Interaction styles: An aesthetic sense of direction in interface design

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ABSTRACT

In architecture and industrial design, the concept of style plays a major role in education as a way of establishing an understanding of visual design expression.

In this article we claim that interaction design can benefit greatly from an understanding of the concept of style. It can provide designers with strong visions and a sense of direction in designing new interfaces. In particular we focus on Solid User Interface design, i.e. products with small displays and a limited number of keys, because of the tight coupling of interaction and industrial design.

We explore style theory and an aesthetic for interaction design and report on an experiment with introducing interaction style thinking in a user centred design practice in industry. Further we open the discussion about parallels between our approach to interaction design and the dominant styles of the 20th century - Scandinavian design in particular.

Keywords

Interaction Style, Interaction Design, Quality in Use, Solid User Interface

1. INTRODUCTION

In architecture and industrial design, the concept of style in new designs is used to achieve an aesthetic coherence with the predominant atmosphere in society. Style plays a major role in education as a way of explaining the historical inheritance and debating the relationship between alternative design solutions.

Since user interaction design shares characteristics with industrial design, we will claim that interaction design can benefit greatly from an understanding of the concept of style. It could provide designers with strong visions and a sense of direction in designing new interfaces.

In particular we focus on Solid User Interface design, i.e. products with small displays and a limited number of keys, because of the tight coupling of interaction and industrial design (Black and Buur 1996). As it is today, SUI design seems largely governed by technological progress and to a large extent SUIs seem to inherit user interface principles from the computer world, just one generation delayed. HCI interface principles were designed for full keyboard and mouse operation, therefore they become much more cumbersome with a tiny display and a limited number of keys.

We are concerned that interaction designers in enthusiasm with new technologies fail to preserve or transfer the qualities of use, which were achieved with outdated technologies. For instance, the digital adjustment of settings using plus/minus buttons, though more precise, loose the feeling of being-in-

control and the sense of range and proportion offered by analogue potentiometer knobs.

In industrial design, values and needs are often categorised and discussed using the concept of style. In the Quality in Use project, Ehn proposed applying style thinking to the design of computer applications because they saw styles as a way of developing a repertoire of interaction design exemplars (Ehn et.al. 1995). They launched a web site with a quality-in-use award as a motivation for designers to share their examples and contribute to developing some general interaction styles. These efforts inspired us to attempt an initiative in the context of a corporate design team working in the historical continuum of a company.

Danfoss is a manufacturer of mechatronic products like flow meters, temperature sensors and controllers. It has a turnover of about 2 billion USD and 20.000 employees. Products are used in a diversity of settings ranging from private homes, super markets, and district heating stations to wastewater treatment plants. The products are often only a small part of some complex technological system.

The User Centred Design group at Danfoss has been heavily influenced by Scandinavian participatory design practices. Historically, usability lab tests have been replaced with ethnographic field studies and with co-design workshops, bringing together daily users, service technicians, sales staff, product developers, and designers (Buur and Bagger 1999, Binder et.al. 1998). The starting point for the initiative described in this paper was a concern in the group about design identity. In particular the industrial designers felt that the massive user involvement might restrict the development of a clear design expression and design identity in the group.

Through the 20th century the major issue in architecture and design has been the relationship between form and function. Should form, expression, and product identity represent the functional nature of the product, its reason-for-being, or should form decorate and augment function, broadening the communicative qualities of the product?

2. THE CONCEPT OF INTERACTION STYLES

In the Human Computer Interaction field interaction style is usually seen as a mode of interaction between man and machine based on a particular technological platform. The interaction style is explained through prototypical elements of the interface and how they behave, for instance command line, pull down menu, form fill in, or direct manipulation (e.g. Shneiderman 1992).

Sometimes, however, an 'outdated' interaction style may be reused on a newer technological platform because it has a better performance for a specific task. For instance today we have graphical user interfaces combining direct manipulation on the screen with a drawing tablet. We have pull down menus and dialog boxes with buttons operated by mouse, and form fill-in, question/answer, and command language styles, operated from the keyboard.

This description of style through interface elements and their behaviour has severe limitations. It does not capture the underlying structure of objects and their relationships, which are shaped by the designer's conception of what the product is in relation to users. This paradigmatic understanding of the interface becomes visible in the way we think about computers. Four perspectives of the computer have been proposed (Kammersgaard 1988, Maaß & Oberquelle 1992):

1. The *system perspective* assumes that the user may be treated like a machine, with characteristics that must be allowed for in the design of the technical system in order to provide reliable and effective operation.

2. In the *information processor perspective*, the human is a cognitive information processor in a communication system. This may take the form of a dialog partner perspective, where the computer and the human are equal partners searching for a common understanding, or a formal communication perspective. The human has to accept formalism and procedure in order to communicate with the machine.

3. The *workshop perspective* sees the computer as a collection of tools, locations and activities that are available to empower the user in his or her work.

4. The *media perspective* favours the computer as a medium for storing information for others to pick up. The media perspective assumes that the designer of the information freezes his or her ability to influence the message once it is placed in the medium, and leaves it to the reader to decipher, interpret and act upon.

These four perspectives indicate that there are very different expectations coupled to ways of seeing the computer. Svanes has shown how these understandings manifest themselves in a tacit dimension of interaction design (Svanes 1997). The kinaesthetic experiences of the user find verbal or visual expression in the form of analogy and metaphor. The users construct naive theories for themselves in order to understand how the

product reacts. Svanes suggests that every usability test, which incorporates qualitative questions, is a search for such theories on parts of the designer. But he does not find any general theories about these phenomena that are applicable to design.

Schneiderman, Kammersgaard and Svanes all attempt to capture qualitative aspects of the computer in use, focusing on the opportunities of technology, on the meaning of the product, and on the experience of using it. In this article we claim that the style concept known from architecture and design is suitable for explicating and organising these kinds of understanding. To the interaction designer, this could mean clearer visions and a sense of direction in his work.

The style concept in Architecture and Industrial Design

The concept of style has been discussed for more than 2000 years. It involves aspects of technology, characteristics of the designer, and the resulting expression of the artefact. Style in the original Latin meaning denoted a writing implement the 'Stilus' while 'Stile' was a hand imprint characteristic of the artist or writer. 'Stimuli' meant to produce vital energy or strength. They are all derived from a root denoting an upright expressive object (Ylimaula 1992). Today style theory has numerous applications. For instance in literature, art, theatre, dance, archaeology, architecture, design. As a result we are overwhelmed by popular uses of the term: X is a style, X has its own style, X has no style, X was made with style, X is only styling, etc. Academia, however, is converging on a semiotic understanding of style (Øritsland 1999).

Style as a reflection of values

A dominant conception of the style of artefacts is what Ylimaula calls the 'labelling method' of studying style (Ylimaula 1992). It has been in favour for about 100 years and has evolved from the simple categorisation of more or less specific terms like type, for instance 'Gothic' or 'Renaissance' to an analysis of artefacts in the culture and value systems that gave rise to them. "… architecture exists to satisfy concrete needs", Ylimaula writes. "If style or form are manifestations of concrete values, then this brings us to architectural history's essence. The buildings and the milieu reflect the needs of the people involved, and these needs emerge from people's values." Continuing this line of reasoning, she defines style as "…the underlying philosophy, the carrying idea which goes through the whole work of art. If philosophy is too demanding a word, maybe sound thinking and common sense could be used. But if the project lacks this thinking, if architecture lacks philosophy, no style can emerge." (Ylimaula 1992). Although this definition argues for the importance and unavoidable presence of style, it hardly offers any operational description. To the designer, interaction style must be concerned with both artefacts and people.

Enkvist proposes an understanding of style of action as a person's predisposition to act in a certain way: "Styles may be sought within all systems, which allow different behaviour within limits demarcated by a certain set of rules. Such a style definition may be applied to all art, to clothing, games, athletics, sports, and other types of action. A business man or a surgeon or a car driver would then have style: the car driver for example, might, within the framework of the traffic laws, choose whether he would drive softly or unevenly, closer to the middle or to the side of the road etc. The context stands forth as a style defining factor and any violations of the rule become style markers..." (Enkvist 1974). Let's move on to study what such style rules are, then.

Style as a network of norms

Enkvist observes that the basic thesis of linguistic style is that all style experiences arise from comparison (Enkvist 1983). When we observe an artefact we compare it consciously or unconsciously with our prior experiences of comparable artefacts. We choose the artefacts for comparison because our knowledge of the relevant cultural background indicates that they are related to the artefact we observe. This kinship can depend on content and theme, on function and the technology by which the artefact was made, and on connections in time, space and social situations. The artefacts for comparison have been systematised, by the person experiencing the style, to a reference system, which Enkvist calls a network of norms. This network of norms is a compilation of prior experiences with artefacts into a style taxonomy that makes it possible to find correspondences, both differences and similarities, between new artefacts and the previous norms.

The comparison results in an identification of style markers: Elements in the artefact that show significant correlation with or deviation from the relevant norms. It follows that every new style experience can influence the relevant norms, so that they change with accumulated experience. Also, different individuals will have different experiences and therefore different norms, which can lead to different conceptions of style in the same artefact.

Only a common network of norms can lead to a common style experience.

So, in pragmatic terms, if a design team wants to benefit from interaction style thinking, it needs to identify common systems of norms concerning technology and action. This system of norms has to be based in history. According to Ylimaula: The philosophies, needs and values of the social systems in which products are made and in which interaction with them takes place. At a detailed level, according to Enkvist, the system of norms must be defined by a compilation of experiences with artefacts, and each individual experience is the result of comparison.

3. PINPOINTING THE AESTHETICS OF INTERACTION

In order to understand the practical value of interaction style at the detailed level, where most design work takes place; the design team needs to establish a common vocabulary of experiences - an aesthetic of interaction based on the actions and technologies of existing products. Art and industrial design has a rich vocabulary that can be used to describe visual aesthetics, the experiences, and semantics of looking at artefacts (for instance deSausmarez 1990, Vihma 1995). But a language of dynamic aesthetic experiences is lacking. For a description of kinaesthetics we have to look elsewhere. Laban has made a thorough systematisation of movement quality by analysing bodily and mental effort in dance and human movement at work. He distinguishes four basic components in an aesthetic of movement (Laban et.al. 1974):

1. The management of weight - strong or light?
2. The flow of movement - free and flowing or bound, restrained and controlled?
3. The use of space to achieve movement - is movement direct or indirect and flexible?
4. The use of timing and rhythm - is the movement executed smoothly or rhythmically, quickly or with restraint?

These four components are concerned with individual movements or simple movement compositions. At a higher level, Hammergren adds to these factors that the composition of a dance (Hammergren 1991):

5. Focuses and directs attention
6. Represents reality
7. Applies compositional forms
8. Uses auditive elements.

A use situation at a district heating plant:

Work is a complex interaction between watching and operating equipment in the plant, and monitoring and controling in the control room.

A handheld PDA “Smart Window” for looking into the electronics of components out in the plant would help.

With a starting point in these kinaesthetic elements, in addition to visual aesthetics, we made an attempt at understanding how interaction styles develop over time.

So, in accordance with Ylimaula we set out to learn about the social systems in which the products were designed and in which interaction with the user took place. We devised a workshop on interaction styles through the company history at the Danfoss Museum. This workshop initiated an interaction style experiment in the Smart Window project.

4. THE SMART WINDOW PROJECT

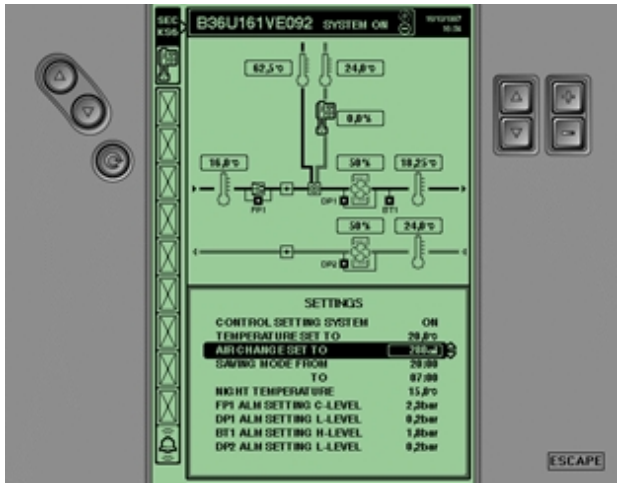
The Smart Window project was a 6-month effort to explore the use of PDA type equipment for operators of large plants like district heating and power plants. Danfoss manufactures controllers and components (sensors, valves, motors) for the process industry, and the trends are towards increasing computer power in every component, and components being connected in networks with a central control room for monitoring and control. However from previous studies of user work practices we knew, that it is pertinent for the operators

The Smart Window form prototype – Tool Style

that they 'walk the plant' and get a hands-on feeling of the plant operation – something they can't get in front of computer screens in the control room. So the basic idea was to provide the operator on the move with a portable 'window' – an industrial PDA - which would enable him to look into and interact with the electronics of the components on the spot.

The goal of the project was to create a vision for the company to work towards in this area. It was run by the corporate User Centred Design Group in collaboration with invited experts and researchers from universities. The team was 8 in total with additional members moving in and out of the project when required.

Based on extensive field studies in district heating and power plants a set of use situations was distilled to provide a basis for creating use scenarios for the Smart Window. An example of such a use situation was an incident, where the operator on his daily round of the plant decides to start a cleaning process of a condensing filter. This requires shifting the flow over to a parallel duct and administering a high-pressure airflow through the filter. This isn't a simple change of a valve. In the plant the operator is facing a complex of several manually operated valves with heavy hand wheels and electrically operated valves and pumps, which are remote controlled by the central computer system. So to complete the operation, the operator has to call his colleague in the control room on the intercom and negotiate with him the exact sequence of operations.



The Smart Window screen prototype

In the corresponding future scenario, the operator in the plant would be able to control the electrical valve and pump on location using his Smart Window, but he might still need to warn the control room of what he is doing, not to trigger a false alarm. Operating the manual valves requires two hands, so he will need to place the Smart Window somewhere while working the hand wheels.

A particular reason for introducing interaction style thinking in this project was that the user studies showed extreme – and often justified - scepticism towards the reliability and usability of new computer technology. We felt that it was necessary not only to go for high usability but also to aim for an interaction style, which would appeal to the user population.

5. INTERACTION STYLES IN THE COMPANY HISTORY

The Danfoss Museum contains a complete chronological display of products from 1933 until today. It also houses a library with comprehensive archives of sales material, manuals and news clippings.

For this study we were kindly granted the use of the entire museum for two days. Nine people, 3 industrial designers, a computer science researcher, a multimedia designer and 4 usability engineers worked in three teams to study user interaction designs. Every team was asked to look for significant changes in interaction principles related to one of three perspectives on style:

Technology - As technology evolves product properties such as activation force, user feedback, construction and visual form change. This opens up new possibilities for

designing and has an influence on prevailing interaction styles. How does changing technologies influence the interaction styles?

Company spirit - The way people work and view themselves is an integral part of the designs they produce. When choosing functions and interface components, when writing documentation and sales material, people in the organisation have to make judgements of their customers and users. How is the Danfoss spirit reflected in the design of user interfaces? Is an evolution of the Danfoss spirit apparent?

Society trends - In industrial design, architecture, and the arts, styles are often created on a macro level by referring to the "spirit of the times". Later, in books of style history, causality is established between social, political, economic and technological factors and the emergence of new styles. From a micro-perspective, styles are exemplified by pointing out characteristic details and their role in the totality of the object. How does the social situation, political climate, and technological paradigms influence the view of human and machine? How is this reflected in the interaction styles of the products at the museum?

The museum focuses on presenting the technological development of the company in relationship to its physical growth, market growth and production technology. It is possible to feel the action of knobs and switches but there is little information about users and use contexts. The museum offers no explicit understanding of the company spirit (beyond the pioneering days), what users thought of the products, what using the products was like in context - this must be inferred indirectly.

Changes in interaction style are most obvious when following the development of one product or a particular function over time. When looking at the full range of products or functions over time the picture is much more complex. Each product line seems to follow their individual paths - answering to different impulses within the style.

The research teams observed that it was important to track where inspiration for a particular solution came from to be able to judge the product before them: "We need to know about the products that created the archetype or paradigm for the style".

Towards the end of the workshop, the teams presented and compared their observations. There was reasonable overlap of style periods identified from the three perspectives. Developments in technology, company spirit and society trends seemed to fit easily together, supporting the claim for a causal relationship between influencing factors and the resulting styles. Finding names for the style periods generated discussions between the teams. Finally the teams agreed on labels referring to the technology paradigms in society.

As a result, we identified four interaction style periods in the history of Danfoss products.

The Machine Cowboy Epoch 1933 - 69

Interaction requires heavy activation forces and provides direct tactile feedback; there are few buttons and few operations. The company spirit is that of the pioneer, Mads Clausen, who is a problem solver of few words; solutions are simple, quick and self-made. The company's relationship to users is personal and based on shared technical knowledge. Interface design and aesthetics is only icing on the cake. In this period a positivist view of technology dominates society. Flash Gordon wins the fight between good and evil with blasters and rockets. Interaction is working with tools or machine-like controls. Controls are often hidden inside the product or part of the structure.

The Analogue Professional Epoch 1970 - 79

Analogue electronics takes over control of the mechanism. Activation forces are reduced and direct feedback disappears. The LED is introduced into the interfaces. The trend towards miniaturisation of product and interface starts. In the company the willingness to find and implement quick solutions is replaced by thoroughness and professionalism. User interfaces have a clean functionalistic style. Instructions and product graphics are given higher priority. As computing and automation become reality, fear of being replaced by the machine grows in society. Central data processing is a reality. The hippie movement counterpoises the view of the scientist as an objective genius without social

abilities. In the Tintin comics, Professor Turnesol can build a moon rocket but is unable to get dressed properly! Interaction goes off-line. Parameters are manipulated before hand to set up the system.

The Digital Hacker Epoch 1980 - 94

Miniaturisation reaches the limit; interfaces stabilise on a practical size. LCD screens and plastic foil buttons with weak feedback dominate. Electronics goes from analogue to digital and the number of parameters to control starts an exponential growth. Interaction is built around a menu-tree structure instead of the one-control-one-function design. In the company, bureaucracy increases, and a growing self-consciousness adds to the pride in products. Users have become anonymous to the developers: Sales people act as go-betweens. PCs are introduced to everyday lives. In sci-fi movies like Startrek, pressing the right buttons solves problems. Blade Runner introduces a new view of technology as something that can be perverted, ethically complex and dirty. Technology is no longer the domain of scientists. Everybody uses hi-tech.

The Molly Epoch 1995 - ?

Remote controls and communication busses are the new interface components. User interaction moves away from menu juggling towards direct control and manipulation. In the company there is a reaction against the arrogance of previous times. Developers become aware that they know too little about users and customers. There is an increasing attention to the professionalism of design processes and user/customer involvement. In society, the first generation born with computers is growing up. Gibson's novel "Neuromancer" coin the terms cyberspace and cyberpunk. We are disillusioned about science and technology but accept it as a part of life and a major means of expression. The Gibsonian figure Molly lent name to this style.

This analysis helped understand the roots and possible motivations of the interaction styles. The research teams found qualities of use, which might still have a bearing on interface design even though the embodiments are outdated. They also became aware of the underlying philosophies governing the choice of functions and their realisations. This provided insights into alternative value systems.

Could we apply the knowledge we gained in the company museum to the design of a new product? Would it be possible consciously to choose an 'old' interaction style for a product based on new technology? Or would it just appear old and outdated?

It seemed that we needed to rework the styles and think about them as contemporary expressions in our time, rather than style periods belonging to the past.

6. DEVELOPING CONTEMPORARY INTERACTION STYLES

A few weeks after the Museum Workshop, the User Centred Design group arranged a new activity with the goal of establishing a set of contemporary interaction styles in some operational form and then plunge into designing products with identical functionality but different interaction style expressions. In order to bring the historical interaction styles up to date, we abstracted the information we had collected, and then found new, up-to-date representations of the same values and philosophies. The period resulted in a set of three style mood boards after three days of group work and discussions. Roughly the same group of people as in the Museum Workshop participated, nine in all.

The group made a series of semantic transfer exercises in which we negotiated agreement on the meaning of the historic material we had found, what values and philosophies the material represented. First, we generalised the historical information by describing four user perspectives and four technical perspectives, which contained representations of the values we had identified (inspired by Kammersgaard 1988). Then, to bring these general descriptions of values and philosophies back into reality, we searched current trend analysis journals in the fashion and interior industry to find materials, graphics, activities, types of people and expressive words that conveyed the values and philosophies we were interested in.

The results were synthesised into three mood boards containing collages of the visual material we found, with a list of expressive words beside them:

Tool Style interaction: Actions are smooth, positive and goal oriented. The world is mediated through things that are portable, dynamic and protective.

System Style interaction: Precise action to build strength as armour of formality. The world is unsafe – don't get hurt – have goals, be efficient, reliable, and in control.

Dialog Partner Style interaction: Activity is seamlessly integrated with technology. The artificial world is safe because it is adaptive. The user evolves with it through technology.

Later when referring to the style or presenting the mood boards to people outside the design team it became apparent that we had indeed developed a strong mutual understanding of the styles. It was difficult, however, to convey the nuances of the style through the mood boards and names alone. One designer observed that "The styles need names that denote action, the ones we used are too "internal" to the design team".

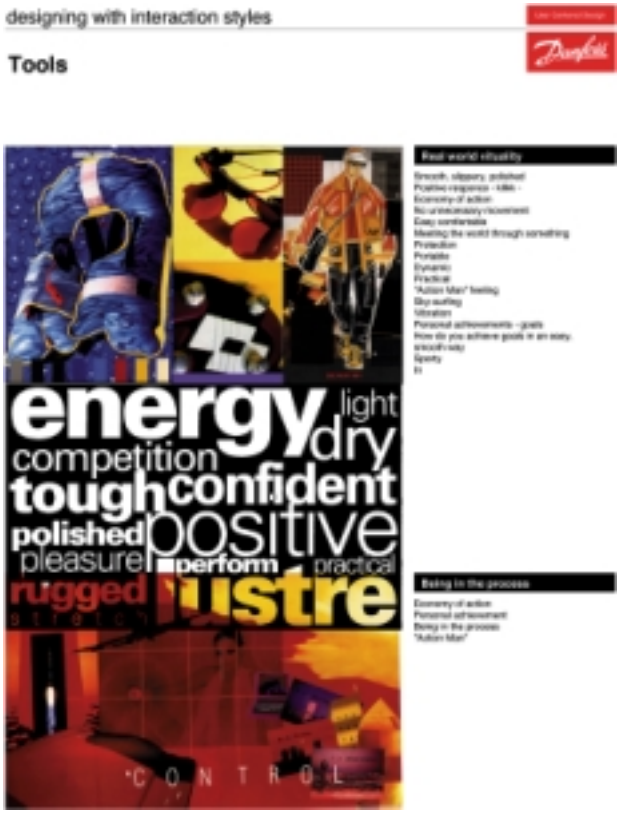
7. WORKING WITH THE STYLE MOOD BOARDS

The style mood boards were developed midway through the project, at a point when the team had completed ethnographic field studies, created a set of use scenarios in collaboration with users, and experimented with preliminary ideas of wearable types of equipment.

For the remaining three months of the project the team worked through three design iteration cycles. Each cycle included a user workshop to explore the concepts in use scenarios. In the first cycle, it developed form and interaction concepts based on each of the three styles. These were created in parallel by three sub-teams through an intensive two-week period. The designs were presented using foam mock-ups and paper prototypes for interaction.

Then, over the next month, the field was narrowed down to two concepts (Tool and System styles) in the second cycle. Interaction concepts were prototyped on computers.

Finally, based on user preferences, the team decided to engineer a Tool style concept in the last design cycle. The concept was presented both in an industrial design



The Tool Style mood board: Actions are smooth, positive and goal oriented. The world is mediated through things that are portable, dynamic and protective.

mock-up and in a working prototype on a commercial PDA platform.

Some design decisions of the product cannot be attributed to functionality and users' work practices entirely. In the second iteration loop for instance, three of the key discussions were

- If the PDA should be designed to fit into the operator's pocket or into his toolbox

- If the PDA should be operated with a pen (System) or with buttons (Tool)

- If navigation between components of the plant should work through plant overviews and zoom (System) or by touching the component physically on location (Tool).

Neither of these questions could be solved through knowledge of user work practices only, they were as much based on personal preferences of the individual operators.

8. LESSONS LEARNED

Frequent discussion sessions throughout this interaction design process disclosed three aspects relating to the interaction style work:

Interaction style vs. user descriptions and use scenarios

When introduced to interaction style thinking and the style mood boards, the team had difficulties getting to grips with the aesthetics in relationship to the User Centred Design practice of describing users (real or generalised) and future scenarios of use (Verplank et.al. 1993). Are interaction styles synonymous with the preferences of particular users? Are some use scenarios related to a particular interaction style?

After some days of struggling, the break through came when one designer reflected on this relationship: "User characters work well to build empathy with all types of users. But it is difficult to immerse yourself in a style when you don't like it!"

User characters lets the designer keep a distance and assumes that interaction design may be derived causally from user understanding. The style mood boards force a personal affective judgement. "In the style mood boards there is more kind of dream-stuff while the user characters tend to contain some of the prejudices we have against each other." "Style thinking seems to give us an empathic understanding without stigmatising users or contexts".

When working with different style expressions for products in the same use scenario, the team learned that some scenarios seemed to fit better in one style than others. It seemed that users with different style preferences might act differently in the same work situation - which isn't much of a surprise. In other words, interaction styles may modify the behaviour we anticipate of users in scenarios.

First design itteration cycle: Three prototypes representing System, Dialogue and Tool styles

So the interaction style thinking provokes an important discourse between empathy with the users and personal artistic expression of the designer, and it enhances the designer's ability to create potential use scenarios.

Interaction design style vs. product design style

It felt extremely difficult for the team to distinguish between interaction design style and product (industrial) design style. It was much more difficult to discuss variations in interaction expression than in visual expression – which is part of the industrial designer's competencies. It can be seen from the prototypes of the first design iteration round that the visual expression is shaky. Later on the team acquired more confidence in finding visual expressions which supported each interaction style.

The designers developed the understanding that "Interaction style is about the quality of action, not visual expression". Naturally the two are closely intertwined because the product semantics, as well as its visual expression raises expectations with the users as to the feeling when interacting with it. For instance the two bulges on the final prototype afford holding. This property is enhanced by the product semantics (Vihma 1995) - large, black, rubberised, rounded forms, in contrast to the angular, smooth yellow of the body being signs of handgrips on a heavy-duty tool.

The art of interaction design vs. user involvement

Another initial concern of the team was how the style thinking should relate to its participatory practice of involving users in design in the Scandinavian tradition. Could users be involved in the questions of interaction

Catwalk: Presenting the interaction design concepts to users at a workshop

Scenario design: A user fits the Smart Window concept to a familiar work situation

aesthetics? How should the team model and present interaction design alternatives? And how would it be possible for users to evaluate concepts with identical functionality but different interaction styles?

In both first and second iteration rounds the team chose to present the design alternatives in catwalk fashion: At the user workshops a designer dressed in stereotype cloths (expressing the style) would present each design concept in front of a projection screen with plant pictures and screen prototypes.

The first level had paper prototypes only of the interaction, at the second level; users could try out basic tasks on computer prototypes. An attempt to engage users in a semantic evaluation on the first level (attach 'experience' key words to each of the style prototypes) didn't succeed. It was probably too abstract, and confused the users so that many of the keywords were connected to functionality issues rather than experiences. A usability designer reflected on this workshop: "Interaction style is not visible in a quick presentation. You have to experience it yourself or take time to think in terms of actions."

Based on the computer prototypes the users were much more clear on their evaluation of the style alternatives: They preferred the Tool style while the R&D engineers participating liked the System style which is much closer to the WIMP interface principles on their PC.

When collaborating with users the interaction style thinking helps clarifying the distinction between user intentions (interface functionality) and user values (interaction experience).

Second design iteration cycle: Two concepts left. System Style fits in toolbox, Tool Style in pocket

9. A "SCANDINAVIAN INTERACTION DESIGN" STYLE?

By making a clear distinction between user experiences and user intentions, interaction style thinking brings up the major philosophical issue of 20th century design, the relationship between form and function. The architect Louis Sullivan coined the functionalistic position "Form Follows Function" in 1986. It came to mean that by developing a clear understanding of the functional necessities of a product, it should be possible to develop a minimalist form that purely and truthfully represents the true nature of the product, its materials and mechanisms. Such a form will then be the new style of the modern era. In opposition are the embellished styles of the 18th and 19th centuries, which use form to decorate and refer to classical symbols, applying them over the functional structure of the product. In opposition, also, to functionalism, is the Post Modern position that "Form Follows Fancy". Inspired by the writings of Roland Barthes, Umberto Eco, Jean Baudrillard and others, form is understood as a dimension of design that may be used independently as a communicative function, to add extra meaning to the product. Form may be used to raise issues of sarcasm, to analyse, to demarcate social groups, or to explore novel experiences with familiar object types. PostModern style is semiotic; an exploration and trade in meanings.

At its worst, functionalism developed disrespect for the user, treating formal, technological, and economic minimalism as the only benchmarks. "Scandinavian Design" originating in the 50's was a successful interpretation of functionalistic style. It acknowledged

the human aspect of products. Softer forms; focus on natural materials: textile, wood, stone, glass and steel. Letting the natural qualities of the materials dominate the product and following their inherent properties when making the product. Making socially responsible products, and products that addressed the needs of ordinary people, rather than an intellectually and physically capable elite.

In the Smart Window project we used a style characterisation process to become conscious of our possibilities for expression. Therefore we worked with multiple styles. We did not seek to define our relationship to, or follow any existent style of industrial design. However, we see that many of the qualities we discussed are also present in the Scandinavian Participatory Design approach to HCI and in mainstream User Centred Design.

Future applications of interaction style thinking would benefit from a better understanding of the directions current interaction design is taking. Are we currently suffering misguided functionalism in interaction design? Are we moving towards the pitfalls of Postmodernism if we focus too much on the use of analogy and metaphor? Is there a "Scandinavian design" style in our work that seeks simple, harmonious, direct interaction with the real world through Smart Windows into technical process systems?

10. CONCLUSIONS

Designing with interaction styles is still a very immature field, but one that holds great promise for designers, once we learn more about what constitutes a style, and how it is practical to work with interaction styles.

We have shown that there is no simple relationship between the interface technology and the interaction styles that designers may realise. Rather style relates broadly to the philosophies, needs, and values of both the social systems in which the products are made, and that in which the user interaction takes place.

With the style mood boards we have illustrated that it is possible and rewarding to make the transition from periods of interaction style in history to contemporary style expressions, which co-exist in product designs today.

The mood boards were developed for one type of products (industrial components with solid user interfaces) and for one particular company. How much of this can be reused and generalised to other types of products and other industries is yet too early to discuss.

The introduction of the interaction style thinking into an industrial user centred design practice – though it required a substantial effort – was a definite success. It succeeded in providing clear visions and a sense of direction for the design team, so it holds great promise for future experiments.

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