Semantic & Aesthetic Functions in Design

Report of the workshop and three papers from the 2nd Nordcode Seminar
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Workshop

This number of the F-series of the University of Art and Design Helsinki reports the outcome of a workshop linked to the 2nd Nordcode seminar and includes three articles from the seminar.

   The 2nd Nordcode seminar was held in Helsinki 2.–3.10.2003. The aim was to gather together researchers interested in design semantics, especially emphasizing communicative aspects of design.

Nordcode, a research network started in 2000, tries to improve cooperation between scholars and doctoral students and further design studies, see **www.nordcode.hut.fi**. In the beginning of networking, researchers introduce and discuss their approaches and preliminary results, compare fruitful methods and share ideas on how to proceed. As the work progresses, research can also be carried out in cooperation, i.e. in Nordic research projects.

THE WORKSHOP

In connection with the program of the 2nd *Nordcode* seminar in Helsinki a workshop was arranged at the Usability Laboratory of the Helsinki University of Technology (see program in appendix and www.nordcode.hut.fi). The intend was to look closer at a few chosen methodological approaches and discuss their possible benefits for design semantics research. Design semantics has, during its history of more than 40 years, included both theoretical and practical activities. For example, already at the HfG Ulm in the beginning of the 1960s, both ways were regarded[1].

   In recent years, information about user experiences for design purposes has been collected in various ways, in field studies, laboratories, etc. Methods in user-centered design hardly involve semantics at all, which can easily be seen in the descriptions of methods and in the illustrative material of the reports. Instead of semantics, user-centered design research has turned towards the analyses of emotional experience (the most visible manifestation are the conferences organized by the Design & Emotion society since 1999). The intriguing question remains, however. How can a useful, ergonomically tested product, when it all comes around, escape semantics?

   On the other hand, design semantics has used empirical data from user experience surveys rather seldom. Li Wickström's study is a valuable exception in this sense[2]. Semantic aspects have been considered more often in educational contexts since the mid 1980s[3] and in various analyses of design products. As a result of these, methods of applying semantic analyses have been developed[4]. Often such procedures rely on verbal descriptions and the use of visual material is limited.

   The Nordcode workshop intended, therefore, to examine methodological approaches of design semantics in usability context, the emphasis being on the scrutiny of meaning production during the interpretative act and on the use of visual material in the work. The participants got together in the usability laboratory's test room, where Lauri Repokari introduced the facilities. He went on by surveying common approaches used earlier in the usability laboratory tests and, thus, familiarizing the participants to the possibilities of the facilities.

PART 1: A ROUND TABLE DISCUSSION ON SEMANTIC QUALITIES

Toni-Matti Karjalainen presented the first task that had been prepared for the workshop. The group was going to analyze semantics of concrete design products by looking and handling the item. Models of actual mobile phones from Nokia were examined one at the time by the participants, all educated

design experts. A smaller group of the participants gathered in the control room of the usability laboratory in order to follow the overall course of actions around the table, to survey the discussion and treatment of the objects (especially touch, grip, gestures), and to adjust the recordings (video and tape). With the help of this hands-on approach, it was demonstrated how a test situation (discussion, handling a test item, a person's relation to the item and to other persons, etc.) can be documented for further analyses.

The combination of visual and audio documentation, the possible limits, shortcomings and benefits, were commented upon after the session. A general conclusion was that designers could benefit from using a laboratory setting in analyses of semantic qualities.

Cooperation with industry should be encouraged to use the facilities and expertise of design researchers even at early stages of the product development process.

PART 2: FOUR GROUPS EXAMINING FORMS OF MOBILE PHONES

The Nordcode workshop continued in a different manner in the afternoon. Participants were divided into 4 groups and they were given specific tasks.

One group continued discussion on applying usability laboratory equipment for design semantics and use analyses, and was guided by Lauri Repokari.

The second group, headed by Toni-Matti Karjalainen[5], used a variety of mobile phone images and product examples from Nokia as material to support discussion. The main questions illustrate the theme: Is there something in the design of the phones that makes them specific for Nokia? Are there any design elements that clearly appear in every product?

It was agreed that the design of Nokia had been recognizable and consistent for some time. Most of the models (mainly before 2001) were characterized by a specific way to frame the display. The buttons also had their particular form and structure, and the same could be said about the overall treatment of form elements and some other details. These applications made the Nokia products quite different from, e.g., the phones of Ericsson that also had a recognizable and consistent design of their own. Since 2001, the picture has become more complex.

It is more difficult to identify characteristics, which can be seen across the whole product portfolio of Nokia. The design approach emphasizes segmentation of customers, i.e. phones are designed for specific target customers. This does not support the use of standard elements. In addition, fast-changing markets seem to require a high degree of renewal of models. However, a clear consistency is not necessarily contradictory to customization. By using consistent signs for all the products, brand recognition would remain stronger. If the variety of design becomes too wide and lasts for too long, the core message of the brand may become mute for a target audience.

The third group, prepared by Outi Turpeinen, focused deliberately on visual analysis in order to produce alternatives for the design. The participants (all design professionals well accustomed to analyzing design products) were asked to consider semiotic and aesthetic aspects of mobile phones and to make visual notes of them. The idea was to brainstorm new ideas for the design of phones freely and openly, not tied to any specific practical or functional problems. The aim was to play around with visual metaphors of the phones. Colored paper and various photos from magazines were used for making collages during the group discussion.

The outcome was, first of all, a stimulating discussion of ideas and themes. Feminine and masculine features of a mobile phone were conceived as intriguing themes, and the visual appearances were discussed from these points of view. The forms of the phones were compared to stereotypical forms in other contexts, for example, flowers in cover design for women, do-it-yourself type of products for men, etc. Phone models that seemed to express various professions were debated. Individuality was considered an important quality for a mobile phone. However, also a universal design would be a challenging design task.

The phones used for the test were not especially interesting according to the group's point of view, because they all seemed to belong to the same context. With the help of the collages, one participant started to develop her design of a phone in a more feminine direction and connected its appearance to the context of sewing.

The fourth group concentrated on visual metaphors and metonymies. Susann Vihma introduced the use of metaphors in a design context. Four mobile phones from Nokia were examined in detail. Their visual form and feel of touch evoke various

metaphorical ideas, which were compared and reflected upon. Next, the members of the group searched for pictures in magazines to illustrate these metaphorical ideas for each of the four phones. The selected images were discussed during the procedure and agreed upon; all members worked on the collages together simultaneously, which led to spontaneous reactions furthering the production of imagery. The pictures also seemed to deepen the metaphorical ideas. Some of pictures were chosen to illustrate the overall form of the phone, others focused on some detail. One of the collages started to highlight only one specific semantic characteristic of a phone, the surface structure and its play with light reflections.

The intension of the group was, actually, to communicate as clearly as possible the interpretation of visual qualities to others, not only to build visual scenarios of the metaphors. As a result of the work, four collages were prepared. Especially the detailing, colors and surface structure stimulated interpretation, production of visual metaphors, and seemed to characterize the overall conception of the concrete product.

The workshop session part 2 ended with presentations by the four groups and a discussion.

Appendix: The structure of the workshop day and list of participants

Nordcode workshop 1.10.2003
Semantic & Aesthetic Functions in Usability Context
Place: Usability laboratory / HUT, Otaniemi Campus, Espoo
Host: Lauri Repokari
    10:00 Registration & coffee
    10:30 Welcome
    11:00 Introduction to the workshop
    Toni-Matti Karjalainen & Lauri Repokari
    11:30 Workshop, part 1
    13:00 University walk & Lunch
    14:30 Workshop, part 2
    16:00 Summing up and discussion
    17:00 Closing (transfer to Helsinki city centre)
    18:00 Presentation by James Putnam: Museum as art… art as museum (at the Finnish National Gallery *www.fng.fi*)
    Dinner
For a list of participants see
www.nordcode.hut.fi/helsinki.html

REFERENCES

[1] See e.g. *uppercase 5*. Whitefriars, London, 1961.

[2] Wikström, Li.: *Produktens budskap: Metoder för värdering av produkters semantiska funktioner ur ett användarperspektiv.* Chalmers tekniska högskola, Göteborg, 2002.

[3] Workshops in educational institutions and business enterprises.

[4] E.g., Butter, Reinhart: *Putting Theory into Practice: An Application of Product semantics to Transportation Design.* In: Design Issues, Vol V, No 2, 1989.

[5] This report about the activities of the groups is based on a summary and documents turned over to me by the leaders of the respective groups Toni-Matti Karjalainen and Outi Turpeinen, and on my own notes and documents.

Torben Lenau
Per Boelskifte

Soft and hard product attributes in design

This working paper describes an experiment with students, where lists of words describing soft product attributes were tested. The purpose was triple: 1) To make the students aware of the importance and the possibilities in putting words on their aesthetic experiences 2) to develop the testing method and 3) to develop and test the list of words. Two lists describe sensory (44 words) and symbolic (48 words) product attributes.

51 students of Products Design Engineering organized in groups of two persons filled out the 2 questionnaires on their laptop computers. In the first questionnaire, they named products which they associated with each of the sensory and symbolic attributes. In the second questionnaire, they indicated which of the attributes matched four products they were presented with: A digital camera, a bicycle lamp, a shaving brush and working gloves. The results indicate a general agreement about the meaning for most of the attributes and indicate areas for refinement of the test.

BACKGROUND

Products are to a growing extension being sold based on their soft values such as aesthetic design, styling and the image they give the owner. This makes it more important that people, who are involved in product design and development, can communicate these softer or more intangible values. Studies within this area are pursued in a number of places (Lopez 2003, Govers 2000, Govers et al. 2003, Warell 2001).

The authors have experienced the need when searching for materials that can give the product a certain expression (www.designinsite.dk). When physical products are designed, the selection of materials and manufacturing methods play important roles for the function, the appearance and expression of the product. These properties are not solely associated with the material itself, but with the specific interplay between material, manufacturing, form and other properties of the specific product.

The selection of, say, materials is, therefore, often done by searching for similar products. The product and the materials it is made of possess a number of technical (hard) attributes like strength, stiffness and hardness. Furthermore, the product possesses a number of semantic properties associated with the meanings we can deduce from the form, colour, texture, and the sound of the product.

Working with semantic properties helps the designer

- to make the product more self-evident
- to form the cultural meanings of the product
- to give the product a distinct character

Technical properties are dealt with a well developed and commonly accepted terminology that can be utilized for product search and material selection (Ashby 1999). This is not the case for semantic properties, despite their importance for the communication within the product design processes.

In a previous study, an interdisciplinary group of 14 students (from industrial design, business and engineering programs) showed consensus on assigning certain words to specific products in order to express their sensory and perceived experiences (Johnson et al. 2003). An initial vocabulary was formulated with the help of design literature. The study showed that a significant amount of the test group agreed on assigning the same words to 6 specific products (see below). Based on the input from the study, the initial vocabulary was revised (shown below in Table 1).

Figure 1. The six products used in the previous experiment (Johnson et. al 2003).

Aesthetic (sensory) attributes (**bold face** = significantly selected in previous experiment)		Perceived (symbolic) attributes (**bold face** = significantly selected in previous experiment, parenthesis = close to being significant)	
<u>Feel:</u> **Soft**, **hard**, warm **cold**, light, heavy, flexible, stiff <u>Texture:</u> Smooth, rough, rubbery, slippery <u>Form:</u> **Organic**, **angular**, **aerodynamic**, flat, squared, rounded <u>Smell:</u> Fresh, stale, natural, **artificial**	<u>Optics:</u> Transparent, translucent, **opaque**, **reflective** <u>Colour:</u> Clear, white, muted colours, bright colours, grey/black, metallic, natural <u>Taste:</u> Sweet, sour, salty, bitter <u>Sound:</u> **Muffled**, ringing	**Aggressive** – Passive **Cheap - Expensive** Classic - **Trendy** Clinical- Cosy **(clever) - (silly)** **(Common) – Exclusive** Decorated – Minimal Delicate – Rugged Anonymous – Inviting Elegant - Clumsy **Masculine – feminine**	Formal – Informal Fragile – Robust Friendly - Frightening **Functional** - ornamental **(Futuristic)** - historic Handmade - **Mass-produced** High-tech – Simple Humorous - Serious Mature - **Youthful** Restrained – Extravagant Temporary – Permanent
Words deleted from the initial list: **Industrial**		Words deleted from the initial list: **Clean, (Dull), Strong**	

Table 1. The revised vocabulary from the previous experiment (Johnson et. al 2003). Words used by a significant number of the participants to describe the 6 products in Figure 1 are shown in boldface.

THE EXPERIMENT

In the present experiment we wanted to test the vocabulary generated in (Johnson et al. 2003) with a larger group of students in design engineering (51 students) in order to

• make the students aware of the importance and the possibilities of putting their aesthetic experiences in words,
• develop the testing method
• develop and test the contents in the lists of words.

As preparation the authors first critically revised the lists of words. One of the authors has a background in industrial design and a comprehensive experience in both practical design work and in teaching industrial design. The logic consistency was checked and compared with the terminology used in industrial design teaching. The sequence of the sensory attributes was changed. It now starts with visual attributes followed by attributes of feeling, smell, taste, and hearing. Furthermore, the consistency of the translation between Danish and English was examined. Based on the revised lists, the internet questionnaires shown in Figures 2 and 3 were made. The questionnaires themselves were made using standard html-programming. By combining this with a simple cgi-script the answers from the questionnaire were added as new lines in a text file each time the send button was pressed. After pressing the send button a confirmation message was displayed. The text file was easily imported into an excel spreadsheet for further data treatment and statistical calculations.

The size of the questionnaires was discussed. With altogether 92 sensory and symbolic attributes they became rather large. By testing the questionnaire with colleagues, we found that the questionnaires can be filled out in 45+45 minutes. However, this requires that the participants are highly motivated and concentrated, and that they are given very precise instructions. We used second year students from the Design & Innovation Engineering education at the Technical University of Denmark (DTU), who were well known to us.

Figure 2. Questionnaire 1 (only the top part is shown).

The experiment was performed in 2 steps:

First, the students should tell which products they thought were described by each word in the questionnaire. The instruction was that they should write the first thing that came to their mind, and not be speculative. Knowing that they had only 45 minutes to describe the 92 attributes gave the students about 30 seconds for each attribute. The purpose was to find out if the words were meaningful to the students and if they associated the words to types of products that are similar. Furthermore, being forced to consider each of the 92 attributes gave the students an overview of the lists. In this way it became realistic to fill out the second questionnaire.

Second, they filled out questionnaire 2, which presented 4 products: A digital camera, a bicycle lamp, a shaving brush and working gloves. We had 2 samples of each product (except the shaving brush) which were passed around. Furthermore, the pictures in Figure 4 were projected on a screen. The selection of products was a compromise: Considering the number of attributes in the questionnaire it was realistic to have only 4 products. Therefore, we chose products which represented the widest range of options possible for the sensory attributes.

Figure 3. Questionnaire 2 (only the top part is shown).

Figure 4. The 4 products used in questionnaire 2: A digital camera, a bicycle lamp, a shaving brush and working gloves.

THE RESULTS, DATA TREATMENT AND DISCUSSION

Our plan to use in total 90 minutes for the experiment seemed to work nicely. As mentioned earlier, the students were well motivated and interested in the experiment, which contributed to its success. The students used their own portable computers connected to a wireless network, which made it possible to carry out the experiment in one large room. It seemed to work well to let the students work together in groups of two, especially for questionnaire 1. It stimulated thoughts about the products. During the experiment, we encountered minor misunderstandings, which we had not foreseen: When discussing colours some of the groups described specific colours rather than products, e.g. red as a warm colour instead of an orange or a sports car. Only a few words were unknown to some of the students (e.g., stale smell), but since the vast majority of the students answered the question in a meaningful way, we do not consider this a significant problem.

We received in total 30 answers for questionnaire 1. However, 4 of them were completely identical with other answers and were, therefore, deleted. This complies with the fact that one of the groups (told us) had sent an answer twice by mistake.

The answers from questionnaire 1 was evaluated by counting how many identical or similar products matched each attribute and by judging if the attribute was interpreted in an *unclear*, *clear* or *very clear* manner. Answers to the attribute "organic form" varied from "clay" (probably meaning any undefined shape), "a sponge" (probably meaning an amorphous shape), "a ball" (a well defined geometric shape), "a part of the body" (something smoothly curved). We concluded that the interpretations were too far apart from each other. Hence, the attribute was classified as unclear. On the other hand, answers to the attribute "rounded form" seemed much more focused (13 answered "ball", the majority of the rest answered "VW beetle", "handle" and "Apple computer"). Hence, it was classified as very clear. The results can be seen in Tables 2 and 3.

Category	Word	Most chosen products or group of products and the frequency	Interpretation
Form (form)			Unclear, amorphous or smoothed curved?
	Organisk /fri form (organic)	Sponge 2 Chair 3	
	Afrundet (rounded)	Ball 13	Very clear
	Strømlinet (aerodynamic)	Aero plane 12 Car 9	Very clear
	Kantet (angular)	Table 5	Very clear
	Flad (flat)	Plate 3 LP/CD 4 Paper 6	Very clear
	Aflang (Long)	Stick/rod 9	Very clear
Farve (colour)		Orange 4 Glowing metal (oven, stove)	
	Varm (warm)	7 Highly red products 7	Very clear
	Kold (cold)	Computer 4 Ice 3 White goods 6	Unclear, physical cold or looks cold?
	Klar (clear)	Glass 13 Glass, window, bottle 24	Unclear, same as transparent
	Lys (light)	Lamp 10	Unclear, giving light or opposite to dark?
	Mørk (dark)	Chocolate 3 Black bard 2 Brown or	Clear

		black products 19 Dark room 5	
	Kraftig (strong)	Panton product 3 sports equipment 4 Neon light 3 Neon and other light 5	Unclear, strong or neon?
	Afdæmpet (Muted)	Cosmetics 2 Muted colour products 21 Other meaning 6	Clear
Glans (glossiness)	Mat (matte)	Computer 3 Matte products 22+	Very clear
	Halvblank (semi glossy)	Lacquered products 4 car 3	Unclear, mixture of matte and neon
	Blank (glossy)	Billiard ball 5 Chrome plated handle 3	Very clear
	Blank transparent (glossy transparent)	Glass 8	Very clear
	Mat transparent (matte transparent)	Matte glass products 12	Very clear
	Metallisk (metallic)	Car 8	Unclear, looking like metal or metallic paint?
Overfladetekstur (texture)	Glat (smooth)	Soap 2 Billiard ball 3	Unclear, mix with soft and slippery
	Ru (rough)	Sandpaper 13	Very clear
	Gummiagtig (rubbery)	Tire 7 Rubber-like products 27	Very clear
	Fedtet (slippery)	greasy/oily products 18	Unclear, greasy, sticky of fast grip?
Følelse (feel)	Blød (soft)	Pillow 12	Very clear
	Hård (hard)	Table + chair 9	Very clear
	Varm (warm)	Blanket 6 Oven or radiator or stove 6	Clear
	Kold (cold)	Refrigerator 6 Ice cube 7 Metal products 6	Clear
	Let (light)	Feather 7 Paper 3	Very clear
	Tung (heavy)	Weight 4	Very clear
	Fleksibel (flexible)	Rubber band 7	Very clear
	Stiv (stiff)	Rod/tube/table leg 5	Very clear
Lugt (smell)	Frisk (fresh)	Lemon/fruit 7 mint 4 Toothpaste 4	Very clear
	Hengemt (stale)	Old cloth 7 Unclean refrigerator 2	Very clear
	Naturlig (natural)	Wood 5 Grass 2 Shampoo/deodorant/perfume 5	Clear
	Kunstig (artificial)	Cheap lemonade 3 Perfume 2 Air freshener 3 Candy 7	Clear
Smag (taste)	Sød (sweet)	Sugar 9 Candy 9 Cake 2	Very clear
	Sur (sour)	Lemon 13 Vinegar 2	Very clear
	Salt (salt)	Liquorices 5 Salty candy 11 Chips 7	Very clear
	Bitter (bitter)	Bitter snaps 9 Bitter lemon 4	Very clear
Lyd (sound)	Dæmpet / dump (muffled)	Car door 3 Pillow 5	Very clear
	Hul (hollow)	Well 3 Empty box 4	Very clear
	Klingende (ringing)	Bell 8 Triangle 7	Very clear
	Harmonisk (harmonic)	Piano 4 Harp 4 Musical instrument 16 purling water 2	Very clear
	Skinger (shrill)	Chalk or nail on a blackboard 6 Alarm 3	Very clear

Table 2. Answers in Danish and English from questionnaire 1: Products associated with sensory attributes and the interpretation of how clearly they were understood

Symbolic attribute	Most chosen products or group of products and the frequency	Interpretation
Agressiv (Aggressive)	Ferrari 6 Sports/racing car 10 Motorcycle 5	Very clear
Passiv (Passive)	Sponge 1 mailbox 1 cigarette 1 pencil 1	Unclear, Anonymous, not active or not aggressive?
Billig (Cheap)	Ikea furniture 2 Plastic, disposable cutlery 1 Nails 1 milk 1 lighter 1	Unclear, price or bad quality?
Dyr (Expensive)	Rolex/gold watch 5	Very clear
Klassisk (Classic)	Piano 5 Musical instruments 9 Branded products (coca cola, Rolls Royce, Hugo Boss) 3	Clear
Trendy (Trendy)	Mobile phone 4 "designed" products (Panton, Ph. Stark, Gucci) 3 Branded products (Coca cola, Nike) 2	Unclear, special or latest new?

Klinisk (Clinical)	Scalpel 7 Dentist equipment 6	Very Clear
Hyggelig (Cozy)	Sofa 6 Fireplace 7 Pillow 2	Very clear
Kvik (Clever)	Calculator 5 Computer 4 Mobile phone 2 Palm pilot 3	Very clear
Dum (Silly)	Plastic flower 1 Silly hat 1 Bone lock glue 1 Electric kettle 1	Unclear, easy to use or annoying? Clear
Almindelig (Common)	Chair 3 Toilet paper 2 Dinner knife 1	Clear
Eksklusiv (Exclusive)	Fur coat 3 Perfume 2	Very clear
Dekoreret (Decorated)	Christmas tree 5	Very clear
Minimalistisk (Minimal)	B&O 2 Arne Jacobsen products 4 Mobile phones 3	Very clear
Sart (Delicate)	Crystal or thin glass 7 China products 4 Silk 3	Very clear
Grov (Rugged)	Saw 2 File 3 Rye bread 3	Very clear
Sløv/Kedelig (Dull)	Knife / spoon 5 Blotting-pad 2 Low status car 3	Clear
Sexet (Sexy)	Underwear/lingerie 13 Sports car 3	Very clear
Anonym (Anonymous)	Something white 3	Unclear, common or without contours? Very clear
Markant (Inviting)	Famous buildings 2	Very clear
Elegant (Elegant)	Jaguar car 3	Very clear
Kluntet (Clumsy)	Certain cars 3 Moon boots 2	Very clear
Feminint (Feminine)	Makeup 5 High heels 4 Bra + lingerie 4	Very clear
Maskulint (Masculine)	Tools 9 Dumb bells 3	Very clear
Formel (Formal)	Suit /tie 16	Very clear
Uformel (Informal)	Jogging clothes 7 Jeans 4	Very clear
Skrøbelig (Fragile)	Crystal / glass / china 16	Very clear
Robust (Robust)	Something heavy and solid (rail, brick, hammer) 10 Safe 2 Baby toys 1	Very clear
Venlig/Imødekommende (Friendly)	Teddy bear 3	Very clear
Skræmmende (Frightening)	Knife / sword / chainsaw 11	Very clear
Funktionel (Functional)	Swiss knife 7 Can opener 5 toilet 1	Very clear
Ornamenteret (Ornamental)	Gold frames 2 Stucco 3 Church furniture 4	Clear
Futuristisk (Futuristic)	Science fiction & space 7	Very clear
Historisk (Historic)	Bible / church 3 Stone axe 2 Book 2	Very clear
Håndlavet (Handmade)	Ceramics/ jar 13 Oriental carpet 2 Sweater 2	Very clear
Masseproduceret (Mass-produced)	Electronics 4	Very clear
Teknisk komplekst (High-tech)	Computer and -equipment 9 Space shuttle 2 Airplane 2	Very clear
Enkelt (Simple)	Cutlery 10	Very clear
Morsom (Humorous)	New years eve products 6 Toys 5 Cartoons 3 Kinder egg 1	Clear
Alvorlig (Serious)	Coffin 3 Newspaper 3	Clear
Voksen (Mature)	Living house 5 Pipe / cigar 4 erotic toy 1	Very clear
Ung/Ungdommelig (Youthful)	Skateboard / roller-skates 5 Electronic games 2 Beer and booze 3	Very clear
Begrænset (Restrained)	Prison / hospital 6 Gold bar / money /special offer 3	Unclear, limited, rare or constrained? Very clear
Ekstravagant (Extravagant)	Luxury products (caviar, Porche, champagne, fur coat) 8 diamantes 3	Very clear
Midlertidig/Flygtig (Temporary)	Disposable products 5 Candy floss 2 Money 2 Ice cube	Very clear
Permanent/Varig (Permanent)	Solid lasting things (mountain, brick, toilet, house, stone axe) 8 Tattoo 5	Clear
Svag (Weak)	Easy breakable products (crackers, thread, membrane) 12 Not powerful products (moped, infrared signal) 2	Unclear, easy breakable or not powerful?
Stærk (Strong)	Rope / wire 5 Powerful products (truck, car, f-16, acid) 4 Strong food 3	Unclear, lasting, powerful or taste?

Table 3. Answers in Danish and English from questionnaire 1: Products associated with symbolic attributes and the interpretation of how clearly they were understood

The answers from questionnaire 2 are quantitative and it was, therefore, possible to make a statistical evaluation. We wanted to know if there is a common understanding among a larger group of people on the meaning of the words we have selected. To answer this question we used standard statistical methods. If we make the assumption that there is no correlation between the attributes of the products and the words in the lists, we should expect the results to be distributed randomly. The statistical methods can be used to show if the results differ significantly from a random distribution.

The results from the sensory attribute section in questionnaire 2 are grouped into 8 groups (form, colour, glossiness, etc). Within each group one or more words can be selected. If the selection was restricted to one word for each group the results would follow a polynomial distribution. Since more words can be selected, we use an approximation, where the results are weighted depending on how many there are. For the digital camera the calculations are shown in Table 4.

	Organisk /fri form (organic)	Afrundet (rounded)	Strømlinet (aerodynamic)	Kantet (angular)	Flad (flat)	Aflang (Long)	Σ	Ave. no. of answers u
Number of answers	1	7	8	25	7	0		
Weighted number of answers x	0,34	3,5	3,67	15,5	3	0		4,34
Deviation $(x-u)^2/u$	3,7	0,2	0,1	28,8	0,4	4,4	37,5	

Table 4. Statistical calculations for answers on "form" for the digital camera.

The X^2 distribution for 5 degrees of freedom (6 possible answers) and 5 % significance level has the value 11,1. For 0,05% significance level the value is 22,1. The square sum of the deviations is 37,5 , which is much larger than 22,1. It is, therefore, very unlikely that the distribution is random.

The word "angular" contribute with 28,8. It is, therefore, considered significant. Hence, we concluded that there seems to be a general agreement on the use of the word. Similarly, the 8 groups are evaluated according to the 4 products, and the results are shown in Table 5. Of the 32 groups of results, 20 are significant, and differ from a random distribution. The words shown in Table 5 seem to be commonly accepted. For the last 12 groups the results do not significantly differ from a random distribution, and we cannot tell if there are generally accepted words or not.

	Significant words (and words that are not significant but chosen many times) Grey fields are not significant but most chosen words are shown			
	Digital camera	Bicycle lamps	Shaving brush	Working gloves
Form (form)	Angular	(Organic), rounded, (aerodynamic), (long)	(Organic), rounded, angular	Organic, (rounded), flat
Farve (colour)	Cold, (Muted)	(cold), dark, (strong)	Warm, cold, (light), (muted)	(Warm), light, (strong), (muted)
Glans (glossiness)	Semi glossy, metallic	Semi glossy, (glossy transparent)	Matte, glossy, metallic	Matte
Overfladeteksur (texture)	Smooth	Smooth, rubbery	Smooth,	Rubbery
Følelse (feel)	Hard, cold, (heavy), stiff	Hard, (cold), (heavy), stiff	Soft, hard, cold, (heavy)	Soft, (warm), (light), (flexible), (stiff)
Lugt (smell)	(Artificial)	Artificial	(Natural)	(stale), (natural), (artificial)
Smag (taste)	-	-	-	(salt), (bitter)
Lyd (sound)	(Muffled)	(Muffled)	Muffled	(muffled)

Table 5. Answers in Danish and English from questionnaire 2: Significant (and close to significant) sensory words for the 4 products.

The symbolic attributes in questionnaire 2 are organized into opposite pairs (e.g., aggressive – passive), which means that one, another or none is selected. The results are expected to follow a binomial distribution. We know that we have 27 answers, and we assume that the probability of selecting one of the two words is 0,5. With 1% significance level, the critical number of answers is 20. If 20 or more select one of the two words, e.g., aggressive, it is very unlikely that it is chosen at random. Hence, we may conclude that there seems to be a general agreement on the use of the word.

The significant words can be seen in Table 6.

Digital camera	Bicycle lamps	Shaving brush	Working gloves
Expensive	Common	Expensive	Common
Trendy	Minimal	Classic	Rugged
Clinical	Functional	Exclusive	Anonymous
Clever	Mass-	Inviting	Clumsy
Exclusive	produced	Elegant	Masculine
Minimal	Simple	Masculine	Informal
Elegant		Functional	Robust
Functional		Historic	Functional
Futuristic		Handmade	Mass-produced
Mass-produced		Simple	Simple
High-tech		Mature	Mature
Mature			Strong

Table 6. Significant symbolic words for the 4 products. Significant here means 20 or more of the 27 answers.

CONCLUSION

An experiment with students was carried out to test their interpretation of words, which described *soft* product attributes. Feed back from the students attending the test showed that the students became more aware of the importance and the possibilities to put their aesthetic experiences in words. The experiment stimulated them to discuss the meanings of 92 words and to sharpen the students' conceptions of the words.

The experimental method was developed, and we know now more about how to set up this type of experiment, how to use internet and other computer tools for questionnaires. We have also improved our insight in applying the data treatment including statistical methods. We have improved the two lists of words, which described sensory and symbolic attributes. The words have now been tested with a larger group of students. 51 students, divided into 26 groups, participated. All of them completed answering the questionnaires satisfactory. The answers imply that most of the proposed words were clearly understood in the same way, while a minor part of the words were more or less unclear.

Future research could include investigating the understanding of the words by a still larger group (students) and by groups with other backgrounds and/or in another cultural and linguistic context (maybe in other Nordic or European countries). It could also be interesting to determine if the words represent a more long lasting meaning.

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Bosse Westerlund

Co-designing with and for families – semantic aspects

This working paper will briefly discuss some of the semantic aspects of a cooperative design project *interLiving*. The focus is on the design of a technology probe, which was installed in some families' households in Sweden. The paper deals more with ideas and thoughts than real results. The results will be discussed when the project reaches its final stages and the prototypes are more developed.

The research project aims at discussing different layers of meaning; of how the artefact is used for communication (socially) between people and how individual persons responded and understood the artefact.

INTERLIVING

The research in *interLiving* is currently carried out in Stockholm and Paris. The project is financed for three years by the EU's Dissappearing Computer initiative.

The goal of *interLiving* is to study and develop technologies and artefacts for communication between generations within a family. The research is done together with the families. The work also involves investigating existing methods and developing new design methods.

The main research question is, how we can work with families in the cooperative design tradition in order to develop new and meaningful technology for communication within a family.

The design approach includes:
- working closely with families during the whole project
- the use of a mixture of methods: interviews, workshops, and probes
- multidisciplinary research. Researchers from at least two different fields participate in all work done together with the families.
- technologies not defined in advance.

This approach enables the project to work in situations with actual needs and desires by using conceptual categories that the family members themselves conceive as meaningful. Accordingly, the project will get insight into how meanings are constructed by the different individuals, i.e. what really matters to the individual person, the household and the family (see Westerlund et al. 2003a and 2003b).

In Sweden the research is carried out closely with 3 families living in eight households, a total of 24 people between 2 and 74 years of age. The aim is to consider the whole context of use for these different people.

INQUIRY INTO THE CONTEXT OF USE

The project conceives design as aiming at artefacts, which fit into people's lives in such a way that the families will accept to have them in their homes and other locations. Therefore, the research tries to learn about and understand the whole context, where the artefacts will be present. This involves the material context in which the people live and pass through. Also the social context, communication of needs and desires, which people might have at different times, is included.

The aim is to enable the design of artefacts in such a way that the families will accept to have them in their homes. Of course, all kinds of aspects, like status, exclusiveness, etc. have an impact on the process. The results can even involve "invisible" design, in which technology is hidden. While *interLiving* is a research project, no aspects of marketing, branding, manufacturing, distribution, disposal, recycling or price is considered. The research looks at the situation, when the artefact is in the home (or in the pocket of a person).

The main task is to try to understand the "needs and desires" that the individuals express through different means, verbally and during action. It seems

important to use the family members' own language and categorisation. If researchers would look through a grid of their own, it would easily shadow the families' view. The approach is not easy, it increases working time and requires careful reflection.

"*... we can no longer insist that others respond to how we see things. We have to respect their own understanding. Thus, asserting what something means for others constitutes a relationship between constructions on different logical levels: our understanding and our understanding of someone else's understanding.*" (Krippendorff 1992:36)

CULTURAL PROBES

One of the many approaches was to use cultural probes, a technique, which Bill Gaver developed some years ago (Gaver et al. 1999). The probes are "designed to provoke inspirational responses." The family members were given diaries and disposable cameras with the assignment to take photos of:

- places where you leave messages to the others.
- things that remind you of the others in your family.
- things that you think are nice in your home (and ugly).

Things cannot be objectively "nice" or "ugly". However, these are categories, which are familiar to many people.

There are obviously trade offs between being specific in asking questions and thereby obtaining answers to those questions, and asking vague and unspecific questions. In the latter, there is a possibility of getting surprised and receiving information about things that was not considered important.

Discussion with the family members was conceived as a good start.

Fig.1 and 2. Two nice kitchens (probe photos).

Figures 1 and 2 are probe photos of two kitchens. The different owners have expressed that they have a nice kitchen. The photos show that the style and character differ between the kitchens. The artefacts in the kitchens are presumably chosen with great care in both families. The collection of artefacts is also arranged with care. One can see that the composition of the kitchen in figure 2 has evolved over a long period of time.

Planning and rearranging furniture at home is a design activity that almost everybody has been involved with sometimes (Heskett 2002). Considering these two kitchens the owners would probably not agree to exchange any single artefact between them. All this seems to indicate that it is important to study what artefacts signify in the domestic environment. This is due to several factors. One is the notion of "dirt", i.e. "things in the wrong place".

"Mud" is accepted in the ditch, but not on the kitchen table (Douglas 1966). Cords and computers are accepted in the workplace, but not in all homes. The home is historically seen as a place separated from work, as a place for rest (Forty 1986; Nippert-Eng 1996). Many people may still agree. Electronic artefacts, computers and computer applications, may often signify "work" to people.

After having received the probe photos, several visits and interviews in the households were made. These activities improved understanding aspects of needs, desires, tastes and preferences. One question arose. Could a new device be designed to fit into both of these kitchens?

DESIGN OF A TECHNOLOGY PROBE

A method called technology probes was developed to be able to better understand the family members' use of technology (Hutchinson et al. 2003). A probe functions as a simple-to-use technology, which is open to diverse interpretations by users. It is by no means a prototype.

It is a tool that combines three aspects at the same time.

"*Technology probes are simple, flexible, adaptable technologies introduced into families' homes with three interdisciplinary goals: the social science goal of collecting data about the use of the technology in a real-world setting, the engineering goal of field-testing the technology, and the design goal of inspiring users and designers to think about new technologies*". (Hutchinson et al. 2003:17)

One of the technology probes developed in the *interLiving* project is the **messageBoard**, which is basically a shared drawing surface. It is a visible tool and it is possible to draw on it in several locations at the same time. It has a flat display, which one can "write" on with a special pen, an interactive pen display, the Wacom Cintiq. Accordingly, drawing and writing would be very similar to "real" drawing on paper. The drawing is done on virtual "notes", which are mirrored at all the households by remote family members.

DESIGN ASPECTS

Since *interLiving* is a cooperative design project, one would imagine that the probes also should be designed in close cooperation with the users. But this is not the case. In order for the probes to work as probes, the users cannot be involved in their design. Users would get too much involved with the "wrong" aspects of the probe as an artefact. They would probably have more opinions about improving the product design than the use of the probe. Therefore, it is important to understand that the probes are not prototypes.

Intentions

The aim of using technology probes in the design research was that they should feel more like appliances, for example a toaster, than a computer. The aim was to investigate different aspects of use. The artefact itself, hardware and software, should cause as little resistance as possible to the family members. There are several models available to support the design work, and three of them will be mentioned here. Janlert and Stolterman (1997) describe the importance an expected character has on making an artefact easy to use. If the artefact does not function according to our expectations, we will hesitate in using it. Gaver (1991) and Norman (1988) have applied Gibson's (1982) concept of affordance in relation to the use of everyday artefacts. And finally but not least importantly, Klaus Krippendorff and Reinhardt Butter have coined and taught a great deal regarding the concept of Product Semantics (1984, 1992, 1995).

The ideal would be, when the users feel that the probe's qualities fit into the context of the household, visual and other contexts. A strategy had to be worked out, because the households in which the probes were going to be installed, had different characters, as discussed above. Individually designed probes could be designed for the different households or only one, which would go into all households. Two approaches included different advantages and drawbacks.

Choices

Designing individual probes for each household would probably function better, if they could be made of a high quality. That would take a lot of effort, because of several probes are made and also, because it requires a lot of work to fit in artefacts to environments that are not familiar to the researchers. Therefore, while one design (probe) would require less work and also give some feedback about a more "generic" design approach, this was the choice.

Besides, if the user would construct an appropriate character, the technology may be easier to use, because the expectations of the user would be fulfilled (Janlert 1977). Therefore, many of the common computer elements, like keyboard, mouse, and on the display title bars, borders, bad typography, menus, symbols to click on, etc. were minimized. Not only were the visual elements considered. Also a computer without a fan (fan is a typical computer element), the Apple Macintosh Cube, to minimise the noise, was chosen. The noise (of the machine) is a property that users probably do not want anyway.

"... *the concept [*of affordance*] is a powerful one for thinking about technologies because it focuses on the interaction between technologies and the people who will use them.*" "*Affordances exist whether or not they are perceived, but it is because they are inherently about important properties that they need to be perceived ...*" (Gaver 1991:80)

The design should help the users perceive the affordances and the signs that the users construct are the means to achieve suitable affordances. The aim of the design was to simplify and minimize the interaction with the machine; instead the human to human interaction was emphasized. It became obvious that two different "views" or states were needed. First, one view, where all notes (written or drawn) were visible in order to provide an overview and allow the user to look at any note, was needed.

Second, the note, which is written for the moment, should be large enough. The reason for that is to make writing and drawing easier. One solution could be to use a "menu" and two different "symbols/buttons" with magnifying glass icons on them. It would resemble the controlling of a machine. Therefore, the interaction was rather made similar to handling of physical tools, for example, a pen. When the user moves a pen around on the shared surface, (s)he has one available possibility of action only. In addition, by pressing the pen on a note on the board makes marks. Pressing the pen outside a note show all notes.

Fig. 3 and 4. Sketches illustrate the two different "views", which the message board affords. On the left, all notes that have been made are visible. Tapping on the pad in the lower right corner creates a new note. The picture on the right shows a view, where a note is shown bigger in order to afford drawing and writing.

The blank note interface affords the user to act in any meaningful way. There is no predefined path of activity that must be followed. Since no possibility to erase or delete was provided, nothing would get deleted by mistake.

Even though the intention was that the probe always was on, a power failure may occur, or a family member would want to move the probe to another location. Therefore, the start and other overall handling were designed in the same "appliance" spirit. After connecting the power cord into an outlet, the probe was ready to use. There was no need to "manually start" any application, log in, or perform similar operations that would have signified a normal computer.

USE OF A TECHNOLOGY PROBE: REACTIONS AND REFLECTIONS

So far the **messageProbe** has been used in two different families in Sweden, in one, where three households were connected. In the other family only two households could be connected because of trouble getting a broadband connection to one of the households. One family preferred to use the mobile

phone and only made two handfuls of messages. The other family used the **messageProbe** intensely. They claimed that the **messageProbe** actually had added a new dimension to their communication.

Fig. 5. Some examples of what was drawn during a couple of months.

The people that intensely used the **messageProbe** did not seem to have given much thought to the appearance or any other aspect of it, except the social aspects. They seem to have focused on just writing and interacting with the person(s) on the "other side". As an example of the ease of use, a four year old girl had no problems using and understanding the probe. She found the probe meaningful and made drawings intended for her aunt at a remote probe.

Klaus Krippendorf writes:

"...*makes the very difference between affordances and meanings of prime interest to a semantics for designers. It also shifts the aim of design from creating aesthetic forms of products to providing those affordances that enable ordinary users to understand their artifacts in their own way and to engage with them in socially desirable practices*". (1992: 41)

However, some people reflected on the appearance. Thomas, who works all day in a computer related area, first thought that the **messageProbe** looked like a Beta-release due to the lack of technological features, like sound alert, date and time stamps, indication of sender, etc. But after using it for some time, he changed his mind and said:

"*I start to think it is brilliant. It's so simple but you get so much anyway*."

Jonas commented that he is "so used to the appearance of Microsoft products that you more or less expect that of all things you see on a screen."

People tend to regard the probe both as a whole and in relation to the meaning it had to them. When they could fulfil their intentions, they focused on the interaction, just doing. Some of them reflected on aspects of the probe.

LOCATION/PLACEMENT OF THE MESSAGEBOARD

Analyzing where the family members decided to locate the **messageBoard** we identified two rather different strategies or choices. The first approach was to have the **messageProbe** in a central place where it was easily visible most of the day when people were at home. This is a rather utilitarian approach and most often involved either moving something else away or squeezing the probe between other stuff. The other households decided to put the **messageProbe** in a more remote location, like a bedroom. This way it would not interfere with the way that they wanted their household to be perceived.

Most of the households placed the probes centrally. One example of this is seen on figure 6. The discussion around this involves similarities with other technical artefact that you choose to have in your house, like television sets, stoves, refrigerators, etc. As a designer you may not think that they fit into the environment. They have different character and all that. The family members also think that the stuff is ugly when specifically asked, but regarding the whole context it is naturally meaningful for the family members to have these artefacts.

Fig.6. One of the contexts where technology has been installed.

CONCLUSION

We have learned a great deal about the different individuals lives from all the different activities we have done together. Because of this understanding,

the result from the families' use of the **message-Probe** did not surprise us. The different peoples' reactions made sense according to our preconceptions.

Users acquire different meanings from the same artefact. This seems to be emphasized more in domestic environments and family settings than in work places:

"*But one can argue that the home contains the most special objects: those that were selected by the person to attend to regularly or to have close at hand, that create permanence in the intimate life of a person, and therefore that are most involved in making up his or her identity.*" (Csikszentmihalyi and Rochberg-Halton 1981:17)

In this research, we are now beginning to do prototyping together with the family members. We need to figure out ways of understanding what design decisions have to be made in order for the artefacts to be thought of as meaningful by the different persons.

We are also discussing how and how much people should be able to adapt the technology for their own purposes. It seems that less constraint means more room for personal strategies to evolve.

Acknowledgements

Note
The names of the family members are not their real ones, and we are glad to have everybody's permission to publish the research.

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Marianne Stokholm

The function of design products in the context of integrated design

The article aims at presenting a Model of Integrated Design as a tool for understanding and communicating design in general and the aesthetic function of a product in specific.

The background of the model and the related concept of design will be described. The model is evaluated with respect to its ability to improve understanding and communicating the aesthetic function of a product.

PARADIGMS AND DISCIPLINARY DISTINCTIONS

Product aesthetic is not only an integrated part of a product represented in form, but acts as the carrier of immaterial values. As such it is related to the use experience, cultural context and the function of meaning making.

Design as a means to improve business and meet the market has become more evident to the companies. In order to succeed, industrial design must be rooted in both meaning making and business making. The aesthetic function is suggested to play a major role as an integrating factor in these activities as well as in the activities related to designing and using.

Companies often claim that designers do not understand the business aspects of design. Few companies work professionally on describing values in relation to business strategies and product design. Few aesthetic oriented designers work with business strategies or describe the product form in terms of values in a way their business partner understand.

When a product becomes a market success, it is not a common procedure to analyze why it happened in terms of business strategy, product aesthetics and value communication, which means that this valuable experience is not picked up for a continuous development and improvement of design.

There are several reasons for the situation described above. One is the overall lack of common understanding concerning the concept of design. Another is the lack of a practical tool or model to trace and relate the different contexts and aspects of design and their interactions.

A common ground, in form of a general concept of design and a multipurpose "game board" to expose the field of design and as a communication aid it, could possibly help to improve the cooperation about design.

INTEGRATED DESIGN

Design is moreover understood as a competition parameter and a powerful tool to increase product values. The practical use and understanding of design has moved from an added to an integrated function and is now tending to be an overall concept for the use and integration of information (Burnett, 1997).

The interactive nature of design is becoming more evident as are the active concept of design designing. Not as a one man show but as a cooperation and team work.

This situation requires a common understanding of design, its elements, structure and the principles of their interaction.

In order to create a common ground for understanding and organizing design more models have been created though out time representing the move of design from an added to an integrating factor (Stokholm, 2003).

In line with this a model has been developed by the author, as a universal tool for a new and more holistic understanding of design. It aims at improving the communication in designing and to support practical work with design.

The model describes design as a contextual cross field, and uses the concept of system as a metaphor for and approach to design, in which transformation take place as a simultaneous process of integration of aspects and optimization of values.

The model was originally created to support the planning of new design education, especially an interdisciplinary education program in which the progression in complexity of the design process is the central issue. Furthermore it has been used to describe different professional profiles within the field of design

In this project the model is further developed and used as a tool to analyze product design cases in order to research and explain the aesthetic functions of products related to industrial design as a business making and meaning making activity.

A MODEL OF INTEGRATED DESIGN

Integrated design is understood as a contextual cross field of dualistic areas including at first level aesthetic-technology and philosophy-strategy and on second level man-environment and culture-business (Fig. 1A). First level can bee seen as representing Aristoteles' definition of things including the form-material and the cause-purpose relation. Second level represents the position of things (during production and use) in the field between man and the physical environment. All industrial design objects and the activity of designing are suggested to be routed in both a cultural and a business context.

The axis of form-material or aesthetic-technology represent the level of design based products and the axis of cause-purpose or philosophy-strategy represent the level of design based business. In industrial design both levels are present, but with variable professional attention.

The center of the cross field represents the interference in which design as product exists and designing takes place in form of a process of interaction and transformation, in which integration and optimization takes place. Further more the model suggests the concept of system as a metaphor and approach to design.

The model presents a platform, a "game board" and a general tool to support the improvement of design in theory and practice, not a statement or "the truth" about design.
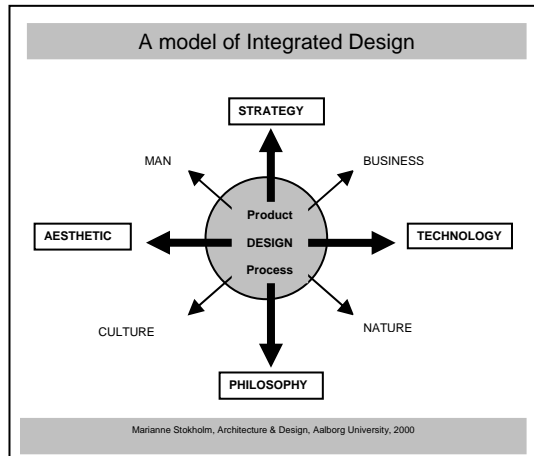

Fig.1A. Model of Integrated Design

- Design as *contextual cross field*
- *System* as metaphor and approach to design
- Design ad *transformation* processes
- Design through *integration* and *optimization*
- Focus on *contexts* and *value mission*

Fig.1B. Concept of integrated design

Two main axes are evident in the company's work with design. One deals with design at product level and the other with design at business level. Companies that understand the full potential of design will work at both levels and manage to integrate them. Less experienced companies work separately with product design. Several companies work with product design mainly in the technological context and are inexperienced in the integration of this with the aesthetic context.
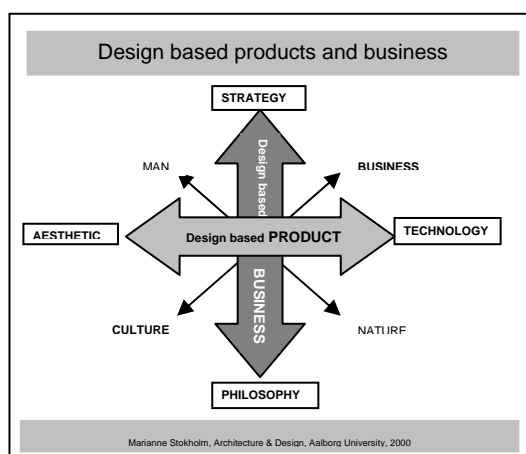

Fig.2. Interacting levels of design

THE AESTHETIC ASPECT OF A PRODUCT IN INTEGRATED DESIGN

Aesthetic form acts a medium for messages about values. Sources of values are drawn upon before and during the design process, where they are transformed and communicated using the language of form.

These sources are most often not described nor are their roots clear. Their instinctive present and use act as an important element for the designer when designing. They are often not made clear to the company and the rest of the design team, who might possibly draw upon other value sources in their judgment of the proposed form. This means that the aesthetic aspect of a design proposal is not discussed in a professional manner before, during or after designing. Nor can the values be related to the overall business strategy or the market and advertising strategies.

The relation between, on the one hand, strategic activities concerning business, product and communication and, on the other hand, the value mission, interaction, vision, and product concept expressed through the aesthetic functions are the basis of the analysis of the practical examples.

Further the relation between the product aesthetic, the communication of the immaterial and the use capacity are investigated in order to research their interactions and optimizations.

PROCEDURE

The planning and communication of the values as represented in the aesthetic function of the product is investigated using the model of Integrated Design.

The elements suggested to be involved are mapped on the model of Integrated Design and a structure of their interaction is suggested.

On this basis the cases can be analyzed using the mapping of elements and structures, concerning the specific presence and representations of the elements, their integration and optimization and the resulting business success.

Finally the model of Integrated Design can be evaluated due to its capacity to unravel, explain and communicate the aesthetic function of a product in the context of integrated design.

DESIGN BASED PRODUCT

Using the model of Integrated Design product aesthetics is related to the horizontal axis of *Product based design* as the interaction of aesthetic based activities and technology based activities, and representing the interaction of design and engineering. The aesthetic context is in focus, not the technological.

A link to the product-man axis is suggested in order to include the capacity of the product as experienced by the buyer and user of the product.

The illustration Fig.4 shows the mapping and suggests an interaction with the product's use.
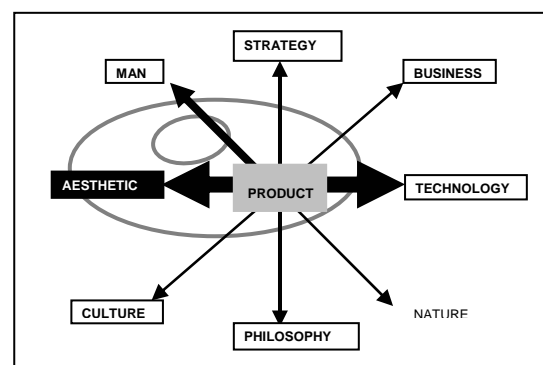

Fig.4. Elements related to *Design based product*

THE CAPACITY OF THE PRODUCT

John Heskett (1998) defines three use capacities, which a product must posses to compete in the new economy. He calls them Utensil capacity, Symbolic capacity, and Systemic capacity.
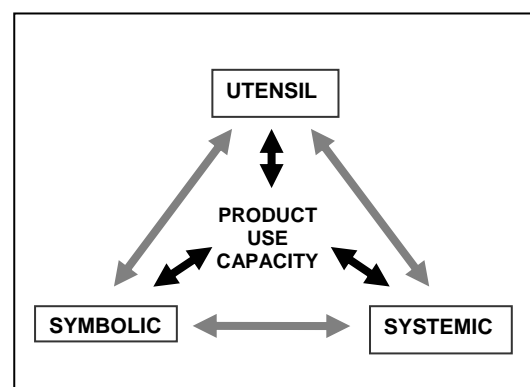

Fig.5. Model of the use capacity of a product

Use capacities are experienced and tested by using the product, not only through the users interaction with the real product, but also with his/her imagination of use based on the communication of the product, its values represented in by the product as sign, and its visual and verbal context. The decision of buying the product is based on a positive relation between capacities and price (value for money), which is related to desires, needs and resources. If the first relation is judged very positive, the second relation will often be adjusted to meet the decision of buy.

In a consumer and information society the symbolic capacities of a product are conceived important by the user. The market may already offer several products with the same utensil capacity, and social needs play a major role for the user. In the model of Integrated Design symbolic parameter is represented by the relation man-product-culture worked out in the aesthetic function of the product and expressed through the form. It is founded in the axis of philosophy-strategy and closely linked to the communication strategy.

The systemic capacity is playing an increasing role in new products and is foreseen to play a major role in the Knowledge and Dream Society.

istic for several products in a rapidly changing society. The ability to adjust the product design to be in line with the situation is vital to a company.

In the design process, the use capacities is primary worked out in the stage of Interaction vision (Fig. 8 and 9), which ought to include utensil as well as symbolic and systemic capacities and use scenarios, and acting simulation as a prime method. However, many designs are not rooted in a systematic work on the symbolic function of a product design. Nor is this issue discussed by designer and his client or professionally linked to the strategy of the product line or the company's strategy in general.

DESIGN BASED BUSINESS

Using the model of Integrated Design product aesthetic is related to the vertical axis of *Design based business* like the interaction of strategic based business activities and philosophy based design activities (Fig. 7).

A link to the business-culture axis is suggested in order to include the concept of design as a meaning making and a business making activity.
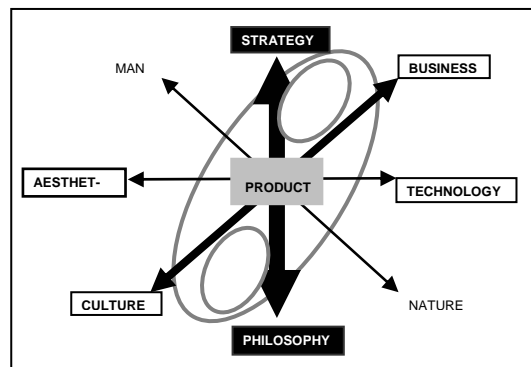
UTENSIL Capacity	Tool values	Physical qualities	Physical needs	Craft society Industrial society
SYMBOLIC Capacity	Sign values	Socio-cultural qualities	Social needs	Consumer society Information society
SYSTEMIC Capacity	Symbiotic values	Interactive and transformative qualities	Mental needs	Knowledge society Dream society

Fig.6. Product use capacity (Heskett, 1998)
Related to needs and society (Stokholm, 2003)

The capacities are all wanted and can not replace one another. Quite the opposite, their present can create synergy and raise the total value of the product. Depending on several parameters like user needs, development of society, market competition and the specific product type, the focus may be different. A shift in capacity requirements is character-

Fig.7. Elements related to *Design based business*

The illustration shows a mapping of the product related to *Design based business* and suggests an interaction with the axis of business-culture contexts.

BUSINESS MAKING THROUGH MEANING MAKING

In Aristotle's definition of things, it is the cause-purpose axis, which differentiates man-made objects from natural objects and, therefore, most interesting

to the concept of industrial design. In the model of Integrated Design, the concepts are translated to philosophy-strategy in order to place it in a modern industrial design context, where focus on the value aspect of the causes and the business aspect of the purpose are evident and refer to the slogan "value for money".

A subdivision of the subjects and activities, which are related to the implementation of both philosophy and strategy outlined towards the integration with the product, is suggested.

Philosophy in terms of causes of values in industrial design includes three stages towards integration in the product: Value mission, Interaction vision and Product concept (Lerdahl 2001).

Strategy in terms of purposes transformed to an operational plan for reaching business goals is, in the context of product design, suggested to include three stages towards the integration with the product: Business strategy, Product strategy and Communication strategy.

Rooted in our time of a highly developed consumer society, where products not only serve basic needs, but also socio-cultural needs, the first can bee seen as the activities leading to *"The big idea"*, and the second as the activities leading to *"Storytelling"*. In practice, this is demonstrated by the product and its advertising. Both are evaluated by the consumer through perception and other forms of interaction. At first, often based on pictures of the product, the user evaluates the products capacity of meaning making. The company evaluates the money making capacity. Industrial design is finally evaluated by its capacity to create meaning and business success; through the integration of philosophy and strategy as the two are depending on one another.

In design of consumer products the idea and its communication plays an important role, due to the competition on the market.

To succeed, the business strategy and the cultural values on the market, one to two years ahead, must be in line. Meaning making must meet business making.

The business aspect has got much attention for years. Tools and methods to deal with business are widely spread and taught. The cultural aspect has only recently become subject of research and practical use within the design field. The integration of the two is still managed very poorly. One reason for that could be a missing common ground, which would support a combination in practice.

Based on the model of Integrated Design a map is suggested to illustrate how the two contexts meet on the product level (Fig.8). This link is considered by the author to become increasingly important as we enter the Knowledge and Dream Society.
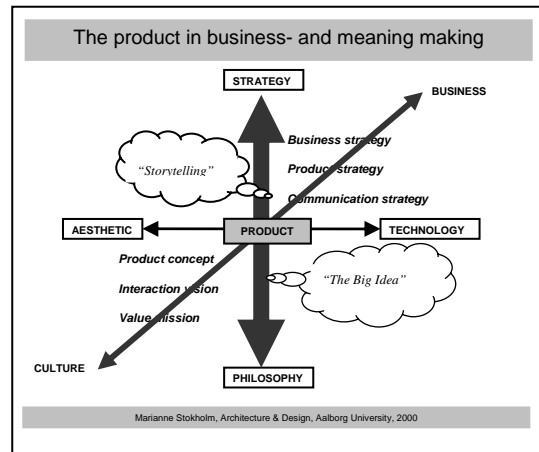

Fig.8. Design based business activities.

The elements represent stages towards product design (Fig. 9). The product in this matrix includes product development and production. The content describes the factors considered and proposed. The aim and method describes the main activities and its result.

Elements	Content	Aim and method
STRATEGY		
Business strategy	Business profile and goal	Business making
Product strategy	Product Type Price Quality	Design brief
Communication strategy	Media Time Space Rhythm	*"Storytelling"*
PRODUCT		
Product concept	Idea as system	*"The big idea"*
Interaction vision	Use capacity	Scenarios and simulations
Value mission	Cultural profile and goal	Meaning making
PHILOSOPHY		

Fig. 9. Description of the business and design activities.

The qualities of the different elements and their links, interaction and optimization play important roles in the synergetic totality.

In a broader perspective, meaning making and business making reflect one another and reflect

again a wider understanding of design, described as "A meaning making and business making activity through transformation" including transformation as "the learning organization", the "market trends" and the change of the concept of design itself.

The analysis is based on the model of Integrated design, using the description of business and design activities related to the level of Design based Business and the elements of product use capacities related to the level of Design based product.

Describing and analyzing case studies (Stokholm 2003) by using the model of Integrated Design and its extension with models from Heskett (1998) and Lerdahl (2001) has resulted in a deeper understanding of the successes and failures in the cooperation between designer and company, and also in the potential of design as a means for business making. It has also supported and professionalized the reflection of means and methods during the design and communication processes.

In specific the following findings have been important during applications of the model:

A close relation between the product concept and the communication strategy is vital to a power full presentation of the use capacity of the product.

The design brief could benefit from methods used in the interaction vision.

A design that meets the cultural profile up front and, at the same time, carries familiar signs has great sales potential.

The company has lacked methods to work with value missions related to cultural profiles at the time when the projects were realized.

The designer was able to explain the design proposals to the company by describing the interaction visions and by suggesting a product strategy in a way, which was understood by the company.

The aesthetic function of the product has acted as the physical representation of the values mission and a documentation of the product strategy, because it was not conceived as pure form only, but as a system based principle of value interaction between designer, company and user.

EVALUATING THE MODEL OF INTEGRATED DESIGN

The aim of the model of Integrated Design is primarily to give an overview of relations and interaction. A deeper understanding requires studies of the different contextual areas. The aesthetic function of a product can be mapped and important relations become clearer. Inclusions of other models, e.g., the model of product use capacity, enlarge the potential of the model of Integrated Design.

The model as a tool for communication between designer and company requires a test in practice to reveal its capacity and ad new perspectives.

So far, the model has served design analysis in two case studies (Stokholm 2003).

PRELIMINARY CONCLUSIONS

A common platform in form of a model is seen as a help to clarify the sources, tracks and interactions of values that leads to the decision and description of a specific set or profile of values, which in combination with a strategy concerning business, market and communication will professionalize the cooperation between designer and company on the aesthetic aspects of product design.

In addition, such a tool, representing a systematic approach, is expected to supplement the intuitive approach of the designer and support reflection in designing. Furthermore, it is supposed to help the designer's argumentation for the chosen aesthetic and enhance the company's understanding of it.

A systematic approach to design is complex by nature, but so far the only one, which is in line with the interactive characteristics of design activities.

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