

SCIENCE FOR THE PROFESSIONS

Report no. 2

Smart Textiles



UNIVERSITY COLLEGE
OF BORÅS

SCIENCE FOR THE PROFESSIONS

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THE PRESENT REPORT is the second in the report series Science for the Professions. The purpose of the series is to present results from ongoing and finished research projects at the University, as well as publishing contributions in an ongoing discussion about the profiling of science and applied methods within the framework of the idea of Science for the Professions. An annual output of four to six reports is the goal. The editor of the series is pro-rector Björn Brorström, assistant editor is the chairman of the Research and Education Board Kim Bolton and the technical editor is the research coordinator Stina Sundling Wingfors. Members of the editorial staff committee are Olov Forsgren, Lars Hallnäs, Lars Höglund, Kaj Lindecrantz, Maria Nyström and Bengt Persson. The committee's task is to assume responsibility for evaluation of contributions to the report and thereby for assuring it maintains a high standard. In certain cases external experts may be asked to leave their opinion.

The report series Science for the Professions:

1. Forskning vid Högskolan i Borås. Om förhållningssätt, innehåll, profil och metod
2. Smart Textiles

Graphic form

THERESE ROSENBLAD

Print

LIVRËNA, KUNGÄLV, 2008

ISSN 1654-6520

ISBN 978-91-85659-23-4

Preface

BJÖRN BRORSTRÖM | *Pro-rector University of Borås*

There is an increasing research activity at the University of Borås (UCB). Our ambition is to create a strong research setting oriented towards studies in two research arenas; growth and welfare. We have developed and defined strong research programs and a few very special research programs that represent the profile of UCB. The research strategy includes a development of these special programs with the aim to create a comprehensible profile. It is at the same time important in this process towards an apparent profile to carry out broad based research in different disciplines and to give space for individual researchers to gain further knowledge in a particular research project.

One of our strong and special research programs is named Smart Textiles. In this second report in the series Science for the Professions, professor Lars Hallnäs and his colleagues present the program with a special emphasize on the research strategy. There is a presentation of the technological research and the design research and how these two parts interact. The report also includes a lot of interesting comments concerning the relation between core research and the development of new products. Another significant question is about the relation between academia and industry. The authors discuss the importance of exchange of ideas under the absence of domination.

The report is a description of the program Smart Textiles and some important issues concerning research activities. The program is exceptionally promising and many important results will be published as a result from research in progress and planned research. One important aspect from an academic perspective is a thematic discussion about the potential of Smart Textiles as a research discipline, from hype to an important research field. The authors will come back to this question in forthcoming reports.

Smart Textiles – An Initiative for Research and Innovation¹

LARS HALLNÄS

Smart Textiles is an initiative aiming at building a platform for a future dynamic and internationally well-positioned center for textile development in the area of West Sweden; development, design, and specialized production of the next generation of hi-tech smart textile products.

The initiative is based on a triple helix cooperation between industry, academia and public sector. Main partners are²:

- The University of Borås,
- Espira – Center for economic growth in the Sjuhärad region,
- West Sweden Region,
- Sjuhärad Association of Local Authorities,
- Teko - The Swedish Textile and Clothing Industries' Association,
- Swerea IVF AB – Swedish Research Institute,
- SP Technical Research Institute of Sweden,
- The Interactive Institute and
- Vinnova.

The initiative is based on combining industrial development projects with experimental research at institutes and universities. Cooperation works through joint project groups, seminars and workshops coordinated by a process group.

The working methods of the initiative are based on two main strategic ideas:

(i) To open up for communicative action relating a double focus on industrial development work and academic experimental work.

(ii) To use experimental design work as a basic driving force in development.

¹From an invited talk given at THE CHALLENGE OF SMART TEXTILES, 15th of February 2008, Riga Technical University, Riga, Latvia.

²The Sjuhärad Association of Local Authorities consists of the municipalities of Bollebygd, Borås, Herrljunga, Mark, Svenljunga, Tranemo, Ulricehamn, and Vårgårda.

1 Communicative action

A radical shift in product development needs lots of experimentation. This in turn needs a firm foundation in basic academic experimentation. We know from experience that communication here is rather slow and at times difficult. We simply have very different perspectives on results and the outcome of our work.

The more effective and profound link between academia and industry is of course based on education and publication of research results, which is a slow communicative process.

When we have very specific problems at hand cooperation can work very well, but this often just means expanded development work where we add skills and competence in specific areas. But joint work for development in a more foundational sense is much more difficult to organize in a meaningful and effective way. Without industrial development work in the smart textiles area there will of course be no new smart textiles products. Without basic experimental work there will of course be no foundation for product development in the area of smart textiles. We cannot hide these rather trivial facts behind wishful thinking about joint work and cooperation we know by experience to be problematic.

The first working axiom of our initiative is then to respect the difference between industry and academia and try to use it rather than hide it:

- In industry we solve problems and develop things with focus on the product as result.
- In academia we solve problems and develop things with focus on foundational knowledge as result.

In the model we try to develop we distinguish between industrial development projects and academic experimental projects and they are and must be different in character. The industrial development projects must be owned by companies and the academic experimental projects must be owned by researchers and research institutes.

In concrete terms this means that the initiative provide funds for both these activities. Companies apply for projects and the process group reviews applications. Research institutes and schools are given basic funds for experimental work.

In a long-term perspective this will certainly work well with education and publication of research results as the basic links of communication. But how can

we open up for communication that somehow shortens the distance and the time gap a bit, and at the same time respect and take advantage of the differences? This is of course one of the main problems that challenge all triple helix initiatives for economic growth. The second working axiom of our initiative is to enforce the idea of the university as an open arena and interface for communicative action.

The German philosopher Jürgen Habermas use the term “communicative action” to discuss the free exchange of beliefs and intentions under the absence of domination. Here this means to define Smart Textiles at the University as a neutral arena and interface for the free exchange of ideas at the same time as we provide funds for the development of ideas with a double focus on industrial development and academic experimental work.

Research institutes provide the other basic interface; communication between industry and academia through a double focus on experimental work and development work. There is no given clear direction of research to provide solutions or with focus on applications. There is no domination of research that puts up stop signs for initiatives and seemingly crazy ideas.

Solutions and applications appear as results of communicative actions which means there is basically no conflict of interests. The open arena is defined on basis of respect for differences in perspectives and in interests. This means we have to define arenas and interfaces in practice. We do this by introducing all sorts of meetings in the name of Smart Textiles;

- from small open international workshops to conferences,
- from project meetings where researchers involved in industrial projects host discussions to open challenges with invited key speakers from industry,
- from small technical workshops to joint project work in our full scale workshops.

We try in this way to introduce a notion of the Smart Textiles collegium, the glue that link all parts of the initiative. The main enemies we have to fight are all those ideas we have about what academia is like and what industry is like and the strong urge we have to organize everything.

There must be strong elements of trust and respect and also a large portion of anarchy to make this work – the free exchange of ideas under the absence of domination. So one main strategic idea in our initiative is the perhaps a bit old fashioned idea to reclaim the University as an open arena for the free exchange of ideas, the natural interface in the triple helix model. What we add in the Smart

Textiles initiative is that we together with others focus a discussion on a certain thematic question; what is smart textiles all about?

Progress and success of “smart textiles” as a program for the next generation of high-tech textiles will to some extent depend on how successful we are in combining theoretical and experimental work in several rather different disciplines; from materials science, electronics and computer science to textile technology and textile design. What role can experimental design work play here?

To use experimental design as a driving force in development is a central idea in the Smart Textiles initiative. What does that mean?

2 The role of experimental design

Smart Textiles is a so-called “buzz word” today, a hype. It is difficult to say what directions the development of new products will take. Like other hypes it will pass by and transform into something more mature in five years or so – both in research and in product development. But I think it is a hype that will have a profound impact on the textile area. The notion of smart textiles is a key factor in the rather radical development of experimental design within the textile area today. This development of experimental design will for sure be a strong driving force forming textile product design in the near future.

Experimental textile design as a driving force in the initiative is a hub we use for developing programs and projects for textile technology and product development.

Scientific and technical discoveries introduce new possibilities we explore; development is technology driven. Nuclear power is a typical example of that. Visions and dreams about things introduce new challenges we explore; development is design driven. Let’s go to the moon for example.

What is really the main difference between these two perspectives of driving forces? The difference lies somehow in the directions of interaction between discovery and suggestion. Technology opens up for suggestions and design calls for technical discovery and development.

Design is a hub; it explores technology at the same time as it calls for technology. As a driving force it provides directions and meanings to technology development. Just as technology as a driving force provides materials and possibilities for design development. There is an important difference here; in design there is

a strong focus on expression while in scientific discovery or technical invention there is a strong focus on functionality.

It is clear that functional possibilities only have concrete meaning through design expressions. To use experimental design as a driving force in technology development then simply means that we use experimental products to explain, motivate and give meaning to scientific work and technical innovation.

Technical innovation becomes expressional exploration rather than a search for functional solutions. We use experimental design in the Smart Textiles initiative to define technical innovation. When we design and produce products we express something, it is after all things we intend to sell and dwell with. The resulting expressions are what define the product, what makes it into what it is. This means that technology in the products we use is not just neutral functional solutions, but very much expressive design materials.

If we use experimental design as a driving force in technology development it means somehow that it is expressive design materials we develop. Technology development becomes inherent to, and displayed through, the experimental product. We view technology, not in isolation, but as something that builds things we use. This is not technology development as applied research, but as design research.

Using experimental design as a driving force in the initiative means that this is where we start, the experimental exploration of new textile expressions. But it is also where we close the circle, the realization of new textile materials and products; it is a matter of

...exploring new design technology

It is a matter of exploring new design technology. This is the foundation of technology that defines the next generation of high-tech textiles materials and products.

To explore and develop new means of expression; new expressional materials and construction techniques. Carbon nano tube technology may open up for the development of conductive fibers, but what does it mean? If we turn this around and explore conductive fibers as a new expressional possibility in textile design we start with a different perspective where the issue of meaningfulness is fundamental for the questions we ask.

...exploring new design aesthetics

It is a matter of exploring new design aesthetics. This is the foundation of expressiveness that defines the new products. To explore and develop new perspectives on textile expressions; new ways of understanding the basic logic of textile expression. The textile sensor is not only a smart way to introduce soft and flexible sensors with use potential in many areas, it is also a way to extend our understanding of textile expression. The notion of a textile surface will be different if we add sensing to expressional variables such as color and texture.

...exploring new design dimensions

It is a matter of exploring new design dimensions. This is what the big change in thinking about and using textiles is all about. To explore and develop textile design as a design profession; to open up for new design variables by adding basic dimensions of expression.

We all know what a textile pattern is, don't we? But assume that we open up for time as a new explicit design dimension, what does that mean in terms of textile patterns? This is what makes programming and computational technology meaningful in textile design, rather than the other way around which is to view things in terms of technology driven development.

...exploring new design directions

It is a matter of exploring new design directions. This is where we are going. To introduce and explore the visions that tell stories about where we are going; the way in which all these new textiles and textile expressions will change our way of working and living.

When technology changes and becomes textile in expression, interaction with technology will change and become different; soft and flexible properties of interaction will become a focal issue.

...displaying design technology

It is a matter of displaying design technology. To critically review the foundations of the next generation of high-tech textiles materials and products. Experimental design is important in the sense that it displays design technology; this is where the objects of design become a material thesis that open up for discussion about technology.

Waiting for the future conductive fibers we design with steel, copper etc. to show what it is we think about.

...displaying design aesthetics

It is a matter of displaying design aesthetics. To critically review the new expressiveness. Experimental design is important in the sense that it displays design aesthetics; this is where the objects of design become a material thesis that opens up for discussion about expressional matters.

We design the dynamic patterns to show what it is we think about.

...introducing new design programs

It is a matter of introducing new design programs. To define the new products. We need to introduce and experimentally explore new design programs that sketch new areas of textile products as a way to bring change about.

Smart textiles has initially been a rather technology driven area. Although there are attempts to introduce more general design programs as driving forces there are still much to do here. Mixing programs for sustainable design with ideas about smart textiles design would be interesting given the inherent tension in images between these both directions of textile design. The non obvious here could helps us to deepen both perspectives.

... changing the design education

It is a matter of changing the design education. To change and redefine the textile design profession. There is certainly a radical shift in education necessary to prepare for professional work within a changing profession. The ideas of textile materials, techniques, design expressions and design programs are changing and the issue of mastering basic means of expressions calls for a radical revision.

- What does the textile designer have to know about new materials and techniques in order to master these materials and techniques as design materials and design techniques?
- What does the textile designer have to know about programming in order to master the techniques of new notions of textile patterns?

It is not enough to say that this calls for interdisciplinary cooperation. The designer has to master the basic means of expression at hand and for that we need to change education. But in what way?

Smart Textiles – Research Program

LARS HALLNÄS AND PERNILLA WALKENSTRÖM

1 Vision

Research within the Smart Textiles initiative will contribute to strengthen the textile innovation system with a basic platform for technology and design through the

- development of new textile materials and new textile technology,
- development of programs for new textile products,
- development of methods and techniques for the design of new high tech textile products,
- development of high level education in textile technology and textile design.

We envision how the Swedish School of Textiles and the School of Engineering at the University of Borås together with Chalmers University of Technology, Swerea IVF, SP Research and Interactive Institute develop the Smart Textiles Research Labs into an internationally leading lab environment in the area of smart textiles, a research environment characterized by a very strong interaction between technology research and practice based design research and by being a powerful driving force in a nationally and internationally successful innovation system.

2 Strategy

Our overall research strategy is based on a double focus on

- textiles as a construction material and as a construction technique,
- research as technology and materials research and as practice based design research

and on close design driven interaction between

- textile technology and practice based design research,
- experimental research projects at universities and institutes and company based research and development projects.

The initiative builds on the idea of interaction between company based research and development projects and experimental research at universities and institutes as the basic driving force. Company based projects are “owned” and initiated by the companies, experimental research at universities and institutes are “owned” and initiated by the researchers; experiments opens up for ideas to be explored in R&D-projects whereas these projects ask questions that initiates experiments. Technology research display possibilities and ask questions through materials research and development of new techniques, practice based design research display possibilities and ask questions through experimental product design. The experimental product expresses possibilities and asks questions about materials and techniques, questions that direct the development of technology research at the same time as technology research opens up for new design experiments. It is a circle of close cooperation that we build up through seminars, joint experiments in the open research environment of the initiative, through joint R&D-projects and through discussions and meetings in process groups and working groups. The experimental research as well as the company based R&D-projects focuses on research and development both in textiles technology and textile design. This double focus on technology and design radically shortens the distance between basic research, applied research and product development.

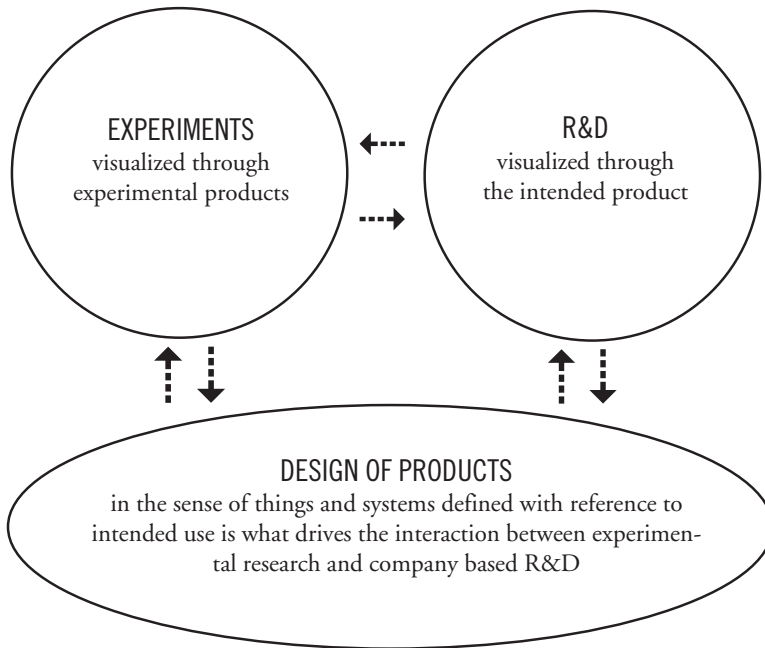
As we develop new materials and new products the experiment is a focused issue; experiments to further knowledge, in general and for specific applications, at universities and institutes and experiments to further product development at companies.

Experimental research at the universities and institutes as well as company-based research and development projects are about experiments to discover and develop materials, technology and products. It is just a matter of a difference in complementary perspectives.

A basic idea in the Smart Textiles initiative is to let the interaction between these two perspectives function as a driving force in the development of the next generation of textile materials and products. Interaction between the perspectives opens up for, and develops, new ideas as questions and answers that move back and forth between universities, institutes and companies. The examples are important here; it is through the many examples of possible and impossible things and products that we suddenly get a hint of a good answer or a good question.

The product plays a major role. In experimental product design the product is a methodological tool that carries questions and answers. In the company based research and development projects the product lurks in the background, as a

means of motivation and as a final objective. The interaction between these two perspectives widens the horizon, enables solutions we otherwise wouldn't have been able to see, enforces research as well as development environment and fuels the development through change of perspectives.



We interpret these questions and answers in relation to products and theories. When changing perspectives both questions and answers are interpreted differently and linked to another path. What is special is highlighted through a more general perspective and vice versa. From experience we know that it is through that kind of “general” disorder that sustainable ideas are born and thrive. We create a scientist’s and inventor’s workshop where theory and practice meet and where ideas and problems are twisted and turned.

The universities role in the Smart Textiles initiative is to develop methods and techniques in design and technology, focusing on principle issues:

- In what way is it possible to develop conductive polymer fibres?

- How does textile design change in the meeting with computational technology?

It is in the meeting with company-based research and development that answers to this type of more general questions suddenly can change direction and become practical and useful in a more specific sense.

The role of the institutes in the Smart Textiles initiative is to develop methods and technology in design and technology, focusing on application, a focus that links experiment and products to each other.

It is the meeting with experimental research, that such applications suddenly can change direction and turn into matters of principle. To develop the area we need this exchange between general experiments and specific applications.

3 General Research Program

3.1 Technological Research

Smart textiles has its origin in the area of textile technology research that is characterised by strong focus on development of materials in connection with new combinations of materials, multidisciplinary and development of new production technology. The drive for innovation is strong and fuelled by a constantly increasing demand, from industry and society, for improved functionality in textile materials; new kinds of functionality call for new kinds of constructions.

A central field in Smart Textiles is electro active textiles. In this area there is presently technical research about melt spinning of electro conductive fibres. This research is strongly affiliated with research in electronics and design research. In the latter, new kinds of sensor possibilities in conductive textile structures are introduced; textile pressure and stretch sensors – for clinically medical applications, for interior design, for textile car interiors, for work, sports and leisure wear, for extreme environment clothings, etc.

The strong development in nanotechnology is central to Smart Textiles too, both in the area of materials research and in the area of production technology development. During the last few years new production technology has been developed for nano-scale fibres, “electro-spinning in nano-scale”.

The fibres have unique characteristics and contribute to technical added values in products within sound absorption, filtering, medical textile applications, etc. In general, the development of functional fibres is central to the Smart Textiles initiative. Functional fibres are the building blocks for smart textiles; temperature regulating and electronically conductive fibres, fibres that act as actuators that transform a signal, eg. an electronic signal that is converted into kinetic energy.

3.2 Design Research

Design of the next generation of textile products presupposes a radical change in professional work and the development of new methodology and new technology in textile design. To be able to develop new kinds of textile products that we want to use and live with we have to be able to deepen our understanding for the expressiveness of these new materials and technology. We also have to be able to transform such understanding to more general programs for meaningful new products; to explore possibilities in new kinds of textile materials and techniques, with respect to construction, expressiveness and use, through systematic experimental product design.

Innovation is both about finding something new and about seeing what already exists in new ways. A long and strong textile tradition is in this sense both a foundation for experimental work and at the same time something that we need to relate to in a critical manner.

For that very reason there is need for experimental design research that critically examines established conventions and practices.

An example where this is evident is the issue of sustainability, where elementary everyday occurrences, such as heating and lighting, need to be fundamentally changed. Here, critical research of what we normally perceive as apparent can reveal new opportunities when textile materials and products are given new characteristics and new areas of use.

4 Organisation and Infra Structure

Research within the Smart Textiles initiative is organised in two interlinked labs:

4.1 Smart Textiles Technology Lab (STTL)

STTL organises the initiative's technology research. The activity takes place at the University of Borås, at SP, at Chalmers University of Technology and at Swe-

rea IVF, with geographical coordination in the Västra Götaland region. Senior researchers, postgraduate students and master students conduct the major part of the research. Research and project groups, common and complementing equipment and complementing competence are the basis for STTL's activity.

Research in textiles technology is conducted in co-operation between the actors involved and, if possible and required, industry partners involved. Research is based on co-operation and co-production is supported. The environment is characterised by openness between the participants and a constant exchange of each other's resources, staff and equipment.

4.2 Smart Textiles Design Lab (STDL)

STDL organises the design research of the initiative and is based on a closely connected environment at the Swedish School of Textiles, where master students, PhD students and senior researchers work in parallel with textile design research and higher textile design education. Senior researchers and exchange students at the advanced level and at research level are invited for short or long term stays.

The design research in Smart Textiles is carried out in close co-operation between STDL, Chalmers University of Technology and the Interactive Institute, within the framework of national and international networks. Co-operation is carried out through research schools, guest research at STDL, common projects and a joint design seminar at STDL.

4.3 Infrastructure

The initiative's open experiment environment is primarily developed in a co-operative effort between the Swedish School of Textiles, the School of Engineering at the University of Borås, Swerea IVF and SP and comprises a collected resource for experimental research as well as company-based research and development. The experiment environment is characterised by high competence and drive for innovation, as well as unique equipment, suitable for the development of the Smart Textiles initiative. Fibre spinning equipment (melt and electro-spinning) on various scales with complementary equipment for compounding, full-scale workshops in weaving and knitting technology, experiment workshops in preparation and chemical technology, equipment for textile coating of various kinds (conductive), workshops for printing and experimental knitting and ready-made clothing technology, and equipment for characterising mechanical, acoustic, chemical, electronic and fireproof characteristics in textiles.

Textile Interaction Design¹

LARS HALLNÄS AND JOHAN REDSTRÖM

Introduction

For the last ten years, we have been investigating the intersections between textiles and information technology, between textile and interaction design. Through a series of design experiments focused on emerging expressions and aesthetics rather than technical functionality, we have created a series of design examples and exhibitions. Now, almost ten years after our first experiments, the area of “smart textiles” is in a quite different position and there has been a definitive move from initial small-scale experiments to larger research programmes and educational curricula, as the understanding of the design and research issues have deepened.

In the following, we would like to revisit some issues in the previous research process as to be able pose some questions for the future. As research unfolds, we must ask whether initial ideas about core research issues are still valid or if we instead should direct the attention elsewhere. Especially, we continuously have to address the question of how to frame and express the basic aesthetic perspectives necessary for this kind of research.

Definitions, programs

As practices and disciplines change and evolve in relation to new technologies and their possibilities, relations to other disciplines sometimes have to change too. With the emergence of smart textiles, new intersections between textiles, electronics, computation, etc. have been created (cf. e.g. Braddock and O’Mahony 2005, Van Langenhove and Hertleer 2004). To ground collaborative research, as well as to frame research questions, we can not always rely on established disciplines and normal modes of conduct in such situations and there is often a certain need to reframe questions and revisit basic definitions in terms of both theoretical and practical experimentation. In this work, we have aimed not only at joining people from such diverse disciplines as textile design and interaction design, textile and electrical engineering, but at creating a new

¹*From Nordic Textile Journal '08.*

common ground for such diverse disciplines as textile design and interaction design, textile and electrical engineering, etc. in order to explore smart textiles, their applications and implications.

The research discussed here works with notions of “programs” and “definitions” as a way of dealing with such issues (cf. Hallnäs and Redström 2006). Programs are used to frame questions and gather resources, creating a basis for experimentation by setting an overall agenda and design focus, often also including basic research methodology. Definitions, on the other hand, are specific proposals, or propositions, regarding what it is we design and experiment with. For instance, such definitions can be about re-defining what a certain kind of object is, like how we initially defined a computational thing as a display, i.e. as something presenting the results of computation. It could also be a (re-)definition of what a certain kind of design is all about, as in how we worked with definitions of interaction design as “act-design” (as distinct from e.g. a kind of design being about interfaces or interactive artefacts).

This makes it possible to trace general developments and basic transitions in how both programs and definitions are revisited and restated as the research process unfolds. And so before presenting a new program, let us revisit some of the original ideas and experiments.

A short history

First Program

The starting points for this research came from our work on Slow Technology, a design program centred on the aesthetics and especially temporal expressiveness of computational technology (Hallnäs and Redström 2001). The first design research program for textiles and computational technology published in the Nordic Textile Journal (Hallnäs et al 2002b) was based on two basic (re-) definitions: that computational technology is a material, and that computational things are displays. The focus of the program was the interplay between spatial and temporal gestalt in the design of everyday (textile and computational) things. As such, the program called for a close integration and combination of computational and textile materials on basis of their expressions rather than in terms of technological innovation. Although such technological innovation will be part of the research carried out, the idea was work on basis of an aesthetic perspective.

The very first experiments we made explored different kinds of both static and dynamic projections on textile surfaces, including surfaces that would move slightly (e.g. the Chatterbox, Redström et al 2000). The projections were later replaced by more focused work on the movements and dynamics of textile materials as expressions of information and computation (e.g. the Information Deliverer, Hallnäs et al 2002a).

Second Program

After the first experiments, which in many ways were quite abstract, there was a shift towards working with applications. Working with a wider range of disciplines, as well as with both academic and industrial partners, a new program called “IT+Textiles” was formed where notions of materiality were combined with a stronger focus on use and use contexts (Redström et al 2005). While notions such as that computational technology is a material, and that computational things are displays were still central, additional perspectives were added. Especially by the (re-)definition of interaction design as being act of use. In this program we also put focus on a certain kind of applications for smart textiles, namely information and communication devices. The basic perspective was, however, kept as we worked with emotional and aesthetical aspects of communication. Working with everyday things and environments, the program was also an exploration of the transformation of everyday things by the introduction of information and communication technology, and how this might create new intersections between the traditions of technology development, textiles, and craft.

Reformulating basic positions

During the last five years there has been significant developments within the area of smart textiles. There are now both curricula, PhD programs and established conferences. It is a development that goes from experimental products to systematic investigations, and development, of basic advanced textile design- and construction techniques (cf. Berglin 2005a, 2005b); and from experimental design programs to development of foundations for a changing textile design (cf. Hallnäs and Zetterblom 2004, Jacobs and Worbin 2005, Landin and Worbin 2005, Worbin 2005).

Although there have been significant developments in terms of both theory and practice, the basic need to develop a new textile and interaction aesthetics remains. There is a constant need for developing the basic aesthetic perspective as to make sure we continue to push the boundaries of the design space avoiding irrelevant technological kitsch and too-early conservation of expressiveness possi-

bilities. And so we formulate a new position with respect to aesthetics based on the results and knowledge gained a kind of textile interaction design aesthetics.

The notion of “textiles” refers usually to categories of materials, techniques and products. As such there is a natural distinction between the areas of textile- and fashion design, textile technology and textile management. Smart Textiles extends the material and technological basis for the textile area thus forcing textile design to radically change. This is somehow the common picture; smart textiles design is technology driven. But it would also be possible to turn this picture up side down.

Let us imagine we view textiles from the point of view of use and expression of use. “Textiles” is then not primarily a matter of materials and techniques, but things we use for this or that. From this point of view, smart textiles extends the product/things basis for the textile area forcing textiles technology – and management – to radically change: smart textiles is design-driven. In this up side down picture, Smart textiles is seen as a design program that is a driving force in the development of technology and management.

In reformulating our initial position we sketch in what follows a program for textile interaction design.

In a design program we always refer – implicitly or explicitly – to a notion of form that defines the design perspective the program rests on. There is, for example, a big difference in automotive design between construction of the car and the design of its outer shape respectively; we build the car and form its outer appearance. In the first case it is a matter of expressing functionality, while in the second case it is perhaps more a matter of expressing style in a broad sense.

Textile interaction design

By interaction design form we understand in what follows the way a thing/system relates function and interaction to each other. Function refers to what the thing/system does when we use it. Interaction refers to what we do when we use the thing/system. Thus, in textile interaction design focus is on a relation between function and interaction, e.g., the carpet is not first of all the thing laying on the floor, but a relation between me walking, talking, sitting, etc. and the carpet protecting, absorbing, being soft, etc. This relation has its foundation in our exploration of two basic questions:

- (A) What are we doing using textile things?
- (B) What are textile things doing when we use them?

It is the way in which we answer these two questions that draw the boundaries of the design space. It is here we formulate the foundations of the design program. This is not far from actual fashion design practice, but for textile design, being much more technical in nature, it would be a rather radical shift in perspective.

So what does it mean and how does this view of textile interaction design relate to smart textiles issues like the integration of textile- and computational technology and the use of new high tech textile materials? Since we do not start off from materials and techniques there are no, implicit or explicit, boundaries drawn up by materials and technology. It is for instance rather natural to interpret “being flexible” in terms of integrating programmability and stretch-ability.

The more general issue here is somehow to redefine “textiles”, not in terms of new materials and techniques, but in terms of characterisations of relations between “textile” function and “textile” interaction. As a design program it focuses on exploring definitions of “textile” function and “textile” interaction as a foundation for experimental interpretations of the relations between them. This is not mainly a matter of conceptual work, but design work that can take many different forms: things, experimental products, video works, photography, performances, interventions, text, etc. We express this relation; being “textile” is a property of the relation. The basic program aim is thus to explore this alternative way of defining “textiles” in terms of expressions of interaction; it opens up an opportunity to explore and suggest new meanings through a sort of experimental textile interaction design. We design with focus on a “textile” expression of interaction.

So let us imagine we design something and present it as textile design with reference to a textile expression of interaction. What could that mean? Well, we explain what it means to use it and what it does as we use it and finally point out the basic characteristics of the way in which it relates these two perspectives in a “textile” manner. It is like presenting a car; we explain what it means to drive it, we give a basic technical description of the car and then we say something like “so you see it is a rather sporty, environmental friendly, etc, vehicle”. We could of course do the same with a “carpet” without any reference whatsoever to weaving, wool, etc.

However, notions of function need not be as detailed as in the description of the use of a car or carpet. Just as current textile design sometimes (have to) work

with more general functional properties such as sound absorption, heat isolation, softness, etc., so could textile interaction design by asking basic questions like how isolation properties are related to my body heating the material, how the sounds I make relate to the acoustics of the textile, etc. In this sense, work with interaction form might still be rather abstract or vague with respect to use, but still highly specific in terms of expressiveness. Indeed, a typical example of an experimental design program along this line of thinking would be to systematically explore notions like “soft”, “flexible”, etc., as basic characteristics of a textile expression of interaction.

Remarks

Textiles “do” things also without electronics or computation, and thus explorations of textile expressions of interaction need not be restricted to the area of smart textiles. Explorations of notions like soft, flexible, etc., does not have to be based on how new and increasingly smart textiles might extend temporal flexibility, e.g., materials that can be re-programmed or that have elaborate programmed dynamics. In fact, studies of textile interaction form will probably imply work on both smart as well as more traditional textile design.

This issue of how we may relate to the dynamic properties of smart textiles is also one of the things that differ the most between our early experiments and the new program proposed here. Whereas we from the start set out to explicitly explore relations between spatial and temporal form, in order to put an emphasis on how we might think about combining textile and computational material from an aesthetic point of view, this new program deals much less with the issue of material integration. Instead, it is a response to the increasing body of work on such new materials, and how an often technology-driven development risks generating solutions waiting for a problem; a kind of technological kitsch where issues of how function, interaction and form are related to each other have been neglected.

What is difficult here is to think upside down. It is difficult to leave the idea that it is certain materials, technologies and techniques that characterises “textiles”, even if it is just for the purpose of exploring an experimental design program. But the basic problem is that foundations are already unstable. Already now, it is difficult to define what constitutes a textile material or technique in a way that will not just conserve the status quo, thus risking that new smart textiles will be treated as yet another component of information and communication technology development. We need to find other ways of expressing a design-driven perspective on smart textiles. We need to dwell on the issue of textile things, to revisit and rethink matters of function and use.

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In this second report in the series Science for the Professions, professor Lars Hallnäs and his colleagues present the program Smart Textiles with a special emphasize on the research strategy. There is a presentation of the technological research and the design research and how these two parts interact. The report also includes a lot of interesting comments concerning the relation between core research and the development of new products. Another significant question is about the relation between academia and industry. The authors discuss the importance of exchanging ideas under the absence of domination.



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