Differential social attributions toward computing technology: An empirical investigation

Richard D. Johnson\textsuperscript{a,}* , George M. Marakas\textsuperscript{b}, Jonathan W. Palmer\textsuperscript{c}

\textsuperscript{a}College of Business Administration, University of Central Florida, Orlando, FL 32816-1400, USA
\textsuperscript{b}School of Business, University of Kansas, Lawrence, KS, USA
\textsuperscript{c}School of Business Administration, College of William and Mary, Williamsburg, VA, USA

Received 29 July 2004; received in revised form 16 August 2005; accepted 19 September 2005

Communicated by P. Zhang

Abstract

A debate exists as to whether social cues should be intentionally designed into the user interface. Some have argued that such interfaces will improve comfort with the interface, create a more natural interaction and improve productivity, although others have argued that these interfaces will lead individuals to ascribe characteristics and responsibilities to computing technology that it does not have. Despite the debate, limited research has focused on the impact these interfaces have on how people ascribe responsibility to computing technology. Drawing from social psychology, empirical work regarding social responses toward computing technology, and attribution theory, this research empirically tests a model developed by Marakas et al. [2000. A theoretical model of differential social attributions toward computing technology: when the metaphor becomes the model. International Journal of Human Computer Studies 52, 719–750] which identifies and explains several of the factors that contribute to differential social attributions toward computing technology.

Using data from 240 students and professionals, results from a laboratory study indicate that attributions toward computing technology are influenced by an individual’s core self-evaluations, their generalized beliefs about the social role of computing technology and the nature of the computer interface used. Specifically, the results provide support for the argument that certain individuals do indeed attribute independent agency to computing technology and respond accordingly, and that this propensity is magnified when exposed to a computer with a distinctly social interface. Implications for both the applied and academic research communities are discussed.

© 2005 Elsevier Ltd. All rights reserved.

Keywords: Interface design; Anthropomorphism; Core self-evaluations; Computer as social actor; Social responses toward computing technology; Attribution theory

1. Introduction

Both the information systems (IS) research and applied communities have long sought to understand how to best leverage computing technology in an organizational setting for maximum benefit. To that end, one area of focus has been the development of more human-like interfaces intended to promote greater comfort with the technology by providing common social cues to the end user. In an effort to better describe and understand such technologies, users, developers, and those who train people to use computers have adopted an anthropomorphic lexicon that describes computers via the human metaphor. As such, computer functionality is commonly described with words like “reads”, “writes”, “thinks”, “is friendly”, “catches and transmits viruses”, etc. Despite this pervasive approach, some researchers have argued that this propensity to anthropomorphize computing technology and to design interfaces that use anthropomorphism creates potential confusion as to the true nature of computing technology (cf. Winograd and Flores, 1987; Shneiderman, 1998). Through vigorous debate, others have argued in favor of
such interfaces (cf. Reeves and Nass, 1996) suggesting the value of the underlying application is enhanced by the presence of human-like characteristics in the interface.

At the heart of this debate is the implicit assumption that users of computing technologies are essentially homogeneous with regard to their acceptance of a human-like interface. Despite their vigor in defending their position, neither side of the debate acknowledges that the logical heterogeneity of human beings suggests that individual characteristics may play a part in the effectiveness of a chosen interface design and, as such, anthropomorphic interfaces may not have the same effect across all users.

This debate becomes more critical because, “Any time there is communication between a computer and a human, the information presented by the computer has a certain style, diction, and tone of voice which impact upon the human’s attitude and response toward the software” (Shirk, 1988, p. 320). As such, individuals are able to uniquely orient to computing technology in the same fashion as they do people (Harris and Loewen, 2002), using social rules normally reserved for human to human interaction (cf. Nass et al., 1995, 1997, 1999; Nass and Moon, 2001). Although this natural social orientation and interaction can serve to increase productivity and customer responsiveness in e-commerce (Moon, 2000; Bergeron, 2001) and to increase training motivation and performance (Lester et al., 1997), there is also a potential risk to this natural interaction, especially when reinforced through anthropomorphic cues. Users can become misled as to the true capabilities of computers (Winograd and Flores, 1987). For example, Shneiderman (1998, p. 380) argues:

“...There is a great temptation to have computers “talk” as though they were people. It is a primitive urge that designers often follow, and that children and many adults accept without hesitation. ...Children accept human-like references and qualities for almost any object, from Humpty-Dumpty to Tootle the Train. Adults reserve the anthropomorphic references for objects of special attraction, such as cars, ships, or computers...Attributions of intelligence, autonomy, free will, or knowledge to computers can deceive, confuse and mislead users. The suggestion that computers can think, know, or understand may give users an erroneous model of how computers work and what the machines’ capacities are.

The main argument against an anthropomorphic interface is the potential risk that users will go beyond simply responding to the computer naturally and socially and instead begin to attribute characteristics and motives to the machines (as they would other humans) that the machines do not possess. This risk is especially relevant to computing technology because compared to most other technologies, computing technology displays similarities to humans. Although there are thousands of ways in which computers are different than people, there are a few potentially significant ways in which they are highly similar: computers use language, respond based on multiple prior inputs, fill roles traditionally held by humans and are capable of producing human-sounding voices (Moon and Nass, 1996); prior to the widespread application of computing technologies, these social cues were uniquely associated with other humans. Additionally, computing technology is becoming ubiquitous and ingrained in our society, often becoming the focal point of our businesses and social interactions. For example, we depend heavily on computers for everyday personal and organizational tasks such as communication (email and chat), banking, paying bills and taxes, decision-support, as well as recording and storing most organizational data (i.e. sales, purchases, payroll, human resources, etc.). In each of these cases, when interacting with humans we make attributions about the results of our interactions in these activities. Thus, given the similarities between humans and computing, it can be natural to extend our attribution patterns with humans to computers when we engage in similar interactions.

As an example, individuals may respond to a decision support or expert system as if it is an all knowing, all accurate, unbiased independent expert with which they interact. Feeling dependent upon the computer, they may cease to question computer output, to search for further information, or to place deep cognitive effort into making decisions, instead focusing on the computer as the source of knowledge, expertise and decisions. In fact, evidence has shown that some users have interacted with computing technology in a manner where they trusted the computer to generate a final decision without questioning its actions (Hirschheim and Klein, 1989; Will, 1991). Yet, very little research has focused on whether or not social interfaces magnify the propensity of certain individuals to attribute responsibility, control and other characteristics to computing technology as they would to a human (even though the computer does not have these characteristics).

It is important that we begin pursue this research for several reasons. First, as previously discussed, the nature of computing technology and human responses toward that technology suggests that there is a strong potential for individuals to begin responding to and making attributions to computing technology as they do to humans. Second, as we move further into the 21st century, experts believe we will continue to increase our ability to develop more human-like, smart thinking machines and software applications (Miller, 1999) and as such, we will continue to be faced with encounters and interactions containing them. Third, as computing technology gets more and more complex, “each leap in complexity has meant further loss of understanding” (Rawlins, 1997, p. 35). Ultimately, if we do not begin to understand the phenomenon of human response to computer interfaces, we may be left in a situation where the level of complexity of it exceeds our ability to understand. Finally, differential attributions toward computing technology are also important to understand because the attributions that individuals make have consequences for future behavior or interactions.
(Dubinsky et al., 1989). If individuals begin ascribing responsibility to computing technology they are likely to continue to do so. Therefore, we were interested in the following research question:

What are the factors contributing to individuals making different attributions of causality toward computing technology?

To investigate this research question, we validated a model of attributions toward computing technology, proposed by Marakas et al. (2000), that focuses on the nature of the interface, an individual's core self-evaluations, and their generalized beliefs about the social role and capabilities of computing technology.

2. Attributions toward computing technology

Attribution theory (Heider, 1958; Kelley, 1972, 1973; Weiner, 1985) focuses on how individuals interpret and ascribe causality to events. The theory suggests that when we interact with a person or an object, we associate our favorable or unfavorable attitudes or responses toward that person or object with the attributes it contains (Pate, 1987). Dubinsky et al. (1989) summarize three key assumptions in attribution theory: (1) people try to determine the causes of their and others' behavior, (2) people assign causal explanations for behavior in a systematic manner and (3) attributions which people make have consequences for future behavior. Using the "covariation principle" and "discounting principle" (Kelley, 1972, 1973), individuals establish the validity of the impression of the other with which they are interacting. The covariation principle suggests that an effect is attributed to an event, or cause, when the event is present and the effect is present, and absent when the effect is absent. The discounting principle suggests that people will discount evidence that suggests that either a person or object is acting to cause the behavior if there is something specific in the situation which may be acting to cause the behavior (Kelley and Michela, 1980). Attribution theory has been widely used to explain phenomena related to a variety of organizational issues including performance (Taggar and Neubert, 2004), skill development and learning (Schunk and Gunn, 1986), performance appraisal (Struthers et al., 1998), leadership (Davis and Gardner, 2004), consumer behavior (Tsirod et al., 2004), motivation (Weiner, 1985), user resistance to technology (Martinko et al., 1996) and decision support system use (Hughes and Gibson, 1987).

An individual is thought to attribute his or her (or another's) behavior or attitudes to characteristics of the stimulus (object), themselves (person), the circumstances, or some combination of these. A person attribution is an internal attribution where individuals perceive themselves as being the cause for their attitudes and behavior. A stimulus, or object attribution is an external attribution, where individuals sees the object or person with whom they are interacting being the cause for their attitudes or behavior. A circumstance or situation attribution occurs when an individual attributes his or her attitudes and behavior to be a result of the situation in which they find themselves (Kelley, 1973).

Using attribution theory, Marakas et al. (2000) suggested that two categories of attributions within the domain of computing can be identified. Internal attributions, considered to be rational and rooted in our assumption that humans control the functions of computers and thus responsible for their outcomes, are categorized as tool attributions. Conversely, external attributions of causation become manifest with individuals who perceive the computer as responsible for any feelings, attitudes, processes and performance from their interaction with it. In an external attribution, the power and causality of the interaction are focused on the computer and are described as a social actor attribution (Marakas et al., 2000).

Regardless of the nature of the attribution, however, they posited such attributions are determined by four factors: (1) the social character of the computing technology, (2) an individual's core self-evaluations, (3) the context and nature of the interaction with the computing technology and (4) the presence or absence of certain attributional information cues. In addition, Marakas et al. (2000) theorized that an individual’s generalized beliefs regarding the social role and capabilities of computing technology, described as the computing technology continuum of perspective (CP), are linked to these four factors in a measurable manner. Of particular interest in this research is the social character of the technology, an individual’s core self-evaluations and an individual’s CP, each of which are discussed in the following sections.

2.1. Social character of the computing technology

Both anecdotal and experimental results have provided evidence that humans respond socially to the computing artefact (cf. Nass et al., 1995; Turkle, 1997). These artefacts may be intentionally designed to encourage social responses, but more often they affect persons socially in ways unimagined by their creators. For example, individuals have invoked gender-stereotypical reactions when interacting with computers with male or female voices (Nass et al., 1997), responded differentially to computers with different voices (Nass and Steuer, 1993), perceived personality differences in computers and interacted with those personalities in a similar fashion as they would a human (Nass et al., 1995; Dryer, 1999), perceived a computer’s evaluation of its own performance to be more biased than that same computer’s evaluation of another machine (Nass et al., 1994) and even responded socially to flattery provided by a computer (Fogg and Nass, 1997).

Research has also shown that individuals can identify multiple social-oriented cues embedded in an interface including intelligence, socialness and emotions. For example, Turkle (1984, 1997) found that both children and...
adults identified responses from computing technology as representing intelligence and affective states. In response to these cues, individuals responded socially, with some individuals actually flirting with a computer program in an online multi-user domain. Further, Sproull et al. (1996) found that individuals were able to differentiate between two interfaces on dimensions that reflect intelligence, social interactivity and affective states. Users were more likely to feel like they were in a social setting with the interface displaying strong social cues, as well as being more likely to ascribe personality to the machine. Overall, these results suggest that an interface with greater social cues will increase the likelihood that users will perceive themselves as being in a social setting as they interact with the computer. When engaged in a social setting, users will be more likely to interpret the results of these interactions using similar rules that they do for their interactions with other humans, including making attributions of responsibility to the computer. Thus, the following hypothesis was investigated:

H1. Individuals who interact with a computing technology high in social cues will be more likely to make social actor attributions than individuals who interact with a less social interface.

2.2. Computing technology continuum of perspective

An important consideration for this research is that individuals typically make attributions on the basis of limited information (Kelley, 1972, 1973). They are able to do this because they make use of personal theories or preconceptions about what causes are associated with what effects. Kelley refers to these preconceptions as causal schemata. Thus, a person can interpret cues and stimuli by comparing them to, and integrating them within, an existing personal schema developed under a previous set of conditions. With respect to computing technology, Marakas et al. (2000) theorize that individuals have such a schema with respect to their beliefs about the social role of computing technology. Over time, as individuals interact with computing technology, they will not only tend to respond socially, but some may actually begin to believe that computing technology in some way has agency and can act independently. Marakas et al. conceptualize this schema in the form of the computing technology continuum of perspective (CP).

The CP is an individual's generalized beliefs about the social role and capabilities of computing technology in social settings. The continuum is thought to be anchored by individuals with locally simplex (LS) and globally complex (GC) perspectives. For individuals at the locally simplex end of the continuum, computing technology is thought to be within their immediate, or local, control and the actions of the technology are bounded by the structure of the underlying program instructions. Thus, computers and their associated software applications are seen as a tool within the complete control of humans. Only through the active volitional use of users can the technology be leveraged to successfully complete tasks. This perspective is a common and popular perspective likely held by most information technology professionals and computer enthusiasts within the general populace. An example of this is found in the position held by Winograd and Flores (1987):

The first question one might ask is why anyone would consider that computers could be intelligent. A computer, like a clock or an adding machine, is a complex physical device exhibiting patterns of activity that represent some external world. But it hardly seems worthwhile asking whether a clock or an adding machine is intelligent. What then is different about computers?“ (p. 93)

At the other end of the continuum, individuals with a globally complex perspective view computing technology as exerting some type of control or influence over their life, as an external, autonomous entity with whom they are forced to interact. These feelings may be magnified in situations where the computer is providing cues intended to encourage the user to perceive its actions as they would another social actor’s. For individuals whose perspective resides at the globally complex end of the continuum, a risk associated with continued interaction with a highly social interface is that they may begin to believe that they are dealing with an autonomous entity that in some way exerts control over their environment. Further, they may govern their future interactions based on this belief. Computer phobics, who have a powerful sense of lack of control when confronted with computer technology (Kay, 1990), are a likely example of a group of individuals who view technology from this extreme end of the continuum. Fig. 1 illustrates the continuum and the characteristics of those found at the extremes.

The argument underlying the continuum is similar to many researchers focusing on the role of computing technology in society who have suggested that our conceptions of computing technology are polarized, ranging from viewing computers as useful tools to be utilized to perception of the device as a controlling entity (Cancro and Slotnick, 1970; Lee, 1970; Coover and Goldstein, 1980). Thus, we believe one factor that can influence the formation of social actor attributions toward computing technology is an individual's position on the CP.

Bandura (1997) suggests that an individual's previous experience and attitudes shape their behavior and attitudes in new situations and environments. Thus, individuals who generally believe that computing technology is a tool (locally simplex) are likely to carry their perspectives with them as they interact with a new computing technology and should be more likely to view themselves as the agent of causation in their interactions with computing technology. Conversely, those individuals who generally believe that computing technology is a social entity with which they are forced to interact (globally complex) are likely to carry
those perspectives with them as they interact with a new computing technology and should, therefore, be more likely to make social actor attributions. Thus, the following hypothesis was investigated:

H2. Individuals with a more globally complex perspective will be more likely to make social actor attributions than individuals with a more locally simplex perspective.

2.3. Core self-evaluations

The third factor that should influence an individual’s attribution is their personality. Personality plays a key role in understanding people’s attitudes and behaviors in organizations (Judge et al., 1998b) as well as their interactions with computing technology (Bostrom et al., 1990; Compeau and Higgins, 1995; Johnson and Marakas, 2000). Personality research focuses on characteristics within the individual, how individuals systematically differ from each other and how this influences behavior. Previous research on personality has identified many different personality traits, but two dominant models have argued for a core set of personality traits. One of these is the Big Five factor model (Digman, 1990; Goldberg, 1990) that includes extraversion, agreeableness, conscientiousness, emotional stability and culture. The other dominant model is the core self-evaluations perspective (Judge et al., 1998b) that includes locus of control (LOC), self-esteem, general self-efficacy and neuroticism (i.e. emotional stability). Core self-evaluations are “fundamental, subconscious conclusions individuals reach about themselves” (Judge et al., 1998b, p. 18). Individuals with lower core self-evaluations are thought to view their environment more negatively, to be less confident and to feel less control over their environment. Conversely, individuals with higher core self-evaluations are more confident, view their environment more positively and feel greater control. For the purposes of this study, we adopt the core self-evaluations approach to describing individual personality.

Findings have indicated that both individually and collectively, an individual’s core self-evaluation plays an important role in how an individual interprets, responds to and leverages his or her environment (Judge et al., 1998a; Erez and Judge, 2001; Judge and Bono, 2001). Marakas et al. (2000) argue that core self-evaluations play an important role in how an individual interprets or understands computing technology. Just as an individual’s core self-evaluation impacts an individual’s interpretation of a specific event, so also does it impact his or her broader view of the world and environment. Individuals with lower core self-evaluations will be more likely to have a negative and dependent view of the world, which will extend to their beliefs about the nature of computing technology. The computer is yet another component within a complex social situation where these individuals feel a lack of control or understanding of the role of the “others” in that situation. As such, they will be more likely to have a more globally complex perception of computing technology. Conversely, those with higher core self-evaluations will view the environment as more within their control and influence, and these perceptions can be logically extended to their perceptions of computing technology. Thus, the following hypothesis was investigated:

H3a. Individuals with lower core self-evaluations will be more likely to have a globally complex perspective than those with higher core self-evaluations.

Core self-evaluations should also affect the attributions that individuals make. For example, the individual personality factors comprising an individual’s core self-evaluations have been linked to attributions across multiple domains (cf. Schunk, 1984; cf. Midkiff and Burke, 1991;
Ashkanasy and Gallois, 1994; Silver et al., 1995). Consistent with relationships found in the broader domain, an individual’s core self-evaluation should influence how they interact with computing technology. For example, research has found that LOC was the strongest predictor of computer awareness among college-level education and business majors (Griswold, 1983). In addition, negative feedback from a computer with personal human-like features triggered self-esteem responses similar to feedback from a human more than negative feedback from a computer with impersonal, machine-like features (Resnik and Lammers, 1986). Finally, computer self-efficacy has been one of the key factors in understanding how people learn and use computers (Marakas et al., 1998). Given the strong results linking personality to computer use and understanding, as well as the broader relationships between personality and attributions, we believe that an individual’s core self-evaluation will impact how he or she interprets a specific interaction with computing technology. Thus, the following hypothesis was investigated:

**H3b.** Individuals with lower core self-evaluations will be more likely to make social actor attributions than individuals with higher core self-evaluations.

Fig. 2 graphically illustrates the hypotheses tested in the study.

### 3. Method

#### 3.1. Overview

To investigate the hypotheses, a laboratory study using a between-subjects design was conducted. Participants were randomly assigned to interact with one of two versions of a vacation planning software program that focused on vacation opportunities in the mid-Atlantic area of the USA. Based upon participant responses to questions about their work, hobbies and interests, as well as their geographic preferences for vacation travel, the program displayed two suggested vacations for the participants.

#### 3.2. Creating the interfaces

For this study, two versions of the interface were created using Visual Basic 6.0, Microsoft Agent 2.0 and the Lernout & Hauspie TruVoice Text to Speech Engine (L&H). All of the underlying program logic regarding the vacation selection process was the same for both versions. Version 1 (coded as 1 for analysis purposes) of the application employed a traditional GUI interface, but also made use of embedded social cues and human-like characteristics via an animated, interactive character named “Merlin.”

Merlin had a range of sounds, animations and vocabulary that were programmed to respond to a variety of user input. From the users perspective, Merlin displayed an ability to actively participate in the various inputs provided by the user and was programmed to require interaction on the part of the user and to respond to user input. Merlin regularly appeared throughout the input process and, when not asking a direct question of the participant requiring input, would perform random animated actions (such as stirring a cauldron, looking at his wand, or moving across the screen). For example, when a user had completed input of certain parameters, Merlin instructed the user to “tickles him” by double-clicking with the cursor to move on to the next section of the program.

In addition to asking questions of the user, Merlin would also make supportive comments and would engage in seemingly intelligent behavior by responding to inputs provided by the user. For example, when a user input their age (i.e. 33 years old), Merlin would respond with, “You must have been born in either 1971 or 1972” and when a participant would select a state they would like to visit, Merlin would tell them a special fact about that state (i.e. Delaware was the first state to ratify the US Constitution). In summary, Merlin’s actions were purposefully programmed to create the various social characteristics of the interface.

Version 2 (coded as 2) of the application employed a traditional GUI interface without any embedded social cues or human-like characteristics. Movement from screen to screen was through the use of conventional GUI buttons and point-and-click mouse movement. Results from multiple pilot studies indicated that users were able to perceive the differences between the two interfaces with regard to their social character along three dimensions: intelligence, socialness and emotion.
3.3. Procedures

Upon arrival, participants signed in, completed an informed consent form and were randomly assigned to work with either the interface with higher social character (Version 1) or the interface low social character (Version 2). Next, the facilitator, using a pre-tested and validated prepared script, introduced the session and read the instructions for the task. Then, participants completed a pre-test questionnaire consisting of items measuring their position on the CP and their core self-evaluations. Following this, participants interacted with the vacation selection software, which also captured demographic information. Participants were not aware of their assignment and were positioned such that they could not discern any differences between themselves and other participants around them. All participants were asked to wear the headphones during the process to ensure no differences regarding the manipulation could be detected. Participants receiving Version 1 listened to verbal interactions and sounds generated via the software while participants receiving Version 2 listened to soft music during their session. Finally, participants completed a post-test questionnaire that measured their perceptions regarding the social character of the software they used (as a manipulation check) along with a measure of their attributions regarding the outcome. Participants were then debriefed and excused to leave.

3.4. Participants

A total of 251 participants participated in this study. Of these, data from 11 participants were removed due to post experiment feedback suggesting they did not accurately follow the directions, leaving 240 usable responses. Participants were drawn from undergraduate (n = 166) and graduate (n = 57) students at universities in the mid-Atlantic and southeastern United States as well as professionals from outside the academic environment (n = 17). The average age was 26.8 (s.d. = 12.8) and all reported themselves to be experienced computer users. The subject base was slightly male dominated, with males comprising 55% of the sample.

3.5. Measures

3.5.1. Computing technology continuum of perspective

This scale was developed and validated for this study in accordance with sound scale development practice (Straub, 1989), including the use of multiple pilot studies. The scale was designed to measure the perceptions of three elements identified by Johnson (2001) as facets of an individual’s CP that individuals have been shown to perceive in their interactions with computing technology: socialness, intelligence and control. The complete scale development process is described in detail by Johnson (2001) and a summary is included here. First, a list of keywords that people associated with computing technology (including both anthropomorphic and instrumental words) was developed. These were given to pilot research participants who were asked to select words they associated with computing technology and to write any additional words they associated with computing technology not listed. From this list, an initial list of 36 scale items were developed and then refined through several pilot studies, leading to a final scale consisting of 13 items. The scale used a 7-point strongly disagree to strongly agree response format. The coefficient alpha reliability estimate for this scale was .72. A lower score on the CP indicated a relatively locally simplex perspective while a higher score reflected a more globally complex perspective.

3.5.2. Core self-evaluations

This construct was measured using a series of scales representing each of the elements identified by Judge et al. (1998a, b). Each of the four sub-scales were piloted individually and collectively to ensure acceptable reliabilities and appropriate factor loadings. The locus of control component of this scale was measured with a 7-item subset of Levenson’s (1973) scale. Self-esteem was measured with a 7-item subset of Rosenberg's (1965) scale. The neuroticism factor was measured with a 9-item subset of the Eysenck Personality Inventory Neuroticism Scale (Eysenck and Eysenck, 1968). Each of these scales were Likert type and used a 7-point strongly disagree to strongly agree response format. With strong empirical evidence suggesting that domain specific measures of self-efficacy are the most predictive (Bandura, 1997) for the computing domain, the appropriate construct becomes generalized computing self-efficacy (GCSE), or “an individual's perception of efficacy in performing specific computer-related tasks within the domain of general computing” (Marakas et al., 1998, p.128). GCSE was measured with a 7-item scale developed consistent with the Marakas et al. (1998) and Bandura (2001) measurement development frameworks and used a response format of 0 (Cannot Do)–100 (Totally Confident) in increments of 10.

Empirical evidence from Judge et al. (1998b) has shown that together the four dimensions of individuals’ core self-evaluations can be aggregated into a single measure of core self-evaluations. In this study, the four scales were combined to form a single measure of core self-evaluation by first converting the computer self-efficacy scale to a 7-point scale consistent with the scaling of the other dimensions. The scales were then averaged, creating a single average score representing an individual’s overall core self-evaluation. In doing this, a higher overall score indicated an individual with a more internal locus of control, higher self-esteem, a lower level of neuroticism, and a higher level of GCSE and a lower score indicated an individual with a more external locus of control, lower self-esteem, a lower level of neuroticism and a lower level of GCSE. The coefficient alpha reliability estimate for the overall scale was .80.
3.5.3. Attributions

The scale for attributions toward computing technology was developed for this study. Based on the theoretical definition of attributions toward computing technology, an initial 20-item scale was developed focusing on measuring attitudes, feelings and outcomes related to the interaction with the computing technology. This scale was then piloted and refined to a final scale of 7-items. The scale was Likert-type scale and used a 7-point strongly disagree to strongly agree response format. The coefficient alpha reliability estimate for this scale was .86.

3.5.4. Social character of the interface (i.e. manipulation check)

Three scales were used to assess the social character of the interface. The scales were originally developed by Warner and Sugarman (1986) and Buss and Plomin (1984) and previously validated by Sproull et al. (1996) for use in the computing domain. The intelligence scale consisted of 5 items ranging from 1 to 7, with anchors such as unintelligent-intelligent and ignorant-knowledgeable. The coefficient alpha reliability estimate of this scale was .83 and was .93 for the emotion scale. The coefficient alpha reliability estimate for the socialness scale was .87 and was .93 for the socialness scale. The socialness scale consisted of 4 items and the emotion scale consisted of 11 items. Each of these utilized a 5-point, Likert type response format anchored by not at all true and very true. The coefficient alpha reliability estimate for the socialness scale was .83 and was .93 for the emotion scale. To further assess the validity of the scales, an exploratory factor analysis was conducted, with the results indicating that all items loaded well on their specified factors. A complete listing of all constructs and scale items can be found in Appendix A.

4. Results

As noted above, a manipulation check was conducted to confirm that the participants could indeed differentiate between the social cues in the two interfaces. Results indicated users were able to differentiate between the two versions of the interface on all three dimensions (although intelligence was significant at the more liberal 0.10 level of significance): socialness (p ≤ .001), emotions (p ≤ .05) and intelligence (p ≤ .09). Table 1 contains the cell means and standard deviations for the each version of the interface used. In accordance with the suggestion by Marakas et al. (2000) that the distribution of individuals along the continuum reflects a normal distribution, a Kolmogorov-Smirnoff test of normality indicated this assumption could not be rejected (K-S Z = 1.24, p > .05).

Several demographic variables were investigated to determine if they were related to the variables of interest in the study, including computer experience, computer use, work experience, age and gender. Of these, only gender was related to an individual’s CP (p ≤ .05) and attributions (p ≤ .05). Given the presence of the relationship, it was deemed appropriate to use gender as a covariate throughout the remaining analysis. The means, standard deviations and correlations of the variables included in the study are found in Table 2. Next, To rule out a potential moderating impact of an individual’s CP on the relationship between the interface and attributions (i.e. the presence of a social interface alone may not induce a person at the locally simplex end of the CP to make external attributions), we tested for the presence of an interaction effect as well as main effects. Results indicated the presence of an interaction effect could not be supported.

With the interaction effect ruled out, the model was tested using path analysis and structural equation modeling using EQS 6.1. As can be seen from the results in Table 3, fit statistics were found to be above recommended thresholds (Hair et al., 1998).

Given that the hypotheses were directionally specified, significance levels were assessed using a one-tailed test. Consistent with prior research, support was found for H1. Individuals who received an interface with more social cues were more likely to make a social actor attribution (β = -.104, p ≤ .05). Support was also found for H2, indicating that an individual’s positioning on the CP was related to the extent to which social actor attributions were made (β = .394, p ≤ .001). The results for H3a indicate an individual’s core self-evaluations were related to his or her placement on the continuum (β = .282, p ≤ .001), providing support for this hypothesis. This negative relationship indicates that individuals with more positive self-evaluations are associated with a more locally simplex perspective and those with a less positive self-evaluation are associated with a more globally complex perspective.

H3b also received support suggesting that individuals with lower scores on the core self-evaluations scale tend to make more social actor attributions (β = -.105, p ≤ .05). Recall that a low score on the core self-evaluations scale represents an overall external or negative self-evaluation and a high score represents an internal or positive self-evaluation. Conversely, the attribution scale is coded such that a low score indicates a less social actor attribution (i.e. computer is a tool and I was in control of the interactions). Thus, the negative relationship indicates that individuals with more positive self-evaluations are associated with less social actor attributions.

<table>
<thead>
<tr>
<th>Table 1: Descriptive statistics for manipulation check</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimension</td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>M</td>
</tr>
<tr>
<td>Socialness</td>
</tr>
<tr>
<td>Intelligence</td>
</tr>
<tr>
<td>Emotions</td>
</tr>
</tbody>
</table>
Finally, as a covariate, gender\(^2\) was related to both an individual’s placement on the continuum (\(\beta = -0.193, p \leq .01\)) and the attributions that they made (\(\beta = 0.137, p \leq .05\)). Interestingly, the direction of significance for the CP and attribution suggests that men may be more likely to hold a globally complex perspective on computing technology than women, but that women may be more likely to make more social attributions toward a specific computing technology. Together, the interface, core self-evaluations, the CP and gender explained over twenty percent of the variance in the attributions that were made (\(R^2 = 0.21\)) and an individual’s core self-evaluations and gender explained ten percent of the variance in an individual’s CP (\(R^2 = .10\)). Overall, this provides strong evidence that individuals possess differential perspectives of computing technologies and that these perceptions influence their interactions with computing technology. The results of this analysis are graphically displayed in Fig. 3.

Given the support for the model (all hypotheses supported), we undertook some additional analysis of a subset of the data that included only globals and locals (defined as ±1 s.d. from mean; \(n = 70\)). This was done because we were interested in investigating whether the nature of the relationships might change for those at the extremes of the continuum. For example, one of the basic premises of the work of Nass and colleagues (cf. Nass and Moon, 2000) is that all individuals will have similar reactions and perceptions of computing technology. Conversely, Marakas et al. (2000) and this study have suggested that the positioning of individuals along the CP is normally distributed and that beliefs about the social role and capabilities of computing technology can vary. Underlying this suggestion is an implicit suggestion that those at either end of the continuum will be very different from each other in terms of both their perceptions of computing technology and personality. Implicit also is the assumption that for the extremes, the role of the CP may actually become stronger and more central to attributions that are made. The results of the additional analysis are shown in Fig. 4 and Table 4.

Consistent with the full data, the relationship between the continuum and external attributions was as theorized, but the relationships were stronger, for both the CP and attributions (\(\beta = 0.554, p \leq .001\)) and the interface and attributions (\(\beta = -0.199, p \leq .05\)). As with the full data set, an individual’s core self-evaluations were also related to their CP (\(\beta = -0.447, p \leq .001\)). In contrast to this, the direct relationship between an individual’s core self-evaluations and attributions was found to be non-significant (\(\beta = 0.054, n.s.\)), suggesting that the continuum may fully mediate the impacts of an individual’s core self-evaluations on attributions for those individuals lying at the extremes of the CP. Finally, gender was also related to both an individual’s CP (\(\beta = -0.245, p \leq 0.05\)) and attributions made (\(\beta = 0.163, p \leq 0.05\)). Together, the variables explained 21%
of the variance in an individual’s CP and 32% of the variance in the attributions that were made. Although additional work in this area is needed, this provides additional support for the thesis that individual’s who view technology from a locally simplex perspective are different from those who view technology from a globally complex perspective and that these differences are magnified at the extremes. It also suggests that as individuals move toward the poles of the continuum that their core self-evaluations play less of a role in the attributions that they make and that their CP becomes even more important.

5. Discussion

The goal of this study was to investigate the factors that contribute to the formation of attributions of causality toward computing technology. Overall, the results provide strong support for the proposed model, showing that an individual’s core self-evaluations, an individual’s generalized beliefs about the social role and capabilities of computing technology, and the nature of the interface each influenced an individual’s attributional response to an interaction with a computer.

This research makes several contributions to our existing literature. First, it extends our understanding of social responses toward computing technology. Using an interface and task unique to previous studies, this research also found that the nature of the computing interface can induce specific social responses (in this case, attribution of causality) toward computing technology. Second, this research extends the work of Marakas et al. (2000) by examining aspects of their Computer as a Social Actor model. Although previous research has suggested that all people “automatically and unconsciously respond socially and naturally” (Reeves and Nass, 1996, p. 7), Marakas et al. (2000) theorized that other factors may influence individual reactions to computing technology. In addition to the nature of the interface, both an individual’s core self-evaluations and an individual’s generalized beliefs about the social role and capability of computing technology play important roles in both how an individual attributes the results of their interactions with computing technology.

Finally, this research extends our understanding of the attribution theory in IS research. In contrast to the global social responses to technology reported in previous research, the results of this study suggest that individuals utilize the same processes to explain their interactions with computing technology that they do with human beings, even the extent to which they ascribe causation to computing technology. Further, the results suggest these processes are driven by characteristics unique to the individual. This occurred in spite of the fact that the pace and order of interactions were well within the participant’s control.

6. Implications

This study has multiple implications for both research and practice. For researchers, it reinforces the need to focus on the diversity of perspectives and needs of software users. Beyond the instrumental (i.e. processes, functions, technology, etc.) aspects of the IT artefact, researchers need to understand that users of computing technology bring a myriad of social norms and rules that they apply to their interactions with computing technology. For researchers, the risk is that they dismiss the use of human-like interfaces because such interfaces are inconsistent and incongruent with their personal understanding of computing technology. What they may fail to realize is that all others do not share their perspective and some, therefore, may find comfort in a more human-like interface. Further, this comfort may serve as either a positive or negative reinforcement.

Through a deeper understanding of both the social perceptions of an interface and an individual’s beliefs about the social role and capabilities of computing technology, researchers may gain a better understanding of how these different segments of users respond to a particular system. In essence, we believe the results of this study provide evidence to suggest that not all users are
created equal with regard to their perspective regarding computing technology or their acceptance of a human-like interface and that these differences affect how individuals interpret their interactions with the computer. As such, the continuum can be used as part of a research process to determine for what segment of the population a highly social and interactive interface could provide positive outcomes and when a more human-like interface may be detrimental to a given user constituency.

The results of this study also have implications for the computer training community. With individuals differing in their beliefs about the social role and capabilities of computing technology, it is possible that our use of anthropomorphic metaphors in training may have a larger and more unpredictable impact than previously thought. For example, does our use of this metaphor actually induce those with a strongly global complex perspective to even further misunderstand the role and capabilities of computing technology, or does its use make these individuals more comfortable? Future research needs to investigate these questions with an eye toward the development of diagnostic and prescriptive approaches to computer training that take into account both the participant’s position on the CP and their core self-evaluations.

For practitioners, this study has the potential to inform the use of computer-based decision aids. Previous research has shown that expert system users have a propensity to rely on the output of the tool, even when wrong (Will, 1991). This research provided evidence that certain individuals will externalize the results of an interaction with a piece of software, including the results. Other research has found that the use of computer-based decision-making tools do not always lead to higher quality decisions, but often to similar quality decisions with less effort (Todd and Benbasat, 1991). Combined, these two results suggest that there may be an increasing reliance on the output of decision tools, with limited effort being placed into questioning the results. Over time, individuals may develop a tendency to inordinately rely on these aids. For those who are more global, this problem may become magnified. Such individuals may begin to rely more heavily on the technology, attributing the success or failure of the decision to the computer, instead of the true agent of the decision...themselves.

This research also provides evidence for the importance of understanding individual differences, such as personality, when designing software—particularly user interfaces. Given the increasingly ubiquitous and social nature of computers, it should not be surprising that the factors which contribute to differential behavior and perceptions of other humans are being extended to human-computer relationships. Designers should seek a deeper understanding of their influence since it “would aid in designing a workable partnership between human beings and machine” (Robey, 1983, p. 581). The likelihood that the majority of software developers are locally simplex could explain why these issues are often rebuffed as irrelevant and, thus, not addressed, and why further research needs to be conducted in this area. If the designers of our technologies are unable to understand how those at a more globally complex perspective perceive technology, nor even understand their language, how can they develop effective software to meet the needs of these individuals?

7. Limitations

Although this work extends our understanding of social responses toward computing technology, there are factors that must be considered when determining its generalizability. The research was conducted in a laboratory setting and utilized students as a large proportion of the sample. Thus, the question of generalization to other settings or populations must be considered. One accepted method to minimize the effect of this potential limitation is to use participants similar to the population of interest. In this case, we believe the student participants represent a subset of the broader population and have the skills and knowledge to both answer the questions posed to them and perform the tasks assigned. Given the strong findings in the study as well as the distribution of individuals along the continuum, we believe this potential area of concern is mitigated. In fact, with a broader subject base, the variance would likely increase, including a potential widening of participants along the continuum, thus further reinforcing the strong results found in this study.

A second potential limitation arises from the task and the nature of the experimental session. An experimental session held in a computer lab is not likely to represent a “real” experience and the computer program developed for the manipulation was necessarily limited in scope. Thus, generalizations to other tasks and domains cannot be broadly made with certainty based on these results. While this potential limitation exists, the comments made by those participating in the study indicate they believed they were evaluating a real software package. Some even suggested ways to improve the product, such as “I thought it was helpful for finding vacations, but consumers may be leery.” With actively engaged participants, however, the impact of this limitation should be reduced. Another reason this limitation may not be as important as it would be in other situations is that the focus of the study was not on the task, but instead on the responses to the technology. Finally, given the small sample and the large number of items in the scale, this study was unable to conduct a complete test of both the structural and measurement components of the model. Thus, the fit statistics shown do not account for any error associated with the measurement of the constructs and interpretation of the results should be done in light of this limitation.

8. Future research

Although the current research investigated three key factors that influence attributions toward computing
technology, future research should expand the model by looking at other factors that influence attributions, such as those theorized by Marakas et al. (2000): the type of interaction that the individual has with the computing technology and the nature of the attribution information cues. This can provide an even more detailed understanding of the factors that influence attributions toward computing technology. Given the findings with respect to gender in this study, future research can also be informed by investigating the role that gender or gender role (Bem, 1993) plays with respect to both attributions and the development of generalized beliefs about the social role and capabilities of computing technology. This can provide a more detailed understanding of the factors that influence attributions toward computing technology.

Associated with this, future research should also seek to gain a better understanding of how the nature of the interface and an individual’s belief about the social role and capabilities of computing technology influence decision-making. With this research showing that individuals were more likely to attribute responsibility to the computer, the potential exits for highly informational and interactive decision-aids to actually increase the confidence of the decision maker without an associated influence in decision-making quality. It also creates the potential for the user of the decision aid to rely inappropriately on that decision aid, even when inaccurate information is provided.

Future research might also focus on issues related to user interface design, usability testing and enhancement of user satisfaction in light of the CP. There is significant disagreement in the literature regarding user interface design and user satisfaction: with one argument that the development of human-like interfaces will make the system easier to use and understand, and ultimately, more natural for the user (Reeves and Nass, 1996; Nass and Moon, 2000) and the other that human-like interfaces might actually reduce satisfaction because they interfere with the task and distract the user from the task (Shneiderman, 1988). Still others have suggested while these social interfaces may improve satisfaction and enjoyment with the system, they may not necessarily increase performance (cf. Takeuchi and Naito, 1995). Through a deeper understanding of how both the social characteristics of an interface and an individual’s CP impact their interpretations of their computing interactions, software developers might find a way to better understand and possibly predict, how these different segments of users may respond to the system.

Finally, we believe this research may prove valuable in furthering our understanding of the role of the users in the normative systems development and implementation process. Given the proclaimed importance of user involvement in IS development projects (Barki and Hartwick, 1994; Hunton and Beeler, 1997; Marakas and Elam, 1998) accurate assessments of user attitudes, opinions and perceptions are crucial in eliciting the set of requirements essential for the development of systems that will meet user needs or expectations.

9. Conclusion

This study was motivated by the desire to develop a better understanding of both an individual’s generalized beliefs about the social role and capabilities of computing technology as well as their attributions of causality toward interactions with a specific instance of computing technology. To address these questions, a model was developed and validated using a controlled laboratory study. The results indicate that attributions of causality toward computing technology are influenced by individuals’ core self-evaluations, their generalized beliefs about the social role and capabilities of computing technology, and the nature of the computer interface used.

The results indicate that, contrary to the beliefs of many IT professionals and those with a locally simplex perspective, a significant portion of our society do indeed believe that computers have social agency and respond to computing technology accordingly. In fact, this propensity is actually magnified when exposed to a distinctly social interface. Given the results associated with this and other studies, research that delves deeper into the social meanings and perceptions of computing technology by all who use the technology can provide insights that can aid in the development of computing technology that supports all users in the most effective manner.

Appendix A. Research constructs and scale items

The following scales were assessed using a 7-point Likert-type scale with anchors of strongly disagree and strongly agree.

Computing technology continuum of perspective (self-developed)

1. Computers are capable of telling doctors how to treat medical problems.
2. Computers are capable of effectively teaching people.
3. Computers are capable of facilitating large group meetings.
4. Computers are capable of remembering things.
5. Computers are capable of learning from their experiences.
6. Computers are capable of caring for children.
7. Computers are capable of holding intelligent conversations.
8. Help-menus are capable of telling you the answer when you have questions.
9. When I play a game with a computer, I worry that it might cheat.
10. I have used a computer who didn’t like me.
11. Computers are capable of controlling my actions.
12. Computers are capable of infringing on personal rights and freedoms.
13. I have had my privacy invaded by a computer.

**Social attributions (self-developed)**

1. The computer was primarily responsible for my level of satisfaction with the vacations chosen today.
2. The computer was primarily responsible for the sequence of questions I answered today.
3. The computer was primarily responsible for my satisfaction with the interactivity of TRAVEL.
4. The computer was primarily responsible for choosing the final vacations today.
5. The computer was primarily responsible for the amount of time I had to spend to complete vacation selection today.
6. The computer was primarily responsible for my sense of control during my interaction with TRAVEL today.
7. The computer was primarily responsible for my perceptions of the friendliness of TRAVEL.

**Locus of control (Levenson, 1973)**

1. It’s chiefly a matter of fate whether or not I have a few friends or many friends.
2. It’s not always wise for me to plan too far ahead because many things turn out to be a matter of good or bad fortune.
3. Even if I were a good leader, I would not be made a leader unless I play up to those in positions of power.
4. Often there is no chance of protecting my personal interest from bad luck happenings.
5. I feel like what happens in my life is mostly determined by powerful people.
6. My life is chiefly controlled by powerful others.
7. Whether or not I get to be a leader depends on whether or not I’m lucky enough to be in the right place at the right time.

**Self-esteem (Rosenberg, 1965)**

1. On the whole, I am satisfied with myself.
2. I wish I could have more respect for myself.
3. I am able to do things as well as most people.
4. All in all, I am inclined to feel that I am a failure.
5. I feel that I have a number of good qualities.
6. I feel that I am a person of worth, at least on an equal plane with others.
7. I feel that I do not have much to be proud of.

**Neuroticism (Eysenck and Eysenck, 1968)**

1. I often feel lonely.
2. My feelings are easily hurt.
3. My mood often goes up and down.
4. I am often troubled by feelings of guilt.
5. I am an irritable person.
6. I often feel “fed up.”
7. I am often tense or high strung.
8. Sometimes I feel miserable for no reason.
9. I often worry too long after an embarrassing experience.

This construct was assessed with a 10 point scale ranging from 0 (Cannot Do) to 100 ( Totally Confident) in increments of 10.

**General computer self-efficacy (self-developed)**

1. I believe I have the ability to unpack and set up a new computer.
2. I believe I have the ability to describe how a computer works.
3. I believe I have the ability to install new software applications on a computer.
4. I believe I have the ability to identify and correct common operational problems with a computer.
5. I believe I have the ability to remove information from a computer that I no longer need.
6. I believe I have the ability to understand common operational problems with a computer.
7. I believe I have the ability to use a computer to display or present information in a desired manner.

**Scales used to measure the social character of the computing technology**

Each item in this scale ranged from 1 to 7 and was anchored by the following word pairs.

**Intelligence (Warner and Sugarman, 1986)**

1. Unintelligent–Intelligent
2. Ignorant–Knowledgeable
3. Incompetent–Competent
4. Irresponsible–Responsible
5. Foolish–Sensible

The following scales were 5 point-Likert type scales anchored by “not at all true” and “very true.”

**Socialness (Buss and Plomin, 1984)**

1. Likes to be with people.
2. Prefers working with others rather than alone.
3. Finds people more stimulating than anything else.
4. Is something of a loner (reverse coded).

**Emotions (Buss and Plomin, 1984)**

1. Frequently gets distressed.
2. Often feels frustrated.
3. Everyday events make troubled and fretful.
4. Gets emotionally upset easily.
References


