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Bridging gendered and scientific cultures in a healthcare technology context

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ABSTRACT

The project Gender Perspective on Embedded Intelligent Systems – Application in Healthcare Technology (G-EIS) financed by Vinnova is integrated into the research environment Embedded Intelligent Systems (EIS) at Halmstad University. EIS is contributing to the regional Triple Helix innovation system Healthcare Technology by developing new technology for application within the health and care sector, and there is an outspoken a need for a more articulated gender perspective within the research environment. The project is inspired by the Technoscientific gender research. It has a qualitative and action research approach and is oriented toward development. In the project process the difference between epistemological cultures has been obvious. In the interaction between the researchers we realize that engineering and other technological sciences not only consider aspects of science to be separate from reality, but also seek positivistic proof in research, something not always possible in the more qualitative research of the social sciences. In the paper we discuss how to bridge and create understanding between sciences and different epistemological cultures.

KEYWORDS: gender, technology, healthcare, epistemology, innovation system

INTRODUCTION

In this paper we want to bring to discussion how conflicting perspectives and cultures should be fruitful in innovation processes. The authors' main perspective is grounded in gender science both theoretically and methodologically.

Embedded Intelligent Systems (EIS) is the joint research field at the School of Information Science, Computer and Electrical Engineering (IDE) at Halmstad University. The research is integrated into a research environment within embedded systems (EIS) – with a perspective reaching from the enabling technology via new system solutions and intelligent applications to end user aspects and business models. It is an expanding research area with many applications, not least ones that exist in everyday life.

When Vinnova – the Swedish Governmental Agency for Innovation Systems – in 2008 launched the programme Applied Gender Research for Strong Research and Innovation Milieus (TIGER), EIS successfully applied for the project Gender Perspective on Embedded Intelligent Systems − Application in Healthcare Technology (G-EIS). It is a three year project and we have now passed two thirds of the time. According to the call, the Tiger programme, in the longer term, aims to promote sustainable growth in Sweden. The call was directed to R&D projects in areas supported by other programmes and was based on the logic that strengthened competitiveness and sustainable growth are achieved as the numeric gender equality increases and a gender perspective is integrated. The innovation capability then is no longer restrained by current normative thinking about sex/gender (Pettersson 2010).

EIS is a research environment with a diversity of nationalities and ages. It encompasses four labs with approximately 85 employees ranging from 25 to 65 years old and originating from around 20 countries. The research budget for 2010 is around 45 MSEK, 70% of which is external funding. Despite the fact that the research environment has a better balance between men and women, among researchers as well as Ph.D. students, than most comparable environments in the field of computer science, it still operates in surroundings with a tangible imbalance. Almost all contacts with partner companies are with Swedish men, conferences on related subjects are mostly visited by men, and any teaching the researchers and Ph.D. students do is mainly for men of many nationalities. Within computer science, the

subject that dominates EIS, it has for many years been difficult to recruit students, and the numbers of women undergraduates is almost negligible.

The research environment has several aims with the project. EIS research is carried out in close collaboration with partner companies and the innovations that are generated should, when implemented, be both functional for and acceptable to both men and women. The research environment's management has realised the importance of integrating a gender perspective throughout and of working toward opening up to new perspectives and research questions among the research environment's contributors. In the pilot project that preceded the application to Vinnova, interviews with researchers, Ph.D. students and collaborative partners in business showed a need to carry out development work for a more gender equal and gender aware operation and work environment. Interest in understanding what knowledge about gender and gender equality could generate, especially in the link between research and application, was high.

In the long term, the project is also expected to lead to more students (men and women) being attracted to an education within the field. The pilot study showed that the researchers and Ph.D. students all believed that both the research and the educational programme would be considered more attractive and would reach a broader recruitment base if one could make visible applications used in everyday life as areas of computer technology. An even gender distribution among co-workers and work groups is also expected to lead to a better working environment.

THE G-EIS PROJECT ORGANISATION

The G-EIS project is organised with a management group, a steering group, a gender group, and a group of change agents, all of which together make up the project team.

The project leader is the professor of computer systems engineering who is also chairman of the steering group for the research environment EIS. The management group involves the leaders of the four laboratories within EIS; "Centre for Research on Embedded Systems"; "Intelligent Systems Laboratory"; "Man and Information Technology Laboratory"; "Centre for Applied Mathematics and Physics"; and further the leader of the regional "Centre for Health Technology", located in the EIS environment.

The project team also includes another eight persons involved in different working groups; the change agents and the gender group. The gender group together with the project leader form the steering group.

Four young researchers, one from each of the four laboratories, together form the team of change agents. Their role is to interpret and translate the meaning and relevance of bringing a gender perspective into the EIS environment. The change agents meet regularly and have, in the beginning of the project, been trained by the gender researchers in basic gender theory.

The gender group consists of a gender researcher, a project secretary and two gender researchers/consultants who both act as senior advisors and process evaluators. The members of the gender group bring their gender competence into the project and support the project team in the process. Work meetings and seminars are regularly organised and it is in the dialogue and knowledge exchange between the change agents and the gender researchers that concrete gender problems are discussed and the main interventions and actions are planned.

This article is the result of a joint reflection by the members of the steering group, where the change agents have also taken part in a reflection process about the project.

INNOVATION SYSTEM IN HEALTHCARE AND INFORMATION TECHNOLOGY

EIS is contributing to the regional Triple Helix innovation system Healthcare Technology which the region has pointed out as a prioritised development sector. With its strong connections to both established and new expanding firms hived off from the university, the research environment is active in the Healthcare Technology Alliance , a network of around fifty companies, counties and healthcare providers in south-western Sweden with the aim of developing the region into a leading arena for the development of health technology products and services. Several projects together with these participants concern both research and technology transfer.

EIS involvement in the G-EIS (G for gender) project is built on the assumption that an integrated gender and gender equality perspective in innovations within the health technology area is necessary in order to be able to meet the needs of a population and especially in an ageing population. Here the relevancy of a gender perspective is clear in relation to the fact that the great majority of all those older than 75 years are women. Older women are on average cared for in hospital twice as long as men, partly due to differing disease panoramas, but also because men are more often cared for in the home by a woman while the women who live longer more often live alone. With the expansion of home-help and home nursing new needs follow and it is likely that a gender perspective will become necessary for the development of products and services that can make daily life easier for the elderly. The gender perspective also has relevance from the point of view of care staff. New technology is developed for application within the health and care sector where the larger professional groups consist mainly of women. The technology, most often designed by men, is used by women. With this in mind it is clear that an important aspect of good innovations is that the end users are involved in the innovation process. Thus the G-EIS project is designed to involve both end users and those who work in the health care sector.

As a consequence of our membership in the EU, the regional perspective has become more prominent in Swedish growth politics. Economic growth is

increasingly focused on as an important part and prerequisite for regional development. The growth potential of regions rests in their ability to utilise the special competencies that companies and other parties in the region have, as well as in coordinating these and thus supporting innovative processes that generate new products and services. In so called Triple Helix collaboration (see Vinnova's website for key concepts), politics, companies and universities interact in regional innovation systems and clusters. The idea is that innovations are created in these collaborations, which in turn leads to those regions where innovation systems exist becoming competitive on an international market.

There are a number of studies that in different ways view clusters and innovation systems from a gender perspective and that show that these are "male" arenas where both those who make decisions and those who are active and receive support from regional policies mainly are men. Researchers argue that clusters and innovation systems tend to view the male as norm and are also gender blind (Lindberg 2009, Hallencreutz, Lundequist & Pettersson 2003, Forsberg & Lindgren 2010). The innovative entrepreneur tends to be seen as a man (Nyberg 2009 och Gunnarsson & Westberg et al 2007). The technical, traditionally male dominated, base industries receive a disproportionately large amount of support from innovation policies, despite other industries having great growth potential. As Lindberg points out, two of the most successful Swedish trading companies are IKEA and H&M (Lindberg 2010).

Women are heavily underrepresented within IT and computer technological education, research and professions. Men have symbolic power over technology, i.e. it is a clear majority of men who research and develop technology. This majority is also a relatively homogenous group of men who develop technology based on their conceptions and life experiences. It is not difficult to argue that this is problematic from a democratic fairness point of view, but it also creates problems from a technology perspective. Women and men in general still have life patterns that diverge and bring differing experiences. These experiences and perspectives on life are consciously or unconsciously brought into one's work and professional role. An increased share of women within IT and computer technology would likely induce new questions for and perspectives on technology and thus also influence research focuses. Breaking up the homogeneity and having a greater diversity among those who produce technical solutions would reasonably lead to a technology that satisfies more needs and appeals to more groups in society, and thus contributes to sustainable growth (KTH 2006).

Many feminist researchers question even the concept of technology itself: that mainly what men do is considered technology, but seldom what women create or use (Berner 2004). The understanding of technology and technics in western culture mainly focuses on men's artefacts, activities and fields of knowledge.

Considering that the lines of business usually identified as successful often have a distinct masculine character with focus on sectors that traditionally create growth, as for example the engineering industry and IT-based companies, it is interesting to study health technology as a field of expansion. In the regional development program the field is described as "A cross-disciplinary area where engineering and natural science meets health care science and social and behavioural science" (Region Halland 2005). What characterises the field of health technology in relation to many other areas where innovation systems and clusters are defined is that it brings together male dominated areas such as manufacturing industry, electronics, biotechnology and chemistry with the female dominated areas of healthcare and home care services. Lindberg argues that the field of health technology has a potential in challenging the dichotomies and dualistic gender constructions that the present innovation policies build upon – she calls it a boundary-crossing potential (Lindberg 2009). In the G-EIS project we study this boundary-crossing potential by introducing a gender perspective to the innovation system Healthcare Technology.

GENDERED AND SCIENTIFIC CULTURES

In the G-EIS project we apply theories from gender and feminist research, and also methods from an epistemological perspective that differs considerably from the scientific perspective in which the natural science participants have been trained.

Our view of gender is that it is ongoing process where we, men and women together, construct gender. We are here inspired by the work of Joan Acker (1992) and have in the project used her model of analysing gendered organisations both as theory and method. As the context of the G-EIS project is technology and computer science, we are also inspired by the Technoscientific gender research (Trojer 2002), developed in Sweden and internationally, that studies the basis for classic engineering science with its indisputable classifications, standardisations and formalisations from a critical perspective.

Our research is action-oriented; we want change in actions and in thinking. We here take our standpoint in the epistemology of action research, which on a very general level can be described as the study of, and with, social systems in action. It is not a method in the limited or traditional sense of the word. It is the co-acting and the joint learning that is the focus for action research (van Beinum et al, 1996, Svensson et al. 2002).

Doing Gender

In the design of the G-EIS project we were inspired by a research and development project accomplished at Vinnova, The Swedish Governmental Agency for Innovation Systems, from 2003 to 2006. We saw similarities between the incentives for Vinnova and EIS to take part in a gender project: to strengthen gender equality in the organisation and to integrate the gender perspective in the definition of research questions and evaluating projects and project results (Gunnarsson & Westberg et al 2007).

The Vinnova project was based on Acker's thinking

on organisations as gendered and her understanding of gender, not as a personal, individual and social role, but as a social construction. In her "doing gender perspective" Acker talks about the gender we do, instead of the gender we are and argues that gender is embedded in the processes that constitute the way we organise our lives and our institutions and that inequalities between men and women are continually reproduced through our interactions to keep organisations going.

Acker focuses on four different processes through which the construction of gender in organising settings can be discovered and analysed, which has inspired Scandinavian gender researchers to develop a model that functions both as theory and method (Andersson, Amundsdotter & Svensson 2008, 2009; Gunnarsson, Westberg, et al 2007). The four processes are gender division, i.e. women and men have different task assignments which position them differently within organisations and thereby in different subject positions; symbols and images constructed to express and explain these divisions; interaction and spatial closeness between the sexes and, within each category; identity and personal constructs.

We have in the G-EIS project used these four processes as an analytical tool in order to penetrate the EIS environment and to highlight where interventions are motivated. We have also been inspired by Vinnova to work with change agents from the organisation who function as intermediators of knowledge and "translators" between the different scientific cultures of the EIS staff and the gender researchers (see below "the G-EIS process").

Epistemological Encounter

Traditionally one can see a conflict between researchers in technology/natural sciences on the one hand and gender researchers on the other. However, it is more multifaceted than that – within the cross-disciplinary EIS-environment we find several different scientific traditions and viewpoints. It is interesting to see how all these different approaches, when set against each other, can contribute to the whole, which presumably is important in an innovation system. In other words, it is not about how to handle conflicts, but rather about how different approaches complement each other and are needed in various parts of the innovation system.

The EIS researchers often fetch their theories, concepts and methods from the science and technology tradition which claims that science is objective and value-free, and that there exists a truth to discover. This perception of knowledge has over the last century formed the traditional academic research ideal where the academic subject with professional rules and hierarchic relations is central. The aim is objective, theoretical and generalisable knowledge. This positivistic perception of knowledge (developed by the 19th century sociologist August Comte) is described by Mårtensson and Nilstun (1988) with the following characteristics:

> "…produces knowledge about relationships that follow laws.
>
> …is objective and requires freedom from preconceived notions.
>
> …is the opposite of non-verifiable speculation.
>
> …prefers quantitative methods to qualitative methods.
>
> …has its value in its technological and social applications."

The positivistic perception of knowledge is distinguished from the research ideal of the humanistic social sciences which the gender researchers and research represent, and it is not self-evident that it is sufficient for handling the demands placed on today's universities to meet new knowledge requirements, collaborate with politics and industry, and to contribute with expertise in a rapidly changing development process. These latter roles characterise work in the EIS research environment to a high degree and the environment is therefore not unaccustomed to – though not necessarily in a conscious manner – handling several different knowledge and science paradigms. Over the last few decades, an alternative ideal to the traditional science ideal has emerged and had an increasingly strong impact both within universities and research councils and foundations. A few international researchers who have challenged the traditional academic perception of knowledge have had importance for our Swedish research policies. One of these is Henry Etzkowitz (1997) who launched the Triple Helix model (see above) which has had an impact on Vinnova. Others are Michael Gibbons, Helga Nowotny and Peter Scott (1994, 2001) who set an alternative model, which they call "Mode 2", against the traditional perception of knowledge ("Mode 1"). "Mode 2" is mainly determined by the benefits, effectivity and usefulness for the participants. It is characterised by a processual way of working where researchers and experts collaborate in an open, flexible and equal manner. The research takes place in an interaction between different parties: "Proximity to practice is an important factor which can contribute to developing research /…/. The development of theory is stimulated by meetings, developmental processes, networks, collaboration, debate – not by detachment and isolation /…/. New groups must be included in the formation of knowledge, not be excluded from this by an unreflecting perspective constituting the template for questions and analysis." (Svensson, Brulin & Ellström 2002 s.7).

This action-oriented model is characterised by an aspiration for change and for research to contribute to development, problem-solving and joint learning for those involved. When combined with a gender perspective the aspects of power-relations become visible and possible to handle (Gunnarsson & Westberg, 2008).

Technoscientific Gender Research

On the same grounds as described above, feminist researchers in the field of technoscience are critical of objectivity paradigms and of the researcher as the neutral and objective observer – i.e. that it is possible to map and observe a true reality. Feminist researchers do not accept the ideas of science and the scientists as neutral and objective or the idea that abstract and theoretical thinking

and knowing ("knowing that") is considered superior while bodily knowing and practical thinking ("knowing how") is seen as inferior (Björkman 2005, Trojer 2002). In her article about feminist research and computer science Björkman criticises the role of abstraction in computer science. She wonders how computer science can understand the world via a rationality based on abstraction while the products of computer science are very concrete. She argues that technology is culturally situated, like all processes that produce knowledge. Objects and processes are situated in the context where they are created and this situating brings with it valuable knowledge about the different circumstances surrounding the creation (ibid, p.183). She refers to Sandra Harding who explains the technoscientific bias in this way:

> "Most engineers would argue that their technologies are not social at all in any meaningful sense of the term (….). By excluding from their definition of a "technology" not only its social applications and meanings, but also the knowledge of how to make it, use it and maintain it, they can perpetuate the illusion that technology is not cultural at all".

By broadening the concepts and understandings of technology, feminist research brings a new perspective and an added value to technoscience that may contribute to an ethical and more sustainable future. Feminist research, in other words, contributes to bringing technoscience beyond the positivistic knowledge tradition, a tradition that becomes more and more inadequate in the research and technology-dependent society of our time.

Pitting these knowledge traditions and scientific approaches against each other is experienced as positive and creates interesting discussions in a multi- and cross-disciplinary environment like EIS. Even if, for example, computer scientists value and are dependent on the power of abstraction for the development of new methods, tools and approaches, they are generally, through the collaborative projects (within as well as outside the research environment) they are often involved in, highly conscious about technology developing in a social context. Within the project we, the gender researchers and the EIS researchers, have had many interesting, rewarding and conflicting discussions about e.g.; what is true knowledge; evidence based results; epistemological views: the core of science; and how to translate theories and abstractions into application in social contexts.

THE G-EIS PROCESS

Our point of departure has been a mapping work based on Acker's model to find change potentials in the EIS organisation. This work has entailed a learning process for both the change agents and the gender researchers as well as for the whole project team.

One of the first tasks the change agents took on was to map the gender distribution at the School of Information Science, Computer and Electrical Engineering (IDE) where the project is located. The mapping was valuable mainly from a learning perspective. The change agents also used observation as a method to study interaction patterns at meetings. Following the mapping and observations, a report was written that contained not only statistical results, but also reflections from the change agents mirroring their acquired knowledge about gender and hence a new way for them to view and interpret their environment. As the mapping and observations did not touch on gender equality aspects of the work environment at IDE, however, the change agents also developed a questionnaire that went out to all personnel. The object of that was to capture the existing moods and opinions about gender equality as well as to make visible needs and desires concerning gender equality measures among the staff.

Parallel to the work of the change agents, regular meetings and educational opportunities have been held with the entire project team. The majority of the gatherings have been seminars where inspirational external lecturers relevant to the project have been invited to speak. Other than this, the project team itself has held a number of so called future seminars where various possibilities for integrating gender in the development processes facing the research environment have been discussed. These have also led to decisions on the focus and delimitations of the project.

The pilot study that preceded the project application showed that the employees at the School of Information Science, Computer and Electrical Engineering (IDE) at Halmstad University chiefly desired increased knowledge about gender and gender equality. Therefore the process has to a large extent been knowledge-enhancing; we believe that basic knowledge about these issues followed by gender awareness is a first step toward changed patterns of behaviour and alternative processes which eventually bring about a more inclusive and gender equal research environment.

The change agents' interest in gender issues has both increased and deepened during the mapping of the organisation and thus the project, so far, has became more education-oriented for the change agents. We saw this as a prerequisite for the continued development of the project and the aim of achieving a more gender aware organisation.

We have gradually become aware of the fact that it is a complex and rather impracticable task to gender integrate a whole research environment. When we, halfway through the project period, started the phase where we were to intervene in real action, we had reached the conclusion that the project requires a clear delineation and instead agreed to focus on some of the new development processes in the environment where we could be engaged early in integrating a gender perspective. We perceived it as better aimed to be involved in the start of new processes than to try to change those already existing. One such new process was the Centre for Health Technology, which, connected to the EIS environment, provides a platform for industry-related research and development leading to new products and services in the area of health technology. From autumn 2010, halfway through the G-EIS project, gender mainstreaming the newly started Centre for Health Technology has therefore been the primary empirical task for G-EIS.

CONCLUDING REMARKS

As there still remains one third of the project time it is too early to judge in what way we have been successful in implementing gender mainstreaming in the research environment and the regional innovation system.

All through the project the meeting of two epistemologically opposed theories of science has caused confusion to the project participants. The understanding within gender studies that research and production both create reality and are informed by it is not always accepted within the areas of natural science. Engineering and other technological sciences seek positivistic proof in research, something not always possible in the more qualitative research of the social sciences.

Despite the project being taken seriously by those involved and a strong commitment from the management of the research environment, our efforts to reach the whole organisation have not been entirely successful, partly because of a shortage of time. The EIS-researchers are expected to teach, to administrate, to attend meetings, conferences, research seminars and to supervise students and doctoral candidates, and when all these demands clash, the gender project is not always prioritised.

We have also struggled with the problem of inclusion. At first the project was politely welcomed, but more as a parallel process to the regular mainstream R&I activity. Our conclusion was that the project would be more successful if we could join R&I processes when they start instead of trying to make changes in ongoing processes. We decided to put our focus on the concrete health technology process which has resulted in a clearer focus on actions to be taken. Our expectations are that successful integration of a gender perspective in some processes will have positive spin-off effects on the research environment as a whole.

Bridging scientific cultures is not a quick fix task. The project has a qualitative and action research approach and is oriented toward development and change. With a relatively open approach we expect the project to be innovative regarding how a gender perspective can be applied and have an impact on a computer technological environment and on an innovation system based on the theme healthcare technology.

We expect innovative research questions to arise as a result of the meeting between

- The male-dominated technical culture and the women-dominated field for applications
- A positivistic research tradition and the interactive action research
- A technological rationality and a humanistic responsible rationality

The intention is to follow the emergence of new procedures in the organisation that lead to gender integrated innovations and to develop a model for how to continue working with the issues after the completion of the project.

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