Computers in Human Behavior 33 (2014) 39–48

Contents lists available at ScienceDirect

Computers in Human Behavior

journal homepage: www.elsevier.com/locate/comphumbeh

The affective outcomes of using influence tactics in embodied conversational agents

Douglas C. Derrick *, Gina Scott Ligon

University of Nebraska at Omaha, 6001 Dodge St, Omaha, NE 68182, United States

ARTICLE INFO

Article history:
Available online 20 January 2014

Keywords:
Embodied agents
Influence
Impression management
Gender differences

ABSTRACT

In this study, we highlight the theoretical underpinnings of human impression management tactics and link them to current research in embodied conversational agents. Specifically, we incorporated impression management behaviors into an embodied conversational agent in order to show that different influence strategies affect user perceptions, and how those perceptions might be moderated by user gender. We programmed the agent to use two human impression management techniques (ingratiation and self-promotion) and had the agent interact with 88 users. After the interaction, users reported their perceptions of the system's power, trustworthiness, expertise, and attractiveness. The impression management techniques altered users' perceptions and these perceptions were moderated by gender differences.

1. Introduction

As information systems have become more pervasive, human–computer-interaction has also become more ubiquitous, natural, and prolific. With the introduction of automated assistants (e.g., Apple's Siri), it is important to understand how communication behaviors of automated information systems can affect human perceptions, human behavior, and decision-making. Technology pervades daily life and aids decision-making at every level of human activity from where to eat lunch to how to deploy company resources, resulting in intertwined and often long-lasting relationships between users and information systems. Similarly, embodied conversational agents (ECAs) are increasingly incorporated into a variety of contexts as the interface to complex systems (Derrick, Jenkins, & Nunamaker, 2011; Nunamaker, Derrick, Elkins, Burgoon, & Patton, 2011). These ECA human-like renderings, often coupled with environmental sensors, are interfacing with people in natural ways. The ability for computers to interact naturally with people leads to the question as to whether communication techniques and patterns that are useful in human-to-human interactions can be extended to human–computer interactions. To date, there has not been a systematic examination of how behavioral influence tactics affect users of computer systems. Similar to an individual's influence mechanisms to others, it follows that an embodied agent can affect its environment by the messages that it delivers and behavior that it exhibits. As machines become more integrated into human teams, human–computer systems should be capable of encoding and relaying deliberate actions to their human communication partners. Thus, a central goal of the present effort is to examine whether communication tactics can be generalized from the human-to-human interactions, to human–computer interactions.

In this study, we highlight the theoretical underpinnings of human impression management tactics and link them to current research in embodied conversational agents. Specifically, we incorporate impression management behaviors into an embodied conversational agent to investigate how different influence strategies might affect user perceptions, and how those perceptions might be moderated by user gender. In the following sections, we will review the theoretical background of Embodied Conversational Agents (ECAs), impression management and influence, and gender differences. We also share the results of a study in which an ECA employed various impression management techniques (e.g., ingratiation, self-promotion), and then we measure the effects these actions had on the human participants' perceptions of the system using validated measures of source credibility (e.g., power, expertise, likability, attractiveness, and perceived trustworthiness). We conclude by discussing the results, limitations, implications, and offering future research directions.

2. Theory

As systems advance, we need to explore new dimensions of human–computer interactions based on natural communication patterns. Next generation information systems will involve both the automated delivery of human-like communication and the interpretation of human verbal and non-verbal messages (Derrick

* Corresponding author. Address: Peter Kiewit Institute, University of Nebraska at Omaha, Suite 280C, 1110 S. 67th Street, Omaha, NE 68182, United States. Tel.: +1 402 554 2060.
E-mail address: dcderrick@unomaha.edu (D.C. Derrick).

0747-5632/$ - see front matter © 2014 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.chb.2013.12.027

et al., 2011; Elkins & Derrick, 2013; Nunamaker et al., 2011). Given these assertions, the ability for a computer system to have a knowledge-base on which to draw in order to deliver appropriate messages to a human user is an ambitious undertaking and is a novel concept for future information systems (Burgoon, Derrick, & Elkins, 2011; Zeng, 2004). Users and information systems have intertwined and often form long lasting relationships. These relationships are complex and, in some ways, mirror human-to-human interpersonal relationships (Nass, Moon, Fogg, Reeves, & Dryer, 1995). Information systems are often viewed as social actors (Nass, Moon, Morkes, Kim, & Fogg, 1997). Information systems are the conveyors of communication messages, and, in some cases, may be the creators of the messages themselves. As machines become more integrated into human teams, human–computer systems should be capable of encoding and relaying deliberate actions to their human communication partners. These communication actions (i.e., behaviors and messages) are analogous to *effectors* in the context of intelligent agents. An effector is a device used or action taken by an artificially intelligent agent to produce a desired change in an object or environment in response to an input (Wooldridge & Jennings, 1995). We posit that ECA systems may be able utilize behavioral effectors to affect human perception. Examples of human-perception effectors may include human influence tactics, impression management techniques, communication messages, agent appearance, agent demeanor, and many other interpersonal communication and persuasion strategies.

2.1. Embodied conversational agents

Embodied conversational agents are computer-generated cartoon-like characters that demonstrate many of the same properties as humans in face-to-face conversation, including the ability to produce and respond to verbal and non-verbal communication (Cassell, Sullivan, Prevost, & Churchill, 2000). These agents have been used as in connection with Computers as Social Actors (CASA) theory, which proposes that human beings interact with computers as though computers were people (Nass, Steuer, & Tauber, 1994). In multiple studies, researchers have found that participants react to interactive computer systems no differently than participants react to other people (Nass et al., 1997). It is suggested that people fail to critically assess the computer and its limitations as an interaction partner (Nass & Moon, 2000) and, as a result, the norms of interaction observed between people occur no differently between a person and a computer (Hall & Henningsen, 2008). Given these assertions, it is reasonable to propose that impression management techniques that work in human-to-human interactions also have an effect in human–computer interactions. Some similar studies include instances where computers (not ECAs specifically) have been purposefully designed to praise or criticize performance (Nass & Steuer, 1993), to display dominant or submissive cues (Moon & Nass, 1996; Nass et al., 1995), and to flatter participants (Fogg & Nass, 1997). Other studies have explored the role of gender and flattery (Lee, 2008) and the effect of displaying similar or dissimilar interaction cues with participants (Moon & Nass, 1998).

Mindlessness is a similar concept to CASA. Langer (1992) explains the similarity of human-to-human and human–computer interactions by positing that individuals respond unthinkingly to computers as if they were other people. That is, they do not stop to think that the representation is just a series of bits and lights, but "mindlessly" (Nass & Moon, 2000) view it as a social partner (Hall & Henningsen, 2008). Other studies examine different behaviors in pedagogical agents (embodied agents used for teaching). These studies are relevant because some of them focus on the behavior of the agent (Krämer & Bente, 2010; Mayer, Johnson, Shaw, & Sandhu, 2006; Wang et al., 2008).

2.2. Studies involving ECA appearance

Multiple studies have shown that ECA appearance affects users' perceptions. For example, Van Vugt, Bailenson, Hoorn, and Konijn (2008) investigated the effects of facial similarity between users and embodied agents under different experimental conditions. Their results showed that the facial similarity manipulation sometimes affected participants' responses, even though they did not consciously detect the similarity. Specifically, when the agent was helpful, facial similarity increased participants' ratings of involvement. However, when exposed to unhelpful agents, male participants had negative responses to the similar-looking agent compared to the dissimilar one. Similarly, Qiu and Benbasat (2010) demonstrated that matching ECA and users' ethnicity (not gender) resulted in Product Recommendation Agents being perceived as more social, enjoyable, and useful than mismatched demographics. Nunamaker et al. (2011) showed that changing the gender of the ECA affected perceptions of users.

Another group of researchers demonstrated that an ECA had greater influence on participants' attitudes and self-efficacy than a disembodied voice alone (Rosenberg-Kima, Baylor, Plant, & Doerr, 2008). In addition, they showed that the agent models that were similar to the young women in their study tended to be the most effective for positively influencing the participants' stereotypes and self-efficacy. In short, the agents that participants perceived as peer-like were the most effective in improving attitudes and beliefs.

Green, MacDorman, Ho, and Vasudevan (2008) measured human responses to varying facial proportions in people, androids, mechanical-looking robots, and two- and three-dimensional characters. They showed that participants had greater agreement on the best proportions of faces they considered more humanlike and more attractive, and less tolerance for deviation from these proportions in more attractive faces. MacDorman, Green, Ho, and Koch (2009) also studied the effect of the uncanny valley in ECA appearance. They varied a computer generated human character's facial proportions, skin texture, and level of detail to examine their effect on perceived eeriness, human likeness, and attractiveness, and propose a set of design principles for bridging the uncanny valley.

2.3. ECA facial expressions

Multiple studies have been conducted on the effect of avatar demeanor on human perceptions (Beale & Creed, 2009; Clayes & Anderson, 2007; Cowell & Stanney, 2005; Rosenberg-Kima et al., 2008). Cowell and Stanney (2005) found that changing the demeanor through facial expression changed perceptions of an avatar's credibility. Similarly, Clayes and Anderson (2007) found that agent facial features were able to affect perceptions of likability. Bartneck and Reichenbach (2005) examined the influence of the geometrical intensity of an emotional facial expression from an ECA on the perceived intensity and the recognition accuracy by the human. Niewiadomski and Pelachaud (2010) present an ECA capable of displaying a vast set of facial expressions to communicate its emotional states as well as its social relations. They created an algorithm to determine the correct display for an affective state and compared computer generated affective displays to users' perceptions of the display with high accuracy. Another study showed that a smiling versus a neutral ECA affected user perceptions (Nunamaker et al., 2011).

2.4. ECA behaviors

Beyond appearance, ECA behavior and the messages that it sends have an effect on users' perceptions and behavior. For exam-