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Examining the relationships between online store atmospheric color, flow experience and consumer behavior

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ABSTRACT

Although atmospherics and flow experience are widely studied, the relationship between online store atmospheric cues and flow experience has received a little attention. Furthermore, there is a lack of published results about the role of atmospheric color in creating flow. Using the Stimulus – Organism – Response model and the theory of optimal experience of flow, this study investigated the impact of online store background color on the achievement of flow and its effects on online consumer behavior. In this study, an online experiment was conducted to investigate the effects of a warm hue – yellow versus a cool hue – blue of the background and used a self-administered online survey for data collection. The results underscore the important role online store color plays in creating the flow experience and revealed that blue hue induces more flow than yellow. The two dimensions of flow (perceived enjoyment and concentration) have direct and mediating effects on purchase intention and revisit intention. Concentration, but not enjoyment, has direct and mediating effects on the number of viewed pages and time spent per visit. This research enhances our understanding of the relationship between online store atmospheric color and flow and highlights the role of flow as an extension of SOR model applied online. Other theoretical and managerial implications of the results are discussed. Finally, suggestions regarding future research are presented.

1. Introduction

Research indicates that approximately 80% of what we assimilate through the senses, is visual and that about 80% of the assessment of the surroundings is based on colors (Morton, 2009). Colors form a ubiquitous part of our daily lives, affect our perceptions and transmit a considerable amount of information. Colors boost memory, engage participation, attract attention, convey messages, and create feelings (Singh, 2006).

Use color to sell a product is not a new idea. However, “how to use it?” remains an up-to-date issue (Pelet, 2014). It is important that managers understand how to use colors, not only to create brand identity and differentiate their offerings from those of competitors, but also to influence moods, attitudes, emotions, and behaviors of a target market.

Although colors are used as a marketing tool, yet academic research on color is not abundant (Bagchi and Cheema, 2013; Labrecque et al., 2013). Though, there has been some early work that focuses on topics relating to colors such as advertising (Lichtlé, 2007), atmospherics (Bellizzi and Hite, 1992; Chebat and Morrin, 2007), product or its packaging (Pantin-Sohier, 2009), and brand logo (Labrecque and Milne, 2012), little is known about how color affects consumers and the underlying process in online purchase settings. Very few researchers have investigated the effects of websites’ color (Drèze and Zufryden, 1997; Gorn et al., 2004; Hall and Hanna, 2004; Pelet, 2014; Pelet and Papadopoulou, 2012; Bagchi and Cheema, 2013). All of these investigations acknowledge that color is an important feature of websites’ design that favors the users’ interactions and online shopping experience.

Recognizing the substantial impact of atmospheric color inside traditional stores on consumer behavior (Bellizzi and Hite, 1992; Brengman and Geuens, 2004; Chebat and Morrin, 2007), there is a need to investigate the effects of colors as a component of the online atmosphere of websites on online consumer behavior. Managers have little enough information on how to use color to create a compelling and stimulating online shopping experience that enhances the website's ability to retain online customers and prolong the duration of each visit. More theoretically based research is needed to move beyond the unreliable subjective use of color (Labrecque and Milne, 2012).

Empirical research examining store's atmosphere (Bellizzi and Hite, 1992; Brengman and Geuens, 2004; Chebat and Morrin, 2007) use the Stimulus - Organism - Response framework (SOR) (Donovan and Rossiter, 1982; Mehrabian and Russell, 1974). More recent investigations attempt to transpose this theoretical framework in e-commerce

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context (Eroglu et al., 2001, 2003; Sautter et al., 2004). By adapting the definition of Kotler (1973–1974) of atmospherics, Eroglu et al. (2001, p. 179) define atmospheric stimuli as “the sum total of all the cues that are visible and audible to the online shopper.” The online store atmospheric cues (such as text, links, animations, colors, and audio) are the "Stimulus". The PAD (Pleasure, Arousal, and Dominance) and cognitive states are the “Organism.” The “Response” represents the outcome, the approach or avoidance behaviors of the consumer.

Overall, the results of empirical work examining specific online store atmospheric cues and their effects on shopper responses were inconclusive. According to some researchers, this is due to the shortcomings of PAD (Eroglu et al., 2001, 2003; Sautter et al., 2004). The PAD's Dominance dimension is problematic and was not included in several works on the SOR model (Sautter et al., 2004; Eroglu et al., 2001). The PAD is too narrow in scope and not capturing the range of possible variations in emotional reactions and much of the effect of site atmosphere (Eroglu et al., 2001, 2003). The online environment is interactive and immersive. Design tools such as video, sound, 3D presentation, uploading, dynamic discussion, and sharing might offer an absorbing, escaping and gratifying experience, whereby the consumer becomes totally involved within the experience and forgets the time elapsed and worries. The PAD does not encompass the range of these possible reactions. Flow - an intrinsically optimal state during which an individual is intensely engaged in an activity to the exclusion of all other thoughts - has been established as a critical determinant of online experiences such as online shopping (Hoffman and Novak, 1996; Novak et al., 2000; Koufaris, 2002; Gao and Bai, 2014). Hoffman and Novak (1996) argue that the objective of online stores should be to facilitate “flow opportunities” in which consumers are entirely engaged during the shopping experience. A convenient, interactive, and compelling online store atmosphere provides rewarding “flow opportunities” enhancing the hedonic and utilitarian value of consumers' online shopping experience that people appreciate and attempt to replicate (Sénécal et al., 2002). Thus, an important online extension of the SOR might integrate the flow experience.

Despite the importance of the flow state in online environments, and its links to the atmospherics and consumer behavior (Hoffman and Novak, 1996), little is currently known about the configurations of online atmospheric cues that optimize the flow experience for the consumer (Gao and Bai, 2014). This research attempts to contribute to this area by focusing on one specific cue: the color of the website's background that consumers are exposed to in the online shopping experience.

Therefore, the objective of this research is to analyze the role of color in achieving a state of flow and to determine if the flow experience enhances behavioral outcomes during shopping in online stores. The results of this research aid understanding the impact of colors in the online shopping experience. Moreover, the results of this research can help e-commerce and m-commerce managers develop tactics that engage users and enhance the total online experience by using colors. Outcomes might consist of extended time on the site, increased site visits and increased site activity.

In this paper, we begin by describing the concepts of color, flow, and approach behavior. Next, we present our research model and provide supporting literature to specify a range of testable hypotheses involving the relationship of model constructs. We present the methodology, discuss the results and provide theoretical and managerial implications. Finally, we conclude with a description of the research limitations and suggestions for future research.

2. Overview of conceptual framework

2.1. Background to color: dimensions and typologies

Color derives from the light carried on wavelengths that the brain converts into six distinct colors categories: red, orange, yellow, green, blue, and violet (Singh, 2006). Colors are represented by three dimensions (Munsell, 1966): hue, saturation, and brightness. A color's hue (gradation or tonality) is the pigment of the color which perceived in categories (e.g., blue, yellow, red) (Gorn et al., 2004). Short wavelengths are associated with colors such as violet and blue. Long wavelengths are associated with colors such as red and orange (Babin et al., 2003). Saturation (or chroma) refers to the intensity or amount of pigment in a color. Saturation is a continuous dimension that ranges from high to low chroma. Higher chroma colors are more vivid and stand out more than lower chroma colors (Gorn et al., 2004). A color's brightness (or value) refers to its lightness or darkness. It corresponds to the extent to which a surface illuminated by a source seems to emit more or less light (Pelet and Papadopoulou, 2012). Brightness is a continuous dimension. Colors with low brightness have a blackish quality, whereas colors with high brightness have a whitish or pastel quality (Gorn et al., 2004). The current research emphases on the hue dimension, which has been the focus of in-store atmospheric color research (Bellizzi et al., 1983; Bellizi and Hite, 1992). We estimate that the hue dimension is more directly related to the online atmosphere and more powerful to elicit the entire experience of flow in this context. However, the two other dimensions of color, saturation, and brightness, need to receive more attention in forthcoming work (see Pelet (2014) and Pelet and Papadopoulou (2012)).

Most of the research focusing on the psychological effects of color on consumers contrasts the effects of warm colors with those of cool colors. Warm colors are high wavelengths such as reds, oranges, and yellows. Cool colors are low wavelengths such as blues, greens, and whites. The present study adopts this typology. Past work shows that cool and warm colors have differential and strong effects on consumer response (Bellizi et al., 1983; Bellizi and Hite, 1992; Chebat and Morrin, 2007; Gorn et al., 2004). The cool – warm interpretation of colors seems to have permitted to capture efficiently the differences in terms of emotions (stimulation, pleasure, anxiety, etc.) and behavior (impulsive buying, purchase intentions, and time perception) in these researches. A warm hue is more vivid and exciting than a cool hue, and a cool hue is more pleasant, soothing, relaxing, calm, peaceful, restful, happy and induces leisure and contemplation (Crowley, 1993; Babin et al., 2003; Bellizzi et al., 1983; Bellizzi and Hite, 1992). Therefore, this scheme appears suitable to explore whether warm and cool color impacts the flow experience in an e-commerce environment. Massel (2016) gives examples of e-commerce websites using cool/warm hues (such as http://helbak.com for cool hues and https://www.oipolloi.com for warm hues). It should be pointed out that even though the aforementioned research has shown that cool hues such as blue are seen as calming and relaxing whereas warm hues such as red are seen as exciting and stimulating, a cool colored website does not exclude that the user might be excited and experiences socialization. It is the whole website's content and interactive features that will be decisive.

Besides, in the empirical phase of this research, we compare blue with yellow for the following reasons. First, as we discussed previously, blue is a cool color and yellow is a warm color. Having an opposite chromatic tonality, blue and yellow might elicit contrasting feeling states (Bellizi et al., 1983; Bellizi and Hite, 1992; Chebat and Morrin, 2007; Gorn et al., 2004). Second, in the context of online browsing, Gorn et al. (2004) test the links between color and feelings of relaxation and between feelings of relaxation and time perception. The authors predict that the background screen color influences how quickly a page is perceived to download and that feelings of relaxation mediate this influence. Also, their findings reveal that color affects users’ evaluations of the website and their likelihood of recommending it to others. Gorn et al. (2004) use blue and yellow to test the effects of colors on an emotional variable (relaxed feeling state) and cognitive variable (evaluations of the website), as we should do in our study since flow encompass two dimensions: enjoyment (emotional dimension) and concentration (cognitive dimension).

2.2. Understanding the experience of flow

Flow is a cognitive state characterized as an intrinsically enjoyable optimal experience associated with intense engagement, loss of self-consciousness, distorted sense of time, and heightened motivation (Csikszentmihalyi, 1975, 1990). In flow, people are fully absorbed in what they are doing and intrinsically motivated to repeat an activity continually (Csikszentmihalyi, 1975, 1990). In flow, time might seem to stand still while people engaged in a consumption event (Lutz and Guiry, 1994). It is an exceptional experience compared to daily activities. Flow is a continuous variable with different levels, ranging from an absence of flow to an intense state of flow (Csikszentmihalyi, 1990).

Flow is experienced in a variety of daily activities such as reading a book, watching a movie, or playing sports. Hoffman and Novak (1996) and Novak et al. (2000) adapted Csikszentmihalyi's theory of flow to cover the use of computer-mediated environments. Hoffman and Novak (2009) argue that online flow can be experienced when one is immersed in an online activity. In computer-mediated environments, the online flow has been proposed as the central process in a user's web navigation (Novak et al., 2000), software use (Webster et al., 1993), online gaming (Chang, 2013), and online shopping (Koufaris, 2002).

Csikszentmihalyi (1990, p. 53) summarizes the main characteristics of flow. Flow occurs when tasks involve a balance between challenge and skill; the task has clear goals, and the task provides immediate feedback. This usually improves our concentration on the task. In flow, involvement in the activity is deep but effortless; enjoyable experiences allow people to exercise a sense of control over their actions; concerns for the self are wiped out; and finally, the sense of the duration of time is distorted. The mixture of all these elements causes a sense of deep enjoyment.

Since Csikszentmihalyi's work, there is still some debate concerning the dimensions, antecedents and consequences of flow due to the multifaceted and broad set of related constructs. For example, Trevino and Webster (1992) propose a causal model using four dimensions to describe the flow: control, attention focus, curiosity, and intrinsic interest. Webster et al. (1993) empirically distinguish intrinsic interest and curiosity. They also recommended a third dimension representing a combination of intrinsic interest and curiosity. Ghani and Deshpande (1994) argue that two key characteristics of flow are the total concentration and enjoyment one derives from an activity. Hoffman and Novak (1996) outline that flow is a cognitive state, which is determined by (1) high levels of skills and control, (2) high levels of challenge and arousal, (3) focused attention, and (4) interactivity and telepresence. Agarwal and Karahanna (2000) suggest flow with five constructs: curiosity, control, temporal dissociation, focused immersion, and heightened enjoyment. Koufaris (2002) conceptualizes flow as comprised of intrinsic enjoyment, perceived control, and concentration/attention focus. Huang (2003) considers four constructs, including control, attention focus, curiosity, and intrinsic interest. For Li and Browne (2006), flow includes four dimensions: focused attention, control, curiosity and temporal dissociation.

In this research, the flow concept is operationalized with two dimensions: enjoyment and concentration. We perceive curiosity and control to be less relevant to our research. Enjoyment and concentration are expected to be more directly related to colors. These two dimensions are commonly examined in computer-human interaction research as key components of flow and have received consistent support in marketing research (Koufaris, 2002; Domina et al., 2012; Mahnke et al., 2015; Sanchez-Franco, 2006). Ghani and Deshpande (1994), Ghani et al. (1991), Lu, Zhou, and Wang (2009), and Sanchez-Franco (2006) find that enjoyment and concentration are sufficient to represent people's flow state in the human-computer environment. Thus, the bidimensional structure seems sufficiently parsimonious to capture the entire experience of flow in the context of online shopping. Below, we describe enjoyment and concentration in more detail.

Enjoyment has been designated as an intrinsic motivation. It has been defined as the degree to which using a virtual world is perceived as pleasurable, regardless of performance consequences resulting from system use (Domina et al., 2012). It captures an individual's subjective gratification of the interaction with the technology (Ghani and Deshpande, 1994). The flow experience itself is regarded as pleasant, interesting, fun and exciting. In an e-commerce context, consumers value the online shopping trip not only for the utilitarian benefits gained but also for the enjoyment and gratification they obtain from the shopping act itself.

To be in the flow, an individual's attention must focus on the activity. Concentration can be defined as the extent to which the individual's attention is completely absorbed by the activity to the degree that nothing else matters (Csikszentmihalyi, 1990). It's the intensity of focus of attention given to the task at hand (Domina et al., 2012). While shopping online, computerized distractions such pop-ups, e-mail, social networks, and instant messaging, and human distractions such children, television, telephone, and colleagues would decrease the visitor's attention during the online shopping and thereby inhibit flow.

2.3. Approach behaviors toward online stores

Approach behavior concerns all positive behaviors that might be related to a store, such as intentions to stay, explore, or affiliate, whereas avoidance refers to opposite behaviors (Donovan and Rossiter, 1982). The literature based on the SOR framework in online shopping context shows some support for the link between the organism, affective and cognitive states, and the response, that might be an approach or avoidance behavior. Researchers have focused on outcomes such as satisfaction (Eroglu et al., 2003; Mummalaneni, 2005), purchase intention (Hsieh et al., 2014; Mazaheri et al., 2011; Wu et al., 2014), site revisit (Koo and Ju, 2010; Mummalaneni, 2005), time spent in the online store (Mummalaneni, 2005), exploration of the online store offerings (Richard, 2005), and impulse-buying behavior (Floh and Madlberger, 2013).

Similarly, some researchers have studied the consequences of flow. Flow experience may enhance increased learning, increased perceived behavioral control, increased exploratory and participatory behavior, positive subjective experiences, and time distortion (Hoffman and Novak, 1996, 2009). In online shopping context, the existent empirical findings indicate that flow influences satisfaction (Gao and Bai, 2014), purchase intention (Gao and Bai, 2014; Hausman and Siekpe, 2009), site revisit (Koufaris, 2002; Hausman and Siekpe, 2009), exploration behavior (Huang, 2006), and impulse-buying behavior (Koufaris, 2002).

This research contributes to the empirical advancement of the experience of flow during online shopping by considering the following four consequences as the target approach behavior: number of visited pages, visit duration, purchase intention, and online store revisit intention. These constructs are poorly investigated in previous research. Moreover, these constructs are of interest because they may be an important measure of customer retention and the online store's stickiness (Lin, 2007). Stickiness, the website's ability to retain online customers and prolong the duration of each visit, is a significant feature of successful e-commerce websites (Zott et al., 2000). When stickiness occurs, the consumer will browse more content and spend more time on the site, which may enhance his/her intention to transact (Lin, 2007).

In this study, the number of visited pages refers to the number of requests for a new page within the site (Bucklin and Sismeiro, 2003). Thus, the corresponding requests to hyperlinks on the same page of the site or frames (HTML areas on the same web page) were not considered as new pages. The visit duration is defined as the number of seconds spent by the visitor in browsing the online store (Bucklin and Sismeiro, 2003). Purchase intention, a predictor of effective online buying behavior, refers to the desire of consumers to make a purchase through

the website (Yoo and Donthu, 2001). Revisit intention, a predictor of actual online loyalty, indicates the willingness of consumers to revisit the website in the future (Coyle and Thorson, 2001). The next section presents our conceptual model, explains the relationships in the model, and outlines the associated hypotheses.

3. Research model and hypotheses

3.1. Effects of the online store atmospheric color on flow

Enjoyment is similar to the emotional response of pleasure (Koufaris, 2002). The theory of Csikszentmihalyi (1975, 1990) regards enjoyment as an intrinsic motivation that is more emotionally intense and a deeper experience that mere pleasure. It can't be enjoyment without pleasure. Nevertheless, in several studies (e.g. Ghani and Deshpande, 1994; Koufaris, 2002), enjoyment is measured by the pleasure from environmental psychology (Donovan and Rossiter, 1982). The experience of flow itself is regarded as pleasant, interesting, and fun. Thereby, to understand the relationship between colors and enjoyment, it will be reliable to build on previous research linking colors to pleasure in the traditional store's context.

Researchers show that cool colors are more strongly linked to pleasure than warm colors. Short-wavelength hues such as blue, blue-green, red-purple, purple, and purple-blue are more pleasant than long-wavelength hues such as yellow and green-yellow (Valdez and Mehrabian, 1994). Prior research has suggested that cool colors should produce more positive outcomes than warm colors, and cool colors were associated with happiness (e.g. Babin et al., 2003; Bellizzi et al., 1983; Bellizzi and Hite, 1992). Moreover, hues might be ranked according to their pleasantness, in a descending order, as follows: blue, green, purple, red, and yellow (Mehrabian and Russell, 1974). Therefore, as blue will increase pleasure, we expect that consumers who are exposed to blue color will experience more enjoyment than consumers who are exposed to yellow color.

The concentration characterizes computer users (Ghani and Deshpande, 1994). Concentration is the product of extensive navigation and focused attention (Chen et al., 1999). Little is known about the relationship between colors and concentration. Researchers notice that environmental stimuli might explain such concentration (Ghani and Deshpande, 1994; Chen et al., 1999). In online stores, concentration can thus be stimulated by colors inter alia. Blue, a cool hue, is often associated with many redeeming properties. It's soothing, relax, calm, peaceful, restful, and induce contemplation (Bellizzi et al., 1983; Madden et al., 2000). Warm colors are more disruptive than cool colors when customers face tough purchase decisions (Bellizzi et al., 1983). Consequently, we assume that cool colors aid concentration more strongly than the warm colors. Our first hypothesis is as follows:

H.1. *Online stores with a blue versus a yellow atmospheric hue will elicit higher flow.*

H.1a. *Online stores with a blue versus a yellow atmospheric hue will elicit higher enjoyment.*

H.1b. *Online stores with a blue versus a yellow atmospheric hue will elicit higher concentration.*

3.2. Effects of flow on the approach behavior

Flow affects the key consumer behavioral responses (Hoffman and Novak, 2009). Consumers who experience flow are less price-sensitive, have more fun, and develop more favorable attitudes toward online stores and purchase intentions (Huang, 2006; Korzaan, 2003; Koufaris, 2002; Novak et al., 2000). A higher level of flow is positively associated with emotional responses and revisits to the website (Fortin and Dholakia, 2005; Nel et al., 1999). Flow is a driver of positively aroused feelings, higher satisfaction levels, favorable word-of-mouth (O'cass and Carlson, 2010; Shin, 2006), exploratory behavior (Korzaan, 2003), website browsing (Smith and Sivakumar, 2004), and unplanned purchases (Koufaris, 2002).

In the flow literature, concentration and enjoyment have been found to increase the overall experience for computer users (Webster et al., 1993). As a result, consumer approach behavior is enhanced (Koufaris, 2002; Wakefield and Baker, 1998). Enjoyment as a dimension of flow has been shown to influence the user's attitude toward new technology (Childers et al., 2001; Domina et al., 2012) and positively influence e-mail use (Trevino and Webster, 1992), software use (Webster et al., 1993), and web use (Koufaris, 2002; Novak et al., 2000). The enjoyment improves customers' satisfaction and loyalty (Koufaris, 2002; Lin et al., 2010). Concentration is particularly important as when users are highly focused they are more likely to use a system intensively and repeatedly (Webster et al., 1993). High concentration level has a positive impact on website user's intention to return and purchase intentions (Hooker et al., 2009; Koufaris, 2002). Concentration influence perceived usefulness and perceived ease of use of web environments (Agarwal and Karahanna, 2000; Zhang et al., 2006) and mobile TV (Jung et al., 2009). Interrupted or irritated users report a decrease in their satisfaction in an online shopping or a gaming environment (Xia and Sudharshan, 2002). We, therefore, postulate that enjoyment and concentration will positively affect consumer behavioral responses on an online store such as purchase intentions and revisit intentions.

In defining the flow, Csikszentmihalyi (1990), refers to a condition of time distortion. Individuals who are in a state of flow are characterized as being so deeply involved in the task at hand that they lose the sense of self and track of time. Consequently, they are unaware of time passing. The immersive and gratifying experience causes browsers to forget the time elapsed in the computer-mediated environment (Hoffman and Novak, 1996).

Moreover, a direct consequence of flow in computer-mediated environments is exploratory behavior. Exploratory behavior increases the amount of time spent online. In flow, the user is willing to interact with the environment to prolong the experience. Subsequently, the user loses track of time (Novak et al., 2000). Therefore, we hypothesize that flow experience will increase the number of visited pages and the visit duration. Building on previous research results, our second hypothesis is as follows:

H.2. *Higher levels of flow lead to a more approach behavior during shopping on online stores.*

*Higher levels of enjoyment (**H.2a**) and concentration (**H.2b**) lead to a higher number of visited pages*
*Higher levels of enjoyment (**H.2c**) and concentration (**H.2d**) lead to a higher visit duration*
*Higher levels of enjoyment (**H.2e**) and concentration (**H.2f**) lead to a higher purchase intention*
*Higher levels of enjoyment (**H.2g**) and concentration (**H.2h**) lead to a higher revisit intention*

Moreover, we expect that flow will mediate the effects of online atmospheric color on the number of visited page, number of visited pages, visit duration, purchase intention, and revisit intention. This prediction is based on the studies referenced above granting the supposed relationship between colors and flow and the literature that asserts the positive effect of flow on behavior. Concerning flow as a mediating variable, research is scarce. So, based on the above studies, we expect flow to be a mediator between colors and behavior:

H.3. *Flow mediates the relationship between the online store atmospheric color and approach behavior.*

*Enjoyment (**H.3a**) and concentration (**H.3b**) mediate the relationship between the online store atmospheric hue and the number of visited pages.*

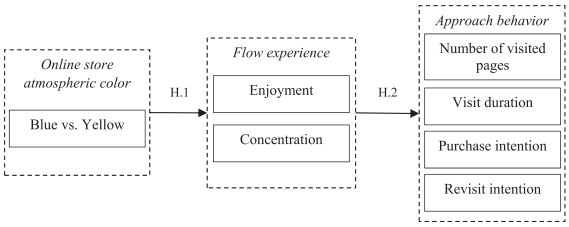

Fig. 1. Conceptual model.

*Enjoyment **(H.3c)** and concentration **(H.3d)** mediate the relationship between the online store atmospheric hue and visit duration.*
*Enjoyment **(H.3e)** and concentration **(H.3f)** mediate the relationship between the online store atmospheric hue and purchase intention.*
*Enjoyment **(H.3g)** and concentration **(H.3h)** mediate the relationship between the online store atmospheric hue and revisit intention.*

The following model depicts our hypothesized relationships. The color is expected to predict the flow experience during shopping in online stores and explain how this experience can influence a user's approach behavior in terms of the number of visited pages, visit duration, purchase intention, and online store revisit intention (Fig. 1). The proposed model is grounded in the previous literature review. It is unique in two ways. First, few researchers have examined how colors may influence the flow and its effects on outcome variables. Second, this research extends the online SOR framework by integrating the experience of flow as an Organism state. However, it should be noted that the list of dimensions and effects included in this model is not exhaustive, and we do not claim that the variables within each block are independent. Particularly, the two flow dimensions and the response variables may be interconnected. We focus on the examination of a number of relationships rather than expanding the investigation to all the interrelations between constructs.

4. Research methodology

4.1. Data collection and stimuli

An experiment was conducted to test the hypothesized relationships. A between-subjects design with two experimental conditions: blue hue and yellow hue were used. Referring to Gorn et al. (2004), we used the hue 204 and 60 respectively for the blue and yellow (using the Hue, Saturation, and Brightness, HSB model). Hexadecimal codes of the two hue are Hex = {FF, FF, 00} for yellow and Hex = {00, 99, FF} for blue. We set the chroma and brightness levels at 100%. Two versions of a fictitious online store selling high-tech products have been designed. Only the background hue differed from one version to another. The informational content, font, images and all other aspects of the site design were kept constant in both versions. High-tech websites were chosen because these websites are among the most visited (Statista.com, 2016). Li et al. (2002) use high-tech products to study online atmospheric cues. When designing the website, we took into account the congruence between the color of the background and the color of the text. The congruence of colors can affect the visibility and aesthetics of the site. Achromatic color (gray) was used for the text. Achromatic colors are neutral (Valdez and Mehrabian, 1994). The experimental website has been pretested with 39 respondents. The results showed a very satisfactory perception of all aspects of the online store and its contents (layout design, irritation, readability, informativeness, interactivity, usefulness, ease of use, and commercial offer) (Appendix A). Similarly, the effectiveness of color manipulation and the level of congruence or the contrast between the foreground (text) and background color were satisfactory (Appendix B).

Also, a lot of attention has been devoted to tracking down the sources of experimental contamination that may affect the results. Indeed, the accuracy of color vision of the web depends on the user's operating system, monitors graphic card, and browser. Blue (0099FF) and yellow (FFFF00) are safe colors that can be easily and conveniently displayed regardless of the viewer's devices (Morton, 2010; Farley, 2011). The instability of the website's colors was tested across different operating systems and most popular browsers (Internet Explorer, Mozilla, Chrome, and Safari). Situational factors (such as time pressure, users' eyes, and presence of others) and environmental conditions (such as distractions, room temperature, colors of the wall, and light of the environment) are external factors that might affect the dependents variables. Since the present experiment was conducted online, the only possible way to control all of these factors was the random assignment of respondents to the two treatments of the experiment.

4.2. Procedure and sample

A convenience sample of 465 online shoppers was recruited. A website link was distributed to the sample via an email pointing to the survey website. This website allowed them to access the experimental online store homepage and the survey questions. Participants were randomly assigned to one of the two treatment conditions. While browsing the online store, subjects were instructed to simulate the purchase of a high-tech product. The subject should click on a link to the questionnaire once he/she has properly explored the offer of the online store. Respondent is requested to spend as much time as he/she wants and to choose the product that fits his/her needs, preferences and budget. In order to encourage participation, subjects were eligible for winning an e-coupon of € 30 upon completing the survey.

After removing inadequate responses, we retained a final sample size of 342. Fifty-one percent were male. The average age of the respondents was 30 years old. Approximately, all the sample had a computer and Internet connection. Most respondents were highly educated (university level, 89%), 45% had managerial occupations, and 42.1% were students. All participants declared having normal color vision.

4.3. Measurements

The log files register all the requests and information transferred between the visitor's computer and the website server. These files provide a rich set of information such as the number of visitors, number of sessions, number of requests, number of bytes transmitted, and time and day of requests (Bucklin and Sismeiro, 2003). We used log files to capture the consumer's number of visited pages and his visit duration. In order to obtain an accurate measurement of the visit duration, participants were requested to do nothing while visiting the experimental online store. We followed previous research and considered that a visit with a duration of more than 30 min and/or including less than 3 visited pages as inadequate shopping session and should be deleted from the analysis (Bucklin and Sismeiro, 2003; Catledge and Pitkow, 1995). For a triangulation purpose, we measured the perceived visit duration (was measured with a single item).

For the other constructs in our model, validated measures were adopted from previous research. Enjoyment and concentration were assessed by a four-item scale adopted from Ghani and Deshpande (1994). A four-item purchase intention scale was adopted from Yoo and Donthu (2001). Revisit intention was evaluated by two items adopted from Coyle and Thorson (2001). All items were five-point Likert scales (Appendix C).

5. Results

5.1. Measurements evaluation

An exploratory and confirmatory factor analysis were performed on

Table 1
Indicators of reliability and validity of constructs (N = 342).

Constructs	Cronbach Alpha	CR	AVE	Enjoyment	Concentration	Purchase	Revisit
Enjoyment	0.86	0.84	0.57	**0.753**			
Concentration	0.90	0.89	0.65	0.472	**0.807**		
Purchase intention	0.93	0.94	0.79	0.516	0.267	**0.888**	
Revisit intention	0.84	0.85	0.74	0.607	0.347	0.771	**0.861**

Note: The diagonal elements show the square root of the Average Variance Extracted; the off-diagonal elements show the correlations between the constructs.

the final sample. The Cronbach alpha of the various scales exceeded the lower limit of acceptability of 0.70 ranging from 0.84 to 0.93 confirming the internal consistency of the scales (Nunnally, 1978). For all constructs, the Composite Reliability (CR) exceeded 0.70, and the Average Variance Extracted (AVE) surpassed the recommended value of 0.50 suggesting adequate convergent validity (Hair et al., 2010). As shown in Table 1, the square root of the AVE of each construct was greater than the correlations between the construct and any other construct in the model, satisfying Fornell and Larcker's (1981) criteria for discriminant validity.

5.2. Hypotheses testing

An ANOVA analysis was employed to examine the effects of hue on the two components of flow (H1). Shown in Table 2, the results indicated that the assumption of Homogeneity of Variances was met, as Levene's Test was not significant. Hue significantly influences both enjoyment ($F_{[1340]} = 5.339$; $p = 0{,}021$) and concentration ($F_{[1340]} = 10.142$; $p = 0{,}002$). In accordance with our hypothesis, the enjoyment ($M_{Blue} = 3.465$; $M_{Yellow} = 3.245$) and concentration ($M_{Blue} = 3.282$; $M_{Yellow} = 2.961$) were significantly higher for consumers who visited the blue online store version than for consumers who visited the yellow online store version. Thus, H.1a and H.1b were supported. The effect of hue on enjoyment ($\eta^2 = 0.015$) was less strong than on concentration ($\eta^2 = 0.029$).

To test the second hypothesis, the extracted dimensions of the exploratory factor analysis were used in a series of multiple regression analyses (Table 3). For all regressions, the assumptions of linearity, collinearity, independence, homoscedasticity, and normality were met.

Using the Enter method, it was found that enjoyment and concentration explain a significant amount of the variance in the number of visited pages ($F_{[2339]} = 22.953$, $p < 0.01$, $R^2_{Adjusted} = 0.064$), actual visit duration ($F_{[2339]} = 5.004$, $p < 0.05$, $R^2_{Adjusted} = 0.012$), perceived visit duration ($F_{[2339]} = 10.330$, $p < 0.01$, $R^2_{Adjusted} = 0.028$), purchase intention ($F_{[2339]} = 49.802$, $p < 0.01$, $R^2_{Adjusted} = 0.240$), and revisit intention ($F_{[2339]} = 71.043$, $p < 0.01$, $R^2_{Adjusted} = 0.312$).

Enjoyment did not significantly predict the number of visited pages ($t_{[339]} = -1.571$, $p > 0.10$), actual visit duration ($t_{[339]} = 0.635$, $p > 0.10$), and perceived visit duration ($t_{[339]} = 1.462$, $p > 0.10$). However, enjoyment positively predicted the purchase intention ($\beta = 0.434$, $t_{[339]} = 8.023$, $p < 0.01$) and revisit intention ($\beta = 0.489$, $t_{[339]} = 8.958$, $p < 0.01$). Thus H.2a and H.2c were rejected whereas H.2e and H.2g were supported.

Concentration positively explained the number of visited pages ($\beta = 0.259$, $t_{[339]} = 4{,}791$, $p < 0.01$), actual visit duration ($\beta = 0.124$, $t_{[339]} = 2.237$, $p < 0.05$), perceived visit duration ($\beta = 0.176$, $t_{[339]} = 3.214$, $p < 0.01$), purchase intention ($\beta = 0.122$, $t_{[339]} = 2.257$, $p < 0.05$), and revisit intention ($\beta = 0{,}145$, $t_{[339]} = 2.816$, $p < 0.01$). Thus H.2b, H.2d, H.2f and H.2h were supported.

Several approaches to examine mediation effects have been used. The most common method is the causal steps approach, proposed by Baron and Kenny (1986). To test whether flow dimensions (enjoyment and concentration) mediate the effects of hue on approach behavior (number of visited pages, visit duration, purchase intention, and revisit intention), we applied Baron and Kenny's (1986) approach. A variable is a mediator when it meets three conditions: (1) in a first regression, the independent variable (X) must significantly affect the mediator (M), (2) in a second regression, the independent variable (X) must significantly affect the dependent variable (Y), and (3) in a third regression, the mediator (M) must affect the dependent variable (Y) and the effect of the independent variable (X) on the dependent variables (Y) must be insignificant (full mediation) or remain significant but decreases (partial mediation). It is important to knowledge that in recent years, this approach has been criticized mainly because the requirement of a significant association between the independent and dependent variable (condition 2) is seen as too restrictive and some authors argue for waiving the X-Y test (Hayes, 2009; Collins et al., 1998; MacKinnon et al., 2000; Shrout and Bolger, 2002). Zhao et al. (2010, p. 200) stated that "the X-Y test is never relevant to establishing mediation." The results of the mediation test are presented in Tables 4 and 5.

As shown in Table 4, results of the procedure revealed that the independent variable hue significantly predicted the mediator variable enjoyment ($\beta_{color} = -0.223$, $t_{[257]} = -2.023$, $p < 0.05$). This result satisfied the first condition of the mediation for the five relationships. To examine the third condition, the effects of the independent variable, hue, and the mediator variable, enjoyment, on the dependent variables were tested. The results indicated that the number of visited pages ($F_{[2256]} = 0.325$, $p > 0.10$) and the actual visit duration ($F_{[2356]} = 1.402$, $p > 0.10$) were not significantly related to hue, but to enjoyment too. So, the third condition was not met. Perceived visit duration ($\beta_{Enjoyment} = 1.108$, $t_{[256]} = 3.483$, $p < 0.01$), purchase intention ($\beta_{Enjoyment} = 0.464$, $t_{[256]} = 7.354$, $p < 0.01$), and revisit intention ($\beta_{Enjoyment} = 0.620$, $t_{[256]} = 10.284$, $p < 0.01$) were not significantly related to hue and significantly related to enjoyment. Thus, the third condition was met, and enjoyment was a full mediator. Hence, H.3a was not supported, H.3c was partially supported, and H.3e and H.3g were supported. Consequently, enjoyment mediated the effects of online atmospheric hue on consumer approach behavior in terms of perceived visit duration, purchase intention, and revisit intention, but not in terms of the number of visited pages and actual visit duration.

The same mediation analysis, as enjoyment, was conducted for concentration (Table 5). The results satisfied the first condition of the

Table 2
One-way ANOVA analysis results of the color impact on flow (N = 342).

Dependent variables	Independent variable	Mean (Std. Deviation)	F	p	η^2	Levene's statistic (p)
Enjoyment	Blue (N = 180) Yellow (N = 162)	3.465 (0.909) 3.245 (0.990)	5.339	0.021	0.015	1.989 (0.176)
Concentration	Blue (N = 180) Yellow (N = 162)	3.282 (0.948) 2.961 (1.015)	10.142	0.002	0.029	1.128 (0.311)

Table 3
Regressions analysis results of the flow impact on approach behavior (N = 342).

Dependent variable	Independent variables	F	β	t	$R^2_{Adjusted}$	Tol.	VIF	DW	Hypotheses
Number of visited pages	Enjoyment	22.953***	−0.094	−1.571ns	0.064	0.812	1.231	2.115	H.2a: rejected
	Concentration		0.259	4.791***		1.000	1.000		*H.2b: supported*
Actual visit duration	Enjoyment	5.004**	0,039	0.635ns	0.012	0.820	1.219	1.748	H.2c: rejected
	Concentration		0.124	2.237**		1.000	1.000		
Perceived visit duration	Enjoyment	10.330***	0.088	1.462ns	0.028	0.820	1.219	2.047	*H.2d: supported*
	Concentration		0.176	3.214***		1.000	1.000		
Purchase intention	Enjoyment	49.802***	0.434	8.023***	0.240	0.814	1.188	1.733	*H.2e: supported*
	Concentration		0.122	2.257**		0.842	1.188		*H.2f: supported*
Revisit intention	Enjoyment	71.043***	0.489	8.958***	0.312	0.814	1.188	1.893	*H.2g: supported*
	Concentration		0,145	2.816***		0.842	1.188		*H.2h: supported*

ns: not significant; Tol.: Tolerance; VIF: Variance Inflation Factor; DW: Durbin-Watson
* $p < 0.10$.
** $p < 0.05$.
*** $p < 0.01$.

mediation for the five dependent variables ($\beta_{color} = -0.347$, $t_{[257]} = -3.086$, $p < 0.01$). The number of visited pages ($\beta_{Enjoyment} = 0.608$, $t_{[256]} = 3.091$, $p < 0.01$), actual visit duration ($\beta_{Enjoyment} = 0.731$, $t_{[256]} = 2.596$, $p < 0.01$), perceived visit duration ($\beta_{Enjoyment} = 0.829$, $t_{[256]} = 2.672$, $p < 0.01$), purchase intention ($\beta_{Enjoyment} = 0.265$, $t_{[256]} = 3.994$, $p < 0.01$), and revisit intention ($\beta_{Enjoyment} = 0.375$, $t_{[256]} = 5.608$, $p < 0.01$) were not significantly related to hue and significantly related to enjoyment. Therefore, the third condition was met, and enjoyment is a full mediator. Then, H.3b, H.3d, H.3f, and H.3h were supported. Accordingly, concentration mediated the effects of online atmospheric hue on consumer approach behavior in terms of the number of visited pages, actual visit duration, perceived visit duration, purchase intention, and revisit intention.

6. Discussion

Overall, the results provide support for most hypotheses regarding the directional linkage among the model's variables. The empirical findings reported that consumers navigating in the blue online store experienced higher levels of flow as captured by enjoyment and concentration compared to those navigating in the yellow online store and highlighted the importance of the flow state in shaping online shopping behavior. The enjoyment enhanced the purchase intention and revisit intention. The concentration increased the number of visited pages, visit duration, purchase intention, and revisit intention.

The findings contribute to environmental psychology literature and specifically to the experimental research suggesting that cool-colored store environments are more associated with positive feelings than warm colors (Babin et al., 2003; Bellizzi et al., 1983; Bellizzi and Hite, 1992; Valdez, 1993; Valdez and Mehrabian, 1994). We show that a blue high-tech online store atmosphere (cool color) is more likely to increase the flow than yellow high-tech online store atmosphere (warm color).

In particular, this research shows that enjoyment is more associated to blue than yellow in an e-commerce context. The present finding agrees fairly well with the large body of research supporting the premise that cool hues elicit more pleasant emotional states than warm colors (Babin et al., 2003; Bellizzi and Hite, 1992; Jacobs and Suess, 1975). For instance, Crowley (1993) shows that atmospheric shorter wavelength hues (such as blue) are more pleasant than longer wavelength hues (such as yellow).

As for enjoyment, the concentration is found to be linked to colors. Consumer's concentration during shopping in online stores is found to be better with blue hue than with yellow hue. We affirm that in online stores, colors are a needed element in enabling a person to concentrate on a computer-based task. This is consistent with the extensive body of research examining cognitive outcomes of color stimuli (Bonnardel et al., 2011; Chebat and Morrin, 2007; Gorn et al., 2004; Pelet and Papadopoulou, 2012). The present result supports recent studies

Table 4
Regressions analysis results of the enjoyment mediating impact (N = 342).

Hue (X) - Enjoyment (M) – Approach behavior (Y)					
	Equations	F	$R^2_{Adjusted}$	t	Hypotheses
Dependent variable	Cond. 1: M = 0,169 + (−0,223)X	4091**	0,016	$t_{(X)} = -2023$**	
N. of visited pages	Cond. 2: Y = 6922 + 0,003X	0,008ns	–	–	H.3a: rejected
	Cond. 3: Y = 7015 + 0,005X + 0,178M	0,325ns	–	–	
				–	
A. visit duration	Cond. 2: Y = 4594 + (0,172)X	0,122ns	–	–	*H.3c: partially supported*
	Cond. 3: Y = 4673 + 0,192X + 0,485M	1402ns		–	
				–	
P. visit duration	Cond. 2: Y = 6969 + (0,140)X	0,063ns	–	–	
	Cond. 3: Y = 6819 + 0,405X + 1108M	6105***	0,039	$t_{(X)} = 0,713$ns	
				$t_{(M)} = 3483$***	
Purchase intention	Cond. 2: Y = −0,028 + (−0,058)X	0,232ns	–	–	*H.3e: supported*
	Cond. 3: Y = −0,111 + 0,031X + 0,464M	27,183***	0,175	$t_{(X)} = 0,283$ns	
				$t_{(M)} = 7354$***	
Revisit intention	Cond. 2: Y = 0,091 + (−0,206)X	2742*	0,011	$t_{(X)} = -1656$*	*H.3g: supported*
	Cond. 3: Y = −0,020 + (−0,087)X + 0,620M	54,831***	0,304	$t_{(X)} = -0,831$ns	
				$t_{(M)} = 10,284$***	

ns: not significant.
* $p < 0.10$.
** $p < 0.05$.
*** $p < 0.01$.

Table 5
Regressions analysis results of the concentration mediating impact (N = 342).

Hue (X) - Concentration (M) – Approach behavior (Y)					
	Equations	F	$R^2_{Adjusted}$	t	Hypotheses
Dependent variable	Cond. 1: M = 0,224 + (−0,347)X	9,521***	0,036	$t_{(X)} = -3,086^{***}$	
N. of visited pages	Cond. 2: Y = 6,922 + 0,003X	0,008ns	–	–	*H.3b: supported*
	Cond. 3: Y = 6,667 + 0,218X + 0,608M	4,780***	0,030	$t_{(X)} = 0,601^{ns}$ $t_{(M)} = 3,091^{***}$	
A. visit duration	Cond. 2: Y = 4,594 + (0,172)X	0,122ns	–	–	*H.3d: supported*
	Cond. 3: Y = 4,497 + 0,435X + 0,731M	3,429	0,019	$t_{(X)} = 0,848^{ns}$ $t_{(M)} = 2,596^{***}$	
P. visit duration	Cond. 2: Y = 6,969 + (0,140)X	0,063ns	–	–	
	Cond. 3: Y = 6,824 + 0,326X + 0,829M	3,574**	0,020	$t_{(X)} = 0,570^{ns}$ $t_{(M)} = 2,672^{***}$	
Purchase intention	Cond. 2: Y = −0,028 + (−0,058)X	0,232ns	–	–	*H.3f: supported*
	Cond. 3: Y = −0,093 + 0,026X + 0,265M	8,098***	0,054	$t_{(X)} = 0,220^{ns}$ $t_{(M)} = 3,994^{***}$	
Revisit intention	Cond. 2: Y = 0,091 + (−0,206)X	2,742*	0,011	$t_{(X)} = -1,656^{*}$	*H.3h: supported*
	Cond. 3: Y = −1,12E-005 + (−0,087)X + 0,375M	17,264***	0,116	$t_{(X)} = -0,733^{ns}$ $t_{(M)} = 5,608^{***}$	

ns: not significant.
* p < 0.10.
** p < 0.05.
*** p < 0.01.

advocating the development of a Stimulus-Organism-Response comprehensive model of online consumer behavior that includes not only emotional variables but also cognitive variables (Gao and Bai, 2014; Liu et al., 2013; Mazaheri et al., 2011).

In addition to the effects of color on flow experience, our findings highlighted the positive effect of flow on approach behavior. These results mirror those obtained by other researchers in the context of computer-mediated environments (Agarwal and Karahanna, 2000; Chang and Wang, 2008; Lu et al., 2009; Novak et al., 2000; Pelet et al., 2017) and they support previous empirical findings of flow as an antecedent of shopping behavior (Koufaris, 2002; Hausman and Siekpe, 2009; Lin et al., 2010; Mahnke et al., 2015).

More specifically, these results are in line with theoretical elaborations on the relationship between approach behavior and the enjoyment dimension of flow. Our findings suggested that enjoyment leads to greater purchase and revisit intentions. Therefore, this research confirms as did Domina et al. (2012), Eroglu et al. (2003), Koufaris (2002), Lin et al. (2010), Mummalaneni (2005), and Wulf et al. (2006), that enjoyment is a key element of the online shopping experience and e-merchants' commercial success. However, our results did not indicate the existence of a significant relationship between enjoyment and the number of visited pages and between enjoyment and the visit duration. The present result is not consistent with previous studies that linked flow to exploratory use behavior (Ghani and Deshpande, 1994; Hoffman and Novak, 1996; Korzaan, 2003; Richard and Chandra, 2005). Considering the lack of empirical evidence in the e-commerce context, a posteriori, we posit that the absence of relationship points to the existence of intervening variables that may inhibit the direct effect such as time pressure or distractions. Future research needs to consider testing reversed relationships and reexamining the relationships we tested as well as introducing other relevant constructs.

Unlike enjoyment, the concentration was found to increase the number of visited pages and visit duration. Prior work suggests that flow is linked to time distortion and exploratory behavior (Agarwal and Karahanna, 2000; Hoffman and Novak, 1996; Pace, 2004). Exploratory behavior is a direct outcome of flow during website navigation, which in turn, increase the amount of time spent on the site (Hoffman and Novak, 2009; Zhao et al., 2011). The deep involvement and cognitive absorption that characterize the flow experience lead to a temporal dissociation; the inability to register the passage of time while engaged in interaction (Agarwal and Karahanna, 2000). So, the user spends more time and visits more pages. According to our results, it is concentration, not the enjoyment dimension of flow that may be the basis of time distortion and exploratory behavior.

Similarly, the concentration was also found to be positively correlated to future shopping intention and revisit intention in online stores. Thus, the concentration dimension of flow not only extends the visitor's browsing process but also may translate into future sales and helps consumers reach their online purchasing goals. It implies that distractions, interruptions, irritability with the system's performance, or lack of control during the shopping trip, might decrease the level of mental concentration on the task at hand. As a result, visitors can not effectively direct their cognitive energy to discover relevant information, evaluate product's attributes, or make comparisons. Thus, if distractions are numerous and recurring, the concentration will be limited, and subsequently, the exploratory behavior and intentions will be partial. This is consistent with the flow literature, which posits that concentration during browsing websites would be likely to generate transaction and loyalty intentions (Luna et al., 2002, 2003; Nel et al., 1999; Richard and Chandra, 2005; Xia and Sudharshan, 2002). However, this result was different from that of Koufaris (2002). In his research, Koufaris (2002) found no significant effect of concentration on user's intention to return to an online store.

Further analyses established that flow mediated the relationships between online atmospheric colors and consumer approach behavior. There are only a few or no studies in which these effects are empirically investigated. It is important to notice that these findings suggest that the flow experience is a relevant concept substituting the Pleasure Arousal Dominance (PAD), disapproved in a number of studies (Eroglu et al., 2001, 2003; Hausman and Siekpe, 2009; Sautter et al., 2004), in the online Stimulus – Organism – Response framework.

7. Implications for theory and practice

For academics, the current research has important implications for the literature of online consumer behavior in e-retailing settings. First, while there has been some early investigation that focuses on topics pertaining to colors of e-commerce websites, more empirical researches are needed. This work contributes to this literature by providing empirical tests of the neglected relationship between color and flow. This study is perhaps among the first to empirically test the effects of online atmospheric colors on flow achievement during shopping

experience in online stores.

Second, the present research furthers evidence suggesting the important role of flow in shaping consumer reactions during online shopping experience. A primary role that is highlighted in research in the field of marketing and information system (Domina et al., 2012; Gao and Bai, 2014; Hausman and Siekpe, 2009; Hoffman and Novak, 1996, 2009; Mahnke et al., 2015).

Third, most previous works in the retail online store environment have considered the emotional responses of online atmospheric cues and adopted the criticized (PAD) as the "organism" in the online SOR model (Brunner-Sperdin et al., 2014; Eroglu et al., 2003; Hsieh et al., 2014). However, relatively few studies have investigated the cognitive responses (Eroglu et al., 2003; Wu et al., 2014). This work extends the online SOR by integrating the flow experience, which captures much more of the emotional and cognitive effect of online atmospheric cues. Specifically, our investigation contributes to this research area by testing and validating the urgently needed relationship between online atmospheric colors and flow. The use of color in e-commerce websites is often not based on scientific investigation, but on intuition, fashion, personal experience or the advice of consultants.

Fourth, many authors have based their online atmospheric investigations on a holistic approach (e.g. Ballantine et al., 2015; Eroglu et al., 2003; Gao and Bai, 2014; Hsieh et al., 2014; Richard and Habibi, 2016). This view suggests assessing atmospheric attributes in the holistic way that customers perceive it rather than focusing on the very specific atmospheric variable. For illustration, Gao and Bai (2014) measure site informativeness, effectiveness, and entertainment as online atmospherics. We agree that examining atmospheric attributes holistically is valuable. However, given a large number of atmospheric cues that are present in the e-retail environment, this approach will necessarily be limited in terms of the development of practical knowledge. Online stores designers could not establish which atmospheric attribute is more useful to produce the desired effect. In view of that, the present work is more accurate. It helps managers of online stores to understand the potent drivers of flow experience more thoroughly. Our findings shed light on the effect of colors on the achievement of flow in an online shopping environment, particularly, how the delivery of certain hues of colors of the online atmosphere can encourage the flow.

Lastly, from a methodological perspective, the use of log files to measure the number of visited pages and visit duration was successfully implemented. The ability of websites to track the behavior of their visitors throughout clickstream-recorded data provides researchers and practitioners with the opportunity to study how users browse websites (Bucklin et al., 2002; Bucklin and Sismeiro, 2003). This study is a successful illustration of the use of clickstream data to measure e-consumer behavior. The discrepancy between perceived time (as measured by a question in the survey) and objective time (as recorded in the log files) was important. This double measurement of visit duration shows that visitors are often unable to assess properly the time spent on the site.

Apart from theoretical considerations, our results also have key practical implications for companies and e-commerce practitioners. The predominant implication is that online atmospheric color can be consciously used to induce flow experience, and in turn, invokes consumers purchase and revisit intention, extends the experience, and encourages the exploration of the online store. In this way, color schemes might serve as a competitive advantage to online stores. As websites may use several color options, our research informs that the achievement of flow experience requires web managers to privilege cool colors such as blue. However, choosing an appropriate color scheme might differ by product category. Our proposed model was tested using a high-tech online store. Therefore, warm colors may be better for other product categories, purchase situations, or targets (Bagchi and Cheema, 2013).

Another key practical implication of our findings is related to the design of online stores. With the proliferation of online shopping, some e-tailers tend to differentiate themselves by emphasizing convenience, ease of use, and ergonomic aspects. The online store atmospherics are designed to facilitate the accomplishment of the shopping tasks. However, other e-tailers emphasize the experiential components. The atmospherics are designed to be enjoyable, stimulating and recreational. Our findings have shown that both the cognitive (concentration) and experiential aspects (enjoyment) are needed. Online atmospheric colors add to the creation of an environment that could evoke the emotional state of enjoyment and cognitive state of concentration related to flow that entices behavior. Therefore, it could be argued that online atmosphere should provide both the utilitarian value as well as the hedonic value to their visitors, significantly by providing them with the more suitable colors. Colors are essential not only as decorative cues but also as ergonomic aspects of the visual display. In other words, it is prescribed to web designers to find a balance between ergonomic and experiential qualities of colors; qualities that are not usually easy to reconcile. Designers should not neglect the cognitive side at the expense of the experiential side and reciprocally. Colors might be used to enhance the two aspects, but "how could they do it?" is challenging: a hue might be more ergonomic but eliciting less stimulation than the other hue. Our findings provide some responses in the context of high-tech online stores: blue elicit more flow which is an experience valued cognitively and experientially.

In addition to the above implications related to colors, we believe that the findings would help e-commerce websites better understand how concentration and enjoyment as components of flow shape their online consumer behavior. In view of that, the web managers should effectively provide the online atmospheric cues that help consumers enhance enjoyment and achieve concentration during an online shopping experience. They are recommended to include visually appealing elements in the online store design. For instance, rich and interactive media tools such as streaming video demonstrations, 3D modeling, avatar salespersons, and virtual reality can be used to offer a total customer experience providing fun, entertainment, and enjoyment. In the same way, effort needs to be taken to increase consumers' concentration and avoid irritation by reducing distractions such as ad-banners and non-shopping relevant cues.

8. Limitations and future research directions

As with all investigations, there were a number of limitations, which may suggest directions for future research. Almost 42% of the sample were students due to the use of a convenience sampling method. Thus, the sample might not be representative of the basic Internet shopper population.

Country of origin information was not collected from respondents. As indicated by Cyr et al. (2010), website design is not culturally neutral. Their results suggest that website color influences trust and satisfaction with differences noted across cultures. Hence, the lack of information on respondents' country of origin limits the external validity of the results across cultures. Further work would be necessary to enhance our understanding of the influence of online atmospheric colors on flow experience for different cultural groups.

An online experiment was conducted, and a fictitious retail website was used. Thus, the online shopping experience seems real, since many of the features that respondents would usually expect to find in a real-world online store were fully replicated. The online experimental design strengthens the external validity of the research. However, many intervening factors, for example, light and room temperature, that may influence respondents' reactions, were not fully controlled. These factors limit the generalizability and internal validity of the research. Future research is therefore recommended in order to replicate the experiment of this research in a laboratory and test, whether the online versus laboratory implementation would affect the results.

The present study examines the differential effects of yellow (warm

hue) and blue (cool hue). Other colors were not tested. Similarly, the two other dimensions of color, saturation, and brightness, were not investigated. Thus, a generalization of findings should be made with caution. Other hues and the two other dimensions of color, regarding their effects on all the range of flow dimensions, should receive more attention in forthcoming work. In addition, it would be interesting to use a different colors' taxonomy, beyond the broad warm and cool categories. A taxonomy that considers the cultural and symbolic particularity of colors may perhaps be more relevant for websites.

Data from a retrospective self-report questionnaire was used to measure the constructs in this study. Future research is therefore recommended in order to make more precise measurements of these variables, specifically the flow experience. Csikszentmihalyi and LeFevre (1989) recommended the use of the Experience Sampling Method where respondents are intercepted at random intervals throughout the day and asked to describe their flow experience.

Another possible future extension of this work could be to investigate whether the results from this study can be applied to various products' categories including cultural goods, experience goods, and tourism. Similarly, future research could explore the effects of other variables, since our model might not have incorporated all relevant variables, especially moderating variables such as product involvement, shopping motivations, and consumer socio-demographic characteristics.

A final avenue of research might be the investigation of possible interactions between colors and other atmospheric cues such as 3D presentations, rich media tools, avatars, and virtual visits. Interactions that produce a more compelling shopping experiences, and then more flow.

Appendix A. Results of the experimental online store pretest (N = 39)

Questions	% of respondents who agreed
Website layout design (Gonzalez, 2001)	82.0% ($p < 0.001$)
It is easy to understand the layout of the website.	72.8% ($p < 0.001$)
I would be able to tell a friend where and how he/she can find some information on the website.	
Website irritation (Siekpe, 2003)	07.7% ($p < 0.001$)
The website is annoying.	01.0% ($p < 0.001$)
This website is irritating.	12.8% ($p < 0.001$)
The website is frustrating.	
Website readability (Gonzalez, 2001)	82.1% ($p < 0.001$)
The website is readable.	
Website informativeness (Siekpe, 2003)	64.1% ($p < 0.001$)
The website is a good source of high-tech product information.	74.3% ($p < 0.001$)
This website supplies relevant information.	74.3% ($p < 0.001$)
This website is informative about the company's products.	
Website perceived interactivity (Coyle and Thorson, 2001)	66.7% ($p < 0.001$)
The website offers several opportunities for interaction.	
Website perceived usefulness (Siekpe, 2003)	48.7% ($p < 0.01$)
Using this website can improve my shopping performance.	51.3% ($p < 0.01$)
Using this website can increase my shopping productivity.	41.0% ($p < 0.001$)
Using this website can increase my shopping effectiveness.	64.1% ($p < 0.001$)
I find using this website useful.	
Website perceived ease of use (Siekpe, 2003)	84.6% ($p < 0.001$)
Learning to use this website would be easy for me.	87.2% ($p < 0.001$)
It would be easy for me to become skillful at using this website.	89.8% ($p < 0.001$)
I find this website easy to use.	
Website perceived commercial offer (Gonzalez, 2001)	74.3% ($p < 0.001$)
The website offers a wide variety of products.	84.6% ($p < 0.001$)
The website offers new products.	82.1% ($p < 0.001$)
Product's prices are suitable.	79.5% ($p < 0.001$)
The products are interesting.	79.5% ($p < 0.001$)
The products are good.	66.7% ($p < 0.001$)
The products are attractive.	

Appendix B. Results of the color manipulation pretest (N = 39)

Questions	% of respondents who agreed
Congruence between the hue and website content (Heckler and Childers, 1992)	66.4% ($p < 0.05$)

The dominant color of the website is expected. The dominant color of the website is relevant to its content.	69.2% ($p < 0.05$)
Hue manipulation check The following question was used to check if the website's dominant color has been successfully perceived by respondents (as the website has other colors of pictures, text…). What was the dominant color of this website? ☐ White. ☐ Black. ☐ Red. ☐ Blue. ☐ Yellow. ☐ I don't remember.	Version 1 of the (website blue): Blue: 90% I don't remember: 10% ($p < 0.001$) Version 2 of the (website yellow): Yellow: 100%

Appendix C. Measurement scales

Scales
Enjoyment (Ghani and Deshpande, 1994) Interesting. Fun. Exciting. Enjoyable.
Concentration (Ghani and Deshpande, 1994) I am deeply engrossed in the activity. I am absorbed intensely in the activity. My attention is focused on the activity. I concentrate fully on activity.
Purchase intentions (Yoo and Donthu, 2001) I will definitely buy products from this site in the near future. I intend to purchase through this site in the near future. It is likely that I will purchase through this site in the near future. I expect to purchase through this site in the near future.
Revisit intentions (Coyle and Thorson, 2001) It is very likely that I will return to this site. I will return to this site the next time I need a high-tech product.
Perceived visit duration Without checking your watch, how much time do you think you spent on this site?

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