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**VISUAL DESIGN AND ONLINE SHOPPING EXPERIENCES: WHEN EXPERTISE  
ALLOWS CONSUMERS TO REFOCUS ON WEBSITE ATTRACTIVENESS**

**Florence Jeannot**<sup>a,\*</sup>

Associate Professor

INSEEC School of Business & Economics, CERAG FRE 3748 CNRS / Univ. Grenoble-Alpes,  
France

[fjeannot@inseec.com](mailto:fjeannot@inseec.com)

**Eline Jongmans**<sup>b</sup>

Assistant Professor

Univ. Grenoble Alpes, CERAG FRE 3748 CNRS / Univ. Grenoble-Alpes, France

[eline.jongmans@univ-grenoble-alpes.fr](mailto:eline.jongmans@univ-grenoble-alpes.fr)

**Maud Dampérat**<sup>c</sup>

Full Professor

Univ. Lyon, UJM-Saint-Etienne, COACTIS, EA 4161, F-42023, Saint-Etienne, France

[maud.damperat@univ-st-etienne.fr](mailto:maud.damperat@univ-st-etienne.fr)

<sup>a</sup> INSEEC School of Business & Economics, 25 Rue de l'Université, 69007 Lyon, France

<sup>b</sup> Université Grenoble Alpes, 1 Place Verdun, 38000 Grenoble, France

<sup>c</sup> Université Lyon, 2 Rue Tréfilerie, 42023 Saint Etienne, France

\* Corresponding author: Department of Marketing, INSEEC School of Business & Economics,  
69007, Lyon, France

E-mail address: [fjeannot@inseec.com](mailto:fjeannot@inseec.com)

Postal address: 25 Rue de l'Université - 69007 Lyon, France

Phone number: 33 (4) 78 29 80 28

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## VISUAL DESIGN AND ONLINE SHOPPING EXPERIENCES: WHEN EXPERTISE ALLOWS CONSUMERS TO REFOCUS ON WEBSITE ATTRACTIVENESS

**Abstract:** To improve consumers' online shopping experiences, companies invest in the visual design of their websites. Although some studies show that visual design exerts a positive influence on consumer reactions, other studies do not confirm that influence. This research is aimed at exploring those contrasting findings by investigating two boundary variables (website use and user expertise) that delimit the scope of the positive influence of visual design on consumer intentions towards using and recommending e-commerce websites. Two preliminary studies (Study A and Study B) investigate the level at which visual design is mentally construed. The two main studies (Study 1 and Study 2) test our research hypotheses. The Study 1 results reveal that visual design exerts different effects on individuals' intentions depending on when the site is evaluated (before vs after use). Study 2 provides greater insight into the role of visual design after actual use of the website by considering the moderating role of user expertise. Those findings lead to the formulation of concrete recommendations about how e-retailers can create more engaging experiences.

**Keywords:** visual design, digital marketing, user expertise, construal level theory, experimental method

**Résumé :** Afin d'améliorer l'expérience d'achat en ligne des consommateurs, les entreprises investissent de plus en plus dans le *design* visuel de leurs sites Internet. Bien que certaines études montrent que le *design* visuel exerce une influence positive sur les réactions des consommateurs, d'autres études ne confirment pas cette influence. Cette recherche vise à apporter un nouvel éclairage sur cette littérature contrastée en analysant deux variables modératrices (utilisation du site et expertise de l'utilisateur) délimitant le périmètre d'influence du *design* visuel sur les intentions d'utilisation et de recommandation de sites de commerce électronique. Deux études préliminaires (étude A et étude B) analysent le niveau selon lequel le *design* visuel est représenté mentalement, et deux études principales (étude 1 et étude 2) testent les hypothèses de recherche. Les résultats de l'étude 1 révèlent que le *design* visuel exerce différents effets sur les intentions des individus selon le moment où le site est évalué (avant vs. après utilisation). L'étude 2 approfondit la compréhension du rôle du *design* visuel après l'usage réel du site, et ce, en considérant le rôle modérateur de l'expertise des utilisateurs. Ces résultats conduisent à formuler des recommandations concrètes sur la manière dont les sites d'e-commerce peuvent créer des expériences en ligne plus engageantes.

**Mots-clés :** *design* visuel, marketing digital, expertise de l'utilisateur, théorie des niveaux de représentation, méthode expérimentale

## INTRODUCTION

The visual design of an e-commerce website is a vector of differentiation for companies seeking to gain a competitive advantage in increasingly competitive markets (Bleier et al., 2019). A GfK survey of 26,000 consumers across 22 countries indicates that one in three consumers agree that a technology product's look and style play a significant role in their purchasing decisions (GfK, 2015). A visually attractive website is a valuable asset for a company, as it contributes to the unique shaping of the corporate image (Jiang et al., 2016) and improves consumers' online shopping experiences (Xu and Schrier, 2019). Yet, a study by the consulting company Cognizant (Pring, 2014) reports that fewer than 30% of the 300 American and European executives interviewed believe that their company offers customers 'high quality' digital experiences (p. 4). Our research analyses the extent to which the visual design of a web interface can contribute to creating more engaging consumer online shopping experiences.

Research in marketing, information systems and human-computer interaction has long focused on interfaces' so-called functional features, such as usability, that help consumers perform tasks or achieve goals (Ziamou et al., 2012). Although some researchers also stress the importance of considering non-functional features, especially interface visual design, for improving consumer online experiences (Coursaris and Van Osch, 2016), their studies have yielded contradictory results. Some studies confirm that visual design positively influences consumer judgements (e.g. Cai and Xu, 2011; Coursaris and Van Osch, 2016; Jiang et al., 2016; Lee and Koubek, 2010; van Schaik and Ling, 2008, 2009), but others find it has no influence (e.g. Ben-Bassat et al., 2006; Cyr et al., 2006; Kim and Lennon, 2008; Hassenzahl, 2004; Sheng and Teo, 2012), or even a negative influence (Wu et al., 2017), on product or system evaluation. Visual design's influence on consumers' online shopping experiences is thus more complex than it initially appears, thereby stressing the need to examine the boundary variables<sup>1</sup> that might explain such seemingly contradictory results.

The time frame within which a consumer evaluates an interface – before vs after use – is a factor identified both in the marketing (e.g. Wood and Moreau, 2006; Thompson et al., 2005) and the human-computer interaction literature (e.g. Hassenzahl, 2004; Lee and Koubek, 2011; Tuch, 2012; van Schaik and Ling, 2009) as modifying consumer attitudes towards an interface. Although the human-computer interaction literature reveals that visual design's effects depend on whether the systems are evaluated in pre- or post-use contexts, it fails to

provide a rationale to explain those results. Conversely, the marketing literature does offer solid arguments based on Construal Level Theory (CLT) to explain why that occurs, but it does not examine visual design and its effects before versus after use (see Thompson et al., 2005).

Based on CLT, our research is aimed at extending our understanding of visual design's effects on consumer intentions (to use/reuse and recommend) towards e-commerce sites. Specifically, we propose that such effects depend on the point at which (before vs after website use) visual design is mentally construed by consumers. We also propose that the expertise gained by consumers while initially navigating a website may modulate the effects of visual design. That focus on the early stages of interface use is consistent with the lack of research conducted in post-use contexts (Lakshmanan et Krishnan, 2011; Monnot, 2020; Renata et al., 2018).

This study is part of a research stream challenging the common assumption that enhancing the attractiveness of visual design automatically leads to positive outcomes. It contributes to enriching prior research on visual design effects in three ways, by: 1) providing for the first time, to the best of our knowledge, empirical evidence, using both an Implicit Association Test (IAT) and the Behavioural Identification Form (BIF), that visual design activates high-level (abstract) construals. That association is important because it clarifies why, in certain circumstances, visual design does not have the expected beneficial effects on consumer behaviour and, consequently, why it is appropriate for companies to address that issue. 2) confirming that visual design has a positive influence before use, but its main originality is in providing evidence that visual design continues to play an important role during the post-use phase only if consumers have gained expertise in navigating the web interface. 3) confirming that visual design positively affects not only consumer intentions to use an e-commerce site but also their intentions to recommend it to others. The latter is significant as it contributes to triggering positive word of mouth, which is essential to the success of online retailers (Berger, 2014).

## **THEORETICAL FRAMEWORK**

To better understand the influence of visual design on online shopping experiences, our research mobilises CLT as the theoretical foundation. We first define the concept of visual design and provide an overview of the studies that examine its effects on consumer

judgements and reactions to systems. We then refer to CLT in stating the conceptual assertion from which our research hypotheses are derived.

### **Visual design definition and characteristics**

Visual design plays a predominant role in influencing consumer attitudes and behaviours (Bloch, 1995), and it is an important aspect of product or system design (Mishra et al., 2015). The visual design field developed from both user interface design and graphic design. The term ‘visual design’ is widely used by practitioners and researchers. For example, the Norman Nielsen Group lists ‘visual design’ as an article-search keyword for its database.<sup>2</sup> Academic studies (e.g. Coursaris and van Osch, 2016; Cuddihy and Spyridakis, 2012; Deng and Poole, 2010; Tuch, 2009) also use it to refer to the sensory and structural features, as designed by engineers or web designers, from which consumers form their first impression (King et al., 2020) of a product or interface and a global attitude towards its appearance (Mishra et al., 2015). Specifically, Cyr et al. (2006) define 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). That definition stresses the distinction between the global evaluation, referring to its appeal (or attractiveness), and the specific features on which the evaluation is based. Several studies investigate the design features that determine the attractiveness of digital interface visual designs, such as on websites (for a summary, see Post et al., 2017). Colour combinations, symmetry and framework shapes are widely recognised as being capable of improving product or system beauty appreciation (e.g. Coursaris and Van Osch, 2016; Schloss and Palmer, 2011; Tuch et al., 2010; Westerman et al., 2012), especially when it is being used (Minge, 2008).

### **Visual design effects**

Despite its centrality and importance in consumer attitudes and behaviours, there is a lack of research into visual design’s effects. As various researchers (see, for instance, Cai and Xu, 2011; van Schaik and Ling, 2008) note, there are fewer empirical studies on the effects of interface visual design than on their functional features, such as their usability. Some studies show more positive user judgements when digital systems are perceived to be highly visually attractive rather than lowly visually attractive (Cai and Xu, 2011; Coursaris and Van Osch, 2016; Ha et al., 2007; Hall and Hanna, 2004; Jiang et al., 2016, Lee and Koubek, 2010; Mishra et al., 2015; Robins and Holmes, 2008; Schenkman and Jönsson, 2000; van der Heijden, 2003; van Schaik and Ling, 2008, 2009), but other do not support such findings. For

example, Kim and Lennon (2008) show that website visual design positively influences consumer attitudes when they navigate a website, but it has no significant effect on their purchase intentions. Hassenzahl (2004) also shows that, during the early stages of interface use, consumer satisfaction relates more strongly to pragmatic than hedonic attributes (including visual design). Ben-Bassat et al. (2006) find that visual design has no significant effect on the perceived value of computer-based phone book systems. Other studies show that visual design has no direct effect on consumer evaluations of mobile phone interfaces (Cyr et al., 2006; Sheng and Teo, 2012; Chopdar and Balakrishnan, 2020) and websites (Xu and Schrier, 2019; van der Heijden, 2003). Finally, Wu et al. (2017) emphasise a potential negative effect on the consumption of highly visually attractive products, as people appreciate the extra creative effort invested, but it makes people less prone to consume them, so as to avoid destroying the results of that effort.

Tuch et al. (2012) note that the different methods used to investigate visual design's effects may explain such contrasting results.<sup>3</sup> They also stress the correlational nature of such studies and the need for more experimental studies to enhance internal validity. Other researchers indicate that the effects of product or system visual design depend on individual (Bloch et al., 2003) and contextual variables (Hoegg et al., 2010; Cai & Xu, 2011; van Schaik and Ling, 2008, 2009). We propose that visual design's effects depend on the level at which visual design is mentally construed and we provide arguments for that conceptual assertion below.

### **Construal level of an interface's visual design**

According to CLT, psychological entities (actions or objects) can be interpreted in accordance with various levels of representation. Liberman and Trope (1998) specify that high-level construals – compared to low-level construals – are characterised by two criteria: (1) their high level of abstraction (*versus* low-level); and (2) their focus on desirability (*versus* feasibility). (1) Regarding the level of abstraction, Liberman and Trope (1998) specify that high-level construals are general and abstract, while low-level construals are specific and concrete. Liberman et al. (2007) give the example of the entity 'tiger', which can be construed, at a higher level, in terms of a global animal family ('feline') and, at a lower level, in terms of concrete morphological characteristics ('large quadruped'). (2) Regarding the focus on desirability, Liberman and Trope (1998) posit that high-level construals focus on an object's desirability, i.e. the benefits a consumer can derive from object purchase or use. Conversely, low-level construals focus on the object's 'feasibility' aspect, which refers to the

means that a consumer should implement for purchasing or using it. For example, in a gambling context, the value of winning refers to the desirability of the object ‘game’, i.e. the benefits, whereas the probability of winning refers to its feasibility, i.e. the means (Sagrignano et al., 2002). Another example is that of the object ‘kitchen’ being represented in high-level construal as ‘a room where a good meal can be prepared’, whereas the low-level representations relate to specific elements, such as the size of the sink, the number of chairs, or the type of kitchen hood.

Based on the literature review, we propose that visual design owns the two aforementioned characteristics of a high-level construal, i.e. a high level of abstraction and a focus on desirability. First, a digital system’s visual design is based on the specific features defined by engineers or designers, but consumers perceive them in a general and abstract way. Mishra et al. (2015) discuss television screen resolution and pixel density as examples. The specifications provide consumers with an overall subjective perception of visual clarity which is more abstract (or global) than the technical components. Similar reasoning can be applied to interface visual design. For example, hue, saturation and brightness rely on specific technical characteristics, but users get a global perception of those characteristics that influences their judgements about interface visual appearance (Seckler et al., 2015). Second, by providing pleasure and sensory stimulation, a product’s visual design is a source of ‘value or benefit’ for consumers (Bloch, 1995, p. 378). That concurs with how Liberman and Trope (1998) define desirability. For that reason, Hassenzahl (2004) considers digital interface attractiveness (or beauty) to be a ‘high-level construct’ (p. 323) compared to usability features. Fiedler (2007) also argues, but offers no empirical evidence, that an object’s visual appearance (or beauty) corresponds to a high-level construal. Elder et al. (2017) also show that visual images trigger higher construal levels. By analogy, we propose – as our conceptual assertion – that visual design activates high-level construals, i.e. a high level of abstraction and a focus on desirability.

## **DEVELOPMENT OF THE HYPOTHESES**

### **Combined effects of visual design and website use**

The CLT founding principle is that psychological distance, in general, and temporal distance change the level at which an individual mentally construes an action (or object). Liberman and Trope (1998) define psychological distance as the degree at which an individual perceives



an entity (an object or action). Individuals primarily form high-level representations of temporally distant actions, with low-level construals formed as the temporal distance decreases. Such temporal distance influences on construal levels have given rise to several marketing studies (see Maglio, 2020 for a synthesis). Taking temporal distance to be when technology product (digital audio player) use is considered (before vs after use), Thompson et al. (2005) analyse its impact on consumer perceptions of added features. Those authors indicate that, before product use, consumers perceive additional features as increasing desirability, which results in a positive evaluation. In contrast, after using the product, the addition of new features is interpreted as decreasing the ease of use, thereby resulting in a negative evaluation. Thompson et al. (2005) explain that in the ‘before-use condition’ (p. 437), when product usage is considered psychologically ‘distant’ (p. 433), consumers tend towards high-level construals and focus on desirability aspects. In contrast, in the ‘after-use condition’ (p. 437), where temporal distance is psychologically ‘near’ (p. 433), product use leads consumers to prioritise low-level construals and be more focused on feasibility features.

We propose to adapt that well-established temporal distance operationalisation to website use (before use = distant vs after use = near) and we expect it to moderate the influence of visual design on consumer intentions (i.e. intention to use/reuse and intention to recommend).

*Intention to use* is an established system acceptance indicator (Venkatesh et al., 2012), also used in e-retailing contexts (Belanche et al., 2012), reflects the anticipated degree of system use and recognised as a strong predictor of actual system use (Morris and Dillon, 1996). It is part of user experience under the International Organisation for Standardisation (IOS) definition: ‘a person’s perceptions and responses that result from the use and/or anticipated use of a product, system or service’.<sup>4</sup> Intention to use is largely utilised in pre-use contexts (i.e. when consumers have not used a system), especially by researchers applying technology acceptance models (e.g. Davis, 1989). In post-use contexts (i.e. when consumers have navigated the system at least once), researchers refer to intention to continue using a system (Jasperson et al., 2005). That is similar to intention to revisit (Cuny et al., 2015) or reuse a system (Hung et al., 2016).

*Intention to recommend* is recognised as a strong predictor of customer loyalty (Moldovan et al., 2011). Finn et al. (2009) note studies revealing that it predicts firm performance better than customer satisfaction. Recommendations indicate positive word of mouth (Berger, 2014)

and explicit endorsement, as opposed to implicit endorsement, where people only say they like a product or system, without recommending it (Packard and Berger, 2017). To the best of our knowledge, visual design's influence on the intention to recommend a system has not been empirically tested. Our research addresses that gap by suggesting that the effect of visual design on intention to recommend a system depends on website use (before vs after use). Relying on those founding principles of CLT, we might expect visual design to exert a greater influence on intentions to use and recommend systems before use than after, as it refers to system desirability and is perceived in the abstract. To that end, we propose:

**Hypothesis 1 (H1):** Visual design *before use* has a positive effect, such as highly (vs lowly) attractive visual design triggering higher (vs lower) intention to use the website, whereas visual design has no effect on the intention to reuse the website *after use*.

**Hypothesis 2 (H2):** Visual design *before use* has a positive effect, such as highly (vs lowly) attractive visual design triggering higher (vs lower) intention to recommend the website, whereas visual design has no effect on the intention to recommend the website *after use*.

### **The moderating role of user expertise in post-use situations**

When navigating a new website for the first time, users learn where to find the information and how it is structured. That helps them to develop procedural skills and gain an understanding of how the website works for them. Accordingly, we expect that users might activate high-level construals through which they enjoy the beauty of the website. Thus, we define the concept of user expertise and justify its moderating impact.

#### *Definition of User expertise*

Alba and Hutchinson (1987) define consumer expertise as 'the ability to perform product-related tasks successfully' (p. 411). It is well-recognised that consumers gain knowledge after an initial experience with a product or system (Billeter et al., 2011; Wood and Moreau, 2006). Gaining knowledge while interacting with a system increases consumers' familiarity with the system (or similar ones) without necessarily increasing their expertise (Alba and Hutchinson, 1987). To become an expert in a specific domain, consumers must be able to use the available information to develop new or restructure defined knowledge (Alba and Hutchinson, 1987). Expertise in using digital products is more difficult to acquire when it involves high learning costs (Lakshmanan et Krishnan, 2011; Monnot, 2020). Human-computer interaction (e.g. Grossman and Fitzmaurice, 2015; Lawson et al., 2009) and information system (e.g.

Aljukhadar and Senecal, 2016; Sedera and Dey, 2013) literature widely discusses the user expertise concept, with such expertise defined as ‘a user’s ability to complete tasks with the system’ (Grossman and Fitzmaurice, 2015, p. 472).

#### *Expert users, high-level construals and visual design*

Prior studies show that people with extensive knowledge tend to develop more abstract mental representations of information (i.e. using high-level construals) than those with limited knowledge (Vaubel and Getty, 1990). Researchers also suggest that experts might be more receptive to stimuli congruent with their tendency to favour abstract mindsets. For example, Hong and Sternthal (2010) argue that experts (vs novices) react more favourably to stimuli that are congruent with their tendencies to process information in an abstract (vs concrete) way. They show that experts evaluate an MP3 player more favourably when an advertisement focuses on product desirability (a high-level construal) rather than device usability (a low-level construal). The opposite is observed for novices. Hong and Sternthal (2010) argue that the fit between the experts’ abstract processing of environmental stimuli and the high-level construals they emphasise triggers positive feelings, which, in turn, positively influence experts’ evaluations. Other studies (e.g. Kelting et al., 2017; Nam et al., 2012) show the positive effects of that fit, but our research extends the scope to the context of consumer evaluations of e-commerce sites.

Given all those findings, particularly by Hong and Sternthal (2010), we suggest that user expertise moderates the influence of visual design on website user intentions to use and recommend. When consumers gain expertise in navigating systems – that is, according to Alba and Hutchinson (1987), when consumers have acquired the knowledge, skills or ability to perform specific tasks effectively with systems – they will be favourably influenced by the system features that fit with expert users’ abstract (or high-level) processing, as is the case with visual design. As such, we propose that, in a post-use situation, visual design’s positive influence, such that highly (vs lowly) attractive visual design triggers higher (vs lower) intentions, would depend on users’ interface navigation expertise.

**Hypothesis 3 (H3).** After use, the positive influence of visual design on intention to reuse the website only occurs when the level of user expertise increases.

**Hypothesis 4 (H4).** After use, the positive influence of visual design on intention to recommend the website only occurs when the level of user expertise increases.

## **OVERVIEW OF THE STUDIES**

We conducted four studies with two main objectives. First, *to confirm our conceptual assertion*, positing the association between visual design and high-level constructs, two preliminary studies (Study A and Study B) were developed. Study A tests the abstraction at which visual design is represented using an Implicit Association Test (IAT). Study B explores the degree at which visual design activates a high-level (or desirability-focused) mindset using a Behavioural Identification Form (BIF). Second, *to test our research hypotheses* we conducted two main studies (Study 1 and Study 2). Study 1 tests H1 and H2 through manipulation of a fictitious website's visual design (lowly vs highly attractive) and website use (before vs after use), and studying their interaction impact on intentions (to use/reuse and recommend a website). Study 2 focuses on the after-use stage and tests H3 and H4 by considering the moderating role of user expertise in the relationship between visual design and consumer intentions regarding a website. Figure 1 shows the proposed research model and summarises the hypotheses. Figure 2 summarises the study objectives and details the research design.

INSERT FIGURE 1 AND FIGURE 2

### **PRELIMINARY STUDY A: IMPLICIT ASSOCIATION TEST**

To confirm the association between visual design and high-level (or abstract) constructs, we conducted an Implicit Association Test (IAT) in a computer laboratory. IAT is especially useful for exploring concept abstraction levels (Bar-Anan et al. 2006). IAT performance results, calculated from participants' speed in categorising words, are a robust measure of people's automatic associations (Rozin et al. 2012; Greenwald et al, 2003) and particularly useful in our context. On entering the laboratory, participants were randomly assigned to computers, told that the purpose of the study was to test word associations and asked to read the on-screen instructions, which stated that the study would consist of several blocks.

#### **Participants and procedure**

Study A involved ninety-two French undergraduate students tasked with categorising stimuli into four categories (design, usability, abstract and concrete). We used *usability* to compare our results, as that concept is associated with concrete features (Ho et al., 2015). The words appeared in the middle of the screen, with the category labels at the top. IAT stimuli were

drawn from four categories of words associated with: (1) *design* (stylish, attractive, colourful, beautiful, decorative, harmonious, illustrated and aesthetics), (2) *usability* (simple, easy, useful, convenient, operational, guided, usable and functional), (3) *abstract* ideas (arts, sciences, models, dietetics, love, time, mind and movement), and (4) *concrete* things (train, bicycle, chair, perfume, chocolate, watch, brain and book). Two human-computer interaction and two CLT-expert researchers discussed and chose all the words. Synonyms were used for the words related to design and usability. A pre-test with 48 participants confirmed that the participants perceived the selected concrete and abstract words according to different levels of abstraction  $M_{\text{concrete}} = 2.02$  ( $SD = 0.91$ );  $M_{\text{abstract}} = 4.54$  ( $SD = 0.79$ );  $M_{\text{diff\_abst-conc}} = 2.52$  ( $SD = 1.22$ );  $t(47) = 14.33$   $p < 0.001$ . We used a bipolar scale ranging from 1, for concrete, to 7, for abstract.

During the IAT, when each word appeared on-screen, the participants pressed a key on the right or left side of the keyboard to associate it with the right or left category shown. Only one answer was correct, with a red cross appearing to indicate participants answered incorrectly. Instructions were given before each block. Participants were asked to minimise their incorrect answers and complete the task as quickly as they could. In line with the established protocol, each participant completed seven trial blocks, including two critical blocks. Stimuli from all four categories were presented in blocks 3, 4, 6 and 7, for a total of 128 trials per participant across four blocks (see Table 1 for details). The two critical blocks were block 4 (CLT-incongruent), with category labels *concrete or design* (vs *abstract or usability*), and block 7 (CLT-congruent), with category labels *abstract or design* (vs *concrete or usability*). An implicit association between abstract and design was reflected in faster response latencies than for the responses between concrete and design.

INSERT TABLE 1

## Measurements

The revised IAT scoring algorithm (Greenwald et al., 2003) used resulted in a final sample of 90 respondents ( $M_{\text{age}} = 19.20$ ,  $SD = 0.67$ ; 95.6% male). The data was scaled down due to: (1) eliminating nine trial response latencies over 10,000 milliseconds, (2) excluding two participants with response times under 300 milliseconds on more than 10% of the critical trials, (3) including all response latencies (wrong responses were transformed using the block mean and adding 600 ms), and (4) calculating two difference scores reflecting the response latency differences between the CLT-congruent and CLT-incongruent blocks. The first

difference score used critical test blocks 4 and 7; the second used practice blocks 3 and 6. Each difference score was divided by the pooled standard deviation (SD) of the associated blocks' response latencies, and we averaged the quotients. The resulting measure is the IAT D effect (Greenwald et al., 2003). Mean response times were calculated in milliseconds for each critical block.

We used three control variables to rule out alternative explanations for the findings. Involvement during IAT task completion was measured using three seven-point items (*very involved / very uninvolved, concentrating very hard / concentrating very little, paying a lot of attention / paying very little attention*,  $\alpha = 0.873$ ) (Martin et al., 2009). Task enjoyment was measured with an item we created (*To what extent did you like doing this association test? I did not like it at all = 1 to I liked it a lot = 7*) and subjective task difficulty (*What degree of effort did you use when doing the association test? Not a lot of effort = 1 to a lot of effort = 7*).

## Results

The response times are significantly faster in the CLT-congruent blocks than in the CLT-incongruent blocks ( $t(89) = 5.39$ ;  $p < 0.0001$ ;  $D = 0.18$ ;  $SD = 0.32$ ). The mean response time when participants classified stimuli into the CLT-congruent categories was 1,242.55 milliseconds in the CLT-incongruent block 4 ( $SD = 295.03$ ), compared with 1,166.01 milliseconds ( $SD = 260.15$ ) in the critical CLT-congruent block 7 (see Figure 3). In line with our predictions, Study A results show the participant responses to be faster in CLT-congruent conditions (abstract and design) than in CLT-incongruent conditions (concrete and design).

The results also indicate that none of the three control variables influenced the IAT D effect (involvement:  $t(88) = -0.14$ ,  $p = 0.890$ ; task enjoyment:  $t(88) = 0.80$ ,  $p = 0.424$ ; and task difficulty:  $t(88) = 0.84$ ,  $p = 0.403$ ), so those variables do not explain the implicit association.

In agreement with our conceptual assertion, the participants implicitly associate visual design with high-level (or abstract) features, which correspond to the first characteristic of a high-level construal. Building on that result, we further tested our assertion to show an association between the second characteristic of a high-level construal (i.e. desirability-focused) and visual design in a new preliminary study using an explicit measure and real-life stimuli.

INSERT FIGURE 3

## **PRELIMINARY STUDY B: BEHAVIOR IDENTIFICATION FORM**

The purpose of preliminary Study B was to replicate the findings of the association between high-level construals and visual design shown in Study A. In Study B, we use the second characteristic of high-level construals and another measurement tool, the Behaviour Identification Form (BIF) (Vallacher and Wegner, 1989). The BIF allows the association between the visual design of a website and its high-level (or desirability-focused) construal to be explored. The BIF is a 25-item dichotomous response questionnaire in which respondents are asked to describe 25 actions. Previous studies have used this test to evaluate the construal level induced by psychological distance.

### **Participants and procedure**

Study B examined whether priming individuals on visual design would lead them to adopt a high-level mindset focusing on entity desirability instead of usability. Thirty French business school undergraduates completed a written questionnaire (age = 19.96, SD = 1.20; 78.6% males). The between-subjects factorial design included two different priming conditions by adapting the Lee et al. (2010) protocol to our context. The participants were exposed to a printed screenshot of a fictitious travel agency's web interface. We primed either visual design or usability by asking the participants to think about the website's visual design (visual design,  $n = 15$ ) or about the way they would navigate it (usability,  $n = 15$ ). They then completed the BIF, as developed by Vallacher and Wegner (1989), which asked them to describe 25 actions (e.g. making a list) identified either from low-level construals related to how the action is performed and to the feasibility of the action (e.g. writing things down), or from high-level construals related to why, or with what effect, the action is performed and to the desirability of the action (e.g. getting organised). They had to choose between those two descriptions for each action. Each high-level oriented choice was coded as 1, with each low-level oriented choice coded as 0. Scores were totalled for each participant, resulting in a high-level identification score (or a BIF score) ranging between 0 and 25 ( $M_{\text{BIF}} = 16.07$ ,  $SD = 4.03$ ).

### **Results**

We analysed BIF score variance (ANOVA) with the type of priming (visual design vs usability) as the independent variable. In line with our predictions, participants in the visual design condition achieved a higher BIF score than those in the usability condition ( $M_{\text{Visual\_Design}} = 17.67$ ,  $SD = 3.83$  vs  $M_{\text{Usability}} = 14.47$ ,  $SD = 3.68$ ;  $F(1, 28) = 5.44$ ,  $p = 0.027$ ) (see Figure 4). That

indicates that individuals in the visual design condition identify the actions using higher-level construals than those in the usability condition.

INSERT FIGURE 4

Having validated our conceptual assertion regarding the relationship between visual design and high-level construals, we further tested our research hypotheses through two main studies. Study 1 tested H1 and H2. Study 2 tested H3 and H4.

### **STUDY 1: THE INFLUENCE OF WEBSITE USE ON CONSUMER INTENTIONS**

Study 1 tests H1 and H2, with two types of website use (before vs after use) combined with two levels of visual design (lowly vs highly attractive) to produce four treatment conditions. Table 2 shows the design details.

INSERT TABLE 2

#### **Subjects**

Using a French Qualtrics panel of internet users over the age of 18, we collected 235 online responses, which were randomly assigned to one of the four conditions (58 - 60 participants in each of the four experimental cells) (Table 2). Males comprised 49.8% of the sample ( $M_{\text{age}} = 41.09$ ,  $SD = 12.80$ ). In terms of familiarity with websites, there is no difference between the two design conditions ( $M_{\text{fam\_lowly\_attractive}} = 4.45$ ,  $SD = 1.34$ ;  $M_{\text{fam\_highly\_attractive}} = 4.62$ ,  $SD = 1.60$ ;  $t(233) = 0.91$ ,  $p = 0.366$ ) or between the two website use conditions ( $M_{\text{fam\_before}} = 4.66$ ,  $SD = 1.51$ ;  $M_{\text{fam\_after}} = 4.41$ ,  $SD = 1.44$ ;  $t(233) = 1.35$ ,  $p = 0.180$ ; *I am familiar with browsing websites* from 1 = *I do not agree at all* to 7 = *I totally agree*).

#### **Experimental procedure**

The participants were exposed to a travel agency's web interface for a visit to Morocco. The stimulus was identical to an actual web interface, with the participants offered various options, such as type of stay, hotel category, city, hotel comparison and activities. A web developer created two versions of the web interface to operationalise the independent variables. The participants were first exposed to the site, then had to provide information about it and answer questions about their experience, which was measured in terms of intention to use (in the before-use condition) or intention to reuse (in the after-use condition) the system and intention to recommend it to others. Additional questions checked the manipulation of the visual design and profile (e.g. age, gender and familiarity with travel websites). Intention to use and intention to reuse the system refer to potential subsequent use



of the travel system in question, with the reference point as the stage when consumers express their intentions: after merely being exposed to a system (before-use condition) or after system navigation (after-use condition).

## **Measurement**

### *Independent variable*

Similar to Minge (2008), we simultaneously manipulated three noticeable design characteristics which, at first sight, create lowly-attractive versus highly-attractive visual design conditions: colour combinations, symmetry and framework shapes.

*Colour:* Individuals holistically process colour pairs (Schloss and Palmer, 2011). Low contrasts between colours lead to greater feelings of harmony that increase individual preferences (Ou and Luo, 2006) and are preferred over combinations of high-contrast colours (Minge, 2008). As colours with long wavelengths (e.g. red) are less appealing than colours with short wavelengths (e.g. green) (Jacobs and Hustmyer, 1974), we assume that combinations of contrasting background colours (e.g. red and green) would be less attractive than backgrounds with more balanced colour combinations (e.g. orange and blue pastel colours).

*Symmetry:* Symmetry has a positive effect on consumer website perceptions (Tuch et al., 2010) and its role in visual design is recognised by Gestalt psychology laws of perceptual organisation. Symmetry guides website beauty perceptions by establishing a regular structure and meaningful form on interfaces (Bauerly and Liu, 2006). We use block alignment as a specific component of vertical symmetry that increases interface attractiveness (Tuch et al., 2010) and assume that aligned blocks would be more attractive than non-aligned blocks.

*Framework shape:* Consumers tend to prefer round objects to angular ones (Westerman et al., 2012). Round objects appeal more than sharply-contoured ones due to the common knowledge that sharp objects can cause physical harm (Bar and Neta, 2007). As such, we assumed that round framework shapes would be more attractive than square framework shapes.

A web designer combined those three characteristics to create two versions of the travel system. The highly attractive condition included a low background colour difference (pastel

orange and blue, and white), aligned blocks and round framework shapes. The lowly attractive condition included a high background colour difference (green and red), non-aligned blocks and square framework shapes (see Figure 5). Two design developers also assessed the interfaces. Participants either viewed a site screenshot (before actual use) or were asked to navigate the interface (after actual use) and evaluated their experiences, with consistency ensured by all undertaking the same number of tasks. The before-use scenario involved three tasks with two printed screenshots showing a lowly or highly attractive visual design (e.g. ‘What is the activity offered by the online travel agency?’). The after-use scenario had three tasks involving navigating one of the two web interfaces (e.g. ‘How many five-star hotels offer a desert visit?’).

#### INSERT FIGURE 5

##### *Dependent variables*

We measured intention to use (before-use condition) or to reuse (after-use condition) the system with a two-item scale adapted from Venkatesh et al. (2003): ‘I intend to add this website to my bookmarks’; ‘I intend to use this website to book my trip’ (from 1 = *strongly disagree* to 7 = *strongly agree*) (Pearson correlation coefficient = 0.886,  $p < 0.0001$ ). For intention to recommend, we used one item adapted from Finn et al. (2009): ‘I would recommend this website’ (from 1 = *strongly disagree* to 7 = *strongly agree*).

##### *Manipulation checks*

To check the manipulation of the visual design, we used a three-item scale of perceived design adapted from Ben-Bassat et al. (2006): ‘This website seems visually attractive’; ‘This website seems beautiful’; ‘This website seems to have an attractive design’ (from 1 = *strongly disagree* to 7 = *strongly agree*) (Cronbach’s alpha = 0.963). The perceived visual design result is higher in the highly attractive condition than in the lowly attractive condition ( $M_{\text{lowly}} = 4.27$ ,  $SD = 1.58$ ;  $M_{\text{highly}} = 5.07$ ,  $SD = 1.31$ ;  $t(233) = 4.228$ ;  $p < 0.0001$ ).

##### *Control variables*

There was no difference between the visual design conditions in terms of gender ( $\text{Chi}^2 = 1.54$ ,  $p = 0.215$ ), familiarity ( $t(233) = 0.91$ ,  $p = 0.366$ ) or age ( $t(233) = 0.65$ ,  $p = 0.516$ ). A statistically significant difference between the website use conditions was noted in terms of gender ( $\text{Chi}^2 = 4.09$ ,  $p = 0.043$ ) and age ( $M_{\text{before}}$ : 42.71 years old ( $SD = 12.77$ ) >  $M_{\text{after}}$ : 39.41 years old ( $SD = 12.67$ ));  $t(233) = 1.99$ ,  $p = 0.048$ ), but not in terms of familiarity ( $t(233) =$

1.35,  $p = 0.180$ ). As such, we added gender and age variables as covariates to the model for testing our hypotheses. Table 3 presents the sample's descriptive statistics.

INSERT TABLE 3

#### *Data analysis*

Two regression models using the Preacher and Hayes (2004) macro for SPSS tested the effects of visual design and website use, and their interaction time frames, on intention to use/reuse and intention to recommend (see Table 4). The results show that interface visual design had a statistically significant positive main effect on intention to use/reuse ( $M_{low}$ : 3.78 (SD = 1.74) <  $M_{high}$ : 4.26 (SD = 1.61);  $t(233) = 2.12$ ,  $p = 0.036$ ,  $b = .230$ ) and on intention to recommend ( $M_{low}$ : 4.03 (SD = 1.72) <  $M_{high}$ : 4.57 (SD = 1.76);  $t(233) = 2.36$ ,  $p = 0.019$ ,  $b = 0.270$ ), but website use had no statistically significant main effect on the two dependent variables. More importantly, a statistically significant interaction effect was recorded on intention to use/reuse ( $t(233) = -1.96$ ,  $p = 0.052$ ,  $b = -0.213$ ) and on intention to recommend ( $t(233) = -2.21$ ,  $p = 0.028$ ,  $b = -0.249$ ). The spotlight analysis showed, for both intentions, a statistically significant difference between the lowly and highly attractive design conditions before use (intention to use:  $t(233) = 2.90$ ,  $p = 0.004$ ; intention to recommend:  $t(233) = 3.26$ ,  $p = 0.001$ ), but no statistically significant difference between the lowly and highly attractive design conditions after use (see Figure 6, Graphs a and b). In line with H1 and H2, those results indicate that the visual design of an e-commerce site has a stronger impact before actual use than after actual use. Age and gender were used for control purposes, and added as covariates (Model 1.2 and Model 2.2, Table 4). Age appears to have a positive direct effect on consumer intentions.

INSERT TABLE 4 AND INSERT FIGURE 6

In line with previous studies, the results show that, overall, when visual design is highly attractive, consumer intention is higher. More importantly, our results suggest that the effect depends on website use, as it only appears to be significant before use. Building on that finding, we aimed to gain a deeper understanding of the effects of visual design by introducing a boundary condition to their occurrence during the after-use condition.

## **STUDY 2: THE MODERATING ROLE OF USER EXPERTISE AFTER USE**

### **Subjects, procedure and measurements**

Using a similar panel and procedure to Study 1, we collected 225 responses from participants randomly assigned to one of the two visual design conditions (109 in the lowly attractive condition and 116 in the highly attractive condition). The participants (49% male,  $M_{\text{age}} = 40.69$ ,  $SD = 14.53$ ) were fairly familiar with travel websites ( $M = 4.48$ ,  $SD = 1.64$ ; responding to the statement, ‘I am familiar with travel websites’ from 1 = *strongly disagree* to 7 = *strongly agree*). The main difference between the Study 1 and Study 2 procedures was that a user expertise measure was calculated for Study 2.

As with Study 1, Study 2 involved questions about browsing one of two web interfaces depending on the experimental condition. Our measure of user expertise reflects the definitions provided by Alba and Hutchinson (1987) and Grossman and Fitzmaurice (2015), and is consistent with prior studies (e.g. Demangeot and Broderick, 2010; Roehm and Sternthal, 2001; Sujan, 1985). A user expertise score was constructed by totalling each participant’s score on each of the 12 questions asked (four questions for each of the three different navigation tasks), with a correct response valued as 1 and an incorrect response as 0. For example, one task asked participants to look for a five-star hotel offering a desert trip. They had to answer four questions related to: (1) how many hotels they found, (2) the hotel name(s), (3) the city/cities where the hotels were located, (4) the price(s) to book a room in the hotel(s). There was only one correct answer for each question, so each participant could get a user expertise score ranging from 0 to 12 ( $M_{\text{expertise}} = 7.42$ ,  $SD = 2.79$ ,  $\text{Min} = 2$ ,  $\text{Max} = 12$ ) (see Table 3). Study 2 used the same scales as described for Study 1 to measure intention to reuse ( $r = 0.944$ ,  $p < 0.0001$ ) and intention to recommend. Table 3 shows the sample’s descriptive statistics.

### **Manipulation check and control variables**

The Study 2 manipulation check is the same three-item scale as described in Study 1 (Cronbach’s alpha = 0.99). That indicates that the perceived design is more attractive in the highly attractive condition than in the lowly attractive condition ( $M_{\text{lowly}} = 3.74$  ( $SD = 1.80$ ) <  $M_{\text{highly}} = 4.65$  ( $SD = 1.61$ );  $t(223) = 3.98$ ,  $p < 0.0001$ ). No statistically significant difference was recorded between the two conditions in terms of age or familiarity (age:  $t(197) = 0.905$ ,  $p = 0.366$ ; familiarity:  $t(223) = 0.718$ ,  $p = 0.473$ ), or in terms of gender ( $\text{Chi}^2 = 1.64$ ,  $p = 0.200$ ). Likewise, no statistically significant difference was found in the expertise scores across the visual design conditions ( $F(1,223) = 0.585$   $p = 0.445$ ;  $M_{\text{exp\_lowly\_attractive}} = 7.28$  ( $SD = 2.70$ ) vs  $M_{\text{exp\_highly\_attractive}} = 7.56$  ( $SD = 2.88$ )).

## Data analysis

We applied two regression models using the Preacher and Hayes (2004) macro for SPSS to test the effects of visual design, user expertise and interaction stage on intention to reuse and intention to recommend (see Table 5). The results show that neither visual design nor user expertise have a statistically significant main effect on user intentions. A statistically significant interaction effect was, however, observed on intention to reuse ( $t(223) = 2.49$ ;  $p = 0.014$ ,  $b = 0.111$ ) and on intention to recommend ( $t(223) = 2.17$ ;  $p = 0.031$ ,  $b = 0.097$ ). Using the Johnson-Neyman test, the floodlight analysis identified regions along the user expertise continuum where the simple effect of visual design was and was not significant. For both intentions, when the user expertise level increases, the visual design effect becomes statistically significant on consumer intentions (intention to reuse: ranging from 8 to 12; intention to recommend: ranging from 9 to 12) (see Table 6 and Figure 7). In line with H3 and H4, those results indicate that the visual design impact depends on how a consumer performs when using the e-commerce site. Age and gender were used for control purposes, and added as covariates, but the results show that they have no simple effect on the two dependent variables, with the interaction result unchanged by their addition (Model 1.2 and Model 2.2, Table 5).

INSERT TABLE 5 / INSERT TABLE 6 / INSERT FIGURE 7

The aim of Study 2 was to improve our understanding of an e-commerce site's visual design impact on intentions to reuse and recommend it after actual use. The results show that visual design has no direct effect on such intentions, but those effects depend on the consumers' ability to perform product-related tasks successfully. The visual design positively influenced the adoption process only when consumers performed well during site navigation.

## DISCUSSION

### Theoretical contributions

This research makes several contributions to the literature. It uses the CLT framework to offer a new perspective for understanding visual design's complex effects. Indeed, to the best of our knowledge, our research is the first to provide empirical evidence that visual design triggers high-level (or abstract) construals. We use renowned tools to show the implicit associations between visual design and abstract concepts (IAT), and to evaluate the construal levels induced by an e-commerce site (BIF). This work also contributes to the temporal distance literature. Such psychological distance is studied in various contexts, such as

communication (Kim et al., 2009) and pricing (Bornemann et Homburg, 2011). Similar to Ho et al. (2015), our research applies the temporal distance concept to understand how consumers interact with e-commerce websites. In particular, it extends the work of Thompson et al. (2005) by focusing on how the time frame in which a system is used influences consumer responses to visual design.

Our findings are unique within visual design research, where the majority of digital system studies examine the effects after a single exposure or after use. In line with Thompson et al. (2005), our research focuses on those two stages simultaneously and shows that the time of judgement modifies the effects of visual design on consumer intentions. The positive effects of visual design after merely being exposed to a product or system are well-recognised in the literature and confirmed by our research. A more important result is that visual design still has a positive influence on consumer intentions in a post-use situation, but only when users have gained a high level of expertise in using the website. That finding concurs with research highlighting experts' superior perceptual skills to those of novices in various domains. For example, experts are more able than novices to process visual information holistically (Sheridan and Reingold, 2017), rapidly distinguish between visual areas relevant for making judgements on environmental stimuli (Sheridan and Reingold, 2014) and solve complex tasks after glancing very briefly at a picture (Kundel et al., 2007). Our study shows that experienced users are more able to take account of website design elements in an evaluation than less experienced users.

Our research also adds to the literature on the early stages of consumer interaction with technological innovations (Lakshmanan and Krishnan, 2011). Understanding how people use interactive devices is critical because under-usage (or non-usage) can negatively affect consumer satisfaction (Shih and Venkatesh, 2004). Our findings clarify how an e-commerce site's visual design contributes to user retention, as the recommendation intention is a strong predictor of user loyalty and positive word of mouth (Moldovan et al., 2011).

### **Managerial implications**

This research identifies an important condition in the emergence of the beneficial effects of websites' visual design during the use phase: the acquisition of the skills needed to browse an interface smoothly. In other words, our results show that consumers only appreciate visual

design if they can find products or information easily. That result is consistent with the Nielsen Norman Group's recommendations to companies in a report about interface design:

‘A pretty design can make consumers more forgiving of *minor* usability problems, but not of larger ones. (As the first law of e-commerce states, if the consumer can't *find* the product, the consumer can't *buy* the product). Even great-looking sites will have no revenue if they suffer from poor findability).’<sup>5</sup>

Our results provide empirical evidence of the conditioned role of visual design discussed by the Nielsen Norman Group. Thus, our research validates the observation that skills-acquisition enabling consumers to achieve their goals successfully is necessary for visual design to be beneficial in terms of consumer intentions. We believe that companies should implement tools to facilitate interface browsing and ensure that consumers can easily access the information they want. Although companies currently invite consumers' purchasing experience feedback, we suggest that be extended to cover information-search activities. If such feedback suggests that consumers are not navigating the system effectively (e.g. failing to find the information they require), companies can help to improve that aspect and, as indicated by our results, give consumers the opportunity to derive benefits from the visual design of the e-commerce site.

Some companies have been investing in design, especially in intensely competitive industries (Luchs et al., 2015), as a point of differentiation and a potential source of value (Luchs and Swan, 2011). Nevertheless, significant spending to create appealing systems cannot lead to success if consumers do not value those systems. We also recommend that companies consider the positive effects of visual design on intention to recommend a system, as recommendation intent is considered a positive word-of-mouth indicator. A Word-of-Mouth Marketing Association report (Fay, 2014) stresses the significant value of word of mouth for marketers: ‘Nothing persuades brand trial, adoption and loyalty better than a recommendation from another consumer, particularly a trusted friend or family member’ (p. 3). As our research provides evidence of visual design's positive influence on the intention to recommend a system, companies should consider that visual design investments could, potentially, generate long-term benefits for customer acquisition and retention strategies.

### **Limitations and avenues for future research**

This research has several limitations, which serve as avenues for future research. First, it focuses on the day-to-day, utilitarian activity of searching for information. It would be

interesting to examine whether our findings apply to hedonic tasks when navigating systems, especially as the internet is becoming an entertainment source to fulfil consumers' hedonic needs (Novak et al., 2000). This study could also integrate the hedonic aspect of the experience. In trying to understand how visual design affects online customer experience, the role of hedonic variables can be studied, such as pleasure, which is the intensity with which an individual feels joy and contentment with their environment (Broach et al., 1995). That variable seems especially interesting as a strong correlation appears between the appeal of a website and the amount of pleasure users experience during their interactions (Lavie and Tractinsky, 2004).

Second, this research uses a categorical variable to study the moderating role of website use, since the aim is to explore the effect of visual design both before and after use. Future studies should study more diverse times of judgement. Indeed, we concentrate on initial interactions with a single interface to understand the consumer experience as it unfolds. As such, the results are only indicative of visual design's short-term effects. Participants could have been asked to reevaluate their experience after a few days to assess whether the visual design impact remains the same. More research is needed to assess visual design's long-term influence and external validity. Using a continuous variable would allow more precise identification of the point at which visual design impact decreases. Future research should seek to replicate our findings in prolonged use and real market conditions, but focusing on the early use experience stage is critical, as learning costs are especially high for technological innovations at that stage (Ziamou et al., 2012).

Finally, another interesting avenue for research would be to include in our experimental design some individual variables likely to moderate the effects observed in our study. Adding other variables could also help increase the model's determination coefficient. Particularly valuable variables to consider would be the centrality of visual product aesthetics or the level of importance that visual design holds for a consumer in their relationships with products, because it may affect the visual design impact (Bloch et al., 2003).



## FOOTNOTES

<sup>1</sup> Ball and Swayer (2013) consider that boundary variables allow researchers to delimit the scope of application of prior results and deepen the understanding of theories and causal relationships.

<sup>2</sup> <https://www.nngroup.com/articles/gestalt-similarity/>

<sup>3</sup> All the studies cited share a similar conceptualisation of visual design, although different terminologies are used, such as ‘website design’ (e.g. Moshagen et Thielsch, 2010; Tuch et al., 2009) and ‘design aesthetics’ (e.g. Ben-Bassat et al., 2006; Cai & Xu, 2011; Post et al., 2017; Van Schaik et Ling, 2008, 2009).

<sup>4</sup> <https://www.iso.org/obp/ui/#iso:std:52075:en>

<sup>5</sup> <https://www.nngroup.com/articles/aesthetic-usability-effect/>

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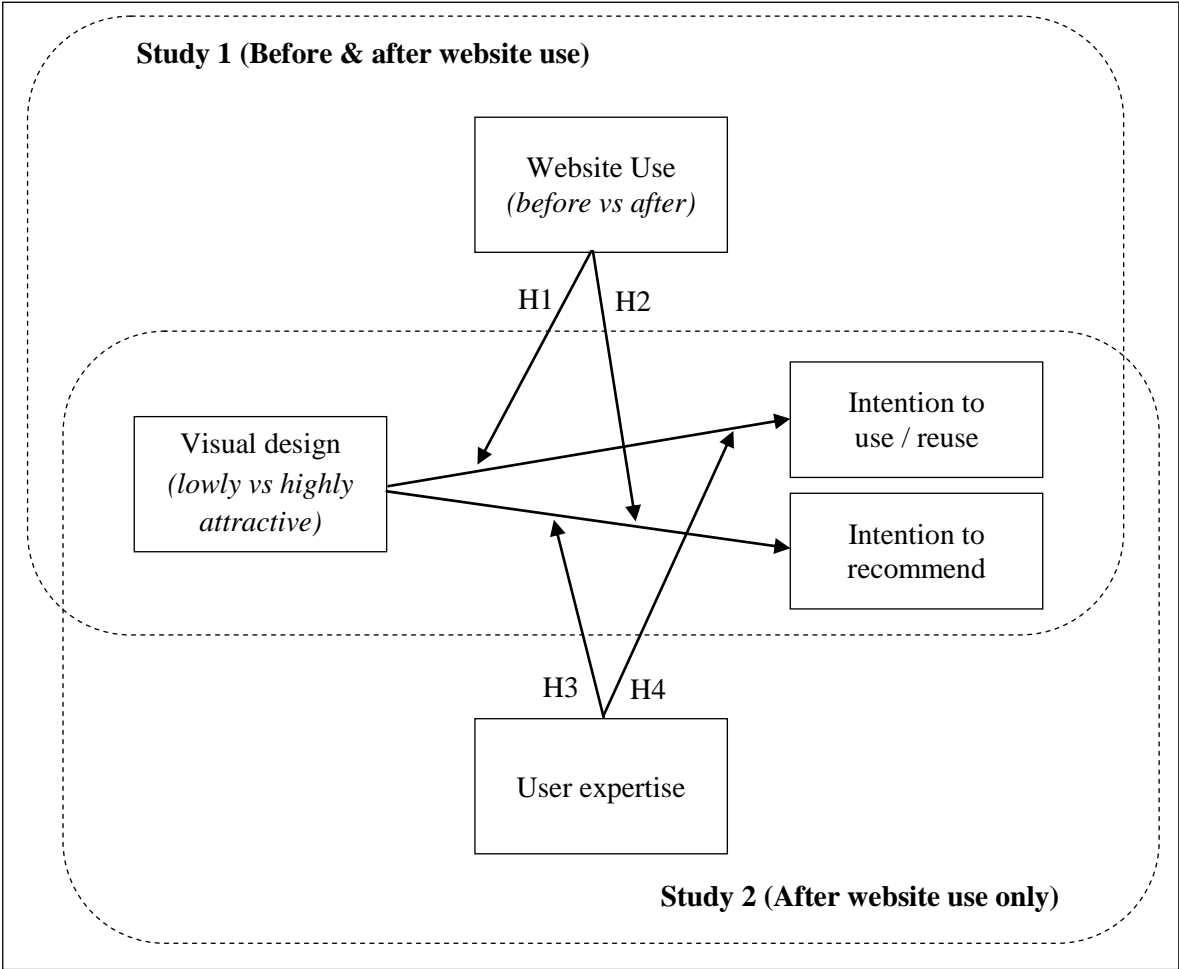
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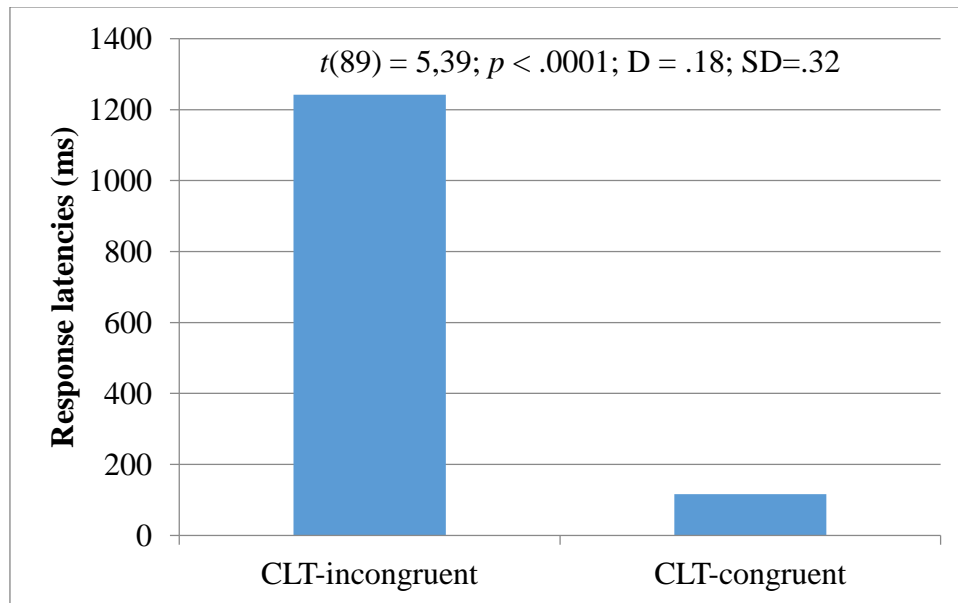
**Figure 1. Research model and hypotheses**



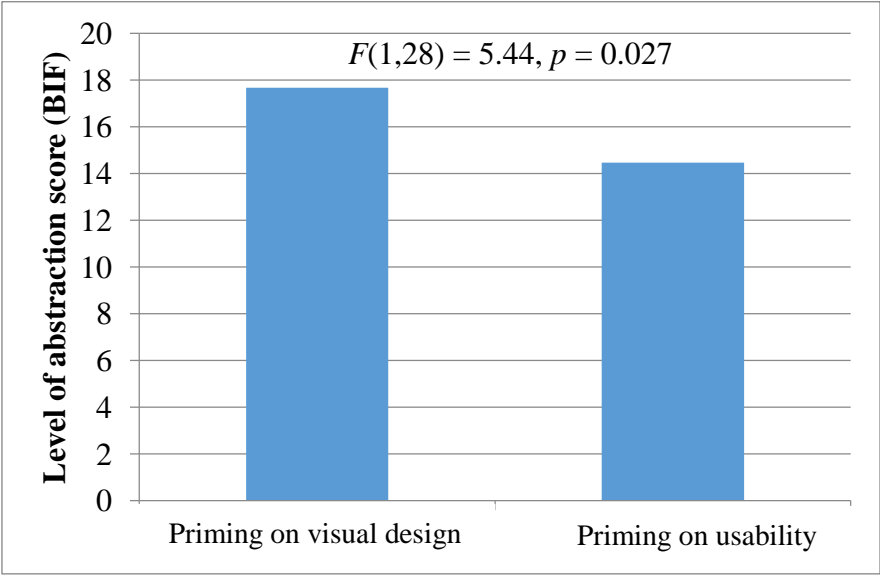
**FIGURE 2. Summary of the study’s aims and research design**

Confirm conceptual assertion		Test hypotheses	
Study A (preliminary)	Study B (preliminary)	Study 1	Study 2
<p><i>Objective:</i> To test the association between visual design and high-level construals via an Implicit Association Test (IAT)</p>	<p><i>Objective:</i> To test the association between visual design and high-level construals via the Behavioural Identification Form (BIF)</p>	<p><i>Objective:</i> To test the moderating role of website use (H1 and H2)</p>	<p><i>Objective:</i> To test the moderating role of user expertise (H3 and H4)</p>
<p><i>Design:</i> one-factor (CLT-congruent vs CLT-incongruent) within-subject design  <i>Test:</i> factor effect on response latencies  <i>Controls:</i> involvement, task enjoyment, task difficulty  <i>Procedure:</i> laboratory experiment  <i>Sample:</i> 92 French undergraduate students</p>	<p><i>Design:</i> one-factor (priming on usability vs priming on visual design) between-subject design  <i>Test:</i> factor effect on the level of abstraction score  <i>Procedure:</i> laboratory experiment  <i>Sample:</i> 30 French undergraduate students</p>	<p><i>Design:</i> two-factor between-subject design: website use (before vs after) X visual design (lowly vs highly attractive)  <i>Test:</i> moderation by website use of the effects of visual design on intention to use and to recommend  <i>Controls:</i> familiarity, age and gender  <i>Procedure:</i> online survey  <i>Sample:</i> 235 Internet consumers (from a panel)</p>	<p><i>Design:</i> focus on after-use, one-factor between-subject design visual design (lowly vs highly attractive)  <i>Test:</i> moderation of user expertise on the effects of visual design on intention to use and to recommend  <i>Control:</i> familiarity, age and gender  <i>Procedure:</i> online survey  <i>Sample:</i> 225 Internet consumers (from a panel)</p>

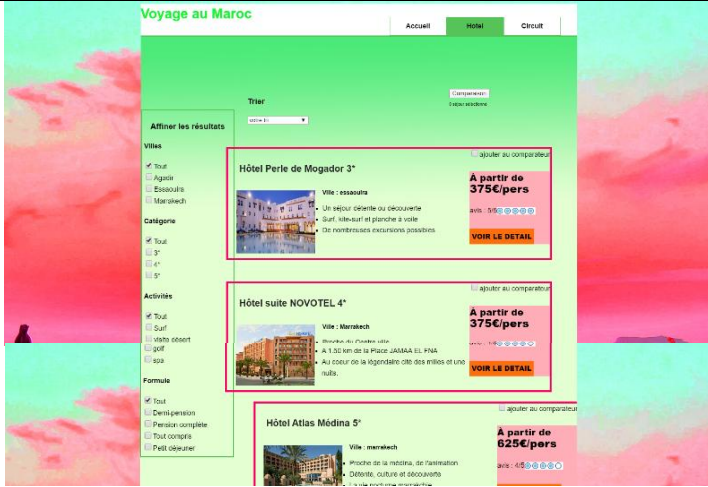
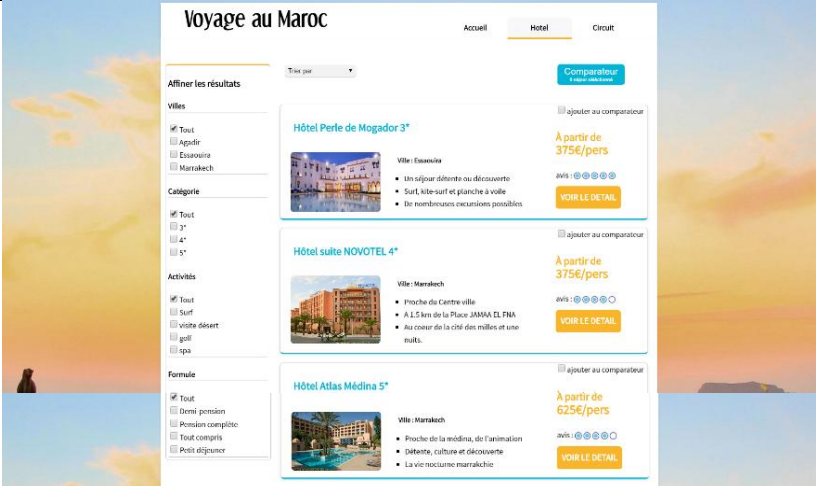
**FIGURE 3. CLT-incongruent (concrete/visual design) versus CLT-congruent (abstract/visual design) associations according to IAT results (Preliminary Study A)**



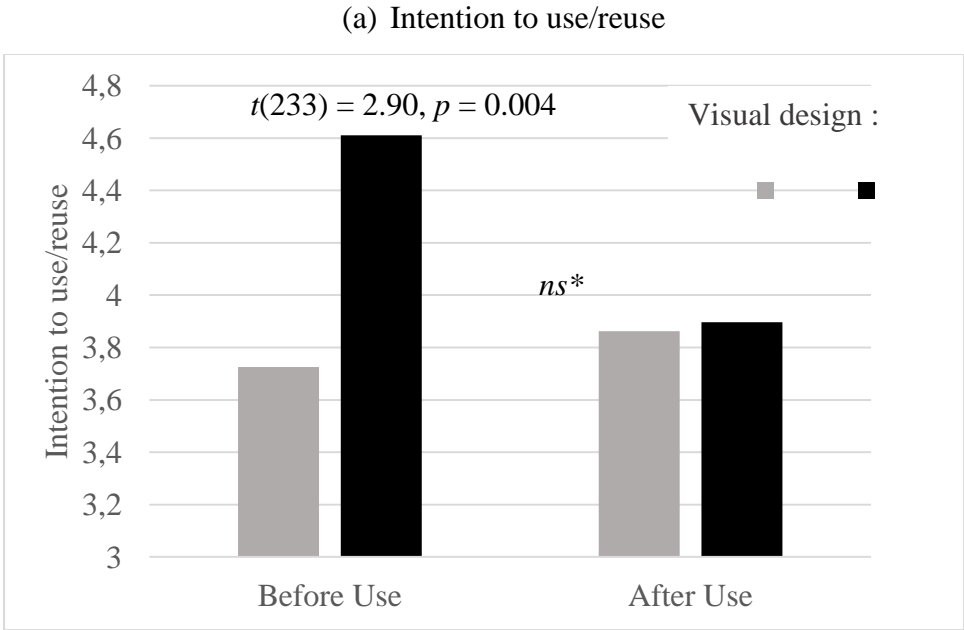
**FIGURE 4. BIF scores across visual design versus usability priming conditions (Preliminary Study B)**



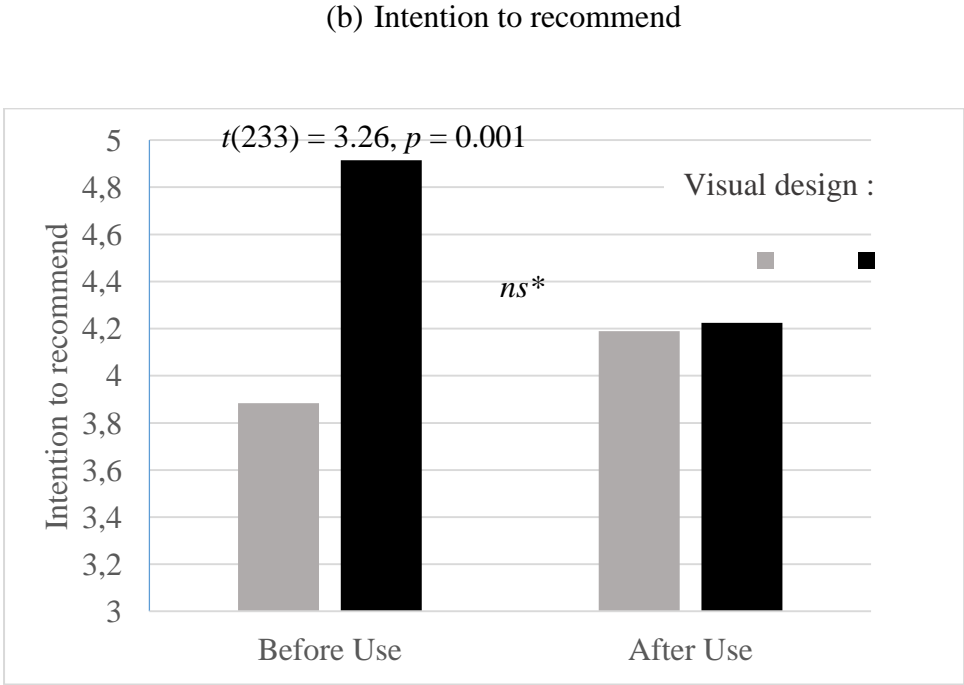
**FIGURE 5. Website stimuli used in Study 1 and Study 2 (created and implemented by a web developer)**

	Visual design (lowly attractive)	Visual design (highly attractive)
<b>Printscreen</b>	 <p>Accessible at : <a href="http://ihm.imag.fr/projects/tigre/userx/mini-site-1/index.html">http://ihm.imag.fr/projects/tigre/userx/mini-site-1/index.html</a></p>	 <p>Accessible at : <a href="http://ihm.imag.fr/projects/tigre/userx/mini-site-2/index.html">http://ihm.imag.fr/projects/tigre/userx/mini-site-2/index.html</a></p>
<b>Colour</b> (Minge, 2008)	High background colour difference	Low background colour difference
<b>Symmetry</b> (Bauerly and Liu, 2006; Tuch et al. 2008)	Non-aligned blocks	Aligned blocks
<b>Shapes</b> (Bar and Neta, 2007; Westerman et al. 2012)	Square framework	Round framework

**FIGURE 6. Interaction effect between visual design (lowly vs highly attractive) and website use (before vs after) on (a) intention to use/reuse and (b) intention to recommend**



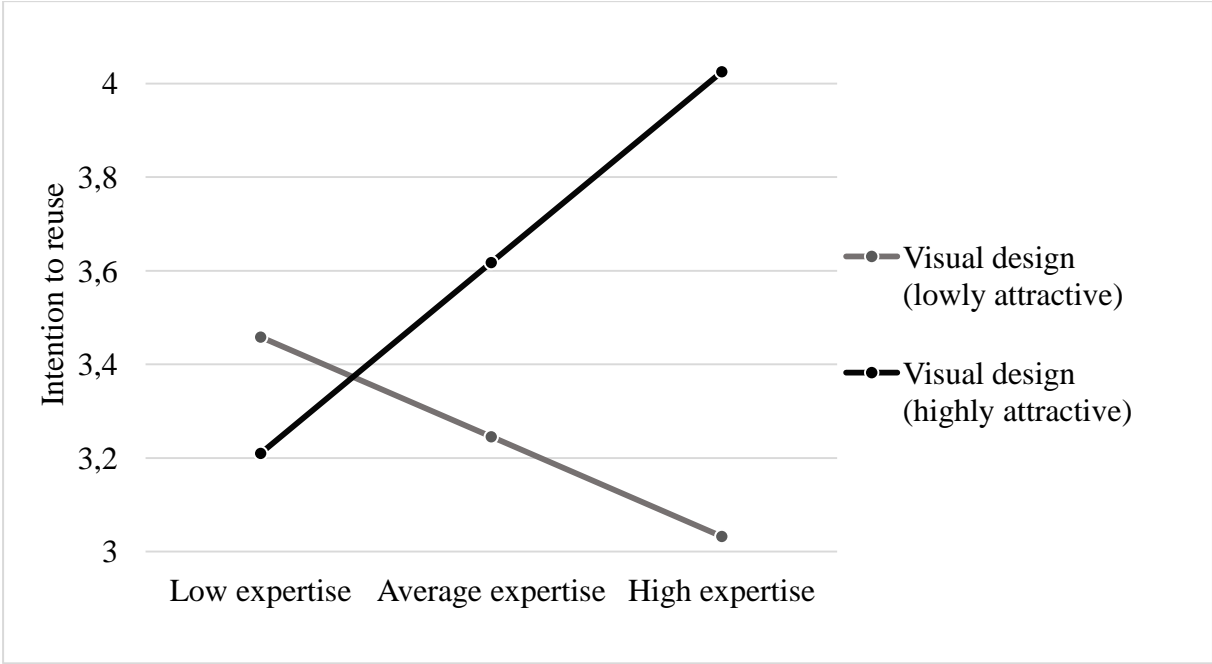
\* The effect of visual design is statistically not significant in the after-use condition



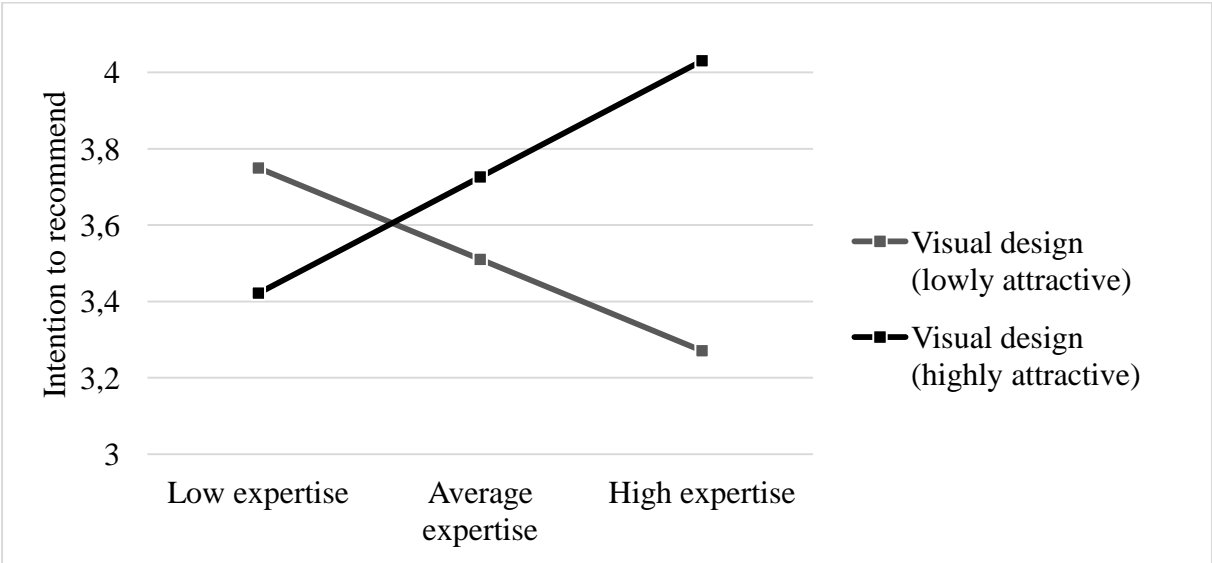
\* The effect of visual design is statistically not significant in the after-use condition

**FIGURE 7. Moderating effect of user expertise on the impact of visual design on (a) intention to reuse and (b) intention to recommend in post-use situation**

(a) Intention to reuse



(b) Intention to recommend





**TABLE 1. Sequence of the trial blocks in IAT (Study A)**

<b>Blocks</b>	<b>Number of trials</b>	<b>Function</b>	<b>Items assigned to left-key response</b>	<b>Items assigned to right-key response</b>
1	32	Practice	Usability	Design
2	32	Practice	Abstract	Concrete
3	32	Practice	Abstract Usability	Concrete Design
4	32	CLT-incongruent test block	Abstract Usability	Concrete Design
5	32	Practice	Design	Usability
6	32	Practice	Abstract Design	Concrete Usability
7	32	CLT-congruent test block	Abstract Design	Concrete Usability

**Example of instructions given to participants (Step 1)**

*Please place fingers from your left and right hands on the keys **A** and **L**, respectively. At the top of the screen, you will see two categories - one of the left and one on the right. Words will appear, one by one, in the middle of the screen. When the word belongs to the category on the left, please press the **A** key on your keyboard as fast as you can. When the word belongs to the category on the right, press the **L** key on your keyboard as fast as you can. If you make an incorrect answer, a red **X** will appear. Please try to make as few errors as possible.*

*When you are ready, please press the [space] bar to begin*

*Part 1 to 7.*

**Explanations of each step**

The first three steps are for practice purposes: Step 1. Respondents have to associate the words that appear in the middle of the screen with either the ‘Usability’ or ‘Design’ categories at the top of the screen (left and right, respectively); Step 2. Respondents have to categorise the words that appear as either ‘Abstract’ or ‘Concrete’; Step 3. Respondents categorise the words as either ‘Abstract / Usability’ or ‘Concrete / Design’;

Step 4. Respondents repeat the same task as described in step 3 (This is the CLT-incongruent test);

Steps 5 and 6 are for practice, similar to Steps 1 and 3, but this time ‘Usability’ is on the right at the top of the screen and ‘Design’ is on the left;

Step 7. Respondents repeat the same task as described in Step 6 (This is the CLT-congruent test).

**TABLE 2. Treatment condition (frequencies) (Study 1)**

	<b>Visual design (lowly attractive)</b>	<b>Visual design (highly attractive)</b>
<b>Before website use</b>	Group 1 (n = 60)	Group 2 (n = 59)
<b>After website use</b>	Group 3 (n = 58)	Group 4 (n = 58)

**TABLE 3. Descriptive statistics (Study 1 and Study 2)**

	<b>STUDY 1 (n = 235)</b>		<b>STUDY 2 (n = 225)</b>	
	<b>Mean</b>	<b>SD</b>	<b>Mean</b>	<b>SD</b>
Intention to use/reuse	4.02	1.69	3.45	1.88
Intention to recommend	4.30	1.76	3.64	1.88
User expertise	-	-	7.42	2.79
Age	41.09	12.80	40.69	14.53
Familiarity	4.54	1.48	4.48	1.64
Manipulation check of visual design	4.67	1.50	4.21	1.76

**TABLE 4. Results of regression analysis (Study 1,  $n = 235$ )**

		<b>Intention to use/reuse</b>		<b>Intention to recommend</b>	
		<b>Estimates</b>		<b>Estimates</b>	
<b>Models</b>	<b>Variables</b>	<i>Model 1.1</i>	<i>Model 1.2</i>	<i>Model 2.1</i>	<i>Model 2.2</i>
	Visual design (a)	0.230*	0.246*	0.270*	0.291*
	Website Use (b)	-0.144	-0.119	-0.095	-0.083
	Interaction (axb)	-0.213*	-0.222*	-0.249*	-0.261*
	Gender	-	0.129	-	0.282
	Age	-	0.020*	-	0.019*
	R <sup>2</sup>	0.042	0.066	0.047	0.069

\*  $p < 0.05$

**TABLE 5. Results of regression analysis (Study 2,  $n = 225$ )**

		<b>Intention to reuse Estimates</b>		<b>Intention to recommend Estimates</b>	
<b>Models</b>		<i>Model 1.1</i>	<i>Model 1.2</i>	<i>Model 2.1</i>	<i>Model 2.2</i>
<b>Variables</b>					
Visual design (a)		0.186	0.198	0.108	0.102
User Expertise (b)		0.038	0.055	0.015	0.025
Interaction (axb)		0.111*	0.120*	0.097*	0.121*
Gender		–	–0.104	–	0.177
Age		–	0.005	–	0.0002
R <sup>2</sup>		0.042	0.054	0.025	0.041

\*  $p < 0.05$

**TABLE 6. Johnson-Neyman significance regions: Conditional effect of visual design on use intentions of user expertise score (Study 2)**

<b>Expertise Score</b>	<b>Intention to reuse</b>			<b>Intention to recommend</b>		
	<i>Estimates</i>	<i>t</i>	<i>p</i>	<i>Estimates</i>	<i>t</i>	<i>p</i>
2	-0.361	-1.43	0.153	-0.371	-1.47	0.144
3	-0.250	-1.17	0.245	-0.274	-1.27	0.205
4	-0.139	-0.77	0.441	-0.177	-0.98	0.329
5	-0.028	-0.18	0.855	-0.079	-0.52	0.601
6	0.084	0.64	0.522	0.018	0.14	0.890
7	0.195	1.57	0.118	0.116	0.93	0.355
8	<b>0.250</b>	<b>1.97</b>	<b>0.050</b>	0.213	1.59	0.114
9	<b>0.361</b>	<b>2.53</b>	<b>0.012</b>	<b>0.305</b>	<b>1.97</b>	<b>0.050</b>
10	<b>0.472</b>	<b>2.78</b>	<b>0.006</b>	<b>0.359</b>	<b>2.10</b>	<b>0.037</b>
11	<b>0.584</b>	<b>2.87</b>	<b>0.004</b>	<b>0.456</b>	<b>2.24</b>	<b>0.026</b>
12	<b>0.695</b>	<b>2.90</b>	<b>0.004</b>	<b>0.554</b>	<b>2.30</b>	<b>0.023</b>