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THE EFFECTS OF PERCEIVED WEBSITE COMPLEXITY - NEW INSIGHTS FROM THE CONTEXT OF MOBILE ONLINE SHOPS

Stefanie Sohn
Technische Universitat Braunschweig, s.sohn@tu-braunschweig.de

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Complete Research

Sohn, Stefanie, Technische Universität Braunschweig, Germany, s.sohn@tu-braunschweig.de

Abstract

As Internet-enabled mobile device use has grown steadily, consumers increasingly appreciate the opportunity to visit commercial websites (i.e., online shops) on the go. Because mobile online shops represent under-researched consumer touchpoints with loyalty-enhancing potential, this paper seeks to answer how mobile-website design and, in particular, perceived mobile-website complexity affect individuals' cognitive, affective, and conative responses. Powerful mobile technologies have paved the way for sophisticated mobile-website design which is associated with complexity. Given the physical constraints of mobile devices, one might assume that the previously observed positive effects of website complexity would vanish on mobile devices, replaced by confusion and dissatisfaction. The results of two empirical studies confirm this assumption, demonstrating that increasing perceived website complexity (PWC) negatively influences user satisfaction with mobile online shops. Further, increasing PWC augments individuals' perceived confusion which, in turn, contributes to mental and behavioral disengagement. Disengagement further reduces individuals' intention to visit the mobile online shop in the future and diminishes loyalty towards the online shop. Individuals' negative beliefs about the performance of mobile online shopping strengthen these effects. Such negative beliefs therefore represent a manageable starting point to reduce the overall negative effects that PWC has, even indirectly, on reuse intentions.

Keywords: Perceived Website Complexity, Mobile Online Shops, Confusion

1 Problem Statement and Motivation

With consumers' rising interest in online shopping, the creation of appealing online shops has been shown to be indispensable for establishing sustainable customer relationships (Wang *et al.*, 2010). While today's powerful information and communications technologies pave the way for sophisticated online-shop designs (Hoffmann *et al.*, 2011), exploring the effects of complexity which result from website information and design cues is important for both marketing practitioners and academics.

Website complexity—which generally refers to a websites' density and dissimilarity of information and design cues—can induce both positive (i.e., arousal-enhancing) and negative (i.e., pleasure-decreasing) effects among users (Mai *et al.*, 2014; Deng and Poole, 2010). The topic of perceived complexity has engaged researchers from various disciplines, including advertising, branding, point-of-sale, and product design (e.g., Pieters *et al.*, 2010; Janiszewski and Meyvis, 2001; Orth and Wirtz, 2014; Orth and Crouch, 2014). When accessing an online shop using a computer, medium levels of complexity are generally perceived as more satisfactory and enjoyable to users than are low and high complexity levels (Nadkarni and Gupta, 2007; Mai *et al.*, 2014). Although previous research has highlighted situational circumstances under which the effects of (perceived) website complexity may vary (Deng and Poole, 2010), the relationship between website complexity and the use of Internet-enabled mobile devices (i.e., smartphones, tablets), which have grown in popularity among consumers but still suffer from physical constraints (e.g., limited screen size), remains unexplored. To bridge this gap, this research broadly attempts to answer the following research question: *How do individuals' perceptions of mobile online-shop complexity impact their responses toward that shop?*

While extending existing research on website complexity, this question has increasing relevance given recent developments. Mobile devices represent an everyday companion for a large part of the global population today. While mobile-device dependency intensifies mobile-website access, device users' interest in using these gadgets for purchases online and for pre-purchase activities is growing (eMarketer, 2015). In light of this evolution in consumer behavior, the topic of mobile shopping has drawn the attention of both marketing practitioners and academics (Wang *et al.*, 2015). Mobile online shopping generally involves the use of Internet-enabled mobile devices (i.e., smartphones, tablets) for shopping purposes, including, pre-purchase (e.g., price comparison), transaction (e.g., using mobile device for online purchases), and post-transaction activities (Holmes *et al.*, 2014). Even considering the fact that mobile online shops represent a supplementary e-channel through which a customer relationship can be fostered (Kumar and Venkatesan, 2005), academic insights regarding the effects of mobile website design are scarce (Groß, 2015). Cyr *et al.* (2006) emphasized the importance of the aesthetic design of mobile websites, since the connected perceptions are the primary trigger of enjoyment during usage. Furthermore, when measuring users' perceived mobile service quality (Lu *et al.*, 2009; Huang *et al.*, 2015), design issues are an indispensable dimension, which justifies exploring specific design parameters, such as complexity, of a mobile online shop. Additionally, as mobile hardware, software, and communication networks become increasingly powerful, mobile websites are designed with richer modes of presentation, such as videos and animated pictures (Kim and Sundar, 2015). Given the physical constraints of mobile devices and the short sessions during which mobile devices are used under diverse environmental distractors (Oulasvirta *et al.*, 2012), online retailers should address the question of how mobile online shop visitors respond to complexity. Research findings regarding computer-based website access can serve as a beginning for the creation of mobile online shops. Nevertheless, unmodified transfer has to be treated carefully, because mobile devices significantly differ from computers and notebooks (Kourouthanassis and Giaglis, 2012), and these differences affect individuals' experiences (Venkatesh and Ramesh, 2006). Moreover, the theory of a dual environment proposes that individuals must bridge two distinct environments when visiting an online shop (Sautter *et al.*, 2004). On the one hand, online shoppers interact with their Internet-enabled devices, therefore handling device-related peculiarities during online-shop access. On the other hand, individuals have to process high task-relevant cues (e.g., product description, price) and low task-relevant cues (e.g., typestyles, color, animation) when visiting online shops (Eroglu *et al.*, 2001). Both the operator and the online-shopping environment affect the way individuals respond to their online shopping experiences. Hence, one may assume that the effects of PWC depend on which type of device is used to access an online shop.

2 Conceptual Framework and Hypotheses

A theoretical model of consumer responses to online shop atmospherics (Eroglu *et al.*, 2001) inspired the development of the conceptual framework used here. Eroglu *et al.* (2001) postulated that online shop design cues shape individuals' cognitive, affective, and conative states. Because perceptions of complexity are closely related to the design of online shop cues, this framework underlies this research. To highlight the importance of perceived website complexity in mobile interfaces, this study examines the direct impact of PWC on individuals' cognitive (i.e., satisfaction), affective (i.e., confusion), and conative (i.e., disengagement and reuse intentions) responses. Furthermore, this research analyzes the interrelationships between cognitive, affective, and conative responses, and sheds light on selected individual predispositions which are proposed to moderate the effect of perceived website complexity. Against this background and considering further relevant theories and research findings, the following hypotheses are derived below.

2.1 The Concept of Perceived Website Complexity

Complexity is a function of the number, dissimilarity, and grouping of elements, thereby defining, among other things, the information rate of a stimulus (Berlyne, 1960). Complexity and subsequently

the information rate therefore rise when elements in a stimulus pattern are numerous, dissimilar, and loosely assorted. Definitions of website complexity largely rely on task and non-task relevant cues on websites (e.g., navigation tools, structure, colors), because cue design is central to understanding complexity (Wood, 1986). To fulfill task goals (e.g., browsing, goal-directed search) in virtual stores, visitors mentally process both task- and non-task-relevant cues. While some researchers have emphasized an objective, rather indicator-related definition of complexity to capture the complexity of single design cues (e.g., Berlyne, 1960), others have defined complexity with respect to individuals' perceptions (Gupta *et al.*, 2005), instead measuring complexity "at a global level as the sum of all the different and diverging elements" (Mai *et al.*, 2014, p. 102). Because objectively equivalent website complexities can be perceived differently depending on individuals' background and knowledge, in this work, complexity is measured as users subjectively perceive it.

While Nadkarni and Gupta (2007) suggested that website complexity represents a function of dynamic, coordinative, and component complexity, Mai *et al.* (2014) proposed distinguishing among structural, content-related, and visual complexity. Visual or component website complexity has received particular attention in academic research (e.g., Tuch *et al.*, 2009; Deng and Poole, 2010), because this facet, which captures the diversity, number, and discriminability of website design cues, can be perceived after a few seconds of visiting a website. Whereas information processing guides attitude and behavior formation, visual complexity reflects a key indicator of individuals' information processing (Titus and Everett, 1995), especially in online shopping (Tuch *et al.*, 2009). Visual complexity is assumed to be particularly relevant to accessing an online shop on a mobile device, because mobile interactions are relatively short; first impressions therefore gain in importance. Against this background, for the purpose of this research, perceived website complexity refers to the degree to which an individual visually perceives a commercial website as complex.

2.2 Consequences of Perceived Website Complexity

Users' satisfaction is a central concept in website experience research (Palmer, 2002) because of its relevance to the prediction of behavioral intentions (e.g., McKinney *et al.*, 2002). Harmonizing with the confirmation-disconfirmation paradigm (Oliver, 1980), the cognitive component has often been highlighted when conceptualizing user satisfaction. Hence, in this research, satisfaction captures individuals' post-experience evaluations (Oliver, 2014), which encompass the mental comparison between individuals' expectations and the perceived performance of the mobile online shop.

Previous research on website complexity examined the effects of website complexity on users' satisfaction, finding an inverted U relationship between both website complexity and satisfaction when individuals accessed the website on their computers (Nadkarni and Gupta, 2007). The theory of aesthetic response (Berlyne, 1974) proposes that a medium complexity level provides the ideal solution for individuals (i.e., provides the highest satisfaction). Accordingly, maintaining a minimum level of complexity is seen as indispensable for holding interest and avoiding annoyance among individuals. The optimal level of complexity depends upon personal and situational circumstances. First, the theory of the optimal stimulation level suggests that individuals differently perceive which level of environmentally induced input is optimal (Raju, 1980). Second, whereas websites are largely understood as a medium for achieving certain task goals, task and non-task relevant cues presented at these websites are central to users' perceptions of website complexity (Wood, 1986). Hence, the effort individuals spend in performing a specific task at websites interacts with the optimal level of website complexity (Nadkarni and Gupta, 2007). Specifically, in order to produce positive responses among users, website complexity levels should be lower in effortful than in effortless task situations, because websites of high complexity shift individuals' attention away from task goals, hampering task completion (Ward *et al.*, 1992). Generally, complex (effortful) stimuli (tasks) are assumed to require more cognitive resource and information-processing capacities than are simple (effortless) cues (tasks) (Plass *et al.*, 2010). Because individuals' capacities for information processing are limited (Kahneman, 1973), exhaustion of these capacities (e.g., during effortful task completion in complex environments) creates

cognitive overload and affects individuals' responses (e.g., decreases satisfaction) (Reber *et al.*, 2004; Schmutz *et al.*, 2009).

In accordance with the theory of a dual environment (Sautter *et al.*, 2004), visitors to mobile online shops mainly fulfill two tasks: (1) they handle all the information in an online shop and (2) they interact with the mobile device to access the online shop. Because the task of mobile device interaction requires more cognitive and physical effort than computer-based website access (Ghose *et al.*, 2013; Chae and Kim, 2004), one might assume that rather low, not medium and high levels of perceived online shop complexity harmonize with online shop access via mobile devices. As mobile devices can be used anywhere, multiple distractors (e.g., the presence of other people, noise) may increase the perceived effort associated with use of a mobile device. Research on the effects of screen size has further demonstrated that devices equipped with relatively small displays (e.g., smartphones) worsen individuals' experiences of displayed content (Kim and Sundar, 2014; Detenber and Reeves, 1996). The distractions experienced by mobile device interaction and by medium or high levels of mobile online shop complexity might diminish individuals' overall satisfaction, while low levels of perceived mobile online shop complexity may lead individuals to increased satisfaction. Thus:

H1: An increasing PWC negatively impacts an individuals' satisfaction with the mobile online shop.

In accordance with environmental psychology theories (e.g., Mehrabian and Russell, 1974), emotional responses which trigger information processing and approach-avoidance behavior emerge from perceived environmental stimuli. Because perceived confusion summarizes "negative feelings that make it difficult for consumers to select and interpret store environmental stimuli" (Garaus and Wagner, 2013, p. 407) and can be induced by the store environment (Garaus *et al.*, 2015), (perceived) complexity as an environmental property might represent a driver of confusion. Complexity represents an essential component of the overall environmental information rate (Berlyne, 1960). As such, an increase in complexity raises the environmental information rate, which, in turn, increases the effort required for information processing. In accordance with cognitive load theorists (Plass *et al.*, 2010), processing complex stimuli requires a significant proportion of individuals' overall limited information-processing capacities. Exceeding a critical threshold results in perceptions of overload and, finally, feelings of confusion (Mitchell *et al.*, 2005).

Although research on website complexity has shown that it reduces positive feelings (Deng and Poole, 2010), no empirical study has examined the confusion-evoking effect of PWC. Furthermore, to date only one academic contribution has concerned the concept of confusion in an online-shopping context (Garaus, 2014). Examining negative feelings as outcome variables of complexity perceptions is particularly valuable because the broaden-and-build theory of positive emotions (Fredrickson, 1998) emphasizes that distinct cognitive and psychological effects emerge from positive compared to negative emotions. Moreover, dissatisfaction resulting from negative experiences contributes to greater word-of-mouth engagement than do satisfying experiences (Anderson, 1998). Hence, it is particularly important for online retailers to manage negative experiences and their antecedents. To shed light on this, the following hypothesis is proposed:

H2: An increasing PWC augments individuals' confusion during mobile online shop visit.

Prior academic research analyzing website complexity has mainly focused on the effects of PWC on individuals' cognitive and affective responses, such as enjoyment or ease-of-use (Mai *et al.*, 2014), which have been shown to trigger their behavior-related intentions. This perspective neglects the fact that individuals often directly take actions to handle mentally exhausting situations. Because consumers adapt their decisions in accordance with environmental stimuli (Payne *et al.*, 1993) and generally strive to conserve additional cognitive effort to attain their goals, it is plausible to assume that under high levels of environmental complexity, individuals use heuristics to save additional cognitive effort (Todd and Gigerenzer, 2000). The theory of the optimal stimulation level additionally postulates that when environmental input exceeds individuals' optimal stimulation levels, individuals take immediate steps to optimize this level (Raju, 1980). While coping "is aimed at changing the person-environment

relationship for the better" (Strizhakova *et al.*, 2012, p. 416), the application of coping strategies might constitute an escape from situational overload. PWC might serve as an external cue that induces immediate reactions. Though coping generally refers to "people's attempts to manage stressful situations" (Yi and Baumgartner, 2004, p. 304), typologies of coping strategies can illustrate specific strategies that might comprise such reactions. For instance, mental and behavioral disengagement represent two distinct types of coping strategies. While both involve individuals' attempts to separate from the problem, mental disengagement captures the extent to which individuals try to forget about confusing situations and try to create distance from them. Behavioral disengagement, by contrast, summarizes thoughts about avoiding any further action because individuals acknowledge that goals cannot be attained (e.g., Yi and Baumgartner, 2004). To summarize, the following hypothesis is suggested:

H3: An increasing PWC positively influences individuals' mental and behavioral disengagement from a mobile online shop visit.

2.3 Consequences of Satisfaction, Confusion and Disengagement

Examining the predictive power of users' satisfaction has a long tradition across different fields of academic research. Research on human-computer interaction has predominantly illustrated how satisfaction induces long-term effects and augments an individuals' intention to reuse a website (DeLone and McLean, 1992; Bhattacherjee, 2001), intention to purchase a product on this website (Shiau and Luo, 2012), and intention to recommend the website to others (McKinney et al., 2002; Shankar et al., 2003). Research on mobile commerce shows that satisfaction elevates users' intention to reuse or to recommend a mobile service (Wang and Liao, 2007; Kuo et al., 2009). Despite multi-channel retailers' attempts to integrate todays' customer touchpoints and to increase loyalty across all channels, little is known about the impact of user satisfaction with a mobile online shop on individuals' overall reuse intentions. In harmony with signaling theory, prior research has demonstrated that individuals' channel perceptions may shape intentions and overall attitudes towards multi-channel retailers (van Birgelen et al., 2006; Montoya-Weiss et al., 2003).

Therefore, in focusing on reuse intentions, this work defines them from two perspectives: individuals' future willingness (1) to reuse the online shop regardless of the respective access device and (2) to revisit the mobile online shop. Considering reuse intentions as outcome variables in this research has different reasons. First, the Technology Acceptance Model (Venkatesh and Davis, 2000) generally postulates that behavioral intentions are a strong predictor of actual behavior. Moreover, (re-)use intentions are seen as a good approximation of individuals' loyalty toward a service provider (Koufaris, 2002). Establishing deep customer-retailer relationships can, in turn, result in a sustainable competitive advantage (Balabanis et al., 2006). Furthermore, retaining customers is associated with lower costs than acquiring new customers (Zeithaml et al., 1996). Second, revisiting an online shop has been found to increase individuals' purchase probability in this shop (Moe and Fader, 2004). Against this backdrop, shedding light on individuals' reuse intentions of the mobile online channel can be particularly valuable, because Internet-enabled mobile devices broaden the scope of situations during which access to an online shop becomes possible. Thus:

H4: Increasing satisfaction with mobile online shop positively influences individuals' reuse intentions.

Consumers' feelings of confusion often have negative consequences for both consumers and marketers. Given this, Mitchell *et al.* (2005) suggested a distinction between immediate and retarded, action-related consequences. Immediate consequences include, for example, decreased consumer satisfaction and trust (Walsh and Mitchell, 2010), as well as the reduction of perceived hedonic and utilitarian value (Garaus *et al.*, 2015), because confusing elements inhibit the attainment of the shopping goal. Furthermore, confusion diminishes both in-store searches and the time spent in-store, as well as individuals' store-related behavioral intentions (Garaus and Wagner, 2013). Based on written scenarios, Garaus (2014) found that when consumers shop online, confusion reduces unplanned expenditures, detailed store exploration, and time spent in store. However, the extant research on virtual environ-

ments neglected to test the effect of confusion in real online shopping situations, nor has any effect been tested on intervening variables, such as user satisfaction. The general influence of negative feelings on judgements largely depends on individuals' attributions for their current feelings (Kehner *et al.*, 1993). Individuals tend to blame third persons, instead of themselves, for any perceived failures (McAllister, 1996). Hence, blame for service failures associated with negative feelings (i.e., confusion) is often attributed to the service provider (Folkes, 1984), which might result in lower satisfaction with the provided service. Thus:

H5: Individuals' perceived confusion negatively influences satisfaction with the mobile online shop.

Generally, individuals tend to regulate negative feelings in a conscious and voluntary way by applying appropriate coping strategies (Smith and Alloy, 2009), which might represent action-related consequences of consumers' confusion. Coping theory postulates that consumers apply coping strategies to overcome negative experiences of consumption episodes (Duhachek, 2005). Although research on coping strategies dates back to the late 1980s and demonstrated how negative emotions foster the application of coping strategies (Strizhakova *et al.*, 2012; Yi and Baumgartner, 2004; Duhachek, 2005; Terry, 1994), no empirical research has investigated to what extent confusion in particular induces the application of coping strategies. Nevertheless, the feeling of helplessness, a sub-dimension of confusion, is, it has been suggested, closely related to individuals' disengagement activities (Carver *et al.*, 1989). Hence, the following hypothesis is proposed:

H6: Individuals' perceived confusion positively influences mental and behavioral disengagement from a mobile online shop visit.

When individuals are forced to cope with confusing situations by applying strategies such as mental and behavioral disengagement, they take active steps to deal with their perceptions of confusion. Hence, one can infer that they are likely to avoid the reoccurrence of such situations (Mitchell *et al.*, 2005). As self-regulatory behaviors (Carver *et al.*, 1989), mental and behavioral disengagement might lower an individuals' specific future intentions to reuse an online shop or specific channel. Penz and Hogg (2011) found that situational avoidance behavior negatively predicts consumer purchase intentions. Hence, it is suggested that:

H7: Increasing mental and behavioral disengagement negatively influence individuals' reuse intentions.

2.4 The Influence of Prior Online Shop Experience

The concept of expertise summarizes an individuals' familiarity with a specific object that arises from previously performed actions (Sun and Zhang, 2006). Numerous studies have focused on the role played by prior experience with specific technologies (Im Hyunjoo and Ha, 2013; Chang and Chen, 2008; Yang *et al.*, 2013). Sun and Zhang (2006) concluded that select effects, such as the effect of perceived ease-of-use, diminish with increasing experience. Chang and Chen (2008) illustrated that expertise lowers the effects of perceived interface qualities on user satisfaction. Humans who gain considerable knowledge of a task stimulus are generally thought to focus on task-related information, while ignoring ambient cues that are irrelevant to task completion. Specifically, individuals familiar with a task are able to distinguish relevant from irrelevant stimulus cues as they form large schemata (Larkin 1980). Whereas Cox and Cox (2002) additionally mentioned that preference for complexity grows with repeated exposure, Nadkarni and Gupta (2007) empirically illustrated that an individuals' familiarity with a website and the products sold on that website diminish the PWC ratings given to an equal amount of objective complexity. Hence, inexperienced individuals perceive greater website complexity even when confronted with the same complexity level as individuals familiar with the website because they have difficulties to distinguish between task-relevant and task-irrelevant cues. Nevertheless, these researchers have failed to provide empirical evidence related to the moderating effect familiarity might have on the effects of PWC. Hence, it is proposed that:

H8: Individuals' prior experience with an online shop reduces the effects of PWC on confusio and satisfaction.

2.5 The Influence of Negative Beliefs about Mobile Online Shopping

Beliefs generally summarize the perceived consequences of certain behaviors. While attitudes represent an evaluation of an outcome (e.g., behavior), beliefs subsume the subjective likelihood that performing the behavior will lead to a specific outcome (Davis, 1993). Accordingly, this study captures individuals' perceived likelihood or beliefs that using mobile devices for shopping purposes will result in errors and confusion (Dabholkar and Bagozzi, 2002). Following the reasoning of Venkatesh (2000), general beliefs might serve as an anchor and guide to subsequent topic-related perceptions. In a similar vein, the Modality, Agency, Interactivity, and Navigability (MAIN) model suggests that the sheer presentation of features or stimuli might reactivate previously defined images in individuals' minds that ultimately shape subsequent perceptions (Sundar, 2008). Kim and Sundar (2015) specified that screen size represents such a salient cue that implies a certain performance level. Individuals use this fundamental impression as a mental shortcut that thereby predetermines their perceptions when using small-sized devices. Hence, individuals' prior or fundamental beliefs about the non-performance of mobile shopping might guide their experience-related perceptions:

H9: Individuals' prior negative beliefs about mobile shopping strengthen the effects of PWC on confusion and satisfaction.

3 Methodology

To test the aforementioned hypotheses, two empirical studies were conducted. The first study used an online-based survey in Germany with the goal of capturing prior mobile online shopping experiences. This approach has a long tradition when examining website experiences (e.g., Parasuraman, 2005), which strengthens the external validity of results. Because survey research lacks internal validity, a second study involving a laboratory experiment was performed, also in Germany. This country focus is justified by the fact that little academic research to date on mobile marketing has been conducted in that country, even though mobile Internet use in Germany has grown steadily and growth is projected to continue in the future (ECommerce Europe, 2014).

3.1 Data Collection in Study I

An online survey was created to capture consumers' prior experiences of mobile online shops. To qualify for participation, subjects needed to report consulting an online shop via a mobile device (i.e., smartphone and/or tablet) within the last six weeks. The process to recruit this target group and final data collection were performed by a market-research agency in Germany that utilized a mobile access panel comprising mobile Internet users of all ages, incomes, and educational classes in order to best mirror the population of German mobile Internet users. Because mobile Internet use infiltrates wide population segments, and in order to augment the external validity of the study's results, quota sampling was applied according to that distribution of age, gender, profession, and education that approximates mobile Internet users in Germany (Statistisches Bundesamt, 2014).

Before data collection took place in the spring of 2015, the questionnaire was developed and validated by a sample of 99 participants who were excluded from the subsequent main study. This pre-test served to test the reliability and validity of the measurement models. Furthermore, participants had the opportunity to mention any perceived weaknesses of the questionnaire at the end of the survey. On the basis of their feedback and given the results of analysis, a final version was created and then submitted to the abovementioned agency for data collection. The questionnaire comprised four parts. First, participants were asked to indicate which mobile devices (i.e., smartphones, tablets) they used for Internet access. Additionally, subjects reported their familiarity regarding the use of online shops via mobile devices, including pre-purchase information-gathering activities. Second, after confirming their prior

mobile shopping experience, sociodemographic data were gathered. Third, participants were asked to note the name of the mobile online shop they most recently visited. Following the method described by Kim and Niehm (2009), they were asked to search for a present for a close friend from this recently visited online shop using their mobile device. This approach was intended to help them reconstruct previous experiences. Fourth, referring all evaluations to the previously visited mobile online shop, participants expressed their perceptions on the complexity of, confusion with, satisfaction with, and behavioral intentions towards that mobile online shop using five-point Likert or bipolar scales. To measure these constructs, previously tested multi-item scales were adapted to the research context and then employed (see Appendix).

3.2 Data Collection in Study II

To test the effects of website complexity, similar to previous research (Martin *et al.*, 2005), this study manipulated visual website complexity. Perceived visual complexity might have numerous indicators (e.g., Martin *et al.*, 2005; Miniukovich and Angeli, 2014). Based on the results of a qualitative pre-study conducted among 378 students using the sentence-completion technique (Nadkarni and Gupta, 2007), animation and color design emerged as crucial for inducing perceptions of visual complexity in mobile interfaces. Hence, visual complexity was manipulated using the number of animated pictures (i.e., the same images were presented either statically or dynamically) and using text-background contrast (i.e., white background versus light-grey background against a font color of dark grey), which finally led to a 2 x 2 factorial design.

The four online shops sold cookware and skillets. This decision bases on a pre-test conducted among students. They were asked to assess these preselected product categories in terms of their intentions to purchase such products online via a mobile device. Using a five-point scale (1 = very improbable, 5 = very probable), the 49 responses showed on average a relatively high level of purchase intention ($M = 4.33$). No gender-specific differences could be detected. Lastly, a professional agency created the four mock online shops, holding all creative elements constant across the four except for the manipulated variables. In contrast to some related studies, such as Geissler *et al.* (2006), the created online shops provided study attendees with the opportunity to use them as they would use real online shops (e.g., allowed to move backward and forward).

After creating the stimuli, the success of the manipulations was tested during a pre-test among students who would not take part in the experiment. Using an online-based survey, participants were asked to search for a present at one of the four randomly assigned online shops using their mobile device and to assess afterwards their perceived degree of visual complexity (Tuch *et al.*, 2009). A total of 163 students took part in this pre-study, with 81 using a tablet and 82 using a smartphone to access the respective online shops. The perceived degree of visual complexity differed among the online shops in the anticipated directions ($F(3,159) = 3.561$, $p < .05$); the online shop without animations and high text-background contrast was perceived as less visually complex than the remaining shops.

The laboratory experiment (i.e., study II) was carried out among students at a German university, who received a non-monetary reward (i.e., useful items for their academic studies) for participating. Students were chosen for this study because, on the one hand, they represent a convenient experimental sample, while, on the other hand, embodying a relatively homogenous group, which facilitates rigorous testing of hypotheses. To further reduce undesired heterogeneity among treatment groups, all participants were screened to ensure that they had prior experience with online shopping and mobile Internet use.

The experiment was organized into two steps. In the first step, the students were asked to complete an online survey to screen potential experiment attendees. To control for confounding effects and in line with prior research (e.g., Nadkarni and Gupta, 2007), subjects were asked to indicate, for example, their familiarity with the selected product category. At the end of this initial questioning, participants were asked to make an appointment to take part in the laboratory experiment. In the second step, participating students were confronted with the manipulated online shops in a room largely isolated from

interfering noise. All participants were randomly assigned to one out of the four prepared online shops. To augment the external validity of this study, subjects randomly received either a tablet or a smartphone to solve the search task in their respectively assigned online shops. Because device manufacturers' brand reputation might shape individuals' perceptions (Raptis *et al.*, 2013), two Samsung devices running the same operating-system release were chosen, and brand names were masked. Before visiting the online shop, the researcher asked subjects to hold the device in landscape mode during any further interactions and to read carefully through the task instructions, which were handed out on a piece of paper. This principal-agent task asked study attendees to visit the randomly assigned online shop using a smartphone/tablet and to select a skillet for a friend whose birthday was in a couple of weeks (Diehl, 2005). After searching, the participants were asked to indicate their perceptions in an online-based survey. This questionnaire consisted of previously used scales measuring the core constructs (see Appendix). Additionally, subjects rated their perceptions of task comprehension (McKinney *et al.*, 2002), task realism (Jones *et al.*, 2014), and structural, as well as content-related complexity (Hoffmann *et al.*, 2011).

4 Data Analysis, Results, and Discussion

4.1 Study I

Of the original 525 participants who opened the questionnaire link, 295 valid responses remained for data analysis, and 230 responses were discarded due to incomplete answers (in 95 cases, surveys were incomplete because respondents did not fit in the target group of the survey). The demographic backgrounds of these 295 respondents were distributed in terms of age, gender, and profession in a way which mirrors the distribution of German mobile Internet users (Statistisches Bundesamt, 2014). Only the amount of medium-level education slightly differed from this distribution.

Analyses of measurement and structural models were performed using Mplus 7.3. Due to the non-normality of the data and subsequent analysis of interaction effects, subsequent data analysis bases on the MLR estimator with Satorra–Bentler robust standard errors (Satorra and Bentler, 2001). Data analysis revealed that the construct of confusion in this study consisted of only two, not three dimensions and cannot be operationalized as a reflective, second-order-construct. Hence, the two constructs, namely "helplessness/irritation" and "inefficiency," that emerged in the analysis were considered separately. Furthermore, the two dimensions of reuse intentions (i.e., reusing e-channel and reusing the online shop) were insufficiently correlated; so, in the end, two single-item outcome variables were used. After discarding items of poor reliability, all items/constructs considered fulfilled the requirements of reliability and validity (Bagozzi and Yi, 1988). Examining discriminant validity yielded that the lowest average variance extracted (AVE) of all measures exceeded the highest squared correlation between all constructs (Fornell and Larcker, 1981). Moreover, fit indices confirmed the appropriateness of employed measurement models (see Appendix), as all fit indices met the recommended thresholds (Steenkamp and Baumgartner, 1995).

Structural equation modeling confirmed the majority of the hypothesized relationships. The proposed model fit the empirical data well (see Table 3). Accordingly, PWC decreases individuals' satisfaction with the mobile online shop, which supports the assumption of Mai *et al.* (2014), who expected that an increasing level of complexity would be inappropriate in mobile interfaces. While PWC has no effect on perceived inefficiency, it does enhance individuals' feelings of irritation and helplessness. This finding sheds light on the nuanced effect that the complexity of virtual environments has on individuals' perceptions of confusion, thereby complementing the work of Garaus and Wagner (2013), who summarized from several qualitative studies in offline retail settings that complexity represents "pronounced confusion potential" (Garaus and Wagner, 2013, p. 407). The missing effect of PWC on perceived inefficiency can be explained by the selected expertise with online shopping of individuals in the sample. Mai *et al.* (2014) additionally found that PWC has no linear effect on perceived ease-of-use, a construct closely related to self-efficiency (Yi and Hwang, 2003). Both perceived inefficiency

and helplessness/irritation lower users' overall satisfaction with the mobile shop, which supports the view of Garaus (2014), who emphasized that individuals' negative responses result from confusion. Satisfaction with the mobile shop, in turn, elevates individuals' intentions both to reuse the online shop and to reuse the respective e-channel. Assessing the significance of the indirect and total effects in this study relied on bias-corrected bootstrap confidence intervals (CIs) using Mplus (Mackinnon *et al.*, 2004). Based on calculations with *N = 1.000* random samples, the results demonstrate that the indirect effect between PWC and satisfaction, considering the intervening variable "helplessness/irritation," reaches a significant value of $\beta = -.141$ ($CI_{95\%} = -.107, -.049$), whereas the indirect effect of PWC and satisfaction considering inefficiency is insignificant ($\beta = -.005$, $CI_{95\%} = -.020, .016$). The total effect of PWC on satisfaction is $\beta = -.279$ ($CI_{95\%} = -.197, -.085$), which further supports hypothesis *H1*. Furthermore, the total effect between PWC and reuse intentions of the respective online shops ($\beta = -.152$, $CI_{95\%} = -.143, -.065$), as well as between PWC and reuse intentions of the mobile online shop ($\beta = -.090$, $CI_{95\%} = -.119, -.043$), both strengthen the overall hypothesis that complexity has a negative effect in mobile interfaces and demonstrate that the mobile online shop experiences even affect responses related to the online shop regardless of the respective access channel.

	B	*Hypotheses*
H8: PWC x Online Shop Experience → Confusion (Perceived Inefficiency)	$.087^{ns}$	×
H8: PWC x Online Shop Experience → Confusion (Perceived Irritation/Helplessness)	$.079^{ns}$	
H8: PWC x Online Shop Experience → Satisfaction	$.065^{ns}$	
H9: PWC x Negative Beliefs → Confusion (Perceived Inefficiency)	$.125^{ns}$	✓×
H9: PWC x Negative Beliefs → Confusion (Perceived Irritation/Helplessness)	$.174^{**}$	
H9: PWC x Negative Beliefs → Satisfaction	$.140^{**}$	
Note: ** p < .05, * p < .1, ns non-significant, × hypothesis rejected ✓× hypothesis partially accepted, B unstandardized path coefficient		

Table 2. Results regarding hypotheses H8 and H9 in Study II

In line with the procedure described by Maslowsky *et al.* (2014), the moderating effects of individuals' beliefs and individuals' experiences on the effects of PWC were estimated using the approach of latent moderated structural equations (LMSE). Following the results depicted in Table 2, hypothesis *H8* must be rejected. Hence, the effects of PWC on confusion and satisfaction in mobile interfaces are independent of individuals' prior familiarity with an online shop. Experience occurs at different levels (e.g., experience with online shop versus experience with the mobile online shop) whereas experience at lower levels (e.g., experience with mobile online shop) contribute more to explaining interrelationships, whereas broader externally induced experiences are losing their relevancy (Eastin 2002). While the interaction term of PWC and individuals' beliefs on both helplessness/irritation and satisfaction were significant, a non-significant result was found with regards to inefficiency. Therefore, *H9* can be partially accepted. Hence, individuals' negative beliefs shape the effects of PWC on helplessness/irritation and on satisfaction, in that they strengthen the respective effects of PWC.

4.2 Study II

In total, 248 students took part in the laboratory experiment. Because of missing data, subsequent data analysis was based on the responses of 239 students, of which 65.3% were male. First, analysis of variance was performed, with the results confirming that participants in this study perceived the manipulation of visual website complexity as intended ($F(3,235) = 10.668$, $p < .01$). Second, although participants were randomly assigned to the treatment groups, an additional analysis of potential interfering effects was conducted. The results of variance analyses and chi-square tests demonstrate that no significant differences exist between the four groups regarding subjective Internet experience ($F(3,229) = 1.084$, $p > .1$), product familiarity ($F(3,229) = 1.236$, $p > .1$), attitude towards cooking ($F(3,229) = .094$, $p > .1$), understandability of the search task ($F(3,229) = .302$, $p > .1$), search task realism ($F(3,229) = .418$, $p > .1$), content-related complexity ($F(3,229) = .724$, $p > .1$), or structural

complexity ($F(3,229) = .705$, $p > .1$). Third, the analysis of measurement models, relying on the same procedure as in Study I, demonstrates overall satisfactory results regarding the reliability and validity of the employed constructs. Nevertheless, the data cannot confirm the expected three dimensions of confusion. In this empirical study, a unidimensional measure of individuals' confusion represented the best solution, discarding items of poor reliability. Due to low inter-item correlations, two single-item measures were finally employed to measure individuals' intention to reuse the mobile channel and the respective online shop. Although the construct "behavioral disengagement" exhibited an AVE slightly below the recommended threshold of .500, discriminant validity between all constructs was achieved. To summarize, with the exception of the significant χ^2 value, the fit indices yielded no further concern (see Appendix). Hence, the theoretical model fit well the data.

	Study I (N = 295)		**Study II (N = 239)**	
Main Effects	*ß*	*Hypotheses*	*ß*	*Hypotheses*
H1: PWC ⟶ Satisfaction	$-.134^{**}$	✓	-	-
H2: PWC ⟶ Confusion	-	✓×	$.392^{***}$	✓
H2: PWC ⟶ Confusion (Inefficiency)	$.017^{ns}$		-	
H2: PWC ⟶ Confusion (Irritation/Helplessness)	$.331^{***}$		-	
H3: PWC ⟶ Mental Disengagement	-	-	$.060^{ns}$	×
H3: PWC ⟶ Behavioral Disengagement	-		$.162^{ns}$	
H4: Satisfaction ⟶ Shop Reuse Intention	$.546^{***}$	✓	-	-
H4: Satisfaction ⟶ Channel Reuse Intention	$.322^{***}$		-	
H5: Confusion (Inefficiency) ⟶ Satisfaction	$-.284^{***}$	✓	-	-
H5: Confusion (Irritation/Helplessness) ⟶ Satisfaction	$-.425^{***}$		-	
H6: Confusion ⟶ Mental Disengagement	-	-	$.558^{***}$	✓
H6: Confusion ⟶ Behavioral Disengagement	-		$.441^{***}$	
H7: Mental Disengagement ⟶ Shop Reuse Intention	-	-	$-.029^{ns}$	✓×
H7: Mental Disengagement ⟶ Channel Reuse Intention	-		$-.208^{**}$	
H7: Behavioral Disengagement ⟶ Shop Reuse Intention	-		$-.200^{*}$	
H7: Behavioral Disengagement ⟶ Channel Reuse Intention	-		$.004^{ns}$	
Model Fit Information	$\chi^2_{(df)} = 149.545_{(129)}{}^{ns}$, RMSEA = .023, CFI = .992, TLI = .990, SRMR = .038		$\chi^2_{(df)} = 169.958_{(96)}{}^{***}$, RMSEA = .057, CFI = .919, TLI = .899, SRMR = .056	
Note: *** p < .01, ** p < .05, * p < .1, ns non-significant, ✓ hypothesis accepted, × hypothesis rejected, ✓× hypothesis partially accepted, ß standardized path coefficient				

Table 3. Results regarding hypotheses H1 - H7 in Study I and Study II

Fourth, the structural equation model was analyzed using the same approach as in Study I. The results show (see Table 3) that PWC positively influences shoppers' confusion, which in turn induces both mental and behavioral disengagement. Mental disengagement was found to reduce the intention to reuse the mobile shop, while behavioral disengagement, by contrast, decreases the intention to reuse the online shop in the future, with no specific impact on mobile shop reuse intentions observed. Subsequently, path and mediation analyses were performed using bias-corrected bootstrap CIs. Based on the results of *N = 1.000* random samples, the indirect effect of PWC on behavioral disengagement was significant ($\beta = .173$, $CI_{95\%} = .090, .331$), whereas the total effect of PWC on behavioral disengagement had a value of $\beta = .335$ ($CI_{95\%} = .149, .542$). The indirect effect of PWC on mental disengagement was estimated as $\beta = .219$ ($CI_{95\%} = .113, .360$), whereas the total effect in this case was estimated at $\beta = .279$ ($CI_{95\%} = .093, .497$). Because the relationship between PWC and coping strategies was non-

significant, while the indirect effects of PWC on coping via confusion were significant, the condition of full mediation was deemed satisfied. Additionally, PWC has a negative total effect on the intention to reuse the online shop (β = -.075, $CI_{95\%}$ = -.235, -.026) and on the intention to reuse the mobile online shop (β = -.057, $CI_{95\%}$ = -.259, -.022).

5 Theoretical and Managerial Implications

Examining the effects of PWC on individuals' perceptions of and behavior-related intentions in mobile interfaces is the focal point of this work. This research contributes to existing knowledge regarding computer-based website complexity. First, PWC has a strongly negative effect on user satisfaction when individuals access an online shop on their mobile device. One can therefore conclude that medium and high levels of complexity seem inappropriate for constrained mobile interfaces, contradicting the theory of Berlyne (1974) in this context. Second, perceptions of confusion intervene in the relationship between PWC and user satisfaction, as well as between PWC and situational coping strategies. These findings contribute to the extent that they shed light on previously unexamined consequences of PWC. Further, the results confirm that perceptions of confusion occur even in virtual retail environments and that these perceptions are highly important, diminishing online shop users' satisfaction as well as enhancing their tendencies to mentally or behaviorally disengage. Satisfaction and disengagement, in turn, significantly affect individuals' intention to reuse an online shop, in general, and a mobile online shop, in particular. Third, whereas individuals' prior online shop familiarity neither strengthens nor weakens the effects of PWC, individuals' negative beliefs towards mobile shopping shape the effects of PWC. These findings supplement the previously examined influences under which the effects of perceived complexity vary and clarify previous findings in this regard (Deng and Poole, 2010; Orth and Wirtz, 2014).

For online retailers, the most important implication of the two studies conducted is to avoid (visual) complexity when designing mobile online shops. Because PWC induces perceptions of confusion, visitors become dissatisfied and finally disengage from taking further action. Managing mobile-based complexity perceptions requires creating optimized and mobile-adapted online shops. To attain this goal, a simple size-scaling procedure seems insufficient, because text-background contrast and animated images or logos also contribute to perceptions of complexity. Hence, providers of online shops should even question current responsive design approaches that mainly rearrange existing content and neglect to adapt color schemes to mobile (e.g., Nebeling and Norrie, 2013). Another avenue could be for retailers to promote the performance advantages of mobile online shopping, because, as the presented results demonstrate, negative beliefs about mobile shopping significantly shape the effects of PWC.

6 Limitations

Because this research focuses on particular measures, constructs, and methods to investigate the effects of PWC, it has some limitations that should be addressed by future research. Although the second study considered both figure-background contrast and animations, which are related to perceptions of visual complexity, additional indicators of complexity perception should be identified and tested by empirical research. To that extent, the identification of mobile-specific complexity indicators represents a promising avenue which might shed light on the nature of mobile website complexity. Moreover, future research should address previously identified facets of complexity, such as structural and content complexity, to extend the findings presented here. Furthermore, additional effects of PWC that have been considered in prior research should be validated for shops accessed on mobile devices. For instance, positive outcome variables, such as enjoyment, could clarify the role played by PWC in mobile online shops. Specifying coping strategies users adopt during mobile interactions (e.g., switching to another app, functionality) could represent another promising avenue for research. Future research should also consider additional shopping situations (e.g., browsing and searching), because the type of shopping situation might moderate the effects of PWC in mobile interfaces (Deng and Poole, 2010).

Appendix

		Study I				Study II			
Construct	**Items Used for SEM**	**FL**	**ICC**	**CR**	**AVE**	**FL**	**ICC**	**CR**	**AVE**
PWC (Geissler *et al.*, 2006; Tuch *et al.*, 2009)	The mobile online shop is (visually)easy to view, dense, dissimilarly designed, varied	.862	.331	.959	.853	.642	.391	.801	.576
Confusion (Garaus and Wagner, 2013)	*helplessness:* I felt helpless/lost/overstrained when I was visiting the mobile online shop.	.843	.459	.953	.772	.656	.534	.869	.632
	irritation: I felt annoyed/irritated/nerved when I was visiting the mobile online shop.								
	inefficiency: I felt efficient/productive/high-performing when I was visiting the mobile online shop.	.659	-.207	.784	.550				
Disengagement (Yi and Baumgartner, 2004)	*mental:* I tried not to think about the situation./I wished that I could escape from the situation.	--	--	--	--	.665	-.212	.790	.659
	behavioural: 1 couldn't go on, so I just quit trying./1 gave up the attempt to get what I wanted./1 resigned myself to the fact that further efforts were futile.					.654	-.213	.660	.471
Satisfaction (Frank *et al.*, 2014)	disconfirmation of expectations/need fulfilment/comparison with ideal	.695	.546	.793	.563	--	--	--	--
Reuse intentions (Kim and Forsythe, 2009)	*online shop:* I would be likely to use online shop XY again for online shopping.	-	.440	-	-	-	.137	-	-
	mobile online shop: I would be likely to use the mobile online shop again.	-	.440	-	-	-	.137	-	
Prior online shop experience (Rose *et al.*, 2012)	I consider myself experienced using this online shop.	-	.327	-	-	--	--	--	--
Negative Beliefs (Dabholkar and Bagozzi, 2002)	Using an Internet-enabled mobile device for online shop visits will: be complicated/take a lot of effort/require little work/take a long time/be reliable	.849	-.311	.949	.788	--	--	--	--
		$\chi^2_{(df)}=269.586_{(227)}^{ns}$; CFI=.989; TLI=.987; RMSEA=.028; SRMR=.029				$\chi^2_{(df)}=141.898_{(91)}$; CFI=.945; TLI=.927; RMSEA=.048; SRMR=.043			

Note: FL (lowest Factor Loading), ICC (highest Inter-Construct Correlations), CR (Composite Reliability), AVE (Average Variance Extracted), CFI (Comparative Fit Index), TLI (Tucker-Lewis- Index, RMSEA (Root Mean Square Error of Approximation), SRMR (Standardized Root Mean Square Residual)

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