

Social Interactivity and Its Impact on a User's Approach Behavior in Commercial Web Sites: A Study Case of Virtual Agent Presence

Sihem Ben Saad¹ & Fatma Choura Abida²

Abstract

The purpose of the current research is to investigate the impact of social interactivity (the presence of virtual agents in a commercial web site) on the approach behavior. The experimental study was deemed to be the most relevant for collecting data. The study revealed that indeed the presence of virtual agents in a commercial web site has a positive impact on the perceived interactivity which in itself helps increasing the state of flow.

Keywords: *social interactivity, virtual agent, telepresence, state of flow, perceived interactivity, perceived risk, approach behavior.*

1. Introduction

The recent report 2016 of UNCTAD³ shows that between 1990 and early 2000, the number of French Internet users has increased by more than 10 to around about 300 million. Indeed, this growth is supported by the number of online shoppers. But today, Internet users are currently over 5 times more than in 2000. Two billions at the beginning of this decade, estimated to have moved to 2.25 billion in 2016. But for most companies, information and communication technologies (ICT) are underemployed, which affects competitiveness. Indeed, many companies face particular difficulties of the adoption of information and communication technologies in the marketing of products. For the development prospects they carry, information and communication technologies have become a central place on to business development policies at many levels of organization of society and the institutions that manage them. Emerging economies are characterized by an increase in foreign trade and especially the prospects of proven growth, thanks to the size of their domestic market (Lafargue, 2011). In this context, e-commerce is emerging as one of the emblematic figures of this phenomenon which entangle values and practices, information and equipment capital (Lafargue, 2011).

New technologies are more and more penetrating our daily lives and helping the knowledge economy development which is the cornerstone in the third industrial revolution (Courvoisier and Jacquet 2010; Thurau, Hofacker and Bloching 2013; Gensler and al. 2013; Almeida and al. 2014; Marschner and al. 2015). The nowadays lifestyle requires the consumer spends much time with the new technologies, especially the Internet; now an irrefutable marketing and communication tool. The extensive use of the Web as a marketing medium can be justified by its extensive domestic coverage and reach, low costs and ability to present products and services.

¹ PhD student, IHEC Carthage, Diar ben Mahmoud, Agba, Denden, Tunis 2011. (+216) 94 47 81 00, sihem.bensaad87@gmail.com

² PhD: Assistant Professor, High Institute of Computer Science- University of Tunis El Manar, Affiliated Research Lab: LARIME, Ariana, Tunis, 2091.

³ United Nations Conference On Trade And Development

That is why, merchant websites have become the focal contact point with a large number of consumers and a crucial mean to business' development (Ben Mimoun, Garnier and Poncin 2011; Gensler and al. 2013). Charfi and Volle (2011) also asserted that if indeed the Web site marketing is proving its worthiness as a marketing channel more and more, there are still many unanswered questions about the factors contributing to his sustainable competitive advantage. In fact, Keating, Jyothi and McAvinia (2011) found out that creating an alluring atmosphere as well as providing a suitable environment satisfactory enough for customers' expectations are the main criterions to enhance a merchant website visiting experience. Ergonomics and atmosphere of commercial websites are now among the priorities of web designers, especially in such a competitive environment characterized by a significant evolution in design technology, user-friendly sites and the growing needs of both customers and users, attractive and above all interactive. Therefore, the interactivity of a website is becoming a requirement when creating links and social exchanges with users.

There are several academic studies on the physical atmosphere of websites (Lemoine 2008; Choura, Lemoine and Chtourou 2012) as compared with those on the role of social factors are still at an early stage (Ben Mimoun, Garnier and Poncin 2011; Gensler and al. 2013; Almeida and al. 2014; Jamy, 2015; Marschner and al. 2015; Zhao and al. 2015; Nowak, Fox and Ranjit , 2015; Lingel and Golub, 2015). The social dimension is a powerful tool which can transform a website into a virtual community (Hagel and Armstrong 1997). Therefore, virtual agents aim to eliminate the dehumanizing character of a virtual store and be able to get people to trust them by presenting a social illusion to the site (Jamy, 2015; Marschner and al. 2015). The importance of computer-mediated environment of interactivity was highlighted by Hoffman, Novak and Yang (2000) who explained the immersion (flow) of the user and his experience of telepresence. Indeed, we advocate that the success of the sites necessarily involves their ability to create the flow state and to lead the user to experience the feeling of being truly present in a mediated environment. An exploratory research is conducted to study the impact of virtual agents on the approach behavior of the user. Our interest is centered on the phenomena of perceived interactivity, the flow state and telepresence experience during and after the purchase process.

1. Social Interactivity: A Distinctive Feature of Websites Merchant

Interactivity is a very old concept that has been defined by several researchers and has evolved with the ever shifting technology. Blattberg and Deighton (1991) define interactivity as easiness with which individuals and organizations communicate directly with others regardless space or time. Steuer (1992) and Cook (1994) distinguished two types of interactivity: technical and social interactivity. Interactivity was defined as a technique because it is caused by stimuli and determined by the technological structure of the media. Also, it is considered social when it refers to the interpersonal human interaction. The social factor reflects the interaction of the site's visitor with vendors or other consumers.

Thus, social interactivity refers to interpersonal communication possibilities offered by the site, particularly through virtual agents. According to (Notebaert 2005; p26) virtual agents are defined as "characters, human or not, animating the human-machine interface. They provide different types of missions requiring user interaction and are generally embodied, that is to say they have a visual representation." Without a doubt, these agents in virtual stores play a crucial role in creating and strengthening the relationship between the company and users (Almeida and al. 2014).

Holzwarth, Janiszewski and Neumann (2006) emphasize that to reduce the impersonal nature of the act of buying online; the use of virtual agents can be used to inform consumers about the products online. Since the early work of Cassell, and al. (2000) on virtual agents, literature reports several studies on the impact of embodied virtual agents as a part of online business. Certainly, their presence has a positive impact on the exploratory behavior of consumer on Internet and his online presence time (Takahashi, Takeushi and Katagiri 2000; Charfi and Volle 2011; Allen and al. 2014; Jamy, 2015; Marschner and al. 2015). Other studies focused on the impact of embodied virtual agents on presence and immersion (Jeandrain and Diesbach 2008), on emotions and social perceptions (Wang and al. 2007) and on satisfaction, attitude and purchase intent (Holzwarth, Janiszewski and Neumann 2006).

According to the majority of previous work, the presence of virtual agent has a positive and significant impact on satisfaction, trust, immersion, attitude and purchase intent. Besides these reactions, the focus is particularly focused on the ability of the virtual agent to easily interact with the user in a virtual environment and therefore its ability to achieve the flow state, to live by the user the experience of telepresence and create approach behaviour. The objective in this work is to highlight the positive consequences of the virtual agent for professional e-commerce and more generally Internet marketing. Like physical sales points, commercial websites provoke among Internet users strong emotional reactions. The extent of interactivity in virtual worlds seems to go well beyond how users interact with commercial sites. Besides interacting with the products presented, a new form of interaction it creates, especially with the incarnate virtual agent triggering emotional reactions during the episode of navigation. This form of exchange is made simultaneously and the presence of this information and communication technology, has a positive impact on psychological states experienced by the user and thus on its approach behaviour.

2. Psychological Consumer's State during Commercial Web Site Browsing

The marketing literature has focused on the perceived interactivity, flow state and the concept of telepresence as part of the communication policy, direct marketing and media. In fact, researchers highlighted the role of flow and telepresence experience as mediators in explaining the behavior of the user computer-mediated environments (Steuer 1992 ; Hoffman and Novak 1996; Shih 1998) ; and the perceived risk as a moderating variable of the impact of the social interactivity on approach behavior (McCorkle 1990).

2.1 Perceived Interactivity: According to (Wu 2006, p28) "*perceived interactivity is the psychological state experienced by a site user during his interaction with the website since it takes into account implicit cognitive processing, and participation in activity*". It is defined with respect to its structural properties (participation, mediation, identification, synchronization) and qualitative experience generated through the cognitive, affective and behavioral involvement in the interaction, reciprocity and individualization of communication (Burgoon et al. 2000). According to Mollen and Wilson (2010), perceived interactivity is an empirical phenomenon that occurs when the user interacts with the Web site or other cyberspace communication entities.

2.2 State Of Flow: The flow state is a psychological concept, initially introduced by Csikszentmihalyi (1975). Indeed, the original theory of Csikszentmihalyi (1975) postulates that the state of flow is a philosophical concept and is experienced by the individual when he perceives a balance between the challenges of the business and individual skills to face these challenges. Csikszentmihalyi (1975) was the pioneer in introducing the concept of flow and defining it as an optimal experience process. Csikszentmihalyi (1975) explained that in a flow experience, consumers are very involved in an act of navigation making this concept essential to describe the human-computer interactions. When applying this concept to the Internet, Hoffman and Novak (1996) define the state of flow as a condition that occurs during the sailing experience. This state is accompanied by a total concentration and thanks to the interactivity of the machine, it can facilitate responses. Hoffman and Novak (1996) also underlined the fact that consumers focus their attention on interaction, and the consequences of this experiment are learning, exploration and participatory behavior. Consequently, Csikszentmihalyi (1975) defined the flow state in four interlinked and interdependent dimensions which are: playfulness, concentration, sense of control and collection of challenges.

2.3 Telepresence Experience: The concept of telepresence was initially developed by Minsky (1980) and means that an individual feels that he is physically present at a remote location through interaction with the user interface -machine. Indeed, the user perceives this virtual interface with which he interacts as a more real environment or more dominant than the physical environment. Shih (1998) finds that the telepresence experience involves a sense of playfulness and play. Accordingly, it can be assumed that telepresence has a positive effect on the achievement of flow state. In their model, Hoffman and Novak (1996) consider telepresence as an antecedent of the flow state which is undeniable, seeing that by focusing attention on the business, telepresence can generate a flow state. Many researchers assert that every user, whose perception is mediated by communication technology, necessarily perceives two types of separate environments: a real environment (physical) and a virtual environment (mediatized) (Kim and Biocca 1997; Lombard and Ditton 1997; Steuer 1992; Klein 2001).

2.4 The Perceived Risk: This construct is considered crucial by several researchers studying consumer behavior online. Gharbi, Ettis and Ben Mimoun (2003) argue that risk is a source of much debate in consumer behavior. Gharbi (1998) thinks that consumers often perceive some risk when shopping online. Consumer behavior involves a risk in that consumer action will have consequences difficult to anticipate with certainty and some of which could be unpleasant. With the advent of the Internet as a new shopping environment of a virtual nature, the perceived risk associated with internet buying has been defined as "*the subjectively determined pending loss by an internet marketer especially in an online purchase*" (Forsythe and Shi 2003; p25). It hence appears that the two fundamental components of risk are loss and uncertainty.

2.5 The Approach Behavior: Once the individual develops emotional reactions and / or cognitive ones towards a commercial website, they can influence behavior in two ways: the consumer can feel good about the place of sale and develops an "approach" behavior. He adopts an "avoidance or flight" behavior, where he is not comfortable (Mehrabian and Russel 1974). The choice of this variable is mainly based on the fact that the approach behavior does not simply include a purchase. Indeed, approach behavior can manifest itself through other variables such as the desire to remain at the point of sale, to communicate with others, to explore and to contact the environment.

3. Towards A Better Understanding of the Social Dimension of Interaction Impact on the Internet Approach Behavior

Most of the work involved in the Web context has focused on the lively dimension of the commercial sites' atmosphere. Given the small number of the previous studies on the social dimension of interactivity, a qualitative study was conducted in order to develop a better understanding of the potential impact of the social dimension of interactivity on the behavior of the user.

3.1. Qualitative Study

This study aims to promote a better understanding of the effectiveness of the social dimension of interactivity on merchant websites and the reactions that it may have on Internet users. A qualitative approach through semi-structured interviews was carried. Data collection is conducted on a group of twelve respondents via "Facebook" instant messaging application. The interview guide is centered on four themes namely: a focal theme "Internet and interactivity," a main theme "virtual agents and reinforcing social cohesion," a theme of deepening "virtual agents and reactions" and finally the theme of "virtual agents and approach behavior" to conclude research. Respondents were questioned first on the types of sites in which the user thinks he needs interactivity and what this concept represents for him. In the second theme, it comes to defining the concept of virtual agents and determining their roles on merchant websites.

It is also to identify their ideal characteristics. Moreover, understanding the psychological states and feelings of Internet users in their interactive site visits is investigated in this guide. Beyond the psychological responses that can create interactivity on a merchant website, it is important to investigate the behavioural consequences that this dimension can have on the user. The results of the qualitative research associated to literature review on interactivity enable us to propose research model to test through a quantitative study. Before statistically validating the model, we present a theoretical justification for each of the model relationships. Edwards (2001) believes it is preferable to specify, from a theoretical point of view, the various aspects and interrelationships of the concepts studied. For this, we examine the model and each relationship before formulating the hypotheses. The analysis tables which represent the different themes according to their citation frequency are presented as follows: (table1, table2, table3 and table4).

Table 1: "Surfer and interactivity"

Component / sub theme	Theme	Number of citations	Verbatim
Blogs, facebook	socio cultural nature websites	17	"Facebook, twitter, blogs, social networking sites, online journals, university sites ..."
Sites of online sales	commercial nature websites.	22	"Sites for the sale of cosmetics, wedding dresses, accessorie, shopping site "
the site ergonomics	Technical interactivity	14	"Colors, ease of use, animated images, sounds ...".
Social ties, social interaction, interact with someone	Social Interactivity	32	"Exchange of opinions, interact with someone from the company, a representative of the company speak for him,..."

Table2: "virtual agents and reinforcing social ties"

Component / sub theme	Theme	Number of citations	Verbatim
Virtual agents are guides	virtual agents as assistants	23	"Have people who work for the site", "Have people who work for the site", "I thought that an agent is a real person as a webmaster who is 24h / 24h logged in to answer questions and guide the consumer on line in its site visit , are agents to facilitate use of the site...."
Virtual agents are virtual sellers	Virtual agents as sellers	16	"A virtual agent is the equivalent of the seller or salesperson," virtual agents, this is the kind of guide on sites that replaces a salesperson in a shop, and helps the user to use the site " "Virtual agents are vendors on a merchant website. ...".
virtual agents must perform command and transaction operations of real seller	Agents recommendation and transaction	27	"Credibility of information, sincere in the information transmitted, give the necessary information, and ability to respond to all questions; "Knowing all the details of the product"; "Negotiates prices; "Sorting facilities..".

Table 3: "virtual agents and experienced psychological states»

Component / sub theme	Theme	Number of citations	Verbatim
Trust	Trust	12	"I'll feel safer knowing that he has someone to help me, I am reassured, I feel that there is less risk of errors," "I'm sure I make good choices, I feel that I will not waste much time in my search".
Perceived interactivity	Perceived interactivity	28	This is the kind of experience that I really want, it facilitates communication between the visitor and the website, these agents give us the impression that they want to listen to his visitors, a new experience, it revives the site and it animates, it also has a playful side, "" a pleasant environment. "
Involvement / concentration / playfulness	The flow state	23	"I feel a great pleasure," "Very involved and focused."
The feeling of presence in a virtual environment	Telepresence experience	18	"I am intensely absorbed when I visit a commercial site containing an animated agent, I forget all that exists around me when visiting a site that contains a virtual agent"

Table 4: "virtual agents and reactions"

Theme	Number of citations	Verbatim
The approach behavior	17	<i>"Yes it will encourage people to buy by giving credible information they wish to have, This can cause a good impact on the online retail level, "" I will recommend this site to my friends. "</i>
Lack of impact	5	<i>"The virtual agent does not encourage me to buy," it revives the site and it animates, but sometimes I ignore them, it does not attract me, Maybe it's better than a website without virtual agents, but I do not think it grows to purchase directly.</i>

Relationship between the presence / absence of virtual agents and perceived interactivity

Virtual agents facilitate direct communication between users. Courvoisier and Jacques (2010) found that the majority of consumers do not want to visit a commercial Web site which does not include at least one media more interactive. Virtual agents play a great role to convey the image and values of the company, to optimize customer loyalty and gather information.

It seems that virtual agents are intended to humanize the virtual interface and can be used to reduce information search costs. Furthermore, their presence increases the interactions and makes them more conversational and reciprocal (Balbo, Jeannot and Helme-Guizon, 2014).

The presence of virtual agents is a social factor referring to the interaction between the user and the site. Indeed and according to the results of the qualitative study, the majority of interviewees associate perceived interactivity to the presence of these virtual agents in a commercial site *"as the kind of experience I want really, it facilitates communication between the visitor and the website, these agents give us the impression that they want to listen to his visitors»* -28⁴. From there emerges our first hypothesis:

Hypothesis 1: "The presence of virtual agents positively affects perceived interactivity merchant Web site."

Relationship between perceived interactivity and the state of flow / telepresence

Perceived Interactivity is an empirical phenomenon that creates a flow between the transmitter of information and its receptor. Interactivity is seen when it is due to the synchronized, reciprocal and controlled dialogue between advertiser and user. Mollen and Wilson (2010) place the perceived interactivity as an antecedent of the state of flow and telepresence. Indeed, researchers show that perceived interactivity has a positive impact on the psychological state of the Internet use, specifically the state of flow and experience of telepresence. It is possible to state the following hypothesis:

Hypothesis 2: "Interactivity perceived positively influences the experience of telepresence and flow status".

Relationship between the state of flow / telepresence and Internet user behavior approach

The flow state is both a psychological and philosophical concept. It can be defined as a cognitive state sometimes experienced by individuals deeply involved in the Internet. First, Csikszentmihalyi (1990) affirms that the flow is an essential construct to describe the human-computer interactions.

⁴ Numbers in bold refers to the frequency of occurrence

Malone (1981) argues that the flow state on the Internet has a positive effect on behavioral responses of the user. In addition, Hoffman and Novak (1996) explain that when the skills of the consumer and the challenges of the shopping environment are equivalent, the presence of the user in the mediated environment is longer and it encourages its approach behavior (i.e. more page views, more clicks, more file downloads, etc.).

The concept of telepresence is used to describe the rewarding sense of being present in a mediated environment that appears as it was natural.

Chang (2006) notes that telepresence is used as an intermediate variable between the properties of a commercial website like virtual reality, on the one hand and attitudes and consumer behavior on the other hand. The choice of this variable is important because the main challenge of the virtual environment is to maintain a strong focus, a feeling of fluidity that captures the subject (Volle, 2000). Moreover, a commercial site with compelling content allows the user to experience telepresence. The experience of telepresence has also a positive impact on the strength of belief and intensity of attitudes toward a product (Klein 2001). Mollen and Willson (2010) focus on the decisive role of the state of flow and experience of telepresence. In fact, they find that the two concepts positively influence the approach behavior of the user. Thus emerges the following hypothesis:

Hypothesis 3: "The psychological states experienced by the user, specifically, the state of flow and telepresence experience, have a positive impact on the approach behavior."

Relationship between the presence / absence of virtual agents and Internet user behavior approach

The literature reports several studies on the impact of virtual embodied agents within the online business. Notebaert (2005) considers the use of an embodied agent on a merchant website as a strategy that can improve both confidence and satisfaction of the user. Other researchers are studying the impact of virtual embodied agents on presence and immersion (Jeandrain and Diesbach 2008) and their impact on emotions, social perceptions, satisfaction, attitude and purchase intention (Holzwarth, Janiszewski and Neumann 2006). Moreover, there are several researches that focus on the influence of virtual agents on other variables such as purchase intent of the user, online time presence and attractiveness of a site (Takahashi, Takeushi and Katagiri 2000; Holzwarth, Janiszewski and Neuman 2006; Bickmore, Campbell and Yan 2009). In our qualitative study, the Internet users surveyed indicate the importance of virtual agents and their positive impact on the approach behavior of the user. "Yes there is a relationship because if we trusted the agent so automatically is done to the site then it will encourage people to buy while giving credible information they wish to have"... "This can lead to good consequences the level of selling online ... " -17. So, it is possible to state the fourth research hypothesis:

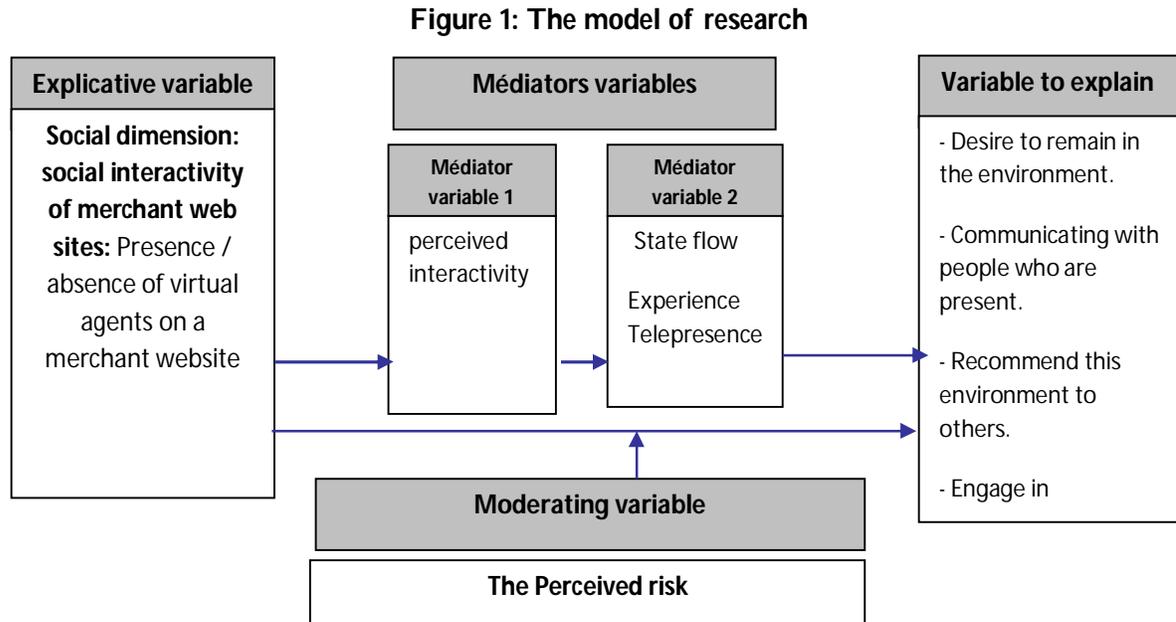
Hypothesis 4: "The presence of virtual agents in a merchant web site has a positive impact on the approach behavior of the user."

Perceived risk: a moderating variable of the impact of virtual agents on the approach behavior of the user

Several researchers consider the importance of taking the perceived risk as a moderating variable (Rieunier, 2000; Chang 2006). Perceived risk tends to increase when consumers use a new shopping environment. During an online buying behavior, the perceived risk of the users neutralizes the effect of the feelings of playfulness, of being present in this mediated environment and of fluidity, that attract the user. It is important to examine the perception of risk associated with the online Internet shopping behavior as a moderator variable of interactivity social link of the user- approach behavior merchant websites. In addition, with the advent of the Internet as a new shopping virtual environment, especially in the Tunisian context, the perceived risk associated tends to increase (Forsythe and Shi 2003). Therefore, the perceived risk on the Internet is considered a precursor of the Internet user behavior. These findings are clearly expressed by many of participants in the qualitative study who report that they perceive a risk during a purchase online, "I fear that the amount of money, I'll spend, I'd be doubtful of receiving a poor quality item, I feel uncomfortable when I buy online ... " -11. From there emerges the fifth hypothesis:

Hypothesis 5: "the perceived risk moderates the relationship of the effect of the presence of virtual agents on the approach behavior of the user".

The proposed model is shown in figure 1:



3.2. Method

3.2.1 Procedure, design and participants

The empirical study is based on an experimental approach given the causal nature of the relationships to be tested and the research objectives. To check whether the presence of a virtual agent on a merchant Website can improve the relationship between users and the company carrying on business on the Internet, a merchant of clothing for men, women and babies has been designed. Two experimental versions of the Web site were developed: without a virtual agent and with a virtual agent named Elizabeth (**Appendix A**). This agent is Chatterbot type, it has the conversational skills, it aims to inform users about selling clothes online and presents the products offered by the brand. We specify that the agent called Elizabeth was not intrusive, that is, it did not fulfill its advisory role spontaneously but only if the consumer requests its intervention by clicking on it.

For the purpose of the study, a convenience sample of 600 respondents was formed. Akrouf (2010) suggests that the size should be equal to (5-10 times) the number of observables variables. 600 students from different academic specialties participated to the quantitative study. To avoid a possible prior knowledge of the brand which can influence the responses of participants, the study focused only on subjects not knowing previously the brand "online store." Respondents were randomly assigned to both versions of the site. 290 participants viewed the first version of the site (without a virtual agent) and 310 were exposed to the second version (with virtual agent). An experimental study was performed in laboratory conditions in order to control external variables which can bias results such as atmospheric conditions, presence of other persons while visiting the web site or responding to the survey, as well as to reduce biases due to respondents' profiles. During the experiment, each respondent was free to browse the Web site as much time as wished without any special requirement. Participants were asked to respond to a questionnaire after browsing the web site.

We specify that each questionnaire is fully identified and associated with a given experimental condition.

3.2.2 Measurement scales

All scales used were the subject of an empirical validation and satisfied good psychometric properties in previous research. Scales studied for each variable are displayed in (Table 5).

Table 5: Operationalization of research variables

Variables	Number of items	Authors	Dimensions	choice of scale
Perceived Interactivity	15	Liu (2003)	The active control-synchronization-the communication bidirectional	Liu (2003) demonstrated the reliability and validity of this scale ($\alpha= 0.75$ for the active control, $\alpha=0.86$ for bidirectional communication and $\alpha=0.86$ for synchronization).
The flow state	13	Ghani and Deshpande (1994)	Playfulness-concentration, control-perception challenge	The authors reported that LISREL analyzes reveal a non significant chi square with a probability greater than .05 and Goodness of Fit Index 0.88. They demonstrated the reliability and validity of their scale ($\alpha=0.88$)
Experience telepresence	7	Klein (2001)	Telepresence	This scale is suitable for our research because it involves studying telepresence to the same environment as the one studied by Klein (2001). Moreover, Klein (2001) has checked the validity and relevance of this scale.
Perceived Risk	15	Jacoby and Kaplan (1972)	financial Risk-risk related to time, performance risk, psychological risk, social risk and global risk	Jacoby and Kaplan (1972) have shown accurate information on the loyalty and the validity of their scale with Cronbach's alpha of 0.87.
The approach behavior	8	Sweeny, Jilian, Wyber and Fiona (2002)	The approach behavior	Sweeney, Jillian, Weber and Fiona (2002) showed that all items are reliable; they are between 0.74 and 0.92. Thus, Cronbach's alpha is 0.92, which indicates the validity and relevance of this scale.

3.2.3. Results

Psychometric properties and reliability of the measurement scales are performed before verifying the validity of their factor structures through confirmatory. The table 6 displays the main results of the analysis step. To perform the statistical tests of hypotheses and research proposals, variance and regression analyzes are thus conducted. Many researchers assert that the single or multiple regressions is a relevant method of analysis relationships between a metric dependent variable and one or more independent variables (Edvard, Pras and Roux, 2009). Here, the regression is deemed most efficient because it minimizes the risk of co-linearity between variables. Thus, the model which explains the greater variance in terms of adjusted R2 is retained (Malhorta, 2004).

Table 6: Summary of key figures for the AFE and the AFC measuring scales

Scales measures	AFE	AFC (after respecification)
Perceived Interactivity	Reliability the synchronization: $\alpha=0,804$ Bidirectional communication: $\alpha=0,801$ The active control: $\alpha=,832$ KMO= 0,833 Bartlett sphericity test: 3175,946 ; $p=,000$	Absolute indices Chi deux=65,544 ; $dl=17$; $p=,000$; GFI=,979 ; AGFI=,944 ; RMR=,139 ; RMSEA=,069 Incremental indices NFI= ,976; TLI=,971 ; CFI= ,982 The parsimony indices Chi-deux normé= 3,85 ; PGFI= 0,68
The flow state	Reliability = $\alpha = ,979$ KMO = 0,951 Bartlett sphericity test = 12335,878, $p=0,000$	Absolute indices Chi deux=208,587 ; $dl=48$; $p=,000$; GFI=,951; AGFI=,906 ; RMR=,125 ; RMSEA= ,075 Incremental indices NFI= ,983 ; TLI=,979; CFI= ,987 The parsimony indices Chi-deux normé=4.34 ; PGFI= 0,65
Experience telepresence	Reliability = $\alpha = ,982$ KMO = 0,921 Bartlett sphericity test = 7320,750, $p=0,000$	Absolute indices Chi deux=34,780 ; $dl=8$; $p=,000$; GFI=,984; AGFI=,945 ; RMR=,022 ; RMSEA= ,075 Incremental indices NFI= ,995 ; TLI=,990; CFI= ,996 The parsimony indices Chi-deux normé=4.34 ; PGFI= 0,38
Perceived risk	Reliability = $\alpha = ,934$ KMO = 0,858 Bartlett sphericity test = 10446,123 ; $p=,000$	Absolute indices Chi deux=226,947 ; $dl=56$; $p=,000$; GFI=,946; AGFI=,911 ; RMR=,110 ; RMSEA= ,071 Incremental indices NFI= ,978 ; TLI=,977 CFI= ,984 The parsimony indices Chi-deux normé=4.05 ; PGFI= 0,68
The approach behavior	Reliability = $\alpha = ,985$ KMO = 0,937 Bartlett sphericity test = 9406,350 , $p=0,000$	Absolute indices Chi deux=70,949 ; $dl=15$; $p=,000$; GFI=,972; AGFI=,932 ; RMR=,030 ; RMSEA= ,079 Incremental indices NFI= ,993 ; TLI=,989; CFI= ,972 The parsimony indices Chi-deux normé=4.72 ; PGFI= 0,38
Footnote : GFI: Goodness of fit index / AGFI: adjusted Goodness of fit index / RMR: Root Mean Residual / RMSEA: Root Mean Squared Error Of Approximation / TLI: Indice of Tucker Lewis / NFI: Normed Fit Index / CFI: Comparative Fit Index / PGFI: Parsimonious Goodness of fit Index		

The tables that present the exact results of the various variance, regressions and covariance are displayed as following.

Impact of the presence / absence of virtual agents on perceived interactivity

Depending on the nature of the variables, analysis of variance is selected as being the most appropriate method of analysis. Therefore, it's possible to assert that the proposed test has shown significance for dimension «bidirectional communication" ($F = 622.231, p<.001$). In reality, this variable is well perceived by users in case of a merchant website with a virtual agent and not seen in case of his absence. Conversely, there is no significant effect for the two dimensions of "active control" and "synchronization", respectively ($F = ,083, p = ,773$; $F = 608, p = .436$).

Thus, the proposal P1 is validated for the second dimension "bidirectional communication" and rejected the other two dimensions (table 7).

Table 7: Impact of the presence / absence of virtual agents on perceived interactivity

Explicative variables	explained variables	F	Sig	proposals	Validation
Presence / absence of virtual agents	the synchronization	,608	,436	P1.1	Rejected
Presence / absence of virtual agents	Bidirectional communication	622,231	,000	P1.2	Validated
Presence / absence of virtual agents	The active control	,083	,773	P1.3	rejected

Impact of perceived interactivity on flow condition and the feeling of telepresence

Depending on the nature of two metric variables, the regression analysis is selected. The results of linear regression show that the overall model is significant ($F = 316.482$, $p < .001$). Indeed, it explains 61.2% of the total variance and all the coefficients are significant except for the active control dimension of perceived interactivity. The direction of the relationship is For the flow state clarified by analyzing the signs of the estimated coefficients of the model. Indeed, the dimensions "synchronization" and «bidirectional communication» positively explain the state of flow, while the dimension "active control" has a negative impact. The hypothesis H2.1 is thus validated for the first two dimensions of perceived interactivity and rejected for the third dimension "active control". Similarly, the test of the impact of perceived interactivity on the telepresence experience is achieved thru regression analyzes. Concerning the impact of perceived interactivity on the feeling of telepresence, the overall model is significant ($F = 243.401$, $p < .001$). Indeed, it explains 54.8% of the total variance and all the coefficients are significant except for the active control dimension of perceived interactivity. The analysis of the signs of the estimated coefficients of the model shows that the "synchronization" dimensions, "bidirectional communication" and "active control" also positively explain the feeling of telepresence. The hypothesis H2.2 is thus validated for the first two dimensions of perceived interactivity and rejected in the case of the third dimension "active control" (table 8 and 9).

Table8: Impact of perceived interactivity on flow condition

Explicative variables	Estimation and model fitting				Validation
	Bêta	T	Sig	R2 adjusted	
Constant		,000	1,000		
<i>the synchronization</i>	,196	7,707	,000	,612	Validated
<i>Bidirectional communication</i>	,759	29,834	,000		Validated
<i>The active control</i>	-,002	-,071	,944		Rejected

Table 9: Impact of perceived interactivity on the feeling of telepresence

Explicative variables	Estimation and model fitting				Validation
	Bêta	T	Sig	R2 adjusted	
Constant		,000	1,000		
<i>the synchronization</i>	,218	7,928	,000	,548	Validated
<i>Bidirectional communication</i>	,708	25,792	,000		validated
<i>The active control</i>	,040	1,458	,145		Rejected

Impact of psychological states (the state of flow and telepresence) on the approach behavior

The psychological states experienced by the user (flow status and telepresence) seem to have a significant impact on the approach of the user behavior, leading to confirm both assumptions H3.1 and H3.2. The results of the adjustment and the estimated seized model ($F = 540.459$, $p < .001$) show a good proportion of explained variance (64.3%). In addition, these two psychological states have a positive impact on the approach of the user behavior, as reflected in the positive sign of the estimated coefficients; hence it is possible to assert the hypothesis H3 (table 10).

Table 10: Impact of psychological states (the state of flow and telepresence) on the approach behavior

Explicative variables	Estimation and model fitting				Validation
	Bêta	T	sig	R2 ajusted	
Constant		,000	1,000		
flow	,287	5,766	,000	,643	validated
Telepresence	,541	10,879	,000		validated

Impact of the presence / absence of the virtual agents on the approach behavior

The ANOVA results show that the presence of the agent in a virtual merchant website has a significant impact on the approach of the user behavior. Results shows that a Web site containing a virtual merchant agent, increases the user's approach behavior ($F = 361.735, p < .001$). However, a site without virtual agent does not have a significant impact on the approach behavior. Therefore, we can see confirm the hypothesis H4 (table 11).

Table 11: Impact of the presence / absence of the virtual agents on the approach behavior

Explicative variables	variables explained	F	Sig	hypothesis	Conclusion
<i>presence / absence of virtual agents</i>	<i>the approach behavior</i>	361,735	,000	H4	validated

The moderating effect of the perceived risk of the relationship "presence / absence of virtual agents - approach behavior

To check this relationship, the methodology of Baron and Kenny (1986) is held by implementing a covariance analysis. The results show that the financial risk, performance risk and psychological risk are significant moderators of the relationship between the presence / absence of virtual agents and the user approach behavior, respectively ($F = 38.007, p < .001$; $F = 64.878, p < .001$; $F = 53.185, p < .001$). However, the risk related to the time had no significant impact on this link ($F = 416, p = ,660$). In addition, all β coefficients are positive except for the risk related to the time, which leads to the conclusion that increasing the level of financial risk, psychological and performance intensifies moderate relationship. The hypotheses H5.1, H5.2, H5.3 are, therefore, validated; against the hypothesis H5.4 is rejected (table 12).

Table 12: The moderating effect of the perceived risk of the relationship "presence / absence of virtual agents - approach behavior

variables explained: <i>the approach behavior</i>					
Explicative variables (<i>presence / absence of virtual agents</i>)	Interaction between the explicative variable and the moderator				Conclusion Presence / Absence of moderating effect
	F	t	Sig	β	
Moderator: (financial risk)	38,007	6,584	,000	,188	Presence
Moderator: (performance risk)	64,878	10,736	,000	,303	Presence
Moderator: (risk at the time)	,416	,274	,660	-,008	Absence
Moderator: (psychological risks)	53,185	7,949	,000	,230	Presence

4. General discussion

This research starts from the observation that commercial websites have become the main point of contact with a large number of consumers. The objective of this work is to question about the optimization methods of interactivity of these sites to enable them to offer companies a sustainable competitive advantage.

Knowing that the technical dimension of interactivity is developed on merchant websites, the problem arises is to ensure their differentiation to influence the perception of users and re-enchant? This technical dimension that refers to the elements of the virtual environment of purchase is able to stimulate the senses and touch the perceptual field of the user's, but it does not seem to produce this fiction that the individual is interacting with another real person. Its effect is soon at much less than the social interactivity, strangely less studied or forgotten by the studies on merchant websites. Therefore, social interactivity into a merchant website is little used by advertisers to enhance the liveliness in a commercial site.

Furthermore, a lack of consensus was found in the works that have studied the impact of this variable on the behaviour of the user. While some authors confirm its positive impact (satisfaction, trust, immersion) (Janiszewski and Neumann, 2006; Notebaert, 2011; Lemoine, 2012; charfi, 2013; Jamy, 2015; Zhao and al. 2015), others show the opposite (attitude) (Diesbach, Chandon and Galan, 2007; Jeandrain and Diesbach, 2008). These differences can be attributed to methodological differences in the operationalization of the social dimension of interactivity. The main objective of this research was to study the effectiveness of the social component of interactivity on behaviour approach. The role of embodied virtual agents is especially investigated. It is possible through this work to assert that a merchant web site with virtual agent is perceived more interactive than a site without an agent. We can confirm, as well, the significant impact of psychological states experienced by the user, respectively the state of flow and feeling of telepresence on the approach behavior of the user. Therefore, commercial sites with a virtual agent are more successful than ones without it, thanks to their ability to generate among visitors the state of flow and feeling of telepresence. Indeed, these variables positively influence the approach behavior of the user. It has been shown that the perceived risk is a moderator in the relationship between the presence of virtual agents and the approach behavior. The released results confirm the moderator character of financial risk, performance risk and psychological risk. However, the moderating role is refuted when risk is related to time. All these results represent a managerial contribution to commercial site designers on the effectiveness of inserting virtual agents. All the assumptions and proposals are summarized in (Table 13).

Table 13: Summary of results of hypotheses and research proposals testing

Assumptions / proposals	Validation
Hypothesis 1: The presence of virtual agents positively affects perceived interactivity of the merchant website.	partially Validated
H1.1: The presence of virtual agents has a positive impact on the size of the synchronization of perceived interactivity.	Rejected
H1.2: The presence of virtual agents has a positive impact on the size of the two-way communication of perceived interactivity.	Validated
H1.3: The presence of virtual agents has a positive impact on the size of the active control of perceived interactivity.	Rejected
Hypothesis 2: Interactivity perceived positively influences the experience of telepresence and flow status.	partially Validated
H2.1: Interactivity perceived has a positive impact on telepresence.	Validated
H.2.1.1: Synchronization dimension of perceived interactivity has a positive impact on telepresence.	Validated
H.2.1.2: The bidirectional communication dimension of perceived interactivity has a positive impact on telepresence.	Validated
H.2.1.3: The active control dimension of perceived interactivity has a positive impact on telepresence.	Rejected
H2.2: Perceived Interactivity has a positive impact on the flow state.	Validated
H.2.2.1: Synchronization dimension of perceived interactivity has a positive impact on the flow state.	Validated
H.2.2.2: Bidirectional communication dimension of interactivity perceived has a positive impact on the flow state.	Validated
H.2.2.3: The active control dimension of perceived interactivity has a positive impact on the flow state.	Rejected
Hypothesis 3: The psychological states experienced by the user, specifically, the state of flow and experience of telepresence, have a positive impact on its approach behavior.	validated
H3.1: The flow state has a positive impact on the approach behavior of the user.	Validated
H3.2: The feeling of telepresence felt by the user has a positive impact on the approach behavior of the user.	Validated
Hypothesis 4: The presence of virtual agents has a positive impact on the approach of the user behavior.	Validated
Hypothesis 5: the perceived risk moderates the relationship of the effect of the presence of virtual agents on the approach behavior of the user.	partially Validated
H5.1: financial risk moderates the relationship of the effect of the presence of virtual agents on the approach behavior of the user.	Validated
H5.2: performance risk moderates the relationship of the effect of the presence of virtual agents on the approach behavior of the user.	Validated
H5.3: psychological risk moderates the relationship of the effect of the presence of virtual agents on the approach behavior of the user.	Validated
H5.4: the risk related to time moderates the relationship of the effect of the presence of virtual agents on the approach behavior of the user.	Rejected

Conclusion

Over the past two years, e-commerce has undergone considerable changes. These changes have allowed commercial websites designers to realize many tools that can amplify the process of communication and imagination of the user. Thus, the presence of these tools is now able to create environments in which the user can live original experiments, similar to those experienced in reality. Experiences that generate emotional responses equivalent to those experienced in traditional contexts. The prospect of e-commerce raises a particular awareness of the economic issues linked to its adoption. Electronic commerce led companies to redefine a set of objectives and means necessary for achieving this new way to enhance marketing of goods and services. Based on these observations, the development of electronic commerce encourages commercial websites designers to adopt a virtual agent to manage direct relationship with customers.

Indeed, the adoption of a virtual agent immediately raises interest by facilitating opportunities and streamlining business functions. The multifunctional of virtual agent is an undeniable argument and has a real appeal to adopt the information and communication technology. Because commercial websites managers are looking more and more to promote the feeling of being physically present in a virtual environment, create among Internet users the feel of state of flow and therefore generate approach behaviour during their online experiences, the objective of this study is to assess the effectiveness of social interactivity in a commercial website. Trying to answer to the following research question: **to what extent does social interactivity into a merchant website affects the user's approach to behavior?**

Isaac and Volle (2008) argue that if the use of the Web as a marketing channel is growing, several questions remain unanswered as the factors likely to bring to commercial websites a competitive advantage. Indeed, technical interactivity of commercial sites plays a vital role in encouraging consumers to buy online (Steuer 1992; Pelet 2008). Other researchers find that among the reasons that hinder the consumer to proceed with the act of online shopping, it's possible caused by the static nature of commercial sites (Cook 1994; Charfi and Volle 2011; Lemoine and Notebaert 2009; Weinberg and al. 2013; Almeida and al. 2014; Jamy, 2015; Marschner and al. 2015). The growing interest in the study of virtual agents in the literature stresses the importance of social interaction commercial sites to reduce the impersonal nature of buying online. Observing the Web landscape reveals a relatively limited use of virtual agents in market websites, particularly in Tunisia. All the findings from the literature review and observations of web design trends motivated our desire to better understand and appreciate the role of virtual agents and test their effectiveness by studying the reactions their presence can have on the approach behavior of the users. In fact, working on virtual agents in commercial websites is a relatively new field of research, which represents a significant theoretical contribution. It should also be noted that the present investigation is, to our knowledge, one of the few researches that focused on the role of virtual agents in developing the approach behavior. So, this research provides a theoretical contribution to the several studies that had focused on other factors mainly related to the liveliness of websites.

From a managerial perspective, the results of this research may provide answers to the managers and Web site designers about the insertion of virtual agents in order to generate an interaction between the user and the site and to enhance the vivacity of merchant Web sites. Indeed, virtual agents appear to be very important marketing tools of customer relationship management. They also present a source of value and differentiation since they impact positively the confidence of users. Despite the care taken in the realization of this survey, it is appropriate to draw some limits. In fact, a more diversified sample that did not include only students would improve the external validity of the results. Then the value of this work has focused on a single dimension of social interaction to study its impact on the user's behavior; a further investigation of other tools, namely FAQ (Frequently Asked Questions), should be conducted. For future research, it would be relevant to study the impact of virtual agents on other responses of consumers, such as the level of involvement, product knowledge or attitudes, etc. It could also be useful and interesting to have a holistic approach by considering the interactions between the different atmospheric components of commercial websites, specifically the interactions between environmental factors (music, colors, animations, ...), design factors (navigability of the site) and social factors (the presence of virtual agents).

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Appendix A/ sample of experimental Web pages



