Verbal communication of semantic content in products

The purpose of the present research work is to explore how precise verbal communication can capture the semantic content of physical products. The paper presents an overview of the background and work done so far. Furthermore are ideas for future work discussed. The background includes the increasing need to communicate soft qualities in all stages of complex design processes.

Research carried out so far includes 3 investigations with a combination of questionnaires and an experiment where product search was carried out based on verbal communication alone. Preliminary results indicate that there exists a mutual understanding of many of the terms describing the qualities and properties and that good verbal communication of sensory and perceived product qualities are possible. However a number of the selected terms seem to have several interpretations causing ambiguous information. We suggest more emphasis in design education on training precise verbal communication concerning semantic contents in products.

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RELATED WORK

Products are to a growing extent being sold based on soft values such as appearance, style, emotions and brand value making it increasingly important that people involved in product design and development processes can communicate these softer or more intangible values amongst themselves and in the products. Work within this area is pursued in a number of fields. Lopez et al. [1] have developed an acoustic measurement technique that makes it possible for non-experts to evaluate product sound. The technique is used for evaluating sounds from lid-closing and button-pressing on mobile phones. Warrell [2] have developed a theoretical framework he names"design syntactics". According to Warell it links the aesthetic shape of products with functional reasoning. The framework includes terms like *form functionality*, *shape syntactics* and *design formats*. He also describes how it is possible to identify the important shape elements which gives a product its characteristic expression (for example the recognition of a brand). Vihma [3] describes how aesthetic appreciation can be related to semantic and semiotic analysis. Vihma makes a closer examination of four types of products: Irons, fitness cycles, telephone boxes and bicycle helmets. Goovers et al. [4] examines whether it is possible to build "personality" into a product. 18 design students sketched irons that should be either "happy","cute" or"tough". An 88 person panel then ranked the sketches based on the three terms. The conclution was that the panel members understood the design intention, even though the differences between"cute" and"happy" were less distinct. It is also described how the students could formulate which visual means they used to obtain a certain expression. Pascalle et al. [5] has investigated how 12 persons describe 30 different watches using so called "intangible attributes" (reminds of the first questionnaire in Lenau & Boelskifte [6]). She concludes that there is an agreement about the use of a number of the terms.

Johnson et al. [7] describes earlier research on identifying terminology for the semantic properties of products. They classify the properties into sensory attributes (input directly registered by our senses), perceived attributes (the interpretation of what is sensed) and stylistic attributes (placement in a period of style). An experiment with a cross disciplinary group of students (from industrial design, business administration and engineering) indicated consensus about which words described the sensed and perceived experiences for 6 selected products.

Desmet [8] has studied how products evoke feelings and he has developed a framework where 14 categories of feelings (e.g. satisfaction, joy, contempt,…) are linked to views on the product (product focus) and expectations (concern). "Product focus" can either be an "event" (anticipated consequences, reminds of the semiotic index term), an "agent" (the product as a personal image) or the object in itself. "Concern" is about attitudes and preferences and reminds of the semiotic term "code". The term "appraisal" (i.e. an explanation on how a

certain product evokes a certain feeling) links "focus" and "concern" to the feelings given by the product. He has furthermore developed an elegant and comprehensive web-based database (Product & Emotion Navigator). Here 32 persons describe the feelings that a larger number of different products give them. Every single product is documented with a picture and a description in accordance with the above mentioned dimensions of analysis. From the database it can be seen that there are very large differences between how precise and articulated the persons are in the description of their "appraisal". We see this as an indication for the need of awareness for the terminology we are in the process of identifying.

We have also encountered this need when searching for materials that play a role for the semantic qualities in products, e.g. in the materials encyclopaedia Design inSite [9].

Restrepo [10] describes the development and testing of a *Content Based Image Retrieval System* for the designer. Restrepo pursues getting results without having to describe, organize and index each image, as is necessary in current systems to handle design precedents, escaping the subjectivity of the interpretations, escaping the imprecisions of language and avoiding differences in opinions between the users. In his approach, a search is therefore based on the semantic distance between two concepts instead of matching keywords, and the fact that the concepts are given to the system using examples of images instead of keywords.

Figure 1: Questionaire 1 as seen from the students.

EXPERIMENTS WITH SEMANTIC QUALITIES USING QUESTIONAIRES

Using questionaires it is realistic to carry out experiments with a larger group of people. We formulated 2 questionaires based on work from [7] where a revised vocabulary was generated. This was tested on 2 groups of design engineering students (50

students each time). The results were similar for the 2 tests indicating a general agreement about the meaning of most of the attributes. However the tests also showed that there were ambiguous words, where a number of meanings were associated to a word. The first test is reported in [6]. In the following a more brief description of the experiments and the results are given.

Questionaire 1

In the first questionaire (figure 1.) the students should tell which products they thought were described by each word in questionaire 1. The instruction was that they should write the first thing that comes to mind, and not be speculative. Knowing that they had only 45 minutes to describe the 92 attributes gave them about 30 seconds for each attribute. The purpose was to find out if the words were meaningful to the students and if they associated them to types of products that are similar. Furthermore being forced to consider each of the 92 attributes gave them an overview of the lists. In this way it became realistic to fill out the second questionnaire.

The answers from questionnaire 1 were evaluated by counting how many identical or similar products there were for each attribute and by judging if the attribute was interpreted in an unclear, clear or very clear way. Answers to the attribute "organic form" varied from "clay" (probably meaning any undefined shape), "a sponge" (probably meaning an amorphous shape), "a ball" (which is a well defined geometric shape), "a part of the body" (something smoothly curved). We thought that the interpretations were so far apart so we classified the attribute as unclear. Answers to the attribute "rounded form" on the other hand seemed much more focused (many answered "ball" and the majority of the rest had answers like "VW beetle", "handle" and "Apple computer") and was therefore classified as very clear. Based on the answers we classified 17 of the 92 attributes as unclear, 12 attributes were clear and the remaining 63 attributes seems to have a clear and distinct meaning to the students.

Questionaire 2

Secondly they filled out questionnaire 2 presenting 4 different 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 2 were projected on a screen. Selecting the products was a compromise: Considering the number of attributes in the questionnaire it was only realistic to have 4 products. So we selected products which represented as wide range of options as possible for the sensory attributes.

Figure 2: The four products used for questionaire 2.

The answers from questionnaire 2 are quantitative and it was therefore possible to make a statistical evaluation. The results from the sensory attribute section in questionnaire 2 are grouped into 8 groups (form, colour, glossyness,…). Within each group one or more words can be selected. Attributes that

were chosen by a significant amount of the students are shown in table 1 and 2.

	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	**Bycycle lamps**	**Shaving brush**	**Working gloves**
Form (form)	Angular	(Organic), rounded, (aero-dynamic), (long)	(Organic), rounded, angular	Organic, (rounded), flat
Farve (colour)	Cold, (Muted)	(cold), dark, (strong)	Warm, cold, (light), (muted)	(Warm), light, (strong), (muted)
Glans (glossy-ness)	Semi glossy, metallic	Semi glossy, (glossy transpa-rent)	Matte, glossy, metallic	Matte
Over-flade-tekstur (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 1: Answers from questionnaire 2: Significant (and close to significant) sensory words for the 4 products

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

Table 2: Significant symbolic words for the 4 products. Significant here means 20 or more of the 27 answers.

EXPERIMENT WITH SEMANTIC QUALITIES AT THE DANISH ARTS AND CRAFTS MUSEUM

Another expriment was caried out as part of a workshop with participants from the 3rd Nordcode seminar on design communication in April 2004. The experiment were carried out at The Technical University of Denmark and at the Danish Arts and Crafts Museum. The purpose was again to explore how precisely verbal communication could capture the semantic content of physical products. The participants first made the exercises with the questionaires described in the previous section. Then the 12 participants in groups of 2 selected exhibited products at the Danish Arts and Crafts Museum and described them verbally. This means that 12 products were selected. Based on the verbal description other teams should then identify the products in question. 5 of the products were identified.

Figure 3: Oven.

The experiment indicates that it is possible in a few words to capture an essence of a products semantic content. 2 examples of products chosen in the experiment are shown in figure 3 and 4. The oven in figure 3 was easy to identify due to distinct attributes like dark colour, decorated, rough, clumsy, ornamental and historic. These attributes were distincly different for the products around the oven. The jugs in figure 4 illustrates that it can be more difficult to distinguish between similar products. Both jugs are glossy, metallic, smoothly textured, minimalistic and simple.

Figure 4: 2 jugs.

The experiment also illustrated a number of problems in using this type of explorative research. Many participants chose a larger number of words (in some cases more than 30!) to describe the products which maybe made the message less precise. It is not clear if the participants thought that the many words were necessary to give a comprehensive description of the objects or if the formulation and layout of the lists invited to select the large number of words. Another obstacle was that the form of the experiment reminded of a game, and some participants therefore faced the dilemma: Should they describe

the products so well that they were easy to identify (and thus help the other team to win) or should they make it more difficult. This work is described in more detail in [11].

RESEARCH METHODS

It is our hypothesis, that everyone in common daily language uses a number of aesthetic, semiotic and semantic terms. The question is how large a part of this assumed vocabulary has a more general and clear meaning. Our investigations serve as a starting point to achieve this understanding.

There are a number of different methods to investigate this question e.g.

1.   Mapping the terminology used in literature

2.   Letting experts formulate and criticise selected sets of words

3.   Description of specific products using predefined set of words

4.   Description of specific products using own words

5.   Identifying products that match predefined words

6.   Identifying products that match predefined words (from a limited set of products)

7.   Sketching/designing products characterized by certain predefined words

8.   Making mood boards and identity boards to describe certain predefined words

Johnson et al. [7] used a combination of method 1, 2, 3 and 4. Terminology used to describe products in design magazines and museum catalogues were collected (method 1). The result was a substantial list that was classified into 3 groups: Sensory, perceived and stylistic attributes (method 2). Since the object in this literature is so called "designed products" the question is if the identified terminology is to narrow. To overcome this problem a group of test persons were asked to describe specific products in their own words (method 4). The question is how many different people it is necessary to ask to get a good picture. Method 3 was used to test if the words could be used to describe semantic qualities and if there were agreement on the meaning of the words. The difficulty here is that many products are needed in order to cover all the words. The described experiment had 6 products.

Lenau & Boelskifte [6] uses a combination of method 2, 3 and 5. The terminology lists suggested by Johnson et al. [7] were critically revised (method 2). The logical structure was examined and compared with the terminology, which is used in the teaching of industrial design. The sequence of sensory attributes was changed, so it now starts with visual attributes, followed by other attributes for feeling (tactile / haptic / kinaesthetic), smell, taste and hearing. Method 5 was used to examine if the words were meaningful to the test persons. This was examined by seeing if it was possible for the participants to identify products for all words and whether the answers indicated some sort of agreement on their meaning. This requires a subjective evaluation from the authors. Method 3 was used similarly to Johnson et al. [7] but only for 4 products. The products were selected to cover a broad range. Method 3 allow for statistical treatment. The work in Lenau & Boelskifte [11] use method 6.

IDEAS FOR FUTURE WORK

Our research has focused on identifying a set of "most used" words in the form of a vocabulary of sensory and perceived terms. The vocabulary includes 96 words at the moment. The vocabulary has been tested by asking a number of people using questionnaires which products they associated to the words (research method 5). Another test was to use a questionnaire where people should mark the words that best described a product displayed to them (research method 3). A third test was an experiment where one group of people described a product using the words in the vocabulary. Based on the selected words another group should identify the words (method 6).

Possible questions for future research are the following:

1. How good/robust is the vocabulary at the moment? Have we identified the most used words? Are we sure which words have unclear meaning? Presently we have quantitative statistical results that indicate words with unclear meaning but we cannot be sure if we have captured enough relevant words. This is best investigated using qualitative methods. One way to explore the questions is to conduct experiments with smaller groups of people followed by round table discussions. This would be a combination of research methods 4 and 6.
2. To what extent is the vocabulary culturally dependent? Products are sold globally but are they perceived in a similar way? To witch extend are perceptions context dependant? English being the "lingua Franca" develops different "vocabularies" in each culture it is used in. Vocabularies and words used to describe properties/attributes also change over time.
3. How can design students, professionals as well as design teachers be trained in order to ensure a clearer verbal communication concerning semantic qualities? This is a design task itself.
4. How does the vocabulary angle interact with other approaches? (i.e. Restrepo)

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