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Americas Conference on Information Systems (AMCIS)

December 2004

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ABSTRACT

With the prevalence of online shopping, companies have begun to provide "Live Help" functions through instant messaging or text chat on their websites to facilitate interactions between online consumers and the serviceperson. But the reliance on text alone reduces nonverbal feedback and social context information. With the help of multimedia technologies, companies could now use computer-generated voice and humanoid avatars to embody a serviceperson and enhance the interaction with their customers.

A laboratory experiment was designed to empirically test the effects of information presentation mode and animated embodiment on consumer trust towards the serviceperson. TTS voice was implemented to read aloud the answer, with the 3D avatar as a humanoid representation of the serviceperson. The results demonstrate that the presence of TTS voice significantly increases consumer's cognitive and emotional trust toward the serviceperson. These findings offer practitioners guidelines on how to improve the interface design of real time human-to-human communications for e-commerce websites.

Keywords

Text-To-Speech (TTS) Voice, Avatar, Trust, Live Help, E-Commerce, Human-Computer Interaction.

INTRODUCTION

As competition increases in Business-to-Consumer e-commerce, online retailers are struggling to gain and retain more customers by implementing new customer support features. The importance of real-time human-to-human contact in establishing and maintaining relationships with customers have been realized by more and more merchants. Some pioneering companies have deployed a feature called "Live Help" to assist online shoppers while they search for specific merchandise and to answer shoppers' questions instantly through real-time communications with a serviceperson. "Live Help" distinguishes itself from other online customer support functions in that it involves human assistants (Aberg and Shahmehri, 2003). Currently, most "Live Help" services are implemented through instant text chatting between shoppers and customer service representatives (CSR). These conversations can be initiated either by a customer or by a service representative who engages customers proactively by greeting and inviting them to chat online. Such instant interactions have been claimed to be one important factor that bolstered Lands' End's e-commerce success (Dukcevich, 2002); the average value of an order increases by 6% when a potential customer uses the "Live Help" function, and an online visitor who uses Lands' End's instant messaging is 20% more likely to complete a purchase than one who does not.

The current study focuses primarily on the interface design of "Live Help" features provided by online shopping websites. Although significant progress has been made with real-time collaboration technologies and they have proved helpful in some situations, it is still not clear whether or not they are better than text-only instant chatting. With the availability of relatively low-cost multimedia and virtual reality (VR) technology, particularly Text-To-Speech (TTS) voice technology and 3D avatars, the media richness of both website interfaces and users' shopping experiences can be increased. However, before implementing these technologies based solely on intuition and common sense, their impacts on users' perception of the communication deserve a through investigation.

Kiesler, Zubrow, and Moses (1985) found that when two people met for the first time and discussed a series of questions in order to know one another, those who communicated by computer evaluated each other less favorably than did people who communicated face-to-face, felt and acted as though the setting was more impersonal, and their behavior was more inhibited. Similar arguments are also found in the literature of Computer-Mediated Communication (CMC) where the term "social

presence" was often used to describe a perception that a mediated experience is real rather than mediated (Lombard and Ditton 1997). According to Short, Williams, and Christie (1976), visual media have more social presence than verbal (audio) media, which in turn have more social presence than written media. In the context of electronic shopping, these findings may imply that the initial trust between consumer and a CSR would be even more difficult to build and develop, compared with those interactions took place in a physical store. Would multimedia and multimodal communication interfaces make a difference? Could the interface with higher level of social presence enhance consumer trust towards the CSR? These are the questions we tried to answer through this study.

The next section of this paper discusses the role of trust in electronic commerce and introduces the potential effects of information presentation mode and animated embodiment in a communication interface; the research model and hypotheses are presented thereafter. Section 3 describes the experimental design and methods used during the data collection phase of the study, and Section 4 summarizes and discusses the results. Finally, Section 5 discusses the implications, limitations, and conclusions of the study, as well as suggestions for future research.

LITERATURE REVIEW AND RESEARCH MODEL

Consumer Trust

In this research, we adopt Mayer and Davis's (1995) definition that trust is a "willingness to be vulnerable, based on positive expectations about the action of others". Prior research on online consumer trust mainly focuses on customer's trust towards the website or the company (e.g., Gefen and Straub, 2003; Hoffman, Novak, and Peralta, 1999; McKnight, Choudhury, and Kacmar, 2002). However, the major focus in this paper is interpersonal trust, more specifically, the customer's trust in the serviceperson who provide them with "Live Help", which is a counterpart to consumer trust towards the salespeople in traditional commerce. In the marketing literature, the concept of relationship quality, which to a great extent determines the future sales opportunities (Crosby, Evans, and Cowles, 1990), is composed of two dimensions: (1) trust in the salesperson (Swan and Trawick, 1988) and (2) satisfaction with the salesperson (Crosby and Stephens, 1987). Swan and Bowers (1999) posit that customer trust in the salesperson has two components: affect and cognition. Affect is the feeling secure or insecure about relying on the salesperson, and cognition is the belief that the salesperson has both the necessary competence and motivation to be relied upon. Xiao and Benbasat (2001) further define consumer trust as a three-dimensional concept. The three-dimensions refer to (1) cognitive trust in competence, (2) cognitive trust in goodwill, and (3) emotional trust, which is defined as "*customer's feelings about relying on an entity*".

Trust is also an important issue in the field of Computer-Supported Collaborative Work (CSCW) and Computer-Mediated Communication (CMC). For example, researchers found that interpersonal trust is likely to be affected by mediated communications. Bos, Olson, Gergle, Olson, and Wright (2001) studied the emergence of trust in four different communication situations: face-to-face, video, audio, and text chat. They found that all three of the richer conditions were significant improvements over text chat. Video and audio conferencing group were almost as good as face-to-face. Greenspan, Goldberg, Weimer, and Basso (2000) used a lab experiment to study prospective homebuyers who selected houses of interest using web, telephone, or PhoneChannel (Telephone plus TV). They found that telephone and PhoneChannel could lead to a higher trust.

In this paper, we studied the influences of different "Live Help" interface on both cognitive and emotional aspect of customer's trust toward the CSR under the computer-mediated online shopping environment.

Information Presentation Mode

The first independent variable investigated in this study is the information presentation mode applied in "Live Help". The modes examined are text, speech by a Text-To-Speech (TTS) synthesizer, and both. A TTS synthesizer is a computer-based system designed to read any text aloud (Dutoit, 1997). The fundamental difference between a TTS system and any other talking machine (e.g. a cassette-player) is the ability of the former to automatically produce new sentences. In other words, the TTS system does not simply concatenate isolated words or parts of sentences, but it also automatically produces speech through a grapheme-to-phoneme transcription of sentences (ibid.).

TTS systems are increasingly being used to develop anthropomorphic interfaces, and they have been implemented widely in the area of automated voice response services, Interactive Voice Response (IVR) systems, computer games, and even some Virtual Reality Environments (VRE) like Blaxxun communities. Compared to real human voice, the current TTS voice still has some intrinsic deficiencies because it lacks the quality and prosody of natural human speech. A comparative study (Beutnagle, Conkie, Schroeter, Stylianou, and Syrdal, 1999) shows that the current TTS systems perform pretty well on the intelligibility while still not satisfactory on naturalness. Computer-generated voices tend to have unnatural pauses, accents,

and word emphases, as well as discontinuities between phonemes and syllables (Nass and Lee, 2001). Even with the best TTS synthesizer on the market such as the AT&T Natural Voices, after listening to a couple of sentences, it is still quite easy for users to distinguish it from the lowest-fidelity presentation of human speech.

Limited research had been conducted to explore people's response to such "unnatural" machine voices. Among them, a series of studies (Lee and Nass, 2003; Lee, Nass and Brave, 2000; Nass and Lee, 2000, 2001) investigated whether or not participants would attribute some social responses to the computer-generated voices. It was found that people would regard a computer voice as more attractive, credible and informative, and evaluate products more positively, if the perceived personality of the voice matches their own (Lee and Nass, 2003; Nass and Lee, 2001). It has also been observed that users employ social cues even when they know that the voice speaking to them is not coming from a real person (Ibid.). Jensen, Farnham, Drucker, and Kollock (2000), after comparing four forms of communication, have found that TTS voice applications are perceived significantly more positively than text-only interactions, contrary to the researchers' predictions that TTS voice technology might lack cues that people use in predicting the veracity of utterances.

Animated Embodiment

The second independent variable in regards to "Live Help" interfaces is the use of animated embodiment (implemented with 3D avatar) to represent a serviceperson during the course of communication. The word "avatar" refers to a two- or three-dimensional virtual image symbolizing users. Two issues need to be addressed for the successful implementation of an avatar: function and representation.

(1) Function. Avatars have been used in collaborative virtual environments (CVE) to represent users' presence, orientation and location. Salem and Earle (2000) have proposed that an avatar could also be used to facilitate communications between users. In the current study, the avatar integrated in an online shopping website is used to represent the image of a customer service representative.

(2) Representation. According to Salem and Earle (2000), avatars can be realistic, abstract or naturalistic in form:

Realistic avatars are designed to provide accurate representations of users, for example a real time video image captured by a video camera may be used as the face of an avatar. However, this implementation is constrained by certain technical factors, including the bandwidth and computational power of the user's computer.

Abstract avatars use some cartoon image or fictitious entity, for example an animated talking dog or even a paper clip. Although these implementations have long been used in software-powered interface agents, notably in Microsoft Office, their effectiveness in supporting human-to-human communication has not been demonstrated empirically.

Naturalistic avatars are usually humanoid in form, but they have a degraded level of detail. This type of avatar can emulate natural protocols just enough to achieve recognition of familiar features, like a smile, a waving hand and a nodding head. This type of avatar was chosen in the current study, not only because it is technically feasible, but also because it preserves the multi-modal communications and conventional conversational habits of face-to-face interaction.

Hypotheses

The research model is depicted in Figure 1.

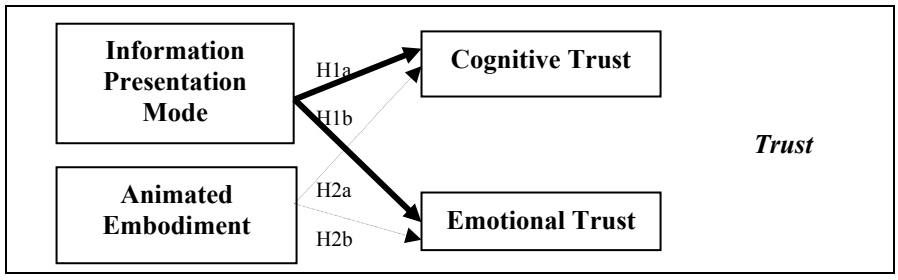

Figure 1: Research Model

Compared with face-to-face conversation, electronically mediated forms of communication, including telephony, video telephony, instant messaging and e-mail, provide less feedback to people who are speaking, and fewer sensory cues to people listening. With the addition of TTS voice and 3D avatars, customers are exposed to more audio-visual communication cues.

Furthermore, when a user interacts with a human-like virtual character that talks and moves in a vividly simulated audio-visual environment, more sensory cues are involved and perceived. Based on previous research into social presence, it is expected that higher level of vividness, determined by the number of sensory channels a medium appeals to (Short et al., 1976) and the quality of the medium's sensory fidelity (Reeves and Nass, 1996), enhances the degree to which senses are engaged, and therefore increases perceived levels of social presence. Although the AT&T Natural Voices TTS system used in this study is still far from satisfactory in naturalness compared with a real-human voice, it could convey some prosodic features, such as intonation and phrasing, by selecting units from a large speech inventory that best matched the prosody predicted by the TTS system (Jilka, Syrdal, Conkie, and Kapilow, 2003). The naturalistic 3D avatar built on Blaxxun Contact platform, although relatively a crude and simple representation of a communicator, is able to generate the most common gestures, such as nodding, shaking head, and waving hand, triggered automatically by the interaction content. We expect that these additional audio and visual cues (compared with text only) would be likely to enhance the users' perception of social presence in the context of receiving "Live Help" from a serviceperson.

Gefen and Straub (2003) showed that perceived social presence could affect consumer trust, the greater the social presence is, the more trust that can be developed by the other party. We posit that communication media richness could not only enhance consumers' perceived social presence, it could also influence the initial formation of positive interpersonal trust:

H1a: Live Help interface with TTS voice would lead to a higher level of cognitive trust in competence than the one without TTS.

H1b: Live Help interface with a 3D avatar would lead to a higher level of cognitive trust in competence than the one without avatar.

H2a: Live Help interface with TTS voice would lead to a higher level of emotional trust than the one without TTS.

H2b: Live Help interface with a 3D avatar would lead to a higher level of emotional trust than the one without avatar.

RESEARCH METHODS

Measurement

According to Xiao and Benbasat (2001), cognitive trust is defined as a trustor's rational assessment that a trustee will have the ability to fulfill its obligations as understood by the trustor; emotional trust is defined as a trustor's feeling secure and comfortable about relying on a trustee. Based on card sorting and factor analysis, they developed a complete set of measurement (all seven-point Likert scale items) for both cognitive trust in competence (5 items) and emotional trust (5 items). These measures were adopted in this study. (See Appendix-1 for complete measures).

Website Design

Six simulated "Live Help" interfaces were constructed (shown in Table 1) and integrated with a shopping website designed to sell digital cameras and camera accessories. The products (digital cameras, camera memories and photo printers) are suitable for this study because they involve a significant amount of technical information, and real-time interactions are highly appreciated by customers who have questions about the products prior to committing to a purchase.

Condition	"Live Help" Interface Features
1.	No Avatar + Text Only
2.	No Avatar + Voice Only
3.	No Avatar + Text + Voice
4.	3D Avatar + Text Only
5.	3D Avatar + Voice Only
6.	3D Avatar + Text + Voice

Table 1: Six Types of "Live Help" Interfaces

The look and feel of the interface was designed to resemble an actual shopping website (as shown in Figure 2 and Figure 3).

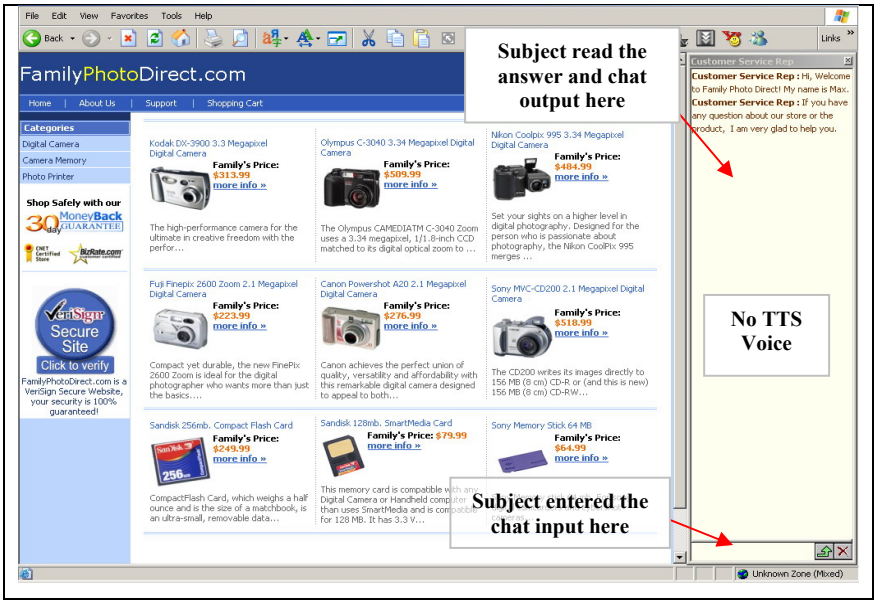

Figure 2: Live Help Interface with Text Chat Only

Figure 3: Live Help Interface with Both TTS Voice and an Avatar

Implementation of Live Help

With the use of "frame" tags of HTML, the shopping site was integrated with a "Live Help" interface that was implemented separately, while giving the subject the illusion that the "Live Help" feature was part of the shopping site.

Two research assistants were recruited for the experiment. One accompanied the subjects and walked them through the entire experimental process; the other remained in a separate room and used a networked computer to play the role of a CSR. This CSR assistant had been extensively trained on both the knowledge of digital camera and customer servicing skills.

Free software called Blaxxun Contact and its online virtual space were used to generate text chatting and to implement 3D avatars (see Figure 2 and Figure 3). Blaxxun Contact is a Virtual Reality Markup Language (VRML) plug-in for designing virtual communities. In this study, it was used in every condition for text chatting and for viewing and controlling a humanoid 3D avatar. In the without-avatar condition, subject saw only the chat input and output frame; in the with-avatar condition, an additional VRML frame was included, in which the subject saw an avatar as embodiment of the CSR. No other avatars were visible on the computer screen. To ensure consistency, subjects were not able to change any visual settings (such as avatar size, distance, view angles, etc.).

Body language is an important characteristic of avatar. The Blaxxun platform enables its avatars to exhibit several body movements, including waving hands, nodding, shaking heads, and frowning. All these body movements are activated by pre-defined keywords in the chat text. During the experiment, only the answers and advices given by the serviceperson could trigger the avatar's various gestures. Commonly used emotion-conveying words (for example, "Hello," "Exactly" and "Thank you") were selected and matched with specific avatar body movements. Figure-4 shows some examples of the avatar's body gesture and corresponding keywords.

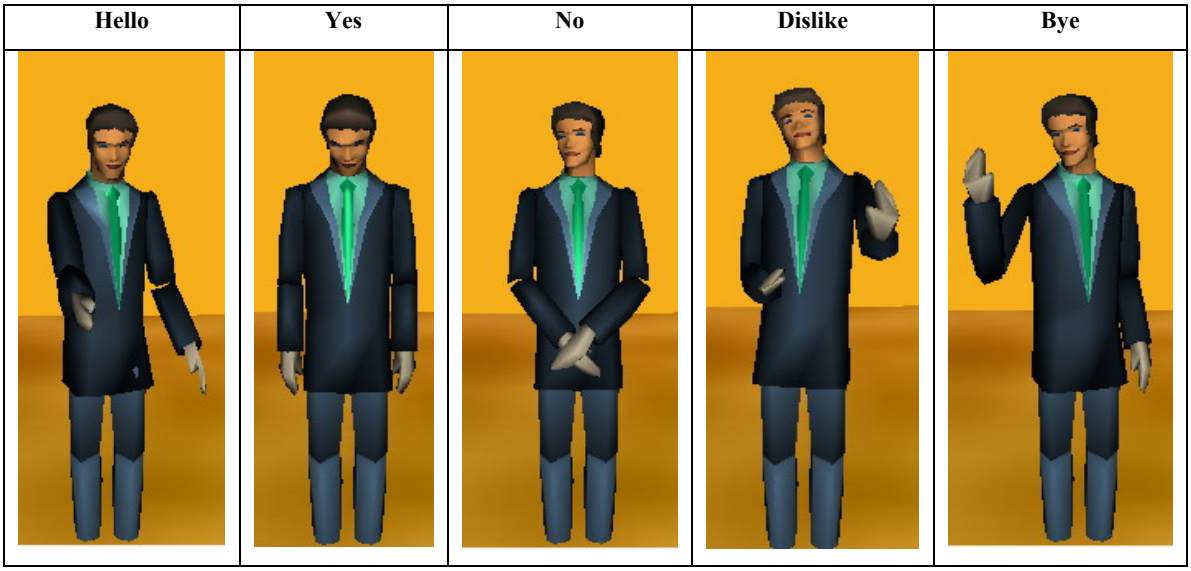

Figure 4: Body Gestures of the Avatar

AT&T Natural Voices was selected as the TTS engine for the current study because it is claimed to provide "the highest measured naturalness and intelligibility for U.S. English TTS in the world" (AT&T Labs, 2003). As a standard Speech Application Program Interface (SAPI) compliant component, it can be integrated with other software to "read" designated texts.

Experimental Procedures

72 participants (38 females and 34 males) were recruited for the experiment through campus advertisement. The average participant was 23 years old and most of them were university students. Their reward was $10 cash, plus a one-in-ten chance to win a gift certificate valued at 50 percent of the price of the camera that they picked during the experiment (up to $200). Subjects were randomly assigned to one of six interface groups. During the experiment, they were asked to buy a digital camera and related accessories as a gift for a friend. Time was not limited, although subjects normally spent around 40 to 60 minutes on the purchase process. The experimental procedures were designed as follows:

Training: At the beginning, each subject was trained by a research assistant on how to use and navigate the website interface and how to use the "Live Help" interface.

Main test: The subject was then asked to examine and to choose a digital camera, camera memory and a photo printer, and informed to use the "Live Help" function to interact with the customer service representative for any questions about the website or the products. After selecting the preferred products, the subject was asked to put them into a shopping cart. A research assistant was there to observe and record whether or not the subject used the "Live Help" feature.

Questionnaire: After completing the shopping task, the subject was asked to fill out a questionnaire with all of the measures.

DATA ANALYSIS AND DISCUSSIONS

ANOVA Results

The data were checked for their integrity and completeness before statistical tests were performed. Reliability tests indicate that the Cronbach Alpha of both dependent variables are over 0.8 (the Cronbach Alpha(α) of cognitive trust and emotional trust were 0.92 and 0.88, respectively), suggesting that these measures are reliable. A univariate ANOVA test was performed on each dependent variable. The descriptive statistics and ANOVA results are shown in Table 2.

	Information Presentation Mode				**Animated Embodiment**		
	Text Only Mean *(s.d.)*	**Voice Only** Mean *(s.d.)*	**Text + Voice** Mean *(s.d.)*	**F Value (*p*)**	**Without Avatar** Mean *(s.d.)*	**With Avatar** Mean *(s.d.)*	**F Value (*p*)**
Cognitive Trust	5.26 (1.15)	5.93 (0.74)	5.38 (1.07)	**3.080 (.053) ***	5.46 (1.03)	5.58 (1.05)	1.154 (.322)
Emotional Trust	4.86 (1.18)	5.45 (0.99)	4.75 (1.17)	**2.679 (.076) ***	4.96 (1.00)	5.09 (1.29)	0.245 (.622)

* p < .10 (2-tailed)

Table 2: ANOVA Results of Cognitive Trust and Emotional Trust

The results revealed that TTS had marginally significant effects on both cognitive trust in competence ($F(2, 66) = 3.080$, $p < .10$) and emotional trust ($F(1, 66) = 2.679$, $p < .10$). In other words, subjects tend to have more trust in the serviceperson's competence and also more likely to trust that person emotionally when the "Live Help" interface is implemented with a TTS voice. Scheffe test further revealed that "Voice Only" group is the highest one within different voice treatments while there is no noteworthy difference between the "Text Only" group and the "Text + Voice" group. No significant difference had been found between the avatar group and non-avatar group. Hypotheses H1a and H2a were marginally supported. Although no significant interaction effects had been found, a pair-wise comparison revealed that when the information presentation mode was "Voice Only", the avatar group reported marginally significant higher cognitive trust than the non-avatar group ($F(1, 22) = 3.879$, $p < .10$).

Discussions

Our experiment results showed that TTS Voice had marginally significant effects on user's perception of both cognitive trust in serviceperson's competence and emotional trust. Consistent with the findings by Jensen et al. (2000), more immediate forms of communications like TTS showed a greater impact on the development of trust. Despite the fact that TTS voice is sometimes monotonous in speed and lack of variety of tones, it is already realistic enough to generate significant social response, which is consistent with the results from other research works (Lee and Nass, 2003; Lee et al., 2000; Nass and Lee, 2000, 2001).

The lack of support for the avatar's effects could be attributed to the limitation of technology. In the current study, although the 3D avatar could generate basic body language, the lack of facial expressions greatly degraded the fidelity and warmness the subject might perceive in face-to-face communication. As well, the synchronization of the voice and body movement is not perfect in the current implementation. Additional studies need to be conducted to test whether the perception of trust could be significantly enhanced when a more vivid avatar with facial expressions and better synchronization being presented. Besides, the marginally significant result from the pair-wise comparison between condition 2 and 5 implies that 3D avatar could have higher impact on consumer's cognitive trust in competence when more attention had been spent on the information presentation medium instead of the content.

SUMMARY

The results from this study provided several important implications for practitioners in evaluating and designing "Live Help" interface features. As mentioned in a report on *The Wall Street Journal*, although people do enjoy the convenience of online shopping, long-distance purchases made without human contact still make them cautious before putting things into their shopping cart (Wingfield, 2002). When the communication interface becomes richer in expressiveness and more closely

emulates the face-to-face interactions, customers might feel that a web merchant is more trustworthy. This implies that the extra costs of implementing those technologies are justifiable from the increase of the merchant's reputation.

Several limitations should also be pointed out. From an experimental design point of view, the limited sample size employed in this study could pose a serious threat to the power level, indicating that the full set of differences between treatments may be difficult to identify. Since it had been demonstrated in similar studies that the effect size is usually either low or medium, additional data should be gathered in future studies to ascertain whether statistically significant effects would emerge. Also, the use of student subjects to some extent limits the external validity and generalization of the results. In addition, users' personal traits may have some effects on the results. For example, an individual's level of extroversion might affect whether she would like to use the "Live Help" function to interact with others during shopping, and the ease with which a feeling of emotional trust is developed.

As an interesting application field in the studies of human-computer interaction and online consumer behavior, the design of "Live Help" interface had been investigated in this paper. The results of this study build the foundation for answering other important questions: how the mediating variables such as feeling of trust would affect users' purchasing decisions? Does a media-rich "Live Help" interface increase the likelihood that users would make repeated visits in the future? Research along these lines is needed to comprehend the full set of potential benefits of TTS and avatar interface technologies.

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APPENDIX-1: MEASUREMENT (LIKERT-SCALE ITEMS)

1. Cognitive Trust in Competence

- I felt that the CSR was like a real expert in assessing products.
- I felt that the CSR was incompetent in evaluating available product choices.
- I felt that the CSR had expertise to understand my needs and preferences.
- I felt that the CSR was unable to capture my needs and preferences.
- I felt that the CSR had good knowledge about products.

2. Emotional Trust

- I felt secure about relying on the CSR for my decision.
- I felt uncomfortable about relying on the CSR for my decision.
- I felt happy about relying on the CSR for my decision.
- I felt unconfident about relying on the CSR for my decision.
- I felt content about relying on the CSR for my decision.