



The effect of colour on teenage state of flow

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Abstract

This paper examines the effects of a commercial web site's colour on the psychological state of young Tunisians. Theory-wise, a survey of the evolution of the concept of atmosphere from its role in a traditional point of sale to its role in a merchant web site helped to highlight the importance of colour as a key factor in designing websites. Colour was found to influence the psychological reactions of online merchants. Empirically, we conducted a quantitative survey to examine the relationship between psychological state, specifically the state of flow, and the most attractive colour for the young who may be influenced by external factors, namely learning and trust toward the web site. This study partially confirms our hypotheses and highlights the dependency relationship between colour and condition of flow of Internet users.

Keywords: Internet, merchant web site, atmosphere, colour, flow status, teenager.

Introduction

Many researchers grew aware of the importance and relevance of the different components of the atmosphere of a merchant web site and some of them were interested in studying the effects of colour. Indeed, "this variable creates an atmosphere, projects an image produces certain biological reactions, causes physiological and psychological responses, creates emotional responses and draws attention" (Bellizi, Crowley and Hasty 1983).

Divard & Urien (2001) argue that the perception of colour is complex because it is not only a physiological or psychological fact, it is also conditioned by culture of the country where users live, their general culture, education, trust toward the site, and their socio-professional membership. According to research exploring colour activation level (Kwallek et al., 1988) "Everyone has an innate physiological ability to perceive (or not) colours. This perception is refined, and will be defined and manifested also during consumption experience, producing certain effects on internet user".

Internet users' psychological responses to this situation are manifested in their emotional states, telepresence experience and their state of flow (Bitner, 1992). Moreover, Daily (1999) argues that given the importance of the consequences of the state of flow, internet marketers should find ways that could increase the experience of flow. They can manipulate the atmosphere of their website to increase the likelihood that users would experience a state of flow and thus increase the likelihood of an exploratory behaviour and the presence of a sense of control.

We chose teenagers as our population because they are the first generation to grow up with the Internet technology and new modes of communication. In addition, in Tunisia, most Internet users are teenagers.

Indeed, our aim is two objectives. The first is to review the concept atmosphere, its dimensions and its influence. The second is to empirically explain through a questionnaire survey the influence of colour as a design factor on the psychological state of the teenage surfer.

Dholakia and Rego (1998) studied the factors that could influence the popularity of websites. They proposed colour as a design factor that could impact the number of visits from people, build "cool" Web pages with colourful backgrounds. They found that the popularity of web sites is strongly and positively influenced by the number of changes made to the sites.

Similarly, Stenvenson et al. (2000) studied the impact of a website background on attention, purchase intention and attitude. The authors chose to handle the complexity of the site's background by varying the number of items, colours and movements. However, they found that, contrary to Dholakia and Rego (1998), the page judged by a consumer group as the simplest was the uncoloured page. Hence, manipulating different sites revealed that Web pages with a complex background are not necessarily the most effective, while the results show that the simplest background is the most efficient.

Finally, it can be argued that following the emergence of new technologies significant mainly with the rise of Internet which offered the opportunity to communicate more, to see, hear, speak, eat, whether information or products. This flexibility offered by computer screens made it the "distributor" immediately recognizable by colour. To convince users to buy the product, advertisers use many techniques. However, it seems that so far the choice of colour is not always a concern for all merchant web sites' designers. In contrast, colour exerts some effect on the psychological state of internet users. Therefore, we empirically examine the effect of colour of a merchant site on users' psychology, more specifically on "teenagers".

State of flow is manifested when individuals perceive a balance between their competencies and the challenges to overcome. In this state of mind, individuals found themselves totally focused on their activity and feel an extraordinary state of enjoyment. During their net surfing, users may feel a state of flow in which they focus their attention on the stimuli by filtering out any thought or perception irrelevant to the stimuli (Webster et al, 1993). These stimuli may be the

different options the technological attributes like colour and sound offered to users (Webster et al, 1993). In this study, we focus on the variable colour. We study its impact on the state of flow teenage internet users.

In general, the authors treated colour as an efficiency and performance factor of the site, while in our study we will focus in particular on the effect on a merchant web site's colour on users' psychology.

Colour is one the many visual atmospheric factors. It is used in commerce in order to induce effects on buyers.

It was defined¹ as "a sensation that produces in organisms the view of light differently thought by corps, colours are the product of the decomposition of light". Chebat(1999) estimates that « colour creates first an atmosphere, projects an image, attracts consumers ».

According D ribere(2000), « colour is a sensation received by means of our eye of a coloured element. This physiological sensation is imperatively linked to three dimensions: the nature of the object, the light that enables the eye to receive the message and the eye that perceives this message and transmits it to the brain ».

According to S.Rieunier (2002), colour itself may be defined in a reduced manner and according to three dimensions: its hue, luminosity and saturation. Hue is the tonality, it refers to a "chromatic colour" as it appears in a rainbow, like yellow, red, and blue. Luminosity indicates clarity of a colour that may take different possible values ranging from black to white, passing by intermediate neutral colours (grey). Saturation (or chrome) is defined as degree of deviation of a given colour from the colour density.

The more a chromatic colour deviates from grey, the less it is "washed", the more it is "saturated", the more its tonality is "dense". Therefore, a clear yellow refers to "yellow" tonality, "vivid" luminosity and a "higher" saturation. Colour plays an important role in communicating feelings, emotions or intentions. The issue has often fascinated researchers by its perception, the sensation it creates, its significance and its symbolism.

Significance and Symbolism of Colour

Perception of colour is complex as it is not just a physiological or psychological fact, It is also conditioned by the culture where users live, their general cultural knowledge, education and their socio-professional membership. Attitudes (aesthetic assessments or evaluations) may be influenced by colours having symbolic connotations implicit and variable according to countries and cultures. Some colours remain positively or negatively remembered in some countries. Goeth J.W. (1990) distinguishes colours by means of their sensations and mood.

Table 1: sensations and mood according to Goethe(1990)

Sensations	Effects	Colours
Warm	Stimulation, animation, vividness, effort	yellow, orange, red, vivid
Cold	Inaction, melancholy, depression	green, blue, purple

Studies have been conducted to show what the main colours represent for the public (Rieunie2000):

- Blue: suggests cold, ice and freshness as well.
- Red: warmth, strength and brutality.
- White: invokes purity and cleanliness
- Brown: the symbol of force, old age and utility.
- Green: invokes freshness and nature.

Colour in the atmosphere of a tradition sales point

The first marketing studies on colour focused on advertising and packaging. Colour influences perception of product weight (Wardner and Flynn 1926), advertising accountability (Luckiesh1923) and influence on consumers' preferences (Strach, 1923).

Bellizi et al. (1993) argue that colour has two other main effects. On the one hand, it helps attract consumers attention while exposed to a stimulus. On the other hand, it physically attracts consumers.

Colour is a main component of the visual atmosphere. According to Rieunier (2002), « once the point of sale is refurbished or launched for the first time, questions on lightning "nd colours are necessarily asked ».

Color in the Atmosphere of a Merchant Web Site

Dreze et al. (1997) used and developED a methodology based on a joint analysis to assess the design of a site. Four elements describing the site have been identified: background colour, image size, ect ... The authors found that background colour has an impact on the number of pages visited and the duration of the visit.

Color and graphics quality are extremely important elements when it comes to brand identity, marketing and especially online sales (Edith Nuss2000). According to the same author, among the two reasons why some people do not buy on the Net found the complexity of surfing where: "Even if payment security reassures gradually, the prospect of having to click a dozen times and complete two forms to buy a product (whose colour is also not certain) restrains surfers in their willingness to consume".

¹ Le nouveau Littr , graded reader of petit Littr  2004

Dholakia and Rego (1998) proposed for example as an element of site design that could have an impact on the number of visits is to build "cool" Web pages with a coloured background. The visitor should be able to find quickly where to click and most importantly reduce pages loading time. This is not necessarily to create a suit-and-tie website with a black or blue text on a white background (Edith Nuss2000). The best combination of colour is the one that allows you to read comfortably, hence the importance of colour of a merchant web site and its influence on users' responses.

Pelet (2006) studied the effect of merchant web sites' colour on users' responses, with the assumption that "certain variables such as colour, with a role, direct or indirect, in advertising effectiveness have been identified, and which we want to measure in the context of marketing applied to e-commerce sites. Studying the effects of colours of a merchant site on recall of commercial information and purchase intention, a certain influence of the context in which the consumer evolves seems to act, because of particular psychological and physiological reasons, prompting the latter to recall a given image of the site, the latter leading to a form of rejection or on the contrary to the act of purchasing".

Internet Users Psychological Responses to Color

A merchant web site, including its design, in particular its atmosphere which is structured through colours, displays commercial readable information eventually stored to trigger in some cases a buying behaviour. The site interface and the contrast of dynamic (text, tables, and pictures) and dominant colours (background) seem to induce consumers to behave. This latter behaviour depends on the information they notice and their ability to memorize it. The visual system processes the merchant site's interface. We believe that the emotions felt by consumers contribute or not in strengthening the acquisition of information, in a way the act of buying seems to depend on the course of consumers visit to the merchant site. The information stored may trigger a buying behavior.

According to data from general psychology (Fleury & Imbert, 1996) in (Divard & Urien, 2001) and according to studies exploring colour's activation level (Wright & Rainwater, 1962), (Nakhsian , 1964), (Wilson, 1966), (Jacobs & Suess, 1975) and (Kwallek et al 1988), every individual has an innate physiological ability to perceive (or not) colours. This perception is refined, and will be defined and will be manifested during consumption experience, producing some effects on users.

Users' psychological state is evaluated by their emotional state, their telepresence experience and their state of Flow.

Emotional state

According to Goueron (1995), emotion is similar to the complexity and depth of human soul. For this author, emotion is a momentary emotional response, multifaceted and more or less intense that triggers an external disturbing factor to the individual. Goueron (1995) also defined emotion by distinguishing it from other states like affective mood and state of mind. The author believes that unlike mood, state of mind or feeling, emotion is not an emotional or mental disposition, rather it is a transient reaction possibly triggered by exogenous situational factors.

Mehrabian and Russell (1974) argue that emotion is a multidimensional concept. They distinguish three dimensions: Pleasure, stimulation and dominance.

Pleasure: According to Mehrabian and Russell (1974) pleasure is a positive emotional state that can be expressed by a smile, a laugh and by verbal or facial expressions. They define pleasure by a happy, a pleasure or a satisfaction feeling. Its items are many: happy / unhappy, upset/ pleased, unsatisfied, happy / sad, hopeful / hopeless and relaxed / bored.

Stimulation: Stimulation refers to the degree by which individuals are excited, stimulated awake, active in a situation (Donoban and Rossite, 1982). The items that Mehrabian and Russell (1974) associate with stimulation are: stimulated / relaxed, excited / calm, frantic / slow, peaceful stirred awake asleep, edgy / quiet.

Dominance: Dominance is an individuals' feeling regarding its ability to control their environment and freedom of action in response to this environment. The items of dominance are: determining / controlled or put down / influenced, influential / influenced important / useless, dominant / submissive and independent / dependent.

Telepresence

Many researchers (Biocca, 1997; Steuer, 1992; Klein, 2001)² argue that each user, whose perception is mediated by a communication technology, necessarily collects two types of environments: a real physical virtual environment and virtual environment (mediated).

The construct of telepresence is used to evaluate the process by which media influences consumer responses (Klein, 2001). Steuer (1992) argues that vividness and interactivity are the main attributes that create a telepresence experience. Volle (2000) believes that the main challenge for a merchant web site is to have an active virtual atmosphere able to maintain a strong focus and a sense of fluidity that captivates the visitor.

Accordingly, telepresence experience is a typical indicator of a pleasant and friendly website design that may influence consumer reactions. Using factor analysis, Kim and Biocca (1997), in a study of telepresence during a television program, found that this concept has two dimensions, namely arrival to the physical environment or "being there" and departure of the physical environment or "not being there".

Volle (2000) argues that the main challenge for a merchant web site is to have an active virtual atmosphere able of maintaining a strong focus and a feeling of fluidity that captivates the visitor.

Likewise, Lombard and Sonyder-Duch (2001), define telepresence as "a psychological state or a subjective perception in which a part or all of the individual's perception fails to recognise the role of technology in the

² Michel Ambaye, « Defining virtual Reality: Dimension determining télé présence », Journal of communication Congrès AFM (mai 2006), P4-7.

experience". Therefore, the term telepresence is used to describe the perception of being present in a mediated environment that seems as if it is less mediated or real.

State of flow

State of flow is a state of mind experienced by individuals during their net surfing. This state describes the quality of their shopping experience in a virtual space and marks their total involvement in the surfing and shopping experiences. Recent studies indicate that consumers' behaviour in a virtual space is explained by reaching or not this state (Hoffman and Novak, 1996; Hoffman, Novak and Yung; 1999). First, we start by defining state of flow, then we present its different dimensions.

State of flow which denotes an optimal experience is a concept difficult to define. Hoffman, Novak and Yung (1999) present a historical review of its definitions. They assume that there are several dimensions that seem to operationalize this concept and put an emphasis on the disagreement between authors on the determinants, dimensions and consequences of state of flow.

Csikszentmihalyi (1975) « propose that flow is a psychological state that emerges when an individual perceives a balance between an activity challenges and his/her competencies". This definition admits that, whatever challenge and competencies level, balance between these two poles is a condition necessary for flow to occur. Csikszentmihalyi (1988) argues « experience of flow starts only when competencies and challenges are below a certain critical level". This definition is more accurate than the previous one as it determines a threshold below which reaching a state of flow will be possible. Nevertheless, it remains incomplete as it does not describe the content of a flow experience as long as it is uniquely limited to indicating its determinants.

Trevino and Webster (1992) define flow as a combination of the four attributes of control, attention, curiosity and intrinsic interest. They argue that flow represents the degree with which users perceive a control over interaction with the computer; users perceive that their attention is centred on interaction, curiosity is awakened and users found the interaction intrinsically interesting. Hoffman, Novak and Yung (1999) argue that it is not clear how these dimensions should be used: are they factors, consequences or dimensions of flow?

Hoffman, Novak (1996) extend the theory of flow in a new context, namely the web. They propose a theoretical model of the state of flow based on the following definition: "flow state is reached during a navigation characterized by sequences of responses facilitated by interactivity intrinsically enjoyable, accompanied by a loss of self-awareness and a strengthening of the self". The gist of this definition is that state of flow is a process (Raman and Leckkenby).

Flow experience is situational. It is a process that combines several dimensions. According to relevant research, four dimensions are frequently used by researchers to capture flow experience in a computer mediated environment (Ghani et al, 1991; Ghani and Deshpande, 1994; Webster and Trevino, 1992; Webster et al, 1993; Gharbi, 1998). These dimensions are: playfulness, focus, control and perception of challenges. In what follows, we present each of these components:

Dimensions of flow:

Playfulness: This is the first dimension of flow state, also called euphoria. Euphoria refers to enjoyment, playfulness, sensory and emotional pleasure and enrichment of self procured by interaction with technology (Csikszentmihalyi, 1990).

This dimension is an intrinsic motivation. Csikszentmihalyi (1990) explains that in a state of flow "people are so intensely involved in an activity that nothing else seems matters, the experience itself is so enjoyable that people live it at a great cost, with an interest to the end".

This implies that euphoria does relate to a result and extrinsic to the activity. It results rather from the pleasure inherent and intrinsic to the activity. Therefore, flow experience is autotelic characterized by an intrinsic reward (self-reward oriented) involving a deep feeling of playfulness, joy and enrichment (Csikszentmihalyi, 1990).

Webster et al. (1993) suggest that individuals interact with the Web not only to accomplish a specific task, but to have fun and pleasure.

Focus: To achieve state of flow, individuals should be focused on the activity. Malone (1981) noticed that focus is an attribute of computer users. The author suggested that the sensory and cognitive curiosity aroused by environmental stimuli is awakened during a flow state, which explains such a focus. This curiosity can be stimulated by the variety, novelty and surprising nature of the stimuli.

In a web environment, Chen, Wigand and Nilan (2000) found, as a result of a qualitative analysis, that flow dimension is most often cited by respondents. Total focus is achieved when the user becomes himself "the topic discussed, the words typed, the sentences read or the machine he/she is working on" (Chen et al. 2000 , p. 271).

This harmony leads to a total focus on the current activity. We witness a rigorous screening of thoughts and perceptions, loss of self-awareness and a strong focus. Thus, because of this deep focus on the activity the person, not just forgets his/her problems, but also temporarily loses his self-awareness. The "I" disappears during a flow experience and the "self" takes over (Gharbi et al., 2002). Generally, when the self is aware of itself, awareness is less effective and the experience becomes less enjoyable.

In a flow state, the self is fully functional without realizing that it is so. Focus is completely absorbed by the activity at hand. Differently put, it is not consumed in part by self-awareness. It is the activity that precedes the self in absorbing focus. The individual spends all his/her mental energy on activity and loses awareness of himself/herself as a separate observer.

Control: Control has proved an important factor in achieving an optimal experience during the interaction with the computer (Ghani and Deshpande, 1994; Malone and Lapper, 1987).

Described as such, control refers to the grip on the environment and actions. In this sense, it is similar to the concept of self-efficacy (Bandura in 1982).

Comparing traditional media and Internet, Hoffman, Novak and Schlosser (2000) consider that the main type of control available to consumers with traditional media is to manipulate their own beliefs and judgment or reject the message.

This construct is "exercise control over his/her environment without actively seeking being in it". This means that the individual during a flow state is perceived in the control of his/her actions without consciously trying to impose himself/herself on the environment: an "invisible hand" produces control on the environment (Said Etti (2003).

It is rather a "secondary control" exerted internally by changing perceptions and preferences. However, in a computer-mediated environment, consumers exercise "primary control". This control is direct.

Challenges: This last dimension describes the level of challenges or perceived complexity of the activity. Csikszentmihalyi (1975) explain that the perceived challenges caused by the activity should be adjusted to the skills and abilities of the individual to cope with them.

Similarly, Ghani and Deshpande (1994, p 382) explain that "there is an optimal level of challenges for a certain skill level. If the challenges are very high, the individual will feel lack of control over environment and becomes anxious and frustrated. If the challenges are very low the individual loses interest. "

Csikszentmihalyi (1997) adds that the challenges and skills should be adjusted but also above a certain critical threshold. According to the same author, any activity is likely to generate a state of flow, but to keep this latter for a long time, it should allow for the challenges and skills to become more complex, Complexity means that the activity should be able to provide more challenges and the individual should be able to develop new skills.

The diversity of merchant websites, the integrated and interactive navigational elements make shopping and surfing on the Internet a better example of this kind of activities that constantly offer new challenges.

In summary, state of flow is defined as an optimal experience in which focus is entirely geared to the activity. In this experience, consciousness merges with action and self-awareness disappears. In a state of flow, the subject has the feeling of controlling the situation and controlling his/her actions. He/she benefits from feelings of cheerfulness, joy and playfulness.

Table 2: Summary of flow dimensions:

<i>Authors</i>	<i>Construct</i>	<i>Dimensions</i>	<i>Main attributes</i>
*Csikszentmihalyi (1990) *Webster et al. (1993)	<i>Flow</i>	- <i>playfulness</i>	- refers to joy, playfulness, pleasure, enrichment
*Malone (1981) * Wigand and Nilan (2000) * Chen et al. (2000)	<i>Flow</i>	- <i>focus</i>	- <i>sensorial and cognitive curiosity, focus, self-awareness</i>
*(Ghani et Deshpande, 1994 ; Malone and Lapper, 1987). *(Bandura 1982) *(Saïd Etti (2003).	<i>Flow</i>	- <i>control</i>	- refers to control over environment and actions, the notion of invisible hand, self-efficacy and direct control
*(Csikszentmihalyi 1975,1997) * Ghani and Deshpande 1994 *(Sandelands and Buckner, 1989	<i>Flow</i>	- <i>challenges</i>	- <i>Need for a balance between competencies and challenges for the state of flow to occur</i>

Intrinsic pleasure in an activity is the only motivation for users. Thus, the concept of flow is a multidimensional variable with four basic components: euphoria, focus, control and perceived challenges. These dimensions are interrelated and consumers need to achieve high levels on all of these dimensions in order to achieve an optimal flow experience (Sandelands and Buckner, 1989).

The main factor influencing the perception of colour of merchant web sites) teenagers:

Definition of Teenagers:

According to Ladwein (2003), it seems important to distinguish between children, adolescents and young adults. The period of childhood can last up to 16 years. Adolescence is a transition between childhood and adult age, from 16 years. This period is essential yet difficult to limit and is often assimilated with to last period of childhood. During adolescence, the individual gradually gains independence from a cognitive point of view and begins to build his/her identity. In our study, we will examine a class of teenagers who are merchant web sites users.

Variables Affecting Teenage Perception of Color:

Among The Variables Influencing Teenagers Perception Of Colour Are:

Experience:

A website is one of the examples of a new technology-based point of sale. The use of this media has many repercussions on consumer behavior on the one hand and the consumption experience on the other hand. Users live a new experience with the web, especially for a new user in a purchase or information-seeking context.

Many mechanisms are likely to trigger a change in consumer behavior as a result of experiencing as a new procurement system like a website. According to Vanheems (1995), the experience induces a "behavioral reorganization" in buyers. This experience is new because it allows the consumer to change a traditional procurement model by a different

technology-based model. "Many consumers recognize an improved quality and satisfaction through the use of the Internet resulting in a better adaptation of the new sales system to their expectations, in particular because of the informative dimension of the web " Rolland (2003). The process begins by learning to access the experience and then it becomes expertise.

Trust:

A site should build trust in the design company. Trust is the result of satisfaction, it results from the general evolution of the quality of a service or a product in relation to expectations. Such an attitude can create loyalty, cooperation and commitment as well. It is part of the three most used marketing research concepts (satisfaction, trust and loyalty)³.

Trust can be expressed by:

- Psychological variables: assumptions, beliefs and expectation
- Behavioural variables: intentions and actions.

The entities likely be subject to consumer trust are: the merchant, the brand, the company and the website.

Determinants of trust of a web site are variables either related to the merchant, the web site or the consumer⁴.

*Perceived market reputation: According to Leblanc (2001), the merchant should respect his obligations. His reputation depends on the belief that he is honest and that he cares about his customers interests. He should be able to honour his promises.

* Previous satisfaction during past experiences with the merchant: trust assumes a gradual formation and a progression in time. Trust is formed, maintained, reinforced or it vanishes. Trust as a dynamic concept that develops with cumulated experience in consumers is characterized by "age of relationship", "duration of relationship" or "experience with the vendor".

* Perception of privacy respect: right of private confidential information refers to the individual's aptitude to determine when, how and to what extent a personal information is communicated to others. To gain consumer trust, web sites privacy policies should answer the following questions: What type of data collected from its visitors? How and for what purpose information is used? Who will share it? What are the measures put in place to protect data?

* The labelling of the site by a trustworthy third party: Its purpose is to reassure consumers, enhance credibility and reduce risk. It reflects the commitment of the e-merchant is committed to meet certain criteria. It relates to the authentication of the seller identity, payment and transactions security or personal data protection.

* Propensity to trust: A variable linked to personality manifested in varying degrees, regardless of the exchange relationship.

* Familiarity: It includes three sub-constructs: familiarity with the merchant, with the Internet and distance purchasing. As a result, we propose a conceptual model that summarizes the effects of different factors forming the atmosphere of the website on the psychological and behavioural states of users.

We present in the following figure the conceptual model that we try to check in our empirical study:

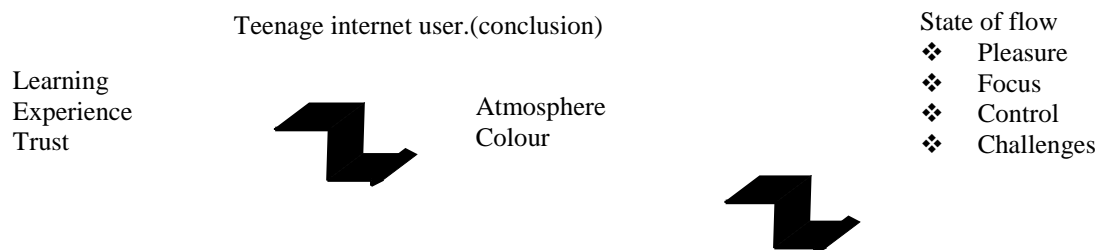


Figure 1: Influence of a merchant web site's colour on the psychological state of teenage surfers (conclusion).

To our knowledge there research conducted on the impact of a merchant site's colour on state of flow. For this end, we focused on the literature on the influence of the variable colour and more specifically its influence on the consumers emotional state believing that there could be some analogy with state of flow.

Researchers often oppose cool colours (blue-green) to warm colours (red-orange). Cool colours are often described as calm and uninspiring while warm colours are described as simulating and exciting colours (Bellizi et al. 1983).

Bellizi et al (1983) compared the effect of these two types of colours. They found that an environment with warm colour is a less pleasant environment than a one with cold colour. The results of their study indicate that red colour was considered less pleasant and appealing than blue colour. According to Chebat (1999), blue color gives more

³ Julien Anne et Tung, (L'impact du comportement du personnel de contact sur la satisfaction, la fidélité et la confiance client : Le modérateur de la personnalité du client », Congrès AFM, (mai2006), P5-11.

⁴ Inès Chouk et Jean Perrien, « Les déterminants de la confiance du consommateur lors d'un achat sur un site commercial », Centre de recherche DMSP, Cahier 318, (mai2003), P4-15.

physiological comfort than red colour. An individual placed in an environment with a blue color may feel happy, satisfied and cheerful.

Against the above literature and findings, we formulate the following hypotheses:

H1 Blue colour helps reach a state of flow than red colour.

H1-1 Blue colour helps reach a more intense pleasure state than red colour.

H1-2 Blue colour helps creating a strong focus than red colour

H1-3 Blue colour influences feeling of control than red colour

H1-4 Perception of challenge is greater under the effect of blue colour than under red colour.

H2. Learning positively influences perception of a merchant web site colour by teenage internet users.

H3. Experience positively influences perception of a merchant web site colour by teenage internet users.

H4. Trust positively influences perception of a merchant web site colour by teenage internet users.

Research Methodology

There are two measurement scales of state of flow: the scale of Webster, Trevino and Rayan (1993) and the scale of Ghani and Deshpand (1993).

Webster, Trevino and Rayan (1993) conceptualized state of flow into the four dimensions of control, focus, curiosity and intrinsic interest. Each of these dimensions is measured by three items on a 7-point likert-type scale (1. Strongly disagree to 7 strongly agree). Webster, Trevino and Rayan (1993) tried to test correlation between four dimensions of state of flow. They could not empirically distinguish between intrinsic interest and curiosity

They found a correlation coefficient of 0.97.

The scale of Gani and Deshpand is a 7-point semantic scale.

The authors provided no specific information on the reliability or validity of their scales. However, they reported a non-significant chi-square (with a probability greater than 0.05). They concluded that the psychometric model is sufficiently fits empirical data.

We present in the following the scales adapted by Ghani and Deshpand

Table 3: The scales items

Factors	Items	Alpha
Pleasure	4	$\alpha = 0,8151$
Focus	4	$\alpha = 0,4683$
	3	$\alpha = 0,3899$
	2	$\alpha = 0,7431$
Control	3	$\alpha = 0,7254$
Challenge	2	$\alpha = 0,9602$
Goodwill	3	$\alpha = 0,8521$
Competence	2	$\alpha = 0,5554$

Items related to pleasure, control, challenges, goodwill and competence are acceptable because their alpha is between 0.6 and 0.8. However, we have to eliminate item 4 and item 3 since their removal improves alpha which moves from 0.46 to 0.74.

Items related to focus on a merchant web site are as follows if we remove items 3 and 4:

Tableau4 : Les items relatifs à l'évaluation de la concentration:

Label	Item
1	I was very busy with this activity.
2	I was extensively taken by this activity.
3	My focus was on my activity.
4	I entirely focused my attention on this activity.

After checking reliability of our items, we will move to the analysis of the relationships between variables.

Results and Analysis of Relationships:

To determine the influence of external factors namely learning and trust of the merchant web site on the perception of colour by the teenage surfers, we test the following interactions:

-An interactions between "learning" and perception of colour.

-An interaction between "trust" and perception of colour.

Effects of learning on perception of colour

Table 5 : interaction between « learning » and perception of colour

Perception of colour	X ² observed	df	α (other dénomination)	Recommendations
User's experience	27,740	2	0,00	$\alpha = 0\% < 5\%$ therefore there is a strong dependency relationship between these two variables.
Duration of internet use	9,36	3	0,025	$\alpha = 2,5\% < 5\%$ there is a dependency relationship between these two variables.

In this table, with an error term of 5% ($\alpha = 5\%$), the two variables of learning are significant (at 5%). Therefore, we confirm the impact of these variables (user's experience and duration of internet use) on perception of colour.

Effects of « trust » on perception of colour

Table 6 : interaction between « trust » and perception of colour

Perception of colour		X ² observed	df	α	Recommendation
Goodwill	The site seems to show concern for my well-being	77,000	5	$\alpha = 0,000$	$\alpha = 0\% < 5\%$ therefore there is a strong dependency relationship between these two variables.
	Importance of my desires to the site	73,760	5	$\alpha = 0,000$	$\alpha = 0\% < 5\%$ there is a strong dependency relationship between these two variables.
	The site seems to know what is important for me	53,360	5	$\alpha = 0,000$	$\alpha = 0\% < 5\%$ therefore there is a strong dependency relationship between these two variables.
Integrity	I like the values of this site	23,620	6	$\alpha = 0,01$	$\alpha = 1\% < 5\%$ therefore there is a strong dependency relationship between these two variables.
Competence	Ability of the site to manage online transactions	50	5	$\alpha = 0,00$	$\alpha = 0\% < 5\%$ there is a strong dependency relationship between these two variables.
	The know-how of the site on online transactions	20,6	5	$\alpha = 0,01$	$\alpha = 1\% < 5\%$ there is a strong dependency relationship between these two variables.

In this table, there is a strong relationship between trust and perception of colour as the variables of trust are significant (at the 5%).

Effects of colour on state of flow

To compare effects of warm colour with cold colour on state of flow of teenage internet users, we use ANOVA. ANOVA helped emerge relationships between a continuous dependent variable and one or more non-continuous independent variables (nominal or ordinal) [(Evard Y. Pras et Roux E, 1997)].

Table 7: intersection warm-cold colour/pleasure

	F	P(significance)
The Net surfing I experienced was interesting.	0,456	0,808
The Net surfing I experienced was pleasant.	1,1087	0,373
The Net surfing I experienced was exciting.	1,128	0,351
The Net surfing I experienced was funny.	1,007	0,418

Analysis of variance showed values of $p > 5\%$ (non-significant). We may conclude that there is no significant relationship between warm colour and cold colour. Pleasure felt by users in the presence of warm colour and cold colour is the same.

Therefore, we totally reject H3-1.

There is no difference between cold colour and warm colour on teenage users' pleasure.

Table 8 : intersection between cold-warm colour/focus

	F	Significance
During my net surfing I was very busy with this activity.	1,461	0,210
During my net surfing I was intensively taken by this activity.	0,508	0,770

Analysis of variance showed values of $p > 5\%$ (non-significant). We may conclude that there is no significant difference between warm colour and cold colour. Focus of users in the presence of warm colour and cold colour is the same.

Therefore, we totally reject H3-2

Cold colour has the same effect of warm colour on teenage users' focus.

Table 9 : intersection cold-warm/ - control:

	F	Signification
During my net surfing I know very well what I should do.	1, 387	0, 236
During my net surfing I felt calm.	0, 679	0, 641
During my net surfing I felt I controlled the situation.	0, 738	0, 597

Analysis of variance showed values of $p > 5\%$ (non-significant). We may conclude that there is no significant difference between warm colour and cold colour. control of users in the presence of warm colour and cold colour is the same.

Therefore, we totally reject H3-2

Cold colour has the same effect of warm colour on teenage users' control.

Table 10 : intersection cold /warm - challenge :

	F	Significance
Surfing the net was easy.	1, 237	0, 298
Surfing the net was simple.	1, 327	0, 259

In this table, the values of p are not significant, therefore perception of warm and cold colours by internet users is the same. Challenging those users in the presence of warm and cold colours is the same.

Then, we reject H3-4.

Cold colour has the same effect on teenage internet users than warm colour.

Consequently, these results reject H3.

Cold colour has the same effect on teenage internet users than warm colour.

Conclusion

The above results inform us about the dependency relationship between learning and perception of colour and the relationship between trust and perception of colour by teenage internet users. Analysis of variance showed that there is no relationship between perception of colour (warm/cold) and state of flow. However, examining frequency we showed the importance of colour for teenage internet users.

With these results, we partially confirm our research hypotheses. Our contributions are three:

- A theoretical contribution: this study tried to present the theoretical contributions, definitions, attributes and effects of colour on pleasure, focus, control and challenge (the four dimensions of state of flow) on internet users.
- The methodological contribution is the methodology adopted to validate the impact of colour on internet users' state of flow. In order to test our research hypotheses, we used a univariate method (simple sorting), a bivariate method (cross-section sorting) and an explanatory method (ANOVA).
- An empirical contribution: the research model has been empirically validated by means of data collected on internet users.

The results indicated:

The importance of warm colour as an essential element of designing a merchant web site (through simple sorting). Then, this atmospheric variable is positively influenced by external factors of learning and trust of the site (through cross-section sorting and Chi-square).

Moreover, our study indicated also that teenage internet users perceive the same way warm and cold colour, therefore these latter have the same effect on their state of flow (through ANOVA).

The study has nevertheless some limitations. They are as follows:

Perception of colour may be influenced by other factors in addition to learning and trust like the physical environment of the user. Moreover, reaching a state of flow may be influenced by other visual factors like image and animation.

Our study contributes to the literature by developing the concept of colour and in particular the notion of a merchant web site's colour (a less researched concept). Future research may include the effect of colour on perceiving commercial information of a commercial web site.

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