Presentation Format and Online Reviews Persuasiveness: The Effect of Computer-Synthesized Speech

Research-in-Progress

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Abstract

Computer-synthesized speech is emerging as a mainstream human-computer interface in post-PC devices. However, there is limited research on its effect on the user experience. We contribute to this emerging stream by focusing on online review persuasiveness. The current presentation standard is the text review accompanied by images and numeric ratings. We review the limited theory on the effect of synthesized speech on users and report preliminary results from a lab experiment. Our findings suggest that varying the message presentation, from text to speech, improves the persuasiveness of online reviews through stronger trust beliefs, attitude toward the subject of the review and purchase intention. However, they don't support the most intuitive explanation for why: that synthesized speech increases user perceptions of trustworthiness, expertise, credibility and similarity of the source. If confirmed, our results would call for an exciting search for the mechanisms by which speech interfaces increase the persuasiveness of massages.

Keywords: Persuasion, Online reviews, Computer-synthesized speech, Presentation format, Laboratory experiment

Introduction

The literature about online consumer reviews received much research attention in recent years. With their first appearance on the Internet in 1999, online reviews offered a possibility to express an opinion and rate products and services. Nowadays it is possible to search the Internet and find opinions about almost everything, from products and hotels to university professors and MDs. Online reviews are peer-generated evaluations posted on a company or third party websites (Mudambi and Schuff 2010). The perception of reviews being authored by peers contributed to their popularity and their influence on users' behavior. Individuals think that the online consumer reviews are written by other people – random first-hand users of a product or a service - people like them (Steffes and Burgee 2009; Zhang 2015). For this reason, they trust them and often prefer them to commercially-created messages (Chakravarty et al. 2010; Chen et al. 2016; Dou et al. 2012). In fact, online reviews are one of the most trusted media for advertising and for recommendations (*Global Trust in Advertising and Brand Messages*. 2013, *Global Trust in Advertising and Brand Messages*. 2015) and 80% of individuals trust them as much as if they were personal recommendations ("Local Consumer Review Survey" 2015). While there are many effects of online reviews, we focus on persuasion because that is their main purpose – they are meant to influence users and to spur them into action. In the commercial context this action is a purchase (or not) for positive (or negative) opinions. People read reviews for varied reasons, from obtaining information to

building relations in an online community, but no matter the motivation, online reviews affect the behavior of readers (Burton and Khammash 2010; Hennig-Thurau et al. 2003). Thus, researchers agree that online reviews influence decision-making processes and affect individuals' performed behaviors (Cheung et al. 2008; Duan et al. 2008; Hong and Park 2012; Kumar and Benbasat 2006; Litvin et al. 2008). The bulk of the literature focuses on the persuasive effects of online reviews, trying to explain what are the elements, having an impact on individuals' decision-making process and behavior. However, even if trust in the online reviews is clearly visible, individuals tend to favor realistic communication more and there is a correlation between perceived reality of settings or behavior of virtual communicator and the level of influence and social interactions of web users (Guadagno and Cialdini 2005; Suh et al. 2003). This shows that there is still a difference between computer-mediated and physical interactions. Thus, it would be beneficial to increase the persuasiveness of online reviews by increasing the realism of interaction with them. One approach is to change the presentation of opinions (Xu et al. 2015).

The current standard of online reviews presentation is the written text accompanied by images and numerical ratings, expressed as stars or 'bubbles'. Previous literature focuses on persuasiveness of review content, source type and readers' characteristics. However, little is known about the effect of presentation format on the persuasiveness of online reviews. Recent research shows that other presentation formats may increase the persuasive potential of online reviews (Xu et al. 2015). While previous work focuses only on online video, there are other emerging formats, such as speech synthesis being popularized by the likes of Apple, Google, Microsoft and Amazon. Although computerized speech synthesis traces its roots to the early 1900s (Mattingly 1970), it is only now becoming a standard feature in consumer electronics. Computer-synthesized speech communication appears to change people's attitude towards computers (Nass and Gong 2000; Nass and Lee 2001). Yet, knowledge about the topic is still limited and little is known about the potential effect of computer-synthesized speech in the context of e-commerce transactions. Early research focused on customer service (Qiu and Benbasat 2005) or retailer's avatars (Wang et al. 2007), but not on computer mediated interactions between customers (i.e., user generated content and online reviews).

Our research contributes new insights about persuasiveness of online reviews presentation formats. We investigate whether computer-synthesized speech can affect the persuasiveness of online reviews and the theoretical mechanisms by which such presentation format affects individual decision-making. The results, if confirmed, may influence the design of future online reviews platforms.

Literature background

Persuasiveness of online reviews

Positive online rating and reviews can 'modify people's attitudes about a product to which the online reviews pertain' (Hong and Park 2012, p. 906) and influence consumers' buying decisions (Goldenberg et al. 2001). Previous research focuses on persuasion by measuring the quantitative elements of online reviews (Duan et al. 2008) or secondary text characteristics such as emotions expressed in the review text (Yin et al. 2014), but not the content of the message itself. Yet, text feedback influences seller's credibility over and above numerical ratings (Pavlou and Dimoka 2006).

While generally trusting online reviews, people spend little time on reading them and comparing different opinions. Recent survey data suggests that most individuals (67% of respondents) read less than 7 reviews when making a decision (Anderson 2013). From 2011 to 2013 the number of people reading seven or more online reviews halved (44% to 22%). In short, people increasingly trust online reviews, but they read fewer reviews. Thus, understanding what makes a persuasive review is increasingly important.

The majority of researchers focus on the effect of valence (Hamby et al. 2015; Schlosser 2011; Xia and Bechwati 2008) or volume (Chin-Lung et al. 2011; Park and Kim 2008; Sher and Lee 2009) of online reviews on many aspects of their influence and persuasiveness. More recently, researchers started focusing also on contextual elements, like platform type (Jeong and Koo 2015; Tsao and Hsieh 2015), purchase and review posting timeframe (Jin et al. 2014) or context of presentation (Lee et al. 2011; Sparks et al. 2013; Sparks and Browning 2011). What is common to all these works is the presentation format, with all studies based on text reviews. A notable recent exception (Xu et al. 2015) demonstrates that a video review was more helpful, credible and persuasive than a standard, written review accompanied by

an image. While no work has investigated how presentation format affects persuasiveness of online reviews, there is evidence that presenting communication messages with avatars, (Lee et al. 2013; Qiu and Benbasat 2005) or computer-synthesized speech (Nass and Lee 2001; Qiu and Benbasat 2005) affects individuals' perception of credibility, expertise or persuasiveness of the message.

Persuasiveness of Computer-Synthesized Speech

Previous research has investigated the effects of computer-synthesized speech on human-computer interactions. People behave differently and hold different attitudes towards technology when computers deliver a message via speech versus text. Computer-synthesized speech increases credibility, conveys personality (Nass and Lee 2001) and persuades users (Joo and Lee 2014). Moreover, researchers proved that this kind of communication can change people's attitude towards computers (Nass and Lee 2001).

The psychology of speech processing is the theoretical underpinning of these findings (Nass and Gong 2000; Nass and Lee 2001). Recognition of speech, even computer-synthesized speech, is automatic and humans process it unconsciously. The presence of social characteristics in a speech makes people behave different, based on the unconscious belief that only other human beings may produce speech-like sounds. Thus, the human brain extends the understanding of speech also to computer-synthesized speech and starts looking for social cues of communication as if it was interacting with another person. When people hear computers "speaking," they 'make attributions about voice systems using the same rules and heuristics they would normally apply to other humans' (Nass and Gong 2000, p. 38). The human brain reads these implicit social cues and forms the belief that the computer is another member of the society. In response, individuals react as if the machines were another social actor (Nass et al. 1994) and start following social norms typical of communication processes between people (Cialdini and Trost 1998). Many Amazon Echo owners anthropomorphize it and refer to the device as "she" because it uses a female voice and it is addressed as "Alexa". A similar dynamic happens to people who have a GPS giving them vocal directions, but it does not occur when they interact through text interfaces or GUI. The phenomenon is unique to speech.

Empirical work finds that when individuals know that the message is delivered by a computer, there is no difference in perception of speech. That is, the effect of human voice on persuasiveness is no greater than the effect of synthesized voice (Stern et al. 2006) and in some cases of problem-solving situations, computer speech is actually more persuasive (Burgoon et al. 2000). The limited work on the role of computer-synthesized speech in computer-mediated, peer-to-peer commercial communication (Qiu and Benbasat 2005; Wang et al. 2007), confirms that even if a computer generates the voice message, speech is more enjoyable than a text message. Receivers of such a communication focus more on the content of the message than they do when they experience text and speech or text only treatments (Qiu and Benbasat 2005). It is recognized in the literature that to persuade an individual to make a decision or perform an action, one has to influence their 'mental states' (O'Keefe 1993). These can take form of beliefs, attitudes and behavioral intentions, which are antecedents of actual behavior (Fishbein and Ajzen 1977, 2011). Thus, to test the effect of presentation format on online reviews persuasiveness we test the effect of computer-synthesized speech on trust belief, attitude towards an object and purchase intention as proxies of persuasiveness. Furthermore, presentation of information via computer-synthesized speech leads to better long-term recall (Gathercole and Conway 1988). Persuasion occurs through a change in the receiver's 'mental states' (O'Keefe 1993), the beliefs, attitudes and behavioral intentions (Fishbein and Ajzen 1977, 2011). Thus, despite the lack of previous work, we hypothesize that the review presentation format has an effect on trust belief, attitude towards an object and purchase intention as proxies of persuasiveness.

> *H1a. Subjects receiving online reviews presented with computer-synthesized speech will form stronger trust belief than the subjects receiving text reviews.*
>
> *H1b. Subjects receiving online reviews presented with computer-synthesized speech will form more positive attitudes towards the reviewed product than the subjects receiving text reviews.*
>
> *H1c Subjects receiving online reviews presented with computer-synthesized speech will form stronger purchase intention than subjects receiving text reviews.*

Some researcher suggests that speech synthesis enhances the credibility of the message source when compared to written text (Burgoon et al. 2000; Nass and Lee 2001). Such a source is perceived as more

reliable and more knowledgeable than a source of a text message. There is no agreement on why this phenomenon occurs, or even if it occurs systematically. Some speculate that it may be due to the human perception of the interface (Burgoon et al. 2000) or because of increased sociability, caused by different presentation format (Burgoon et al. 2000; Nass and Lee 2001). However, there is no systematic evidence of this phenomenon and empirical testing of these explanations awaits. Thus, we posit:

H2a. Computer synthesized speech will increase perceived expertise of a review source.

H2b. Computer synthesized speech will increase perceived trustworthiness of a review source.

The online review literature shows that perceived source credibility has an effect on and is correlated with message credibility (Cheung et al. 2012; Smith et al. 2005) Credibility is defined as the recipient's belief in message reliability and it has been shown to contribute to the review's persuasiveness (Jiménez and Mendoza 2013). Taking into consideration that written text is not the most credible presentation format for online reviews (Xu et al. 2015) and following H2a and H2b, we hypothesize that:

H3. Computer synthesized speech will increase perceived credibility of a review.

Due to the fact that individuals treat speech sounds as produced by humans, we believe that when a computer produces speech, people unconsciously treat it as more akin to them, not like a machine. This creates the effect of similarity. Since the similarity between individuals increases the persuasiveness of a communication source (Burger et al. 2004), when people start perceiving the computer as a social actor who is similar to them, they are more prone to being persuaded by its messages (Nass and Lee 2001).

H4. Computer synthesized speech will increase perceived similarity of a review source.

In current literature, valence is the most studied characteristic of online reviews. A variety of persuasive characteristics like volume, argument quality, time frame interact with valence, affecting its persuasive strength (Flanagin and Metzger 2013; Jin et al. 2014; Schlosser 2011; Zhao et al. 2015). We hypothesize a similar dynamic for computer-synthesized speech.

H5. Presentation format will interact with the valence of a review, increasing the effect of valence.

Methodology

Design

We used a 2x2 factorial design to test our hypotheses in a lab experiment. Participants were randomly assigned to one of four groups. Each group accesses only one version of the experimental website. There were two factors in this study, which serve as independent variables. The first factor - review valence (VAL) with levels: positive valence or negative valence, represented by two sets of online hotel reviews. The second one was a presentation method (PRES), with levels: text or computer-synthesized speech. Control group participants read text reviews and treatment group participants listen to the reviews delivered by computer-synthesized speech. A male voice of a high-quality text-to-speech (TTS) software was used to produce computer-synthesized speech records of the reviews. The content of the reviews was exactly the same for all participants. All the non-treatment elements in for each group were exactly the same.

Variables

We used four dependent variables to measure the influence of the treatment on experiment subjects: perceived credibility, trust belief, attitude towards the hotel, and purchase intention. Each of them was measured with a scale from previous research. First, we focused on belief, attitude and intention as indicators of persuasion (Fishbein and Ajzen 1977; Sparks et al. 2013). We measured trust belief (TRB) with a 5-item scale and attitude (ATT) towards the hotel with a 3-item scale adapted from Sparks et al. (2013), and purchase intention (PI) using a 3-item scale adapted from Xia and Bechwati (2008). We measured perceived review credibility (CRED) with a 5-item scale adapted from Cheung and Lee (2012), Additionally, we measured also three variables referring to a perception of the source - perceived source expertise (SRCE) and perceived source trustworthiness (SRCT) (Ohanian 1990) and perceived similarity

(Lis 2013). Reliability of all the scales was additionally tested and is high or very high. The summary is presented in Table 1.

Table 1. Summary of constructs used in the study			
Construct name	Source	Number of items	Cronbach's α
Purchase intention	(Xia and Bechwati 2008)	3	0,95
Attitude towards the hotel	(Sparks et al. 2013b)	3	0,95
Trust belief	(Sparks et al. 2013b)	5	0,78
Perceived review credibility	(Cheung et al. 2012c)	5	0,77
Perceived source expertise	(Ohanian 1990)	4	0,84
Perceived source trustworthiness	(Ohanian 1990)	5	0,85
Perceived similarity	(Lis 2013)	3	0,79

Table 1. Summary of constructs used in the study

Participants

Participants of the study were university students and received an additional course credit to increase their motivation. We employed convenient, non-probabilistic sampling. All participants remained completely naïve about the aims and purpose of the study during the treatment but were debriefed after the experiment.

Apparatus

First, we prepared two sets of reviews and a model hotel review website. The reviews for the study were extracted from a database containing 200608 real hotel reviews, posted on one of the biggest hotel review platforms. We created two sets of reviews – one negative and one positive. Based on statistics that majority of people read only 6 or fewer reviews before making a decision ("Local Consumer Review Survey" 2015), each of the sets in the study contained only 6 reviews. We matched the content of the reviews in a way that they described similar topics. Additionally, a group of 4 master students were asked to validate the valence of the reviews. On average, the selected text reviews had 87 words and the records lasted 28 seconds. To avoid the bias of extreme rating values (Senecal and Nantel 2004) we kept the star-rating icons constant between reviews in each treatment.

Figure 1. Two formats of reviews presentation in the experiment

After selecting the reviews, we designed four identical model websites of a hotel reviews system (see Figure 1.). Each website presented a fictional hotel name, address, phone number, description and images of hotel interiors, as well as six hotel reviews. All websites had exactly the same non-treatment content and layout design, inspired by the most popular hotel reviews provider websites to increase users' familiarity with the layout and reduce potential usability errors. The difference between the treatments pertains to the valence of the reviews' content (negative vs. positive) and presentation method (text vs. computer-synthesized speech). After checking several options, we selected the most life-like commercial

voice available at the moment to produce the computer-synthesized reviews. All websites tracked users' behavior such as the number of clicks, timestamps, duration of the visit, time spent on reading/listening to each review. All the data from the model websites and the survey were stored in an external database and survey instruments were administered online at the end of the study.

Procedure

The experiment took place in a computer lab. First, participants were informed about the study (without revealing the purpose). All the participants were asked to wear headphones to provide the clear sound of computer-synthesized speech and to separate them from surrounding noise and potential distractions. After agreeing with an informed consent form and reading instructions, each participant was randomly assigned to one of the four treatments. The participants were asked to familiarize themselves with the content of the websites in the same way as if they did when preparing a trip. They were free to use all the information from the provided website. To ensure that all groups had the same conditions, participants had to click on a title of a review to display text or to reproduce sound. They could read or listened to the reviews as many times as they wanted. We did not set any time limits on the task, so that the participants could read the reviews as they normally do. Next, every participant filled a survey about perceptions of the hotel qualities and their purchase intentions. In the end, each subject is debriefed and the real purpose of the experiment is revealed.

Pilot Study

We ran a pilot study to test the experiment application and the variables used to measure the behavior. In April and May 2015, 40 students took part in our experiment. Many of them were not motivated or focused on the study. E.g. they opened the treatment page for too short time to receive the treatment or did not display any of the reviews. Some of them did not read the questions and answered the control questions incorrectly. Out of 40, only 26 records could be considered usable. We improved the design of the application to increase its usability and to control for attentiveness and accuracy of the participants. We included two control questions in the survey, which controlled participants' attentiveness. Additionally, in order to make sure that each participant received the treatment, we made it obligatory to open the reviews before proceeding to the survey. We added also a simple hearing ability test, which each subject had to complete after having time to read or listen to the reviews. Last, we improved phrasing of some questions, which were reported as difficult to understand (e.g. hypothesis-guess question).

Preliminary results

Data cleaning

To date, 40 students participated in the experiment. 3 of them did not pass the control questions or the hearing ability test, thus, we removed their records from the dataset. In the pilot study, many participants opened the treatment page for a short time. It was shorter than needed to read at least the titles of the reviews and it was clear that these participants did not receive the treatment. To avoid that, in this study we excluded all the participants who received speech treatment and spent less than 2,5 minutes on the page or who received the text treatment and spend less than 1,5 minute on the page. After this operation, there were 36 usable records in the dataset. Participants were randomly assigned to the treatments as presented in Table 2.

Sample description

The participants were between 18 and 35 years old and were university students, representing an age group, which constitutes a majority of people who always or most often use the online reviews (Short 2014). Overall, there were 44% females and 56% males. The majority of participants were online reviews users and reported that they usually rely on online reviews before performing commercial activities online.

Table 2. Sample size of treatment groups		
Treatment		**Number**
Presentation	**Valence**	
Speech	Negative	11
Speech	Positive	8
Text	Negative	12
Text	Positive	5
TOTAL		36

Table 2. Sample size of treatment groups

Difference between treatment groups

Table 3. presents averages and standard deviations for the dependent variables in each treatment group. In groups in which participants received computer-synthesized speech treatment, means of all presented variables are higher than in analogous groups with text treatment.

Table 3. Summary of dependent variables averages in each treatment group								
Variable	**Treatment**							
	Speech / Positive		*Speech / Negative*		*Text / Positive*		*Text / Negative*	
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
PI	5.25	1.83	2.7	1.03	3.47	0.99	2.22	0.89
ATT	6	1.01	2.82	0.83	5.07	0.43	2.19	0.86
TRB	5.25	0.97	3.13	0.55	4.4	0.97	2.98	0.61
CRED	5.7	0.79	5.51	0.75	4.64	0.91	5.3	0.87
SIM	5.25	1.63	4.67	0.75	4.13	1.07	4.44	1.33
SRCE	5.03	0.88	4.59	0.74	4.4	0.72	4.48	1.06
SRCT	5.83	0.82	5.07	0.98	4.84	0.5	5.03	0.88

Table 3. Summary of dependent variables averages in each treatment group

We tested *H1* with ANOVA for each of three dependent variables related to persuasiveness and we found statistically significant differences between treatment groups for purchase intention and attitude towards the hotel at the level of significance < 0.01 and for trust belief at the level of significance < 0.05. The results showed that the main effect size (η^2) for purchase intention was medium (0.08) and small for attitude towards the hotel (0.04) and trust belief (0.03). We make allowance for the small sample size. Hence, we cannot unequivocally support *H1a*, *H1b* and *H1c*.

Table 4. The results of ANOVA for PI, ATT and TRB				
Variable	*F-value*	*Sum of squares*	*Effect size* η^2	*P-value*
Purchase intention	8.615	12.57	0.08	0.006
Attitude towards the hotel	15.664	11.23	0.04	< 0.001
Trust belief	6.336	3.461	0.03	0.017

Table 4. The results of ANOVA for dependent variables

However, the results of ANOVA are promising and, if repeated with a bigger sample, they will make it possible to support the predictions about the effect of computer-synthesized speech on online reviews' persuasiveness. Table 4. summarizes the results of ANOVA for online review persuasiveness variables.

Distributions of residuals of perceived source trustworthiness was not normal for both untransformed and transformed (logarithmic and square root) data. Non-parametric Wilcoxon-Mann-Whitney test showed that there was no statistically significant difference between treatment groups (p-value = 0.06). For the same reason, we tested *H3* in the same way and found no main effect of presentation format on perceived credibility (p-value = 0.07). The distribution of residuals for perceived source expertise demonstrated normality. However, ANOVA test did not show any significant difference between treatments (p-value = 0.29). Thus, we reject hypotheses *H2a*, *H2b* and *H3*.

The format of presentation did not affect the perceived source similarity either. The ANOVA showed that there was no statistically significant effect of presentation format on similarity (p-value = 0.18). However, even if insignificant, there was a small effect size of presentation format (η^2 = 0,04). Thus, at this point we reject the *H4*, but acknowledge the existence of small effect size.

The main effect of valence was significant at confidence level < 0.01 for each of three variables related to persuasiveness and demonstrated a very large effect for each of them (PI η^2 = 0.33, ATT η^2 = 0.69, TRB η^2 = 0.55), but did not show the effect on any other dependent variable. The results corroborate the existing literature. However, we did not identify any significant interaction between valence and presentation format. Hence, at this point we cannot support *H5*.

Discussion

Despite being preliminary and based on a small sample, our results suggest promising implications for theory. We have preliminary support for the hypotheses about the influence of presentation format on online reviews persuasiveness. We find that individuals formulate stronger trust beliefs, attitude toward the subject of the review (i.e., the hotel) and purchase intention. In other words, simply varying the message presentation method from text to computer-synthesized speech, persuasiveness improves. This result, if confirmed, is important because it shows that decision-making in commercial settings is influenced by the interface. We are not aware of any work demonstrating this effect in the context of online reviews.

Our preliminary results do not identify any effect of presentation format on individuals' message source perceptions. They also fail to detect the hypothesized perception of increased similarity with the review source. These outcomes could be due to the limited number of subjects in the experiment. An alternative explanation could be the lack of variance in the voice of the computer synthesized speech software. This might create the impression that all the reviews are read by the same person, decreasing trust towards them. However, if confirmed when we eliminate the confounds, the hypotheses would challenge the intuitively appealing expectation that synthesized speech makes the message more persuasive because humans feel closer to computers when they produce speech. This "peripheral cue" explanation (Petty and Cacioppo 1986) suggests that the persuasion is not being affected by the processing of the content by the user, but rather by the perception of the message source. Challenging this expectation opens up a search for competing causes based on a "central cues" reasoning (Petty and Cacioppo 1986). Is synthesized speech more persuasive because people pay more attention to it? This is consistent with some work in the online education context (Gathercole and Conway 1988).

We are in the process of collecting more data and refining our understanding. The preliminary results provide support for the basic hypothesis that synthesized speech affects the persuasiveness of online messages, but they also challenge our expectation of the process by which such persuasion occurs. There is surprisingly little theoretical guidance for those studying the effect of computerized speech synthesis. With the relentless evolution of voice interfaces in the home (e.g., Amazon Echo), in the car (e.g., navigation systems) and in everyday activities (e.g., Siri, Cortana) it is imperative that Information Systems scholars focus on this topic. We plan to contribute our complete findings to this effort.

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