

# DYNAMICS AND DIVERSITY IN USE: IMPLICATIONS FOR AESTHETICS AND USABILITY

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## **ABSTRACT**

The ease of use or usability of a product depends not only on product characteristics, but on the user characteristics and environment in which a product is used as well. Products that are used in varying use situations therefore have to meet varying usability demands. In our research on dynamics and diversity in use we study the means by which designers deal with these demands. In the course human-product relations of the bachelor Industrial Design Engineering (IDE) of the University of Twente, students learn to view and explore the relations between humans and products. These relations can consider aesthetics value, influence of behaviour and usability. When considering the dynamics or diversity of situations in which a product is used this does not only have implications for usability, it influences aesthetic relations as well. Our research on dynamic usability therefore allows for exploration with regard to implications for aesthetic demands. In the course these topics were brought together in a half-day multidisciplinary workshop. The topics were explored by means of theory and exercises. This paper gives an overview of this theory and is illustrated by exercises executed during the workshop and results of the design assignment (street furniture) in which students had to apply the theory. The collaboration in education between researchers in the fields of usability and aesthetics resulted in both interesting design education and inspiration for future research.

*Keywords: Usability, aesthetics, design methods, multi-disciplinary design*

## 1 INTRODUCTION

More and more products encounter varying situations of use when introduced to the market. They are increasingly used by varying users, caused by for example the automation of services, such as box offices that are replaced by ticket vending machines and travel agencies that are replaced by online stores. Contexts of use vary increasingly as well. Growing wireless networks and improved battery capacity offer opportunities for mobile products that can be used in numerous environments. Finally, the number of purposes that products are used for grows when more functions are integrated in one product, the most well-known examples being the Swiss Army knife and the Personal Computer[1]. We define use situations of products that are used by varying users, with varying goals and/ or in varying contexts of use, as dynamic use situations [2]. Since usability is a property of the interaction between a product, a user and the task that he or she is trying to complete [3], a product's usability can vary when it is used in varying use situations. For instance, a mobile phone that has a certain level of usability for someone that uses it occasionally to call home from the car will probably have a very different level of usability when it is used by a teenager to send text messages secretly in a class room. We define this as dynamic usability [4]. Design for usability requires designers to anticipate product use within the whole spectrum of likely use situations. In our research we study the means by which designers deal with dynamic use. This includes analyzing the use situation domain, targeting a use situation domain, and creating solutions for conflicting requirements from the diverse use situations. In the course human-product relations of the bachelor IDE we aimed to teach the results of our research to students. Since the course considers human product relations from different perspectives including usability and aesthetics, we explored the possibilities of extending our design for dynamic usability research to the field of aesthetics. The fact is that different use situations do not only put different demands on products with regard to usability, but also on the aesthetic qualities of the product. So when our mobile phone is used to call 911 in a case of emergency, the user appearance of

the device should not be distracting and it should look reliable to ease the user's tension. But when our mobile phone is used by youngsters for texting with friends, it should express the identity of the user within the group. These issues rely strongly on semiotics and meaning, mostly related to cultural aspects of the intended user groups. But solutions can also be based on archetypes or other known aesthetic features from the user's history.

This paper firstly describes some results of our design for dynamic usability research. Secondly the extension of the research to the aesthetics field is explained. Thirdly we will give insight in the translation of this theory into the course by means of examples of workshop exercises and results of the student assignments. We will conclude with a discussion of applying research to education and using education as a platform for collaboration when exploring research issues.

## 2 RESEARCH DESIGN FOR DYNAMIC USABILITY

The main goal of our research on dynamic usability is to support designers in dealing with dynamic use situations. Since the success of this support depends on the extent to which it fulfils the needs of practitioners [5], this research was started with an exploration of the issue in the context of product development. In a retrospective case study of three design cases in practice we investigated how designers currently deal with dynamic use situations. From these case studies, three categories of strategies to design for dynamic use were formulated [6]. Two categories concern the way designers deal with dynamic use in their design process, namely which sources of information are used to get insight in relevant use situation aspects and the means by which a design team can get insight in the consequences of their design decisions on the future use situation. The third category concerns the types of solutions that are applied to fit a product to varying use situations. These solution principles served as the basis of a half-day multidisciplinary workshop in the course human-product relations.

### 2.1 Solution Principles

Different solution principles were distilled to accommodate products to varying use situations. These principles include one size fits all, accessories, adjustable features and segmentation.

The one size fits all principle is aimed at finding one solution that fits all possible user, environment and or goal characteristics. This principle can be applied in two forms. Firstly, product characteristics can be designed for extreme use situation aspects, so the less extreme use situations will be accommodated as well. Secondly, versatile solutions can be developed that allow multiple ways of use.

Providing accessories is a relatively easy means to extend the target use situation domain. Accessories can be provided to accommodate a product to varying use situation aspects. For example a child's seat makes a car seat more appropriate for children (user characteristic age or length), a headset makes it easier to use a mobile phone hands free (goal) and a lens hood protects a camera lens in the sun or rain (environment characteristic weather conditions).

The same counts for the principle of adjustable features. A bicycle can often be adjusted easily to the user characteristic 'size'. The screen of a navigation system can be adjusted to the context characteristic of light conditions. And products often include different 'modes' to use them for different goals.

In some cases the target use situation is so diverse that applying the above mentioned principles will not result in a satisfying solution for the complete spectrum of the target use situation. In that case designers can choose to segment the target use situation and develop different solutions for different segments. This will result in more optimal solutions for the specific segments.

## 3 DYNAMIC USE: IMPLICATIONS FOR AESTHETICS

The idea of considering the dynamics and diversity of use situations as discussed in the previous section was extended to the field of aesthetics. Here we used the division of dynamics in user, environment and goal and applied similar strategies of accommodating solutions to dynamic use situations.

As with usability issues, segmenting is of importance when it comes to the appropriate aesthetics of the solutions. A broadly applicable solution can be achieved by means of a compromising appearance (comparable to the one size fits all principle). Following the MAYA (Most Advanced Yet Acceptable) principle, coined by Raymond Loewy, the idea is to make an aesthetic design acceptable for a broad group of users and not to stand out at different use environments. This can be done by using 'typical'

designs that are based on archetypes or a shared cultural background [7] (Figure.1a). Also the ideal of the Modernist movement, that for every product there is a universal form, directly derived from the function of the object, can be used. But this always raises questions on what part of the functionality is communicated (Figure.1b and c) [8]. Therefore it is always important to have a clear vision on what message has to be communicated by the aesthetic appearance of the object, in terms of the targeted user, -use or -context [9].



Figure 1. 'Typical' car design (a) - Generic Modernist aesthetics; 'Form follows function' (b) - Problems occur when the relation between form and function is not clear (c)

When the target group is defined more narrowly and homogenously there is also more room for aesthetic preference. Our research shows for example that there are considerable differences in preference between male and female users [10-11]. When separate solutions for different user groups are not possible, aesthetic accessories can be made in a similar manner as functional ones (Figure.2). Also adjustable features can be introduced, similar to forms of co-creation and Do-it-Yourself solutions [12].



Figure 2. Design targeting women (left) - Adjustment of appearance with accessories (mid) - Adjustable aesthetic features (right)

The implications of dynamic use situations on aesthetics are similar to implications of dynamics in usability. In most cases a typical aesthetic appearance will be desirable when a broad range of use situations is expected. To express multi-functionality a particular form of design for multiple use situations is possible. There are roughly two strategies for expressing multi-functionality: using the metaphor of the "Black-Box" or "The Factory" (Figure.3). The black box design is related to the idea of a "not specific" design, so it can do "anything". The (somewhat opposite) multi-functionality association of the factory lies in the multiple associations that are possible with a visually complicated combination of shapes.

#### 4 COURSE ON HUMAN PRODUCT RELATIONS

The course on human product relations is aimed at second year students IDE. In the course they learn about the different types of relations between humans and products and how to apply these to product design. These learning goals are achieved by means of workshops, lectures, and an individual design assignment and essay. The topic of dynamics and diversity in use is tackled in a half-day workshop in which we combine providing theory and applying it in exercises. This section gives some examples of

exercises that show how students learned about the dynamic relations to use situations with regard to both usability and aesthetics. Furthermore it shows one example of a result of the design assignment.

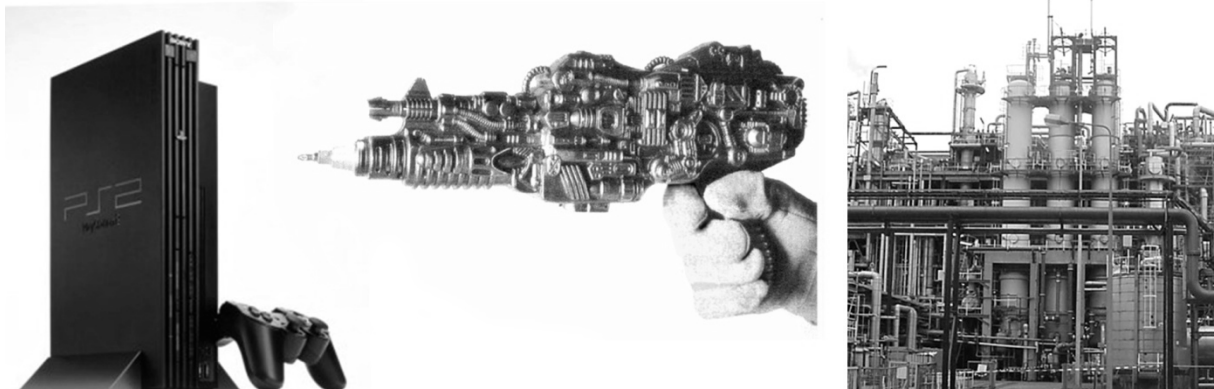


Figure 3. Typical “Black Box” design: Sony PS2 (left), And a cordless screwdriver design depicting multi-functionality (mid), that is derived from the “factory” metaphor (right).

## 4.1 Exercises

### 4.1.1 Awareness of dynamic use: shopping scanner

The goal of the first exercise was to make students aware of the dynamics and diversity of use situations. In small groups they had to write down as much use situation aspects as possible that would have influence on the usability of a mobile shopping scanner for supermarkets. Subsequently we asked them to indicate which aspects were most dynamic. Examples of use situation aspects that play a role in this case are types and sizes of groceries, physical characteristics of users, language of users etc. Although it seemed a relatively easy exercise many students had difficulties in distinguishing use situation aspects, usability issues and requirements. For instance, some groups started directly with writing down requirements such as ‘the mobile scanner should provide auditory feedback’, instead of referring to the use situations that require this auditory feedback.

### 4.1.2 Breadth of target use situation: bicycles

This exercise was aimed at learning students about the breadth of the target use situation domain of a certain product. They had to categorize pictures of different bikes with regard to the breadth of the use situation domain on user, environmental and goal level. Figure 4 shows results on environmental level.

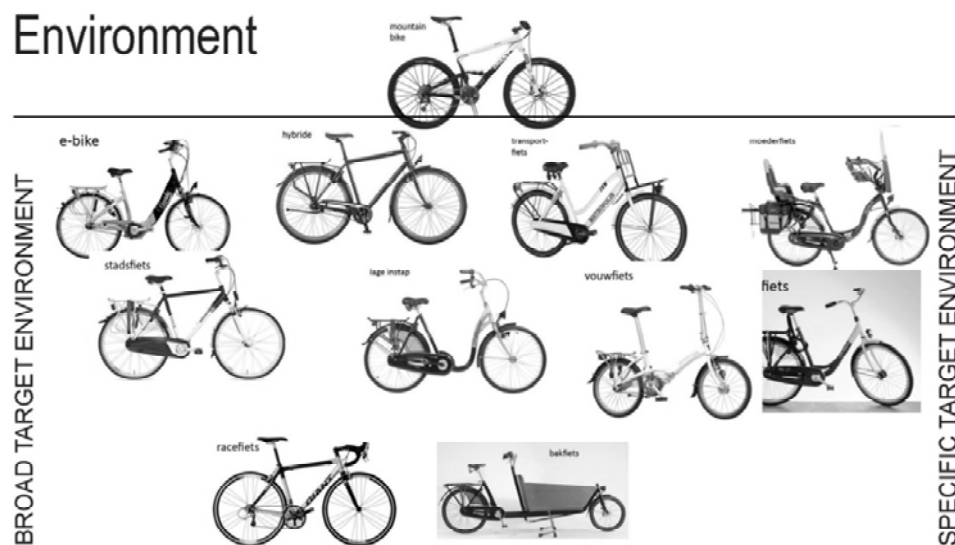


Figure 4. Result of the bicycle exercise of one of the students on environmental level

On user level bikes can be aimed at a very specific target group such as a ‘mother bike’ or an ‘elderly bike’ which allows easy mounting, or at a broader target group such as a rented bike. A city bike is an

example of a bike that is aimed at a specific environment while a hybrid bike has a much broader target use environment. Finally on goal level we can distinguish very specific bikes such as ‘transport bikes’ and ‘racing bikes’ and the broader applicable bikes such as again the hybrid bike. The main discussions during the exercise were about the differences between the targeted use and the situations in which you could possibly use the bikes. Furthermore the exercise proved to be a good means to discuss the breadth of the use situation domain with regard to both aesthetic and usability issues. Often usability and aesthetics are intertwined in the actual use situation. So the mountain bike (top in Figure 4) is targeted for use in rough situations, when crossing the woods. Therefore the aesthetics express toughness and versatility. People however use this appearance also to express their own toughness and versatility in other use situations, when the primary functionality is not necessary.

#### 4.1.3. Use situation and aesthetics: mobile phones

The goal of this exercise was to make students aware of the relations between aesthetic appearance and specific use situations. Students had to search and select pictures of mobile phones for specific use situations. The results were then plenary discussed. A phone for calling roadside assistance merely looks simple, straightforward and ruggedized. And sometimes even old-fashioned, what can be understood as ‘typical’ or ‘familiar’. The device to call your (girl) friend when you feel bored is depicted as stylish and different, with a lot of room to express your own identity and mood. The device that keeps you company in the waiting room has to offer a lot of functionality and should look like that. As waiting is also associated with playing games the phone can also resemble popular game consoles like the Nintendo DS or Sony’s PSP (Figure.5). The results of the exercise showed remarkably unambiguous results, expressing different designs for each situation, without cross references of phone designs in the results of different student groups.



Figure 5. Example of the mobile phone exercise

#### 4.2 Individual design assignment

The theory that was learned in the different workshops and lectures had to be applied to an individual design assignment. The topic of this design assignment was street furniture. Students were free to choose which theoretical approaches to human product relations were included in their design. The individual assignment was completed sufficiently by 82 of the 122 students that had started the course. In this paper we show one example of a student who applied the theory of dynamics and diversity in use in his design. This student chose to design a sitting object in a school or university environment. The dynamic use aspect concerned the desired social interactions between users. Acquaintances want to sit together, while on the other hand strangers want more privacy. This was achieved by creating sitting elements that can be used separately and can easily be combined to a sitting object that allows more social interaction. The aesthetics of the furniture were accommodated to the targeted user group by means of the ‘Tetris’-metaphor which fits the common cultural background of students (Figure.6).

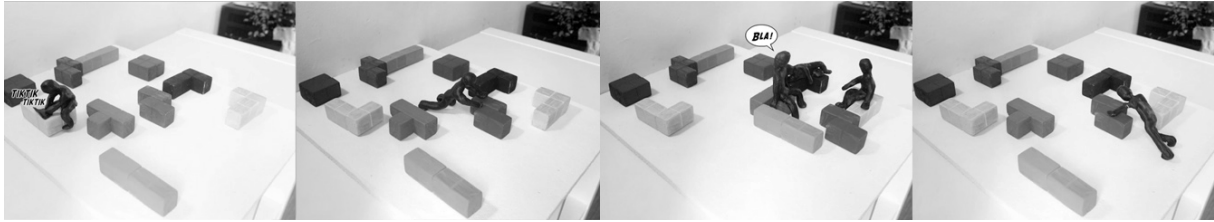


Figure 6. Tetris sitting object is easily adjustable to varying desired social interactions

## 5 CONCLUSION

In this paper we showed how we translated the results of our research on dynamic and diversity in use to education. In a half-day workshop it was possible to stimulate the awareness of students with regard to this topic. However, to give students more support in dealing with dynamic use in design, more exercise and support is needed. Nevertheless some students were already able to apply the theory to a design assignment as illustrated by the above mentioned example of the Tetris sitting object.

Apart from teaching students the results of our research, education also proved to be a valuable platform to extend the results of this usability oriented research to the field of aesthetics. The integration of usability and aesthetic issues in the exercises also clarified the role of the two disciplines in different product design situations, giving inspiration for further research on the topics addressed. Especially the research on aesthetics for specific use situations promises to be a valuable addition to the investigation of aesthetic preferences solely from user characteristics perspective.

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