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The negative impact of saturation on website trustworthiness and appeal: A temporal model of aesthetic website perception

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ABSTRACT

Previous research on the perception of websites has shown that users' impressions of websites generated in ultra-rapid display durations (50 ms) correlate with their assessment after longer display durations. Based on the importance of color saturation in the design of websites, we present a 2 × 3 ×10 study design in which participants either assessed highly saturated or desaturated versions (between-subjects) of 50 websites coming from 10 content domains. All websites were presented three times to each participant in varying durations (50 ms, 500 ms, and 10 s), and each site was rated regarding its trustworthiness, visual appeal, and perceived usability. In contrast to a large body of research describing positive effects of higher saturated colors, our results show that these findings cannot be generalized to website perception, as we found negative effects of saturation depending on the content domain. Furthermore, we propose a temporal model of website perception based on the results in which users first evaluate the visual appeal of a website, followed by a continuous re-assessment of apparent usability, and lastly its trustworthiness. The results have broad implications for the design and presentation of information using digital media.

1. Introduction

When surfing the web, people make quick judgments regarding the websites they visit that determine their website usage. These judgments include whether they trust a website, the visual appeal of a site, as well as how user-friendly a site appears. Among others, these factors influence usage intentions and are therefore vital for the success of a website. Research on website perception has revealed that judgments regarding the visual appeal of a website can be made consistently after seeing a website for as short as 50 ms (Lindgaard, Fernandes, Dudek, & Brown, 2006) and that these ultra-rapid evaluations can be manipulated through visual parameters such as colorfulness (Reinecke et al., 2013), complexity, and prototypicality (Tuch, Presslaber, Stöcklin, Opwis, & Bargas-Avila, 2012). Although trustworthiness is considered to be an increasingly important aspect in the interaction with computers, as we depend more and more on computers in our everyday lives (Cyr, 2011; Gefen, 2000), little research exists on how website judgments can be systematically manipulated through objective visual characteristics, such as saturation. Since there are various examples of rather untrustworthy websites that happen to be extremely colorful, in particular yellow press websites or brightly colored advertising aimed at generating visual interest, users might have acquired a general tendency towards judging websites high in color saturation as less trustworthy. In the present study, we aim to investigate whether website judgments can be influenced by differences in color saturation. Secondly, we want to assess how these judgment processes develop over time, from ultra-rapid presentation durations of 50 ms to longer durations of up to 10 s.

1.1. Website assessment and visual design

Trust and other social concepts are important components in human-computer interaction that have been studied extensively in recent years (e.g., Lee & Nass, 2010; Cyr, 2008; Anderson & Srinivasan, 2003; Cyr, Bonanni, Bowes, & Ilsever, 2005). Previous research in this field has identified trust as a central evaluation criterion of websites, affecting, among other consequences, purchase decisions (Gefen, 2000; Yoon, 2002). Just like people use

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various cues derived from the outward appearance of a person to form a first impression (Brewer, 1988), visual design is used to quickly form an opinion of an artefact in the context of human-computer interaction (Kim & Fesenmaier, 2008). For instance, Sillence, Briggs, Harris, and Fishwick (2007) found that users tend to rate high quality content websites low if they are poorly designed. This result is an example of a halo effect (Nisbett & Wilson, 1977), i.e., a form of judgment bias occurring if the judgment of a property influences other (usually unrelated) judgments. Schenkman and Jönsson (2000) found that aesthetics are the best predictor of a website's overall evaluation, underlining the importance of aesthetics as a result of halo effects. A similar halo effect has been shown in a study that found that the perception of content quality is influenced by usability (Hartmann, Sutcliffe, & Angeli, 2008). As can be seen from this overview, cross-over influences, halo effects, and social cues are web site design factors worthy of more extensive research.

Research has shown that website trustworthiness can be affected by the color scheme used on a website (Alberts & van der Geest, 2011). Color research has revealed a general preference for bright and saturated colors (Camgöz, Yener, & Güvenç, 2002) and has shown that bright and saturated colors receive the most attention (Camgöz, Yener, & Güvenç, 2004). In a study that compared the perception of images of natural scenes, a preference for more colorful images could be demonstrated (Fedorovskaya, de Ridder, & Blommaert, 1997). Furthermore, higher color saturation leads to higher excitement in the context of advertising (Gorn, Chattopadhyay, Yi, & Dahl, 1997).

But what would be the outcome if these research results were directly applied to the design of websites? Previous research has indicated generally positive effects for higher color saturation on website evaluations. For instance, studies have shown that grey websites were rated as less appealing than blue or orange versions of a website, suggesting that the presence of hues is preferred over mere grayscale designs (Bonnardel, Piolat, & Le Bigot, 2011). Reinecke et al. (2013) found that 48% of the variance in first impressions of websites can be explained by a website's visual complexity and colorfulness. Cyr, Head, and Larios (2010) revealed that a website's trustworthiness and user satisfaction ratings are affected by the choice of colors. However, the study also demonstrated intercultural differences: For instance, blue websites received the highest ratings by Germans while grey sites were preferred by Canadians. Coursaris and van Osch (2016) recently presented their Cognitive-Affective Model of Perceived User Satisfaction (CAMPUS). Regarding the use of colors, one of their recommendations is that web designers should choose cooler colors for websites that focus on their functionality, while warmer colors can be used on less serious websites. A study by Harrison, Reinecke, and Chang (2015) found that higher colorfulness negatively affects ratings of infographics for males and people with a higher educational level, underlining that a several variables such as demographics may play a role in research on visual design in applied contexts.

Existing studies on the effects of color saturation in HCI suffer from several methodological issues: Some researchers chose to operationalize colorfulness instead of the objective measure of saturation (Reinecke et al., 2013), thereby having to rely on pretested subjective ratings in the definition of their independent variable. A recent study investigating several components of visual aesthetics of websites by Seckler, Opwis, and Tuch (2015) manipulated website screenshots regarding their saturation. However, saturation was changed using a non-uniform scale (low average saturation = 10% vs. medium average saturation = 40% vs. high average saturation = 70%) that potentially gives an advantage to higher saturated website. Furthermore, the study used a within-subject design in which participants were able to compare different website versions before entering their responses. The use of within-subject designs is a controversial issue in website aesthetics research (Thielsch & Hirschfeld, 2012), as participants may too easily detect the experimental manipulation, potentially biasing their responses due to demand characteristics. Therefore, we argue that using saturation as a between-subject factor with more controlled display durations as well as uniformly scaled saturation differences will lead to more valid results.

We will now discuss the relation between visual appeal, trustworthiness, and perceived usability in more detail and define these dependent variables more precisely. Reinecke et al. (2013) assume the perception of visual appeal to be a rather automatic emotional response dependent on visual preferences. Consequently, individual visual preferences constrain whether the perception of a website evokes positive or negative emotions. In this regard, we suppose visual appeal to be an immediate emotion evoked by a stimulus. Moreover, visual appeal seems to be a key characteristic in visual perception as there is a consensus that visual appeal influences judgments of unrelated properties through halo effects (e.g. Lindgaard et al., 2006; Hartmann et al., 2008). Examples for such properties are trustworthiness (Lindgaard, Dudek, Sen, Sumegi, & Noonan, 2011) and perceived usability (Lavie & Tractinsky, 2004; Sonderegger & Sauer, 2010). With regard to usability, one needs to distinguish between apparent and inherent usability (Thielsch, Blotenberg, & Jaron, 2014). Inherent usability comprises objective criteria such as loading times, readability, and an easily understandable navigation. Nevertheless, users may have a negative impression of a site's usability despite a well-designed inherent usability due to a site's apparent usability. This rather subjective evaluation prone to manipulation is called perceived usability. Due to the presence of halo effects in the literature, we assume these three properties to be inter-related.

1.2. Temporal dynamics of website perception

Regarding the perception and cognitive processing of aesthetics, Leder, Belke, Oeberst, and Augustin (2004) introduced a model of aesthetic appreciation and judgment. Although it primarily describes the perception of visual art, several aspects are highly relevant for website perception. In the model it is assumed that perceivers' current general mood affects the entire aesthetic perception process. Furthermore, the model distinguishes between implicit and explicit evaluation processes. After a first bottom-up stage in which global properties such as complexity and contrast are assessed within a few milliseconds, memories evoked by the aesthetic stimulus are integrated into the information processing cycle. After this implicit stage of perception and evaluation, the next step involving more deliberate reasoning sets in. Perceivers explicitly classify the stimulus and evaluate it according to their domain-specific expertise, interest, and declarative knowledge. The output of the model is on the one hand an aesthetic emotion, and on the other hand an aesthetic judgment.

In line with this model, previous research dealt with the perception of websites and investigated when aesthetic judgments are made. It has been shown that reliable judgments of visual appeal, trustworthiness, and perceived usability are made within ultra-rapid durations of 50–500 ms (Lindgaard et al., 2006; 2011; Reinecke et al., 2013; Thielsch & Hirschfeld, 2010; 2012). Research based on this approach usually emphasizes the importance of first impressions. For instance, Lindgaard et al. (2006) found extremely high correlations between repeated visual appeal ratings of different display durations (50 and 500 ms). In a further study Lindgaard et al. (2011) revealed that first judgments after 50 ms correlate with judgments made after 10 s. Although