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# User Experience in Evaluating Virtual Product Prototypes

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**USER EXPERIENCE IN EVALUATING VIRTUAL PRODUCT  
PROTOTYPES**

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## USER EXPERIENCE IN EVALUATING VIRTUAL PRODUCT PROTOTYPES

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### Abstract

*Experiential and emotional aspects have recently become central to understanding of interaction with technology. Understanding the building blocks of user experience helps in defining and designing better information systems and increasing market success of products. This paper focuses on user experience via users' evaluations of virtual product prototypes. User experience being subjective, we analyse it through users' own interpretations. The specific aim of this paper is to explain the alternative views on how consumers understand virtual product prototypes. We presented three-dimensional prototypes of furniture to twenty test users and interviewed them afterwards. Phenomenography was used as a research approach for analyzing the descriptions, allowing us to outline, with the help of two layers, the differences in consumers' understandings. The first layer contains the conceptions which consumers use when they describe virtual product prototypes. Based on the variations in the versatility of each test user's description we constructed the second layer, which focuses on the forms of thinking. The three forms are: seeing I) a picture of a product via new technology, II) a separate product, and III) a product in its context. In our results, the user experience is understood as a unique combination of various elements, which extends over time.*

*Keywords: Alternative Views of Technology, User Experience, Virtual Environment, Design Science, Phenomenography.*

## 1 INTRODUCTION

The investments of information systems (IS) seldom meet their performance objectives (e.g., Bartis and Mitev 2008, Petter et al. 2008). The reasons are hardly purely technical, but they are related to IS users' needs and practices. Also in the product design business, the human-aspect and customers' needs are one of the central issues. The customers' needs are identified with interviews, focus groups and observations of existing products (e.g., Ulrich and Eppinger 2003). However, the process of negotiation about customers' needs is difficult, as it is multi-professional cooperation, in which the participants have different assumptions about the result (see, e.g., Davidson et al. 2001, Tiainen 2004).

We offer a tool for the negotiation process. So the nature of this study is design science as it is described by Hevner et al. (2004). By its terms, an application is made to the environment of furniture business. It is used by designers who need to show their furniture design to consumers for evaluating them. The created application is Furniture Fitting-Room with which virtual prototypes (VPs) can be presented in a virtual apartment. Furniture Fitting-Room is developed by our research group but implemented by virtual environment (VE) specialists and interior designers, furthermore, the furniture models came from furniture companies. We evaluate how consumers' understand virtual models by using phenomenography as a research approach. Our study utilizes scientific knowledge about people's understanding of product information (as Jiang and Benbasat 2007) and VE studies from human perspective (as Steuer 1992, Bowman et al. 2001). We add to the knowledge base the results of understanding VPs and user experience (UX) in VE, as well as methodological knowledge about using phenomenography in analysing user tests. (Figure 1.)

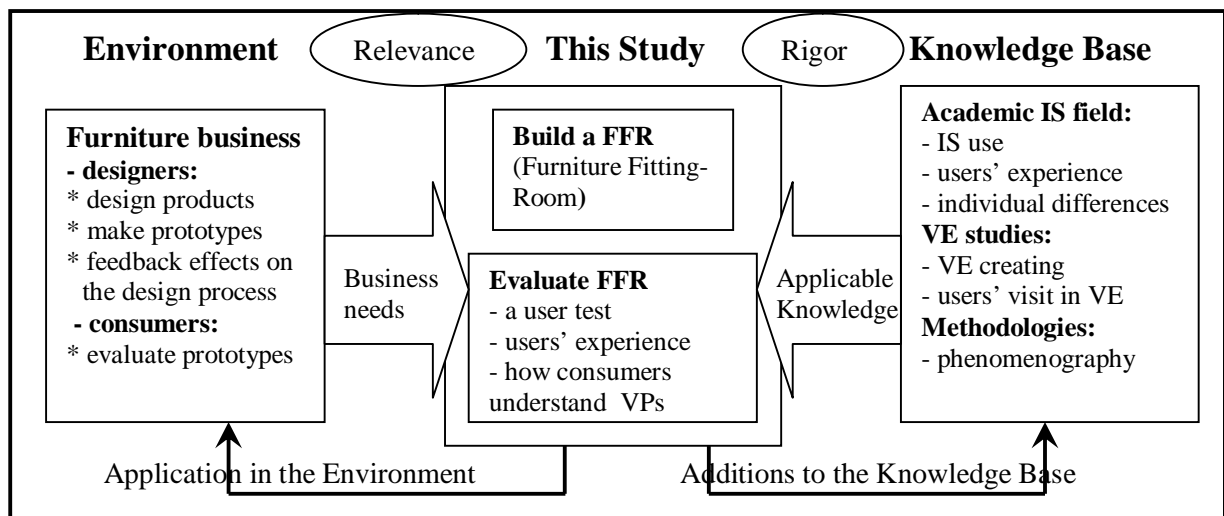


Figure 1. This study in the context of design science (based on Hevner et al. 2004).

We study occasional users' VE visits via the concept of UX. The concept means "a consequence of a user's internal state, the characteristics of the designed system, and the context within which the interaction occurs" (Hassenzahl and Tractinsky 2006). It is conceptualised by three facets by Hassenzahl and Tractinsky (2006), as presented in Figure 2. Each perspective contributes a facet to understanding of users' interactions with technology while sharing some arguments with other perspectives. The first facet, *beyond the instrumental*, includes in the first level traditional usability testing in human-computer interaction (HCI) research. Most often usability studies focus on simple, manageable measures at a micro level (Hornbaek 2006), such as the number of recalled products (Tiainen et al. 2007) and the time that a task takes in VE (Roberts et al. 2003). Besides of the instrumental level this facet could mean easiness of using VE technology and its interior harmony (Hassenzahl and Tractinsky 2006).

The second facet, *emotion and affect*, is mainly employed in the current UX research. It takes a human perspective by focusing on positive emotions, such as joy, fun and pride that deal with subjectivity and takes into account, for example, humans and their feelings (Hassenzahl and Tractinsky 2006). The third facet, *the experiential*, emphasizes two aspects of technology use: technology is situated and temporally-bounded. The experience is understood as a unique combination of various elements, such as the product and internal states of the user. (Hassenzahl and Tractinsky 2006.)

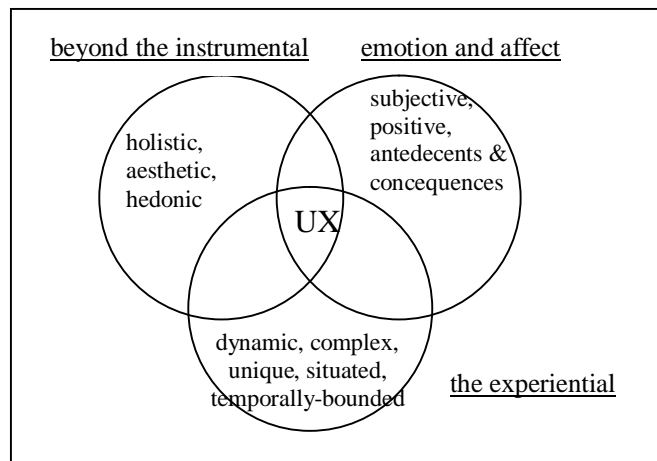


Figure 2. Facets of UX (Hassenzahl and Tractinsky 2006).

In this study, we focus on how consumers understand three dimensional (3D) VPs of products. This question relates to the UX research that has come to fill the gap between a usable and an engaging product. To study the differences among UX of VPs, we use phenomenography as the research approach. It is a qualitative approach focusing on a second-order perspective. We describe consumers' views on 3D VPs as perceived by a certain group of people (not by researchers). This is an appropriate approach when focusing on UX and its three facets (see Figure 2). With this kind of phenomenographical approach it is possible to understand the variety of conceptions of VPs. In practice, we as researchers ask the same question "what is the 3D VP of a product" and informants can freely form their answers. We also report the variation of informants' interpretations without evaluating their knowledge about VE or VPs. When the nature of the interpretations is understood, it offers building blocks for further UX research and for the use of 3D VPs in product design.

In this paper, we first describe the practical background of this study (a business related project) and the technical case situation (Furniture Fitting-Room as a virtual space for evaluation of 3D VPs of furniture). Second, we outline the phenomenographical approach and our research process in practice (the test setup, test users, and interviews). Third, we describe the results of this study: that is, the variation in consumers' interpretations of 3D VPs in VE. We found twelve conceptions which consumers use when talking about virtual products and three forms of thought which describe the alternative collections of conceptions. The forms of thought illustrate the understanding of VPs. Finally, we discuss the results in the context of UX.

## 2 PRACTICAL AND TECHNICAL BACKGROUND

We studied UX by using furniture VPs, since a piece of furniture embodies many meanings as a member of a design-intensive product category. Therefore, consumers have different desires and expectations concerning of the product (e.g., Hart 1996, Gilmore and Pine 1997), which provides promising research situations for studying subjective interpretations without one normative concept that all test users describe.

Our study is a part of a larger research project investigating alternative ways to present furniture prototypes to customers. One sub-project studied the traditional way, in which physical prototypes are presented, while our sub-project focused on the use of VPs. Twenty small and medium-sized furniture companies participated in the project and the furniture prototypes (both physical and virtual ones) came from them. VE was chosen as the alternative presentation environment, as only a minimum change is needed to the traditional setup for this. The traditional way is to present physical prototypes in a room, and a similar environment can be created to VE: a virtual room with VPs of their normal

size. In the case of furniture and interior, the feeling of space is important. That can be created better with immersive VE than with alternative display technologies (e.g., Gomez and Figueroa 2008). VE gives the user an immersive feeling of actually being in the apartment (Steuer 1992).

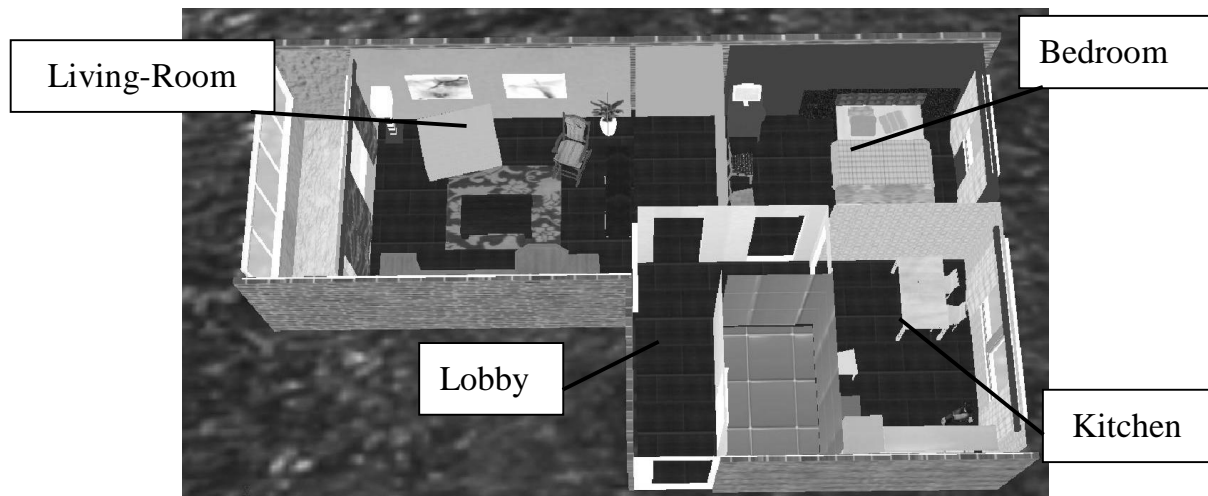


Figure 3. The apartment in the Furniture Fitting-Room used to present the VPs of furniture.

For presenting 3D VPs we used a Cave-like environment in a laboratory. As CAVE is a registered trademark, the term Cave-like environment is used of other cubic, walk-in VEs. In the VE laboratory used for the study, the height of the space is 2.4 meters and its other dimensions 3 x 3 meters. The space has five rear projection surfaces: three walls, a floor and a ceiling. The users' view is rendered according to his/her position and orientation. An active 3D stereo image is produced and a conventional Wand input device is used for the controlling movements.

In our case, the test users evaluated 3D VPs presented in the prototype of Furniture Fitting-Room. The virtual space consists of virtual furniture (3D VPs) and a virtual apartment with a living room, bedroom, and kitchen (see Figure 3). All the rooms are furnished with common furniture such as a sofa in the living room and a bed in the bedroom.

### 3 METHODOLOGY

As UX is subjective and situated (Hassenzahl and Tractinsky 2006), studying it requires a method which gives space to informants. Such methods are qualitative methods focusing on the empirical material without any a priori expectation. The starting point in our study was that we do not know how consumers view VPs, so we let them tell us about their experience. Furthermore, the analysis focuses on informants' own interpretations, without any theoretical framework being employed for the task. Facets of UX by Hassenzahl and Tractinsky (2006) are used for comparison, not as an analysis framework.

Among the possible approaches we chose phenomenography, since it aims to describe, analyse and understand conceptions held by informants (Marton 1982). Phenomenography differs from other same-kind approaches by its emphasizes to the diversity of understandings. According to phenomenographical principles, a conception refers to conceiving and understanding something. People create conceptions with respect to the external and internal horizons of the structural (what) aspect of a phenomenon dialectically merged with the referential (how) aspect of that particular phenomenon (Marton and Booth 1997). In phenomenography, the aim is to create a categorization in which the views differ from each other by the level of abstraction, so that the result can be presented as a hierarchy.

### 3.1 Test Users

As the aim of this study was to find out consumers' alternative interpretations, so for test users we wanted to have consumers, not students of technology, for example. For test users, we wanted to have adult consumers who have their own money to spend on furniture and who have a home to decorate. The aim in the selection of test users was to get consumers from different age groups, to avoid a bias of younger users, as in many studies (e.g., Tatnall and Lepa 2003). Also, earlier studies show gender differences in IT use and in consuming (e.g., Dholakia 2006, Rodgers and Harris 2003), so we decided to make the number of male and female test users as equal as possible. Furthermore, as our case concerns decoration, our aim was to have test users who were interested in decoration. In practice, this means that they were interested in buying furniture and other decoration items for their own home. The variation in the backgrounds was reached for getting alternative interpretations of VPs, not for testing whether the demographical differences were themselves the reasons for multiple interpretations, so the interviewees' backgrounds are not significant for the analysis.

Participation in the test was voluntary. The volunteers were asked to fill in a web form and to give some background information at the same. Altogether 68 consumers filled the form. We chose the interviewees with as broad variation based on their age and sex. We did not have any male volunteers of the age group 60-69 years, so we decided to take the oldest one; he belong to the age group of 70-79 years. However, there were no over 70 years old female volunteers. A brief description of interviewees' backgrounds is shown in Table 1. This may help the reader better understand the empirical base of this study.

We took 20 test users, as in prior phenomenographical studies twenty informants have been found to be a sufficient number for theoretical saturation (Alexandersson 1994, Sandberg 2000). After twenty user tests and the related interview analyses, we agreed that we had reached the saturation point, since the last informants did not contribute any new elements to the categorization.

Participants	Age (years)						Total
	20-29	30-39	40-49	50-59	60-69	70-79	
<b>Male</b>	2	2	3	3	-	1	<b>11</b>
<b>Female</b>	2	1	1	1	4	-	<b>9</b>
<b>Total</b>	<b>4</b>	<b>3</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>1</b>	<b>20</b>

Table 1. *The test users.*

### 3.2 Test Situation and Interviews

The test procedure included three parts: an introduction, a user test, and an interview right after it, furthermore, there were short breaks between the parts. All this was done individually. We planned the test situation carefully by following general user test rules (e.g., Rubin 1994; Dumas 2003). We also practised beforehand, since the research group worked together with each individual test user. A research assistant accompanied the user, conversed with him/her and guided in the use of the control unit. In the test there was also an operator who was responsible for the equipment, and a researcher who observed the test and interviewed the test users afterwards. Each test took about an hour.

The first part of the test use was an introduction, which included a presentation of the research process and a short (about 15 min) practical session on how to use a VE. This was needed, since the test users were not familiar with VE and as during the first VE experience the use of technology can dominate the users' attention (Tiainen et al. 2006).

The second part was the test use in Furniture Fitting-Room. It was video-taped. We asked the test user to think aloud and see if there were something interesting available. In each room, the test user needed to evaluate some variation of the furniture, for example, the sofa in the living-room in different materials. The visit to the Furniture Fitting-Room lasted from 15 up to 30 minutes.

After the VE visit, we collected the empirical material using individual theme interviews (conducted in March and April 2007). The researcher, who acted as an interviewer, observed the test situation, so that she knew how the interviewee's visit to the Furniture Fitting-Room had proceeded. The interview took place immediately after the user test. The main question was "what is the 3D VP of a product" and informants could freely form their answers. If the answer is something else than the understanding of actual product, we also report these interpretations according to the phenomenographical principles. The answer can be, for example, related to the VE experience. The progress of the interviews was quite similar in all of the interviews, although the duration varied from 20 to 45 minutes. The interviewer's role was to follow the interviewees' ideas and explore their narration. The atmosphere in the user tests and interviews was pleasant and friendly, which became evident from the participants' comments: many of them spontaneously expressed their willingness to return if similar user tests were to be arranged in the future.

### 3.3 Analysis

Although VE visits were video-taped, for this study we analysed only the interviews. In the analysis we followed the norms of phenomenographical studies, which say that categorizations are made from those utterances by which informants describe their perceptions, experiences and concepts. These utterances result from a process by which an individual gives meaning to a certain phenomenon. There are no right or wrong conceptions in phenomenography: so all the expressions were incorporated into a pool of meanings formed by the data (Marton and Booth 1997). The analysis focuses on two components in the informants' experiences. How aspect focuses on the referential component, which describes what the phenomenon means in everyday language, and what aspect focuses on the structural component, which refers to a deeper level of the phenomenal meaning of how aspect (Marton and Booth 1997).

Before starting the analysis, the interviews were transcribed. The length of the interview transcripts varied from six up to eleven pages with a single line spacing, so altogether they made up 157 pages. The analysis started with reading through the whole material in order to find all the aspects of the informants' conceptualizations. At first, the focus in the analysis was on the referential component, which focuses on what the interviewees meant with 3D VPs of furniture in the level of everyday language. The interview texts were split in small items, and the texts were categorized in order to obtain a single dimension of the categorization. The analysis continued with focusing on the structural component of VPs. The structure is constructed by analysing the target of the referential component: for example, what the interviewee is talking about, as he/she describes the textile fabrics of a chair or colors of a sofa or a living-room.

The analysis was an iterative process. We conducted six analysis rounds including comparisons and cross-checkings with the whole material so that, finally, our categorization represented the interviewees' views. Having found the conceptions to describe the VPs, we analysed which of them each test user used in their description. This analysis reveals the set of conceptions employed, giving an idea about the wideness or scope of thinking, and about alternative perspectives that were used.

## 4 RESULTS

The result shows how consumers interpret VPs of products. The informants could freely form their answers and we as researchers focused on their narration. The answer can be besides of actual product, for example, related to the experience of 3D VPs or the experience of VE. The phenomenographical result of this study is described by two layers. The first layer includes twelve different conceptions by which consumers talk about VPs. The second one includes three thought models which are combinations of conceptions: consumers use them when describing VPs.



C	<b>One product in an environment</b>	Conception 1C	Conception 2C	Conception 3C	Conception 4C
B	<b>One product</b>	Conception 1B	Conception 2B	Conception 3B	Conception 4B
A	<b>One part of a product</b>	Conception 1A	Conception 2A	Conception 3A	Conception 4A
↑	<b>Referential aspect</b>	<b>As a technical implementation</b>	<b>As a photograph of a product</b>	<b>As a concrete product</b>	<b>As a desired or disliked product</b>
	<b>Structural aspect</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>

Table 2. *The categorization of consumers' conceptions on 3D prototypes of furniture presented in the Furniture Fitting-Room.*

	<b>Conception</b>	<b>Content illustrated with an example from the interview</b>
A: One part of a product	1A (technology)	Consumer 15: When I looked at the textile fabrics on the chair, the model vibrated so much that I didn't get a proper idea of shapes or threads.
	2A (photograph)	Consumer 8: The general picture is very accurate. When I try to focus on details of a piece of furniture I need more sharpness to the picture.
	3A (product)	Consumer 19: In the bedroom, it was easy to see how different colours and materials in bedstead work. It is a very different experience if you see only a piece of something and somebody says that also this colour is possible.
	4A (taste)	Consumer 17: The sofa in the living-room was such a cube. Maybe it was the idea. However, I didn't evaluate that sofa at all because it didn't appeal to me. It was so featureless.
B: One product	1B (technology)	Consumer 5: It was easy when I didn't have to move by myself. At some point, I could see through a piece of furniture.
	2B (photograph)	Consumer 11: I think that this virtual picture should be like a photograph. Then it would give a more realistic sense of a piece of furniture.
	3B (product)	Consumer 2: There were two chairs. I had a realistic feeling that I could sit down on the first chair but not on the second one. It was uncomfortable to sit because it didn't have any support for my lumbar region.
	4B (taste)	Consumer 4: Because I think that the rocking chair doesn't fit in my home I didn't look at it such a way.
C: One product in an environment	1C (technology)	Consumer 7: I would like to evaluate a piece of furniture in a room where I were to place it - and I'd hope that the texture of the model were more realistic.
	2C (photograph)	Consumer 2: Maybe I can interpret these pictures given more time. I would like to have a real photograph in here. I could then see the bookshelf and outline the space needed in the living room.
	3C (product)	Consumer 1: I think that there were many corners in the bedroom and the bed didn't fit in the interior. The bed isn't bad as such, and I think it is a nice bed to sleep.
	4C (taste)	Consumer 4: In the living-room, the interior design was gaudy and the curtains and carpet were really disturbing for the evaluation of any of the furniture.

Table 3. *The contents of the conceptions illustrated with examples from the interviews.*

#### 4.1 First Layer: Conceptions

We identified twelve different conceptions by focusing on referential and structural aspects. Besides of presenting the final categorisation (Table 2) we also illustrate the contents of the conceptions by presenting some examples from the interviews (Table 3).

The referential aspect includes three alternative objects, which differ by their scope. The narrowest scope is possessed by Object A: One part of a product. An example of it is an interviewee's pondering whether the backrest of the rocking chair is high enough. Object B, One product, focuses on a piece of furniture, for example, to a table and its attributes, as whether the table seems steady. The third object, C: One product in an environment, focuses on a piece of furniture as a part of interior. It deals with, for example, judgments about whether some wallpaper colors play well together with other colours in the room.

In the structural aspect, there are four levels of 3D VPs of furniture: (1) a technical implementation, (2) a photograph of a product, (3) a concrete product, and (4) a desired or disliked product. The first hierarchical level is about advantages and disadvantages of graphical implementation. The interviewees often use words like "model" or "texture", which belong to the context of technology. Examples of narratives are interviewees' pondering how it is possible to walk through VPs or what kinds of programs were used.

On the second level, the model of a product is discussed as a traditional photograph or a picture in a catalog. The interviewees compare the image in VE to a picture; they said, for example, that the quality of the virtual model does not reach that of photographs. The difference of two first levels is that on the first level the interviewee focuses on (technical) implementation and on the second level, on the (picture of a) product. On the third level, the focus is on 3D product. The interviewee describe a piece of furniture as it were a concrete one. On this level, a piece of furniture is evaluated as a physical piece of furniture (as a concrete product).

The fourth level consists of evaluation of the product or interior based on personal taste. Sometimes the interviewee, disliking some models, claimed being unable to evaluate that piece of furniture at all or just ignored it. However, this kind of statement nevertheless reveals that the person is interpreting the image as furniture and thus did evaluate it. This level differs from others by a lack of comments being regarded as negative – when the test user did not like something, he/she did not comment on anything more about it.

#### 4.2 Second Layer: Forms of Thought

On the second layer, we describe the interviewees' conceptions as different levels of understanding the phenomena which in this case is VPs. This is in accordance with the primary idea of intentionality in phenomenography: some conceptions form more comprehensive understandings than others. The more comprehensive forms of thought often tacitly imply the understanding of more partial understandings (Marton and Booth 1997). The result is shown as a hierarchical categorization, in which the higher level including the lower levels. A person is located to one level, reflecting the highest form of thought he/she has.

↑	<b>C: One product in an environment</b>			FORM III: context
	<b>B: One product</b>		FORM I: picture	FORM II: product
	<b>A: One part of a product</b>			
		<b>1: As a technical implementation</b>	<b>2: As a photograph of a product</b>	<b>3: As a concrete product</b>
				<b>4: As a desired or disliked product</b>
		→		

Table 4. The hierarchy of the interviewees' individualised forms of thought.

Form	I. A picture of a product via new technology	II. A separate product	III. A product in its context										
Example	Consumer 10				Consumer 3				Consumer 1				
	C	1	-	-	C	-	1	-	C	-	3	4	1
	B	2	1	-	B	2	1	1	B	1	2	3	-
	A	1	1	-	A	3	-	1	A	-	1	1	-
	1	2	3	4	1	2	3	4	1	2	3	4	

Table 5. The way individual consumer's conceptualisations form a layered meaning structure concerning VPs of furniture. Missing number means missing expression(s).

We identified three forms of thought about 3D VPs of furniture (Table 4). They are presented based on the first layer (i.e., referential and structural aspects), since their construction is based on that layer. To illustrate the second layer, Table 5 presents three individualised forms of thought by the interviewees (each table giving an example of one type of the form).

Form I (A picture of a product via new technology) focuses on technology development, as in it the interviewees concentrate on the quality of presentation technology and other technology centred issues. The persons of this level talk only about technology when describing VPs. Form II (A separate product) focuses on separate products, and also includes Form I thought models. The thought model of Form II means that a person thinks of and evaluates separate products when seeing VPs, ignoring technological issues as well as the room space and its interior. Form III (A product in its context) is the highest form as it connects the products to their context – in our case furniture to an interior. However, the use of this form is connected to the interviewees' taste; when the product of the interior of the room did not agree with the test users' taste, they refused to discuss anything else than the clash between the room's (or product's) appearance and the test users' view of a pleasant interior (or product).

## 5 DISCUSSION

Our paper describes the differences in consumers' understanding of VPs of products. Twenty test users evaluated furniture VPs in a virtual apartment. We observed the test situation and interviewed the test users. In the analysis, we identified different ways to view VPs. All qualitative studies contain certain validity challenges. In our study we followed Klein and Myers (1999) principles to enhance the validity of our study. Our results will contribute for further UX research that is discussed in the following.

### 5.1 Consumers' Conceptions on VPs vs. UX Facets

The results of our test use deal with consumers' conceptions on 3D VPs of furniture (see Table 2) and interviewees' individualised forms of thought (see Table 4). For extending the outcome to the UX field, we connect the results to the facets of UX by Hassenzahl and Tractinsky (2006).

The first facet is *beyond the instrumental*. Form I from our results belongs to this facet and includes viewing 3D VPs as a *Technical implementation* and as a *Photograph of a product*. This technology-centred way to think is common among technologists (e.g., Davidson et al. 2001). Furthermore, some parts of as a *desired or disliked product* can be located to *beyond the instrumental*, since in it the goal is to create beauty and harmonic (Hassenzahl and Tractinsky 2006). However, those test users who mentioned their personal taste, explained that the interior or furniture clashed with it, and that they did not find the interior nice or beauty.

The second facet is *emotion and affect*, which focuses on the feelings that the use of a product create. One can expect that in this facet the test users find some of the Furniture Fitting-Room parts as game-like; for example, they may enjoy changing the colours and texture of furniture. This fun-like that in described by Hassenzahl and Tractinsky (2006) was not encountered to be the case by the users during the analysis. However, our result as a whole expresses emotion and affect. Mainly the informants gave evidence to strong emotional relationship to the simulation, although it in some cases the relationship was negative.

The third facet is *the experiential*. It is a temporary context related use situation. The experience is affected by users' state of mind and expectations (Boehner et al 2007). This facet was encountered in our results in *Form III*: the test users feel like being in a space (in a room), describing *a product in an environment* by focusing on a concrete product or their own taste (see Table 4). The understanding by the Form III is close connected to the feeling of telepresence, which is a target in the VE studies (see studies of, e.g., Steuer 1992, Bowman et al. 2001 & 2004, Sander et al. 2006).

## 5.2 Limitations and Future Research

As we investigated UX by test users' understanding of VPs, we describe only some parts of UX. Our starting point was users' own interpretation, not a theoretical understanding of UX. On the other hand, our solution opens a new perspective among UX studies: giving space to informants' experience.

However, the target of our study was to focus on occasional VE users' experience. Still, further studies from different perspectives are needed. We focused on identifying how users' experience VE, but we did not study any casual relationships. Further studies are needed to study them: connecting both personal backgrounds to the UX and situational and temporal issues to it.

We studied UX with one case: evaluation of VPs with one technical environment. Alternative situations (e.g., a larger apartment) with an alternative presentation technology (e.g., with a better 3D image) could give more versatile UX. This could give the test users a better understanding of their own experience by changing their expectations of a VE visit and VP evaluation situation. Furthermore, this kind of research situation could provide an opportunity for comparative research.

## 5.3 Contributions to UX Research

Hassenzahl and Tractinsky (2006) note that "the absence of empirical research – whether qualitative or quantitative – impedes theoretical advancement and restricts our understanding of UX as concept and its further development". However, the research so far has been described as technology-driven (Boehner et al. 2007). Our paper provides empirical research results to advance the research on UX. Overall, the results of this study have provided an example of a case where test users were able to understand and evaluate presented VPs and where UX was described mainly positively in informants' narration.

The other contribution of our study is methodological. Based on our study, the phenomenographical approach is found promising for studying UX for the following reasons. The UX consists of smaller experiences and the UX is in each use case unique, because the user's internal state, the use context, and the system are dynamic (Hassenzahl and Tractinsky 2006). In our study, the reference period include one visit in a VE laboratory. It should be kept in mind, however, that the previous use cases in similar situations clearly affect user's expectations for the examined UX, and, together with information and perceptions received from other sources, build up an attitude towards virtual product presentations in general. Phenomenography allows informants to tell about their experiences in their own words, and it is possible to spot informants' expectations in their descriptions. This can be called also reaching the diversity of understandings that is the main issue in phenomenographical study.

The phenomenographical approach places researchers in a "learning role" within the informants and their context. This means that the researcher has to be humble to understand how the interviewee sees

the phenomenon under study in reality. Like an apprentice and independent craftsman, the interviewer has to learn from the interviewee. The researcher has to listen and accept also understandings different to her/his own without trying to correct the interviewee's conceptions (Marton and Booth 1997). A researcher who takes this approach wishes to get a deep understanding about how people view things, about the underlying causes, nuances and details. In this way, phenomenography merges research and praxis, and thus the informants' answers are not disconnected from the context. In the UX research, to find the key to UX evaluation, a proposal has been made to analyse whether the product meets the expectations that the user had before starting to use it (Hassenzahl and Tractinsky 2006). With the phenomenographical approach also this aspect can be gauged: in our results, the UX is understood as a unique combination of various elements, which extends over time.

## 6 CONCLUSION

This paper presents a study about Furniture Fitting-Room. The nature of this study is design science as we created an application for presenting VPs in a virtual apartment and organized user tests for evaluating VPs. By using phenomenography as a research approach we reached the variation among the test users' UX in evaluating VPs. We created categorization of test users' interpretations by two aspects. The referential aspect includes the wideness of the focus in description varying from one part of a product to one product and even to a product in an environment. The other aspect refers to the structural side of the conceptions. Based on these categories we identified how consumers think about VPs. The result consists of three hierarchical forms of thought. They are viewing VPs as a picture, a product, and a context.

As previous studies (e.g., Jiang and Benbasat 2007) have suggested, there are many different types of virtual product experiences in VEs. UX is connected to user's form of thought about VPs. The first of our forms *Picture* does not consist of many experiential product features while the other two forms do. Besides of user's understanding, also the type of presented product effects on UX. Furniture is an example of highly experiential products. Some other products are more technical and their functions are the central issue, so the UX with such VPs differ from our case. Therefore, we state that our findings are most appropriately generalizable to presentations for experiential type of products.

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