Experiencing Products Virtually: The Role of Vividness and Interactivity in Influencing Mental Imagery and User Reactions

Completed Research Paper

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Abstract

Evaluating products in virtual environments is constrained by the inability of e-commerce to provide a touch-and-feel experience compared to the way to experience products in traditional retail stores. Research has shown that this limitation could be reduced by enabling users to experience products virtually by providing a stimulating virtual product experience, which is reflected in the degree of mental imagery due to the vividness and interactivity of the online product presentation. In this paper we analyze the impact of the vividness, in terms of a two-dimensional versus three-dimensional product presentation, and of the interactivity, in terms of a mouse versus a touch-screen as input device, of the virtual product experience on mental imagery and further user-related outcomes. The results show that mental imagery is positively influenced by the use of a touch-screen, while three-dimensional product presentation had a positive impact on emotions, attitude towards the product, and purchase intention.

Keywords: Interactivity, vividness, virtual product experience, touch-screen, pictorial product presentation, mental imagery

Introduction

Online shopping constitutes an indirect product experience that is mediated by the internet and computer technologies. In real-life stores, consumers are able to experience products directly which results in a more positive attitude towards the products than from indirect product experiences without feeling, touching, or sampling products like in an online store or in a catalogue (Kempf and Smith 1998). However, some online stores offer specific product presentations to simulate a real-life experience with a product. For example, virtual models are dressed by users with the clothes that interest them, replacing somehow a real-life dressing room by providing a highly vivid virtual product experience. In this context, also three-dimensional (3-D) presentations can support users to inspect products in a way that is at least similar to the product experience in brick-and-mortar stores due to a higher vividness of the virtual product experience compared to two-dimensional (2-D) product representations (McGill and Anand 1989). Moreover, products can be rotated and enlarged, or users can navigate through a 3-D environment. The resulting positive effect of such a more vivid product presentation compared to a two-dimensional representation of the product on e.g., users' attitude formation is often attributed to mental imagery (Kisielius and Sternthal 1986; McGill and Anand 1989).

Research on mental imagery has been concerned with how a stimulus (e.g., advertising) should be designed to trigger the memories or fantasies of users, which in turn influence their evaluation of products (MacInnis and Price 1987). For example, an early study showed that it is more effective to ask consumers to imagine the use of a cable television service than to simply name rational arguments for this service (Gregory et al. 1982). Despite the large number of studies on mental imagery, there is still a lack of knowledge about the influencing factors of mental imagery in virtual environments and how mental imagery influences the virtual product experience and further psychographic and behavioral outcome variables e.g., the users' emotions while experiencing products online as well as their purchase behavior.

Currently, online shopping is changing fundamentally because of the diffusion of new mobile devices such as tablets and smartphones (Radwanick and Lipsman 2012; Rainie and Smith 2013). Tablets are primarily used for personal media consumption and to browse or to buy from online stores from the couch, the bedroom or the kitchen (Müller et al. 2012). However, one of the most important features of this mobile technology is the touch-screen. Touch-screens are direct input devices that require fewer cognitive resources compared to indirect input devices, such as a computer mouse, because they can be operated intuitively and allow a more fluid interaction in that no artificial input device is used (Greenstein 1997, Shen et al. 2006). Touch interaction could be considered as one of the major strength of tablet computers or smartphones as it eases the use of the input device and provides a higher interactivity compared to the use of a computer mouse (Steuer 1992). Therefore, this higher interactivity should positively influence mental imagery by enhancing the virtual product experience due to a more direct product experience and should have an impact on the users' product evaluation. But, until today, the influence of touch-screen technology of e.g., tablet computers or Smartphones on online shopping experience has not been substantially explored (Müller et al. 2012).

With regard to the previous discussion, the aim of this study is to examine whether the use of touch-screens and 3-D product presentations offer a stimulating virtual product experience by supporting users' mental imagery of products in online environments and if this results in positive effects for online retailers. To the best of our knowledge, this is the first study investigating the impact 3-D product presentations and touch-screen interaction on mental imagery and further user-related outcome variables in an online shopping context. For example, Hong et al. (2004) tested the effect of flash animations which can be considered as a vivid form of presentation on online users' attention, their recall of specific website elements and their attitude towards using the website. Jiang and Benbasat (2007) conducted an experiment that allowed online users to sample product functions of a sports watch and a PDA. They used static images, videos (with and without narration) and a functional web-based application simulating watch and PDA to manipulate vividness and interactivity and found that both aspects influence the efficacy of online product presentations, but they did not consider the potential influence of vividness and interactivity on as well as the potential mediating impact of mental imagery on further user-related outcome variables of online product presentations. Moreover, in the mentioned studies only 2-D product presentations and only mouse as an input device were used.

Hence, the present study contributes to knowledge in the field of human behavior and IS, especially in an online shopping context in numerous ways: We transfer the framework for the investigation of the impact of advertising-evoked visual imagery on user-related outcome variables proposed by Burns et al. (1993) to an online shopping context and systematically manipulate the predictor variables vividness (in terms of 2-D vs. 3-D product presentations) and interactivity (in terms of mouse vs. touchscreen as input device) in a 2x2 Between Subject Design. More precisely, we expand the findings of previous studies in the field of human behavior and IS by analyzing 1) how three-dimensional product presentation and 2) touch-screen interaction will influence mental imagery and users' emotions, their attitude towards the product, and purchase intention. As previous research has shown, mental imagery could be considered as a mediator between stimulus and response (Burns et al. 1993; Knäuper et al. 2009), we 3) analyze the mediating impact of mental imagery on the relationship between vividness, interactivity and users' emotions, their attitude towards the product, and their purchase intention. 4) We further control for potential moderating impact of the users' touch-screen expertise and their involvement towards the product category on the relationship between the experimental factors and mental imagery.

Theoretical Framework and Hypotheses Development

The present study investigates the impact of two functional mechanisms of online product presentations, namely, interactivity and vividness on mental imagery and further outcome variables. We transferred the framework for investigating moderator and mediator effects of advertising-evoked visual imagery proposed of Burns et al. (1993, p. 74) to the context of our experimental study. Jiang and Benbasat (2007) based their study on the impact of vividness and interactivity on a similar framework, but did not consider the impact on these constructs on mental imagery. Burns et al. (1993) propose that predictors as factors manipulated might create desired effects in users such as positive experienced emotions, a positive attitude and a behavioral intention and that these relationships are mediated by mental imagery. Specifically, the proposed research model is presented in Figure 1.

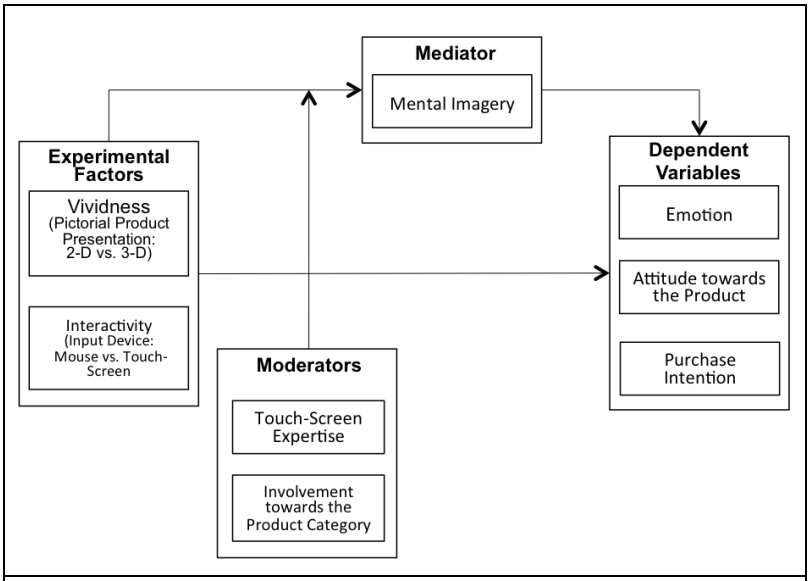

Figure 1. Research Model

Vividness and interactivity act as independent variables in our framework. Interactivity is defined as "the extent to which users can participate in modifying the form or content of a mediated environment in real time" (Steuer 1992, p. 84). Vividness is "the representational richness of a mediated environment as defined by its formal features; i.e., the way in which an environment presents information to the senses" (Steuer 1992, p. 81). In the experimental study vividness is manipulated by different pictorial product presentations on a website (2-D vs. 3-D), and interactivity by different input devices (mouse vs. touch-screen). In our study, according to Jiang and Benbasat (2007), these two major features correspond to

two independent and distinct facets of the virtual product experience, respectively: The way in which users interact with products via the input device (interactivity) and the representational quality of how product information is conveyed to users due to the pictorial product representation (vividness). According to Li et al. (2002) and Yoon et al. (2008) both factors influence the virtual product experience and hence, should also have an effect on mental imagery due to the perception of a more vivid and more interactive online product presentation. With regard to Babin et al. (1992), we included the users' experienced emotions while interacting with a product on a website, their attitude towards the product as well as purchase intention as dependent variables in our research model. These variables are important outcome variables of mental imagery evoking online product presentations and are also influenced due to the vividness and interactivity of online product presentations (Éthier et al. 2006; Park et al. 2005). Furthermore, in line with previous research, mental imagery serves as a mediating factor, operating to accentuate or attenuate the effects of vividness and interactivity on the dependent variables under research (Elder and Krishna 2011; McInnis and Price 1987). Last but not least, according to Burns et al. (1993) and Coyle and Thorson (2001) involvement towards the product category and touch-screen expertise might act as moderators of the strength of the relationship between vividness and interactivity on mental imagery. In the following, a detailed discussion of the constructs under investigation is presented and hypotheses are derived and tested in an experimental study.

Mental Imagery

Richardson (1969, p. 2) defines mental imagery as "(1) all those quasi-sensory or quasi-perceptual experiences of which (2) we are self-consciously aware and which (3) exist for us in the absence of those stimulus conditions that are known to produce their genuine sensory or perceptual counterparts". The aim in providing users with a virtual product experience is to evoke a vivid mental image of the positive use of a product that in turn influences the users' evaluation of the product and the willingness to buy. For example, Babin and Burns (1997) analyzed advertisements for a product that demonstrated concrete use and another that demonstrated less concrete use of the product. The advertisements showed a car driving along a curve (concrete use) and the latter showed three close-ups of the car (less concrete use). The concrete use representation results in higher mental imagery and a clearer and richer mental representation of the car. In a similar experiment, Miller and Stoica (2003) demonstrated that the use of a photograph of a product increases both the liveliness and quantity of mental product representations.

Past research has identified vividness and interactivity as important determinants of mental imagery (McGill and Anand 1989; Naimark 1990; Rheingold 1991). Studies on virtual product experience agree that vividness and interactivity are the two most important factors that foster a more direct perception of a product in a virtual environment (Jiang and Benbasat 2007; Li et al. 2002; Yoon et al. 2008).

Vividness

The way in which users virtually experience products is influenced by the vividness of the virtual product presentation (Jiang and Benbasat 2005). Nisbett and Ross (1980) described vividness as the extent to which information is 1) emotionally stimulating, 2) concrete and imagination stimulating, and 3) sensory, temporally or spatially close. Therefore, vividness is closely related to the sensory richness of a medium that is formed by sensory breadth and sensory depth (Steuer 1992). Sensory breadth is defined by the number of sensory dimensions that are presented simultaneously. Sensory depth describes the quality of a presentation which is related on how closely a medium can replicate and stimulate parts of the human sensory system. Based on this understanding of vividness, in an online environment a vivid website should consist out of sensorially rich content that stimulates a user's senses which should positively influence the virtual product experience as this should be more similar to a direct product contact in an offline environment (Coyle and Thorson 2001). In this context, research on virtual product experiences has been concerned with how a more concrete product experience can be achieved through vividness of product representations within an online environment (Jiang and Benbasat 2005; Li et al. 2001; Park et al. 2008). Some popular approaches are virtual environments in which users can virtually enter a car and take a panoramic view of the interior. In these examples, users can experience products in a similar way to real life, i.e., the web interface simulates a more direct product experience which should lead to a higher degree of mental imagery (Jiang and Benbasat 2007; Li et al. 2001). According to the findings of the mentioned studies, the effect of vividness on mental imagery in an online environment strongly depends

on the pictorial representation of an object. Therefore, a more realistic 3-D product representation with greater sensory depth than a 2-D could be considered as more vivid which should positively influence a user's mental imagery. Overall, drawing on the vividness of the pictorial representation, a 3-D presentation of the virtual product experience will positively influence users' mental imagery in a virtual environment. Therefore, we hypothesize:

H1a: A high (vs. low) vividness of the virtual product experience, in terms of 3-D (vs. 2-D) product representations, will lead to a higher (vs. lower) mental imagery

Interactivity

From a technical perspective, interactivity is a specific property of a medium. In this context, the user's perception of interactivity depends on the degree of how a user can modify the form and the content of a mediated environment (Steuer 1992). A prominent part of research on human behavior and IS is concerned with the question, which input devices allow for the direct, realistic and cognitive resource-saving use of computer systems. Indirect devices such as a computer mouse, trackballs, joysticks and graphic tablets are controlled independently of the screen and are moved to points on the screen. With indirect input devices, users have to perform a mental translation between their physical movement and the movement of a pointer. For example, the mouse has to be moved forward to move the cursor on the screen up, and the user has to mentally translate the motion because a small movement with the mouse leads to a larger movement on the screen (Hinckley 2008; Shneiderman 1987; Shen et al. 2006). Direct input devices such as touch-screens are operated directly on the screen's surface, using a pen or a finger and could therefore be perceived as more interactive compared to indirect input devices. The input is generally faster, and the operation is more intuitive, especially for unskilled users (Shen et al. 2006; Shneiderman 1987). For example, on a touch-screen, the user simply taps with a finger on an item to select it. Another advantage of touch screens is that no artificial control unit must be handheld which should positively influence the users' perception of interactivity.

Elder and Krishna (2011) show that simple motor activity with the hands such as holding a spring-loaded clamp that is used to hold objects together may impede the effect of a visual stimulus. Additionally, Shneiderman (1987) assumes that less interactive indirect pointing devices such as mice generally require more cognitive processing and eye-hand coordination than direct input devices. The necessary motor activity of moving the mouse must be mentally transferred to the movement of the mouse pointer on the computer screen. This should lead to a higher cognitive load which might reduce the cognitive capacity and decrease mental imagery while evaluating a product in a virtual environment (Lei and Wong 2009; Shen et al. 2006). Touch-screens should reduce the cognitive load of the interaction and therefore positively influence mental imagery. Hence, we assume:

H1b: A high (vs. low) interactivity of the virtual product experience, in terms of touch-screen (vs. mouse) as input device, will lead to a higher (vs. lower) mental imagery.

The Moderating Effects of Touch-Screen Expertise and Involvement

According to Alba and Hutchinson (1987, p. 411), user expertise could be defined as "the ability to perform product-related tasks successfully". These authors propose that the advantages of expertise for users are among others reduced cognitive effort and automaticity. Applied to the use of a touch screen as an input device this means that users who are not accustomed to touch screens need to focus on operating the input device, which should lower the cognitive capacity to evaluate products and hence, should be reflected in a lower degree of mental imagery, while expert users can concentrate on the product presented online due to an automatically use of the touch-screen as input device, which in turn should positively influence mental imagery. Hence, we hypothesize:

H2: Touch-Screen expertise moderates the hypothesized relationships between a) vividness and b) interactivity of the virtual product experience on mental imagery.

Past research has demonstrated the importance of involvement for determining the persuasive influence of advertising messages and of pictures on consumer product evaluations and behavior (Miniard et al. 1991). Consumers' involvement can be regarded as their perception of personal relevance of a product category (Zaichkowsky 1985). The operationalization of involvement towards the product category as a

potential moderating effect is often applied in empirical research (Eroglu et al. 2001; Petty et al. 1983; Miniard et al. 1991). In this study we examine the moderating impact of the involvement towards the product category, which is an enduring phenomenon that is mainly based on past consumption experiences with the products from the same product category (as opposed to situational involvement, e.g., Celsi and Olson 1988).

According to the Elaboration-Likelihood-Model (ELM, Petty and Cacioppo 1986) involvement is of crucial relevance for a user's information processing and the degree of cognitive elaboration and the persuasive impact of the processed information (Celsi and Olson 1988; Swinyard 1993). The ELM distinguishes two routes for information processing, the central and the peripheral route (Petty and Cacioppo 1986). The central route is taken when a user has a greater motivation to carefully inspect all relevant cues. In contrast, a user with a lower motivation will process information on the peripheral route and will not inspect all relevant cues. Thus, highly involved users should follow the central route and allocate more cognitive resources to judge the cues provided, which should be reflected in a higher degree of mental imagery compared to low-involvement users who follow the peripheral route. Therefore, we assume:

H3: Involvement moderates the hypothesized relationships between a) vividness and b) interactivity of the virtual product experience on mental imagery.

Consequences of a More Vivid, a More Interactive Virtual Product Experience, and Mental Imagery

Experiencing a product in a vivid and interactive virtual environment will not only have an effect on mental imagery but also on further user-related outcome variables (Burns et al. 1993; Coyle and Thorson 2001; Éthier et al. 2006; Park et al. 2005), as depicted in our research model.

Effects of the Virtual Product Experience on Emotion

Research in the field of human behavior and IS have shown that a user's experienced emotions when visiting an online shop will have an influence on evaluation processes and could also impact satisfaction with the product (Babin and Burns 1997; Seta et al. 1994; Zhou et al. 2007). The findings of Jiang and Bensabat (2007) show that functional product presentation which enables users to explore and experience different features and functions of products will have a positive effect on the user's experienced emotions while interacting with the product. In this context, a 3-D product presentation is more functional than a 2-D representation, which should lead to the stronger experience of positive emotions while evaluating a product on a website (Park et al. 2005; Park et al. 2008). Beside this potential positive effect of a more vivid virtual product experience, previous research has shown that emotions could also be influenced by interactivity. The results of Éthier et al. (2006) and Lee et al. (2007) show that innovative ways to handle the evaluation of a product on a website could evoke positive reactions on the users' emotional state. Therefore, interacting with a product on a website by using a highly interactive direct input device like a touch-screen should lead to stronger positive emotions compared to the use of an indirect input device, e.g., a computer mouse. Hence, we assume:

H4a: A high (vs. low) vividness of the virtual product experience, in terms of 3-D (vs. 2-D) product representations, will positively (vs. negatively) affect the users' emotions.

H4b: A high (vs. low) interactivity of the virtual product experience, in terms of touch screen (vs. mouse) as input device, will positively (vs. negatively) affect the users' emotions.

Effects of the Virtual Product Experience on the Attitude towards the Product

If users interact with products on a website, the way the product is presented will affect their virtual product experience as well as their evaluation of different product attributes which would have an impact on the attitude towards the product (Hassanein and Head 2007). With regard to Park et al. (2005), it can be expected that a more vivid product presentation due to a 3-D pictorial representation of the product will have a positive impact on the users' attitude towards the product by easing the evaluation of several product attributes due to a more realistic product presentation (Kisielius and Sternthal 1986). Furthermore, the way in which a user interacts with a product on a website could also have an impact on the users' attitude. For example, interacting with the product through a more interactive input device (a touch-screen) should stimulate cognitive elaboration and lead to a more realistic impression of the

presented product which could have a positive impact on the users' attitude towards the product (Childers et al. 2001; Kiesielius and Sterntahl 1986). Thus, we hypothesize:

H5a: A high (vs. low) vividness of the virtual product experience, in terms of 3-D (vs. 2-D) product representations, will positively (vs. negatively) influence the users' attitude towards the product.

H5b: A high (vs. low) interactivity of the virtual product experience, in terms of touch screen (vs. mouse) as input device, will positively (vs. negatively) influence the users' attitude towards the product.

Effects on the Virtual Product Experience on Purchase Intention

A 3-D product presentation enables the user to visually inspect the product in a better way compared to a two-dimensional representation on a website by providing richer product information (Elder and Krishna 2011). The ability to comprehensively inspect a product is especially relevant in consumer decision making when purchasing touch-and-feel products (e.g., fashion products) online (Kim and Kim 2004). Three-dimensional presentations as well as a more direct way to interact with the product online will provide more sensory product information than two-dimensional presentations. This will alleviate the online product evaluation which will reduce the perceived risk to make a bad purchase decision (Li et al. 2002). Therefore, the virtual product experience will have an effect on the users' intent to purchase the product. Hence, we hypothesize:

H6a: A high (vs. low) vividness of the virtual product experience, in terms of 3-D (vs. 2-D) product representations, will positively (vs. negatively) influence users' purchase intention.

H6b: A high (vs. low) interactivity of the virtual product experience, in terms of touch screen (vs. mouse) as input device, will positively (vs. negatively) influence the users' purchase intention.

The Mediating Effects of Mental Imagery

Previous studies have found that the strength of an effect of a stimulus (e.g., a product image on a website) on different outcome variables could be affected by mental imagery (Babin and Burns 1997; Elder and Krishna 2011). Knäuper et al. (2009) show that mental imagery could be considered as a mediating variable between stimulus and response. The findings of Burns et al. (1993) provide empirical evidence that mental imagery mediates the effects of several advertising stimuli on e.g., emotion, attitude towards the product, and purchase intention. In line with this stream of research, we control for the mediating effect of mental imagery on the outcome variables of our study. Hence, we assume:

H7: Mental imagery mediates the hypothesized relationships between vividness and interactivity of the virtual product experience on the users' a) emotions, b) their attitude towards the product, and c) purchase intention.

Empirical Study: Method and Procedure

Method

We tested our hypotheses by using a 2x2 between subject design and manipulated vividness (factor 1: low vs. high) and interactivity (factor 2: low vs. high) on four websites. We used photographs of a beige leather purse from the fashion brand Liebeskind/Berlin as product stimulus. In addition to the product name of the purse (Flora beige), we did not provide any additional product information on each of the websites, e.g., brand name, verbal product description or product reviews, to minimize a potential systematic bias of the results of our study due to possible distraction effects (Bellizzi and Hite 1992). According to Babin et al. (1992) the type of product presented on the website will influence mental imagery. In general, strictly utilitarian products (e.g., a computer printer) evoke low mental imagery compared to hedonic products, which are associated with high mental imagery. A purse could be considered as a hedonic product and is therefore suitable with regard to the purpose of our study. Furthermore, we used a purse because users must consider many different attributes such as the quality and the texture of the leather as well as its visual qualities to evaluate the product. The latter aspect can be experienced in a virtual product presentation on a website, but the texture of the leather of the purse can only be imagined due to the mental stimulation of an individual. Furthermore, a purse is often purchased online (Fredricksen 2011)

and is regarded as a high involvement product (Fairhurst et al. 1989), which is of crucial relevance, as mental imagery mostly occurs under high involvement conditions (McGill and Anand 1989).

The vividness of the virtual product experience was manipulated due to the pictorial product representation on the website. In the low vividness condition, the purse was presented by using two-dimensional pictures of the product, which is a common way to present products in online shops. Usually, the product is depicted with one large picture and with additional small thumbnails of different product views that can be selected and enlarged by clicking on them using an indirect input device such as a mouse as well as using a direct input device, e.g., a touch-screen of a tablet. The product was presented in the center of the website (640 x 623 pixels). Furthermore, five thumbnails (90 x 88 pixels) of different product views were provided to the participants as preview images. The preview images exhibited the product from five different angles. If a participant selected a preview image, a large version of the picture replaced the previous product view.

In the high vividness condition, the product was also presented in the center of the website (640 x 623 pixels), but participants were enabled to evaluate the product in a more stimulating way. They had the opportunity to rotate the product on its vertical axis. To enable participants to rotate the product, we took 180 photographs of different product views by placing the product on a rotary table and spinning the product on its vertical axis. This led to a 3-D product representation as well as to a more vivid virtual product experience on the website. The five product views for the low vividness condition (2-D product presentation) were taken from the 180 product views of the three-dimensional product presentation.

Interactivity was manipulated by using different input devices. In the low interactivity condition, the website was presented to the participants on a computer screen. Therefore, participants had to use a computer mouse to select and to enlarge or to rotate the product on its vertical axis. In the high interactivity condition, the product was presented on a tablet computer using the touch-screen as input device. Therefore, participants had to tap on the touch-screen with their finger to select and to enlarge the product views in the 2-D setting or to rotate the product in the 3-D setting. According to Jiang and Benbasat (2005), this should lead to a more interactive experience of the product compared to the use of a computer mouse. The factorial design of our experimental study is summarized in Figure 2.

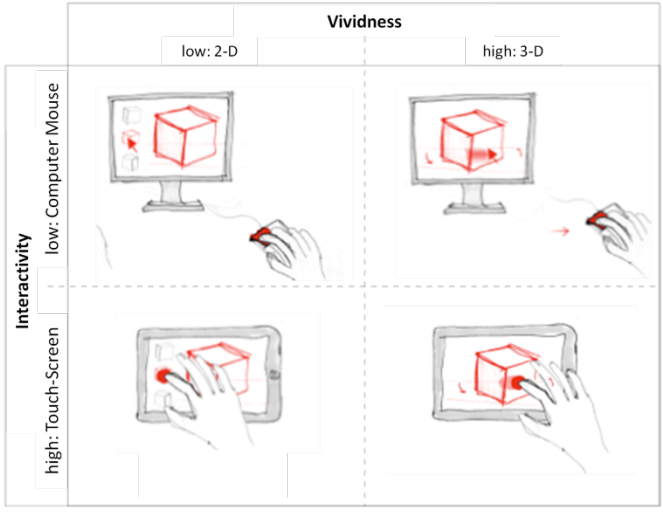

Figure 2: Experimental Design

Measures and Procedure

The participants of our study were randomly assigned to one of the four experimental conditions. Before the participants experienced the product on the website, they had to answer a questionnaire about

whether and how long they had owned and/or used a smartphone or a tablet-computer and about their expertise of using touch-screens with a single-item on a seven-point rating-scale (0 = no expertise - 6 = very good expertise). Moreover, we measured the participants' involvement towards the product category with three items by adapting the scales of Chandrashekaran (2004) and Zaichowsky (1985) to the context of our study (Cronbach's $\alpha = .96$).

We collected age and the field of study of the participants as socio-demographic variables. All of the above-mentioned constructs and variables were used as control variables in the data analysis. Furthermore, the participants' emotional state prior to their exposure to the product on the website was operationalized with bipolar adjectives using the scale of Mehrabian and Russel (1974) (e.g., unhappy/happy, calm/excited, not joyful/joyful, Cronbach's $\alpha = .89$). After the participants finished the first part of the study, they were exposed to one of four websites according to our experimental design. The participants could interact with the product on the website as long as they liked, meaning that there were no time-restrictions given by the investigator. This should have enabled the participants to get a satisfactory impression of the purse due to the virtual product experience. Furthermore, this procedure was chosen to minimize a distortion of the results due to a systematic bias in the experimental design or a negative investigator effect (Bailer et al. 1977). The usage intensity of the website was operationalized by recording the duration of the product interaction and the number of product views (2-D) or frames (3-D). Both indicators were recorded automatically by Javascript and were used as control variables in the data analysis.

After the participants were exposed to the purse on the website, they had to fill out a second questionnaire that included questions about the perceived degree of interactivity as well as their perception of vividness of the website, mental imagery, attitudes towards the product and purchase intention. The perceived degree of interactivity and perceived vividness of the website while evaluating the product was operationalized with bipolar adjectives out of the semantic differential (-3 up to +3) introduced by Diefenbach et al. (2010), which covers similar aspects to measure perceived interactivity and perceived vividness as the approach used in the study of Jiang and Benbasat (2007). Hence, perceived interactivity was measured with the adjectives decelerated/immediately, indirect/direct, unchallenging/challenging and perceived vividness was evaluated with the adjectives unexciting/exciting as well as unlively/lively Mental Imagery was operationalized by adapting the mental simulation scale of Elder and Krishna (2011). Therefore, the participants had to evaluate 1) if they could imagine how it would feel to touch the purse, 2) the extent to which images of using the purse came to mind (e.g., picking it up, holding it in the hand), 3) to what extent they could imagine using the purse, and 4) the amount of images of using the purse came to mind while interacting with the product on the website (0 = not at all - 6 = to a great extent, Cronbach's $\alpha = .79$). Moreover, we also measured the participants' emotional state after they were exposed to the purse on the website using the same items as in the first questionnaire. We calculated the difference of the participants' evaluations of their emotional state between the second and the first questionnaire and used this difference as dependent variable in our hypothesis testing. A positive (negative) difference means that the participants' emotional state was positively (negatively) affected by the virtual product experience. The attitudinal measures were based on Keller (1991) and Babin and Burns (1997) (Cronbach's $\alpha = .92$). Furthermore, we adapted items from Sweeney et al. (1999) and Elder and Krishna (2011) to cover purchase intention after the participants finished the product evaluation on the website (e.g., 0 = will definitely not buy up to 6 = will definitely buy, Cronbach's $\alpha = .88$).

To avoid a potential negative impact of order effects, we randomized the scales and the items in the first as well as in the second questionnaire. Discriminant validity for all indicators was assessed with Fornell and Larcker's (1981) criterion (AVE for all constructs > .5). The average variance extracted (AVE) for each reflective measure was higher than the squared correlations between that construct and any other construct ($r^2 \leq .34$).

Finally, a positive interaction effect between vividness and interactivity on the participants' mental imagery, their emotions, the attitude towards the product as well as their purchase intention could be expected. More precisely, the impact on the dependent variables under study should be higher when the product is presented in a 3-D way and a touch-screen is used to interact with the product, as a user should have access to more relevant associative memories compared to a less vivid and less interactive virtual product experience (Kisielius and Sternthal 1986). Hence, we further exploratory investigate the impact of the interaction between vividness and interactivity in the data analysis.

Pretest

Before we commenced with the main study, we pretested our scales as well our experimental design (N = 48). In the pretest, we also tested for the potential impact of the perceived usefulness of the virtual product presentation, telepresence and perceived diagnosticity on the dependent variables. We adapted Davis's (1993) scale, which was introduced in the technology acceptance model (TAM) to measure perceived usefulness (Cronbach's α = .76). Telepresence was operationalized by adapting four items of Fiore et al.'s (2005) scale to the context of our study. The participants had to evaluate their imagination of the degree of comparability between the sensory product information that was provided on the website and the sensory product experience in stationary retailing (Cronbach's α = .72). We used a scale that was developed by Jiang and Benbasat (2005) to measure the perceived diagnosticity of the virtual product presentation (Cronbach's α = .77). The findings of the pretest showed that the evaluation of the mentioned constructs did not differ between the experimental conditions. Furthermore, these constructs had no significant impact on the dependent variables. Hence, the perceived usefulness of the virtual product presentation, telepresence, and perceived diagnosticity were not examined in the main study.

Subjects

The participants of our study came from a German university campus under the pretense that they were needed for a study on the subject, "Media and Women's Accessories." With regard to the named subject of the study and due to the fact that, in general, prior knowledge of as well as involvement with the product category and intention could be affected by gender (Petty et al. 1983), we only recruited female students on the university campus. According to Park et al. (2005), this proceeding should minimize the artifacts due to a potential systematic bias of the results with regard to gender. Previous research has shown that prior knowledge of the product category will influence mental imagery (MacInnis and Price 1987). In general, mental visualization requires prior knowledge of the stimulus being imagined, and the more familiar an individual is with the stimulus object, the richer is the base from which images will spring (Babin et al. 1992). It seems plausible to assume that women have a higher extent of prior knowledge and are more involveved towards the selected product stimulus compared to men. With regard to the objective of our study, this is another rationale for only acquiring female students in the present study.

Overall, 112 female students from the German university participated in the main study and completed both questionnaires (M = 22.04 years, SD =2.6). With regard to their field of study, about 67.2% of the participants studied to become a teacher, 9.1% Information Management, 6.5% Cultural Sciences, and 4.5% Biogeography (12.9% other). The participants involvement towards the product category was M = 3.99 (SD = 1.8). About 45% of the participants owned a smartphone at the time of the study (holding period: M = 10.6 months, SD = 9.2) and 6.5% of the students stated that they own a tablet. Their average touch-screen expertise was M = 3.99 (SD = 1.4) on a seven-point-scale (0 = no expertise - 6 = very high expertise). We obtained no significant differences between the four experimental conditions with regard to the mentioned variables.

Usage intensity was used to control if the test people followed the instructions of the investigator and experienced the purse in a way that enabled them to thoroughly evaluate the product. Therefore, if a participant interacted with the purse for less than five seconds or was exposed to the product for less than 70 frames (meaning that the purse was not rotated once), we assume that the participant was not able to comprehensibly cognitive elaborate on the purse and therefore, could more or less not be mentally stimulated (McGill and Anand 1989). This would distort the measurement of mental imagery as well as of the other dependent variables. Based on this, we had to exclude five participants from the data analysis, which resulted in a final sample size of N = 107 participants. The participants were nearly equally distributed between the four experimental conditions.

Manipulation Check

We used the participants' evaluations of the perceived degree of interactivity as well as of perceived vividness of the website as manipulation check for our experimental design. Overall, based on the responses from the 107 participants, perceived vividness ranged from -3 to +3 with M = 1.04 (SD = 1.5), and perceived interactivity ranged from -3 to +3 with M = 0.22 (SD = 1.4). According to Perdue and Summers (1986), ANOVA tests were conducted to check whether the intended manipulation of

interactivity, in terms of touch-screen vs. mouse, and vividness, in terms of 3D vs. 2D product representations, was successful. As expected, the results indicate that the subjects' perception of vividness was positively influenced due to the manipulation of the pictorial representation of the product in the experimental conditions (perceived vividness: M_{2D} = 0.44 (SD = 1.5), M_{3D} = 1.72 (SD = 1.2); F(1, 98) = 22.46, p < .001), while the input device did not significantly affect perceived vividness (F(1, 98) = 0.72, p = .79). According to our assumptions, subjects' perceptions of interactivity were positively influenced due to the use of a touch-screen as input device (perceived interactivity: M_{Mouse} = -0.19 (SD = 1.2), $M_{Touch\text{-}Screen}$ = 0.61 (SD = 1.5); F(1, 101) = 9.11, p < .01), but not affected by the pictorial representation of the product (F(1, 101) = 0.74, p = .39). Furthermore, in the ANOVA tests with perceived vividness and perceived interactivity as dependent variables no significant interaction effects between the factors of our experimental study were obtained. Overall, these findings provided empirical evidence for a successful manipulation due to our experimental design.

Results

The Effects of the Virtual Product Experience on Mental Imagery

In hypothesis H1a and H1b, we assumed that mental imagery is affected by the vividness and the interactivity of the virtual product presentation on the website. Therefore, a three-dimensional product presentation should be experienced as more vivid and hence, lead to higher mental imagery of the participants compared to a situation in which the product is represented by using two-dimensional images on the website. Furthermore, if a user can interact with a product on a website via a touch-screen, this should lead to a more interactive product experience compared to the use of a computer mouse as an input device. As stated above, the strength of the proposed relationships could be affected by the participants' involvement towards the product category. To test H1a and H1b, we conducted a repeated measurement ANOVA, with mental imagery as dependent variable. The results of the hypotheses testing as well as for the potential interaction effect are summarized in Table 1.

As the mean values in table 1 show, we obtained differences with regard to mental imagery between the four experimental conditions. If interactivity is low, a three-dimensional product presentation leads to a higher degree of mental imagery compared to a two-dimensional product presentation. Interestingly, mental imagery was highest in the low vividness condition and when the purse was experienced by using a touch-screen. As mental imagery is directly associated with cognitive efforts and hence, cognitive elaboration of the user (Farah et al. 2007; Kosslyn et al. 2001), one could conclude that presenting a product on a website in a more vivid way through a 3-D product representation will decrease the necessary cognitive effort of the user to visualize the product mentally, which could be reflected in a lower mental imagery compared to a 2-D product presentation on a website. But, contrary to our expectations, we observed no significant main effect of the vividness of the virtual product presentation on mental imagery (F(1, 101) = 0.12, p = .73). Therefore, we had to reject H1a.

Table 1: Mean Values of Mental Imagery and Results of ANOVA (DV = Mental Imagery[a])

	Vividness (V)		*F*		
Interactivity (I)	low: 2-D	high: 3-D	*V*	*I*	*V* × *I*
low: Mouse	3.35 (0.22)	3.64 (0.23)	0.12	4.05*	0.89
high :Touch-screen	4.01 (0.21)	3.88 (0.23)			

[a] Mental Imagery was measured on a seven-point likert scale (0 = not at all - 6 = to a great extend) using the approach of Elder and Krishna (2011); *p < .05, **p < .01, ***p < .001; Mean (SD in brackets)

With regard to the proposed effect of interactivity, the findings show a significant main effect of this factor on mental imagery, supporting H1b (F(1, 101) = 4.05, p < .05, η^2 = .08). A more interactive virtual product experience has a positive impact on the mental imagery of the participants. Therefore, in a situation in which a user can evaluate a product in a more interactive mode with a touch-screen, this higher degree of

interactivity will positively affect the cognitive capacity and therefore could increase the user's cognitive elaboration on the product by reducing potential distraction effects that might occur due to interactions such as the handling of an indirect input device (Shen et al. 2006). If a computer mouse is used, a part of the cognitive capacity of a user is absorbed by the handling of the input device, which will distract the user from the product and lead to less mental imagery. The results of the manipulation check provide additional support for this argumentation because using a computer mouse as an input device was evaluated as more challenging than interacting with the product via a touch-screen. Moreover, the findings show no significant interaction effect between vividness and interactivity on mental imagery ($F(1, 101) = 0.89$, $p = .43$).

The Moderating Impact of Touch-screen Expertise and Involvement

In hypotheses H2 and H3 we proposed a moderating impact of touch-screen expertise and the involvement towards the product category on the relationships between the pictorial representation (vividness: 2-D vs. 3-D) as well as the way in which the participants could interact with the product on the website (interactivity: mouse vs. touch-screen) on mental imagery. To control for the assumed moderating influences we applied the approach for moderation analysis proposed by Baron and Kenny (1986, p. 1174) and used hierarchical regression analyses with mental imagery as the dependent variable. In doing so, according to Jaccard et al. (1990), the variables under investigation were z-standardized and then the interaction terms of interest were created.

To test the hypothesis that touch-screen expertise moderates the impact of interactivity, in terms of a 2-D vs. 3-D pictorial product representation on the website on mental imagery (H2b), we included touch-screen expertise and interactivity as independent variables in the first regression model. These variables accounted for a significant amount of variance in mental imagery (Model 1: $\beta_{\text{interactivity}} = .139$, $p = .147$, $\beta_{\text{touch-screen expertise}} = .192$, $p < .05$, $R^2 = .089$, $F(2, 104) = 3.26$, $p < .05$). In the second model, the interaction term between interactivity and touch-screen expertise was added to the regression model, which accounted for a significant proportion of variance in mental imagery (Model 2: $\beta_{\text{interactivity} \times \text{touch-screen expertise}} = .241$, $p < .05$, $\Delta R^2 = .032$, $\Delta F(1, 103) = 3.56$, $p < .05$), indicating that touch-screen expertise moderates the effect of interactivity on mental imagery, supporting H2b. An examination of the interaction plot showed an enhancing influence of touch-screen expertise on the relationship between interactivity and mental imagery (figure 3). If the product is experienced with a touch-screen this has a positive effect on mental imagery when involvement towards the product category is high ($\beta_{\text{touch-screen expertise}} = .642$, $p < .05$). However, the results of the hierarchical regression analyses showed no significant interaction effect of touch-expertise and vividness, in terms of 2-D vs. 3-D pictorial product representation on the website, on mental imagery ($\beta_{\text{vividness} \times \text{touch-screen expertise}} = .146$, $p = .323$), not supporting H2a.

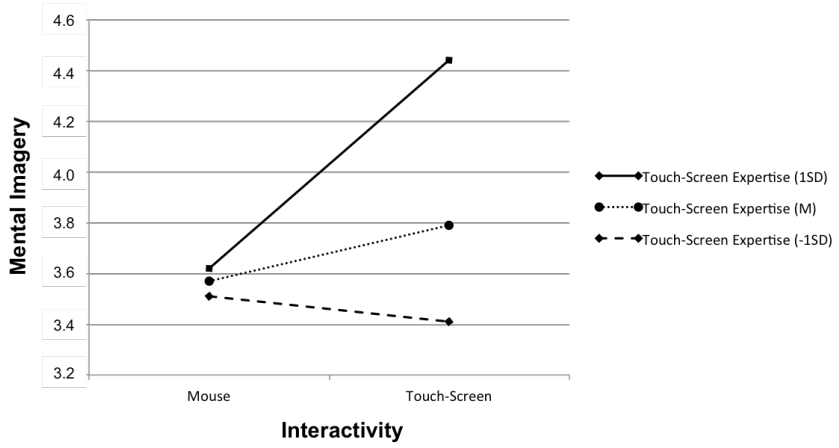

Figure 3: Interaction Plot (Interactivity ✕ Touch-Screen Expertise (DV = Mental Imagery))

The same approach was used to investigate, whether involvement towards the product category moderates the effects of interactivity and vividness on mental imagery. Overall, in both hierarchical regression analyses in the first step involvement of the product category had a significant positive impact on mental imagery and both models accounted for a significant amount of variance in the dependent variable (Model 1 (DV: interactivity & involvement): $\beta_{interactivity} = .185$, $p < .05$, $\beta_{involvement} = .432$, $p < .001$, $R^2 = .191$, $F(2, 103) = 13.42$, $p < .001$; Model 1 (DV: vividness & Involvement): $\beta_{vividness} = .028$, $p = .761$, $\beta_{involvement} = .421$, $p < .001$, $R^2 = .174$, $F(2, 103) = 10.81$, $p < .001$). However, in the second step for both models no significant impact of the interaction term on mental imagery was obtained (Model 2 (interactivity × involvement): $\beta_{interactivity \times involvement} = .071$, $p = .597$, $\Delta R^2 = .002$, $\Delta F(1, 102) = 0.59$, $p = .597$; Model 2 (vividness × involvement): $\beta_{vividness \times involvement} = -.029$, $p = .823$, $\Delta R^2 = .001$, $\Delta F(1, 102) = 0.05$, $p = .823$). Hence, hypotheses H3a and H3b were not supported in the present study. But, in line with previous research, which stated that mental imagery is most likely to occur under high involvement conditions (Babin and Burns 1997; McGill and Anand 1989), the results show a positive impact of the involvement towards the product category on mental imagery. If involvement towards the product category increased, this leads to a higher degree of mental imagery.

The Effects of the Virtual Product Experience on Emotion

With regard to emotions, we surmised in hypothesis H4a and hypothesis H4b that the vividness and the interactivity of the virtual product experience will have a positive effect on the participants' emotional state after they have being exposed to the purse in one of the experimental conditions. Furthermore, we also controlled for a potentially existing interaction effect between vividness and interactivity. One might conclude, if the product is presented in a three-dimensional mode and can be experienced with a touch-screen, this should have a stronger impact on the users' emotional state.

The results of an ANOVA with the differences of the participants' emotional state between the second and the first questionnaire as the dependent variable shows a significant main effect of the vividness of the virtual product experience on a change in experienced emotions ($F(1,100) = 4.07$, $p < .01$, $\eta^2 = .05$), supporting H4a (see Table 2). A three-dimensional product presentation positively influenced the participants' emotions when they experienced the product on the website.

Table 2: Mean Values of Emotion Differences and Results of ANOVA (DV = Emotion Difference[a])

	Vividness (V)		*F*		
Interactivity (I)	low: 2-D	high: 3-D	*V*	*I*	*V* × *I*
low: Mouse	-0.04 (0.58)[b]	0.19 (0.56)	4.07**	0.83	0.26
high :Touch-screen	-0.16 (0.11)	0.17 (0.12)			

[a] Emotion was measured using the scale of Mehrabian and Russel (1974) (e.g., 1 = unhappy - 7 = happy). Emotion Difference reflects the differences in emotion between the second and the first questionnaire. A positive difference indicates a positive effect of the factorial design on the change in the participants 'emotional state. *p < .05, **p < .01, ***p < .001; Mean (SD in brackets)

Against our expectation, we obtained no significant main effect of interactivity on the change in the participants' experienced emotion due to the virtual product experience ($F(1,100) = 0.83$, $p = .389$). Hence, the type of the input device used to interact with the product on the website had no influence on the emotional state of the participants. Therefore, H4b has to be rejected. Furthermore, as a result of the data analysis no significant interaction effect between the experimental factors of our study on the experienced emotions could be identified ($F(1,100) = .026$, $p = .698$).

The Effects of the Virtual Product Experience on the Attitude towards the Product

In hypothesis H5a and hypothesis H5b, we assumed an impact of vividness and interactivity of the virtual product experience on the users' attitude towards a product. According to the proposed relationships, a 3-D virtual product presentation should lead to a better attitude towards a product than representing the

product with 2-D images on a website. Furthermore, if a product could be experienced in a more interactive manner due to a touch-screen, this should also improve the attitude towards the product compared to a situation in which a user has to handle the interaction by using a computer mouse. As hypothesized in H6, we also expect that a positive interaction effect between vividness and interactivity on attitude. If a three-dimensional product presentation is combined with a more interactive handling of the product through a touch-screen this should have a positive impact on the users' attitude towards the product. The results of the ANOVA (see Table 3) show a significant, positive main effect of vividness on the attitude towards the product ($F(1,102) = 5.24$, $p < .05$, $\eta^2 = .04$), supporting H5a.

Table 3: Mean Values of Attitude and Results of ANOVA (DV = Attitude towards the Product[a])

	Vividness (V)		*F*		
Interactivity (I)	low: 2-D	high: 3-D	*V*	*I*	*V* × *I*
low: Mouse	4.11 (0.22)	4.55 (0.24)	5.24*	0.19	0.19
high :Touch-screen	4.13 (0.24)	4.75 (0.24)			

[a] Attitude towards the product was measured based on based on Keller (1991) and Babin and Burns (1997) (e.g., 1 = dislike - 7 = like); *$p < .05$, **$p < .01$, ***$p < .001$; Mean (SD in brackets)

Contrary to our expectations, we find no empirical evidence for the influence of the interactivity of the virtual product experience on the website on the attitudinal measures ($F(1,101) = 0.19$, $p = .671$) Hence, we have to reject H5b. Moreover, no significant interaction effect between vividness and interactivity on the attitude towards the product could be obtained ($F(1,101) = .19$, $p = .673$).

The Effects of the Virtual Product Experience on Purchase Intention

We further analyzed the influence of vividness and interactivity of the virtual product experience on the behavioral intentions of users. With regard to the effect proposed in H6a, users' who were exposed to a three-dimensional virtual product presentation were presumed to have stronger purchase intentions than if exposed to two-dimensional representations of a product on a website. Interacting with the product via a touch-screen should also have a positive effect on the users' purchase intentions (H6b). We further controlled for a potentially existing interaction effect between vividness and interactivity of the virtual product experience on purchase intentions. Again, we conducted an ANOVA to test our hypothesis (see Table 4).

Table 4: Mean Values of Purchase Intention Results of ANOVA (DV = Purchase Intention[a])

	Vividness (V)		*F*		
Interactivity (I)	low: 2-D	high: 3-D	*V*	*I*	*V* × *I*
low: Mouse	1.87 (0.22)	2.24 (0.24)	4.58*	0.66	0.25
high :Touch-screen	1.94 (0.22)	2.54 (0.24)			

[a] Purchase Intention was measured on a seven-point likert scale website (0 = will definitely not buy up to 6 = will definitely buy); *$p < .05$, **$p < .01$, ***$p < .001$; Mean (SD in brackets)

As our findings show, we observed a significant main effect of vividness on the participants' purchase intention. Presenting the product in a three-dimensional mode has a positive impact on the purchase intentions of the users ($F(1,101)$, $= 4.58$, $p < .05$, $\eta^2 = .03$), supporting H6a. However, we identified no significant effect of interactivity of the virtual product experience ($F(1,101) = 0.66$, $p = .424$, not supporting H7b. Moreover, we did not find empirical evidence for the potentially existing interaction effect between vividness and interactivity on purchase intention ($F(1,101) = 0.25$, $p = .621$).

However, as expected, involvement towards the product category does affect the hypothesized relationships ($F(1, 101) = 19.48$, $p < .001$, $\eta^2 = .10$). Therefore, if involvement towards the purse increases, this will lead to higher purchase intentions.

The Mediating Effects of Mental Imagery

We used the approach proposed by Baron and Kenny (1986) and conducted several regression analyses to test the mediating effect between the independent variables of our experiment and the different outcome variables hypothesized in H7. This approach involved three criteria for determining mediation: 1) There must be a significant relationship between the independent and the mediator variable, 2) there must be a significant relationship between the independent variable and the outcome variable, and 3) the mediator must have a significant effect on the outcome variable, while the outcome variable is not influenced the independent variable in an equation including both the mediator and the independent variable.

In H9a we assumed a mediating effect of mental imagery between the independent variables of our experimental design and emotion. Contrary to our expectations, the results of several regression analyses provide no support for the assumed mediating effect between vividness and emotion. Mental imagery also does not mediate between the interactivity of the virtual product experience and emotion. Furthermore, mental imagery does not mediate the interaction between vividness × interactivity on emotion. Therefore, we have to reject H7a.

The same method was used to test for the proposed mediating effects of mental imagery on the attitude towards the product as well as on the participants' purchase intentions. The findings show that mental imagery has a significant positive effect on the users' attitudes towards the product ($\beta = .27$, $p < .01$, $R^2 = .07$), especially when the product is represented in a three-dimensional way on the website. Furthermore, the results of a regression analysis show that a three-dimensional virtual product presentation will foster users' purchase intention when mental imagery increases ($\beta = .35$, $p < .01$, $R^2 = .12$). However, our results provide no statistical support for the other criteria that were established by Baron and Kenny (1986). Hence, we obtain no support for a mediating effect of mental imagery, rejecting H7b and H7c.

Discussion and Conclusions

The basic idea of our study was that a more vivid product presentation (3-D) and a more interactive handling of the product with a direct input device (touch-screen) will positively influence mental imagery, which in turn has positive effects on the users' experienced emotion, their attitude towards the product, and purchase intention in an online shopping context.

We were able to show that a more interactive input device would positively influence mental imagery. Obviously, in situations in which the user can more directly interact with the product with a touch-screen, potential distraction effects due to the handling of an indirect input device (e.g., a computer-mouse) are reduced. Furthermore, touch-screen interaction might provide users with a more realistic impression of the product when evaluating products online, as it might simulate a more haptic experience, which is somehow similar to the way of sampling and testing products in real stores (Li et al. 2001). The results of the moderation analyses have shown that this relationship is determined by touch-screen expertise of the user. If touch-screen expertise is high than the positive effects on mental imagery occur, while mental imagery is not affected when touch-screen expertise is low or on average. This indicates that inexperienced touch-screen users have to concentrate more on the handling of the input device, which reduces their cognitive capacity to evaluate the product and its attributes, e.g., on a tablet computer. Furthermore, according to Anderson and Reder (1979) and Maher and Kim (2006), if a users' cognitions are focused on the handling of the input device when interacting with the product, this will weaken the potential existing impact of a more interactive product experience on the quality of the product evaluation, which in turn will decrease the impact of a more interactive input device on further user-related outcome variables, as reflected in the non-significant impact of a more interactive input-device (touch-screen) on the experienced emotions, the attitude towards the product, and purchase intention.

Contrary to our expectations, the findings of our study did not support our assumption that 3-D product presentations on a website will lead to higher degree of mental imagery, compared to 2-D product presentations. Our findings indicate that presenting a product in a more realistic way could lower

necessary cognitive efforts and hence, the user's cognitive elaboration on the product which is reflected in a lower mental imagery. In this context, our results are in line with the findings of Dahl and Hoeffler (2004). These authors have shown, that products from a well-known product category are easier to mentally visualize compared to unknown product innovations. Therefore, in such situations the pictorial representation of a product on a website is of less relevance for the user's mental stimulation, as the relevant cognitive associations to visualize a product from a well-known product category mentally will already be activated through low vivid pictorial product presentations (McInnis and Price 1987; Smith et al. 1984). When only low cognitive elaboration is necessary to form a mental image of the product, the user has more cognitive capacity to more comprehensively evaluate the product and its attributes (Dahl and Hoeffler 2004), which is reflected in stronger effects of the pictorial product presentations on the experienced emotions, the attitude towards the product, and purchase intention.

Furthermore, we found that involvement towards the product category has a direct effect on mental imagery, but does not moderate the relationship between vividness and interactivity on mental imagery. According to previous research, a plausible rationale for this effect is that a user's cognitive elaboration is positively influenced by involvement, if involvement is high, this should be reflected in a higher mental imagery and also result in stronger effects on further psychographic (e.g., emotions, attitudes) and behavioral outcome variables (e.g., purchase intention). Hence, according to Miniard et al. (1991) one might conclude that involvement towards the product might not only influence mental imagery, but also the users' emotions, their attitude towards the product, and their purchase intention. We controlled for this potential impact in an additional analyses. The results show that involvement has a positive impact on emotions ($\beta = .203$, $p < .01$), the attitude towards the product ($\beta = .216$, $p < .05$), and on purchase intention ($\beta = .318$, $p < .01$). But, we identified no moderating impact of the involvement towards the product category between mental imagery and the dependent variables of our study using the approach of Baron and Kenny (1986). With regard to that, our results are in line with the findings of McGill and Anand (1989). These authors have shown that e.g., vividness influences a user's product evaluation only in situations when cognitive elaboration on a stimulus is high and that this might be a necessary condition to evoke an impact of vividness on attitude. Moreover, we investigated the impact of touch-screen expertise on the outcome variables under study. The results of several regression analyses show no significant direct effect of touch-screen expertise on the experienced emotions ($\beta = .131$, $p = .187$), the attitude towards the product ($\beta = .023$, $p = .815$), and purchase intention ($\beta = .043$, $p = .651$). Additionally, no moderating effect of touch-screen expertise between mental imagery and the dependent variables could be identified.

Overall, our most interesting result is the contradictory effect of our independent variables. With regard to the results of our study, vividness has an effect on emotion, attitude, and purchase intention but not on mental imagery, while interactivity has an effect on mental imagery but not on the other dependent variables. At least in our research setting it seems that a 3-D product presentation is counterproductive for the generation of mental imagery but very productive to generate a better mood, attitude and purchase intention, all of which are more important to online retailers than mental imagery. Providing a vivid and interactive virtual product experience might also have an effect on users' return behavior due to a more comprehensive product evaluation. This should enable users to make better purchase decisions and in turn should decrease product returns, which are very cost-intensive for online retailers. Moreover, the positive effect of interactivity on mental imagery is an interesting result for online consumer research. Thereby, our results also provide insights for an effective and efficient virtual product experience in online stores with the emphasis on users of mobile devices.

Implications for Future Research

The findings of our study show that mental imagery does not mediate between the different proposed relationships in our experimental design. But, this does not mean that there is in general no mediation between the relationships of our experimental design and mental imagery. Therefore, we suggest to further test the mediating role of mental imagery for user consequences in future studies.

The findings of our study show that involvement is an important aspect in the evaluation of our experimental design, as the positive direct effects of the involvement towards the product category on mental imagery, emotions, attitude, and purchase intention indicate. However, in future studies a more differentiated view of the role of involvement seems to be reasonable. Involvement towards a specific product within a product category could differ from the user's involvement towards product category as a

whole. The presentation of a product in a stimulating way on a website which motivates the user to interact with and to elaborate on the product comprehensively could in turn have a positive impact on the involvement towards this specific product due to the virtual product presentation. Therefore, as involvement towards the product could be influenced due to the virtual product experience, a mediating effect of the involvement towards the product between vividness and interactivity and further psychographic as well as behavioral user related outcome variables could be expected (Miniard et al. 1991). Hence, future research should distinguish between the involvement towards the product category and the involvement towards the product to clarify the role of involvement in online shopping settings like the one presented in this study.

In our experiment we only analyzed the impact of vividness due to the pictorial representation of the product and did not account for further facets of vividness e.g., additional verbal product information provided on the website. Therefore, future research should analyze the potential (interaction) effects of written product information and other forms of (progressive) vividness and interactivity on mental imagery and further user related outcome variables.

However, one might argue that in general the ability to mental imagery may vary between the respondents. Some of the participants of our study might be able to form a vivid mental image of the product even with very little information provided, while other participants might fail to have a clear mental image of the product with plenty of information provided. Future research should have a closer look on the impact of the potential differences regarding the ability of mental imagery between users on the effects of the virtual product experience. Furthermore, we only recruited female students for our study and hence, were not able to control for potential existing gender differences. Moreover, the sample size of the present study was relatively small. As the sample size determines the amount of error inherent to the results of statistical testing, the effects of an experimental treatment are more difficult to identify in small samples (Cohen, 2013). Hence, future research is advised to conduct similar experimental studies with larger sample sizes, which will strengthen the statistical power of the hypothesis testing and potentially help to identify more significant effects of the experimental factors on the constructs under study.

Our experiment was limited to one product from one specific product category and was only conduct in one country. Because of this limited external validity, future research is needed to study the identified effects with different products in different product categories. The sample was conducted among students in Germany. Prior research in personality and consumer behavior shows several important differences in personalities with respect to demographic variables (e.g., age, culture, and education) and differences in general online behavior between countries. Hence, the impact of the virtual product experience on user-related outcome variables could also be influenced by culture. Therefore, cross-cultural studies could provide insights on how online product presentation should be adjusted according to the preferences and requirements of the users based on the cultural background of the target groups in different international markets. In follow-up research, this and the previously mentioned issues should be addressed.

Implications for Management

Online retailers can consider the findings of our study to enhance the virtual product experience of the users of their online shops. Our results show that interactivity and vividness could lead to positive effects for online retailers as they positively influence user-related outcomes. First, online retailers could stimulate the use of interactive input devices like tablet computers for online shopping for example by broadcasting ads that show users conveniently browsing the online shop with a tablet from their couch in their living room. Moreover, more retailers should implement or test 3-D product presentations in their online shops to enhance the virtual product experience of their customers.

However, the results for our independent variables are somehow contradictory, for example 3-D presentations can also distract users from the evaluation of products. Consequently, online retailers should test 3-D product presentations and ads before implementation or broadcasting. Possibly those suggestions are especially valuable for products with a target group that is highly involved with the product and or product category. Therefore, online retailers should implement 3-D product presentations for high involvement products first.

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