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JEANNOT F., JONGMANS E., LIANG L., DAMPÉRAT M. (2022). Impact of website visual design on user experience and website evaluation: The sequential mediating roles of usability and pleasure. *Journal of Marketing Management*. Jul., 1-36. https://doi.org/10.1080/0267257X.2022.2085315

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Abstract: In this study, we investigate how website visual design affects users' experience, then their subsequent attitudinal and behavioural outcomes towards the website. We investigate the roles of usability and pleasure, two important constructs of user experience, and propose a three-path sequential mediation model. We test the model with experiments in which we assign web users with varied levels of website visual design in two studies, one with a fictional website and the other with comparable webpages from real e-commerce websites. In both experiments, we find a consistent positive effect of website visual design on website evaluation variables through a sequential mediation of usability and pleasure. An alternative reversed mediation model in which pleasure precedes usability is also tested but found to be unsupported.

Keywords: web user experience, e-commerce, visual design, usability, pleasure, mediational model

Summary of statement of contribution: This study offers a new perspective for understanding web user experiences. Our results identify a serial causal path from visual design to website evaluation through a 'usability-to-pleasure' sequence as an underlying mechanism. Moreover, usability only affects website evaluation outcomes through the mediation of pleasure without its own direct effect. These findings provide researchers and practitioners with a practical agenda for designing more engaging user experiences in the e-commerce context.

Introduction

User experience with websites and other digital platforms, as rooted in research in both human-computer interaction (HCI) and marketing, is increasingly important in this era of e-commerce (Yu & Kong, 2016) as a crucial differentiator in today's fierce competition in engaging online customers (Deng & Poole, 2010). Despite extensive research, industry studies have found that few business executives believe that their companies offer 'high quality' digital mediated experiences to end users (Pring, 2014, p. 4), and they face moderate to severe risks to their revenue and market share as a result of unimproved customer-centric experiences (Forbes, 2019). Rose et al. (2011) suggest that a useful conceptual model of online customer experience must 'identify the elements or states that make up an experience' (p. 27). In an extensive literature review on customer experience research by Waqas et al. (2021), the drivers of customer experience on the internet, as well as the behavioural consequences of the experience are identified as research priorities with several gaps to fill.

An important yet not thoroughly studied element that contributes to user experience with a digital interface is its visual design (Deng & Poole, 2010), which refers to the sensory and structural attributes from which consumers form a global attitude towards an interface's appearance (Mishra et al., 2015). The concept of visual design is related to the aesthetics of the interface, which is often studied as an antecedent of the experience. In a systematic review of the experience literature, Waqas et al. (2021) examine all the antecedents of customer experience, and identifies only four studies (Constantinides, 2004; Constantinides et al., 2010; Martin et al., 2015, Rose et al., 2012) that investigate aesthetics as an antecedent of customer experience in business research. Given the potential impact of visual design on web users' attitudes and behaviours towards the website, understanding how visual design affects website user experience is critical both to marketing practitioners (Nielsen Norman Group, 2017a) and researchers.

Due to the complexity and multidimensional nature of user experience, the findings of previous empirical studies on the role of digital interface visual design have been inconclusive. While some studies reveal that the aesthetics or visual design of digital interfaces positively influences consumers' judgments and behaviours (e.g. Cai & Xu, 2011; Lee & Koubek, 2010; Pengnate, Sarathy & Lee, 2019), others find that visual design does not (directly) affect influence their behavioural intentions (e.g. Chopdar & Balakrishnan, 2020; Pengnate & Sarathy, 2017; Xu & Schrier, 2019). Those mixed findings suggest that the influence of a website's visual design on its users' experiences, as well as their attitudinal or behavioural outcomes towards the website, is a complex process; this motivates our investigation into the underlying mechanisms. In this paper, we study the mechanisms that underlie the effects of website visual design through the lens of web user experience[1].

Since the pioneering work of Hoffman and Novak (1996), the concept of 'experience' has been at the heart of models explaining consumer reactions to web interfaces. The experience is studied in the marketing literature in two ways: in cumulative form after multiple interactions, in which case it is qualified as a *customer experience* (Martin et al., 2015; Rose et al., 2012; Tyrväinen et al., 2020), or at the end of an interaction with the web interface, in which case it is called a *user experience* (Seckler et al., 2015). Becker and Jaakkola (2020) recommend studying the experience immediately after the interaction with the stimuli linked to the offer, which allows us to 'improve the validity of the findings' (p. 638) in relation to surveys sometimes carried out several weeks after the interaction (or interactions) with a site. The first interactions with a website are important as they help consumers form initial impressions that 'have a large impact on [their] subsequent attitudes and behavio[u]r' (Jiang et al., 2016, p. 232). Following Becker and Jaakkola's (2020) recommendation, we study web users' reactions to a concurrent experience they have with web interfaces.

Among multiple dimensions of the web user experience that have been studied by researchers (e.g. Schmitt, 1999; Gentile, Spiller & Noci, 2007; Lemon & Verhoef, 2016), we focus on the cognitive and affective dimensions which are proven to be important from various frameworks of experience studies (Waqas et al., 2021). The two constructs of web user experience we explore are usability and pleasure, relating to procedural cognitions and emotional reactions, respectively. Originating from the field of HCI, usability is an essential component of the experience with e-commerce websites (e.g. Chen & Yang, 2021; Lazard & King, 2019; Pengnate & Sarathy, 2017), and it contributes to the quality of this experience (Loiacono et al., 2002). The pleasure of navigating and interacting with a website is another fundamental component of the web user experience (e.g. Bufquin et al., 2020; Krasonikolakis et al., 2018), but it has generally been studied separately from usability[2]. In classic models from environmental psychology, notably the Stimulus-Organism-Response (SOR) model (Mehrabian & Russell, 1974), pleasure is directly caused by a website characteristic (in this case, visual design). Another approach rooted in the *Aha! Experience*[3] (Lakshmanan and Krishnan, 2011) with technology products suggests that pleasure could also be caused indirectly by an interface's characteristics through the process of learning how to use the interface. The *Aha! Experience* offers a new perspective to understand the role of visual design in e-retailing settings.

This study aims to explore how website visual design influences web users' experiences and their evaluations of a website. Specifically, we propose to study this influence from the perspective of a double serial mediation through website usability and the associated pleasure of using it. The contribution of this research lies in the following aspects: first, by studying web users' experience of a concurrent usage session with e-commerce websites, we identify the mediating roles of constructs from two dimensions of web user experience between website visual design, an important antecedent, and behavioural

consequences of the experience (i.e. perceived value, the intention to reuse and the intention recommend the website); second, we substantiate a sequential mediation path from usability to pleasure, which extends the *Aha! Experience* in the e-commerce context, and sheds light on the underlying mechanisms of how different dimensions of experience work on e-commerce website evaluation; third, unlike prior studies which have largely focused on the effects of visual design on the usability of an interface, this study looks beyond it and further explore the consequences of the experience, namely, the perceived value and the intention to reuse and the intention to recommend. From a managerial perspective, our findings not only provide theoretical and empirical validations of the constant improvement in website visual design from practitioners in e-commerce, but also equip web designers with applicable guidelines for prioritising different user experience dimensions to improve web user experience.

Theoretical framework and literature review

To provide a better understanding of the relationships among website visual design, user experience and evaluation outcomes, we refer to web user experience as a mediating mechanism. We review the definition and characteristics of all the constructs in relation to literature in marketing and related fields, which constitutes theoretical foundations and motivates our research hypotheses development in the next section.

Website visual design

Extant research has studied several elements of website design: navigation and organisation elements, information content or social cues (Cyr et al., 2018; Karimov et al., 2011), along with their roles in consumers' perceptions and reactions in an online environment. Website visual design, an essential element of website design, is defined as 'the attention-grabbing, aesthetic, visual quality of individual web pages' (Demangeot &

Broderick, 2010, p. 127). Cyr et al. (2006) refer to website visual design as 'the balance, emotional appeal or aesthetic of a website and it may be expressed through colours, shapes, font type, music or animation' (p. 951). The difference in its definition stresses the distinction between a global evaluation, referring to its overall appeal (or attractiveness), and specific design factors on which the evaluation is based. In other related fields, such as HCI and e-commerce research, website visual design is described as the sensory and structural features, as designed by engineers or web designers, on which consumers base their first impression of a product or interface (Seckler et al., 2015; Mishra et al., 2015).

Distinct from other web design elements, website visual design deals with multiple factors of a webpage, such as colour, contrast, image size, shape, font size, colour schemes, layout, space or typography, to achieve visually pleasing outcomes, positive emotional appeal and overall enjoyable user experience (Cyr, 2008; Coursaris & Van Osh, 2016; Garett et al., 2016; Post et al., 2017). Despite being determined by specific technical characteristics and design factors, researchers find that consumers or website users tend to form their perceptions of a website's visual appearance in a general, abstract and global manner (Mishra et al., 2015). As Veryzer (1993) states, the reaction a person has to an object (e.g. a product) is based on 'the qualities and configurality of the physical features (i.e. design) of the object (product)' (p. 224). Mishra et al. (2015) illustrate this statement using the example of television screen resolution and pixel density, where resolution is a global measurement of visual clarity while pixel density is a technical factor contributing to the resolution. Similarly, for interface visual design, although characteristics such as colour, symmetry and grid shapes are specific design factors that constitute the aesthetics and visual quality of the website, users rely on a global perception using those characteristics to form their judgements about interface visual appearance and aesthetics. Therefore, in this study, we consider visual design of a website as a global construct, which is also consistent with other well-established

research (e.g. Chopdar & Balakrishnan, 2020; Jiang et al., 2016; Pengnate & Sarathy, 2017; Seo et al., 2016; van der Heijden; 2003; Xu & Schrier, 2019) and industry practice[4].

For websites, visual design plays a critical role in consumer psychological and behavioural responses (Bloch, 1995). Researchers have established that website visual design has a positive impact on constructs including website trust (Karimov et al., 2011; Pengnate & Sarathy, 2017; Seckler et al., 2015), user engagement (Pengnate, Sarathy & Lee, 2019) and website satisfaction (Tractinsky et al., 2000; Coursaris & Van Osch, 2016), yet studies of the mechanisms that underlie the influence of website visual design on online users' judgments and behaviours remain relatively scarce.

Web user experience

In a retailing context, Verhoef et al. (2009) define customer experience as a multidimensional, holistic construct that involves customers' cognitive, affective, emotional, social and physical responses to the retailer. Lemon and Verhoef (2016) provide an extensive review of multiple definitions and roots of customer experience. Becker and Jaakkola (2020, p. 638) propose an integrated view of customer experience by indicating that it comprises 'customers' non-deliberate, spontaneous responses and reactions to offering-related stimuli along the customer journey' and ranges from 'ordinary to extraordinary', depending on the intensity of customer responses to stimuli. The particularity of customer experiences is to encompass all interactions (or touch points) of a consumer with the products or services of a company or a brand (Verhoef et al., 2009). When these interactions occur in a digital environment (in particular, a website), they are referred to as 'online customer experiences' (Agarwal, 2019; Bleier et al., 2019; Jaiswal & Singh, 2020; Martin et al., 2015; Nambisan and Watt, 2011; Pandey and Chawla, 2018; Micu et al., 2019; Rose et al., 2012). Bleier et al. (2019) define online customer experiences as a collection of holistic and subjective

experiences that are triggered by online verbal and visual stimuli (i.e. webpage design elements) rather than physical interactions. The online customer experience is described as 'cumulative' (Rose et al., 2012, p.308). In this sense, it differs from a similar concept derived from the HCI literature, the *user experience*, which refers to 'the perceptions and reactions of a user that result from the actual and / or anticipated use of a system, product or service' (ISO, 2019). User experience is defined as 'a consequence of a user's internal state, the characteristics of the designed system and the context (or the environment) within which *the interaction* occurs' (Hassenzahl & Tractinsky, 2006, p. 95).

Among multiple dimensions of the experience that have been studied (e.g. Schmitt, 1999; Gentile, Spiller & Noci, 2007; Lemon & Verhoef, 2016; Waqas et al. 2021), we explore two essential constructs of web user experience, *usability* and *pleasure*, from the cognitive and affective dimension of the experience, respectively, which have been studied simultaneously by only a limited number of researchers (e.g. Bilgihan et al. 2016; Krasonikolakis et al., 2018; Pandey & Chawla, 2018). It is worth noting that these studies focus on either multiple interactions or memory-based experience, and our study focuses on a specific task-based interaction for a concurrent experience.

Usability. The International Organisation for Standardisation (ISO) defines 'usability' as 'the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use' (ISO, 2009). It also refers to the level at which people perceive that the use of technology does not demand significant effort (Wood & Moreau, 2006). In computer-mediated environments, usability primarily comes from 'ease of use, ease of navigation, efficiency and effectiveness' of the application (Nambisan & Watt, 2011, p. 890). It is an essential component of the experience with e-commerce websites (e.g. Bilgihan et al., 2016; Chen & Yang, 2021; Kang & Namkung, 2019; Lazard & King, 2019; Pengnate & Sarathy, 2017; Yu and Kong, 2016).

Pleasure. Pleasure is an important element of the Pleasure-Arousal-Dominance (PAD) model. Russell and Mehrabian (1977) define pleasure as a mood state that ranges from extreme pain or unhappiness to extreme happiness or ecstasy, and suggest that pleasure, along with the other two emotions, can be affected by stimuli, thus influencing the experience of users with the environment. Broach et al. (1995) define pleasure as the intensity with which an individual feels joy or contentment in an environment. In the online environment, pleasure is defined as a positive emotion that reflects the hedonic dimension of online customer experience (e.g. Bufquin et al., 2020; Huang et al., 2017; Krasonikolakis et al., 2018), but it has generally been studied separately from usability.

Website evaluation outcomes

Ultimately, firms that deal with web users and online customers are interested in value-driven outcomes. Existing research on user experiences of online platforms has examined intentional outcomes such as attitudes towards products and companies (Nambisan & Watt, 2011), shopping satisfaction (Martin et al., 2015; Morgan-Thomas & Veloutsou, 2013; Rose et al., 2012), intentions to visit and revisit (Cuny et al., 2015; Fiore et al., 2005; Hsu et al., 2012; Luo et al., 2011; Morgan-Thomas & Veloutsou, 2013), and intentions to purchase and repurchase (Martin et al., 2015; Luo et al., 2011; Rose et al., 2012). Other research has also examined a few behavioural outcomes such as exploratory behaviours (Novak et al., 2000), actual usage (van der Heijden, 2003) and purchase behaviours (Bleier et al., 2019). The choice of value-driving outcomes is often determined by the specific empirical context and the firm's offerings. In this study, we focus on website evaluation outcomes, i.e. (1) *perceived value, (2) intention to reuse* and (3) *intention to recommend*. Those outcomes are indicators for favourable business outcomes and have important associations with web user experiences.

Perceived value. Perceived value of a website is defined as 'an interactive, relativistic, preference experience that results from visiting the web site' (Steenkamp & Geyskens, 2006, p. 137). The value derived from a website is based on the experience of subject-system interaction. That value is specific to each internet user, and it is affected both by site characteristics (e.g. visual design) and by the person who visits it (e.g. perceptions and emotions). Perceived value can be measured monetarily (Kalish & Nelson, 1991) or non-monetarily (Steenkamp & Geyskens, 2006). In this study, we focus on the non-monetary in-use value (Parasuraman & Grewal, 2000) derived from the actual use of the website.

Intention to reuse. In pre-use contexts, intention to use is a significant variable of the technology acceptance models (TAMs) (Venkatesh et al., 2003). It refers to the anticipated degree of system use and has been recognised as a strong predictor of actual system use (Morris & Dillon, 1996; Benning et al., 2012; Cheng, 2011; Hassenzahl & Tractinsky, 2006; Hsu & Lin, 2008; Liu et al., 2015). The equivalent construct in the post-use context is intention to reuse, which measures the anticipated degree of subsequent system use, such as of a website (Hung, Tsai, & Chou, 2016). In this study, we focus on the post-use context, i.e. after users interact with and experience the actual website.

Intention to recommend. This is a measurement of anticipated positive word of mouth (WOM) and has been recognised as an important predictor of firm performance and customer loyalty (Moldovan et al., 2011). Some empirical studies show that intention to recommend could be a better predictor of future performance than customer satisfaction (Keiningham et al., 2007; Finn et al., 2009), since the action of recommendation indicates explicit endorsement, as opposed to implicit endorsement, in which people are satisfied with a product or system without recommending it (Packard & Berger, 2017).

Development of research hypotheses

We describe our conceptual model (Figure 1) with six hypotheses: the first three hypotheses are built upon existing literature to substantiate the theoretical foundations, with the last three hypotheses proposed as our contribution to advancing the theory on the relationships among website visual design, web user experience and website evaluation outcomes.

How does website visual design affect web user experience?

Website visual design and usability

As noted by Coursaris and Van Osch (2016), various theories may explain the positive influence of *website visual design* on *usability*. For example, a website with an attractive visual design could be perceived as a superior product as compared to an unattractive one. That effect can also be explained by the halo effect, a cognitive bias when people make a judgment based on their selective perception of information, which helps form a first impression of an object or person. Regarding technology, users form judgments about the usability of a website based on their first impressions, which are shaped by initial reactions to the visual design of the interface. Empirical evidence of a positive relationship between website visual design and usability has been found consistently in multiple studies (e.g. Bringula, 2016; Cyr et al., 2006; Lazard & King, 2019; Pengnate & Sarathy , 2017; Tuch et al., 2012; Xu & Schrier, 2019; van der Heijden, 2003). Based on the consensus in the literature, we have the following hypothesis:

H1: ***Website visual design*** has a direct and positive effect on the ***usability*** that users experience with a website.

Website visual design and pleasure

The emotional responses of users refer to psychological phenomena that explain their decision-making behavior in use situations (Seo et al., 2016). The SOR model posits a direct and positive influence of environmental or organisational stimuli, including website elements (Fiore et al. 2005; Ha & Im, 2012; Luo et al., 2011; Yoo & Kim, 2012), on consumers' emotional states of pleasure, arousal and dominance (Mehrabian & Russell, 1974). Naturally, an attractive visual design, serving as a stimulus, determines the pleasure that users experience during their interactions (Broach et al., 1995). There is a consensus in the literature on the positive effect of visual design on pleasure. For example, Lavie and Tractinsky (2004) suggest that visual design is positively correlated with users' pleasure when navigating a website. The positive influence of visual design on consumer pleasure has been shown with various interface types, including e-service systems (Vilnai-Yavetz & Rafaeli, 2006), digital product interfaces (Lee et al. 2011) and websites (Bleier et al., 2019; Cai and Xu, 2011; Deng and Poole, 2010; Van der Heijden, 2003). In the e-retailing context, the visual design of store layout has also been found to increase consumers' enjoyment during the shopping process (Krasonikolakis et al., 2018). Thus, we propose:

H2: ***Website visual design*** has a direct and positive effect on the ***pleasure*** that users experience with a website.

How does web user experience affect website evaluation?

Several studies have shown that users' experiences positively impact their reactions to systems. Sheng and Teo (2012) suggest that user experience positively affects mobile brand equity. Mishra et al. (2015) confirm that relationship with digital devices. In e-commerce contexts, several studies show a positive relationship between website user experience and purchase-related outcomes, such as repurchase intention (Khalifa & Liu, 2007), satisfaction, trust and repurchase intention with online shopping (Rose et al., 2012). Those prior findings

lead us to expect a positive relationship between the web user experience constructs (i.e. *usability* and *pleasure*) and website evaluation outcomes (i.e. *perceived value*, *intention to reuse* and *intention to recommend*). We first describe the hypothesis corresponding to the pleasure and website evaluation relationship, then those associated with the usability and website evaluation relationship.

Pleasure and website evaluation

In the framework of the traditional SOR model, Mehrabian and Russell (1974) posit a relationship between an individual's internal states, which are caused by external stimuli, and their behaviours. In particular, the pleasure of using an e-commerce interface positively and directly influences consumers' satisfaction (Bhattacharya et al., 2019; Ha & Im, 2012, McLean et al., 2018), purchase intention (Bleier et al., 2019; Fiore et al. 2005; Juaneda-Ayensa et al., 2016; Luo et al., 2011; Yoo & Kim, 2012) and intention to reuse the interface during subsequent navigation (Davis et al., 1992; Fiore et al. 2005; Luo et al., 2011; Shen & Khalifa, 2012). We thus hypothesise as follows:

H3: The ***pleasure*** that users experience with a website directly and positively affects their (a) ***perceived value*** of the website, (b) ***intention to reuse*** the website and (c) ***intention to recommend*** the website.

Usability and website evaluation

We propose that the usability that users experience with a website does not directly affect their website evaluation, but rather there is an indirect effect through the pleasure that they experience while using the website. Accordingly, we first justify the direct relationship between usability and pleasure, then we present theoretical arguments for the indirect effect of usability on website evaluation through pleasure.

Usability's direct positive effect on pleasure. Many empirical studies in the area of online customer experience have examined several dimensions (e.g. cognitive vs affective, functional vs psychologic) of the experience (e.g. Krasonikolakis et al., 2018; Pandey & Chawla, 2018; Bhattacharya et al., 2019; Bleier et al., 2019; Micu et al., 2019; Pleyers and Poncin, 2020; Roggeveen et al., 2020; Gao et al., 2021), yet very few has examined the relationship among constructs of the two dimensions of experience.

Traditional models of web user experience from environmental psychology (e.g. the SOR model by Mehrabian and Russell, 1974) suggest that users' pleasure can be induced via external cues such as website stimuli. We propose that pleasure can also be derived from the usability that users experience with the website. In fact, when learning to use a new digital technology, the emotions (positive and negative) triggered exclusively by the task (i.e. not triggered by external cues such as visual design elements) significantly influence users' reactions to that technology (Mick & Fournier, 1998; Wood & Moreau, 2006). Feelings of frustration, confusion or hopelessness usually occur when consumers encounter technical problems (Mick & Fournier, 1998), but learning to use a new technology could also trigger positive emotions in consumers, especially when they gain a sense of control as they make progress in their learning. That gives rise to a positive emotional phenomenon, known as the *Aha! Experience (*APA Dictionary of Psychology, 2015) and defined in the introduction, as studied in marketing by Lakshmanan and Krishnan (2011). In the online retailing context, Lin and Lo (2016) find that the ease of navigation of a website – a concept close to usability (Nambisan & Watt, 2011) – positively influences consumers' emotional responses of pleasure and arousal. Therefore, we posit the following hypothesis:

H4: The ***usability*** that users experience with a website directly affects the ***pleasure*** they experience.

Indirect influence of usability on website evaluation through pleasure. Although usability has been found to have a positive effect on loyalty (e.g. Chiu et al., 2005), there is a lack of research on the relationship between *usability* and the three website evaluation outcome indicators we focus on. A relevant stream of research on user experience and intention outcomes considers ease of use and usefulness, which are two essential constructs from the TAM (Venkatesh et al., 2003). Those studies find no direct link between ease of use and intention to use interfaces (Chau, 1996; Morgan-Thomas & Veloutsou, 2013), but an indirect relationship through consumers' attitudes is present, as suggested by Davis et al. (1989). Krasonikolakis et al. (2018) find some counter-intuitive evidence in the context of 3D online store that ease of navigation around the 3D store does not predict purchase intentions. Those prior findings lead us to propose that usability does not directly affect website evaluation outcomes but has an indirect and positive effect through the pleasure that users experience with a website.

H5: The ***usability*** that users experience with a website has a positive but indirect effect on **(a)** the ***perceived value*** of the website, **(b)** the ***intention to reuse*** the website and **(c)** the ***intention to recommend*** the website through the ***pleasure*** they experience.

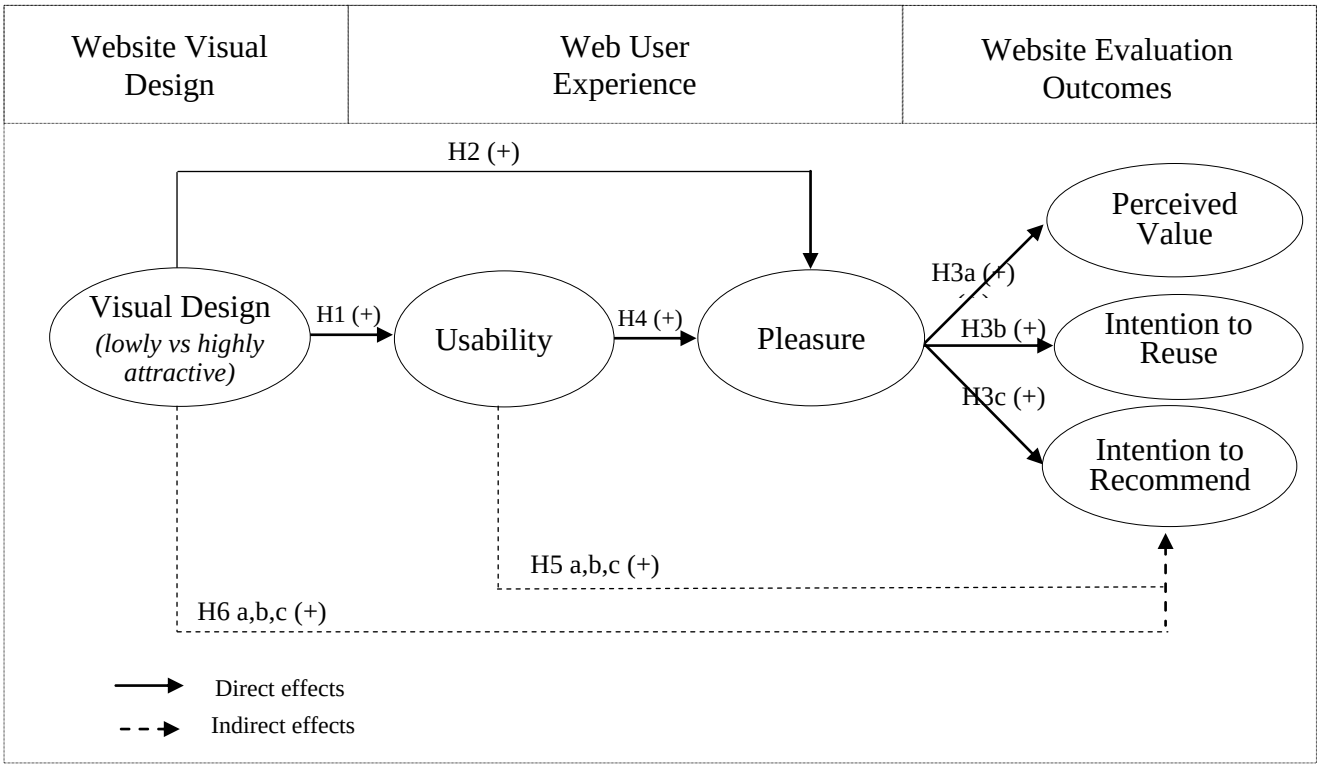
How does website visual design affect website evaluation in relation to web user experience?

Despite its importance to consumer attitudes and behaviours, empirical findings on the effect of website visual design are mixed and thus inconclusive. Some studies find a positive influence of the visual design of digital systems and user judgments (Cai and Xu, 2011; Coursaris & Van Osch, 2016; Ha et al., 2007; Hall & Hanna, 2004; Jiang et al., 2016, Lee & Koubek, 2010; Mishra et al., 2015; Robins & Holmes, 2008; Schenkman & Jönsson, 2000; van der Heijden, 2003; van Schaik & Ling, 2008, 2009). However, quite a few studies suggest

a different story. For example, Hassenzahl (2004) shows that during the early stages of interface use, consumer satisfaction does not relate strongly to hedonic attributes of the interface, such as visual design. Ben-Bassat et al. (2006) suggest that visual design has no effect on the perceived value of computer-based phone book systems. Kim and Lennon (2008) show that website visual design positively influences consumer attitudes when they navigate a website, but it has no effect on their purchase intentions. A few studies show that visual design does not directly affect consumer evaluations of interfaces (e.g. Back et al., 2020; Bufquin et al., 2020; Chopdar & Balakrishnan, 2020; Cyr et al., 2006; Liu et al., 2020; Martin et al., 2015; Pengnate & Sarathy, 2017; Rose et al., 2012; Shen et al., 2016; Xu & Schrier, 2019; van der Heijden, 2003). Wu et al. (2017) find that the consumption of highly visually attractive products has a negative effect on the level of consumption enjoyment. Those mixed findings motivate us to investigate the underlying mechanisms further. We propose that the web user experience acts as a mediator between website visual design and website evaluation outcomes. Derived from H4, usability is an antecedent of the pleasure experienced while using technology products. Thus, we expect a sequential mediating role from usability to pleasure between website visual design and website evaluation outcomes.

H6: The effect of ***website visual design*** on (a) ***perceived value***, (b) ***intention to use and*** **(c)** ***intention to recommend*** is sequentially mediated by the ***usability*** and ***pleasure*** users experience with a website.

Figure 1. The conceptual model: A three-path mediational model



Overview of research methodology

In this section, we present two studies to test our conceptual model and hypotheses. In both studies, we operationalised website visual design consistently as a global measure by changing multiple design elements, echoing our theoretical conception of visual design, in accordance with how prior studies have operationalised this construct (e.g. Chopdar & Balakrishnan, 2020; Jiang et al., 2016; Pengnate & Sarathy, 2017; Seo et al., 2016; van der Heijden; 2003; Xu & Schrier, 2019). Data collection was carried out in the first semester of 2017. In Study 1, we used a fictional website as stimuli, manipulated simultaneously several design elements to achieve two levels of visual design (lowly vs. highly attractive) and surveyed potential customers via an online (Qualtrics) research panel. Study 2 extended the stimuli to a more realistic setting, in which the realisations of different website visual designs were represented by comparable webpages from two real e-commerce websites, with participants required to form their evaluations in a controlled laboratory environment. Results

from both studies support our theory and hypotheses. We describe each study and the respective results in the following subsections.

Study 1

Study 1 was designed to test our hypotheses and establish findings in a controlled setting in which we strictly manipulated the stimuli and controlled other factors. The stimulus in this study was a fictional travel agency website[5] developed specifically for scientific research purposes. A pre-test was developed to ensure the success of the manipulation of visual design. We used a panel of French Internet users aged 18 and older via the Qualtrics online survey tool in both the pre-test and main experiment.

Visual design manipulation

We created two versions of the same travel website by manipulating several distinctive visual design elements referred to in the relevant literature on the design, cognitive psychology and HCI fields. Specifically, we simultaneously manipulated the colour, symmetry, grid shape and typeface, all of which have been found to affect perceptions of visual design (Minge 2008; Coursaris & Van Osch, 2016; Tuch et al., 2010, Henderson et al., 2004). It is worth noting that this manipulation is to help users form a global perception of the website's visual design (considered highly or lowly attractive) and we do not intend to re-establish the effect of each individual design element on the dependent variables.

***Colour*.** Colour information, such as hue, contrast, brightness and saturation, has the potential to affect users' perceptions, emotional reactions or behavioural intentions (Hsieh et al., 2018). Empirically, it has been demonstrated that colour combinations with high-contrast colours are considered less attractive than those with low-contrast colours (Minge, 2008). In this study, we manipulated the background colour of the website and fonts in agreement with

the colour scheme, with two combinations of colour schemes, (1) high saturation green-red and (2) low saturation blue-yellow, because the former combination contains colours further apart (i.e. higher contrast and higher saturation) on the colour wheel than the latter (Figure 2). Based on existing empirical findings (Minge, 2008), the webpage with a 'green and red' colour scheme (Figure 2-a) would be perceived to be less visually appealing than the one with a 'blue and yellow' colour scheme (Figure 2-b).

***Symmetry*.** Gestalt psychology's laws of perceptual organisation have long recognised the role of symmetry in visual design. Several studies in the HCI literature report a positive effect of symmetry on internet users' perceptions of website visual design (Tuch et al., 2010). For example, symmetry of elements within web interfaces guides the perception of beauty by establishing a regular structure and meaningful form on interfaces (Bauerly & Liu, 2006). Aligned elements are perceived as being more pleasant than non-aligned elements (Bauerly & Liu, 2006; Tuch et al., 2010). In this study, we manipulated the symmetry within the webpage by adopting a vertical symmetry, so the webpage that incorporated a block alignment option (Figure 2-b) would be perceived as more visually appealing than the one without the block alignment (Figure 2-a), according to previous empirical findings.

***Grid shape*.** Several studies provide evidence for the effect of object shapes on people's preferences, with Bar and Neta (2006) providing an explanation of that phenomenon, as sharp-contoured objects could be perceived as potential causes of physical harm as compared to rounded objects. Westerman et al. (2012) find that consumers tend to prefer products with rounded forms to those with angular forms when product images with different shapes are displayed to them. In this study, we manipulated the shape of the web grid with either rounded edges or sharp edges. Based on previous findings, the webpage with the rounded grid (Figure 2-b) would be perceived as more visually appealing than the one with sharp edges (Figure 2-a).

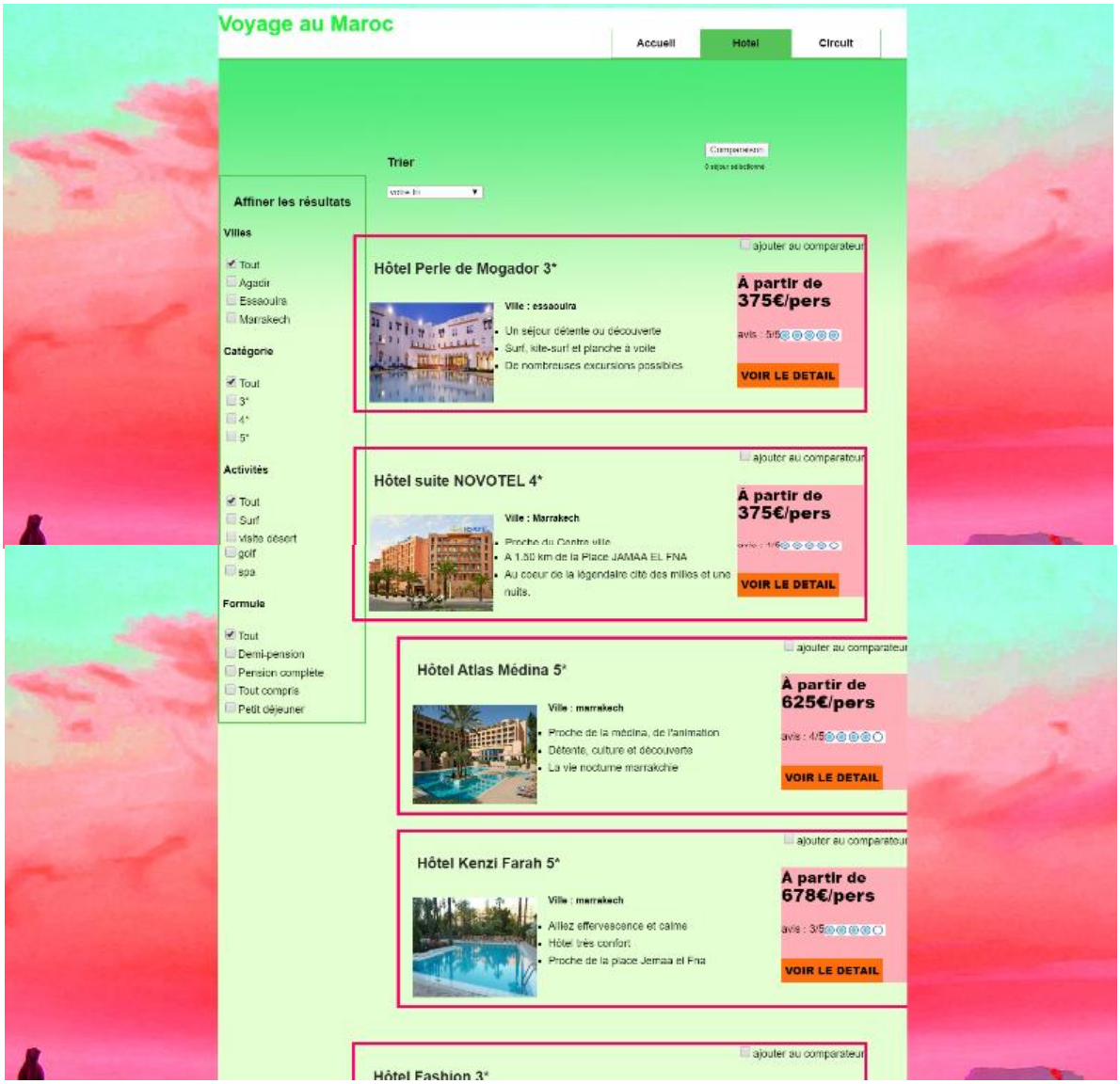
Typeface. An important element of visual design, typeface has many characteristics and dimensions, such as font family, size, weight, curvature, size, symmetry, letter case and serif, many of which have been shown to affect consumer responses. Henderson et al. (2004) have empirically established the relationship between dimensions of typeface design and dimensions of response generated by typeface. Reimer et al. (2014) find that the use of a 'humanist' typeface in a text-rich automotive user interface reduces glance time, response time, number of glances and error rates among some users. Wang et al. (2020) find that round typefaces (high curvature) on marketing materials have a positive effect on consumer preference for hedonic products. Yu et al. (2021) demonstrate an 'uppercase premium effect'. In this study, we manipulated both the heading and body texts of the webpage. For the heading, we expect that a webpage (Figure 2-b) with a more notable and artistic font, namely 'Dream-bd', with a size of 40px, will be perceived more visually pleasing than the one with the most common system font, namely 'Arial', and a size 32 px header (Figure 2-a). For the body texts, we adopted two of the most commonly used system fonts, 'Arial' and 'Source Sans Pro', to facilitate easy web browsing. Moreover, since the latter is perceived to be 'aesthetically more pleasing', 'softer', 'more modern' and more 'humanist' by three web design experts (a type designer/typographer, a design system expert and a web designer/type designer), we expect the webpage with body texts in 'Source Sans Pro' (Figure 2-b) will be perceived as more visually appealing than its counterpart in 'Arial' (Figure 2-a)[6]. All other typeface features such as size and weight remain the same throughout the body texts across the two webpages.

Combining the four design factors simultaneously, a professional web designer created two versions of the same fictional travel website. The realisation of lowly attractive website visual design is characterised by a high-contrast, high-saturation colour scheme, misaligned information blocks, sharp-edged web grids and a common typeface (Figure 2-a). In contrast,

the realisation of highly attractive website visual design is characterised by a low-contrast, low-saturation colour scheme, aligned information blocks, round-edged web grids and a more artistic and modern typeface (Figure 2-b).

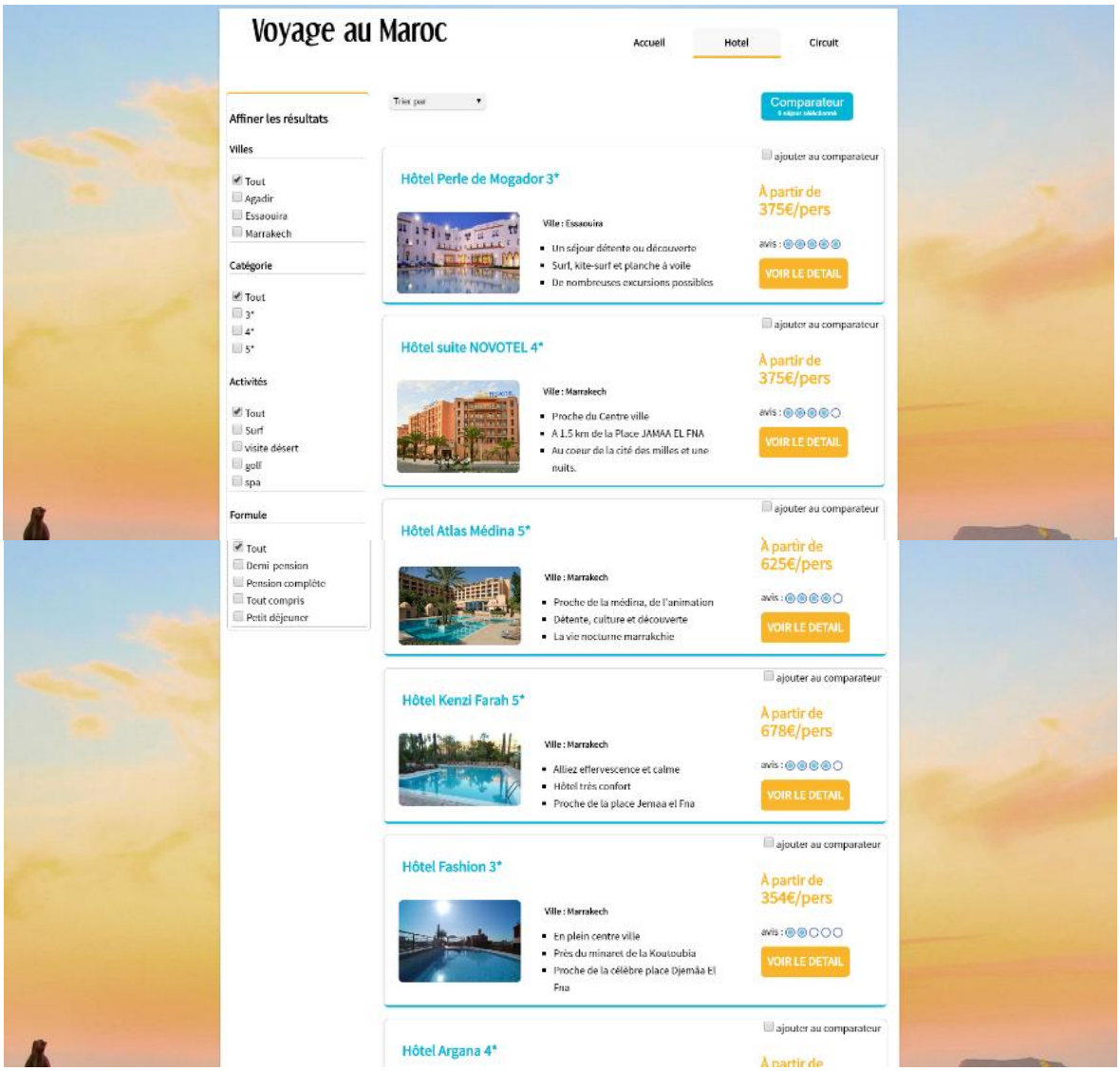
Figure 2. Study 1 – Webpages of a fictional online travel agency website in two visual design conditions

(2-a) Lowly attractive visual design



Available at http://iihm.imag.fr/projects/tigre/userx/mini-site-1/index.html

(2-b) Highly attractive visual design



Available at: http://iihm.imag.fr/projects/tigre/userx/mini-site-2/hotel.html

Visual design manipulation checks

We conducted a pre-test to validate the visual design manipulation using manipulation and instructional checks (Oppenheimer, Meyvis & Davidenko, 2009; Perdue & Summers, 1986). In the experimental survey, 104 French users (45.2% males, M_{age}=44.6 years, sd=14.35) from a paid commercial panel were asked to complete simulated search tasks tied to an envisaged trip to Morocco, with 49 users randomly assigned to the highly attractive website visual design condition (highly attractive condition thereafter) and 55 to the lowly attractive website visual design condition (lowly attractive condition thereafter). In both conditions, participants were asked to complete three bookings. Upon completing the tasks, participants were given a short survey to answer questions regarding their visual design evaluations, age and gender.

To check the manipulation of visual design, we used a seven-point scale adapted from Ben-Bassat et al. (2006) with three items: 'This website seems visually attractive'; 'This website seems beautiful'; and 'This website seems to have an attractive design' (Cronbach's alpha=0.96). We also created a visual design index based on the average of those item scores. As expected, the results indicated a higher visual design evaluation in the highly attractive condition than in the lowly attractive condition ($M_{lowly\ attractive}$ =4.24, sd=1.63 vs. $M_{highly\ attractive}$=5.04, sd=1.01; F[1,102]=8.90; p=0.004).

To check for manipulation of instructions, we adopted two pairs of seven-point scales from Oppenheimer et al. (2009). This tool was created to check whether respondents really did examine the design elements on the website. We asked each participant about the main colours of the website's backgrounds – whether they are mainly 'blue and yellow' (i.e. the colours used in the highly attractive condition) or 'green and red' (i.e. the colours used in the lowly attractive condition). We calculated the difference between those two item scores (highly attractive condition minus lowly attractive condition), and the results demonstrated

that the respondents perceived different colours for the different websites, consistent with the visual design manipulation ($M_{highly\_attractive}$=2.62, sd=2.69 vs. $M_{lowly\_attractive}$=−2.14, sd=3.08; F[1,91]=61.58; p<0.0001): more 'blue and yellow' (BY) colours in the highly attractive condition ($M_{BY\_highly\_attractive}$=5.60, sd=1.25) than in the lowly attractive condition ($M_{BY\_lowly\_attractive}$=3,04, sd=2.09; F[1,91]=48.55; p<0.0001), and more 'green and red' (GR) colours in the lowly attractive condition ($M_{GR\_lowly\_attractive}$=5.18, sd=1.86) than in the highly attractive condition ($M_{GR\_highly\_attractive}$=2,98, sd=1.91; F[1,91]=31.47; p<0.0001). Thus, we concluded that the visual design manipulation was successful.

Sample and protocol

Study 1's sample comprised 205 French Internet users from a paid commercial panel (50.2% males, M_{age}=39.23 years, sd=14.61). The experiment used a between-subject design, with visual design as the independent variable. We randomly assigned each participant to one of the two versions of website visual design (102 respondents in the highly attractive condition and 103 in the lowly attractive condition). In both conditions, the participants were instructed to use the website to complete a series of tasks. For one of the three tasks, we asked the participants to imagine that they are in the process of booking a hotel that offers breakfast in Essaouira (a tourist city in Morocco). While surfing the website, they are required to answer the following questions: (a) 'How many hotels offer breakfast?'; (b) 'What is the name of the hotel you pick?'; (c) 'How far from the beach is the hotel that you found?'; and (d) 'What is the minimum cost per person for a stay in that hotel?' Answering those questions ensured that the participants observed, browsed and used the website under the conditions to which they were assigned. Only one correct answer was possible for each of the twelve questions they answered from the three tasks. In a similar approach to that of Tuch et al. (2012), we calculated an index of task performance – based on the number of good answers

they provide during these tasks – as a measure of usability. Finally, the participants were given a survey to evaluate the website's usability, user-friendliness, their use intentions and their level of recommendation. They were also asked to assess how they perceived the site's value on a seven-point scale.

Measures

Web user experience

Usability and *pleasure*, the two components of web user experience, are the two mediators of our model. As previously indicated, we used the task performance variable as a measure of *usability* ranging from 2 to 12, from twelve questions ($M_{perf.}$=8.62, sd=3.40). To measure *pleasure*, we used a two-item, seven-point scale from an affective product evaluation scale adapted from previous research (Steenkamp & Geyskens, 2006), then took the average of the ratings on the two statements (i.e. 'When surfing this website, I feel: 1. "This website is pleasant to use" and 2. "This website is nice to use"') as the overall measure (those two items' Pearson correlation coefficient was 0.93; $p<0.001$). Considering that the reliability results were satisfactory, we created an index comprising the average of the scale items to test the research models for both usability and pleasure.

Website evaluation variables

Intention to reuse, *intention to recommend* and *perceived value* are the three website evaluation outcomes in our model, and we measured them using established scales based on the literature. For *intention to reuse*, we used a three-item measure based on previous research (Venkatesh, 2000; Steenkamp & Geyskens, 2006) and asked participants to rate their level of agreement with three statements (i.e. 'I intend to visit this website again', 'I will use this website to book my trip' and 'I intend to add this website to my favourites'), in which 1 indicates 'totally disagree' and 7 'totally agree'. The reliability analysis suggested that the

three items had a Cronbach's alpha of 0.97, and the average was calculated as the overall measure of *intention to reuse*. *Intention to recommend* was adapted from Finn et al. (2009) and measured using a seven-point scale to rate the statement, 'I would recommend this website'. Corresponding with the conceptualisation of the perceived value construct, a willingness-to-pay (WTP) measure was used to capture the economic *perceived value*. WTP refers to the maximum price that users are willing to pay for a given product that is equal to its value to the user (Kalish & Nelson, 1991). Accordingly, we captured economic perceived value by asking the following: 'Imagine that you have to book a seven-day all-inclusive stay in Morocco at a four-star hotel in Marrakesh using this website. What would be the maximum amount you would be willing to pay for one person for this stay using this website, knowing that the average price for this kind of stay is around EUR 500?' The average WTP given by the participants was EUR 581.5 (sd=219.03), which represents the average economic *perceived value*.

Control variables

We controlled for the time spent completing the tasks. A comparison of mean time spent between the two conditions indicates no difference ($M_{\_time\_lowly\_attractive}$=16.24 min, sd=9.83 vs. $M_{\_time\_highly\_attractive}$=19.18 min, sd=15.56; F[1,203]=2.60; p=0.109). The respondents spent approximately the same amount of time completing their tasks in their corresponding conditions. We also controlled for respondents' prior exposure to the destination by asking, 'Have you ever been to Morocco?' (35% of respondents answered 'Yes').

Study 1 Results

We tested our hypotheses using the program macro PROCESS (Hayes, 2013). Specifically, we used a mediation model (Model 4) to test H5, which proposed the existence

of an indirect relationship between usability and website evaluation outcomes, whereas all the other hypotheses were tested using a serial mediation model (Model 6). In a serial mediation model, the mediators are supposed to act in a serial order as a causal chain, whereby the independent variable influences the first mediator, which influences the second, which subsequently influences the dependent variables. Using 5,000 bootstrap samples (Preacher & Hayes, 2008), the 95% Monte Carlo confidence interval (CI) estimated the mediating role of web user experience (i.e. usability and pleasure) in the relationship between website visual design and website evaluation outcomes. We present the conceptual model with the causal path results in Figure 3 and calculate the direct and indirect effects in Table 1.

Figure 3. Study 1 – Results of hypothesised three-path mediation model

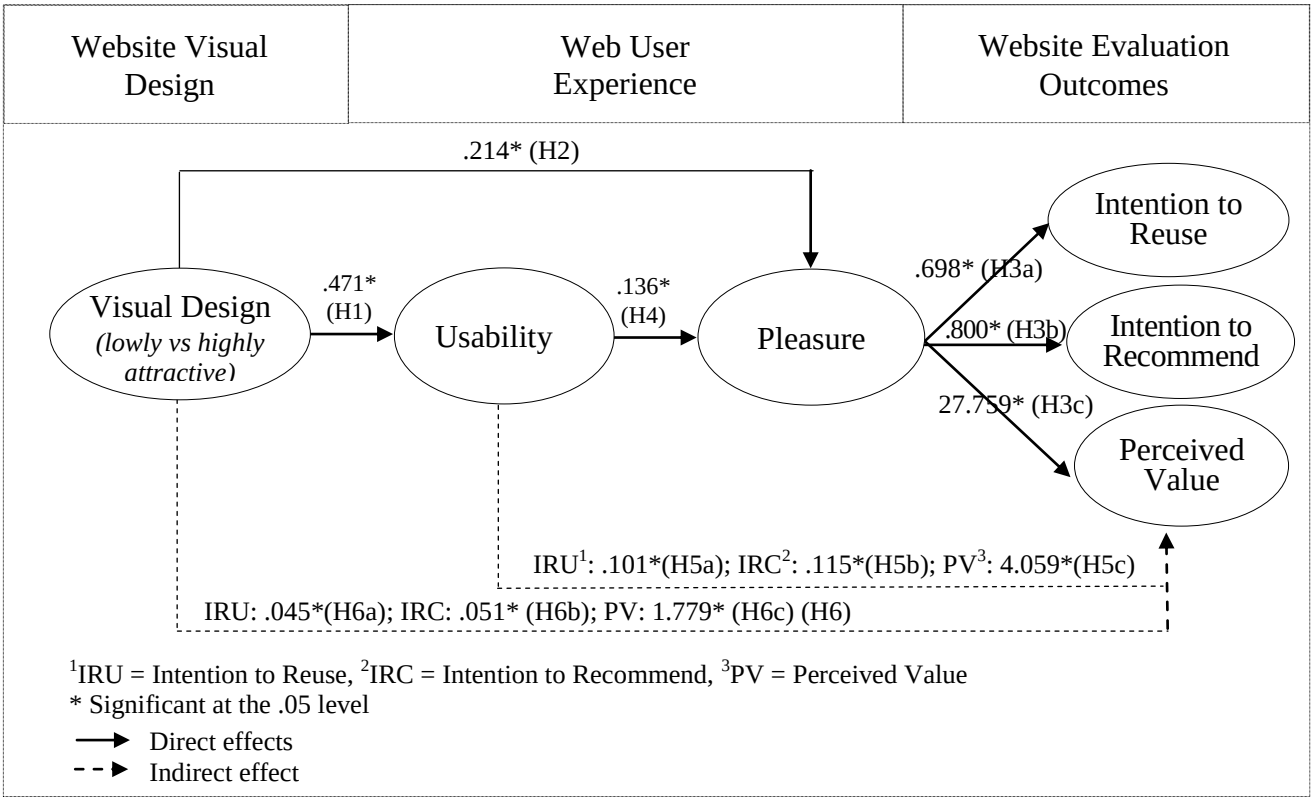


Table 1. Study 1 – Direct and indirect effects, and 95% bias-corrected confidence intervals from OLS regressions predicting website evaluation outcomes (n=205)

Table 1(a). Study 1 – Direct effects of website visual design on web user experience variables, and direct effect of usability on pleasure

Website visual design and web user experience	*Coeff.*	*95% CI*[a]
Visual design → Usability	.471*	(.006, .937)
Visual design → Pleasure	.214*	(.000, .428)
Web user experience	*Coeff.*	*95% CI*
Usability → Pleasure	.136*	(.073, .199)

Table 1(b). Study 1 – Direct effects of web user experience on website evaluation

Website evaluation (WE)	Intention to reuse		Intention to recommend		Perceived value	
	Coeff.	*95% CI*	*Coeff.*	*95% CI*	*Coeff.*	*95% CI*
Usability → WE	-.052	(-.112, .007)	-.023	(-.066, .020)	.005	(-9.218, 9.229)
Pleasure → WE	.698*	(.573, .823)	.800*	(.710, .890)	27.759*	(8.310, 47.209)

Table 1(c). Study 1 – Indirect effects on website evaluation

From website visual design

Website evaluation (WE)	Intention to reuse		Intention to recommend		Perceived value	
	Coeff.	*95% CI*	*Coeff.*	*95% CI*	*Coeff.*	*95% CI*
Visual design → Usability → WE	-.025	(-.082, .001)	-.011	(-.048, .005)	.003	(-4.590, 4.518)
Visual design → Pleasure → WE	.149*	(.002, .309)	.171	(-.004, .342)	5.930*	(.729, 15.881)
Visual design → Usability → Pleasure → WE	.045*	(.004, .104)	.051*	(.008, .121)	1.779*	(.188, 6.121)
Total indirect effects	.169*	(.020, .325)	.211*	(.035, .383)	7.711*	(1.166, 18.976)

From web user experience

Website evaluation (WE)	Intention to reuse		Intention to recommend		Perceived value	
	Coeff.	*95% CI*	*Coeff.*	*95% CI*	*Coeff.*	*95% CI*
Usability → Pleasure → WE	.101*	(.056, .148)	.115*	(.062, .172)	4.059*	(.745, 8.789)

[a]CI = bias-corrected confidence interval
* Significant at the .05 level

The results presented in Figure 3 and Table 1 demonstrate that all the hypotheses in our model are validated. Website visual design exerts a significant direct and positive effect on the web user experience constructs, usability (H1) and pleasure (H2). In agreement with H3, pleasure exerts a significant direct and positive effect on website evaluation variables, i.e. intention to reuse (H3a), intention to recommend (H3b) and perceived value (H3c). Usability exerts a significant direct and positive effect on pleasure (H4) and a significant indirect and positive effect on intention to reuse (H5a), intention to recommend (H5b) and perceived value (H5c). The results also show that website visual design does not have a different effect on any of the three website evaluation variables (Intention to Reuse: coeff.=-.034, CI=-.229 to .162; Intention to Recommend: -.072 CI=-.213 to .068; Perceived Value: coeff.=3.429 CI=-26.867 to 33.724). In addition, without pleasure, the usability-only mediation path is insignificant. Conversely, a significant indirect effect is found for mediation through pleasure only, as well for the full serial mediation model, as suggested in H6. These results support our model and show an 'indirect-only mediation' according to the Zhao, Lynch, and Chen's (2010, p. 201) classification of types of mediation.

We also tested sociodemographic effects on the hypothesised model by incorporating the respondents' age, gender and prior exposure to the destination as covariates. The results demonstrate that all our hypotheses remain validated in the presence of those covariates (Appendix A).

To test our theories further, we submitted an alternative reversed mediation model in which pleasure precedes usability (i.e. website visual design → pleasure → usability → website evaluation). We found no evidence for the reversed mediation model[7]. Those results suggest that our proposed model explains the data better.

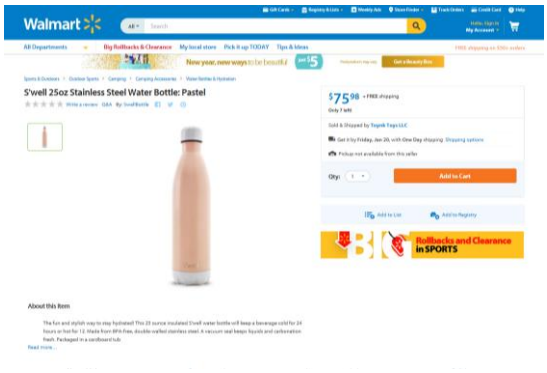
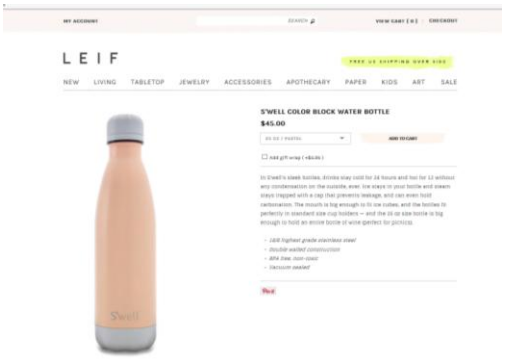
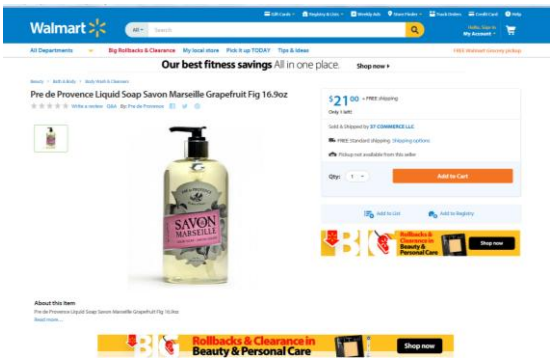
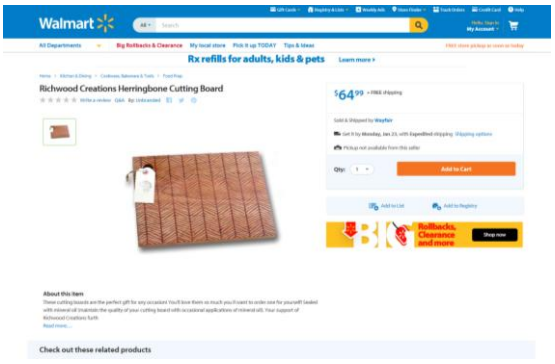
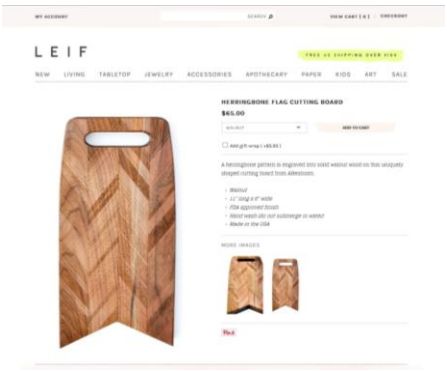
Study 2

Visual design manipulation

To further test the external validity of our theory in a more realistic setting, we conducted a second study utilising actual webpages from two real e-commerce[8] websites as stimuli. The webpages that represent highly attractive website visual design came from Leifshop.com, a lifestyle online shop with a strong position in 'artful, effortless design'[9], and are recognised as one of the most 'beautiful and creative e-commerce website designs' (Macdonald, 2016). The webpages that represent lowly attractive website visual design came from Walmart.com, an international retailer that does not have a particular branding focus on visual design. We selected three products sold on both websites that were of general relevance to our subjects: a water bottle, a liquid hand soap and a cutting board).

Despite many differences between the two retailers, we drew the contrast only on specific and comparable webpages. Specifically, the selected webpages demonstrated differences in several design factors. Some of the most outstanding design factors include colour schemes, layout and white space, as well as size of visual representations, which have been found to affect consumers' perceptions of visual design (Cyr, 2008; Garett et al., 2016; Post et al., 2017). Of the selected webpages, those from Leifshop.com represented the highly attractive condition (low contract and low saturated colour schemes, simpler page layout with more white space and larger product images), whereas those from Walmart.com represented the lowly attractive condition. As in Study 1, we did not intend to investigate the causal relationship between each design element and visual design. Instead, we focused on whether the realisations of website visual design were able to create varied global perceptions of website visual design. Manipulation checks were implemented to ensure that manipulation's validity. Figure 4 presents screenshots of selected webpages in both conditions.

Figure 4. Study 2 – Comparable webpages from two website visual design conditions

Conditions \ Products	Lowly Attractive (from Walmart.com)	Highly Attractive (from Leifshop.com)
Water bottle		
Liquid soap		
Cutting board		

Available at:
https://www.dropbox.com/s/ygkgl0g53n14vs9/Picture%201.pdf?dl=0
https://www.dropbox.com/s/3dtijz8nx2zj3z5/Picture%202.pdf?dl=0
https://www.dropbox.com/s/nde5t31zbn269g0/Picture%203.pdf?dl=0
https://www.dropbox.com/s/ksb4owuflb0n80d/Picture%204.pdf?dl=0
https://www.dropbox.com/s/8q1g83srmoaca83/Picture%205.pdf?dl=0
https://www.dropbox.com/s/2bk0uo6263xw5dq/Picture%206.pdf?dl=0

Sample and protocol

The sample comprised 81 undergraduate students majoring in computer science at a French university who agreed to participate in the laboratory experiment (M_{Age}=19.53, sd=2.01; 96.3% males). We confirmed that the participants had fairly high English proficiency ($M_{English}$=5.85, sd=1.29) on a semantic differential scale from 1 ('not at all comfortable in English') to 7 ('very comfortable in English') to ensure that there were no language barriers in using the webpages. In addition, no difference was found between the two experimental conditions regarding the participants' English proficiency (F[1,79]=2.51; p=.117). Altogether, 40 students were randomly assigned to the lowly attractive condition and 41 to the highly attractive condition.

The participants were instructed to complete three simulated shopping tasks. For each shopping task, the respondents were first asked to scan through information on the assigned webpage to find specific product information to ensure that they actually used the assigned webpages. That task was repeated for all three products to ensure a similar browsing experience between the two conditions. The participants were then instructed to answer questions about the usability and pleasure of their experience, and their website evaluations. The questionnaire also included questions to control for brand familiarity and demographic information (e.g. age, gender and English level). We also measured participants' time spent to complete the entire task (i.e. browsing three webpages for information and answering the questionnaire).

Measures

Website visual design manipulation checks and controls

To ensure the success of the visual design manipulation (highly vs. lowly attractive), we used a single item that asked, 'Thinking about the visual design of the webpages that you

just used, would you say it was visually attractive?' on a seven-point scale from 1 'totally disagree' to 7 'totally agree'. As expected, the webpages from Walmart.com were perceived to be less attractive than those from Leifshop.com ($M_{VD\_Walmart}$=4.40, sd=1.35 vs. $M_{VD\_Leifshop}$=5.46, sd=1.19; F[1,79]=14.15; p<0.001), therefore the manipulation of the visual design was successful. A comparison of time spent to complete the tasks by participants under the two conditions suggested no difference between the two conditions ($M_{time\_Walmart}$=17.28 min, sd=3.55 vs. $M_{time\_Leifshop}$=15.94, sd=3.75; F[1,79]=2.75; p=0.101). We also controlled for brand familiarity. The result from a seven-point scale question showed that the participants were more familiar with Walmart.com than with Leifshop.com ($M_{Walmart}$=4.51, sd=2.61 vs. $M_{Leifshop}$=1.41, sd =1.13; M_{diff}=3.10, sd=3.03; t[80]=9.21; p<0.001). To control for potential effects of brand familiarity, along with other sociodemographic variables, we incorporated respondent brand familiarity, age and gender into the tested model as covariates. The results (Appendix B) demonstrate that none of our hypothesis results were affected by those covariates.

Web user experience

Usability and *pleasure* were the two mediators of our tested model. With the *usability* measure, we used a seven-point scale adapted from Lee et al. (2011) with four items: 'This website (webpage) allows information to be quickly found'; 'This website (webpage) does not require specific effort to find information'; 'This website (webpage) offers easy navigation'; and 'This website (webpage) offers a clear and understandable experience' (Cronbach's alpha=0.90). We calculated the average of those four items as the overall measure of *usability.* To measure *pleasure,* we used a seven-point scale from an affective product evaluation scale adapted from previous research to measure two items (Steenkamp & Geyskens, 2006): 'When surfing this website, I feel…: (1) "This website is pleasant to use" and (2) "This website is nice to use"'. The

Pearson correlation coefficient was 0.93 ($p<0.001$). We calculated the average of those two items as an overall measure of *pleasure.*

Website evaluation variables

As in Study 1, the dependent variables in our model are website evaluation outcomes, i.e. *intention to reuse*, *intention to recommend* and *perceived value* of the webpages. *Intention to reuse* was measured by rating the statement 'I intend to add this website to my bookmark' on a seven-point scale (Steenkamp & Geyskens, 2006), and *intention to recommend* was measured by rating the statement 'I would recommend this website (webpage)' on a seven-point scale (Finn et al., 2009). *Perceived value* is measured using a two-item scale adapted from Steenkamp and Geyskens (2006), i.e. 'Overall, I consider that visiting this website (webpage) is worth it' and 'This website (webpage) met my expectations' ($r=0.525$; $p<0.001$), each on a seven-point scale. We calculated the average of the two items as the overall measure of *perceived value.*

Study 2 Results

As in Study 1, we tested our hypotheses using the program macro PROCESS (Hayes, 2013, Models 4 and 6). Similarly, a mediation model (Model 4) was used to test H5 (i.e. indirect effect of usability on website evaluation), whereas a serial mediation model (Model 6) was used to test all the other hypotheses. We present the conceptual model with the causal path results in Figure 5, then calculate the direct and indirect effects in Table 2.

Figure 5. Study 2 – Results of hypothesised three-path mediation model

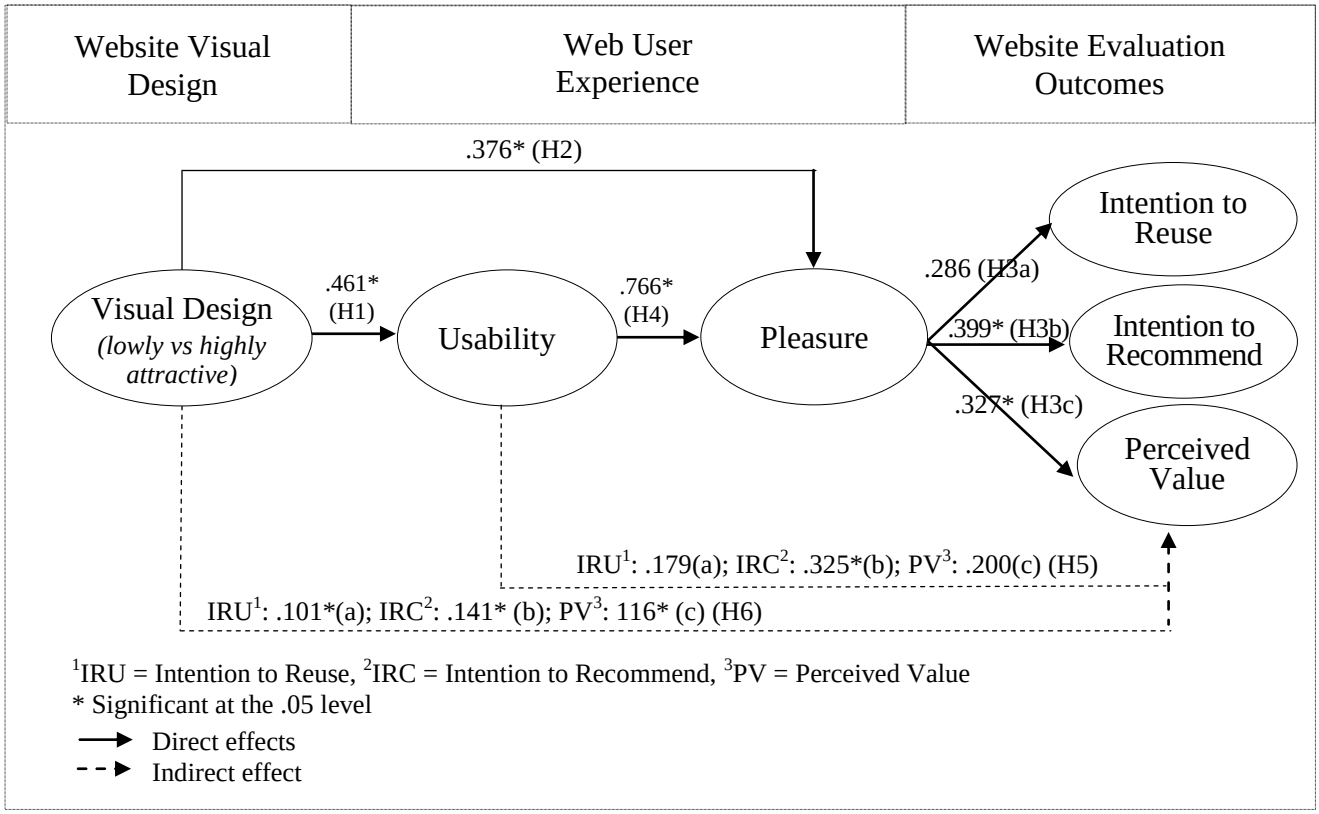


Table 2. Study 2 – Direct and indirect effects, and 95% bias-corrected confidence intervals from OLS regressions predicting website evaluation outcomes (n=81)

Table 2(a). Study 2 – Direct effects of website visual design on web user experience variables, and direct effect of usability on pleasure

Website visual design and web user experience	*Coeff.*	*95% CI* [1]
Visual design → Usability	.461*	(.192, .730)
Visual design → Pleasure	.376*	(.165, .588)
Web user experience	*Coeff.*	*95% CI*
Usability → Pleasure	.766*	(.602, .931)

Table 2(b). Study 2 – Direct effects of web user experience on website evaluation

Website evaluation (WE)	Intention to reuse		Intention to recommend		Perceived value	
	Coeff.	*95% CI*	*Coeff.*	*95% CI*	*Coeff.*	*95% CI*
Usability → WE	.132	(-.206, .471)	.170	(-.209, .548)	.115	(-.194, .424)
Pleasure → WE	.286	(-.033, .606)	.399*	(.042, .757)	.327*	(.035, .620)

Table 2(c). Study 2 – Indirect effects on website evaluation

From website visual design						
Website evaluation (WE)	Intention to reuse		Intention to recommend		Perceived value	
	Coeff.	*95% CI*	*Coeff.*	*95% CI*	*Coeff.*	*95% CI*
Visual design → Usability → WE	.061	(-.044, .191)	.078	(-.072, .262)	.053	(-.073, .232)
Visual design → Pleasure → WE	.108*	(.014, .278)	.150*	(.027, .343)	.123*	(.013, .324)
Visual design → Usability → Pleasure → WE	.101*	(.009, .309)	.141*	(.018, .371)	.116*	(.011, .281)
Total indirect effects	.270*	(.096, .556)	.370*	(.166, .654)	.292*	(.112, .537)
From web user experience						
Website evaluation (WE)	Intention to reuse		Intention to recommend		Perceived value	
	Coeff.	*95% CI*	*Coeff.*	*95% CI*	*Coeff.*	*95% CI*
Usability → Pleasure → WE	.179	(-.046, .467)	.325*	(.064, .661)	.200	(-.071, .469)

[1]CI = bias-corrected confidence interval
* Significant at the .05 level

The results demonstrate that most of the hypotheses from our model are validated. Specifically, website visual design exerted a direct and positive effect on web user experience, i.e. usability (H1) and pleasure (H2). Pleasure has a direct and positive effect on intention to recommend (H3b) and perceived value (H3c), and a marginally significant effect on intention to reuse (H3a: t(77)=1.783 p=.0786). Those findings support H3. Usability has a direct and positive effect on pleasure (H4), with an indirect and positive effect on intention to recommend (H5b), but it has no effect on intention to reuse (H5a) and or perceived value (H5c). Similarly to the Study 1 results, the direct effect of website visual design on website evaluation outcomes is not significant (Intention to Reuse: coeff.=-.219, CI=-.543 to .104; Intention to Recommend: -.072 CI=-.433 to .289; Perceived Value: coeff.=-.264 CI=-.560 to .031). Similar to the Study 1 results, we find that, without pleasure, the mediation through usability only is not significant. Conversely, a significant indirect effect is found for mediation through pleasure only, as well as for the full serial mediation model, as suggested in H6. Those results support our model and indicate again that the full serial mediation model, using both usability and pleasure, is significant. More precisely, as in Study 1, the findings indicate an indirect-only mediation (Zhao et al., 2010).

We further tested the hypothesised mediation chain by submitting the data to an alternative reversed mediation (visual design → pleasure → usability → website evaluation). We did not find evidence for that alternative model[10], suggesting that our proposed serial mediation model explains the data better.

The results from both studies are consistent with the predictions outlined in the literature review. Specifically, a highly attractive visual design leads users to perceive the system as more usable. In turn, that perception of usability increases the pleasure users experience on the website and ultimately leads to their positive evaluation of the website (i.e. users have more incentive to use and recommend the system, and express greater perceived

value). Moreover, the results show that pleasure does not affect usability in this process, and the full proposed model that includes a usability-to-pleasure path is better at capturing user experiences when studying the effect of website visual design on website evaluation.

Discussion

In this paper, we propose and test a three-path sequential mediational model to examine the effect of website visual design, an important antecedent of web user experience, on users' attitudinal and behavioural intentions towards a website through web user experience. Built on the literature of user experience and online customer experience from marketing, information systems and HCI, this research substantiates a sequential mediating chain from usability to pleasure – two important constructs of web user experience. By advancing the understanding of the relationship between the antecedent and consequences of user experience in the context of e-commerce websites, this research also zooms into two dimensions of experience and explores how constructs from different dimensions of user experience work in this chain.

The results from the two experiments support the proposed model. The first study incorporates a controlled website from a fictional online travel agency through which we directly manipulate the website visual design. The second study utilises actual websites from two real e-commerce retailers that vary in website visual design. In both studies, we find a consistent positive effect of website visual design on website evaluation variables through a sequential mediation of usability and pleasure. An alternative reversed mediation model in which pleasure precedes usability is also tested but found to be unsupported, which suggests a sequential influence from procedural cognitions to emotional reactions in web user experience.

Theoretical contributions

The study results have a number of theoretical implications. Aside from providing a new perspective for understanding the relationship between website visual design and website evaluation, a major theoretical contribution of this research is that it sheds light on the roles of usability and pleasure, two important constructs of web user experience, in this relationship for e-commerce. Consistent with those of previous studies, our results show that website visual design has a direct positive influence on both pleasure (Bufquin et al., 2020; Cyr et al., 2006; Ha et al., 2007; van der Heijden, 2003) and usability (Bringula, 2016; Cyr et al., 2006; Lazard & King, 2019; Pengnate & Sarathy, 2017; Tuch et al., 2012; van der Heijden, 2003; Xu & Schrier, 2019).

Contrary to previous studies, our investigation does not find a direct effect of website visual design on website evaluation. Wu et al. (2017) emphasise a potential negative effect of highly visually attractive products on consumption and find that, although appealing products are appreciated, they could decrease people's consumption tendency due to an avoidance of destroying the efforts associated with highly attractive visual design. More importantly, their results indicate that when such appealing products are consumed, consumers feel a low or even negative level of enjoyment because of their concerns over destroying the results of the design efforts. In the same vein, Kim and Lennon (2008) show that visual features do not affect users' purchase intentions in online shopping, whereas verbal features do. Our research is motivated by the inconsistency between the empirical results from earlier studies and the intuition that a good visual design automatically leads to positive business outcomes. The lack of a direct positive effect of website visual design on website evaluation from our results highlights the necessity of understanding the underlying mechanism in capturing the effect through the mediation of web user experience.

An important finding from our analysis is the absence of a direct effect of usability on website evaluation. Instead, we find an indirect effect through pleasure, as fully validated in Study 1 and partially validated in Study 2, since this effect is only significant for intention to recommend. That partial validation could be caused by the complexity in the stimuli used in Study 2. However, what is more important and consistent is the full three-path relationship from website visual design to website evaluation through the 'usability-to-pleasure' sequential mediation validated in both studies. In addition, the finding of an 'indirect only' effect of usability on website evaluation outcomes provides two important implications. First, it highlights a limitation of focusing merely on the usability aspects of web user experience when studying this relationship. Second, it reveals the critical role of pleasure in the pursuit of better business outcomes for e-commerce websites. Based on our findings, without pleasure, usability could hardly affect website evaluation. The critical role of pleasure is also emphasised in our results, as it has both direct and indirect effects on website evaluation variables. Only if users obtain pleasure from interacting with a highly visually attractive e-commerce system will they use it again, recommend it and attach a higher perceived value to the website. Therefore, website visual design not only leads to a positive emotional reaction of pleasure but also helps users in their learning processes when interacting with a system, such as a website.

The direct effect of website visual design on usability is consistent with the well-known 'what is beautiful is usable' proposition (Tractinsky, Katz & Ikar, 2000), which is related to user perception of design and usability. However, it is far more interesting to note that the user performances – the measure of usability used in Study 2 – are also influenced by website visual design, as that result goes beyond commonly held perceptions demonstrating that users interacting with an attractive website actually perform better.

Our results suggest the 'usability-to-pleasure' sequential mediation as a new important framework for examining the relationship between the visual design of digital touch points (e.g. a website) and users' intentions, both attitudinal and behavioural, based on the role of web user experience in this relationship. The alternative sequential mediation (from pleasure to usability) is not supported by our studies. That result is important, because it suggests a practical priority in improving user experience based on the order of those two constructs.

Managerial implications

Companies are increasingly becoming interested in web user experience, because digital technology is ubiquitous and utilised in various industries, such as automotive, health, hospitality, banking and mass retailing. Forecasts suggest that there will be more than 75 billion Internet of Things (IoT) connected devices in use worldwide by 2025 (Statista, 2016). That estimate that should increase with the ongoing pandemic and the rise of telecommuting. The ability to access the Internet of Things using everyday objects (e.g. watches, glasses and refrigerators) provides users with added value in terms of features, information, interactions with the environment and uses (Porter & Heppelmann, 2014). Such value is largely based on the quality of user experience with the digital platforms embedded in the interactive device. Accordingly, current research has identified three lines of action to help practitioners create more engaging digital experiences for users and customers.

Measuring web user experience should include both procedural cognitions and emotional reactions variables. Our results validate that usability has a positive effect on website evaluation variables, but only if it triggers pleasure. From a practical perspective, in developing and testing interface performances, it is important for companies to measure the pleasure in user experience testing, which is currently dominated by cognitive dimension. An example of useful metrics that can be adopted for measuring pleasure is the Practical

Usability Rating by Experts (PURE) method recently developed by the American consulting company Nielsen Norman Group (Nielsen Norman Group, 2017b). An alternative is to adopt more sophisticated measurement tools based on interpreting facial expressions or eye-tracking technology.

Website visual design should be considered by e-commerce companies as a primary attribute. Website visual design is usually considered secondary, but it is important to know that it could positively enhance the user experience by facilitating user learning and performance during website navigation and usage. Our results show that attractive website visual design is a key attribute that contributes to positive website evaluation. The effect of website visual design on usability has been well known both by researchers (Xu & Schrier, 2019) and practitioners since the pioneering work on interface of Kurosu and Kashimura (1995). In accordance with our findings, a recent consulting project also encourages companies to take advantage of the relationship between visual design and perceived usability, and to invest in improving the visual design of their interfaces (Nielsen Norman Group, 2017a). Moreover, our results show that website visual design has a positive effect on objective usability, as measured by task performance.

Website visual design keeps customers satisfied. The full sequential mediation model that we propose shows that good website visual design eventually leads to users' intention to reuse the website, a higher associated economic value and the intention to recommend the website to others. Those post-usage intentions are an important measurement for customer satisfaction and loyalty, so this finding has important implications for companies in highly competitive sectors (e.g. e-commerce) seeking to retain their customers.

Limitations and avenues for future research

This research has several limitations that can serve as potential avenues for future study. First, in the early stages of using a digital platform such as a website, a 'disconfirmation phenomenon' could occur when users underestimate the complexity of the interface, thus triggering negative emotions that influence user evaluations of the platform (Wood & Moreau, 2006). In this study, we focus on the specific positive emotion of pleasure rather than on negative emotions. As negative emotions (e.g. frustration, confusion and hopelessness) can play an important role in the interaction with a website (Tuch et al., 2012; Wood & Moreau, 2006), it would be interesting for future research in this vein to include both positive and negative emotions.

Second, this study focuses on the initial interactions with a website to understand web user experience as it unfolds. We believe that focusing on the early use stage of experience is critical because the cost of learning is especially high then for any technological innovation (Lakshmanan & Krishnan, 2011). As a result, the implications of our study are more informative about short-term effects. Further research is needed to test the relationship in the long run going beyond one specific interaction. Replicating our findings in other contexts, using complementary approaches, such as qualitative studies, to further explore other web user experience constructs, including other dimensions (e.g. social), with other types of websites or digital platforms, under prolonged use and real market conditions would also be interesting.

Third, the proposed research model focuses on explaining the effects of website visual design on only three website evaluation variables, i.e. intention to reuse, intention to recommend and perceived value. Extending the proposed mediation pathway to other evaluation outcomes, such as trust in a system, which is an important indicator of information system adoption, would also be interesting (Chen et al., 2009; Hassanein & Head, 2005; Hsu & Lin, 2008). For e-commerce, trust has been shown to be a key determinant of website

evaluation (Pavlou, 2003). Previous research has specifically demonstrated the mediator role of trust, showing that the appeal of a website affects the initial trust in a company's website. Such trust in turn influences the intention to reuse the system (Hampton-Sosa & Koufaris, 2005).

Fourth, we do not focus in this work on the role of individual characteristics, such as demographic variables and individual price sensitivity which can be valuable for e-commerce businesses. We control the effects of demographics by integrating them as covariates, which is a common approach (e.g. Herhausen et al., 2019). In Study 1, we find a significant effect of gender on usability and a marginally positive effect of age on pleasure (Appendices). Those results are consistent with previous literature on customer experience (Verhoef et al., 2009), where demographics have a moderating impact on the relationship between management strategy and customer experience, which includes both cognitive and affective dimensions. It is important for future research to further explore the role of demographics in web user experience and the proposed model. The setup of this study uses the same price information (or comparable products in the same price range) and does not prime consumers with different pricing perceptions. Recent research in brand communication has identified an 'uppercase premium effect' (Yu et al., 2021), and it is valuable to investigate and identify other design elements that could result in different pricing perceptions, as well as their consequences in terms of consumer preferences and responses.

Finally, it is important for future research to investigate the effect of website visual design on brand equity of e-commerce brands. Mishra et al. (2015) demonstrates that design perception, which includes visual design as one of its components, indirectly affects brand equity through 'experiential value', which includes usability, pleasure and social value. As brand equity is an essential metric of brands and firm performance (Keller & Lehmann,

2006), understanding the relationships among website visual design, web user experience and brand equity would be helpful to firms designing long-term digital strategies.

NOTES

1. In this paper, we choose to use ‘web user experience’ (over other terms such as ‘online customer experience’) because our empirical context focuses on a specific interaction with a website and its related perceptions and evaluations from the perspective of ‘users’ of the website, rather than ‘consumers’ of the firm.
2. For example, in a reference article in marketing that models the online customer experiences, Bleier et al. (2019) includes entertainment – defined as ‘the immediate *pleasure* the experience offers’ (p. 99) – as an affective variable and the informativeness of the webpage as a cognitive variable but they do not integrate website usability, as recommended by Nambisan and Watt (2011).
3. The Aha! Experience – also called the Aha! Moment – refers to ‘the emotional reaction that typically occurs at a moment of sudden insight into a problem or other puzzling issue. It is the experience one would have upon realising, for example, how to fix a computer problem, master a dance step or resolve some other difficulty’, according to the American Psychological Association or APA Dictionary of Psychology (2015).
4. For example, the Norman Nielsen Group – for which ‘visual design’ as an article-search keyword for its database – distinguishes the overall impression conveyed by visual design as a whole (e.g. considering that ‘when looking at a visual, we can usually immediately say whether it is appealing or amiss’) and from the design features and principles (e.g. visual hierarchy, balance, contrast) on which the visual design of the interface is based (https://www.nngroup.com/articles/principles-visual-design/).
5. Consumer adoption of online travel agencies has grown considerably over the past few years as a global phenomenon (Talwar et al., 2020). In France, e-tourism represented 46% of the total tourism and travel market in 2019, with the market size estimated at EUR 21 billion (Lainé, 2020). In addition, we consider a travel agency website to be relevant because the experience users obtain through navigating such websites fits the experiential nature of our methodology (e.g. Ye et al., 2019).
6. One expert recommends to have more than one typeface for good design systems (i.e. one for body texts, and one for heading).
7. The full serial mediation model is not significant for intention to recommend (Coeff.=−0.0038, 95% CI=−0.0173 to −0.0013) and perceived value (Coeff.=0.0009, 95% CI=−1.6993 to 1.4270), and very weak on intention to reuse (Coeff.=−0.009, 95% CI=−0.0305 to −0.0004).
8. E-commerce represents a large portion of the growth in the retail markets in Europe and North America (Centre for Retail Research, 2020). Total e-commerce sales were estimated at USD 791.7 billion for 2020, accounting for 14% of the total retail sales in the United States (US Census Bureau News, 2021).
9. https://www.leifshop.com/pages/about
10. The full serial mediation model is not significant for intention to reuse (coef=.0661, sd=0.0648, 95% CI=−0.0576 to 0.2013), intention to recommend (coef=0.0575, sd=0.0778, 95% CI=−0.0793 to 0.2444) or perceived value (coef=0.0847, sd=0.0918, 95% CI=−0.0800 to 0.2965).

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APPENDIX A. Study 1 – Direct and indirect effects, and 95% bias-corrected confidence intervals from OLS regressions predicting website evaluation outcomes including sociodemographic variables as covariates

Table A(a). Study 1 – Direct effects of visual design and covariates on web user experience variables, and direct effect of usability on pleasure

Website visual design and web user experience	*Coeff.*	*95% CI*[1]
Visual Design → Usability	.466*	(.003, .929)
Visual Design → Pleasure	.255*	(.040, .470)
Covariates:		
Age → Usability	-.029	(-.062, .004)
Age → Pleasure	.014	(-.001, .030)
Gender → Usability	-.970*	(-1.915, -.025)
Gender → Pleasure	.376	(-.0628, .815)
Prior exposure → Usability	.730	(-.278, 1.739)
Prior exposure → Pleasure	.457	(-.009, .923)
Web user experience	*Coeff.*	*95% CI*
Usability → Pleasure	.142*	(.078, .206)

Table A(b). Study 1 – Direct effects of web user experience and covariates on website evaluation

Website evaluation (WE)	Intention to reuse		Intention to recommend		Perceived value	
	Coeff.	*95% CI*[1]	*Coeff.*	*95% CI*[1]	*Coeff.*	*95% CI*[1]
Usability → WE	-.047	(-.107, .014)	-.019	(-.063, .025)	-.835	(-10.280, 8.610)
Pleasure → WE	.723*	(.597, .849)	.792*	(.707, .890)	31.907*	(12.235, 51.579)
Covariates:						
Age	-.006	(-.020, .008)	.009	(-.001, .019)	-1.291	(-3.459, .877)
Gender	-,080	(-.478, .318)	-.127	(-.416, 162)	-48.320	(-110.552, 13.917)
Prior exposure	-.629*	(-1.053, -.205)	-.075	(-.382, .233)	-66.09	(-132.32, .143)

[1]CI = bias-corrected confidence interval

* Significant at the .05 level

Table A(c). Study 1 – Indirect effects on website evaluation (model including covariates)

From website visual design						
Website evaluation (WE)	Intention to reuse		Intention to recommend		Perceived value	
	Coeff.	*95% CI*	*Coeff.*	*95% CI*	*Coeff.*	*95% CI*
Visual design → Usability → WE	-.022	(-.077, .003)	-.009	(-.044, .010)	-.385	(-5.868, 3.390)
Visual design → Pleasure → WE	.184*	(.018, .348)	.204*	(.029, .379)	8.132*	(1.738, 18.144)
Visual design → Usability → Pleasure → WE	.048*	(.006, .113)	.053*	(.004, .125)	2.107*	(.242, 6.744)
Total indirect effects	.210*	(.047, .376)	.247*	(.067, .429)	9.850*	(1.971, 21.743)
From web user experience						
Website evaluation (WE)	Intention to reuse		Intention to recommend		Perceived value	
	Coeff.	*95% CI*	*Coeff.*	*95% CI*	*Coeff.*	*95% CI*
Usability → Pleasure → WE	.109*	(.063, .158)	.121*	(.068, .179)	4.817*	(1.270, 9.823)

[1]CI = bias-corrected confidence interval
* Significant at the .05 level

APPENDIX B. Study 2 – Direct and indirect effects, and 95% bias-corrected confidence intervals from OLS regressions predicting website evaluation outcomes including sociodemographic variables as covariates

Table B(a). Study 2 – Direct effects of visual design and covariates on web user experience variables, and direct effect of usability on pleasure

Website visual design and web user experience	*Coeff.*	*95% CI*[1]
Visual Design → Usability	.485*	(.214, .757)
Visual Design → Pleasure	.347*	(.126, .569)
Covariates:		
Age → Usability	-.003	(-.140, .134)
Age → Pleasure	-.039	(-.142, .064)
Gender → Usability	-1.428	(-2.859, .003)
Gender → Pleasure	.155	(-.952, 1,261)
Brand Familiarity → Usability	.043	(-.047, .133)
Brand Familiarity → Pleasure	-.030	(-.098, .038)
Web user experience	*Coeff.*	*95% CI*
Usability → Pleasure	.780*	(.608, .952)

Table B(b). Study 2 – Direct effects of web user experience and covariates on website evaluation

Website Evaluation Variables (WE)	Intention to reuse		Intention to recommend		Perceived value	
	Coeff.	*95% CI*	*Coeff.*	*95% CI*	*Coeff.*	*95% CI*
Usability → WE	.170	(-.204, .489)	.215	(-.181, .610)	.093	(-.232, .417)
Pleasure → WE	.267	(-.053, .597)	.383*	(.017, .748)	.329*	(.029, .629)
Covariates:						
Age	-.074	(-.221, .072)	-.023	(-.187, .142)	-.023	(-.158, .112)
Gender	.702	(-.866, 2.270)	.666	(-1.094, 2.427)	-.442	(-1.885, 1.002)
Brand Familiarity	-.007	(-.104, .090)	-.026	(-.135, .083)	.007	(-.082, .096)

[1]CI = bias-corrected confidence interval
* Significant at the .05 level

Table B(c). Study 2 – Indirect effects on website evaluation (model including covariates)

From website visual design						
Website evaluation (WE)	Intention to reuse		Intention to recommend		Perceived value	
	Coeff.	*95% CI*	*Coeff.*	*95% CI*	*Coeff.*	*95% CI*
Visual design → Usability → WE	.083	(-.022, .272)	.104	(-.047, .316)	.045	(-.091, .209)
Visual design → Pleasure → WE	.093	(.009, .270)	.133*	(.017, .311)	.114*	(.011, .317)
Visual design → Usability → Pleasure → WE	.101*	(.000, .312)	.145*	(.016, .375)	.125*	(.018, .310)
Total indirect effects	.277*	(.100, .575)	.382*	(.180, .670)	.284*	(.126, .554)
From web user experience						
Website evaluation (WE)	Intention to reuse		Intention to recommend		Perceived value	
	Coeff.	*95% CI*	*Coeff.*	*95% CI*	*Coeff.*	*95% CI*
Usability → Pleasure → WE	.159	(-.067, .482)	.307*	(.052, .663)	.215	(-.072, .502)

[1]CI = bias-corrected confidence interval
* Significant at the .05 level