research team. The case study of a User-Interface (UI) design project serves as a focal point to reflect on the role and task of gender experts in SET research. In addition interviews with six gender experts who have worked in various SET projects were conducted. Based on the experiences of the gender experts, the realities, possibilities, and limitations of gender knowledge transfer are explored in a more general way. The paper concludes with reflections on Gender into Technology as an emancipatory project, based on theoretical debates in the fields of Science and Technology Studies (STS) and Feminist Technology Studies.

KEYWORDS
Gender innovations, gender experts, knowledge transfer

Bringing Gender into Technology:
A Case Study in User-Interface-Design and the Perspective of Gender Experts

INTRODUCTION

Over the last couple of years the inclusion of gender aspects in technology design have gained importance. University researchers as well as corporations seek to develop new products that consider the needs and requests of diverse users. Whether it is for an increase in profit, a quest for new scientific insights, or because funding agencies demand the consideration of gender aspects in the projects they are funding – gender knowledge is increasingly needed. It could be argued that the SET researchers themselves should acquire the necessary knowledge and apply it to their daily work. However, it is not clear how to avoid the stereotyping that frequently occurs when people without any expertise in gender analysis try to approach the topic. Increasingly a mentality of "shrink it and pink it" is being observed. Pink laptops, pink tool boxes, pink sports cars are flooding the market, thus reinforcing gender stereotypes rather than reducing them. This article argues that specialist gender expertise is needed to avoid stereotyping. Furthermore a huge body of feminist or gender aware literature in various SET fields already exists but much of the literature is not easy to find – not all has been published in regular journals, but exists as grey literature, conference proceedings, and so forth. So far no comprehensive collection of relevant literature for the various research specializations are available. Given this situation, interdisciplinary teams of SET researchers and gender experts have the potential to lead to better results in designing gender inclusive technologies. In this article we explore the situation in such interdisciplinary research teams from the perspective of the gender experts.

History and Theoretical Background

When gender is discussed in connection with SET, the debates are predominantly concerned with the number of women in SET education and research. In questioning the objectivity of scientific knowledge, feminist scholars as Sandra Harding, Evelyn Fox Keller, Donna Haraway, Helen Longino and others have, however, enabled discussions about gendered aspects of scientific knowledge itself (Harding 1991, Keller 1985, Haraway 1991, 1996, Longino 1990). Debates on feminist technology design have to be understood within this context, which internationally gained weight from the late 1980s onwards. In fields like Information and Communication Technology, Power Engineering, Environmental Science and Participatory Planning, feminist scientists and engineers conducted projects and were able to transfer theoretical insights into science and engineering practice (Bardzell 2010, Wagner 1993, 2000, Wilkinson & Morton 2007). In German-speaking countries debates on gender aspects within SET research have been conducted by feminist scholars for more than three decades. Annual conferences were held from the late 1970s where up to 400 female students and scientists from natural sciences and engineering came together and exchanged their experiences as well as theoretical positions in various science and engineering

fields (Götschel 2001). However, these developments were for a long time limited almost entirely to discussions and practices within feminist circles.

The situation changed when the European Commission introduced the 6th Framework Program (FP6, 2002-2007) for research funding. Here it was required that submitters of proposals addressed "whether, and in what sense, sex and gender are relevant in the objectives and the methodology of the project" (European Commission 2003). It turned out that without any plans for capacity building, researchers were not able to include gender perspectives into their research. So the requirement to include gender aspects was abandoned again in the 7th Framework Program (FP7, 2007-2013). However, in the upcoming next Framework Program – Horizon 2020 – a reintegration of the gender dimension into all research areas is expected. This is due to massive lobbying of feminist scholars and activists as well as a growing body of literature about the advantages of gender inclusive design. Preconditions are better this time since in the meantime a variety of toolkits, case studies and checklists have been provided (Yellow Window 2010, Gendered Innovations n.d.).

The integration of gender dimensions in SET research and innovation has recently been discussed from two distinct perspectives. First the benefit of such integration has been discussed in terms of *why* we should add a gender dimension to research practices. Second the somewhat more practical question of *how* to integrate gender dimensions into SET research has also been put forth.
The question *why* one should include gender dimensions into SET research has been addressed by various authors. Two broad strands of argumentation can be distinguished: those concerned about the potential market opportunities that are wasted by disregarding women as consumers and on the other hand those arguing that the quality of products is higher when gender perspectives are included. Authors taking a clear market perspective and arguing for better target group orientation and thus better chances for new markets can predominantly be found in the discourses about product design at an industrial level (Danilda & Thorslund 2011, Schröder 2010, Ehrnberg et al. 2012). Likewise the impact of gender knowledge on the quality of SET research and products has also been discussed. Quality is thereby roughly understood as considering and addressing as many different people as possible. The idea is that techno-scientific products should be as useful as possible; they should address the needs and expectations of all societal groups and not only of those akin to the researchers (Schraudner & Lukoschat 2006, Schiebinger 2008, Schiebinger & Schraudner 2011, Pollitzer 2011, genSET 2010). And they should of course not be harmful to special groups of people, as for example an alarmingly large number of drugs have turned out to be harmful for women when clinical studies failed to include an adequate number of women (Kim et al 2010). As it turns out, the arguments from an economic and from a quality perspective resemble each other and are often used in parallel with the quality argument, more often referring to the quality and accuracy of science itself.

One current example of arguing and lobbying for the inclusion of gender dimensions in SET research is the focus of the recently launched COST action *genderSTE* that will last from 2012 to 2016 (COST 2012). GenderSTE is an initiative "to advance the state of the art in knowledge and policy implementation on gender, science,

technology and engineering through creating a network of policy-makers and experts on gender, science and technology" (COST 2012). Besides disseminating existing research and practices, genderSTE wants to provide new knowledge on gender in environment-related fields, namely in the fields of energy and climate change, cities and urban environments, and in transport.

Related to the second big question - *how* to include gender dimensions in SET - there is a growing body of materials, training courses and toolkits. Londa Schiebinger and Martina Schraudner (2011) focus on the proper conduct of a comprehensive sex and gender analysis. Their argument for the implementation of sex and gender analysis is "to enhance excellence by mainstreaming gender perspectives into basic and applied research" (Schiebinger & Schraudner 2011: 158).

A "Gender in EU-funded Research" toolkit has been developed by Yellow Windows Management Consultants. (http://www.yellowwindow.be/genderinresearch/). This development was accompanied by training sessions for researchers that were offered from 2010 to 2012 within FP7. The most comprehensive catalogue of questions is provided by the gendered innovations project (Gendered Innovations n.d.) through different checklists for different fields of research. The project also comprises the biggest number of case studies to provide researchers from varying specializations with examples they can draw parallels from for their own research.

The discourse on gendered innovations and gendered knowledge in science and technology is – at least in Europe - clearly strong enough to influence science policy making and in consequence also research funding. As a result, experiences with the inclusion of gender knowledge in SET research are of increased interest for both scientists and funding agencies.

Introduction - the transfer of gender knowledge
What exactly is gender knowledge or more precisely what could gender knowledge mean in the context of SET research? According to the existing body of literature on bringing gender into technology, this is a complex task. On the one hand the organizational aspects of gendered workplaces, working cultures and everyday practices have to be addressed. On the other hand gender dimensions within the field of research need to be identified and dealt with. For the organizational aspects – the task of including a diverse workforce and being able to manage that diversity in a fruitful way – many recommendations and examples of good practice exist (European Commission 2000, 2004, 2005, 2006, 2008a, 2008b). With regard to research content, the goal of creating gender-responsible science and technology includes knowledge about alternative research methods, about the existing body of relevant literature and about users, target groups and persons affected by the respective research. As Shaowen and Jeffrey Bardzell (2011) put it: "At stake is the tension between traditional science and a science that sees itself as socially and politically engaged" (p 675).To tackle that task, checklists of questions have been created, as well as a number of case studies to provide tangible examples. As shown in the background section, there is plenty of material available for researchers who are interested in gender aspects in SET research and innovation.

Londa Schiebinger and Martina Schraudner have identified necessary steps for avoiding stereotyping: train current researchers, develop evaluation standards for review processes that take into account sex and gender analysis and, last but not least, train the next generation of SET researchers by adapting the curricula (Schiebinger & Schraudner 2011).

But for now, who is eligible to act as a gender expert? Besides avoiding stereotyping another important task is to keep track of the vast body of literature in order to be able to draw on the existing theoretical resources. So including gender experts is often the practical solution for SET research groups. Gender experts are mostly feminist scholars who introduce their specific knowledge and come from various scientific fields, some of them being trained in social sciences or humanities, some of them having a double education in both engineering and social sciences. What is important is a long standing preoccupation with gender topics and the ability to translate that knowledge into another context. In effect a gender expert who is included in a research group as an external expert needs both: actual knowledge on how knowledge transfer can be done and knowledge about the existing body of feminist and gender aware literature in the specific field of research.

Situating Context, Data and Methodology:
The research underlying this paper has been enabled by an Austrian funding scheme RTI (Research, Technology and Innovation) that was introduced in 2009. by the Austrian Research Promotion Agency (FFG) which has been tasked to "*initiate and support projects which specifically focus on the target group "women". The aim is to increase the level of interest among scientists for the issue of "gender" in research projects*" (FFG 2012). So far four calls have been issued with a total of 30 projects being funded; about half of them are currently ongoing. These projects are the main resources for deeper investigations into the transfer of gender knowledge to research projects.

A first evaluation of the RTI-program was conducted in 2010. At that time two calls had been conducted and thirteen projects had been selected for funding (Schaffer et al. 2011). Among others, five expert interviews were conducted that provide valuable insights into the dynamics of the new funding scheme and present the first Austrian experiences with projects explicitly focusing on a gender dimension in research. The experts clearly raised concerns about sex and gender stereotyping in the phase of proposal writing (i.e. producing clichés to meet the focus of the call) and suggested specifying the aims of the program more precisely. The danger of stereotyping was also seen during project implementation, but appeared less severe and somewhat attenuated through the debates about gender knowledge during the course of the projects. Another issue was the question of gender expertise within the project teams. Here the focal point was the question of whether theoretical gender expertise was necessary to conduct RTI research projects and to what extent the practical knowledge of, for example, equal opportunity officers was sufficient. However, the necessity of either theoretical or practical expertise was uncontested. Last but not least the question arose as to whether the gender dimension should be a primary focus of research projects or if

integration of intersectionality to all research programs for applied research was more appropriate. While both perspectives can be argued, it was pointed out that specific calls that primarily focus on the gender dimension are at present necessary for the development of gender sensitive technology design.

An example to clearly depict interactions and practical outcomes of RTI projects– GENUINE (Gender Inclusive Design in User Interface Development) - is presented in more detail here. The following section describes the central content and findings of the GENUINE project. GENUINE aims to include gender perspectives into User-Interface-Design. The project lasted until September 2013, and the detailed project results are available on the project website (http://genuine.ict.tuwien.ac.at/).

To gain a broader understanding of the dynamics and interactions in such projects, experiences of gender experts from eight further projects were collected. The next section draws on the experiences of six scientists who have been involved in various research projects in their role as gender experts. The primary educational background of the gender experts ranged from social sciences to philosophy and to engineering. Narratives were collected partly by a focus group with four gender experts and partly by two additional telephone interviews. The data analysis uses Grounded Theory (Corbin & Strauss 2008, Glaser 1992) to provide an overview on the experts' experiences. Common experiences and perceptions were clustered and connected with existing theories and findings of other research projects. Additional information comes from informal discussions with program managers at Austrian funding agencies.

CASE STUDY
Bringing Gender into Research – the GENUINE project as a case study
User Interfaces (UI) are broadly speaking those means by which a person controls a computer or machine. In the GENUINE project UIs were designed for software applications where the graphical and textual information that the program presents to the users plays a central role. Furthermore, control sequences such as keystrokes on the keyboard, movements with the computer mouse, and selections using a touch screen are of interest. A good user interface provides a "user-friendly" experience, allowing the user to interact with the software or hardware in a natural and intuitive way.

There were three main goals in the GENUINE project:
1. the development of a design guideline for gender inclusive UI development;
2. the integration and evaluation of the design guideline in the context of a model-driven UI development (Popp et al. 2013) by means of a communication model;
3. the creation of a tool that supports gender inclusive UI design and making it available to interaction designers, programmers, and policy makers as a free license tool.

The whole project team first met during proposal writing. When the gender expert joined the team, the central research question had been formulated as: "Do men and women display differences when interacting with UIs?" After some discussions

this question was modified to: "Do men and women display differences when interacting with UIs *or are characteristics like age, education or previous experiences with information and communication technologies (ICT) of greater importance?*" This meant that the project design did not presuppose gender differences in the handling of software and did moreover allow for other categories like age or education to be of greater importance than the sex of a user.

To identify a design guideline that comprises all the important gender aspects in UI design, the project started with testing one model application (i.e. a tourist advertising website). A large user study was performed, with 80 people being tested using smart phones and desktop PCs, in order to gain reliable results. Analysis and interpretation of the test results and then the development of a design guideline that was evaluated with another user study, were the final steps before disseminating the results.

The sampling of test users was carried out according to the initial research question and comprised of half digital natives (i.e. younger than 25 years) and half digital immigrants (older than 40 years); half of the test sample had low educational achievement and half of them were academics. The category of being experienced with ICTs was defined by the possession of smart phones which in 2010, when the project started, was a good indicator for people being "early adopters" (i.e. smart phone users) or "late adopters" (i.e. did not possess a smart phone). Figure 1 shows the composition of the test sample.
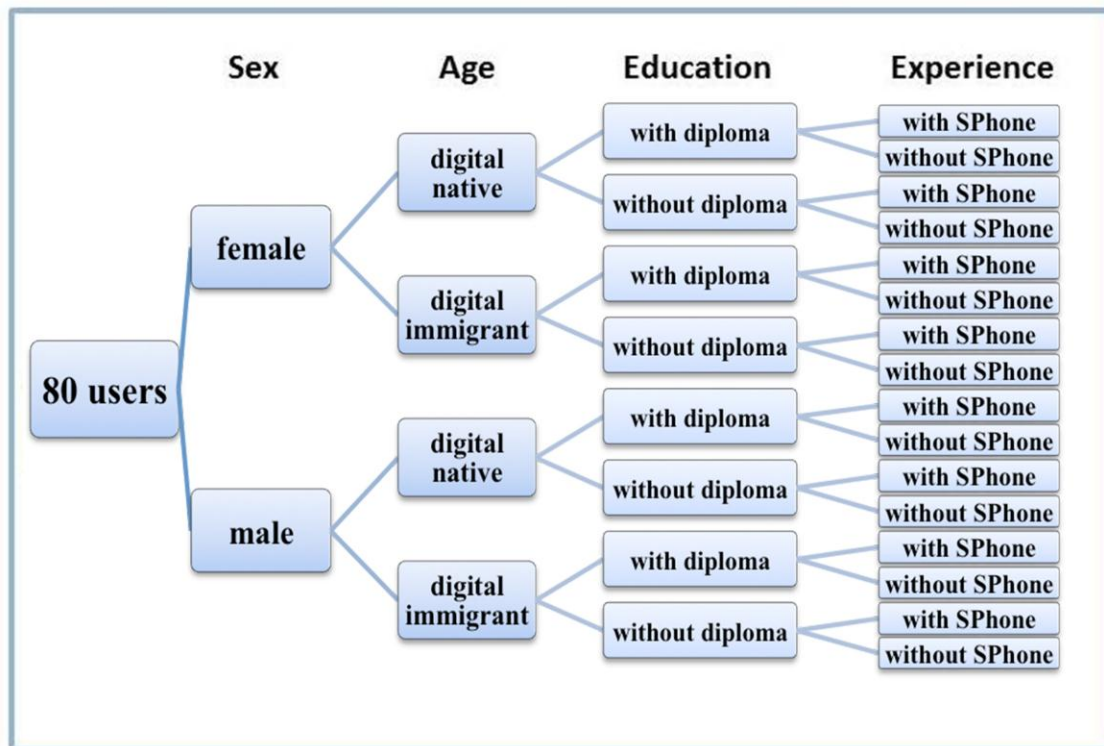

Figure 1: Sampling of test users in the GENUINE project

During the development of theoretical suppositions about expected results some very interesting discussions took place. The usability researchers proposed a theory from evolutionary psychology. They suggested that different inherited cognitive modules for decision making under uncertainty should be observable among men than among women. Women should have the tools for underestimation and thus show lower self-efficacy levels than men. Men should show higher levels of self-assessment regarding computer activities. The idea behind these assumptions was derived from "Error Management Theory" that suggests that adaptations in decision making have evolved through natural sexual selection (Haselton & Buss 2000). In other words, Error Management Theory is one of those theories referring to ancestral times when men were assumed to be the hunters and women the gatherers. The theory tries to explain actual behavior with inherited patterns of action based on a supposed universal division of labor as in the classical 'men the breadwinners and women the housewives' scenario.

Another assumption was that men and women should show different navigation styles and strategies when searching for online information. The whole project team performed an extended literature study and discussed findings of various feminist authors to come to a conclusion regarding the central research hypothesis. We aimed to choose a feasible hypothesis that allowed for an explanation of all possible findings.

It turned out that there is an existing body of literature that is concerned with feminist Human-Computer-Interaction (HCI). Many of the authors argue for a change in project design and methodology. A complete framework for a feminist HCI-methodology has been proposed by Bardzell (2010). Critical considerations of perspectives and hypothesis question the validity and reliability of results. "*For example research questions (…) tend to be framed in terms of what is wrong with the person who is experiencing the problem, rather than in terms of what it is about the current social order that makes the problem likely.*" (Bardzell & Bardzell 2011, p. 678). The concept of users itself is discussed in the light of an expansion "*from workplace to domestic sphere, from waged workers to unwaged workers, seniors, children, people who are at play, in love, at home, solving personal or group problems*." (Muller 2011, p. 448). Ethnographic research on gender and technology (Faulkner 2000, 2001, 2004) illustrates that the relationship is more complex than binary patterns of gender would allow. And Rode suggests "*qualitative work that allows for nuanced understanding of non-binary gender identity as it is co-constructed alongside technological identity.*"(Rode 2011, p. 396). To conclude, a methodology that is seen to be appropriate manifests its gender concerns by "*not using any theories, because they are artificial constructions that have no observational value for real life. So researchers concentrate on experiments, observations and test series by concentrating on what was done or said and abstaining from theoretical explanations*." (Rode 2011, p. 397).

Gender differences in ICT usage were of interest too. One important concept is self-efficacy (SE). SE is defined as "*people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances.*

It is concerned not with the skills one has but with judgments of what one can do with whatever skills one possesses" (Bandura 1986, cited by Compeau & Higgins 1995). There is evidence supporting the view that differences in self-efficacy levels between boys and girls exist (Broos & Roe, 2006; Tomte & Hatlevik, 2011). Moores & Chang (2009) conducted a study suggesting that although there is a positive correlation between SE and performance (and goal), overestimation of one's abilities (high SE) might lead to a premature belief to have reached one's goal and thus to a decrease in effort and performance. Indeed they found that overestimation showed a strong (significant) negative relationship between SE and subsequent performance. Under-confident participants, on the other hand, showed a positive relationship between SE and performance (Moores & Chang 2009).

Possible differences in men's and women's behavior in hypertexts are well researched too, investigating the effects that gender might have in reading and learning in hypertext environment. It may be concluded that the gender gap in online connectivity has disappeared; that there is no significant difference between genders with regard to cognitive styles but that differences exist in web-based learning just as they would in traditional learning environments (Protopsaltis 2008). The literature survey led to the conclusion that gender differences in spatial navigation are not biologically determined but socially constructed. This interpretation consequently allows for possibilities of change and several authors give a series of suggestions about how to make this happen (Palm 2011, Owen 2005; Schmitz 1999, Schmitz & Neidhardt 2001).

Having discussed the main findings of the literature survey in the GENUINE research team, the decision was taken to have no ex-ante hypothesis when conducting the usability test, but to see what the data themselves would reveal as user patterns and preferences. This decision – supported by feminist literature (Bardzell 2010, Rode 2011) - turned out to be a good option. The usability study revealed a number of features on the test website that had a serious impact on different user groups. The results showed that this was correlated with social characteristics like education, age or previous experience rather than with being male or female. For example placing menus on the left side of a UI turned out to be especially important to support the orientation of older people, whereas avoiding the necessity to scroll on the desktop was supportive for older people as well as for less educated ones. The data were reported by describing solely what had been measured – without trying to adapt them to a hypothesis about assumed different performances and preferences of men and women.

So the first result of the GENUINE project was a design guideline. It is meant to provide interaction designers, programmers, and policy makers with information about various target-groups as well as with information about inclusive design principles. The design guideline still has to be validated in a second usability test (that has not yet been carried out) to contrast these preliminary results with what would have been the results when no gender expert was included in the project, see Figure 2. For the design guideline in detail, see the project website (GENUINE n.d.).

Initial study design

	Sex	
	Men ♂	Women ♀
A	x	
B		x
C		x
D	x	
E	x	
F		x

"Gendered" study design

	Sex		Age		Education		Experience	
	♂	♀	< 30	> 40	+	-	+	-
A	x							
B			x				x	
C				x				
D		x						x
E		x	x					
F	x				x			

Figure 2: Comparison of results

The effects of the GENUINE project on the working groups involved are another aspect of the transfer of gender knowledge to SET institutions. Both the usability center and the engineering research team usually carried out their usability studies with far smaller groups of test users (5 to 10 people). In those cases 50% men and 50% women were tested and "differences" in the performance of men and women were routinely reported, but usually not scrutinized. The GENUINE project helped the researchers to better understand conjunctions of various social categories and to understand the effects of sampling on the results of a usability test.

In an interim team reflection, the self-assessment of the project team on working cultures and everyday practices in GENUINE project was unanimously positive. The composition of the research team is not unusual, consisting of three female usability experts, three male engineers concerned with developing the free license tool for automated UI creation and one female gender expert. According to the limited data available about usability specialists, 38% of the usability specialists in the United Kingdom are female and 58% in the United States (Kotamraju 2011) and (software) engineers are 80% to 90% male (cf. SHE figures 2012). Nalini Kotamraju (2011) gives some reflections on the possible impact of the sex of researchers on the interactions between engineers and usability specialists in describing three common behaviors in usability work: playing stupid, caring for users, and putting on a good show. The GENUINE project team took an effort to avoid all of these strategies and adopted a rather cooperative work style.

This brief overview of the GENUINE project has demonstrated the design and implementation of a research project where an external gender expert joins a SET research team. The next section presents an overview of common topics that frequently occur in many research projects of a similar type.

FOCUS GROUP
Bringing gender into research as an external gender expert – realities, possibilities and limitations
The findings presented in the next section were extracted from the transcripts of a focus group discussion and two telephone interviews. Quotations are used to underline the evidence derived from the data set. An interesting point in the group discussion was the fact that all gender experts told strikingly similar stories about the processes and outcomes within their projects. During the discussion it frequently occurred that one expert was relating to incidents in a specific project, and others started nodding and could contribute another story of just the same content. Summing up the discussion process led to four distinct themes: First, the **learning process is mutual** with gender awareness raising on the part of the SET-researchers and awareness raising about the content and de facto starting point for the project on the part of the gender expert. Second, in nearly all projects the **scientific validity and relevance of gender knowledge** as introduced by the gender expert was somehow a topic. Thereby the view of gender knowledge and its relevance for the realisation and quality of the research projects ranged from interested questioning to open disesteem and devaluation. Third, gender knowledge cannot be transferred without including **reflections on the organisational context** and the working culture of the organisation(s) participating in a project. And fourth, the actual **contribution and impact of gender perspectives** within the projects were in all cases essential for the project results, but very small scale. In the telephone interviews all of the above listed topics occurred with varying emphasis.

Mutual Learning
The central task of gender experts in SET projects is building up gender knowledge in an interdisciplinary research team. While all reported projects showed a variety of different approaches and gender sensitizing tools and activities, most projects involved distinct phases of gender learning for the participating researchers. The process of introducing gender competence to a SET research team is in fact a mutual process. The gender experts themselves need to learn about the key concepts, methods and research practices of the SET research project. And of course they need to learn about the point of departure for further education and training with regard to gender knowledge. Introducing gender knowledge has been typically described as follows:

"...they were full of stereotypes saying "men are like that and women are like that" and that was pretty much a light bulb moment when I questioned the homogeneity of men and women as a group..."

Most of the experts had the feeling that gender knowledge was recognized as on the one hand "neutral" and on the other hand more as a social competence than expert knowledge. Therefore, one of the tasks of the early phases of the projects was building a common basis of gender knowledge. This involved clarifying pre-existing knowledge and making researchers reflect on their own blind spots, stereotypes and prejudices. As one expert put it very drastically:

"You start in a cave and then eventually there is a spark and then there will be fire. So now they know that there is fire, that sort of another existence is possible."

The above quotation illustrates perfectly the unanimous opinion of all gender experts – that the starting point with regard to gender was in nearly all projects outdated. The fact that there was little or no gender knowledge within average SET institutions was addressed by all gender experts. They had to explore the precise level of gender knowledge before being able to successfully transfer knowledge that could be understood and applied by the researchers. Indeed the opinions of these gender experts about the level of gender knowledge within SET institutions are supported by broad empirical evidence (Hamilton & Jenkins 2000, Williams et al. 2008, Wajcman 2008).

Interestingly enough throughout this phase there remained a certain degree of 'justifying by facts'. Even in those projects where inclusion of gender aspects was the main purpose of the project, experts felt it was essential to clarify *'why'* including gender aspects was an important issue,.

While bringing gender knowledge into the projects, the experts frequently mentioned economic aspects like competitive advantages, economic benefits and the fulfilment of the needs of many more people. Another rationale was that individual researchers were personally enriched by acquiring gender knowledge and reflecting upon their own gender competence. This strand of argumentation was in fact critically discussed in the focus group. It was considered delicate to involve the researchers too intensely at an individual and partly private level since this may cause emotional defense resulting in resistance within the projects. Nevertheless, at a more professional level holding researchers personally responsible seemed appropriate, with arguments like *"You do a better job, if...", "Your work is more successful, if...".*

Finally there were all kinds of arguments that stress gender knowledge as a means to improve working cultures, organisational cultures and research practices. Here the fact that gender knowledge supersedes the immediate research question and involves a holistic approach to research as a multi-layered practice was addressed. One gender expert explicitly considered these justification strategies as important and an integral part of transferring gender knowledge into different contexts. She suggested that a crucial element for the success of gender projects is to be connected to the participating researchers by considering their previous knowledge as well as demonstrating to them the usefulness of gender expertise in all dimensions involved.

Finally, we would like to point to the gender learning process as a continuous process rather than an isolated event; the first gender inputs in SET projects were not necessarily very extensive. Rather, repeated, often punctual inputs were likely throughout the duration of the projects. Several gender experts explicitly mentioned that SET researchers saw their "gender projects" only as the starting points for further involvement with gender aspects in their research.

The Credibility of Gender Knowledge

The need to prove relevance, reliability and soundness of gender knowledge was a topic that recurred several times in the group discussion as well as telephone interviews. One facet of this is a problem that occurs in many different settings when gender perspectives are discussed: everybody feels like an expert. The problem is aggravated by the fact that in the German language there is only one word for "sex" and "gender" so there is usually no distinction made between the two categories. Since all of us certainly have a (more or less defined) sex everybody feels competent to contribute to such discourses, which then end up reflecting highly stereotypic or biased views. In such a context it can be difficult to achieve a decent level of discussion and to emphasize the value of gender knowledge. *"So the appraisal of this [gender, B.R.] knowledge is – I believe – a fundamental problem that is hardly ever addressed."* as one gender expert put it.

Another aspect of the credibility of gender knowledge is the negative public discussion and general disesteem of feminism and the women's movement in Austria. In particular, the reduction of gender knowledge to two highly contested and emotionally discussed topics – i.e. quotas and gendered language – was perceived as problematic. Concerning quotas it has to be noted that in funding schemes two aspects of gender must usually be addressed: the composition of the research team must be balanced, and gender must be included in the research topic. Male researchers often perceive the request for the inclusion of more women into research as a challenge to their career. Moreover, the discussion is connected to the myth that bringing more women in would mean reducing the quality of research. With regard to gender sensitive language, the gender experts saw another problem as overly equating the use of gender inclusive language with gender competence.

"…it is reduced to the use of language and all other aspects are removed. I see a danger here; it easily gets absurd and ridiculous. They do not understand that language creates reality. (…) And many strategies of devaluation and much resistance is activated here."

Negative reflexes also stem from academic discussions about the establishment of Gender Studies as a distinct field of knowledge. These debates create a context that frequently forces gender knowledge and gender experts into a defensive position and create the pressure for justification. Yet another aspect discussed was the perceived character of gender knowledge. Many researchers feel that the inclusion of gender knowledge is sort of an intervention into their "normal" work. As one expert reported:

"Gender knowledge often is like an add-on, something that has to be done now in addition to the usual work. They say: "Oh my god! We already have so much work – and now this!""

This attitude is also related to the perception that gender experts are meddling in other researcher´s work. Bringing expert knowledge into another field of knowledge

creates difficulties and sometimes conflictual situations. Often, it is perceived that gender experts implicitly criticize common SET knowledge as incomplete or invalid. SET researchers have difficulties in acknowledging gender knowledge as relevant and scientific knowledge (cf. Burack & Franks 2004).
One expert mentioned a situation when she was the only female researcher in a team (a situation familiar to many gender experts in the SET field). She described the interaction especially with one male researcher as challenging and she constantly had the feeling that he was teasing her. After a couple of years – they conducted a series of projects within a temporary funding scheme - the researcher admitted that he somehow had fun in provoking her and seeing how she would react. The gender expert had chosen a strategy of *"always talk back, always give him as good as you get"* and in the end had the impression that she succeeded, but admitted that it was a tiring strategy.

The discussions and remarks on the dubious reputation of gender expertise lead us once more to necessary yet absent measures within science policy making. As recommended in countless EU-reports and national surveys there is a pressing need for measures that enable researchers and science institution managers to see gender knowledge as relevant and sound knowledge (European Commission 2000, 2005, 2008a, Meuser 1998, genSET 2010).

Organizational context and working cultures
The most extensively discussed topic in the group discussion was the comprehensive approach that is necessary when introducing gender in a research environment.
"...it is about gender sensitizing, about the development of gender competence, it is about change in the organisational culture. (...) Because that does not help at all, if they pay the wonderful and extra-competent gender experts but the first-line management afterwards remains as they are now."

All experts described a necessity to include organisational cultures and working cultures into their work and not only restrict their input to the SET research topic.
"Research culture has something to do with the common culture of an organisation. It reflects what happens within the organisation. (...) "

Moreover, including organisational and working cultures into the course of the projects was partly seen as a way to secure sustainability:
"That is also my personal claim that gender does not end when the final report is done. That a process of sensitizing has taken place, that all organisational units broach the issue of gender...."

Some gender experts expressed that working on the organisational culture and working culture is in fact the main part of the task of gender experts in SET projects:
"Introducing gender dimensions is really to be seen as a process of organisation development."

This need to include the organisational context is at the same time often seen as an obstacle for the projects. In many cases single researchers or small groups within a bigger institutional framework apply for the funding of an explicit gender project (see the above description of RTI-projects). Here the organisation itself does not have any further interest in gender knowledge or desire to change with respect to their gender performance. So the gender experts find themselves in a situation where they have to interact with an organisation that definitely does not want to interact with them. Nearly all experts put strong emphasis on the importance of gender projects being located prominently within an organisation. Only a certain level of commitment (or at least interest) from the management brings about the necessary awareness within the organisation.

In addition, the SET researchers working in gender projects often felt that it was difficult to explain the insights and results of their projects to other researchers within their organisation when there was no commitment at a higher level.
In those cases when the gender experts were successful in including at least the immediate surroundings into the project work, they described their work as a process of change that went from sensitizing individual researchers to building up a certain gender competence within the team, to changing working cultures and organisational cultures.

 "I am happy if only some of the researchers afterwards say: "Wow, life is much more complicated now, but it has become much more exciting when I look at the things. And I cannot overlook it anymore.""

The fact that introducing gender knowledge in SET research is such a multi-faceted and multidimensional task was verbalized by all gender experts. To restrict the task to simply the content of the research project was seen as both poor quality of work and anyway impossible. At the same time, the complexity of the task was seen as an excessive demand on gender experts.

"You want to kill two birds with one stone. You want to review the knowledge of the research field and make a contribution there. And you want to import gender knowledge to the researchers and foster their expertise. (...) And there should be an increase in competence within the organization to finally fix the knowledge effectively within the organization."

By bringing in the organizational and working context, a level is addressed that exceeds the immediate scope of work in the projects. This is again a task that has to be solved at the level of science policy making. Today, the majority of managers in science organizations lack gender knowledge. This leads to poor gender awareness within the organizations and finally to research cultures that make the inclusion of gender knowledge somewhat difficult and, in the long term, the development of gender expertise within the organization hardly possible.

From big theory to small steps
"Sometimes the results look so self-evident.(...) What is left in the end seems to be something very small.... if you only look at what is a measurable result. "

17

When reflecting on the actual results of the SET projects and what had been implemented, the experts pointed out that it was mostly small-scale adaptations that had taken place. Single steps and results that were reported by the experts include an equal number of female users in a usability-study, reframing the concept of mobility of people in a way that allowed for many different needs instead of an underlying 'male' and 'female' mobility, adapting the texts and pictures used for advertising material, claiming additional/other questions for a questionnaire, and dismissing a central hypothesis that already included gender stereotypes.

One point was that many problems simply do not have a gender dimension (whereas they might very well have other dimensions such as differences in individual access to certain knowledge or tools). Thus, it is an important task for gender experts to avoid gender stereotyping and confirmation of prejudices while at the same time raise the comprehension of SET researchers for a more sophisticated analysis of users, customers and people concerned. Gender construction in SET projects is clearly dichotomic. The difficult task of avoiding essentialism and still keeping an awareness of structural inequalities between men and women is seen as a challenge.

"For example 'equity of needs' is such a word that is en vogue in the FFG [funding agency, B.R.]. But if you read the subtext there.... that is certainly designed in an essential manner."

Another point is the starting position of the projects with regard to gender and accordingly the limited gender knowledge of SET researchers.

"So to say this aha-experience, yes, that in mobility-research one must not say 'all women are like this and all men are like that'. And this was the starting point."

The expectations of what could or should happen in a gender-SET project were more differentiated for those gender experts who already had more experience with the transfer of gender knowledge. They valued the process that had to take place for both the individual researchers and the organisational cultures as an important part of their project results.

"From my point of view this was a very successful project. Yes they were very happy about what they had learned, what new perspectives they gained....Then they knew that gender is not about doing everything as they had done before and in the end check the language for gendered terms and phrases."

The dialogue between two gender experts exemplifies the area of tension that arises from having a deep understanding of gender dimensions in SET but being forced to start at a very basic level.

"In the end there will not be any result that we would not have known before." – *"Yes, but you will be very content and satisfied because they had a cognitive process....they now have an idea of how to light a fire."*

It is important to learn how to value the progress that happens within a process of individual sensitizing and cultural change. One of the experts stated that "*for my mental health*" she would only pursue a policy of small steps. Otherwise the task of bringing gender expertise to SET projects would be an excessive demand. What was consensual was the perception of bringing quality to research projects. It is a "*simple question of good research practice*" to take a close look at people and their living conditions or to make control samples transparent and define their composition. Otherwise this would be bad research.

"In biology, in physics, in chemistry you have to look at the smallest atoms and their structures. Why don't they do it with individuals? You certainly have to identify concrete individuals and their needs. That is good research."

CONCLUDING REFLECTIONS

As with all qualitative studies, the data and the findings are contextualized to the specific setting. The sample of experts and projects that inform this paper is certainly too small to draw conclusive general statements from the interviews. The high degree of agreement in the group discussion as well as the two single interviews may partly be brought about by the fact that many of the projects the gender experts had been involved in were financed by the RTI funding scheme described above. Thus a high similarity of principal project goals and project designs exists making similar processes within the projects more likely.

Reflecting on the implications as well as the dangers in transferring gender knowledge into SET research I want to point out several features. The first claim is, that in the present state of affairs gender expertise has to be brought in by designated gender experts. The low level of gender knowledge in science organizations and individual SET researchers fosters blunt stereotyping and essentialist perceptions thus aggravating the gender gap rather than removing it (see also Sørensen et al 2011). If we consider the UI-case study presented above, the absence of the external gender expert would have led to totally different results. With a sample of test users only divided into male and female, the results of the usability study could only have been explained by gender differences. So the researchers would in fact have produced some new gender stereotypes by not considering that other social categories might play any role. Moreover, and more worryingly the results would have been explained by a theory – Error Management Theory – that creates gender stereotypes that are directly linked to the sex of people. According to this theory women will perform differently to men because today's women are descendants of ancestral mothers and have no choice about their behavior, but can instead live up to a predefined set of roles. The researchers would have been convinced by their findings and future projects would be designed the same way – producing even more stereotypes and false attributions to both men and women.

However, it cannot be sustainable to routinely include gender experts in SET projects; rather we must seek a gender learning process that enables the SET researchers and institutions to routinely include gender perspectives into their

projects themselves. The curricula of SET subjects are certainly one item on the agenda as is gender training for science institution management.

Another point of concern is to reconsider the justification strategies used by gender experts in the light of recent discussions within feminist scholarship. Nancy Fraser highlights in her powerful essay "Feminism, Capitalism, and the Cunning of History" how "*the selective enlistment of feminist strands ironically served to legitimate neoliberal capitalism*" (Fraser 2009, p. 99). To what extent are the gender expert's claims of economic benefit and broader consumer groups in effect serving neoliberal logics that are far from aiming for gender equity? In many gender discourses arguments placing emphasis on gender justice and equality are disappearing while economic rationality seems to become the only relevant realm. With Nancy Fraser we might think about the possibility that we end up with a "*dangerous liaison with neoliberalism*" that produces "*a strange shadowy vers*ion" of what we initially intended to achieve by bringing gender knowledge to SET (Fraser 2009, p. 114).

Considering the above we would further suggest that strong emphasis should be put on the necessity to transform SET in such a way that not 'women-in-particular' artifacts are produced but 'women-and-everybody-else' artifacts (cf. Spilker & Sörensen 2002). While the 'women-in-particular' strategy is certainly attractive for economic reasons – segmented marketing strategies are more effective than general ones – it reproduces at the same time an unwanted gender formatting.

Last but not least, we want to revisit the connection between profound and robust gender knowledge and the somewhat trivial modifications and results in SET research practice. The inclusion of gender perspectives into SET research practice often results in a re-design of basic concepts and underlying assumptions. It is the level where the quality of products is adjusted by considering the actualities of many different people, by taking into account contexts of use, being mindful of the life realities of marginalized groups and asking for the perspectives of those who have so far been disregarded. What gendered innovations are certainly able to do is to make artifacts available and useful for more people. Gendered innovations add value to research and engineering by bringing them nearer to real contexts and needs. In that sense, gendering SET research ensures excellence and quality in outcomes and enhances sustainability (genSET 2010). In the field of biomedicine the introduction of gender medicine does make health treatments securer for both men and women (Klinge & Wiesemann 2010). In short, there are certainly enough reasons to continue with the current efforts to bring gender knowledge to SET research.

REFERENCES

Bardzell, S. (2010). Feminist hci: taking stock and outlining an agenda for design. In *Proceedings of the 28th international conference on Human factors in computing systems*, ACM, 1301–1310.

Bardzell, S., & Bardzell, J. (2011). Towards a Feminist HCI Methodology: Social Science, Feminism and HCI. In *Proc. CHI*, 675-684.

Broos, A., & Roe, K., (2006). The digital divide in the playstation generation: Self-efficacy, locus of control and ICT adoption among adolescents. *Poetics*, 34, 306-317.

Burack, C., & Franks, S. (2004). Telling stories about engineering: Group dynamics and resistance to diversity. *NWSA Journal*, 16(1), 79-95.

Compeau, D.R., & Higgins, C.A., (1995). Computer Self-Efficacy: Development of a Measure and Initial Test. *MIS Quarterly,* 19(2), 189-211.

Corbin, J., & Strauss, A. L. (2008). *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*. Thousand Oaks: Sage.

COST. (2012). *Gender, Science, Technology and Environment – genderSTE*. http://www.cost.eu/about_cost/governance/genderste [accessed 4 June 2013]

Danilda, I., & Thorslund, J. G. (Ed.) (2011). *Innovation and Gender*. VINNOVA Information VI, Edita Västra Aros AB, Västerås, Sweden.

European Commission (2000). *Science policies in the European Union: Promoting excellence through mainstreaming gender equality*. *A Report from the ETAN Expert Working Group on Women and Science.* Research Directorate General, Brussels.

European Commission (2003). *Vademecum: Gender mainstreaming in the Sixth Framework Programme. Reference guide for scientific officers and project officers.* Research Directorate General, Brussels.

European Commission (2004). *Gender and Excellence in the Making.* Research Directorate General, Brussels.

European Commission (2005). *Women and Science. Excellence and Innovation - Gender Equality in Science*. Research Directorate General, Brussels.

European Commission (2006). *WIST Women in Science and Technology – The Business Report*. Research Directorate General, Brussels.

European Commission (2008a). *Benchmarking policy measures for gender equality in science.* Research Directorate General, Brussels.

European Commission (2008b). *Mapping the Maze. Getting more Women to the Top in Research.* Research Directorate General, Brussels.

Faulkner, W. (2000). The Power and the Pleasure? A Research Agenda for "Making Gender Stick" to Engineers. *Science, Technology and Human Values* 25(1), 87–119.

Faulkner, W. (2001). The Technology Question in Feminism: A View from Feminist Technology Studies, *Women's Studies International Forum*, 24(1), 79–95.

Faulkner, W. (2004). *Strategies of Inclusion: Gender and the Information Society* (SIGIS) Report. Edinburgh: University of Edinburgh Press.

FFG. (2012). http://www.ffg.at/en/femtech-fforte [accessed 4 June 2013]

Fraser, N. (2009). Feminism, Capitalism and the cunning of history, *New Left Review,* 56 97-117.

Gendered Innovations (n.d.) *Gendered Innovations in Science, Health & Medicine, Engineering and Environment.* http://genderedinnovations.stanford.edu/ [accessed 4 June 2013]

genSET (2010). *Recommendations for Action on the Gender Dimension in Science.* genSET consensus report. Retrieved from http://www.genderinscience.org/index.php/consensus-seminars/recommendations-report [accessed 4 June 2013]

GENUINE (n.d.). *Gender Inclusive Design in der User Interface Entwicklung*. http://genuine.ict.tuwien.ac.at/ [accessed 4 June 2013]

Glaser, B. (1992). *Basics of grounded theory analysis.* Mill Valley, CA: Sociology Press.

Götschel, H. (2001). *Naturwissenschaftlerinnen und Technikerinnen in Bewegung. Zur Geschichte des Kongresses von Frauen in Naturwissenschaft und Technik.* Talheimer Verlag, Mössingen-Talheim.

Hamilton, K., & Jenkins, L. (2000). A Gender Audit for Public Transport: A New Policy Tool in the Tackling of Social Exclusion. *Urban Studies*, 37 (10), 1793-1800.

Haraway, D. (1991). *Simians, cyborgs, and women: The reinvention of nature.* New York: Routledge.

Haraway, D. (1996). *Modest_Witness@Second_Millennium: FemaleMan© Meets OncoMouse, Feminism and Technoscience.* New York: Routledge.

Harding, S. (1991). *Whose Science, Whose Knowledge? Thinking from Women's Lives*. Cornell. University Press.

Haselton, M.G., & Buss, D.M., (2000). Error Management Theory – A New Perspective on Biases in Cross-Sex Mind Reading. *Journal of Personality and Social Psychology*, 78(1), 81-91.

Keller, E.F. (1985). Reflections on Gender and Science. New Haven: Yale University Press.

Kim, A., Tingen, C., & Woodruff, T. (2010). Sex Bias in Trials and Treatment Must End. *Nature*, 465 (7299), 688-689.

Klinge, I., & Wiesemann, C. (Eds.) (2010). *Sex and Gender in Biomedicine. Theories, Methodologies, Results*. Göttingen, Universitätsverlag.

Kotamraju, N.P. (2011). Playing stupid, caring for users, and putting on a good show: Feminist acts in usability study work. *Interacting with Computers* 23(5): 439-446.

Longino, H. (1990). *Science as Social Knowledge: Values and Objectivity in Scientific Inquiry.* Princeton, New Jersey: Princeton University Press.

MacKenzie, D., & Wajcman, J. (Eds.) (1985). *The Social Shaping of Technology*. Milton Keynes, Open University Press.

Meuser, M. (1998). *Geschlecht und Männlichkeit. Soziologische Theorie und kulturelle Deutungsmuster.* Opladen: Leske + Budrich.

Moores, T.T., & Chang, J.C-J. (2009). Self-efficacy, overconfidence, and the negative effect on subsequent performance: A field study. *Information & Management*, 46, 69-76.

Muller, M. (2011). Feminism asks the ''Who'' questions in HCI. *Interacting with Computers,* 23(5):365-368.

Owen, L. (2005): *Distorting the Past. Gender and the Division of Labor in the European Upper Paleolithic.* Tübingen: Kerns.

Palm, K. (2011). Räumliches Vorstellungsvermögen – von Natur aus Männersache? In: Wentzel, W., Mellies, S., & Schwarze, B., (Ed.) *Generation Girls' Day* Verlag: Budrich Uni Press, 147 – 169.

Pollitzer, E. (2011). Why Gender should be a Priority for our Attention in Science. *Interdisciplinary Science Reviews*, 36 (2) 101-02.

Popp, R., Raneburger, D., & Kaindl H. (2013). Tool support for automated multi-device GUI generation from discourse-based communication models. In: Proceedings of the 5th ACM SIGCHI Symposium on Engineering Interactive computing systems, ser. EICS '13. New York, NY, USA: ACM.

Protopsaltis, A., & Bouki, V. (2008). Gender and Information Processing in Electronic Age. In: *ACM SIGDOC 26th International Conference on Design of Communication*, Lisbon, Portugal, 131-138.

Rode, J.A. (2011). A theoretical agenda for feminist HCI. *Interacting with Computers*, 23, 393-400.

SHE figures 2012. (2013). Gender in Research and Innovation. Statistics and Indicators. Luxembourg: Publications Office of the *European Union*. http://ec.europa.eu/research/science-society/document_library/pdf_06/she-figures-2012_en.pdf [accessed 7 July 2013]

Schaffer, N. & Holzinger, F. (2011). *Gender in der angewandten Forschung.* Wien. http://www.femtech.at/fileadmin/downloads/Wissen/FEMtech_Publikationen/Gender_in_der_angewandten_Forschung_zsf_final.pdf [accessed 4 June 2013]

Schiebinger, L. (Ed.) (2008). *Gendered Innovations in Science and Engineering*. Stanford University Press, Stanford.

Schiebinger; L., & Schraudner M. (2011). Interdisciplinary Approaches to Achieving Gendered Innovations. *Interdisciplinary Science Reviews*, 36 (2) 154-67.

Schmitz, S. (1999). Gender differences in the acquisition of environmental knowledge related to wayfinding behavior, spatial anxiety and self-estimated environmental competencies. *Sex Roles* 41, 71-93.

Schmitz, S., & Neidhardt, E. (2001). Raumsozialisation von Mädchen und Jungen – Bestandsaufnahme und Möglichkeiten des Wandels. In Sturm, G., Schachtner, C., Rausch, R., & Maltry, K., (Eds.): *Zukunfts(t)räume. Geschlechterverhältnisse im Globalisierungsprozess.* Königstein / Taunus: Helmer, 39-58.

Schraudner, M., & Lukoschat, H. (Ed.) (2006). Gender als Innovationspotential in Forschung und Entwicklung, München. In: Leicht-Scholten, C. (Ed.): *Gender and*

Science. Perspektiven in den Natur- und Ingenieurwissenschaften. Transcript Verlag, Bielefeld.

Schröder, K. (2010). Gender dimensions of product design. Paper presented at the Gender, Science, and Technology Expert Group meeting of the United Nations Division for the Advancement of Women (UN-DAW), 28 September - 1 October, Paris, France.

Sørensen, K., Rommes E., & Faulkner W. (Eds.) (2011). *Technologies of Inclusion: Gender in the Information Society*. Trondheim: Tapir Academic Press.

Spilker, H. S. & Sørensen, K. H. (2002). Feminism for profit? Public and private gender politics in multimedia. In Sørensen, K. H., & Williams, R. (Eds.) *Guiding Policy, Shaping Technology: Concepts, Spaces and Tools*. London: Edgar Elgar, 249-270.

Tomte, C., & Hatlevik, O.E. (2011). Gender-differences in Self-efficacy ICT related to various ICT-user profiles in Finland and Norway. How do self-efficacy, gender and ICT-user profiles relate to findings from PISA 2006. *Computers & Education*, 57, 1416-1424.

Wagner, I. (1993). Women's Voice. The Case of Nursing Information Systems. *AI & Society* 7(4), 295-310.

Wagner, I. (2000). 'Persuasive Artefacts' in Architectural Design and Planning. In *Proceedings of CoDesigning 2000*, Nottingham, 379-390.

Wajcman, J. (2008). Technology as a Site of Feminist Politics. In Lucht, P. & Paulitz, T. (Ed.) *Recodierung des Wissens. Stand und Perspektiven der Geschlechterforschung in Naturwissenschaften und Technik.* Campus Verlag, Frankfurt am Main, 87–101.

Wilkinson, S., & Morton, P. (2007). The emerging importance of feminist research paradigms in built environment research. *Structural Survey*, 25 (5), 408 – 417.

Williams, D., Yee, N., & Caplan, S. (2008). Who Plays, How Much, and Why? Debunking the Stereotypical Gamer Profile. *Journal of Computer-Mediated Communication,* 13, 993-1018.

Yellow Window. (2010). *Gender in EU funded Research.* http://www.yellowwindow.be/genderinresearch/ [accessed 4 June 2013]