Differences in perceptions of communication quality between a Twitterbot and human agent for information seeking and learning☆

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ABSTRACT

Twitter's design allows the implementation of automated programs that can submit tweets, interact with others, and generate content based on algorithms. Scholars and end-users alike refer to these programs to as "Twitterbots." This two-part study explores the differences in perceptions of communication quality between a human agent and a Twitterbot in the areas of cognitive elaboration, information seeking, and learning outcomes. In accordance with the Computers Are Social Actors (CASA) framework (Reeves & Nass, 1996), results suggest that participants learned the same from either a Twitterbot or a human agent. Results are discussed in light of CASA, as well as implications and directions for future studies.

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1. Introduction

With 320 million active users (Welch & Popper, 2015), Twitter holds a position as one of the largest social networking sites in the world. Its extensive adoption and simplicity make Twitter a prominent medium for distributing a variety of information by individuals and organizations alike. Although Twitter offers a streamlined interface both for content creation and consumption, maintaining relevancy requires more than updating a feed. Tweets often require a significant amount of thought and crafting to be effective. Without the resources of time or funding to hire a human, organizations may enlist the help of automated programs. According to Zhao (2003), automated programs "differ from other types of computer programs in that they are specially designed to communicate with humans in place of humans ... [and] can be grouped into two categories: instrumental or communicative" (p. 448). Instrumental automated programs work in scenarios or applications that require simple automated responses (e.g. Google Maps). Communicative automated programs interact with people

in ways that mirror human communication. (e.g. Microsoft's Cortana, Apple's Siri).

Twitter's design allows automated bots to interface with others in a variety of ways. As a result, organizations frequently employ programs that act in the place of human agents. Some Twitterbots spread useful information, such as Adam Parrish's @everyword, which since 2008 continues to Tweet virtually every word in the English language every 30 seconds. Some bots exist for mischievous purposes and damage Twitter's reputation by sending out spam and promotional hyperlinks. Although useful in many contexts, most Twitterbots exist for communicative task-oriented purposes such as reminders, scheduling, content creation, or information dissemination (Edwards, Edwards, Spence, & Shelton, 2014). Automated Twitterbots allow organizations to possess a social network presence with minimal human input. This "botification" allows computer software effectively to replace the role of a human (Hwang, Pearce, & Nanis, 2012). Research exploring methodologies for differentiating human or automated accounts note that being able to distinguish the difference can be difficult. Although there were some differences, the distinction between human or automated accounts in updating patterns was similar (Chu, Gianvecchio, Wang, & Jajodia, 2010). Though research has given insight into the differences between human or automated accounts, further research is necessary to understand how automated

programs, or Twitterbots, can impact the social media network. (Edwards et al., 2014; Wagner, Mitter, Körner, & Strohmaier, 2012).

This two-part study explores the differences in perceptions of communication quality between a human agent and a Twitterbot in the areas of cognitive elaboration, information seeking, and learning outcomes. With the growth of both Twitter and the adoption of automated computer systems intended to interact with people, scholars and professionals alike will benefit from a greater understanding of the potential differences in perceptions of human agents versus Twitterbots. This study examines how individuals consume and perceive information through social media, and Twitter's specific role as an information source.

1.1. Twitter as an information source

Social media refers to the computer-mediated tools that allow people to create, share or exchange information about career and personal interests, news stories, and pictures/videos on online networks (Buettner, 2016). Over two billion people worldwide use some form of social media (Kemp, 2015). People use social media for a host of purposes (Jin & Liu, 2010), especially as a source for information (Pepitone, 2010). Presently, Twitter, the third largest social networking website behind Facebook and YouTube (Barnett, 2011; Parmelee & Bichard, 2012; Top Sites, 2016), is among the most used of these social media information sources. (Morris, Teevan, & Panovich, 2010; Sin & Kim, 2013). Twitter holds a top-ten Alexa rank (a website that measures web traffic and reports the most popular sites on the internet) (Top Sites, 2015). As a social media platform, Twitter provides valuable content for information seeking (Lachlan, Spence, Lin, Najarian, & Del Greco, 2016; Spence, Lachlan, Lin, & Del Greco, 2015). Several factors of Twitter interface facilitate the open and prompt flow of information.

The ability to share previously unknown information proves to be another important consideration in social media as an information source. Sites, such as Twitter, allow users to broadcast their social networks to others (Donath & Boyd, 2004). Users can evaluate and form impressions of other's perceived communication characteristics, such as competence, credibility, or attractiveness. Users may decide to seek additional information, or to be motivated to centrally (or peripherally) process information they read on Twitter based on these factors. Additionally, with the vast ability to create one's online self, being able to discriminate and filter information is a critical skill for people exploring the online world (Haas & Wearden, 2003).

Users form perceptions and impressions of another used based on the various cues within the Twitter pages they observe (Edwards et al., 2014; Lin, Spence, & Lachlan, 2016). Westerman, Spence, and Van Der Heide (2014) found a positive relationship between cues such as update frequency with perceptions of credibility; demonstrating faster updates lead to increased perceptions of credibility. Furthermore, this study found cognitive elaboration mediates the relationship between update speed and information seeking. In another cue system study, Edwards, Spence, Gentile, Edwards, and Edwards (2013) demonstrated that Klout score (the overall influence a user holds over a social network) influenced perceptions of credibility. Cues such as a username, the number of followers, posted links leading to credible sites, the coherence of tweets, the number of retweets, expertise, and reputation of the user all influence source credibility (Morris, Counts, Roseway, Hoff, & Schwarz, 2012).

1.2. Computers are Social Actors (CASA)

The Computers are Social Actors (CASA) framework provides a lens to understand better the potential similarities and differences between Twitterbots and human agents. CASA provides a practical and valuable paradigm through which to observe communication phenomenon (Nass, Steuer, Tauber, & Reeder, 1993). One of the CASA frameworks strengths lies in its simplicity; a researcher simply replaces a human with a computer in an interaction to test it. Studies indicate that when interacting with a machine possessing anthropomorphic traits similar to a humans, (a) individuals mindlessly interact with machine in a social manner, (b) attribute influence to the artificial human characteristics of the computer, and (c) do not centrally process information as indicative of a computer (Nass & Moon, 2000).

Research over an extensive amount of time has demonstrated that traditional social-science and communication theories hold up in human-computer interaction. According to Reeves & Nass "people's responses to media are fundamentally social in nature" (1996, p. 251). Using CASA as a framework, humans identify and assign personalities such as dominance to computers (Nass, Moon, Fogg, Reeves, & Dryer, 1995), and make mindless attributions to computers such as gender (Lee, Nass, & Brave, 2000). Human-computer interaction reflects significant emotional and behavioral effects similarly to human-human interaction (Brave, Nass, & Hutchinson, 2005; Ferdig & Mishra, 2004). Nass, Moon, and Carney (1999) found that proximity affects human's evaluations of computers in a computer-led tutoring session. People treat computers as teammates in task situations (Nass, Fogg, & Moon, 1996), and evaluate computers differently based on vocal characteristics (Lee, 2010).

Research has recently expanded the conceptualization of a "computer" to include websites (Karr-Wisniewski & Prietula, 2010) and social robots (Lee, Park, & Song, 2005; Stoll et al., 2015). Edwards et al. (2014) found that the use of Twitterbots resulted in similar perceptions of credibility as that of human agents. In demonstrating that humans treat computers in a similar manner to how they treat other humans (even in situations with limited social cues), CASA proves to be a simple theoretical framework to use. Whether commonly acknowledged or not, individuals employ human-human interaction cues when interacting with a machine. With CASA in mind, this study conducted two experiments to examine the similarities and differences between Twitterbots and human agents for cognitive elaboration, information seeking, and learning outcomes.

2. Study One

2.1. Cognitive elaboration and information seeking

Cognitive elaboration involves the process of forming associations between new information and prior knowledge (DeFleur & Ball-Rokeach, 1989; Eveland, 2001). Many studies demonstrate the relationship between cognitive elaboration and persuasion processes (Lachlan, Spence, Edwards, Reno, & Edwards, 2014; Spence, Lachlan, Edwards, & Edwards, 2016). Petty and Cacioppo (1986) found the key to audience persuasion relies on an audience's perception of information as logical, and their willingness to centrally process it. Additionally, people with higher levels of information processing will learn more from media than those with lower levels (Fleming, Thorson, & Zhang, 2006).

Related to cognitive elaboration, information seeking refers to the tendency for individuals to search for additional knowledge based on messages they encounter (Lachlan, Spence, Lin, & Del Greco, 2014; Spence et al., 2016). Creators of messages that wish to be effective must consider an individual's orientation to engage in this behavior. Times of risk and crises heighten this desire for information, resulting in many positive outcomes (Spence, Westerman, Skalaksi, et al., 2006). With increases in automation