PRODUCT CONSTRUCTS: INVESTIGATING DIFFERENCES BETWEEN HUMAN FACTORS SPECIALISTS, INDUSTRIAL DESIGNERS AND ENGINEERS

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In the product development work, differences in language, education and cultural thought worlds influence actors' view of the product. Drawing on personal construct psychology, this paper investigates differences in how triads of products are distinguished from each other to reveal the usage of constructs depending on disciplinary belonging. The study identifies some differences in the use of constructs between human factors specialists, industrial designers and engineers.

Product constructs, Repertory grids, Multi-disciplinary product development

1 Introduction

In today's product development work the integration of disciplinary actors such as industrial designers, human factors specialists and engineering is critical. However, when bringing together diverse cultures, languages, tasks, and understandings of the product development goals and activities, disciplinary integration can result in misunderstandings, preconceived notions, distrust and neglection of the product as a whole. Such contradictions affect the product development work, leading to sub-optimised product solutions rather than synergy effects (Jassawalla and Sashittal, 1998; Persson, 2005). Studies have shown that industrial designers, human factors specialists and engineering designers sometimes work under such circumstances (Persson, et al., 2007, Persson, 2005). The differences between disciplines that lead to contradictions are apparent in several aspects of the work activity, understanding and communication about the product being one of them. Since the product is a focal point in product development work and is developed from diverse perspectives, differences in the conceptions of the product could be a barrier in cross-disciplinary work.

The findings in this paper is part of a larger study which has also addressed the use of product constructs in relation to different product types (Jordan and Persson, 2007) and meanings attributed to a set of products and its implications on user studies (Hiort af Ornäs and Persson, 2007). This paper aims at investigating whether personal constructs change in correlation with the disciplinary belonging.

2 Theoretical framework

Several factors influence how successful interdisciplinary collaboration develops (see e.g. Griffin and Hauser, 1996; Jassawalla and Sashittal, 1998). Persson (2005) has identified factors on interpersonal and contextual levels; the former constituting the way communication works; how tasks and activities are connected in terms of content and coordination; and actors' individual and collective mindset during product development work, as a result of their sense-making (Weick, 1995). On a contextual level, collaboration is governed by the context, i.e. the actor's history and experience as well as environmental structures, management and cultures (Persson, 2005, Engeström, 1999, Engeström et al., 1995). The interpersonal and contextual factors are interdependent variables that determine the success of collaborative work.

Studies of interdisciplinary product development work show that the respective disciplinary groups maintain through group members' sense of belonging, which tend to be with the disciplinary group rather than the cross-disciplinary team (Persson, 2005). The disciplinary groups can more easily evolve 'communities-of-practice' determined by a collective understanding of what their group is about, a mutual interaction and a shared repertoire, including e.g. language, routines and tools (Wenger, 2000). Like communities-of-practice, the disciplinary groups are driven by a common value (McDermott, 1999), which according to Persson (2005) differs from one disciplinary group to another in the product development activity, creating barriers between the disciplines.

2.1 Personal construct psychology

Through product developers' history, experiences, work tasks, current situation and values, they anticipate events in individual ways. Hence, the way professionals make sense of products in different ways may be an explanation to the impaired disciplinary integration.

One way of finding out the way individuals make sense of products is through personal construct psychology. According to personal construct psychology "a person anticipates events by construing their replication" (Kelly, 1966), i.e. individuals use a set of constructs to interpret the world around them. The constructs refers to the nature of distinction one attempt to make between events. The distinctions are dichotomous since they contrast between two groups of elements (Kelly, 1966), e.g. 'round – square', 'friendly – hostile' or 'comfortable – uncomfortable'.

By eliciting product constructs for different disciplines and professions, we could find out whether there are differences in perceptions for different actors in the product development work.

3 Method

Data was collected from a total number of 49 participants employed in academia and the industry representing product development disciplines as well as participants from other professions. The informants in academia represented professions in industrial design (n=9), engineering design (n=7) or human factors (n=6) disciplines; and in the automotive industry they represented industrial design (n=6), studio engineering (n=6), human factors (n=5) and engineering design (n=6) disciplines. The participants from other professions (n=5) were regarded as non-representative actors in product development work.

3.1 Data collection

To elicit constructs in a structured way we rely on procedures normally used for repertory grids by asking participants to distinguish between triads of elements. The participants were individually presented six slides on a computer screen, each slide depicting three different products. For each slide, the informant was asked to select one of the three products as the odd one and thereby distinguish it from the two other products. They were also asked to motivate their choice of the odd product in relation to the two other, resulting in an elicitation of a construct used for that particular set of products.

Figure 1. Triads of elements used

Since constructs are distinctions made between elements divided into groups (Kelly, 1966), one product (element) is selected as odd, and the other two are thereby grouped together. The groups constitute poles of the construct; one similarity pole and one contrast pole. In order to achieve this, at least three products are needed. The products selected were limited to consumer goods and combined into triads according to Figure 1. The elements (images of products) were combined so that they on one hand represented a common product type, e.g., cars (Triad 1), coffee makers (Triad 4) or a similar area of operation, e.g., kitchen utensils (Triad 2 and 5); and on the other hand represented a mixture of product types and areas of operation (Triad 3 and 6).

The data collection partly took place in a meeting room at the product design department in the industrial site and partly in informants own offices. The majority of interviews were carried out by two researchers, one asking the questions and one recording the data in protocols.

3.2 Analysis

A total number of 292 constructs were analyzed based on Jankowicz's (2004) method for content analysis of repertory grids. The data was independently analyzed by two coders, in order to attain reliable interpretations of the data. The coders defined fine-grain categories of constructs that where put together in main categories. The results of the main categories were compared. Where differences between the categorizations appeared (5% of the constructs) the category belonging was negotiated and agreed upon so that a pooled result could be achieved.

3.2.1 Categorisation

The main categories developed resulted in the following definitions.

Aesthetics. Constructs referring to aesthetics concerned the products' visual appearance such as colour, form and shape attributes, visual expression, style (e.g. old fashioned, American), brand design, design feature and visual effects (e.g. dynamic, floating).

Usage. Usage involves elicited constructs that concern issues related to the usage of the product, i.e., the application area (e.g. for entertainment or cocking), what the user does with the product, how the user interacts with it, in what context, the utility and purpose of the product.

Technology. Constructs concerning technology include product functionality and structure, physical features (e.g. thermos function) or parts, technology advancement (e.g., hi-tech and low-tech) and operational output (e.g. shows pictures).

Commercial. The commercial category includes seeing the product as goods to be sold or bought in a financial transaction. Constructs in the category includes distinctions made between products due to the direction of a particular market, consumer group and life style (e.g. luxury car, high/low price)

Personal implications. Constructs concerning personal associations and judgements (e.g. desire to own, do not use) were categorised as personal implication.

Miscellaneous. Miscellaneous are constructs not possible to categorise due to ambiguity or not being understood.

4 Findings

This section reports the findings from the analysis. First, the percentage of comments per category and the distribution of categories per slide are presented. Second, differences in constructs (categories) made between human factors specialists, engineering designers, industrial designers and studio engineers are highlighted and finally, differences in distribution of constructs between industrial and academics professionals.

4.1 Constructs category distribution

The composition of triads and other general contextual aspects (not disciplinary specific) could influence the use of constructs, which should be taken into account when interpreting the results. Figure 2 presents a general distribution of constructs made for all participants. The most dominant constructs constituted aesthetics (33%). The second most used construct regarded usage (32%). Constructs concerning technology and commercial aspects (15% and 11%) were used less frequently.

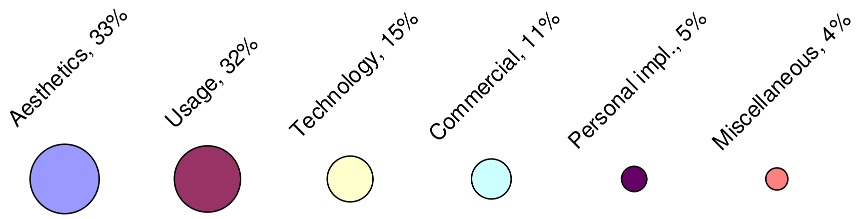

Figure 2. Percentage of constructs for aesthetics, usage, technology, commercial and personal implication categories.

Another essential concern when interpreting the results of elicited constructs is if and how the constructs vary between triads. The triads' composition could be a factor influencing the constructs used. The largest construct category, aesthetics, is the most dominant (slides 2, 4, 5) or second most dominant (slides 1, 3 and 6) category across all slides. Slide 1 stands out with the high percentage of constructs regarding commercial aspects (59%), compared to the other slides (2-4%); while Slide 3 triggered predominantly high percentage of usage constructs.

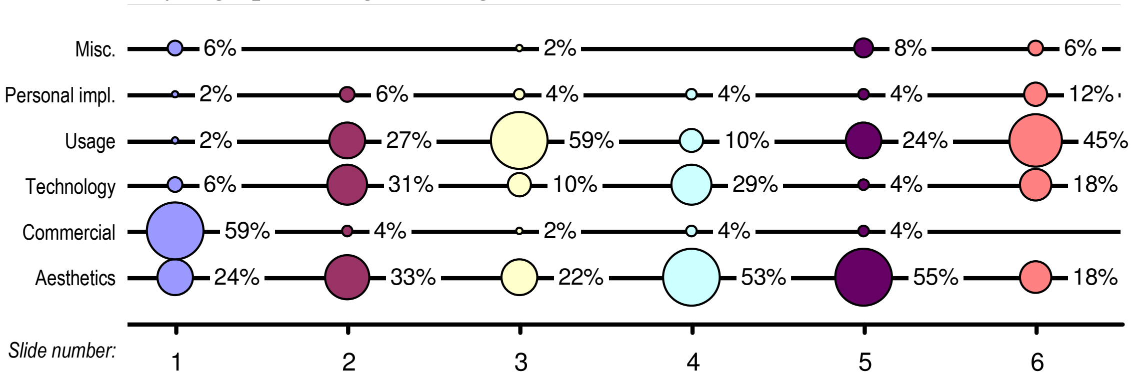

Figure 3. Percentage of commented categories per slide.

4.2 Construct differences between disciplines

For most disciplines constructs correlate with the disciplinary equivalence (Figure 4). As an example constructs concerning aesthetics were most frequently made by studio engineers (42%) whose task is to communicate technical and aesthetical prerequisites to achieve or uphold an aesthetical theme throughout the product development process. The second largest amount of comments about aesthetics was made by industrial designers (40%) whose work in the industry focuses on the visual appearance of the product and in among the academics teaching and research in industrial design. Correspondingly, constructs regarding technology were most frequently used by engineering designers (24%). However, with the human factors specialists, aesthetics was the most commented theme (32%), although closely followed by usage (30%).

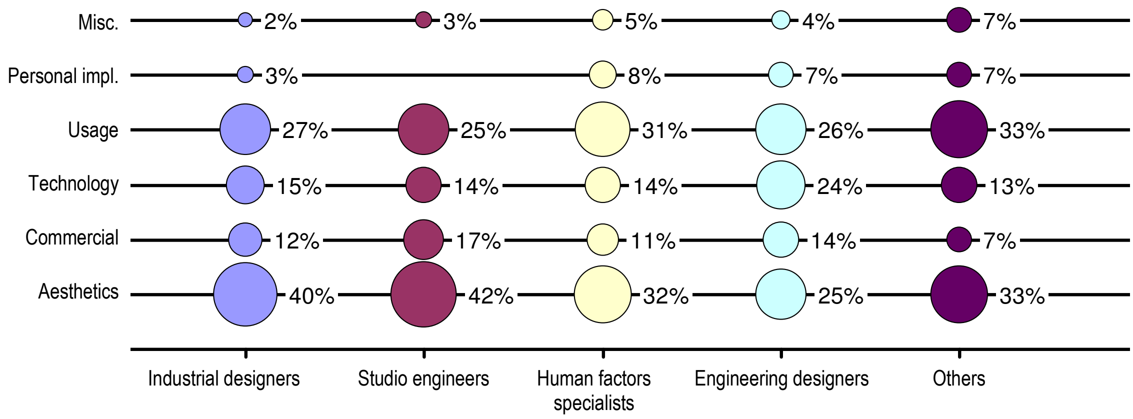

Figure 4. Distribution of categorised constructs per discipline

4.3 Differences between industry and academia

Comparing between industrial and academic participants' use of constructs, there is a slightly more even distribution of comments across the constructs categories in industry than in academia (i.e. the industrial participants use different constructs in a larger extent relative to the academics). The human factors specialists in industry show a higher level of usage comments (47%) than the human factors specialists in academia

(17%) whose comments mostly concern aesthetics (37%). The industrial designers in industry also used equally many constructs about usage and aesthetics, while the academic industrial designers used most constructs concerning aesthetics (47%). Contrary to our expectations, constructs concerning technology was more often used among industrial designers (22%) compared to the engineering designers (17%) in industry.

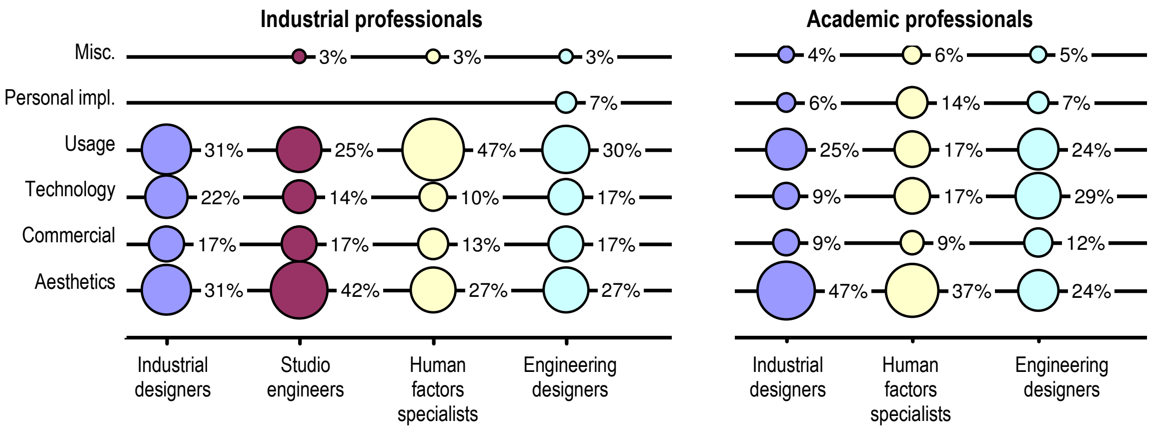

Figure 5. Disciplinary distribution of categorised constructs in academia and industry

5 Discussion and conclusions

This study addressed how the use of product constructs varies between disciplines. The results show a relative difference between disciplines' use of constructs, although smaller than what could perhaps have been expected. Industrial designers and studio engineers used aesthetics constructs more frequently; engineering designers used technology constructs while human factors specialist used constructs focusing on usage relatively more often than the other disciplines.

Despite their engineering background, the studio engineers were the discipline using most aesthetics constructs. A reason could be that while the other disciplines were allocated separately, the studio engineers physically and organisationally belonged to the industrial design department why they were easily influenced by the industrial design culture and discourse. Similarly, many of the human factors specialists from academia taught design students, and had colleagues teaching industrial design within their department.

The constructs used by participants may have been influenced by methodological factors. The generally high percentage of constructs relating to aesthetics across all disciplines could potentially be explained by the use of visual stimuli leading to aspects related to the appearance of the product (such as colour and shape) being the most obvious. Participants' experience and knowledge about the product may have influenced the choice of constructs; i.e., a low degree of product experience or knowledge could lead to constructs building more on a current interpretation, such as the visual aspects. However, no examination of the participants' relation to and prior experiences concerning the products was made. Since a limited number of triads were used it is uncertain whether the results reflect 'fostered' personal constructs or if they are a result of how the triads are composed and presented (mode). Because of practical limitations the number of products presented was limited. Furthermore the data collection concerned dominant constructs while participants are of course aware also of other perspectives. This limited the research to exclude details of differences, and the results were analysed on a high level of abstraction.

While the disciplinary differences were smaller in industry than in academia, and perhaps less extreme than what could have been expected, these findings support that differences in conceptions exists due to cultural differences in discourses, thought worlds and education. There are challenges in working across functions and some of them stem from factors identified in Persson (2005); e.g. lack of a collaborative work environment. To counter this, product development work need to incorporate collaborative social interaction that builds common ground through dialogue, socialisation and learning.

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