2014

A three-part intersection of psychology and information systems

Andrew William Luse
Iowa State University

A three-part intersection of psychology and information systems

by

Andrew William Luse

A dissertation submitted to the graduate faculty

in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Major: Business and Technology (Information Systems)

Program of Study Committee:

Brian Mennecke, Co-major Professor

Anthony Townsend, Co-major Professor

Doug Jacobson

Russell Laczniak

David Peters

Iowa State University

Ames, Iowa

2014

TABLE OF CONTENTS

ABSTRACT iii

CHAPTER 1: INTRODUCTION 1

1.1 ORGANIZATION 1

1.2 LITERATURE REVIEW 2

1.2.1 PERSONALITY 2

1.2.2 COUNSELING 3

1.2.3 SOCIAL 3

1.3 PLAN OF PRESENTATION 4

CHAPTER 2: PERSONALITY AND COGNITIVE STYLE AS PREDICTORS OF PREFERENCE FOR WORKING IN VIRTUAL TEAMS 5

CHAPTER 3: UTILIZING STRUCTURAL EQUATION MODELING AND SOCIAL COGNITIVE CAREER THEORY TO IDENTIFY FACTORS IN CHOICE OF IT AS A MAJOR 31

CHAPTER 4: AN IMPRESSION FORMATION-BASED EXAMINATION OF THE DIFFERENTIAL INFLUENCE OF TECHNOLOGY ACROSS GENDER AND MESSAGE 65

CHAPTER 5: CONCLUSION 124

REFERENCES 126

ABSTRACT

Classically, management information systems has been seen as the intersection of two factions within the firm: the technology workers and management. Those in management information systems were tasked with providing a means of communication between these distant groups that would enable synergy within the organization. To do this, management information systems professionals have a need to understand behavioral aspects of individual psychology. This research examines the intersection of information systems and three areas of psychology: personality, counseling, and social. Three separate papers examine a specific research question within each of these separate areas. The first paper investigates the influence of personality and cognitive style on the preference for individuals to work in virtual teams. The second paper explores the drivers of interest and intention to major in information systems. Finally, the third paper analyzes the impact of impressions with regard to mobile users of technology. Together, these papers provide an interesting cross-section of work within information systems across differing areas of psychology.

CHAPTER 1: INTRODUCTION

1.1 ORGANIZATION

This document is composed of three separate manuscripts exploring the intersection of information systems and psychology. Each manuscript is copied almost exactly from the original submission (except for some minor formatting changes). The figures, tables, and references for each manuscript are included in the same chapter as the respective manuscript as they did for the original submission. A general introduction is provided here as well as a general conclusion at the end of this document. Also, references utilized in the introduction and/or conclusion are included in a reference section at the end of the entire document.

The manuscripts included in this document provide a wide-angle view of information systems in three separate areas of psychology. The first manuscript lies in the area of personality psychology and information systems. This paper extends the work of McElroy and colleagues (2007) by examining the differences between personality and cognitive style in the context of virtual teams. Specifically, this research develops a new measure of preference for working in virtual teams that extends the work of preference for group work over working alone (Shaw, Duffy, & Stark, 2000) by adding a new dimension of preference for working face-to-face over virtually. This new measure is then evaluated in the context of personality using the Revised NEO-PI (Costa & MacCrae, 1992) and cognitive style using the Myers-Briggs Type Indicator Form M (I. B. Myers & Myers, 1998).

The second manuscript lies in the area of counseling psychology and information systems. The paper addresses the recent enrollment crisis in IS (Panko, 2008) by examining methods to increase interest in and intention to major in IT. Specifically, Social Cognitive Career

Theory (Lent, 2005) is used to examine the drivers of interest in majoring in IT using a sample of high school students involved in an outreach program.

Finally, the fourth manuscript lies in the area of social psychology and information systems. This paper examines the role of impression formation (Asch, 1946) when evaluating mobile technology users. An initial instrument development is used to develop a metric for impression formation within a professional business environment. Two studies are then utilized to examine the differences of impressions formed of male vs. female targets with varying message bias in the context of mobile technology use.

1.2 Literature Review

This section provides a brief literature review of some of the more pertinent topics concerning the research in this document. Each of these topics is discussed in greater depth in at least one of the included manuscripts. This section is only intended to give the reader a brief introduction to the topics.

1.2.1 Personality

Personality psychology involves the patterns of thoughts, feelings, and behaviors that distinguishes individuals and persists over time (Phares & Chaplin, 1997). Trait theories subscribe to this notion of enduring patterns that are 1) stable over time, 2) differ between individuals, and 3) influence behavior in some way (Feist, Feist, & Roberts, 2009). Costa and McCrae (1992) formulated the widely used five-factor personality model (Big Five) as a method for measuring individual personality on five separate dimensions: openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism. Another trait-based theory is that of cognitive style. Cognitive style refers to the differences in individual information

processing and decision-making (Ausburn & Ausburn, 1978). Jung (Jung, 1921) developed cognitive style dimensions which are captured in the popular Myers-Briggs Type Indicator (I. B. Myers & Myers, 1998) using four two-dimensional areas: extraversion/introversion, sensing/intuition, thinking/feeling, and judging/perceiving.

1.2.2 COUNSELING

Counseling psychology deals with helping people with personal, educational, and career-related problems that they are unable to solve alone (Heppner, Cooper, Mulholland, & Wei, 2001; Heppner, Wampold, & Kivlighan, 2008). A major aspect of this help involves guiding individuals in their career-related interests. Many different models have been developed to aid in career choice including the learning theory of careers counseling (Krumboltz, Mitchell, & Jones, 1976; Mitchell & Krumbolt, 1996; Mitchell & Krumboltz, 1990), a developmental-contextual approach to career development (Vondracek, 2001; Vondracek, Lerner, & Schulenberg, 1986), the psychological theory of work adjustment (Dawis & Lofquist, 1984), the theory of career choice – RIASEC (Holland, 1959, 1997), and the life-span, life-space theory (Super, 1957, 1981, 1990). Social Cognitive Career Theory (Lent, 2005) attempts to integrate these other career theories by incorporating Bandurra's Social Cognitive Theory (1986). Social Cognitive Career Theory postulates that individual self-efficacy and career-related outcome expectations influence interest in an area, with all three influencing intention to major in the area.

1.2.3 SOCIAL

Social psychology is the study of social connections through the exploration of how we think about, influence, and relate to other individuals (D. G. Myers, 2012). When interacting with people, first impressions are typically the first, and sometimes most powerful, social

interaction we encounter. Asch was one of the first to demonstrate that individuals use specific information to form initial impressions of target individuals (1946). Impression formation involves the assessment by observers of physical and behavioral information presented by a target that leads to impressions of that target (Sherman, Crawford, Hamilton, & Garcia-Marques, 2007). Much of the research involving impression formation deals with stereotypes. Individuals are found to utilize stereotypes when making initial impressions of individuals so as to minimize the cognitive effort expended (Brewer, 1998; Fiske & Neuberg, 1990). These stereotypes are often activated by a response to a particular observed characteristic (Devine, 1989; Greenwald & Banaji, 1995) that signifies a specific group membership to the observer (Perdue, Dovidio, Gurtman, & Tyler, 1990) (e.g. the gender of the subject). Furthermore, the observer develops a certain level of expectancy for how certain individuals in certain groups will perform a given task or in a given context (Correll & Ridgeway, 2006) (e.g. how women will interact with technology).

1.3 PLAN OF PRESENTATION

The following chapters are reprints of papers that have been written pertaining to the research plan above. Chapter 2 explores personality and cognitive style in the context of preference for working in virtual teams. Chapter 3 uses the Social Cognitive Career Theory model to explore the drivers of intent to major in IT. Chapter 4 provides a two-study analysis of impression formation in the context of mobile technology use. Chapter 5 will offer some concluding remarks in regard to the papers.

CHAPTER 2: PERSONALITY AND COGNITIVE STYLE AS PREDICTORS OF PREFERENCE FOR WORKING IN VIRTUAL TEAMS

A paper accepted by *Computers in Human Behavior*

Andy Luse, James C. McElroy, Anthony M. Townsend, Samuel DeMarie

KEYWORDS

virtual teams; personality; cognitive style; Big Five; MBTI

ABSTRACT

This study tests the effects of personality and cognitive style on preference of individuals for working in virtual teams. The results support the use of both personality and cognitive style as predictor variables with each uniquely contributing to two facets of virtual team preference, namely preference for virtual teams over working alone and preference for virtual teams over traditional groups. Results are discussed regarding the impact of cognitive style and personality for corporate implementation of virtual teams.

INTRODUCTION

A virtual team is defined as a group of people with unique skills who work interdependently but are separated geographically which necessitates their interacting using technology (Lipnack & Stamps, 2000). Thus, virtual teams allow members to accomplish specific tasks while transcending traditional restrictions of time and proximity (Montoya, Massey, & Lockwood, 2011; Townsend, DeMarie, & Hendrickson, 1998). Consequently, virtual teams differ from face-to-face teams in that members are physically separated from one another and they rely on technological devices for communication and information exchange (D'Souza & Colarelli, 2010). Virtual teams have become commonplace in large organizations, with one study reporting that 50% of all companies with more than 5000 employees incorporate virtual teams as vehicles for conducting work (Martins, Gilson, & Maynard, 2004). Various issues related to virtual teams have been investigated including effectiveness (Furst, Blackburn, & Rosen, 1999; Maznevski & Chudoba, 2000), trust (Jarvenpaa, Knoll, & Leidner, 1998; Sarker, Valacich, & Sarker, 2003), and adaptation (Majchrzak, Rice, Malhotra, King, & Ba, 2000).

Recent research has begun to examine issues surrounding the selection of virtual team members. A study by D'Souza and Colarelli (2010) found that the skills one brings to a team are a more important selection criteria for virtual team membership than for face-to-face team membership, but that personal characteristics (attractiveness, race, gender, and attitudinal similarity) are more important criteria for selecting face-to-face teams members, as self-reported by team members. What remain unexplored are the factors that predict why someone would want to be a member of a virtual team. The purpose of this study is to fill this gap in the literature on virtual teams.

The two major differences between virtual and face-to-face teams offer insight into this question. Traditional explanations for why people would want to work in a team focus around personal characteristics. Simply put, we prefer working with those who are physically attractive (Patzer, 2006) and/or who are similar to ourselves in terms of race (Wade & Okesola, 2002), gender (Colarelli, Spranger, & Hechanova, 2006) and attitudes (Byrne, 1971). However, since virtual teams do not meet face-to-face, we must look elsewhere for predictors of virtual team preference. The fact that virtual teams rely on computer mediated communication suggests that how one feels about using technology to communicate may play a role in virtual team preference.

Early research on information systems identified personal factors as important determinants of successful IS implementation and adoption (Lucas, 1981). These personal factors were of a dispositional nature and included personality and decision (cognitive) style. Research has looked at the effects of personality (Landers & Lounsbury, 2006; Zmud, 1979) and cognitive style (See Huber (1983), and Robey (1983), for a debate on the role of cognitive style.) as well as on their comparative effects (McElroy, Hendrickson, Townsend, & DeMarie, 2007) on one form of computer mediated communication, Internet use. We build off of this literature by examining the respective roles played by personality and cognitive style as determinants of preference for working in virtual teams.

Personality and cognitive style have already been shown to be important predictors of team member attitudes within the virtual team environment. For example, personality traits have been argued to affect individual trust among team members and willingness to collaborate in virtual teams (Brown, Poole, & Rodgers, 2004) as well as readiness to adopt collaboration technology (Vreede, Vreede, Ashley, & Reiter-Palmon, 2012). Moreover, cognitive style has

also been argued to be a significant predictor of the effectiveness of computer-mediated knowledge sharing among team members (Taylor, 2004).

One avenue which has not yet been explored is the connection between personality and cognitive style, and the relative contribution of both factors towards preference for participating in virtual teams. Our purpose is not to delineate how specific components of personality or cognitive style influence virtual team preference, but rather the collective role played by each of these dispositional factors. Understanding individual preferences for participating in virtual teams is important in that by preemptively selecting or assigning those individuals who prefer working in such teams organizations can minimize resistance and other problems that may occur after virtual team implementation.

BACKGROUND

Personality

Personality is a stable pattern of psychological processes, characteristics, and tendencies arising from motives, feelings, and cognitions which can be used to determine individual commonalities and differences in thoughts, feelings and actions (Maddi, 1989; Mayer, 2005). One way in which personality has been described is in terms of traits. These traits serve as measures of individual dispositions as well as comparative mechanisms of individual differences (Allport, 1966). Various instruments have been developed to measure individuals based on certain specified trait dimensions. Recently, research has shown that several of these measures are related hierarchically with each providing a varying degree of abstractness (Markon, Krueger, & Watson, 2005).

Among the contemporary measures of personality, the Big Five model has proven to be a robust and useful tool for understanding personality among individuals. The Big Five is based on the lexical hypothesis, which posits that socially relevant and salient personality characteristics are embedded in natural language (Allport, 1937; John, Angleitner, & Ostendorf, 1988; Saucier & Goldberg, 1996). The Big Five structure has been extensively tested using disparate samples in various contexts for a number of years, providing substantial evidence of its merits as a measure of individual personality and personality differences (see John, Naumann, & Soto, 2008 for an extensive review of the history of the Big Five factor model).

Within the Big Five, extraversion represents sociability, cheerfulness, and optimism with extraverts seeking out new opportunities and excitement. Neuroticism represents a lack of psychological adjustment with high negative emotional stability. Neurotic individuals are typically fearful, sad, embarrassed, distrustful, and have a difficult time managing stress. Agreeableness represents a tendency to be sympathetic, good-natured, cooperative, and forgiving with highly agreeable people tending to help others more readily. Conscientiousness represents the tendency to be self-disciplined, strong-willed, reliable, and deliberate with conscientious people actively planning, organizing, and carrying out tasks. Openness represents curiosity and willingness to explore new ideas with open individuals tending to devise novel ideas, hold unconventional values, and question authority (Costa & McCrae, 1992).

Recent research has linked personality traits to socio-technical characteristics of virtual teams. For example, personality traits have been argued to affect individual disposition to trust (as it does in face to face teams) and willingness to collaborate in the computer-mediated communication environment used by virtual teams. Research finds that individuals high in affiliation exhibit higher levels of trust in virtual collaboration (Brown et al., 2004). Also, four of

the five Big Five measures (minus neuroticism) were found to correlate with subjects' ease of transition to collaboration technologies, with extroversion negatively correlated, while agreeableness, openness, and conscientiousness had a positive correlation with the ease of transition construct (Vreede et al., 2012). Extraversion (from the Big 5 instrument) was found to be related to both the nature of group interactions and to the actual performance of virtual teams. Virtual teams with either high levels of extraversion or high variation in extraversion between team members had less constructive interaction styles within teams (Balthazard, Potter, & Warren, 2004). Personality-based trust was also found to affect overall trusting motives in a virtual team environment (Sarker et al., 2003). Higher levels of extraversion and agreeableness were found to lead to shorter pauses, and therefore greater trust, among virtual team members in technology assisted communication (Kalman, Scissors, & Gergle, 2010). Furthermore, using meta-analysis techniques, team performance was found to be positively affected by all five dimensions in the Big Five model (where emotional stability is utilized as opposed to neuroticism) (Bell, 2007; Mathieu, Maynard, Rapp, & Gilson, 2008).

While none of these studies juxtapose the personality differences between successful face to face and virtual team members, they do underscore that the socio-technical environment of the virtual team is distinct from the face to face team, and that there are personalities that perform better within this distinct environment. Since the personality requirements for a virtual team are demonstrably distinct, an examination of the impact of personality on individual preference for the virtual environment allows us to assess if an individual's personality profile also directs their disposition toward the virtual work environment. Therefore, we hypothesize:

H1: Personality will explain variation in preference for working in virtual teams.

Cognitive Style

Cognitive style refers to a broad range of theory related to information processing and decision-making among individuals (Armstrong, Peterson, & Rayner, 2011; Ausburn & Ausburn, 1978; McElroy et al., 2007; Messick, 1976). There are a number of measures of cognitive style, such as the Kirton Adaption Innovation (KAI) instrument (Kirton, 1989), the Cognitive Style Index (CSI) (Allinson & Hayes, 1996), and the Kolb Learning Style Inventory (KLS) (Smith & Kolb, 1986). The Myers-Briggs Type Indicator (MBTI) is an omnibus instrument used to capture Jung's (1921) conceptual cognitive style dimensions (Wheeler, Hunton, & Bryant, 2004) and is a (at least partial) theoretical antecedent to the CSI (Allinson & Hayes, 1996), the KAI (Kozhevnikov, 2007), and the KLS (Isaksen, Lauer, & Wilson, 2003). Despite criticism on its psychometric properties (Boyle, 1995; Gardner & Martinko, 1996) and length (Allinson & Hayes, 1996), the MBTI has undergone extensive validity and reliability assessments (Harvey, 1996) and is widely used. The MBTI is designed to measure individual preferences in how people apprehend and process information (Myers, 1995), which lends itself nicely to business environments including decision-based environments such as team-work.

The MBTI consists of four dimensional pairs combining to form 16 possible psychological types. The *extraversion/introversion* dimension refers to the outward or inward attitudes of the individual with extroverts drawing energy from action while introverts prefer reflection and time alone to reenergize.[1] The *sensing/intuition* dimension refers to how new

[1] Extraversion/introversion as measured by the MBTI is related to the extraversion dimension of the Big Five, but is theoretically distinct. The E/I dimension of the MBTI deals with the degree to which individuals look externally or turn inwardly in seeking out and processing information, while the extraversion factor of the Big Five is a measure of one's disposition to behave. Note that in the MBTI the construct is Extraversion /Introversion, not extraversion alone as in the Big 5. Costa and McCrae note: "Users familiar with Jungian psychology should note that the conceptualization of extraversion embodied in the NEO PI-R differs in many respects from Jung's …theory" Costa and McCrae (1992, p. 15). In the NEO PI-R, introversion is characterized as a *lack* of extraversion, rather than as an end of a dialectic preference set. Moreover, extraversion in the NEO PI-R is a broader concept than the

information is understood and interpreted with sensing individuals preferring concrete, tangible facts while individuals prone towards intuition trust information that is more abstract or theoretical. The *thinking/feeling* dimension refers to how decisions are made with thinkers employing a more detached, logical perspective while feelers tend to associate or empathize with the situation. Finally, the *judging/perception* dimension refers to individual preference when relating to decision making and the external world with judgers preferring matters to be settled while perceivers prefer to keep decisions open (Myers & McCaulley, 1985).

Substantial research has linked MBTI measures of cognitive style to decision-making and organizational processes. For example, the MBTI was found to influence the type of ideas in group idea generation (Garfield, Taylor, Dennis, & Satzinger, 2001). The MBTI has also been shown to have a significant impact on overall team project results with extroverted, thinking, judging members showing better overall results (Peslak, 2006). With regards to virtual teams, cognitive style has been shown to have a significant impact on learning effectiveness in virtual environments (Chen & Macredie, 2002). Also, cognitive style has been shown to impact computer-mediated knowledge sharing among organizational team members with analytical thinkers showing higher use of data mining software and knowledge management systems (Taylor, 2004). Finally, in a test of MBTI factors on performance among teams in face to face or computer-mediated communication scenarios, Barkhi (2002) found different cognitive styles were associated with different reactions to the two communication environments.

The above studies suggest that cognitive style has utility as a determinant of various aspects of preferences and abilities relevant to virtual teams, and thus those preferences may affect an individual's preference for virtual teamwork. Therefore, we hypothesize:

---

extraversion/introversion dimension of the MBTI. It includes not only gregariousness but also warmth, assertiveness, activity, excitement seeking and positive emotions.

H_2: Cognitive style will explain variation in preference for working in virtual teams.

Huber's (1983) debate with Robey (1983) pertaining to the role of cognitive style in the context of technology called for abandoning cognitive style as a determinant of IS design due to the lack of explanatory power. While no research has compared the predictive power of both personality and cognitive style in the context of virtual teams, McElroy et al. (2007) compared the relative contribution of each in the context of on-line shopping behavior, finding personality to have greater explanatory power as compared to cognitive style. In this research we do not examine the specific role of each personality trait or cognitive style type, but instead seek to determine the relative contribution of personality versus cognitive style as antecedents of virtual team preference. Since we are examining subjects' thoughts and feelings about the virtual team environment, we expect that personality will predict more variance in preference than cognitive style given personality's usefulness in gauging thoughts, motives, and feelings (Maddi, 1989; Mayer, 2005) as compared to cognitive style which focuses on information processing and decision-making (Armstrong et al., 2011; Ausburn & Ausburn, 1978; Messick, 1976). Thus, we hypothesize:

H_3: Personality will explain more variation in preference for working in virtual teams as compared to cognitive style.

DATA COLLECTION

Participants for this research included 153 business students from a variety of majors. Students received a packet containing the questionnaire and were offered a small amount of extra credit for the completion of the survey. Students were asked to complete the questionnaire on their own time outside of class and return it the next week. Those electing not to participate were

simply asked to return the questionnaire blank, and were rewarded the same extra credit as the other students. Of the 153 subjects, 132 answered every question and offered useful data for analysis. Participants were evenly distributed among genders with 52 percent male and 48 percent female.

MEASURES

Control Variable

Given the technological nature of virtual teams, one's technological background could potentially have a confounding effect on the results of this study. To control for previous individual technological knowledge, a control variable measuring technological background was used. This control variable consisted of one item asking subjects about previous technology courses they had taken, which was used as a proxy for prior technological knowledge.

Personality

Personality was measured in this study using Costa and McCrae's Revised NEO Personality Inventory (Costa & McCrae, 1992). This instrument includes the full 240-item questionnaire which describes the individual's personality according to the Big Five factors. The NEO-PI-R is a widely used instrument whose validity and reliability have been well documented (Costa & McCrae, 1992). Reliability estimates of the items in this study ranged from 0.89 (Agreeableness) to 0.93 (Neuroticism).

Cognitive Style

Cognitive style was measured using the MBTI Form M (Myers & Myers, 1998). We chose the MBTI for this research for several reasons. First, the MBTI focuses on how one makes judgments and arrives at conclusions, which is an important aspect of corporate life and teamwork. Second, other scales such as the CAI, have been shown to correlate highly with the

MBTI (Allinson & Hayes, 1996). Third, the MBTI is popular in industry, and researchers have argued that its wide use by corporations provides more relevance for organizational research (Garfield et al., 2001).

This 93-item instrument uses a forced-choice format where subjects select which of two statements for each item is most applicable. Difference scores were calculated for each subject on the four dimensions of extraversion/introversion, sensing/intuition, thinking/feeling, and judgment/perception, with higher scores indicating preferences for extraversion, sensing, thinking, and judgment. KR-20 estimates of reliability were used, given the dichotomous nature of the scoring, with values ranging from 0.73 for extraversion/introversion to 0.92 for judgment/perception.

Preference for Working in Virtual Teams

Given the novelty of the construct, preference for working in virtual teams has not been operationalized in the literature. Traditional measures of group work have involved several measures including preference for group work, group-member satisfaction, and group-member performance (Shaw, Duffy, & Stark, 2000). Preference for group work, however, is the only construct which occurs prior to group work and, as such, has utility in terms of the selection of virtual team members.

In an attempt to measure preference for working in virtual teams, we first looked at the literature for existing measures. We found none but did discover an existing instrument measuring preference for group work over working alone (Shaw et al., 2000). Four items from this scale were adapted to capture preference for working in virtual teams versus working alone and included "When I have a choice, I would rather work in virtual teams than by myself," "I prefer to work on a virtual team task than on individual tasks," "Working in a virtual group is

better than working alone," and "Given the choice, I would rather do a job where I can work alone rather than do a job where I have to work with others in a virtual team" (reverse coded). While these items measure one's preference for working in virtual teams over working alone, they do not address the degree to which one would prefer working in virtual versus face-to-face teams. Consequently, four additional items were developed contrasting the degree to which individuals preferred virtual to face-to-face teams and included "I would be as comfortable working on a virtual team as I would a face-to-face team," "If given the appropriate technology, I can be just as effective working on a virtual team as I can on a face-to-face team," "I could not feel a part of a team that did not meet face-to-face," (reverse coded) and "I would participate as easily on a team that used chat rooms, e-mail and conference calls to communicate with my fellow team members as I could in face-to-face discussions." Preference for working in virtual teams was, therefore, operationalized as a two-faceted construct; preference for virtual teams over working alone and preference for virtual teamwork over face-to-face group work. The model being tested is shown in Figure 1.

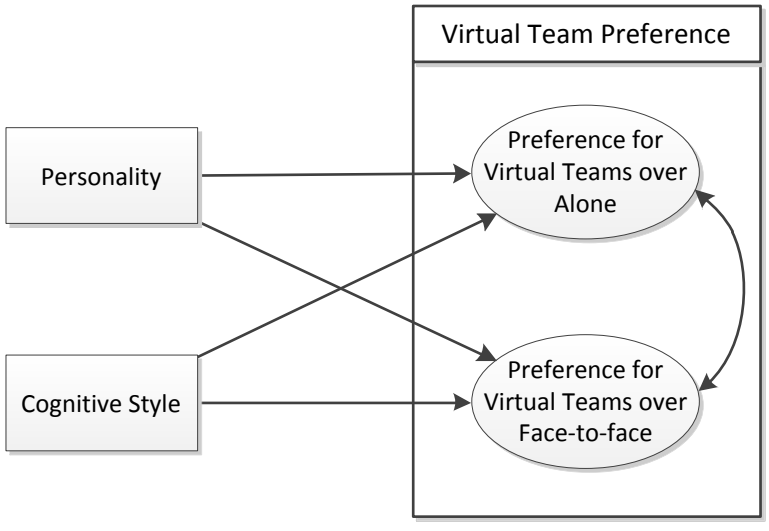

Figure 1: Proposed research model.

RESULTS

Measurement Model

Given the novelty of the proposed virtual team preference construct and the fact that the preference items contrast preference for working in virtual teams to two different alternatives (i.e., working alone and working in face-to-face teams), a full confirmatory factor analysis (CFA) was used to evaluate the psychometric properties of the purported construct. Multiple fit criteria were used to evaluate the measurement model including the comparative fit index (CFI), the Tucker-Lewis index (TLI), the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR). Acceptable levels for each included CFI $\geq$ 0.95, TLI $\geq$ 0.95, RMSEA $\leq$ 0.06, and SRMR $\leq$ 0.08 (Bearden, Netemeyer, & Mobley, 1993; Browne & Cudeck, 1993; Gefen, Straub, & Boudreau, 2000; L. Hu & Bentler, 1999; Kim & Son, 2009; MacCallum, Browne, & Sugawara, 1996).

The measurement model included the two latent factors measuring the two facets of virtual team preference used in the model. The results from the measurement model revealed excellent fit [$\chi^2(19) = 17.52$, $p = 0.55$, CFI = 1.00, TLI = 1.00, RMSEA = 0.000, SRMR = 0.028]. This analysis confirms the existence of two separate dimensions of preference for working in virtual teams. Numerous tests of reliability and validity were used to evaluate the quality of the latent constructs in the measurement model (Bagozzi & Yi, 1988; Fornell & Larcker, 1981). Reliability was examined by employing construct reliability using Cronbach's coefficient alpha and composite reliability. Values for Cronbach's alpha are above the recommended level of 0.7 with the lowest value being 0.82 (Nunnally, 1978). Composite reliability, a reflection of the impact of error on the measurement scale, is widely utilized in the evaluation of latent variable measurement models (Raykov & Grayson, 2003). All constructs

within the measurement model were found to have a composite reliability well above the recommended cutoff of 0.7, indicating high composite reliability (Bagozzi & Yi, 1988; Bearden et al., 1993; Fornell & Larcker, 1981).

Both convergent and discriminant construct validity were tested using the measurement model. Convergent validity is evaluated using the composite reliability (described above), AVE, and factor loadings of items on their respective latent variables. The AVE measures the amount of variance that a construct captures from its indicators and is recommended to be above 0.5 (Chin, 1998; X. Hu, Lin, Whinston, & Zhang, 2004). In the measurement model, the lowest AVE value is 0.55, which is above the recommended cutoff point. Convergent validity is also assessed by item loadings on latent constructs, with each item loading on their respective latent variable at least 0.6 and ideally 0.7 or above. This indicates that each measure is accounting for 50 percent or more of the variance in the underlying latent variable (Chin, 1998; X. Hu et al., 2004). All factor loadings were found to be above the 0.6 cutoff, with only two items (0.69 and 0.66 respectively) falling below the ideal 0.7 mark, indicating good convergent validity (Hair, Black, Babin, Anderson, & Tatham, 2006). Discriminant validity was assessed using a derivation of the AVE, namely, the square root of the AVE. The square root value represents the average association of each latent construct to its respective item measures while the corresponding correlation between the constructs indicates the overlap of associations among the latent variables. Thus, if the square root of the AVE is higher than the correlation of that latent construct with the other construct in the measurement model, this indicates that the construct is more closely related to its own measure than to the measures of the other latent construct (Chin, 1998; Gefen & Straub, 2005; Majchrzak, Beath, Lim, & Chin, 2005). The square roots of the AVE values are both much higher than the correlation between the two latent constructs. In

summary, the results from the measurement model demonstrate high reliability as well as high convergent and discriminate construct validity for both preference constructs. Descriptive statistics, along with the validity and reliability measures are shown in Appendix A.

Research Model

Two hierarchically nested structural analyses were used to test the three hypotheses, with each of the two analyses containing three nested models. Step one in each of the two analyses consisted of entering the control variable of technological background, providing a baseline from which to test the hypotheses. In step two, either the Big Five personality factors or cognitive style dimensions were entered separately. Finally, the third step added both the Big Five factors and cognitive style dimensions to create an omnibus model. Table 1 shows the results.

Table 1: Standardized loadings for personality and cognitive style on virtual two aspects of team preference, controlling for technological background (* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$).

	VT Preference over Alone				VT Preference over F2F			
	Step 1	Step 2		Step 3	Step 1	Step 2		Step 3
		Personality first	Cog Style first			Personality first	Cog Style first	
Technical Background	0.18*	0.18*	0.21**	0.22**	0.18*	0.16	0.20*	0.17*
Agreeableness		0.09		0.19*		0.04		0.12
Conscientiousness		-0.02		-0.27**		0.10		-0.10
Extraversion		0.12		0.26*		-0.17		0.15
Neuroticism		-0.12		-0.11		-0.03		-0.03
Openness		0.06		0.11		0.33***		0.39***
MBTI T-F			0.18*	0.25**			0.13	0.17
MBTI E-I			0.13	-0.07			-0.19*	-0.35**
MBTI S-N			-0.19	-0.06			-0.07	0.21
MBTI J-P			0.22*	0.28**			-0.06	-0.08
R2	0.03	0.09	0.11*	0.19**	0.03	0.13*	0.10	0.23***

The first model with only the covariate of technical background freely estimated was initially run and the model was found to have very good fit [$\chi^2(97) = 116.58$, $p = 0.09$, CFI = 0.97, TLI = 0.97, RMSEA = 0.039, SRMR = 0.076]. Next, allowing personality to be freely estimated revealed an excellent fitting model [$\chi^2(87) = 96.69$, $p = 0.22$, CFI = 0.99, TLI = 0.98, RMSEA = 0.029, SRMR = 0.051] which fit significantly better than the initial covariate only

model [$\Delta\chi^2(10) = 19.89$, $p < 0.05$]. In this model, personality explained a significant amount of variance in virtual team preference over face-to-face teamwork ($R^2 = 0.13$, $p < 0.05$), but was not a significant predictor of preference for working in virtual teams over working alone. Consequently, H1 received only partial support. Allowing cognitive style to be freely estimated in the second model also produced an excellent fitting model [$\chi^2(89) = 93.90$, $p = 0.34$, CFI = 0.99, TLI = 0.99, RMSEA = 0.020, SRMR = 0.059] which fit significantly better than the initial model with only the covariate [$\Delta\chi^2(8) = 22.68$, $p < 0.05$]. This cognitive style-only model explained a significant amount of variance in virtual team preference over working alone ($R^2 = 0.11$, $p < 0.05$), but not over face-to-face teamwork. Thus, H2 was partially supported. Taken together, these results suggest that both personality and cognitive style are important predictors of preference for virtual teamwork, but that they differentially affect the two facets.

A closer look at the individual dimensions of personality and cognitive style reveals that openness to new experiences ($\beta = 0.33$, $p < 0.001$) is the driver behind the significant effect for personality on preference for virtual teams over face-to-face, while both the thinking/feeling ($\beta = 0.18$, $p < 0.05$) and the judging/perceiving ($\beta = 0.22$, $p < 0.05$) dimensions of cognitive style are the significant predictors of virtual team preference over working alone. The finding that the extraversion/introversion ($\beta = -0.19$, $p < 0.05$) dimension of cognitive style significantly predicts virtual team preference over face-to-face groups is discounted by the fact that cognitive style as a whole failed to add significantly to the model

The inclusion of both personality and cognitive style separately as freely estimated parameters (Step 3, Table 1) significantly improved model fit [$\Delta\chi^2(8) = 27.14$, $p < 0.05$ and $\Delta\chi^2(10) = 24.35$, $p < 0.05$, respectively]. Moreover, when both personality and cognitive style are entered into the model, the ability to predict preference for working in virtual teams was

significantly increased over the ability of either one alone. This finding, which applies to both dimensions of virtual team preference, suggests a lack of support for H3.

DISCUSSION

For this research, a theoretical construct of virtual team preference was operationalized based on previous research and accepted measures of face-to-face team research. Two facets of virtual team preference, preference for working in virtual teams over alone and preference for working in virtual teams over face-to-face, were measured. A thorough psychometric analysis indicates that these two facets hold very well and show excellent validity and reliability. In fact, we believe that our virtual team preference construct offers promise for future research analyzing individual preparedness for virtual team work.

The results of our research show that both personality and cognitive style predict aspects of virtual team preference. The overall model fit demonstrates that both cognitive style and personality provide significant improvements in predictive capacity for understanding individual preference to participate in virtual teams and can be used to assess individual preference prior to implementation of such work teams.

The results also show that personality and cognitive style predict the two aspects of virtual team preference differently. First, personality explains a significant amount of variance (ten percent) above that explained by one's technical background in preference for working in virtual over face-to-face teams. This finding is primarily due to the effect of openness. Open individuals may perceive virtual team environments as a way to explore new ideas within a nontraditional team environment, thereby leading to an easier transition to using such technology (Vreede et al., 2012). Second, cognitive style explains a similar amount of variance (eight

percent) in preference for working in virtual teams over working alone, a finding resulting from the roles played by the thinking/feeling and the judging/perceiving dimensions. Given the more detached nature of thinkers, the separated nature of the online environment may be preferential. Also, judgers may perceive the online environment as less accommodating for drawn-out team discussions, leading to decisions which are more quickly finalized with better overall results (Peslak, 2006).

It is significant to note that both personality and cognitive style provide a meaningful explanation of two distinct but critical aspects of virtual teamwork preference. This research suggests that if the issue at hand requires a team approach, then the openness to new experience personality factor will indicate those more likely to prefer a virtual team environment over face-to-face. On the other hand, cognitive style predicts virtual team preference over working alone because of its focus on information processing and decision making. The decision process used in a team situation will vary greatly from individual decision making. Thus the use of cognitive style to assess virtual team preference will be most effective when individuals have the choice of either a team-based or individual work process. Given the added value of both personality and cognitive style, a combined model offered even greater predictive power by explaining 19 and 23 percent of the variance in the two aspects of virtual team preference respectively.

One purpose of this research was to comparatively test personality and cognitive style as predictors of virtual team preference. In contrast to earlier research in a technology-based environment (McElroy et al., 2007), both personality and cognitive style offer significant model fit with regard to virtual team preference, albeit with respect to different dimensions. This argues for a dual approach to the study of virtual team preference using both personality and

cognitive style as each shows different relative strengths in predicting our two dimensions of preference for virtual work.

LIMITATIONS AND FUTURE WORK

This research specifically tests the predictive power of personality and cognitive style on virtual team preference. One limitation of the study is that we focused our work on preference for working in virtual teams rather than what aspects of the virtual team environment potential members might find appealing or repelling. Future research could address the role of personality and cognitive style on individual preferences for specific aspects of the virtual team environment. Because we focused on preference for working in virtual teams, we did not contrast the effects of personality and cognitive style on preference for working in face-to-face groups. Future research using a more complete design could determine whether the personality and cognitive style effects found here for preference in virtual teams also apply to preference for working in face-to-face teams. In addition, other personal factors may be useful in predicting virtual team preference and other methods for measuring personality and cognitive style may produce different results. Personality has also been shown to have various levels of abstraction (Markon et al., 2005) with varying trait levels having different predictive outcomes. Future research should investigate whether the Big Five aggregations offer optimal predictive capacity or whether less broad dimensions are better at predicting virtual team preference as has been suggested in previous research (George, 1992). Also, future research should investigate the impact of personality and cognitive style on other aspects of virtual team use beyond initial preference including during and after implementation of such work teams. It would also be prudent to examine the effect of past experiences in working in virtual teams. Finally, our study

looked only at preference for working in virtual teams. Preference is a far cry from performance. Future research should examine whether preference for working in virtual teams is a determinant of the actual performance of those teams.

The survey method used may also provide some limitations for this research. The data in this study were self-reported at a single point in time. Future research should investigate other methods of reporting as well as longitudinal approaches to data collection. While the student population in this sample represents a population likely to be influenced by virtual teams, student samples can be problematic when generalizing to the workforce at large. Also, given students' above average Internet and technology usage, this research may provide a bias which may not apply as readily to other individuals who are not as technologically literate.

CONCLUSION

This research adds to the extant literature in two significant ways. First, we offer a validated operationalization of a construct central to research concerning virtual teamwork, virtual team preference. This two dimensional latent construct should prove valuable to future research that attempts to explain varying levels of performance in virtual team environments. Second, we have shown that two widely used frameworks, personality and cognitive style, have utility in identifying those most likely to prefer virtual teamwork. Both have explanatory power when used in concert with each other, and need not be posed as an either or choice in future research. However, depending on whether the nature of the structural problem to be solved is one of virtual teams versus face-to-face teams or whether it is virtual teamwork versus individual efforts, either personality or cognitive style will offer insight. In either case, this study offers a first step in understanding why some people prefer working in virtual teams while others don't.

Knowing this in advance of virtual teamwork can go a long way toward alleviating problems associated with virtual teamwork.

REFERENCES

Allinson, C. W., & Hayes, J. (1996). The Cognitive Style Index: A Measure of Intuition-Analysis For Organizational Research. *Journal of Management Studies, 33*(1), 119-135. doi: 10.1111/j.1467-6486.1996.tb00801.x

Allport, G. W. (1937). *Personality: A Psychological Interpretation*. New York: Holt.

Allport, G. W. (1966). Traits revisited. *The American psychologist, 21*(1), 1-10. doi: 10.1037/h0023295

Armstrong, S. J., Peterson, E. R., & Rayner, S. G. (2011). Understanding and defining cognitive style and learning style: a Delphi study in the context of educational psychology. *Educational Studies*, 1-7. doi: 10.1080/03055698.2011.643110

Ausburn, L., & Ausburn, F. (1978). Cognitive styles: Some information and implications for instructional design. *Educational Technology Research and Development, 26*(4), 337-354. doi: 10.1007/bf02766370

Bagozzi, R., & Yi, Y. (1988). On the evaluation of structural equation models. *Journal of the Academy of Marketing Science, 16*(1), 74-94. doi: 10.1007/bf02723327

Balthazard, P., Potter, R. E., & Warren, J. (2004). Expertise, extraversion and group interaction styles as performance indicators in virtual teams: how do perceptions of IT's performance get formed? *SIGMIS Database, 35*(1), 41-64. doi: 10.1145/968464.968469

Barkhi, R. (2002). Cognitive style may mitigate the impact of communication mode. *Information & Management, 39*(8), 677-688. doi: http://dx.doi.org/10.1016/S0378-7206(01)00114-8

Bearden, W. O., Netemeyer, R. G., & Mobley, M. F. (1993). *Handbook of Marketing Scales: Multi-Item Measures for Marketing and Consumer Behavior Research*. Newbury Park, CA: Sage Publications.

Bell, S. T. (2007). Deep-Level Composition Variables as Predictors of Team Performance: A Meta-Analysis. *Journal of applied psychology, 92*(3), 595-615. doi: 10.1037/0021-9010.92.3.595

Boyle, G. J. (1995). Myers-Briggs Type Indicator (MBTI): Some Psychometric Limitations. *Australian Psychologist, 30*(1), 71-74. doi: 10.1111/j.1742-9544.1995.tb01750.x

Brown, H. G., Poole, M. S., & Rodgers, T. L. (2004). Interpersonal Traits, Complementarity, and Trust in Virtual Collaboration. *Journal of Management Information Systems, 20*(4), 115-137.

Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. A. Bollen & J. S. Long (Eds.), *Testing Structural Equation Models* (pp. 445-455). Newbury Park, CA: Sage.

Byrne, D. (1971). *The Attraction Paradigm*. New York: Academic Press.

Chen, S. Y., & Macredie, R. D. (2002). Cognitive styles and hypermedia navigation: Development of a learning model. *Journal of the American Society for Information Science and Technology, 53*(1), 3-15. doi: 10.1002/asi.10023

Chin, W. W. (1998). Commentary: Issues and Opinion on Structural Equation Modeling. *MIS Quarterly, 22*(1), vii-xvi.

Colarelli, S. M., Spranger, J. L., & Hechanova, M. R. (2006). Women, power, and sex composition in small groups: An evolutionary perspective. *Journal of Organizational Behavior, 27*(2), 163-184. doi: 10.1002/job.350

Costa, P. T., & McCrae, R. R. (1992). *Revised NEO Personality Inventory (NEO-PI-R) and NEO Five-Factor Inventory (NEO-FFI) Professional Manual*. Odessa, FL: Psychological Assessment Resources.

D'Souza, G. C., & Colarelli, S. M. (2010). Team member selection decisions for virtual versus face-to-face teams. *Computers in Human Behavior, 26*(4), 630-635. doi: http://dx.doi.org/10.1016/j.chb.2009.12.016

Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research, 18*(1), 39-50. doi: 10.2307/3151312

Furst, S., Blackburn, R., & Rosen, B. (1999). Virtual team effectiveness: a proposed research agenda. *Information Systems Journal, 9*(4), 249-269. doi: 10.1046/j.1365-2575.1999.00064.x

Gardner, W. L., & Martinko, M. J. (1996). Using the Myers-Briggs Type Indicator to Study Managers: A Literature Review and Research Agenda. *Journal of Management, 22*(1), 45-83. doi: 10.1177/014920639602200103

Garfield, M. J., Taylor, N. J., Dennis, A. R., & Satzinger, J. W. (2001). Research Report: Modifying Paradigms--Individual Differences, Creativity Techniques, and Exposure to Ideas in Group Idea Generation. *Information Systems Research, 12*(3), 322. doi: 10.1287/isre.12.3.322.9710

Gefen, D., & Straub, D. W. (2005). A practical guide to factorial validity using PLS-graph: Tutorial and annotated example. *Communications of the Association for Information Systems, 16*(1), 5.

Gefen, D., Straub, D. W., & Boudreau, M. C. (2000). Structural Equation Modeling and Regression: Guidelines for Research Practice. *Communications of the Association for Information Systems, 4*(1), 7.

George, J. M. (1992). The Role of Personality in Organizational Life: Issues and Evidence. *Journal of Management, 18*(2), 185-213. doi: 10.1177/014920639201800201

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2006). *Multivariate Data Analysis* (6th ed.). Upper Saddle River, NJ: Pearson Education Inc.

Harvey, R. J. (1996). Reliability and Validity. In A. L. Hammer (Ed.), *MBTI Applications: A Decade of Research on the Myers-Briggs Type Indicator* (pp. 5-29). Palo Alto, CA: Consulting Psychologists Press.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6*(1), 1-55. doi: 10.1080/10705519909540118

Hu, X., Lin, Z., Whinston, A. B., & Zhang, H. (2004). Hope or Hype: On the Viability of Escrow Services as Trusted Third Parties in Online Auction Environments. *Information Systems Research, 15*(3), 236-249. doi: 10.1287/isre.1040.0027

Huber, G. P. (1983). Cognitive Style as a Basis for MIS and DSS Designs: Much ado about Nothing? *Management Science, 29*(5), 567-579. doi: 10.1287/mnsc.29.5.567

Isaksen, S. G., Lauer, K. J., & Wilson, G. V. (2003). An Examination of the Relationship Between Personality Type and Cognitive Style. *Creativity Research Journal, 15*(4), 343-354. doi: 10.1207/s15326934crj1504_4

Jarvenpaa, S. L., Knoll, K., & Leidner, D. E. (1998). Is Anybody out There? Antecedents of Trust in Global Virtual Teams. *Journal of Management Information Systems, 14*(4), 29-64.

John, O. P., Angleitner, A., & Ostendorf, F. (1988). The lexical approach to personality: A historical review of trait taxonomic research. *European Journal of Personality, 2*(3), 171-203. doi: 10.1002/per.2410020302

John, O. P., Naumann, L. P., & Soto, C. J. (2008). Paradigm shift to the integrative big five trait taxonomy: History, measurement, and conceptual issues. In O. P. John, R. W. Robins & L. A. Pervin (Eds.), *Handbook of Personality: Theory and Research* (3rd ed., pp. 114-158). New York: Guilford Press.

Jung, C. G. (1921). *Psychological Types*. Princeton, NJ: Princeton University Press.

Kalman, Y. M., Scissors, L. E., & Gergle, D. (2010, September 1). *Chronemic Aspects of Chat, and Their Relationship to Trust in a Virtual Team.* Paper presented at the Mediterranean Conference on Information Systems.

Kim, S. S., & Son, J.-Y. (2009). Out of dedication or constraint? A dual model of post-adoption phenomena and its empirical test in the context of online services. *MIS Quarterly, 33*(1), 49-70.

Kirton, M. (1989). *Adaptors and inmlVotors: Styles of creativity and problem-salving*. New York: Routledge.

Kozhevnikov, M. (2007). Cognitive styles in the context of modern psychology: Toward an integrated framework of cognitive style. *Psychological Bulletin, 133*(3), 464-481. doi: 10.1037/0033-2909.133.3.464

Landers, R. N., & Lounsbury, J. W. (2006). An investigation of Big Five and narrow personality traits in relation to Internet usage. *Computers in Human Behavior, 22*(2), 283-293. doi: http://dx.doi.org/10.1016/j.chb.2004.06.001

Lipnack, J., & Stamps, J. (2000). *Virtual Teams: People Working across Boundaries with Technology*. New York: John Wiley & Sons, Inc.

Lucas, H. C., Jr. (1981). *Implementation, the Key to Successful Information Systems*. New York: Columbia University Press.

MacCallum, R. C., Browne, M. W., & Sugawara, H. M. (1996). Power analysis and determination of sample size for covariance structure modeling. *Psychological Methods, 1*(2), 130-149. doi: 10.1037/1082-989x.1.2.130

Maddi, S. R. (1989). *Personality Theories: A Comparative Analysis* (5th ed.). Homewood, IL: Dorsey.

Majchrzak, A., Beath, C. M., Lim, R. A., & Chin, W. W. (2005). Managing Client Dialogues during Information Systems Design to Facilitate Client Learning. *MIS Quarterly, 29*(4), 653-672.

Majchrzak, A., Rice, R. E., Malhotra, A., King, N., & Ba, S. (2000). Technology adaption: the case of a computer-supported inter-organizational virtual team. *MIS Quarterly, 24*(4), 569-600. doi: 10.2307/3250948

Markon, K. E., Krueger, R. F., & Watson, D. (2005). Delineating the structure of normal and abnormal personality: an integrative hierarchical approach. *The Journal of abnormal and social psychology, 88*(1), 139-157. doi: 10.1037/0022-3514.88.1.139

Martins, L. L., Gilson, L. L., & Maynard, M. T. (2004). Virtual Teams: What Do We Know and Where Do We Go From Here? *Journal of Management, 30*(6), 805-835. doi: 10.1016/j.jm.2004.05.002

Mathieu, J., Maynard, M. T., Rapp, T., & Gilson, L. (2008). Team Effectiveness 1997-2007: A Review of Recent Advancements and a Glimpse Into the Future. *Journal of Management, 34*(3), 410-476. doi: 10.1177/0149206308316061

Mayer, J. D. (2005). A classification of DSM-IV-TR mental disorders according to their relation to the personality system. In J. C. Thomas & D. L. Segal (Eds.), *Comprehensive Handbook of Personality and Psychopathology (CHOPP) Vol. 1: Personality and Everyday Functioning*. New York: John Wiley & Sons.

Maznevski, M. L., & Chudoba, K. M. (2000). Bridging Space over Time: Global Virtual Team Dynamics and Effectiveness. *Organization Science, 11*(5), 473-492. doi: 10.1287/orsc.11.5.473.15200

McElroy, J. C., Hendrickson, A. R., Townsend, A. M., & DeMarie, S. M. (2007). Dispositional factors in internet use: personality versus cognitive style. *MIS Quarterly, 31*(4), 809-820.

Messick, S. (1976). Personality consistencies in cognition and creativity. In S. Messick (Ed.), *Individuality in learning* (pp. 4-23). San Francisco: Jossey-Bass.

Montoya, M. M., Massey, A. P., & Lockwood, N. S. (2011). 3D Collaborative Virtual Environments: Exploring the Link between Collaborative Behaviors and Team Performance. *Decision Sciences, 42*(2), 451-476. doi: 10.1111/j.1540-5915.2011.00318.x

Myers, I. B. (1995). *Gifts Differing: Understanding Personality Type* (2nd ed.). Mountain View, CA: Nicholas Brealey Publishing.

Myers, I. B., & McCaulley, M. H. (1985). *Manual: A Guide to the Development and Use of the Myers-Briggs Type Indicator* (2nd ed.). Palo Alto, CA: Consulting Psychologists Press.

Myers, I. B., & Myers, K. D. (1998). *Myers-Briggs Type Indicator Form M*. Palo Alto, CA: Consulting Psychologists Press, Inc.

Nunnally, J. C. (1978). *Psychometric Theory* (2nd ed.). New York: McGraw-Hill.

Patzer, G. L. (2006). *The Power and Paradox of Physical Attractiveness*. Boca Raton: BrownWalker Press.

Peslak, A. R. (2006). *The impact of personality on information technology team projects.* Paper presented at the Proceedings of the 2006 ACM SIGMIS CPR conference on computer personnel research: Forty four years of computer personnel research: achievements, challenges, and the future, Claremont, California, USA.

Raykov, T., & Grayson, D. (2003). A Test for Change of Composite Reliability in Scale Development. *Multivariate Behavioral Research, 38*(2), 143-159. doi: 10.1207/s15327906mbr3802_1

Robey, D. (1983). Cognitive Style and DSS Design: A Comment on Huber's Paper. *Management Science, 29*(5), 580-582.

Sarker, S., Valacich, J. S., & Sarker, S. (2003). Virtual Team Trust: Instrument Development and Validation in an IS Educational Environment. *Information resources management journal, 16*(2), 35-55. doi: 10.4018/irmj.2003040103

Saucier, G., & Goldberg, L. R. (1996). The language of personality: Lexical perspectives on the five-factor model. In J. S. Wiggins (Ed.), *The Five-Factor Model of Personality: Theoretical Perspectives* (pp. 21-50). New York: Guilford Press.

Shaw, J. D., Duffy, M. K., & Stark, E. M. (2000). Interdependence and Preference for Group Work: Main and Congruence Effects on the Satisfaction and Performance of Group Members. *Journal of Management, 26*(2), 259-279. doi: 10.1177/014920630002600205

Smith, D. M., & Kolb, D. A. (1986). *Leaming Style Inventory: User's Guide*. Boston: McBer.

Taylor, W. A. (2004). Computer-mediated knowledge sharing and individual user differences: an exploratory study. *European Journal of Information Systems, 13*(1), 52. doi: 10.1057/palgrave.ejis.3000484

Townsend, A. M., DeMarie, S. M., & Hendrickson, A. R. (1998). Virtual Teams: Technology and the Workplace of the Future. *The Academy of Management Executive (1993-2005), 12*(3), 17-29. doi: 10.5465/AME.1998.1109047

Vreede, T. d., Vreede, G.-J. d., Ashley, G., & Reiter-Palmon, R. (2012, Jan. 4-7). *Exploring the Effects of Personality on Collaboration Technology Transition.* Paper presented at the 45th Hawaii International Conference on System Sciences, Hawaii.

Wade, J. C., & Okesola, O. (2002). Racial Peer Group Selection in African American High School Students. *Journal of Multicultural Counseling and Development, 30*(2), 96-109. doi: 10.1002/j.2161-1912.2002.tb00482.x

Wheeler, P. R., Hunton, J. E., & Bryant, S. M. (2004). Accounting Information Systems Research Opportunities Using Personality Type Theory and the Myers-Briggs Type Indicator. *Journal of Information Systems, 18*(1), 1-19. doi: 10.2308/jis.2004.18.1.1

Zmud, R. W. (1979). Individual Differences and MIS Success: A Review of the Empirical Literature. *Management Science, 25*(10), 966-979. doi: 10.1287/mnsc.25.10.966

APPENDIX A

Means, standard deviations, Cronbach's alpha, composite reliability (CR), average variance extracted (AVE), and correlations (with square root of AVE along the diagonal for the two latent variables)

							Correlations										
		Mean	Std. Dev	Alpha	CR	AVE	over Alone	over F2F	Agreeableness	Conscientiousn	Extraversion	Neuroticism	Openness	Thinking	Extraversion	Sensing	Judging
VT Pref	over Alone	3.04	0.88	0.91 [CI=0.88,0.93]	0.91	0.72	0.85										
	over F2F	3.33	0.82	0.82 [CI=0.77,0.87]	0.83	0.55	**0.42**	0.74									
NEO-PI	Agreeableness	115.13	20.99	0.89 [CI=0.87,0.92]	-	-	0.07	0.01									
	Conscientiousness	125.54	21.55	0.89 [CI=0.87,0.92]	-	-	0.04	0.03	**0.45**								
	Extraversion	118.58	23.08	0.91 [CI=0.89,0.93]	-	-	0.14	-0.01	**0.24**	**0.48**							
	Neuroticism	85.01	24.4	0.93 [CI=0.91,0.94]	-	-	**-0.21**	-0.11	-0.15	**-0.17**	-0.13						
	Openness	114.07	22.33	0.90 [CI=0.87,0.92]	-	-	0.11	0.22	**0.21**	**0.25**	**0.53**	0.00					
MBTI	Thinking	1.99	13.62	0.85	-	-	0.13	**0.06**	**-0.17**	**0.28**	-0.08	**-0.23**	-0.10				
	Extraversion	2.28	12.46	0.73	-	-	0.10	-0.15	0.01	-0.01	**0.60**	-0.14	**0.19**	**-0.19**			
	Sensing	-0.16	13.86	0.91	-	-	-0.02	-0.06	0.09	**0.24**	**-0.17**	**0.21**	**-0.54**	0.15	-0.11		
	Judging	5.45	12.83	0.92	-	-	0.14	-0.05	0.04	**0.30**	-0.10	0.11	**-0.31**	**0.21**	-0.10	**0.61**	

CHAPTER 3: UTILIZING STRUCTURAL EQUATION MODELING AND SOCIAL COGNITIVE CAREER THEORY TO IDENTIFY FACTORS IN CHOICE OF IT AS A MAJOR

A paper accepted by *ACM Transactions on Computing Education*

Andy Luse, Julie Rursch, Doug Jacobson

ABSTRACT

In the USA, the number of students entering into and completing degrees in science, technology, engineering and mathematics (STEM) areas has declined significantly over the past decade. While the past four years has shown modest increases in enrollments in computer-related majors, the prediction is that even in three to four years when these students graduate there will be shortages of computer-related professionals for industry. The challenge this paper focuses on is attracting students to select an information technology (IT) field such as computer science, computer engineering, software engineering, or information systems as a major when many high schools do not offer a single computer course and high school counselors, families, and friends do not provide students with accurate information about the field. Social Cognitive Career Theory (SCCT) has been used extensively within counseling and career psychology as a method for understanding how individuals develop vocational interests, make occupational choices, and achieve success within their chosen field. In this paper the SCCT model identifies factors which specifically influence high school students to select a major in an IT-related discipline. These factors can then be used

to develop new or enhance existing IT-related activities for high school students. The paper demonstrates that both interest and outcome expectations have a significant positive impact on choice to major. Interest also is found to mediate the effects of self-efficacy and outcome expectations on intent to major. Overall the model predicts a good portion of variance in the ultimate outcome of whether or not an individual chooses to major in IT.

KEYWORDS

Structural Equation Modeling, Social Cognitive Career Theory, Self-efficacy, Interest

INTRODUCTION

In the USA, the number of students entering into and completing degrees in science, technology, engineering, and mathematics (STEM) areas has declined significantly over the past decade (Aasheim, Li, & Williams, 2009; Aken & Michalisin, 2007; Granger, Dick, Jacobson, & Slyke, 2007; Patterson, 2005; Pollacia & Russell, 2007; Riemenschneider, Armstrong, & Moore, 2009; Vegso, 2005). A recent NAE report (Committee on Prospering in the Global Economy of the 21st Century: An Agenda for American Science and Technology, National Academy of Sciences, National Academy of Engineering, & Institute of Medicine, 2007) noted that in addition to a declining number of students studying areas of basic scientific knowledge, the country is not producing enough professionals and skilled labor to apply technology in industry. The traditional computer-related college graduates with majors such as Computer Engineering, Computer Science, Information Systems, and Software Engineering are no exception to this large, overarching trend. The bottoming out of student enrollment in Computer Science and Computer Engineering was documented in 2007 by Computer Research Association. Even with increases over the past four years (Zweben,

2012), enrollment will in no way offset the anticipated shortages of computer-related professionals for industry; as expanded growth within the computing industry is expected to continue through 2018 ("Bureau of Labor Statistics," 2010).

The challenge the discipline faces involves attracting students to select an information technology (IT)[2] field as a major when many high schools do not offer a single computer course (Wilson, Sudol, Stephenson, & Stehlik, 2010) and high school counselors, families, and friends do not provide students with accurate information about the field (Babin, Grant, & Sawal, 2008; Huang, Greene, & Day, 2008; Lomerson & Pollacia, 2006a, 2006b). Without coursework or career counseling options to help students make their decisions, we are challenged to find other ways high school students can be encouraged to major in an IT-related discipline.

This paper uses the Social Cognitive Career Theory (SCCT) to identify factors which specifically influence high school students to select a major in an IT-related discipline. Historically, SCCT has been used extensively within counseling and career psychology as a method for understanding how individuals develop vocational interests, make occupational

[2] We understand in the strictest definition IT means the study, design, development, application, implementation, support, or management of computer-based information systems. However, in this paper, the term IT is used as a broad umbrella category when introducing the possible areas of inquiry to novice high school students participating in the IT-Adventures program. The IT-Adventures program is a highly successful high school outreach program developed and delivered by Iowa State University (Rursch, Luse, & Jacobson, 2010) that uses extracurricular clubs and events to increase student interest in IT. Students could explore one, two, or three different technologies in the year-long, inquiry-based learning program. The entire program, as well as the culminating capstone competitive event, is run with an intramural sports flavor where every student is welcome to participate and learn, rather than a varsity sport where students have to already be very good at a specific skill set to participate. Most of the current competitions for students in IT are varsity sports. Because the program was stressing the inclusiveness of all students, not just exclusiveness of the elitist few who already are interested in IT, it was necessary to find an overarching word to be the placeholder to introduce students to disciplines such as Computer Engineering, Computer Science, Information Systems, and Software Engineering. By using the intramural, inclusive approach, IT-Adventures strives to allow high school students to explore and consider a career in an IT-related area without any prior knowledge. The model presented in this paper demonstrates influences on choice of IT-related major and those influences can then be used to modify or enhance the high school outreach program, such as the one used here as the study population for this research.

choices, and achieve success within their chosen field (Lent, 2005). However, previous research conducted on SCCT uses college students who have already chosen which major they will pursue, which can confound the results. This research provides novel contribution in three distinct ways. First, this paper provides a highly detailed exposition of the SCCT model. Second, by utilizing a sample of high school students, this paper demonstrates that SCCT can be used to better understand those aspects which drive the decision of high school students to major in IT. Finally, this paper provides a valuable discussion of high school outreach programs that build self-efficacy, interest, and outcome expectations in IT.

THEORETICAL BACKGROUND

Social Cognitive Career Theory

Career development research has produced a number of theories which aim to explain the career decisions of individuals and also to aid career counselors in assisting in career related problems. Several theories have been developed including the learning theory of careers counseling (Krumboltz, Mitchell, & Jones, 1976; Mitchell & Krumbolt, 1996; Mitchell & Krumboltz, 1990), a developmental-contextual approach to career development (Vondracek, 2001; Vondracek, Lerner, & Schulenberg, 1986), the psychological theory of work adjustment (Dawis & Lofquist, 1984), the theory of career choice – RIASEC (Holland, 1959, 1997), and the life-span, life-space theory(Super, 1957, 1981, 1990). Research has suggested that it may be beneficial to the field of career counseling to consolidate these explanations of career choice and development by…

> (a) bringing together conceptually related constructs (e.g., self-concept, self-efficacy), (b) more fully explaining outcomes that are common to a number of career theories (e.g., satisfaction, stability), and (c) account for the relations among seemingly diverse constructs (e.g., self-efficacy, interests, abilities, needs) (Hackett & Lent, 1992).

Social cognitive career theory (SCCT) (Lent, 2005; Lent, Brown, & Hackett, 1994) is an effort to provide an overarching integration of previous theories in career counseling. Bandura's social cognitive theory (1986) is utilized as the primary foundation for the theory, which explores the complex ways in which people, behavior, and environmental surroundings jointly influence one another. SCCT recognizes the capacity for individuals to direct their own vocational behavior while also acknowledging personal and environmental influences that may strengthen, weaken, or negate human agency in career development.

SCCT explores how people (1) develop vocational interests, (2) make occupational choices, and (3) achieve career-related performance goals. To this end, the SCCT theoretical framework consists of three segmental models (Lent, 2005). The Interest Model explores the development of academic and career interests investigating aspects of home, educational, recreational, and peer environments and how they affect interest in a certain vocational area (Lent, 2005). The Choice Model deals with the formation of educational and vocational choices. This model consists of the (1) expression of career choice as derived from career interests, (2) actions designed to implement this choice (such as participating in training programs or choosing a particular major), and (3) subsequent performance achievements (Lent et al., 1994). The Performance Model can be used to help explain achievements related to goals which have been selected or adopted (Lent et al., 1994). This model is helpful in explaining the level of attainment achieved by individuals and the degree of persistence at a particular task or career path, primarily when obstacles are encountered (Lent, 2005). Lent,

et al.(2008) investigated SCCT in the context of collegiate interest and choice in the computing disciplines and showed support for the model while Smith used SCCT in the context of IT academic performance for undergraduate students (Smith, 2002). A partial examination of the SCCT model was conducted by (Heinze & Hu, 2009), as well as a supplemental model by (Akbulut-Bailey, 2011) in which social supports are included.

One limitation of all the previous SCCT research concerns the samples used. The examples above use college students to test the model. The problem is that many students have already formed their interests and intentions to major in a certain discipline by this time in their academic career. One notable exception is work done by Fouad and Smith (1996), who utilized SCCT to investigate interest of middle-school students in math and science. Their analysis provided support for the relationships proposed in SCCT with strong support for indirect paths within the model. With this exception in mind, the problem remains that much more research needs to be conducted to test the SCCT model on students before they are in college, while they are still forming their interests in possible areas to major.

The SCCT model utilizes three overarching person-centric variables to measure career development: self-efficacy beliefs, outcome expectations, and individual interest. The Choice Model within SCCT utilizes these constructs to help determine the likelihood of an individual majoring in a particular area and is the model used for this paper.

Self-Efficacy

Self-efficacy has been extensively researched in various disciplines as a method for measuring a person's ability to perform a specific task. Self-efficacy says that successful task completion is not only dependent on skills, but on a dynamic set of self-beliefs of an

individual's ability to perform tasks (Bandura, 1986) or activities in particular domains (Lent, 2005). Self-efficacy can be influenced by four primary sources:

1. Personal performance accomplishments (enactive mastery)
2. Vicarious learning
3. Social persuasion
4. Physiological and affective states (Bandura, 1997).

Enactive mastery offers the most influence over self-efficacy in a particular domain (Bandura, 1986) because it enables hands-on interaction within a particular area which, if done correctly, allows the individual to experience personal success with completing the task (Scheibe, Mennecke, & Luse, 2007). Repeated experiences of success within a particular domain raise the individual's self-efficacy with regard to the task.

Measuring self-efficacy within information systems has received a large amount of research. One of the first, and most popular, metrics for measuring computer self-efficacy was proposed by Compeau and Higgins (1995b). This research popularized the notion that one overarching, general measure of computer self-efficacy can be used to measure the entire area of information systems. Later research has drawn serious doubts on an omnibus model of general computer self-efficacy. Research has called for task-specific computer self-efficacy to measure personal self-efficacy within a particular domain area within information systems (Agarwal, Sambamurthy, & Stair, 2000; Johnson & Marakas, 2000; Marakas, Johnson, & Clay, 2007). This requires the researcher to develop self-efficacy measures for the specific area which they are studying (i.e. internet, database, etc.).

While research points towards specific computer self-efficacy as more valid and reliable, a method for measuring general computer self-efficacy is still very attractive.

Marakas, et al. point out that general computer self-efficacy can be thought of as an aggregated, weighted collection of multiple task-specific computer self-efficacy measures (2007). Using this method, a researcher could develop multiple measures of task-specific self-efficacy for the specific computing areas under study and combine these separate measures into one omnibus measure of general self-efficacy in the area.

Outcome Expectations

Outcome expectations refer to an individual's beliefs about consequences of performing a certain behavior (Lent, 2005). While self-efficacy deals with an individual's capabilities, outcome expectations consist of anticipated consequences of particular actions. Bandura describes several classes of outcome expectations including anticipation of physical (e.g. monetary), social (e.g. approval), and self-evaluation (e.g. self-satisfaction) expectations (1986; Lent et al., 1994).

Individuals can develop outcome expectations related to particular career paths through both direct and vicarious learning experiences (Bandura, 1986; Lent, 2005). For example, an individual may decide to pursue math as a major due to past success in the area while another female student may choose not to pursue a major in IT due to secondhand knowledge from others that IT is not for women. As these examples portray, self-efficacy beliefs can have either a positive or negative impact on outcome expectations. Self-efficacy can especially affect outcome expectations when the activity is tied to performance quality as individuals expect more favorable outcomes when performing tasks at which they feel confident (Lent, 2005).

Outcome expectations have been explored within IT quite extensively. For example, they have been used to predict performance. Szajna and Scamell (1993) found an association

between the realism of user outcome expectations and their perceptions of an IT, but not their performance with the same IT. Similarly, Compeau and Higgins found a strong negative effect between outcome expectations and performance (1995a). Studies have also shown a link between self-efficacy and outcome expectations, with user outcome expectations changing as they become more familiar with a particular IT technology (Mathieson, 1991). Utilization of knowledge sharing systems have also been shown to depend both on the knowledge and perceived understanding of the system (i.e. self-efficacy) and the outcome expectations of using the system (Bock & Kim, 2002; Bock, Zmud, Kim, & Lee, 2005).

Outcome expectations play an important role for individuals when deciding to major in IT. Given the research above, it can be hypothesized that an individual's self-efficacy with regard to IT will have an impact on their outcome expectations with regard to majoring in IT. Taking this all together and considering the nature of the high school student population used for this study (described in greater detail in the Methodology section), the following hypothesis is given.

H1: The greater the IT self-efficacy, the higher the outcome expectations towards IT.

Interest

Interests describe those subjects or activities which we enjoy. Strong states "…an interest may be defined as a liking/disliking state of mind accompanying the doing of an activity, or the thought of performing the activity" (1943). He goes on to explain that interests do not have to be consciously thought about, but instead resemble tropisms where an individual is attracted to liked activities and repelled from disliked activities (Strong, 1943). These interests are relatively stable psychological characteristics of individuals (Lowman, 2003) and may cover both occupational, as well as leisure and vocational interests,

from which an individual might find enjoyment (Weiner, Freedheim, Graham, & Naglieri, 2003).

There are many different instruments used to measure individual interest in a particular activity. Probably the most well-known interest assessment instrument was developed by Strong (Campbell, 1971; 1926, 1943). The current Strong Inventory (Hansen, 2000; Harmon & Borgen, 1995; Harmon, Hansen, Borgen, & Hammer, 1994) consists of scales to measure both occupational interest and basic interest, as well as personality related scales which are grouped in line with Holland's Big Five personality types (Holland, 1997; Lindley & Borgen, 2000). Other interest assessment instruments include the Campbell Interest and Skill Survey (Campbell, 1995), the Kuder Occupational Interest Survey (Diamond & Zytowski, 2000; Kuder & Zytowski, 1991), the Unisex Edition of the ACT Interest Inventory (Prediger & Swaney, 1995), and many others. The overarching purpose of all these interest inventories is to assist individuals in identifying career paths which fit with their particular interests.

Interest in IT is a fairly recent phenomenon. Liao, Armstrong, and Rounds developed individual measures for different vocational areas to measure interest in each particular area (Liao, Armstrong, & Rounds, 2008). Their argument is that interest measures should be an ongoing endeavor which changes with the times and the various areas of interest available. Also, the public domain basic interest markers are provided free for use as opposed to the Strong and others which are proprietary material. One of the interest measures developed is in the area of information technology (Liao et al., 2008).

The social learning approach to interest development assumes interests are derived from reinforcements such as parents, educators, or other environmental stimuli (Mitchell &

Krumboltz, 1990). Theories within this approach assume that individuals develop interest in those things they are good at, or believe they are good at, and become disinterested in those things which they do not believe they are good at (Weiner et al., 2003). Given this information we hypothesize

H2: The greater the IT self-efficacy, the higher the interest in IT.

Bandura claims that interests come not only from self-efficacy but from outcome expectations (1986). Outcome expectations have also been hypothesized to influence career-related interests both positively and negatively through a pattern of likes and dislikes (Lent, 2005). SCCT maintains that outcome expectations are one of two pieces which influence an individual's interest in a particular career-related area (Lent et al., 1994; Lent, Brown, & Hackett, 2000; Lent, Brown, et al., 2005). Given this background, we hypothesize

H3: The higher the outcome expectations towards IT, the greater the interest in IT.

Major in Information Technology

As discussed above, the SCCT model is comprised of three separate sub-models: the interest model, the choice model, and the performance model. Each of these models has a different outcome variable based on what is being measured. Given the enrollment crisis currently in effect, the choice to major in IT was the outcome desired, yet raising interest in IT remained a secondary interest in the study. The SCCT choice model allowed for investigation of both interest and major choice in one model providing the best metric for utilization in our study.

Self-efficacy in an area has been theorized to be among the most important determinants of thought and action with regard to the activities that individuals pursue (Bandura, 1986). These beliefs in personal ability to perform a particular task is one of the

most central and pervasive mechanisms of personal agency (Bandura, 1989). Regarding vocational pursuits, self-efficacy has been found to be predictive of both academic and career-related choice as well as performance (Hackett & Betz, 1981; Hackett & Lent, 1992; Multon, Brown, & Lent, 1991; Sadri & Robertson, 1993). Research has shown that there is a link between computer self-efficacy beliefs and choices regarding future endeavors in the area. Those individuals with higher levels of computer self-efficacy may perceive themselves as being able to accomplish more difficult computing tasks (Compeau & Higgins, 1995b) which could lead to greater probability of pursuing a career in the area. Hill et al. found evidence of a relationship between self-efficacy and registration in university computer courses (1987). Perceived self-efficacy has also been shown to be an important consideration in determining computer interest, use, and course enrollment, especially when considering gender differences (Miura, 1987). Also, a correlation has been found between higher computer self-efficacy scores and choice of IT as a major (Heinze & Hu, 2009). Given this information, we hypothesize

H4: The greater the IT self-efficacy, the more likely an individual will major in IT.

Outcome expectations are constructed by individuals pertaining to environmental conditions, which influences the actions which are taken (Bandura, 1986). Individuals adapt their behavior to achieve "positive" outcomes and avoid "negative" outcomes which are determined by the individual's outcome expectations (Bandura, 2001). Given this information, it is likely that an individual will pursue those vocational endeavors which they perceive as having positive outcomes in their lives. Also, outcome expectations about future employment have been shown to strongly influence college major (Berger, 1988; Farley & Staniec, 2004; Felton, Buhr, & Northey, 1994).

Research within information systems has shown a strong link between user outcome expectations and future actions and outcomes. For example, user outcome expectations have been shown to be related to actual system use (DeSanctis, 1983). User outcome expectations have also been shown to be significantly related to user attitudes and use of the system as well as explain the success or failure of the system (Ginzberg, 1981). Other research has found a negative relationship between outcome expectations and future performance when utilizing an information system (Compeau & Higgins, 1995a). This research implies that while positive outcome expectations may lead to greater future utilization and success, negative outcome expectations could result in the opposite. Given this research, we hypothesize

H5: The higher the outcome expectations towards IT, the more likely an individual will choose to major in IT.

Interests, along with self-efficacy and outcome expectations, have been shown to encourage intentions, future goals, and involvement in a particular area (Lent, 2005). An individual's interests orients them towards choices and options which will allow them to pursue these interests (Lent, 2005; Spokane & Cruza-Guet, 2005). These interests push an individual to pursue the career path which aligns with their particular interests (Lent, 2005). Furthermore, interests have been shown to become fairly stable in late adolescence or early adulthood (Hansen, 2005). This strengthens the argument for positively influencing these interests before college which is the purpose of this research.

Interest is a strong indicator of future major or career-related goals with regard to IT. Research has shown that interest in related areas, such as computer gaming, causes students to major in computing-related disciplines (Carter, 2006). Also, interest in specific study

areas, such as math and science, has been shown to be related to a future major in IT (Babin et al., 2008). Personal interests in computing technology have also been shown to lead to a future major in the area (Akbulut, Looney, & Motwani, 2008; D. Kim, Markham, & Cangelosi, 2002; Malgwi, Howe, & Burnaby, 2005; McInerney, DiDonato, Giagnacova, & O'Donnell, 2006; Zhang, 2007). This implies that by spurring interest in computer-related areas, an individual will be more likely to major in a computer-related area in the future. Given this information, we hypothesize

H6: The greater the interest in IT, the more likely an individual will major in IT.

Figure 1 shows the SCCT research model with hypotheses delineated.

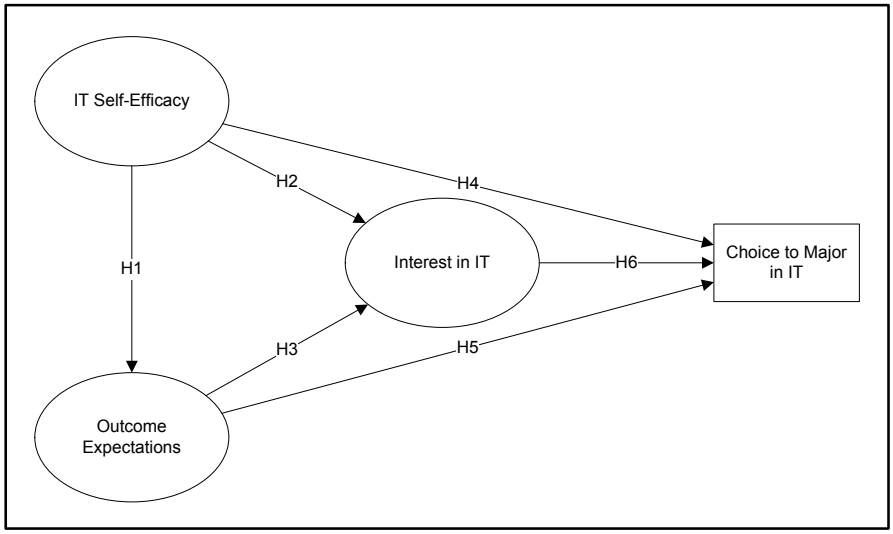

Figure 1. Hypothesized research model.

METHODOLOGY

Subjects for this study were participants in a year-long, statewide high school IT outreach program called IT-Adventures organized by Iowa State University. The target audience for the high school outreach program is those students who previously have not exhibited an interest in studying information technology (IT). There are already programs

available in IT-related areas such as the Lego First Tech Challenge and the Cyber Patriot Games where students who have IT knowledge and experience can gain more knowledge and can compete in these sponsored events. These programs and the students they attract are comparable to varsity athletes competing in a varsity sport where students need to be very good to be able to participate. Instead, our high school outreach program's approach is modeled after an intramural or recreational sport. Through this delivery method, our goal is to enable every student to have an opportunity to explore IT and consider it as a career choice, not just the ones who already excel in mathematics and science in the classroom. This wide exposure is relevant to this research as these students were all in high school and had not yet entered college and/or declared a major. Furthermore, the limited applied knowledge in the area increases the generalizability of the sample.

The IT-Adventures high school outreach program combines educational programming, competitive events, and service learning projects to engage students in learning significant IT content. The underlying tenet of the program is through increasing understanding of and excitement for IT at the high school level, the authors can increase the number of students enrolling in IT-related programs at post-secondary institutions and increase the number of graduates who will fill future IT needs. A secondary and arguably as worthy goal is to make the whole experience fun, just as intramural sports participation is.

In the fall of each year all schools within the state were contacted about the program. Those schools interested could sign up to participate in any or all of three content areas: cyber defense, game design, and robotics. Extracurricular IT clubs which allow students to study one, two, or all three venues are formed by high schools in the fall of the academic year. Students spend the year using the learning materials provided by the program, asking

their own questions about the content areas, exploring additional resources, and determining how to solve the challenges presented to them. The capstone event for students who participate in the high school outreach program is a two-day competition called the IT-Olympics held in April of each year. Students showcase the IT knowledge they gained during the past year by exhibiting a primary challenge solution they have worked on prior to the event, undertaking real-time challenges that are introduced during the competition, and making presentations about their clubs' IT-related community service projects.

Students were solicited by email to participate in the study during the fall of the school year just after they had signed up for the program and their emails had been registered by their advisors. Permission to participate in the survey was handled by each advisor, who received permission from the student's parent or guardian. By surveying the students before the start of the program, this allowed for a cross-section of individuals who had not yet been introduced to the program, so the study could be a measure of initial student assessment without effects of the program confounding the results. The survey was offered online by providing students with a link to the survey sent in the solicitation email. Those who filled out the survey were entered into a drawing for an MP3 music player. The questions were measured on a Likert scale from 1 to 7 and can be viewed in Table 1.

In total, 309 students completed the survey online (a response rate of 30%). These students represented 40 different high schools from across the state. From among the students, 31% were seniors (i.e. fourth year of high school), 30% juniors, 24% sophomores, and 15% freshman (i.e. first year of high school). Also, 83% of the respondents were male while the remaining 17% were female. While it seems the female population is under represented in this survey, the female population in computer engineering and computer

science is under 12% nationwide (Zweben, 2012). Most respondents described themselves as Caucasian (92%) which is not unanticipated since the population of Iowa is only 7% non-white. 95% of the sample showed some intent to go to either a two or four-year college upon graduation.

Table 1. Survey Questionnaire Items

IT Self-Efficacy: *designed after recommendations from (Johnson & Marakas, 2000; Marakas et al., 2007)* *questions 1-3: network computer self-efficacy; 4-6: game-design computer self-efficacy; 7-9: robotics computer self-efficacy* *measured from 1 (not at all confident) to 7 (totally confident)*
1. I believe I have the ability to effectively setup an enterprise email server.
2. I believe I have the ability to administer group permissions in an enterprise.
3. I believe I have the ability to modify the configuration of a web server.
4. I believe I have the ability to design an interactive user interface.
5. I believe I have the ability to program for effective user interaction.
6. I believe I have the ability to program stimulating game logic.
7. I believe I have the ability to successfully construct the physical structure of a machine.
8. I believe I have the ability to fine-tune gear ratios for a mechanical device.
9. I believe I have the ability to use available parts to accomplish a task.
Outcome Expectations: *(Cherry, 1975; Lent et al., 2008)* *measured from 1 (strongly disagree) to 7 (strongly agree)*
10. My chosen career path will allow me to earn a good salary.
11. My chosen career path will keep me intellectually motivated.
12. There will be good chances for promotion in my chosen career path.
13. There will be many opportunities for employment in my chosen career path.
Interest in IT: *adapted from (Liao et al., 2008)* *measured from 1 (strongly dislike) to 7 (strongly like)*
14. Maintaining hardware and software for my family and/or friends' computer(s)
15. Keeping up-to-date on the latest software
16. Researching components and building my own computer
17. Improving computer performance
18. Installing a new computer system
Intention to Major in IT *measured from 1 (strongly disagree) to 7 (strongly agree)*
19. I intend to major in an IT related discipline upon entering college.

RESULTS

Measurement Model

Confirmatory factor analysis (CFA) was used to evaluate the psychometric properties of the latent variables in the model; those variables which are not directly measured but are inferred from other variable measurements. Multiple fit criteria were used to evaluate the measurement model including the comparative fit index (CFI), the Tucker-Lewis index (TLI), the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR). Acceptable levels for each are CFI $\geq$ 0.95, TLI $\geq$ 0.95, RMSEA $\leq$ 0.06, and SRMR $\leq$ 0.08 (Bearden, Netemeyer, & Mobley, 1993; Browne & Cudeck, 1993; Gefen, Straub, & Boudreau, 2000; L. Hu & Bentler, 1999; S. S. Kim & Son, 2009; MacCallum, Browne, & Sugawara, 1996).

The measurement model included all the latent factors used in the research including the three subfactors of IT self-efficacy (cyber, game design, and robotics), outcome expectations, and interest. The second-order factor of IT self-efficacy was not estimated directly in the measurement model, but the three subfactors were instead extracted and correlated with the other latent variables in the model as directed by previous research (Bagozzi & Heatherton, 1994). The fit results from the measurement model had good fit [$\chi^2(124) = 211.79$, $p < 0.001$, CFI = 0.97, TLI = 0.97, RMSEA = 0.048, SRMR = 0.041]. The means, standard deviations, Cronbach's alpha, composite reliabilities, average variance extracted (AVE), and correlations are given in Table 2.

.

Table 2. Means, standard deviations, Cronbach's alpha, composite reliability, average variance extracted (AVE), and correlations (with square root of AVE along the diagonal) of latent constructs in the measurement model.

						Correlations				
	Mean	Std. Dev	Alpha	CR	AVE	ITSE Cyber	ITSE Game	ITSE Robotics	Outcome	Interest
ITSE Cyber	3.16	1.56	0.88 [CI=0.86,0.91]	0.85	0.66	0.81				
ITSE Game	3.34	1.61	0.90 [CI=0.88,0.92]	0.90	0.76	0.76	0.87			
ITSE Robotics	4.25	1.61	0.87 [CI=0.82,0.88]	0.87	0.69	0.76	0.70	0.83		
Outcome	5.95	0.91	0.85 [CI=0.81,0.86]	0.85	0.58	0.68	0.62	0.70	0.76	
Interest	5.37	1.15	0.88 [CI=0.86,0.90]	0.88	0.60	0.74	0.70	0.65	0.60	0.77

Several tests of reliability and validity were used to evaluate the quality of the measurement model (Bagozzi & Yi, 1988; Fornell & Larcker, 1981). Two measures of reliability were examined including construct reliability using Cronbach's coefficient alpha and composite reliability. Values for Cronbach's alpha coefficients were all above the recommended level of 0.7 (Nunnally, 1978) with the lowest value being 0.85. Composite reliability reflects the impact of error on the measurement scale and is widely used in SEM validity checks (Raykov & Grayson, 2003). All constructs in the measurement model had a composite reliability well above the recommended cutoff of 0.7 (Bagozzi & Yi, 1988; Bearden et al., 1993; Fornell & Larcker, 1981), indicating high composite reliability.

Construct validity, including both convergent and discriminant, was also tested using the measurement model. Convergent validity is evaluated using the composite reliability (above), AVE, and the standardized factor loadings of the latent variable indicators. The AVE measures the amount of variance that a construct captures from its indicators (Chin, 1998) and is recommended to be greater than 0.50 (Chin, 1998; X. Hu, Lin, Whinston, & Zhang, 2004). The lowest AVE value in the measurement model was 0.58, above the recommended cutoff point. Another technique for measuring convergent validity is that most loadings of items on each latent variable should be at least 0.60 and ideally 0.7 or above, which indicates that each measure is accounting for 50 percent or more of the variance of the underlying latent variable (Chin, 1998). All items loaded on their respective latent variable at

0.71 or above, indicating good convergent validity (Hair, Black, Babin, Anderson, & Tatham, 2006).

The AVE was again used as a measure of discriminant validity. The square root of the AVE represents the average association of each construct to its respective item measures while the correlations between the constructs are indicators of overlap associations among the latent variables. Therefore, if the square root of the AVE is higher than the correlation of that construct with the other constructs in the measurement model, this indicates that the construct is more closely related to its own measure than to the measures of other constructs (Chin, 1998; Gefen & Straub, 2005; Majchrzak, Beath, Lim, & Chin, 2005). As shown in Table 2, the square roots of the AVE values (along the diagonal) were all higher than the correlations of each construct with all other constructs in the measurement model. In summary, the results from the measurement model demonstrate high reliability as well as high convergent and discriminate validity for all constructs.

Research Model

Structural equation modeling (SEM) was used to test the proposed research model. Maximum Liklihood estimation was incorporated using an expectation maximization algorithm. Mplus was the software package used to estimate the model (Muthen & Muthen, 1998-2011). The results suggest that the model fit the data well [$\chi^2(143) = 235.35$, $p < 0.001$, CFI = 0.97, TLI = 0.97, RMSEA = 0.046, SRMR = 0.047] and explain a significant amount of the variance in the endogenous variables of Interest ($R^2 = 0.45$, $p < 0.001$) and Intent to Major ($R^2 = 0.31$, $p < 0.001$). Additionally, the overall model showed significant paths from IT Self-Efficacy to Outcome Expectations ($\beta = 0.19$, $p = 0.003$) – supporting H1, IT Self-Efficacy and Outcome Expectations to Interest ($\beta = 0.52$, $p < 0.001$; $\beta = 0.34$, $p < 0.001$) –

supporting H2 and H3, and Outcome Expectations and Interest to Intent to Major ($\beta = 0.19$, $p = 0.001$; $\beta = 0.40$, $p < 0.001$) – supporting H5 and H6. One insignificant path was found from IT Self-Efficacy to Intent to Major ($\beta = 0.07$, $p = 0.29$) – not supporting H4. Figure 2 shows these results.

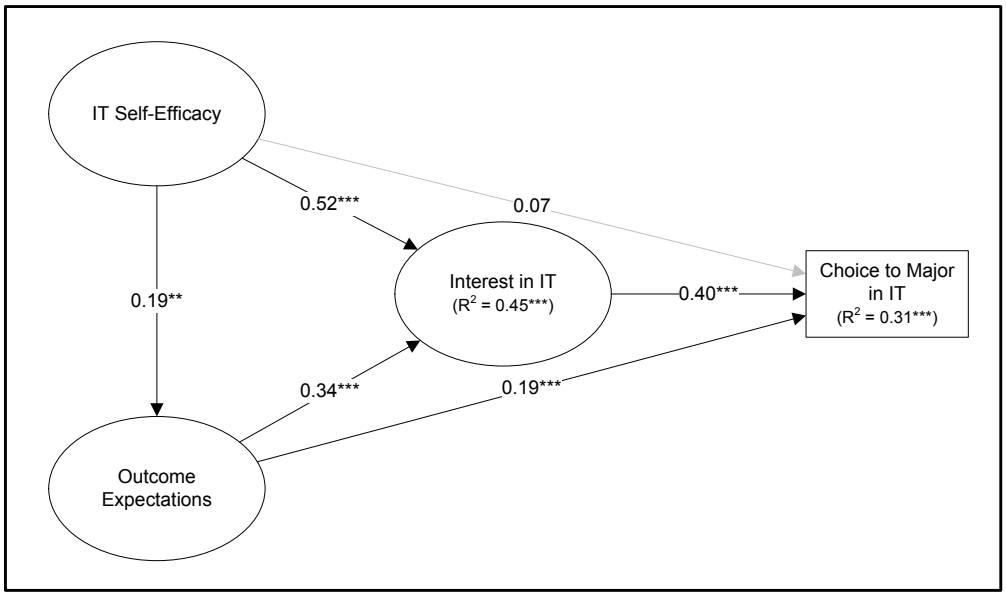

Figure 2. Research model with standardized results (*p < 0.05, **p < 0.01, ***p < 0.001).

CONCLUSIONS AND FUTURE WORK

The enrollment crisis in IT continues to be a critical problem with lagging enrollments threatening both the major in colleges as well as corporations needing this expertise. We have used SCCT (Lent, 2005; Lent et al., 1994) to help demonstrate influences on individuals' choices to major in IT. The results of this work show that both interest and outcome expectations have a significant positive impact on choice to major. Also, interest is found to mediate the effects of self-efficacy on major choice and partially mediate the effects of outcome expectations on major choice. Overall the model predicts a good portion of variance in the ultimate outcome of whether or not an individual chooses to major in IT.

The research also holds promise in increasing interest in IT. The model demonstrates that a substantial portion of the variance in interest in IT can be explained by both self-efficacy and outcome expectations. Given that interest is a strong predictor of major choice, it would behoove us to increase the interest of the individual in IT as a mechanism for improving choice to major in the area. Our research demonstrates that both self-efficacy and outcome expectations have a strong impact on interest in IT and therefore provide two important areas to increase interest in IT and subsequently increase choice to major.

A great deal of research related to the SCCT model has been performed with college students in various areas of study (Cunningham, Bruening, Sartore, Sagas, & Fink, 2005; Gainor & Lent, 1998; Lent & Brown, 2006; Lent et al., 2003; Lent, Brown, et al., 2005; Lent, Singley, & Sheu, 2005; Lent, Taveira, Sheu, & Singley, 2009). While this previous research helps shed light on intent to major in given areas, the fact remains that many college students already have majors or have a good idea of what their major will be. To more fully influence intent to major, students must be reached during those years prior to college. This research addresses this need by utilizing a sample of high school students for the study. By using high school students, we are able to verify the model's utility for this age group as well as provide actionable results.

Given that self-efficacy, interest, and outcome expectations are found to positively influence choice to major in IT for high school students, programs and initiatives that increase these areas are needed. We proffer that the IT-Adventures program, from which this sample was taken, is one such program that strives to increase student levels of self-efficacy and interest in IT. The program combines educational programming, competitive events, and service learning projects to engage students in learning significant IT content. The program

strives to increase positive performance beliefs towards (self-efficacy) and excitement for IT (interest) at the high school level, which holds potential to increase the number of students enrolling in IT-related programs at post-secondary institutions thereby increasing the number of graduates who will fill future IT needs.

While interest is the primary, direct driver of choice to major in IT, self-efficacy and outcome expectations play a critical role in driving interest and should be investigated as to methods to increase both. Bandura (1986) describes two methods, vicarious experience and enactive mastery, for increasing self-efficacy with regard to an area. Vicarious experience can be provided by viewing others completing the activities being learning while enactive mastery can be provided by allowing students to engage in hands-on work in IT-related projects. The IT-Adventures high school outreach program provides both vicarious experience and enactive mastery types of experiences. Vicarious experiences are provided in each of the subject areas through learning materials such as books, web sites, and video lessons prepared for this program. While the books and web sites provide large amounts of background and reference information, the video lessons take a stepwise, cumulative approach to the inquiry-based projects the students complete, Each video lesson demonstrates a particular skill or concept the students need to understand before they tackle the small, stand-alone project assigned at the end of each lecture. When they begin the small, hands-on inquiry-based learning projects, the enactive mastery begins. Each of these small projects that they successfully complete builds their self-efficacy in that specific area and provides them the ability to successfully complete one step in the very large, cumulative project that they will complete during the two day competition. By taking this cumulative approach throughout the year, students build upon their success (enactive mastery) and end

the year with higher self-efficacy than they began with when they complete their final project.

Outcome expectations also is a significant positive driver of interest in IT, implying that the expectations students hold with regard to their future major and career can significantly impact their interest in IT. Educational awareness becomes a critical issue here as students can only have expectations which align with what they have been told. With the current media climate propagating the message that IT jobs are nerdy, boring, and going overseas, the need to educate students as to the promising potential of a career in IT is imperative. In the past the IT-Adventures program has hosted an in person job panel, career discussions, and vendor displays during the two-day competitive event, but these aspects need to be better integrated into the current overall program. The IT-Adventures program is currently working to add online, asynchronous delivery from IT experts talking and demonstrating technical or career aspects of IT not only at the final two-day event, but during the entire year-long program.

The IT-Adventures program provides one example of an intervention mechanism which can be used to potentially raise self-efficacy, interest, and outcome expectations towards IT, thereby hopefully leading to higher intent to major in IT. We hope that other programs can emulate the IT-Adventures program approach to increase interest, self-efficacy, and outcome expectations in high school students.

LIMITATIONS

This research, while providing valuable insight, must be viewed in recognition of its limitations. First, this study uses a high school student population for its subject pool. Some

may argue that some high school students are not yet at the point of making a decision with regard to college major. While we agree with this fact, previous research has utilized college students, many of which may already have a concrete plan as to their major. So while high school students may provide limitations in some regards, we believe that these individuals are at a more optimal place for assessing future major choice and subsequently implementing measures based on these findings to more fully convince students to major in IT.

A second limitation is the use of students which signed up to participate in an IT-related school club. The fact that the students signed up for the program demonstrates some preexisting interest in IT. There is the potential that this interest could be above those individuals that did not sign up for the program, and thereby the average starting point for interest in IT may be greater. To combat this, the IT-Adventures high school outreach program is modeled after an intramural sport. By its inclusive nature, it casts a wider net to allow every student to have an opportunity to explore IT and consider it as a career choice, not just the ones who already excel in mathematics and science in the classroom. This lessens the argument of preexisting interest in IT.

REFERENCES

Aasheim, C., Li, L., & Williams, S. (2009). Knowledge and Skill Requirements for Entry-Level Information Technology Workers: A Comparison of Industry and Academia. *Journal of Information Systems Education, 20*(3), 349.

Agarwal, R., Sambamurthy, V., & Stair, R. M. (2000). The evolving relationship between general and specific computer self-efficacy: An empirical assessment. *Information Systems Research, 11*(4), 418-430.

Akbulut-Bailey, A. Y. (2011, July 2011). *The Role of Contextual Support in Increasing Information Systems Enrollments.* Paper presented at the Digital Enterprise Information Systems, London, UK.

Akbulut, A., Looney, C., & Motwani, J. (2008). Combating the Decline in Information Systems Majors: The Role of Instrumental Assistance. *The Journal of Computer Information Systems, 48*(3), 84.

Aken, A., & Michalisin, M. D. (2007). *The impact of the skills gap on the recruitment of MIS graduates*. Paper presented at the Proceedings of the 2007 ACM SIGMIS CPR conference on Computer personnel research: The global information technology workforce, St. Louis, Missouri, USA.

Babin, R., Grant, K., & Sawal, L. (2008). Identifying Influencers in High School Student ICT Career Choice. *Information Systems Education Journal, 8*(26), 1-18.

Bagozzi, R., & Heatherton, T. F. (1994). A general approach to representing multifaceted personality constructs: Application to state self-esteem. *Structural Equation Modeling: A Multidisciplinary Journal, 1*(1), 35-67. doi: 10.1080/10705519409539961

Bagozzi, R., & Yi, Y. (1988). On the evaluation of structural equation models. *Journal of the Academy of Marketing Science, 16*(1), 74-94. doi: 10.1007/bf02723327

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, N.J.: Prentice-Hall.

Bandura, A. (1989). Human agency in social cognitive theory. *American Psychologist, 44*(9), 1175-1184.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Freeman.

Bandura, A. (2001). Social Cognitive Theory: An Agentic Perspective. *Annual Review of Psychology, 52*(1), 1-26.

Bearden, W. O., Netemeyer, R. G., & Mobley, M. F. (1993). *Handbook of Marketing Scales: Multi-Item Measures for Marketing and Consumer Behavior Research*. Newbury Park, CA: Sage Publications.

Berger, M. C. (1988). Predicted Future Earnings and Choice of College Major. *Industrial & Labor Relations Review, 41*(3), 418-429.

Bock, G. W., & Kim, Y. G. (2002). Breaking the myths of rewards: an exploratory study of attitudes about knowledge sharing. *Information Resources Management Journal, 15*(2), 14-21.

Bock, G. W., Zmud, R. W., Kim, Y., & Lee, J. (2005). Behavioral intention formation knowledge sharing: Examining roles of extrinsic motivators, social–psychological forces, and organizational climate. *MIS Quarterly, 29*(1), 87-111.

Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. A. Bollen & J. S. Long (Eds.), *Testing Structural Equation Models* (pp. 445-455). Newbury Park, CA: Sage.

Bureau of Labor Statistics. (2010). Retrieved May, 14, 2011, from http://www.bls.gov/data/

Campbell, D. P. (1971). *Handbook for the strong vocational interest blank*. Stanford, CA: Stanford University Press.

Campbell, D. P. (1995). The Campbell Interest and Skill Survey (CISS): A product of ninety years of psychometric evolution. *Journal of Career Assessment, 3*(4), 391-410.

Carter, L. (2006, March 1-5). *Why Students with an Apparent Aptitude for Computer Science Don't Choose to Major in Computer Science.* Paper presented at the The 41st ACM Technical Symposium on Computer Science Education - SIGCSE '06, Houston, TX.

Cherry, N. (1975). Occupational Values and Employment: A Follow-Up Study of Graduate Men and Women. *Higher Education, 4*(3), 357-368.

Chin, W. W. (1998). Commentary: Issues and Opinion on Structural Equation Modeling. *MIS Quarterly, 22*(1), vii-xvi.

Committee on Prospering in the Global Economy of the 21st Century: An Agenda for American Science and Technology, National Academy of Sciences, National Academy of Engineering, & Institute of Medicine. (2007). *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*. Washington, DC: National Academies Press Retrieved from http://www.nap.edu/catalog.php?record_id=11463.

Compeau, D. R., & Higgins, C. A. (1995a). Application of Social Cognitive Theory to Training for Computer Skills. *Information Systems Research, 6*(2), 118-143.

Compeau, D. R., & Higgins, C. A. (1995b). Computer Self-Efficacy: Development of a Measure and Initial Test. *MIS Quarterly, 19*(2), 189-211.

Cunningham, G. B., Bruening, J., Sartore, M. L., Sagas, M., & Fink, J. S. (2005). The Application of Social Cognitive Career Theory to Sport and Leisure Career Choices. *Journal of Career Development, 32*(2), 122-138.

Dawis, R. V., & Lofquist, L. H. (1984). *A psychological theory of work adjustment: An individual-differences model and its applications*. Minneapolis: University of Minnesota Press.

DeSanctis, G. (1983). Expectancy Theory as an Explanation of Voluntary Use of a Decision-Support System. *Psychological Reports, 52*(1), 247-260.

Diamond, E. E., & Zytowski, D. G. (2000). The Kuder Occupational Interest Survey. In C. E. Watkins & V. L. Campbell (Eds.), *Testing and assessment in counseling practice*. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Farley, J., & Staniec, O. (2004). The Effects of Race, Sex, and Expected Returns on the Choice of College Major. *Eastern Economic Journal, 30*(4), 549-563.

Felton, S., Buhr, N., & Northey, M. (1994). Factors Influencing the Business Student's Choice of a Career in Chartered Accountancy. *Issues in Accounting Education, 9*(1), 131-141.

Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research, 18*(1), 39-50.

Fouad, N. A., & Smith, P. L. (1996). A Test of a Social Cognitive Model for Middle School Students: Math and Science. *Joumal of Counseling Psychology, 43*(3), 338-346.

Gainor, K. A., & Lent, R. W. (1998). Social Cognitive Expectations and Racial Identity Attitudes in Predicting the Math Choice Intentions of Black College Students. *Journal of Counseling Psychology, 45*(4), 403-413.

Gefen, D., & Straub, D. W. (2005). A practical guide to factorial validity using PLS-graph: Tutorial and annotated example. *Communications of the Association for Information Systems, 16*(1), 5.

Gefen, D., Straub, D. W., & Boudreau, M. C. (2000). Structural Equation Modeling and Regression: Guidelines for Research Practice. *Communications of the Association for Information Systems, 4*(1), 7.

Ginzberg, M. J. (1981). Early Diagnosis of MIS Implementation Failure: Promising Results and Unanswered Questions. *Management Science, 27*(4), 459-478.

Granger, M., Dick, G., Jacobson, C., & Slyke, C. (2007). Information Systems Enrollments: Challenges and Strategies. *Journal of Information Systems Education, 18*(3), 303-311.

Hackett, G., & Betz, N. E. (1981). A self-efficacy approach to the career development of women. *Journal of Vocational Behavior, 18*(3), 326-339. doi: Doi: 10.1016/0001-8791(81)90019-1

Hackett, G., & Lent, R. W. (1992). Theoretical advances and current inquiry in career psychology. In S. D. Brown & R. W. Lent (Eds.), *Handbook of counseling psychology* (2nd ed., pp. 419-451). New York: Wiley.

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2006). *Multivariate Data Analysis* (6th ed.). Upper Saddle River, NJ: Pearson Education Inc.

Hansen, J. C. (2000). Interpretation of the Strong Interest Inventory. In C. E. Watkins & V. L. Campbell (Eds.), *Testing and assessment in counseling practice: Contemporary topics in vocational psychology* (2nd ed.). Mahwah, NJ: Erlbaum.

Hansen, J. C. (2005). Assessment of Interests. In S. D. Brown & R. W. Lent (Eds.), *Career development and counseling: Putting theory and research to work*. New York: Wiley.

Harmon, L. W., & Borgen, F. H. (1995). Advances in career assessment and the 1994 Strong Interest Inventory. *Journal of Career Assessment, 3*(4), 347-468.

Harmon, L. W., Hansen, J. C., Borgen, F. H., & Hammer, A. L. (1994). *Strong Interest Inventory: Applications and technical guide*. Palo Alto, CA: Consulting Psychologists Press.

Heinze, N., & Hu, Q. (2009). Why college undergraduates choose IT: a multi-theoretical perspective. *European Journal of Information Systems, 18*(5), 462-475.

Hill, T., Smith, N. D., & Mann, M. F. (1987). Role of Efficacy Expectations in Predicting the Decision to Use Advanced Technologies: The Case of Computers. *Journal of Applied Psychology, 72*(2), 307-313.

Holland, J. L. (1959). A theory of vocational choice. *Journal of Counseling Psychology, 6*(1), 35-45.

Holland, J. L. (1997). *Making vocational choices: A theory of vocational personalities and work environments* (3rd ed.). Odessa, FL: Psychological Assessment Resources.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6*(1), 1-55. doi: 10.1080/10705519909540118

Hu, X., Lin, Z., Whinston, A. B., & Zhang, H. (2004). Hope or Hype: On the Viability of Escrow Services as Trusted Third Parties in Online Auction Environments. *Information Systems Research, 15*(3), 236-249. doi: 10.1287/isre.1040.0027

Huang, W. W., Greene, J., & Day, J. (2008). Outsourcing and the decrease of IS program enrollment. *Commun. ACM, 51*(6), 101-104. doi: 10.1145/1349026.1349046

Johnson, R. D., & Marakas, G. M. (2000). The role of behavioral modeling in computer skills acquisition: Toward refinement of the model. *Information Systems Research, 11*(4), 403-417.

Kim, D., Markham, F. S., & Cangelosi, J. D. (2002). Why Students Pursue the Business Degree: A Comparison of Business Majors Across Universities. *Journal of Education for Business, 78*(1), 28.

Kim, S. S., & Son, J.-Y. (2009). Out of dedication or constraint? A dual model of post-adoption phenomena and its empirical test in the context of online services. *MIS Quarterly, 33*(1), 49-70.

Krumboltz, J. D., Mitchell, A. M., & Jones, G. B. (1976). A Social Learning Theory of Career Selection. *The Counselling Psychologist, 6*(1), 71-81.

Kuder, F., & Zytowski, D. G. (1991). *Kuder Occupational Interest Survey: General manual*. Monterey, CA: McGraw-Hill.

Lent, R. W. (2005). A social cognitive view of career development and counseling. In S. D. Brown & R. W. Lent (Eds.), *Career development and counseling: Putting theory and research to work*. New York: Wiley.

Lent, R. W., & Brown, S. D. (2006). Integrating person and situation perspectives on work satisfaction: A social-cognitive view. *Journal of Vocational Behavior, 69*, 236-247.

Lent, R. W., Brown, S. D., & Hackett, G. (1994). Toward a unifying social cognitive theory of career and academic interest, choice, and performance. *Journal of Vocational Behaaior, 45*, 79-122.

Lent, R. W., Brown, S. D., & Hackett, G. (2000). Contextual supports and barriers to career choice: A social cognitive analysis. *Journal of Counseling Psychology, 47*(1), 36-49.

Lent, R. W., Brown, S. D., Schmidt, J., Brenner, B., Lyons, H., & Treistman, D. (2003). Relation of Contextual Supports and Barriers to Choice Behavior in Engineering Majors: Test of Alternative Social Cognitive Models. *Joumal of Counseling Psycholosy, 50*(4), 458-465.

Lent, R. W., Brown, S. D., Sheu, H.-B., Schmidt, J., Brenner, B. R., Gloster, C. S., . . . Treistman, D. (2005). Social Cognitive Predictors of Academic Interests and Goals in Engineering: Utility for Women and Students at Historically Black Universities. *Journal of Counseling Psychology, 52*(1), 84-92.

Lent, R. W., Jr., A. M. L., Lopez, F. G., & Sheu, H.-B. (2008). Social cognitive career theory and the prediction of interests and choice goals in the computing disciplines. *Journal of Vocational Behavior, 73*(1), 52-62.

Lent, R. W., Singley, D., & Sheu, H.-B. (2005). Social Cognitive Predictors of Domain and Life Satisfaction: Exploring the Theoretical Precursors of Subjective Well-Being. *Joumal of Counseling Psychology, 52*(3), 429-442.

Lent, R. W., Taveira, M. d. C., Sheu, H.-B., & Singley, D. (2009). Social cognitive predictors of academic adjustment and life satisfaction in Portuguese college students: A longitudinal analysis. *Journal of Vocational Behavior, 74*, 190-198.

Liao, H.-Y., Armstrong, P. I., & Rounds, J. (2008). Development and initial validation of public domain Basic Interest Markers. *Journal of Vocational Behavior, 73*(1), 159-183.

Lindley, L. D., & Borgen, F. H. (2000). Personal Style Scales of the Strong Interest Inventory: Linking Personality and Interests. *Journal of Vocational Behavior, 57*(1), 22-41.

Lomerson, W. L., & Pollacia, L. (2006a). *CIS Enrollment Decline: Examining Pre-College Factors*. Paper presented at the 2006 Southern Association for Information Systems Conference.

Lomerson, W. L., & Pollacia, L. (2006b). Declining CIS Enrollment: An Examination of Pre-College Factors. *Information Systems Education Journal, 4*(35), 3-13.

Lowman, R. L. (2003). Assessment of interests. In R. Fernandez-Ballesteros (Ed.), *Encyclopedia of Psychological Assessment*. Thousand Oaks, CA: Sage.

MacCallum, R. C., Browne, M. W., & Sugawara, H. M. (1996). Power analysis and determination of sample size for covariance structure modeling. *Psychological Methods, 1*(2), 130-149. doi: 10.1037/1082-989x.1.2.130

Majchrzak, A., Beath, C. M., Lim, R. A., & Chin, W. W. (2005). Managing Client Dialogues during Information Systems Design to Facilitate Client Learning. *MIS Quarterly, 29*(4), 653-672.

Malgwi, C. A., Howe, M. A., & Burnaby, P. A. (2005). Influences on Students' Choice of College Major. *Journal of Education for Business, 80*(5), 275-282.

Marakas, G. M., Johnson, R. D., & Clay, P. F. (2007). The Evolving Nature of the Computer Self-Efficacy Construct: An Empirical Investigation of Measurement Construction, Validity, Reliability and Stability Over Time. *Journal of the Association for Information Systems, 8*(1), 16-46.

Mathieson, K. (1991). Predicting User Intentions: Comparing the Technology Acceptance Model with the Theory of Planned Behavior. *Information Systems Research, 2*(3), 173-191.

McInerney, C. R., DiDonato, N. C., Giagnacova, R., & O'Donnell, A. M. (2006). Students' choice of information technology majors and careers: A qualitative study. *Information Technology, Learning, and Performance Journal, 24*(2), 35-53.

Mitchell, L. K., & Krumbolt, J. D. (1996). Krumboltz's Learning Theory of Career Choice and Counseling. In D. Brown & L. Brooks (Eds.), *Career Choice and Development* (3rd ed.). San Francisco: Jossey Bass.

Mitchell, L. K., & Krumboltz, J. D. (1990). Social learning approach to career decision making: Krumboltz' theory. In D. Brown & L. Brooks (Eds.), *Career choice and development* (2nd ed., pp. 145-196). San Francisco: Jossey-Bass.

Miura, I. T. (1987). The Relationship of Computer Self-Efficacy Expectations to Computer Interest and Course Enrollment in College. *Sex Roles, 16*(5/6), 303-311.

Multon, K. D., Brown, S. D., & Lent, R. W. (1991). Relation of Self-Efficacy Beliefs to Academic Outcomes: A Meta-Analytic Investigation. *Journal of Counseling Psychology, 38*(1), 30-38.

Muthen, L. K., & Muthen, B. O. (1998-2011). *Mplus User's Guide* (6th ed.). Los Angeles: Muthen & Muthen.

Nunnally, J. C. (1978). *Psychometric Theory* (2nd ed.). New York: McGraw-Hill.

Patterson, D. A. (2005). Restoring the popularity of computer science. *Commun. ACM, 48*(9), 25-28. doi: 10.1145/1081992.1082011

Pollacia, L., & Russell, J. (2007). Addressing the Decline in CIS Enrollment. *Issues in Information Systems, 8*(1), 97-102.

Prediger, D. J., & Swaney, K. B. (1995). Using UNIACT in a Comprehensive Approach to Assessment for Career Planning. *Journal of Career Assessment, 3*(4), 429-451.

Raykov, T., & Grayson, D. (2003). A Test for Change of Composite Reliability in Scale Development. *Multivariate Behavioral Research, 38*(2), 143-159. doi: 10.1207/s15327906mbr3802_1

Riemenschneider, C. K., Armstrong, D. J., & Moore, J. E. (2009). Meeting the demand for IT workers: a call for research. *European Journal of Information Systems, 18*(5), 458-461.

Rursch, J. A., Luse, A., & Jacobson, D. (2010). IT-Adventures: A Program to Spark IT Interest in High School Students Using Inquiry-Based Learning With Cyber Defense, Game Design, and Robotics. *IEEE Transactions on Education, 53*(1), 9.

Sadri, G., & Robertson, I. T. (1993). Self-efficacy and work-related behaviour: A review and meta-analysis. *Applied Psychology, 42*(2), 139-152.

Scheibe, K. P., Mennecke, B. E., & Luse, A. (2007). The Role of Effective Modeling in the Development of Self-Efficacy: The Case of the Transparent Engine. *Decision Sciences Journal of Innovative Education, 5*(1), 21-42.

Smith, S. M. (2002). The Role of Social Cognitive Career Theory in Information Technology based Academic Performance. *Information Technology, Learning, and Performance Journal, 20*(2), 1-10.

Spokane, A. R., & Cruza-Guet, M. C. (2005). Holland's Theory of Vocational Personalities in Work Environments. In S. D. Brown & R. W. Lent (Eds.), *Career development and counseling: Putting theory and research to work*. New York: Wiley.

Strong, E. K. (1926). An interest test for personnel managers. *Journal of Personnel Research, 5*(5), 194-204.

Strong, E. K. (1943). *Vocational interests of men and women*. Stanford, CA: Stanford University Press.

Super, D. E. (1957). *The psychology of careers*. New York: Harper & Row.

Super, D. E. (1981). A developmental theory: Implementing a self-concept. In D. H. Montross & C. J. Shinkman (Eds.), *Career development in the 1980s: Theory and practice* (pp. 28-42). Springfield, IL: Thomas.

Super, D. E. (1990). A life-span, life-space approach to career development. In D. Brown & L. Brooks (Eds.), *Career choice and development: Applying contemporary theories to practice* (2nd ed., pp. 197-261). San Francisco: Jossey-Bass.

Szajna, B., & Scamell, R. W. (1993). The Effects of Information System User Expectations on Their Performance and Perceptions. *MIS Quarterly, 17*(4), 493-516.

Vegso, J. (2005). CS Bachelor's Degree Production Grows in 2004; Poised for Decline. *Computing Research News, 17*(2).

Vondracek, F. W. (2001). The developmental perspective in vocational psychology. *Journal of Vocational Behavior, 59*, 252-261.

Vondracek, F. W., Lerner, R. M., & Schulenberg, J. E. (1986). *Career development: A life-span developmental approach*. Hillsdale, NJ: Erlbaum Associates.

Weiner, I. B., Freedheim, D. K., Graham, J. R., & Naglieri, J. A. (2003). *Handbook of Psychology: Assessment psychology* (Vol. 10). Hoboken, NJ: John Wiley and Sons.

Wilson, C., Sudol, L. A., Stephenson, C., & Stehlik, M. (2010). Running on Empty: The Failure to Teach K-12 Computer Science in the Digital Age (pp. 76).

Zhang, W. (2007). Why IS: Understanding Undergraduate Students' Intentions to Choose an Information Systems Major. *Journal of Information Systems Education, 18*(4), 447-458.

Zweben, S. (2012). Computing Degree and Enrollment Trends From the 2010-2011 CRA Taulbee Survey. Retrieved April 9, 2012

APPENDIX A

Table A1. Covariance matrix for the structural model.

	ITSE1	ITSE2	ITSE3	ITSE4	ITSE5	ITSE6	ITSE7	ITSE8	ITSE9	Career1	Career2	Career3	Career4	Intrest1	Intrest2	Intrest3	Intrest4	Intrest5	Intent3
ITSE1	2.827																		
ITSE2	2.208	3.045																	
ITSE3	2.013	2.181	3.182																
ITSE4	1.732	1.795	2.099	2.828															
ITSE5	1.698	1.755	2.039	2.611	3.155														
ITSE6	1.407	1.58	1.698	2.127	2.253	3.418													
ITSE7	1.201	1.455	1.269	1.181	1.365	1.156	3.59												
ITSE8	1.11	1.161	1.271	1.216	1.327	1.224	2.622	3.37											
ITSE9	0.763	0.91	0.91	0.931	1.119	0.843	2.158	1.971	2.906										
Career1	0.067	0.108	0.207	0.14	0.212	0.067	0.321	0.149	0.368	1.138									
Career2	0.01	0.08	0.138	0.145	0.189	0.087	0.251	0.092	0.414	0.711	0.957								
Career3	0.331	0.374	0.339	0.242	0.29	0.216	0.418	0.141	0.289	0.705	0.631	1.421							
Career4	0.207	0.305	0.406	0.312	0.349	0.105	0.43	0.174	0.376	0.722	0.638	0.794	1.395						
Intrest1	0.853	1.021	1.086	0.871	0.863	0.61	0.708	0.404	0.659	0.355	0.32	0.544	0.543	1.912					
Intrest2	0.635	0.812	0.897	0.744	0.806	0.496	0.515	0.266	0.552	0.339	0.355	0.535	0.4	1.159	1.842				
Intrest3	0.697	1.005	1.066	0.795	0.848	0.542	1.195	0.785	0.796	0.477	0.358	0.493	0.534	1.24	1.12	2.503			
Intrest4	0.626	0.6	0.765	0.685	0.682	0.332	0.749	0.496	0.672	0.296	0.276	0.387	0.453	1.064	0.984	1.159	1.639		
Intrest5	0.698	0.958	1.06	0.837	0.944	0.644	0.741	0.45	0.669	0.37	0.343	0.441	0.483	1.256	1.054	1.374	1.107	1.874	
Intent3	0.546	0.802	0.998	0.84	0.88	0.632	0.609	0.172	0.485	0.539	0.447	0.66	0.718	1.15	0.859	1.106	0.795	1.064	3.139

Table A2. Standardized factor loadings, standard errors, z-values, and associated p-values for observed items in the structural model.

	estimate	std err	z-vlue	p-value
ITSE1	0.763	0.03	25.803	0.000
ITSE2	0.798	0.027	29.877	0.000
ITSE3	0.879	0.021	41.281	0.000
ITSE4	0.951	0.011	83.922	0.000
ITSE5	0.92	0.013	70.156	0.000
ITSE6	0.729	0.029	25.372	0.000
ITSE7	0.894	0.021	41.938	0.000
ITSE8	0.844	0.024	35.486	0.000
ITSE9	0.746	0.03	24.953	0.000
CAREER1	0.811	0.027	29.515	0.000
CAREER2	0.79	0.029	27.546	0.000
CAREER3	0.712	0.035	20.611	0.000
CAREER4	0.731	0.033	21.973	0.000
INT3	0.812	0.024	33.751	0.000
INT5	0.724	0.031	23.324	0.000
INT7	0.74	0.03	24.808	0.000
INT9	0.752	0.029	26.066	0.000
INT11	0.825	0.023	35.846	0.000

CHAPTER 4: AN IMPRESSION FORMATION-BASED EXAMINATION OF THE DIFFERENTIAL INFLUENCE OF TECHNOLOGY ACROSS GENDER AND MESSAGE

Andy Luse, Brian Mennecke, Anthony Townsend

ABSTRACT

This research examines the relationship between gender, message bias, and technology use on the way that observers form impressions of others. Building on impression formation and gender stereotype research and theory, we develop a two-part research methodology for examining how impressions are formed of technology users. Specifically, we have a male or female "target" engage in either discussions about or use of technology and ask observers to rate the target on several personality characteristics. The results of our two studies indicate that technology use is an important component in impression formation, causing a three-way interaction with gender and informational bias. A key finding of this research is that the presence of technology significantly disrupts the impact of gender stereotyping on both women and men. In other words, when technology is present or used by targets, the technology appears to directly moderate gender cues that are otherwise at play when technology is not present. The result is that technology subverts both the male and female stereotypes observers normally engage and this can potentially be used to equalize the playing field for female technology users. The paper concludes with a discussion of how this process occurs and the implications of these findings for research and practice.

Keywords

impression formation, sex, gender, stereotype, male, female

INTRODUCTION

As social beings, humans have an innate inclination to interpret actions, displays, and other stimuli offered by those around them, and the influence of these interpretations is often long lasting. We often create a stage for our presentation of self and use the tools at our calling to create a scene through which we can enact, either purposefully or without intent, our presentation of self. As mobile information technologies have proliferated, they have become a ubiquitous accessory for a large segment of society, and we are curious as to the effect that information technology has on observers' impressions of a technology user. In general, we expect that an individual using technology induces different impressions on observers than would the same individual without the technology. Of course, technologies do not create impressions in a vacuum; stereotype and impression formation research suggests that factors such as a person's appearance, behaviors, and gender all have important effects on the perceptions people form of one another. Our sense, though, is that the presence and use of technologies will make a pronounced contribution to the impressions formed by those observing the technology-user. In the present study, we are particularly interested in how the gender[3] of the technology-user and his or her technology-use interact in the formation of an impression.

[3] In this research we refer to our experimental manipulation of male and female as sex (i.e., we present targets that are male or female) while the subjects' interpretations of the target individual is affected by the social context and therefore our sex manipulation becomes an interpretation of gender in the eyes of the subject. As a result, when referring to the independent variables in the study itself, the manipulation is characterized as sex, but when referring to the interpretation of the target by the subject the characterization is referred to as gender (Myers 2012).

BACKGROUND

The research examining impression formation spans multiple disciplines and contexts, generally focusing on how the physical and behavioral information presented by a target[4] individual is interpreted and used by an observer to develop impressions of the target (Sherman et al. 2007). Asch (1946), in an early work, demonstrated how individuals utilize specific information to form initial impressions as to the personality of the target individual. Early research also found that observers integrate trait or behavioral information into strong dispositional impressions of the targets that they evaluate (Anderson 1966; Asch 1946).

Impression formation (Reynolds et al. 2000; Rudman 1998) takes place in most social contexts (Ellemers et al. 2002), but one stream of research has focused on the formation of stereotypes and impressions in the context of observers evaluating targets in a situation where these parties do not directly interact (i.e., the observers are passive participants). Within this area, two perspectives have gained prominence (Reynolds et al. 2000): 1) the Attentional Resources Perspective (Brewer 1998; Fiske et al. 1999; Fiske et al. 1990) and 2) Self-Categorization Theory (Oakes et al. 1994). Research in this area has focused on identifying the factors that influence the development of impressions and whether observers interpret specific versus aggregate characteristics of the individual being observed (Neuberg et al. 1987).

The Attentional Resources Perspective, represented by the Continuum Model (Fiske et al. 1990) and the Dual-Process Model (Brewer 1998), is based on the theory that observers will attempt to minimize the cognitive effort expended to develop conclusions about a target

[4] "Target" refers to the individual being observed and evaluated; it is a conventional term in impression formation research, and as such, we will use it throughout.

whenever possible; thus, observers will tend to use a category-based approach (i.e., stereotypes) to draw conclusions about the target (Macrae et al. 1994). This categorization process is often spontaneously enacted through the activation of a stereotype in response to the observation of a particular stimulus characteristic (e.g., race, gender, or other social categories) (Devine 1989; Greenwald et al. 1995). Nevertheless, many times it will not be possible for an observer to place a target into a specific, predefined category. For example, a target may not easily fit into a category or the observer may have motivation to seek out additional information about the target. Motivation to evaluate a target on an attribute-by-attribute basis may come from a number of factors such as the observer's interdependence with the other party (either cooperative or competitive interdependence) or when goals exist that emphasize accuracy in the assessment of the target (Moskowitz 1993; Reynolds et al. 2000). When motivation is present, the observer engages in a process of initial categorization, re-categorization, and categorization by attributes. As this process unfolds, refined impressions are formed through consideration of individual attributes and an integration of these attributes (i.e., piecemeal integration or personalization) (Brewer 1998; Fiske et al. 1990).

Self-Categorization Theory focuses on group membership and the perceived relationship between the observer and the target (Hogg et al. 2000; Reynolds et al. 1999). Like the Attentional Resources Perspective, Self-Categorization Theory predicts that impressions will be formed using categorizations, attributes, or a combination thereof. However, Self-Categorization Theory argues that the impetus leading to *attribute*-based impression formation involves perceptions of group association (Perdue et al. 1990). Three factors mediate the target categorization process 1) perceiver readiness – the perception of

the perceiver is framed by goals, needs, and the context of the perceiver, 2) comparative fit (i.e., the way a target is grouped as being within or outside of a particular group), and 3) normative fit (i.e., the attributes used to identify and classify groups have certain values, direction, and meaning that influence the categorization process) (Reynolds et al. 1999). Comparative fit is especially relevant in stereotype formation when targets are seen as being outside of the observer's group based on certain attributes (Reynolds et al. 2001; Turner et al. 2008). The process is moderated by the way the perceiver categorizes him or herself by framing the observations of others based on the personal and social identity that he or she assigns to themselves (Reynolds et al. 1999).

During this process, observers use normative fit values to assign relative weights to the attributes being considered during impression formation and, as a result, different attributes may become more or less salient in different contexts (Oakes et al. 1991). For example, high value may be assigned to the target's features (e.g. skin color, gender, etc.), actions taken by the target (e.g. skill level demonstrated during a task), or the content of the target's message (e.g. negative or positive comments). While self-categorization theory argues that these values are relative, research has shown that certain characteristics have a relatively consistent influence in similar contexts. For example, research has shown that the nature of what the target says in relation to what he or she is expected to say can more strongly affect impressions (Fiske 1980; Jones et al. 1976; Skowronski et al. 1989). For example, statements that are non-normative receive greater weight in impression formation and often lead to more extreme impressions (Fiske 1980; Jones et al. 1976; Skowronski et al. 1987; Skowronski et al. 1989). Furthermore, the context in which the statement is made will influence perceptions, with targets giving information that is consistent with the context

being perceived more favorably than information that is either non-contextual or contextual but not consistent with expectations (Jones et al. 1987).

In addition to the Attentional Resources Perspective and Self-Categorization Theory, Expectations States Theory (EST) (Berger et al. 1974) is useful as a theoretical foundation for further understanding the cognitive processes associated with the salience and valence of cues and the influence of these evaluations on impression formation. EST proposes that individual social actors will develop expectations about the capacity of other actors to behave or perform in a given task or context (Correll et al. 2006). The two primary factors influencing impression formation posited by EST are the observer's assessment of the target's power and the target's prestige. EST suggests that perceived differences in one or both of these variables from the observer's expectations will strongly influence perceptions (Wagner et al. 2002). Status Characteristics Theory (SCT) extends EST and focuses on how status characteristics are defined and interpreted by observers (Berger et al. 1986). For example, exhibited characteristics include *indicative cues*, which involve explicit expressions or claims made by a social actor (e.g. I am the leader), and *task cues*, which involve information about task specific knowledge, skills, or capabilities (e.g. fluency with completing a specific task). Inferred characteristics include *expressive cues,* which involve external symbols or behaviors that are used to infer status (e.g. style of dress), and *categorical cues*, which incorporate information about group or social affiliation (e.g. speech, dialect, or normative behavior) (Berger et al. 1986; Wagner et al. 1993). These status cues are particularly relevant when social actors are not familiar with each other and are not similar with respect to salient external characteristics. Research has shown that expectations are developed based on these status cues unless there is evidence garnered from other cues

that demonstrates that the status cue is not relevant in the particular context (Wagner et al. 2002).

Expectation States Theory also provides a useful theoretical framework for defining the *factors* that influence impression formation, providing a theoretical basis for defining and categorizing cues and understanding the processes used by observers to develop impressions of targets. Many times, categorical cues such as gender and race are immediately obvious to observers and will typically be the first cues used in the formation of impressions. These cues will typically interact with exhibited behaviors such as task performance or statements made by the target as the observer has time to develop and refine his or her impression based on these behaviors. The category/behavior linkage can be either confirmatory (i.e., the "expert" demonstrates "expertise") or dis-confirmatory (i.e., the "expert" behaves incompetently); when the linkage is confirmatory, the observer's category-based impressions are activated. However, when the linkages are dis-confirmed, the observer is forced to form an attribute-based, more nuanced evaluation of the target.

Gender and Impression Formation

Considerable research has been conducted examining the role that gender plays in influencing the impression formation process (Carli 1990; Carli 1991; Granié et al. 2011; Kriwy et al. 2013; Nieva et al. 1980; Pugh et al. 1983; Rudman 1998; Wagner et al. 2002). Much of this research has examined how gender leads to stereotype formation as well as the way that gender influences the way that information is processed by the observer in relation to the gender of the information source. Research indicates that negative information provided by a male actor will cause observers to consider the target to be more powerful, forceful, and in control (Foschi 1996). Thus, male targets who engage in forceful comments

will likely be viewed more favorably than female targets that make similarly forceful comments. Conversely, females are perceived more favorably when they are less assertive. Thus, when a female makes supportive statements rather than negative statements, she is likely to be viewed more favorably (Abramson et al. 1977; Carli 1991; Nieva et al. 1980; Pugh et al. 1985).

Gender and Technology

As noted above, the gender of the target is a primary influence on impression formation; as it represents a cue that activates a number of assumptions, biases, and expectations on the part of the observer. When impressions are formed of women and men interacting with technology, a set of very complex social and cultural stereotypes are activated. The simplest of these stereotypes are expressed as negative expectations about the potential technological performance of women. While some of these stereotype effects may be moderated in the face of demonstrated competence, they remain an important subtext within organizational and personal narratives of individual's evaluations of others (Liu et al. 2001). Morley (2004) provides evidence that negative stereotypes related to women and information technology come from older cultural biases that question the general technical skills of women, which indicates that these stereotypes are substantially entrenched and powerful. But however entrenched these attitudes that are derived from the general women/technology stereotype, those that relate to women and information technology specifically are more nuanced.

Masculinized Technology

Feeney (2002) notes that technology advertising is dominated by depictions of male users, which reifies the stereotype that women are not technology users or experts, and would

seem to indicate a technology-aversion on the part of women. But the aversion, if it actually exists, is an aversion learned from the broader culture's identification of information technology as a "masculine" domain (Cooper et al. 2003; Hemwood 1993; Lohan et al. 2004; Wajcman 2004).

Perspectives on the origins of this masculinization differ. Wajcman (2004) asserts that the masculinization of technology is a deliberate coding to reinforce patriarchal control; by declaring technology masculine, men continue to control a critical resource of power and production. Wajcman further asserts that this process of masculinization affects the design and use of technologies (a theme that will be repeated by others), with the primary purpose of technology (including information technology) being domination and control. This process then, of first claiming male ownership of technology and then making it attractive primarily for male uses, effectively marginalizes women with regard to technology and its attendant power.

A less radical perspective, argues that the process of masculinization comes not from deliberate efforts to buttress the patriarchy, but rather from the sensibilities extant in the patriarchically dominated system (Bodker et al. 1993; Knupfer 1998; Webster 1993). Discussing business information systems, both Bodker and Greenbaum (1993) and Webster (1993) assert that the business system itself is a product of historic masculine sensibilities, and that information systems are, in turn, built to reflect extant masculine protocols. The information systems developed then are masculinized more by default than by intent, but the result is the same in that technologies' features and function often serve to enhance or sustain masculine prominence of, or association with, technology.

Regardless of one's perspective as to how the systems were masculinized, the effect is the same; information technologies are seen as a male domain (Cooper 2006; Cooper et al. 2003; Lohan et al. 2004; Mercier et al. 2006; Wajcman 2004). This intensely gendered position then has a significant impact on both men and women; for men, it creates expectations of competence with information technologies, while for women, it eliminates the *possibility* of expectations. Hence the stereotype of women *vis a vis* information technology is not that they lack the intellect or acumen for it, so much that they have no role in it…no expectation of performing more than perfunctory operational tasks with information technologies (Cooper et al. 2003; Lohan et al. 2004; Wajcman 2004).

Hypothesis Development

The background section paints a picture of impression formation as dependent on various extenuating factors. First, the message content of the target individual can effect viewer impressions of the individual, especially when this content is non-normative in nature for the given context (Fiske 1980; Jones et al. 1976; Skowronski et al. 1989). Also, this message content effects impressions of a target based on the gender of that target (Abramson et al. 1977; Carli 1991; Nieva et al. 1980; Pugh et al. 1985). This research extends previous research by adding technology as a third factor by investigating the influence of technology, message bias, and target gender on the impressions individuals form of the target. Figure1 shows the research model identifying the hypotheses discussed below.

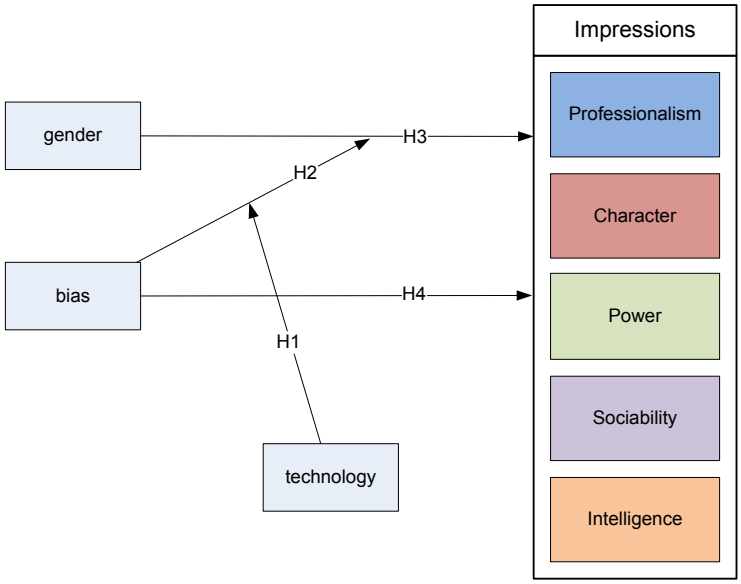

Figure 1. Proposed research model.

Study 1 Hypotheses

Prior research indicates that negative information provided by a male actor will cause observers to consider the target to be more powerful, forceful, and in control (Foschi 1996). Thus, male targets who engage in forceful comments will be viewed more favorably than female targets that make similarly forceful comments. Conversely, females are perceived more favorably when they are less assertive; thus, when a female makes supportive statements rather than negative statements, she will be viewed more favorably (Abramson et al. 1977; Carli 1991; Nieva et al. 1980; Pugh et al. 1985). Taken together, these expectations suggest a clear interaction between the gender of the target and the information bias (favorable/unfavorable).

The literature also indicates that the use of technology by a male is seen as more consistent with stereotypical roles for males than the use and mastery of technology by a female (Feeney 2002). A male using technology is consistent with observers' stereotypes about "maleness" and results in observer impressions that are the result of simple

categorizations. However, when subjects are presented with a female target that is using technology, this violation of the stereotype (i.e., women are uncomfortable/less competent with technology) will subvert the observers' simple categorization and will force observers to make idiosyncratic evaluations of the target. Further, since the subversion is associated with the gender categorization, the presence of technology will weaken other gender categorizations as well.

These arguments, considered together, indicate that an interaction will exist between the three variables in this study. Specifically, *absent technology*, males will likely be held to a different standard than will females while in the presence of technology, both will be evaluated based upon the information that they are presenting:

H1: Technology *presence* will subvert simple categorization of the target (re. Attentional Resources Theory) and will moderate expected effects of the targets' gender and message.

H1a When not using technology, impressions of a target individual are dependent on an interaction of the gender of that individual and the bias of the information communicated.

H1b. When using technology, impressions of a target individual are *solely* dependent on the bias of the information communicated.

Study2 Hypotheses

Study 1's hypotheses test a present/not present condition of technology vis a vis the male and female targets. In Study 2, we want to make the strongest possible test of H1b, to determine if technology completely thwarts the gender stereotype, and so we form hypotheses 2, 3, and 4 around male and female targets directly engaging an information technology in a manner that indicates their level of mastery with the technology.

As noted above, males and females are held to different standards with regard to how they are expected to use and master technology (Foschi 1996). Our belief, as articulated in Hypothesis 1, is that these expectations, when confounded by observation of a specific target, set in motion a process that thwarts the gender categorization when a woman is using a technology. While gender/technology stereotypes may exist in the abstract, our belief is that they can be overcome in an individual evaluation. Study 2 is designed to test the effect predicted in H1b at a granular level. When male and female targets are presenting observers with either a display of competence or incompetence with a technology, the stereotype literature would argue that males will be judged more harshly when they fail to demonstrate technological competence, while females demonstrating the same incompetence will be less harshly evaluated (because expectations are lower). When both genders succeed with the technology, males should gain a more positive response from observers due to the observers' expectations that males should demonstrate such mastery and the observers' lack of a category to recognize the female's technical mastery to her benefit. We believe that these latent categorization preferences are vulnerable to confounding confrontation in the case of a specific target evaluation. When demonstrations of each target's mastery or non-mastery of a technology is specifically enacted for the observers, we expect the stereotype to be subverted, and the observers forced to make idiosyncratic evaluations of the target, according to the following hypotheses:

H2: The impact of an enacted informational bias (i.e., mastery/non-mastery) on impressions of a target individual is not dependent on the gender of that individual, when using technology (i.e. no interaction).

H3: Gender does not impact impressions of a target individual when using technology, regardless of their demonstration of mastery/non-mastery.

H4: Irrespective of gender, an enacted informational bias (mastery/non-mastery) significantly impacts impressions of a target individual when using technology.

METHODOLOGY

To examine our research question, we manipulated three variables that are expected to influence impression formation: the gender of the target, the bias of the information or message presented by the target, and technology use by the target. To accomplish this, we conduct two separate studies to test our hypotheses. Study 1 tests an omnibus model by examining the impact of technology use/non-use, information bias, and gender of the target on impressions of the target formed by subject observers. Study 2 holds technology use constant, but amplifies the interaction between the male/female targets and the technology by having them succeed or fail at an operational task using the technology (while observers form their impressions). Conducting two studies allows us to examine the hypothesized relationships uniquely with different controls and contextual factors and refine our understanding of the relationship between information content and gender. Further, given the unique role of technology use in the context of impression formation, the use of a two-study approach allows us to validate our instrument using data from the two studies, which results in more robust and generalizable findings (see Appendix A for a detailed overview of the instrument development). An overview of the studies and each set of manipulations is explained in more detail below.

STUDY 1

Procedure

A 2x2x2 full factorial design with the independent variables of technology use, information bias, and gender of the target was utilized for the study. The technology

manipulation included 2 levels: the target either read information from a PDA or from a paper document (i.e., the *no-PDA* manipulation). The gender manipulation was implemented by having either a male or a female target read the article. Both targets were students who were of the same general appearance, similar speaking ability, of about the same height and build, and approximately the same age.[5] The information bias manipulation was implemented by having the targets read an article that either had a positive bias toward PDA use or a negative bias (Fiske 1980; Skowronski et al. 1989). The article described a recent study of Japanese PDA usage in either a positive or negative light, depending on the

[5] These similarities among the targets in both Study 1 and Study 2 were independently reviewed and confirmed by a separate panel. Furthermore, a more rigorous post-hoc examination was run to help rule out alternative explanations in the differences observed between the targets under study – outside gender and the treatments of bias and technology. This study consisted of subjects viewing still photographs of each of the targets with neutral facial expressions and without technology present. The subjects then answered five questions for each target regarding the target's perceived level on each of the five impression categories under study (i.e. professionalism, character, power, sociability, intelligence) on a five-point scale from strongly disagree to strongly agree (these categories are described in greater detail in the primary prose of the manuscript). For the primary two studies conducted for this research, we hypothesize that these subjects are of the same general appearance, height, build, and age, so when technology and bias are removed from the situational setting, no significant difference should be seen between the male and female subjects in either study one or study two. We wanted to be certain that no difference would be seen between the negative and positive ends of the measurement scale for each of the five categories, which would conservatively mean there would be no significant difference from somewhat disagree to somewhat agree on the five-point scale. The distance between these two points on the scale would be at least two, so we conservatively chose a confidence interval width for our test of 1.5 to rule out any differences between the subjects. A 2x2 within-subjects full factorial ANOVA was run where each subject saw both the male and female from study one and study two. The sample size requirement needed to find a confidence interval width of 1.5 given the highest variance and lowest correlations among the scores was used (see formula below) (Bonett 2011). Linear contrasts were used for a full factorial when determining the sample size as a conservative estimate, even though we were only interested in the simple main effects of male vs. female for each of the studies separately (i.e. we did not wish to consider effects between study one and study two). Given we were examining two simultaneous simple main effect tests, a reverse Bonferroni adjustment was used so we could claim that the results were not significant at $p > 0.1$ (providing a more strenuous test of insignificance). Results showed that subjects did not perceive a significant difference between the male and female targets on any of the five categories for either study one or study two. This provides support that, without bias and technology present, the male and female subjects were perceived as not significantly different on the categories of interest. Furthermore, the differences found in study one and study two between males and females must be a result of the contextual treatment effects of technology and bias.

$$n = 4\sigma^2\left(\sum_{j=1}^{a} h_j^2\right)(1-\tilde{p})\left(\frac{z_{\alpha/2}}{w}\right)^2 + \frac{z_{\alpha/2}^2}{2}$$

manipulation. Japanese PDA usage was used given the widely held stereotype that the Japanese are thought to be leaders in handheld technology (California 2009), which would cause cognitive dissonance in the subjects given the disparity between the Japanese persona of high technological competence and the negative information regarding this use. Manipulation check questions showed that subjects correctly identified the technology used by the target and the information bias was shown to produce a statistically significant difference in perceptions of the content of the informational article ($p < 0.001$).

Subjects consisted of volunteers from accounting or management information systems (MIS) courses at a large mid-western university. Subjects were recruited in classes in which they were offered the opportunity to participate in this exercise as an alternative to another outside of class assignment. The same targets were used throughout the study by videotaping each target reading the article in each treatment manipulation and then having subjects view the recorded video of the target on a large projector in the front of the room. The use of a recorded presentation provided consistency across research sessions by making sure the targets performed exactly the same in each treatment manipulation.[6] The targets were instructed to read the scripted materials consistently across treatment conditions. To reduce random error from uncontrolled factors, identical rooms were used for each treatment recording and the targets wore neutral-colored shirts and blue jeans when making the presentations.

When subjects arrived at the room, a non-target research assistant greeted them, took attendance, and handed out a questionnaire. Students were randomly assigned to each

[6] The consistency provided by prerecording became even more important in study 2, where the target had to portray either success or failure using a particular technology.

treatment based on the session for which they signed up. The number of subjects per session varied and multiple sessions were used to collect data for each treatment cell (i.e., none of the treatment conditions were completed during one session). Subjects were told in the introduction that they would be asked to complete several questions about PDAs after information about PDAs was read to them. Following the short presentation, subjects were asked to complete a questionnaire about PDAs. This questionnaire was presented to be the main purpose of the research in order to reduce the likelihood that subjects would identify the true nature of the study (i.e., impression formation).[7] Following the questionnaire, subjects were asked to rate the target on the 34 adjective questions related to individual characteristics of the target. The questionnaire specifically asked subjects to rate their impressions of the person who read the article so that they would not confuse the target with the other research assistant. Following completion of the impression formation questionnaire, subjects were asked to provide demographic information and information about their recollections related to the content of the article. The questionnaire is included in Appendix B.

The fictitious article used to present the information bias was adapted from an actual article about cell phone use in Japan by recasting the story in the context of PDA usage among Japanese users. A positive version of the article included information that reported on favorable attitudes that Japanese users had regarding their use of PDAs, its positive impact on their productivity, and its ease of use. Facts and figures used in the article included numeric results from surveys of users, anecdotal reports, and similar pieces of information. For the negative bias, the same basic information was presented; however, the adjectives and

[7] Only one person reported in a follow up questionnaire that they thought the purpose of the research was to examine impression formation. This subject's data were dropped from further analysis.

adverbs describing Japanese user experiences were presented negatively. All of the numeric descriptors reported in the article remained the same; the negative versus positive tone was all that was changed. For example, in the positive version of the story a statement such as the following was made: "65 percent of the respondents under 20 years of age voiced satisfaction with connecting with the Web." In the negative version of the story a statement such as the following was made: "65 percent of the respondents under 20 years of age voiced dissatisfaction with connecting with the Web." The scripts for both conditions are provided in Appendix C.

Results

A total of 134 subjects participated in the research and provided usable data. The factors garnered from the instrument development were utilized for analysis. The means and standard deviations for the dependent measures are summarized in Table 1and the results of the statistical analyses are presented in Tables 2 and 3 (graphic representations of the interaction effects are presented in Figure 2).

Table 1. Descriptive statistics for Study 1.

			Professionalism	Character	Power	Sociability	Intelligence
Technology							
	Female						
		Positive	2.48 (0.63)	2.66 (0.70)	2.91 (0.65)	2.26 (0.59)	2.86 (0.85)
		Negative	2.28 (0.60)	2.37 (0.60)	2.72 (0.60)	2.07 (0.54)	2.56 (0.57)
	Male						
		Positive	2.52 (0.39)	3.08 (0.93)	3.22 (0.89)	2.80 (0.42)	2.60 (0.60)
		Negative	2.08 (0.37)	2.35 (0.51)	2.41 (0.42)	2.29 (0.51)	2.07 (0.46)
No Technology							
	Female						
		Positive	2.39 (0.43)	2.60 (0.39)	2.81 (0.54)	2.14 (0.62)	2.46 (0.69)
		Negative	2.07 (0.64)	2.47 (0.76)	2.46 (0.69)	2.40 (0.72)	2.42 (0.64)
	Male						
		Positive	2.18 (0.54)	2.28 (0.64)	2.64 (0.75)	2.33 (0.65)	2.23 (0.62)
		Negative	2.41 (0.70)	2.86 (0.83)	3.01 (0.63)	2.46 (0.71)	2.81 (0.69)
higher values indicate more postive ratings			6-items	4-items	5-items	5-items	3-items
			1 to 6	1 to 6	1 to 6	1 to 6	1 to 6
			α = 0.83 [CI=0.78,0.87]	α = 0.85 [CI=0.81,0.89]	α = 0.82 [CI=0.77,0.86]	α = 0.82 [CI=0.77,0.86]	α = 0.72 [CI=0.63,0.80]

To examine the overall model, we analyzed the data using MANOVA because of the interrelatedness of the factors used as the dependent variables. The results show that the overall model is significant for the three-way interaction of technology, bias, and gender ($F_{(5,122)} = 2.34$, $p < 0.05$) and that several interactions exist between the three independent variables (see Tables 2 and 3).[8] Specifically, there is a 3-way interaction between the target's gender, information bias, and PDA use for the factors Professionalism ($F_{(1,126)} = 3.94$, $p <$

[8] The sex of the observer was originally added as a covariate to both Study 1 and Study 2 but was found to be non-significant in both ($F = 0.222$, $p = 0.952$; $F = 1.666$, $p = 0.142$); therefore, the sex of the observer was dropped from both analyses.

0.05), Character ($F_{(1,126)} = 5.50$, $p = 0.02$), Power ($F_{(1,126)} = 8.55$, $p = 0.004$), as well as Intelligence ($F_{(1,126)} = 3.221$, $p = 0.075$).[9]

Table 2. MANOVA multivariate test results.

	Wilks Value	*F*-value	Hypo df	Error df	*p*-value
technology	0.99	0.18	5	122	0.97
bias	0.99	1.24	5	122	0.30
gender	0.89	3.08	5	122	0.01
technology*bias	0.91	2.47	5	122	0.04
technology*gender	0.89	3.15	5	122	0.01
bias*gender	0.96	0.92	5	122	0.47
technology*bias*gender	0.91	2.34	5	122	0.05

Table 3. MANOVA tests of between subject effects for 3-way interaction.

	SS	df	MS	*F*-value	*p*-value
Professionalism	1.25	1	1.25	3.94	0.05
Character	2.54	1	2.54	5.50	0.02
Power	3.57	1	3.57	8.55	0.00
Sociability	0.07	1	0.07	0.19	0.66
Intelligence	1.42	1	1.42	3.22	0.08

Hypothesis H1 predicted that there would be a 3-way interaction between the technology used to read the article, the gender of the target, and the information bias presented in the article. The results indicate that there is a significant interaction between these variables for Professionalism, Character, Power ($p < 0.05$), and Intelligence ($p < 0.1$). There was no significant 3-way interaction for the dependent variable Sociability. In summary, the results largely support Hypothesis H1. Figure 2 shows graphical depictions of the three-way interaction effects for each of the five impression measures.

[9] Given the exploratory nature of the study and the fact that these data are examined in an omnibus model viewing 3-way interactions, we consider p-values below the 0.10 cutoff.

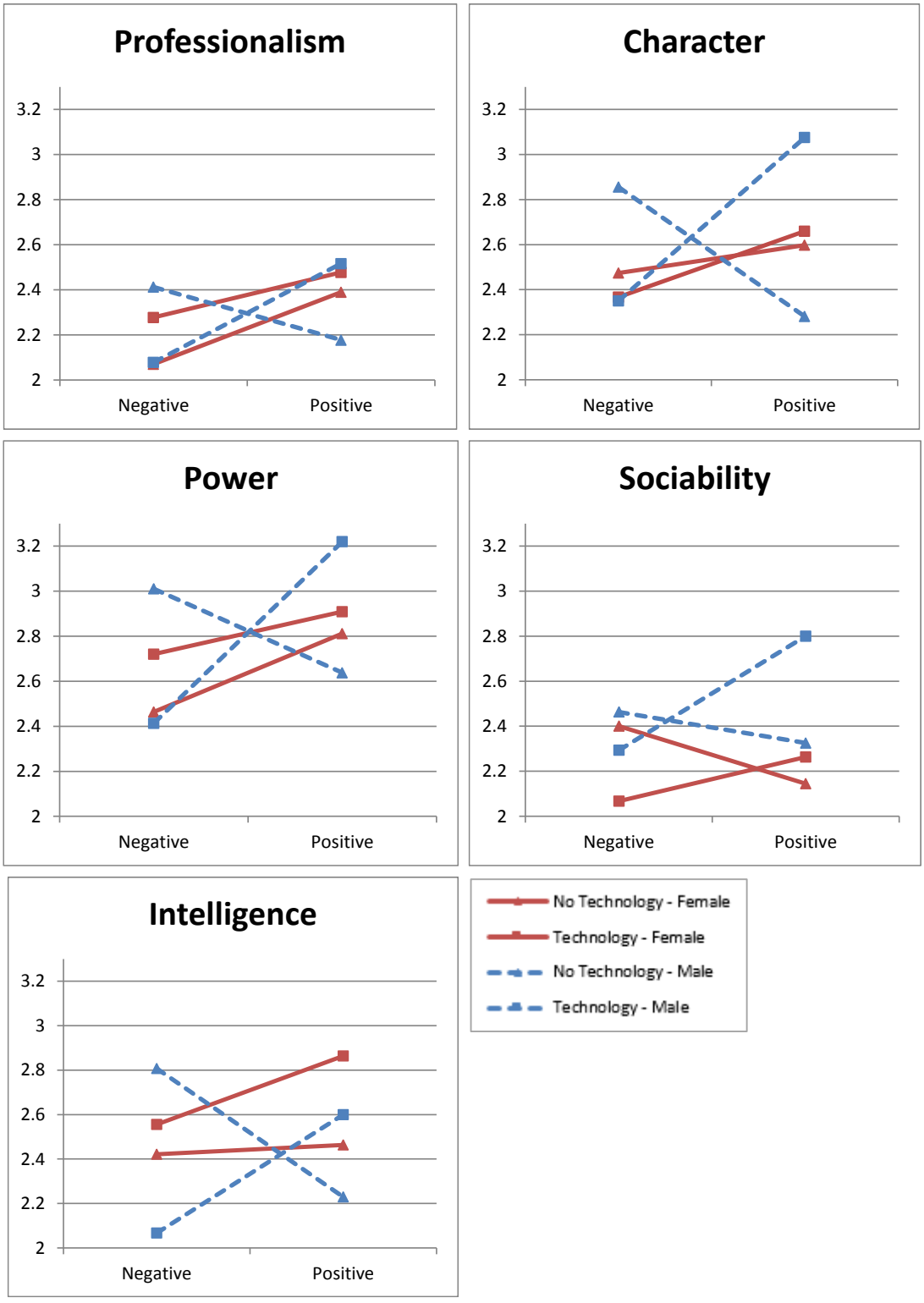

Figure 2. Graphics of 3-way interaction effects for study 1

To gain greater understanding of these data, simple 2-way interactions were investigated (Kerlinger et al. 2000). When viewed within the context of no technology versus technology, we found a significant simple 2-way interaction of bias and gender in the no technology group ($F_{(5,64)} = 3.29$, $p = 0.01$) with Professionalism ($F_{(1,68)} = 3.95$, $p = 0.05$), Character ($F_{(1,68)} = 4.66$, $p = 0.03$), Power ($F_{(1,68)} = 5.45$, $p = 0.02$), and Intelligence ($F_{(1,68)} = 3.96$, $p = 0.05$) showing between subject significant effects, while only Sociability showed no significance (see Tables 4 and 5). Next we investigated the simple 2-way interactions in the technology group and found a significant main effect for bias ($F_{(5,54)} = 2.10$, $p = 0.001$), with all five dependent variables showing significant between-subject effects, but no interaction effect with gender ($F_{(5,54)} = 0.68$, $p = 0.64$) (see Tables 6, 7, and 8).

Table 4. MANOVA multivariate test results for simple 2-way interaction effect in the no technology group

	Wilks Value	*F*-value	Hypo df	Error df	*p*-value
bias	0.90	0.38	5	64	0.22
gender	0.97	1.46	5	64	0.86
bias*gender	0.80	3.29	5	64	0.01

Table 5. MANOVA tests of between subject effects for simple 2-way interaction of bias and gender in the no technology group

	SS	df	MS	*F*-value	*p*-value
Professionalism	1.37	1	1.37	3.95	0.05
Character	2.18	1	2.18	4.66	0.03
Power	2.33	1	2.33	5.45	0.02
Sociability	0.06	1	0.06	0.13	0.72
Intelligence	1.72	1	1.72	3.96	0.05

Table 6. MANOVA multivariate test results for simple 2-way interaction effect in the technology group

	Wilks Value	*F*-value	Hypo df	Error df	*p*-value
bias	0.84	2.10	5	54	0.00
gender	0.70	4.66	5	54	0.08
bias*gender	0.94	0.68	5	54	0.64

Table 7. MANOVA tests of between subject effects for the simple main effect of gender in the technology group

	SS	df	MS	*F*-value	*p*-value
Professionalism	0.09	1	0.09	0.33	0.57
Character	0.57	1	0.57	1.25	0.27
Power	0.00	1	0.00	0.00	0.99
Sociability	2.09	1	2.09	7.32	0.01
Intelligence	2.03	1	2.03	4.52	0.04

Table 8. MANOVA tests of between subject effects for the simple main effect of bias in the technology group

	SS	df	MS	*F*-value	*p*-value
Professionalism	1.46	1	1.46	5.15	0.03
Character	3.71	1	3.71	8.12	0.01
Power	3.56	1	3.56	8.76	0.00
Sociability	1.78	1	1.78	6.22	0.02
Intelligence	2.54	1	2.54	5.65	0.02

Hypothesis H1a predicted that there would be a simple 2-way interaction between the gender of the target, and the information bias presented in the article when technology was not used to read the article. The results indicate that there is a significant simple 2-way interaction between gender and bias for Professionalism, Character, Power, and Intelligence ($p < 0.05$). There was no significant simple 2-way interaction for the dependent variable Sociability. In summary, the results largely support Hypothesis H1a. Furthermore, Hypothesis H1b predicted that there would not be a simple 2-way interaction between the gender of the target, and the message bias presented in the article when technology was used to read the article, with the results supporting H1b ($p = 0.64$). This implies that technology is the driver of the 3-way interactions and that a gender-message bias interaction is not evident when technology is present. Furthermore, in the technology-present condition, only message

bias has a significant main effect on all the dependent variables, with gender retaining a significant main effect on only two of the dependent variables.[10]

STUDY 2

Study 2 provides a more nuanced insight into impression formation of users of technology. Specifically, part of the motivation for the design of Study 2 is to better understand the relationship between the information bias and the gender of the target. An inspection of the pattern of the results from Study 1 (Tables 4 and 5) suggests that while the information bias causes the perception of female and male targets to differ in the no technology sub-condition, this bias does not appear to be sufficient to directly interact with the target's gender in the technology condition (Table 6), even though there is a significant main effect of this information bias (Table 8). An important consideration in interpreting the results of Study 1 is that the technology present/non-present condition was presented in a relatively passive manner; that is, the condition was introduced by having the target read an article from paper or a PDA, which means that there was no demonstration of the target's level of competency with the technology. As a result, in Study 2 we focus our attention on generating a bias that closely associates the target and his or her use of technology. Specifically, we want to examine how an *enacted bias* (the exhibited behaviors of the target when using the technology) influence the impressions formed about the target. In Study 1, we used an *information bias* (a positive or negative story), along with gender and the presence/non-presence of technology to examine the impact of technology on impressions

[10] Technically, given that we have blocked all but the technology-present condition for this part of the analysis, the specific terminology would be simple two-way interaction (describing the interactions at this level) and simple-simple main effects (describing the impact of gender and message bias individually on the dependent measures).

formed of our targets; in Study 2, with technology presence held constant, we examine target gender and an *enacted bias* on impression formation.

Procedure

A 2x2 full factorial design was utilized for the study, with the independent variables of enacted bias and gender of the target. The gender manipulation was implemented by having either a male or a female target read the article. Both targets were students who were of the same general appearance, similar speaking ability, of about the same height and build, and approximately the same age. The enacted bias manipulation was implemented by having the target read an article where the target either correctly operated the tablet during the presentation (positive bias) or made mistakes with the technology and failed in the completion of tasks while using the tablet (negative bias). The targets were well rehearsed for both the failure and no-failure condition, and implemented each manipulation correctly as verified by a research assistant. The scripts for both the failure and no-failure conditions are provided in Appendix D.

The observers who were the subjects in our research consisted of volunteers from a management information systems (MIS) course at a large mid-western university. Subjects were recruited in classes in which they were offered the opportunity to participate in this exercise as a form of extra credit. The same targets were used throughout the study. To reduce random error from uncontrolled factors, the same room was used throughout the study.

When subjects arrived at the room, a non-target research assistant greeted them, took attendance, and handed out a questionnaire. Students were randomly assigned to each treatment based on the session for which they attended. Subjects were told in the introduction

that they would be asked to complete several questions about tablet computers after some information about tablets was read to them. Following the short presentation, subjects were asked to complete a questionnaire about tablets; as in Study 1, this questionnaire was presented as the main purpose of the research in order to reduce the likelihood that subjects would identify the true nature of the study (i.e., impression formation). Following the questionnaire, subjects were asked to rate the target on the same 34 items describing individual characteristics of the target that were used in Study 1. As in Study 1, respondents were asked to provide demographic information and provide information about their recollections related to the content of the article that they were read.

Results

A total of 405 subjects participated in the research and provided usable data. The means and standard deviations for the dependent measures are summarized in Table 9 while the results of the statistical analyses are presented in Tables 10 through 13 (graphic representations of the effects are presented in Figure 3).

Table 9. Descriptive statistics for Study 2

		Professionalism	Character	Power	Sociability	Intelligence
Female						
	Positive	3.35 (0.92)	3.28 (0.81)	2.72 (0.94)	3.15 (0.95)	3.11 (0.94)
	Negative	2.98 (1.07)	3.04 (1.04)	2.75 (1.05)	3.21 (0.86)	2.53 (1.14)
Male						
	Positive	3.29 (1.02)	3.34 (0.92)	2.83 (1.11)	3.39 (0.89)	3.31 (1.07)
	Negative	2.83 (1.12)	2.91 (1.03)	2.52 (1.05)	2.98 (1.08)	2.71 (1.20)
		6-items	4-items	5-items	5-items	3-items
		1 to 6	1 to 6	1 to 6	1 to 6	1 to 6
		$\alpha = 0.90$ [CI=0.88,0.91]	$\alpha = 0.85$ [CI=0.82,0.87]	$\alpha = 0.88$ [CI=0.86,0.90]	$\alpha = 0.86$ [CI=0.84,0.88]	$\alpha = 0.80$ [CI=0.77,0.84]

To examine the overall model, we analyzed the data using MANOVA given the interrelatedness of the dependent variables. The results show that the overall model is significant for the two-way interaction of bias and gender ($F_{(5,397)} = 2.378$, $p = 0.04$) but that only one interaction exists between the two independent variables (see Table 11). Specifically, the results show that there is a 2-way interaction between the target's gender and information bias for the factor Sociability ($F_{(1,401)} = 5.77$, $p = 0.02$). Therefore, while the overall Wilk's test for the interaction effect is significant, the between-subject's effects show that only Sociability displayed an interaction effect of gender and bias, offering good support for Hypothesis H2.

Table 10. MANOVA multivariate test results

	Wilks Value	*F*-value	Hypo df	Error df	*p*-value
bias	0.90	8.80	5	397	0.00
gender	0.96	3.35	5	397	0.01
bias*gender	0.97	2.38	5	397	0.04

Table 11. MANOVA tests of between subject effects for 2-way interaction

	SS	df	MS	*F*-value	*p*-value
Professionalism	0.15	1	0.15	0.14	0.71
Character	0.78	1	0.78	0.85	0.36
Power	2.81	1	2.81	2.61	0.11
Sociability	5.36	1	5.36	5.77	0.02
Intelligence	0.00	1	0.00	0.00	0.96

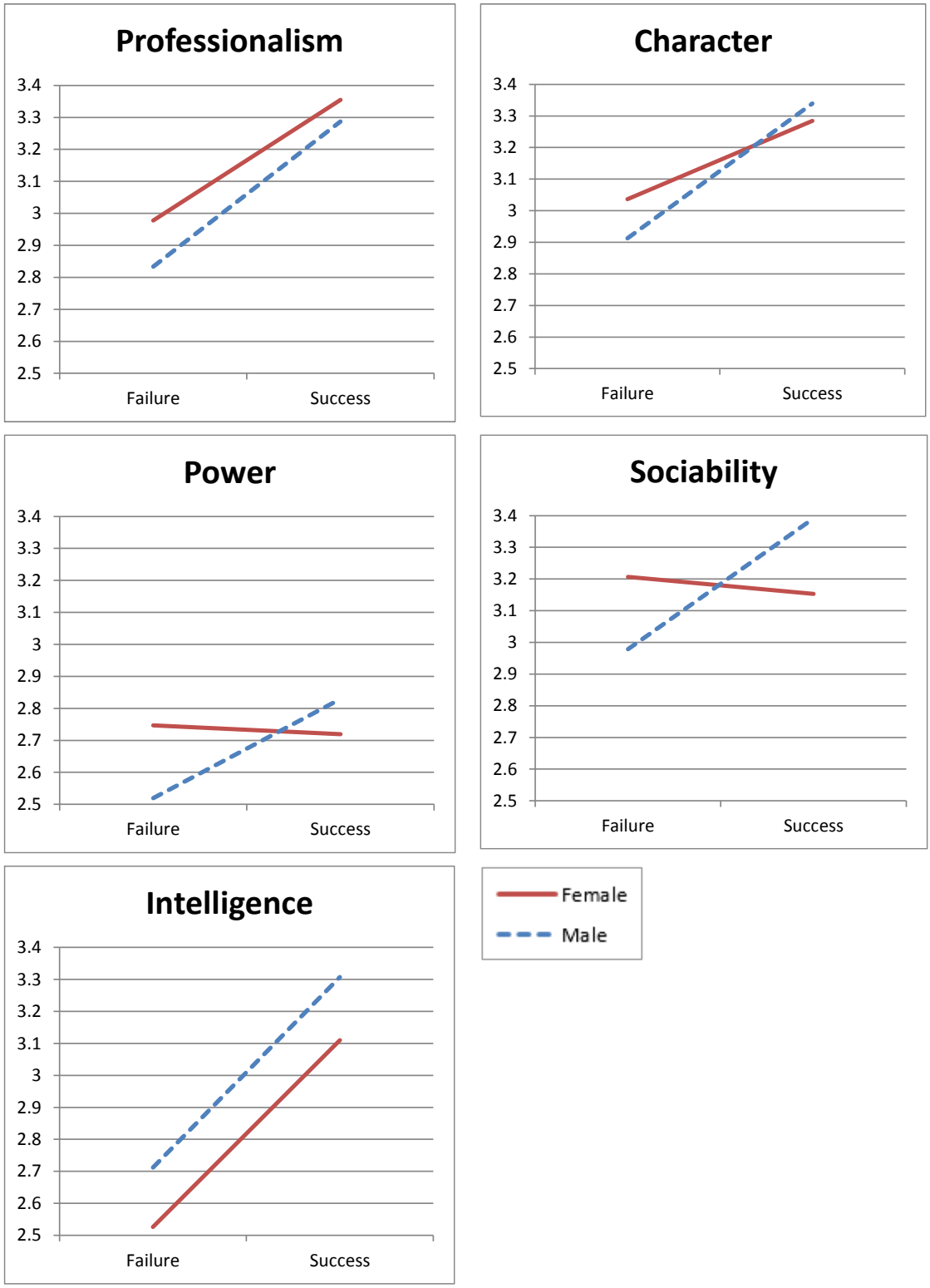

Figure 3. Graphics of 2-way interaction effects for study 2 (only Sociability shows a significant interaction)

Tables 12 and 13 show results of the main effects for each of the independent variables. These results demonstrate that the gender of the target has no significant main effect on the impression of the target for each of the remaining four factors (Professionalism, Character, Power, Intelligence), supporting H3. In addition, bias has a significant effect on Professionalism ($F_{(1,401)} = 15.71$, $p < 0.001$), Character ($F_{(1,401)} = 12.17$, $p = 0.001$), and Intelligence ($F_{(1,401)} = 28.17$, $p < 0.001$), with these effects being much larger than the simple-simple main effects of bias on each of these same dependent variables in the technology group in study 1.[11] These significant effects provide partial support for H4, with the increase in effect size providing support for the use of the more salient enacted bias treatment in study 2, a goal of the study.

Table 12. MANOVA tests for between subject effects for main effect of target gender

	SS	df	MS	*F*-value	*p*-value
Professionalism	1.11	1	1.11	1.02	0.31
Character	0.12	1	0.12	0.13	0.72
Power	0.34	1	0.34	0.32	0.57
Sociability	0.00	1	0.00	0.00	0.96
Intelligence	3.64	1	3.64	2.99	0.09

Table 13. MANOVA tests for between subject effects for main effect of technology-use bias

	SS	df	MS	*F*-value	*p*-value
Professionalism	17.03	1	17.03	15.71	0.00
Character	11.25	1	11.25	12.17	0.00
Power	1.97	1	1.97	1.83	0.18
Sociability	3.18	1	3.18	3.43	0.07
Intelligence	34.32	1	34.32	28.17	0.00

[11] Although Sociability approached significance ($F(1,405) = 3.427$, $p = 0.065$), the interaction supersedes the main effect for this variable.

DISCUSSION AND CONCLUSIONS

The results of these two studies demonstrate that the normal process of impression formation is drastically altered by the targets' use of technology. Study 1 shows that the presence of technology moderates the relationship between gender and message bias, creating a three-way interaction effect. When investigating the simple 2-way interaction effects we see that when technology is not present, the message content interacts with the gender of the presenter. Specifically, men tend to be judged more favorably when making negative comments and more negatively when making positive comments. Women, on the other hand, are evaluated within a much narrower range of favorability, regardless of whether they are speaking negatively or positively, and (different from the men) are perceived favorably when making positive comments and unfavorably when making negative ones. When technology is present, women and men are both evaluated with the same message/favorability standards; a negative message yields a negative impression and a positive message yields a favorable one. In other words, the gender-based differentiation of the message/favorability impact is subverted by the presence of technology.

Study 2 was meant to more thoroughly test the effects seen in Study 1. In Study 1, the technology is *present* for the targets, but it is not a focus of their activity; in Study 2, we made the technology-use of the target a highly-focused part of the presentation (the targets either succeed or fail to repair a technology glitch in their presentation tablet). The results again show that, in this technology-present condition, the target is evaluated based solely on their success or failure with the technology, with gender having no moderating or main effect on the impressions formed of the targets. These results further demonstrate that when technology is present, the gender of the target is no longer a factor in subject impressions of

them, which are only a function of the content of their message or of the abilities that they project.

In summary, these results indicate that the stereotype effect for gender is only apparent when technology use is contrasted. Without technology, we would argue that the stereotype effect is such that it obviates a rational evaluation of the target by the observer; the differential stereotype that evaluates men and women by such different standards has its basis only in archaic attitudes toward the sexes. The disappearance of the stereotype effect in the technology-present condition in Study 1, and the failure of the stereotype to appear in technology-centered Study 2, indicates that a target's use of technology disrupts the simple stereotype-driven categorization process and allows the observer to evaluate the target's specific performance in a context.

We suspect that this effect is the result of one of two processes: First, it is possible that the technology distracts sufficiently from the gender cues of the target to make them inoperative, or second, that the technology modifies the gender cues in such a way as to make them inoperative. In the first case, the technology presence is a simple distraction, making the environment more complex and thus prone to a nuanced evaluation. The gender of the target is proportionally reduced in the cue set of the evaluator, and stereotypes associated with gender are obviated when the complexity demands a nuanced evaluation. In our second possible process, the presence of the technology directly moderates the gender cue itself, subverting both the male and female stereotypes as they become male and female technology users, which is a new combination that does not activate the gender stereotype. This is compatible with dual-process models of attitude change posited by the Elaboration Likelihood Model (ELM) (Petty et al. 1981; Petty et al. 1986) and the Heuristic-Systematic

Model (HSM) (Chaiken 1987). When confronted with a target who is speaking about a technology, but with no heuristic cue (i.e. physical technology), individuals are unmotivated to expend cognitive resources and therefore revert to low effort persuasion using innate biases relating to gender (Taylor 1981). Conversely, when technology is included as a situational factor, an observer's confidence in their personal knowledge about the situation decreases (Chaiken et al. 1989) leading to the individual's personal expectations being disconfirmed, which increases cognitive effort regarding the situation (Maheswaran et al. 1991). In such circumstances, the observer is presented with a scenario where they engage in a deeper, more nuanced evaluation of the target resulting in perceptions that align with actions presented by the targets.

The one evaluation variable that works differently is *sociability*. Sociability does not show a three-way interaction in Study 1, and in Study 2 it has a two-way interaction between the gender of the target and the targets' success or failure to correct their tablet's problem. In Study 1, sociability simply seems to lack strong evaluative attention in the observer; however in Study 2 it appears to retain importance to the observer. The success or failure of the female target had little effect on the sociability perceptions of the observers (similar to Study 1); however, males were viewed with higher sociability when they succeeded and were rated lower when they failed, which is consistent with the findings associated for both sexes with the other four factors. In other words, the only sociability effects in Study 2 were for the male target. We are suspicious that the exaggerated context in Study 2 (direct technology interaction, with technology failure or success) may have uncovered an occasion of a gender stereotype that technology did not obviate. Here too, we think one or both of two processes occurred. First, previous research has attributed to females roles that are more social, warm,

and nurturing (Diekman et al. 2000), interacting better in small groups (Rose et al. 2006), and valuing, and more focused on, relationships (Konrad et al. 2000; Pinker 2008; Tannen 1990). In this light, preexisting perceptual biases about women's roles may have overwhelmed any perceptions developed associated with exhibited aptitude with technology. The sociability measure is much more focused on relational factors, compared to the other measures examined in this study, and the observers' sense of their relationship potential with the female target was unaffected by her technology aptitude. This is then exacerbated by extant attitudes toward women's technology competencies which predisposed observers to low expectations in the first place. These same factors then affected the male target's evaluations, as he was expected to be competent, and his technology abilities affected evaluations of his relative attractiveness for social relationships.

Limitations and Future Research

The study uses an undergraduate student population for its subject pool; while student subjects do represent an important user-group of personal technologies, their use of stereotypes may be confined by their limited life and work experiences and their biases may be different than those of different age groups. Because these students will be in the workforce within the next three years, we believe that they are fairly representative of, at least younger, members of the workforce. The study also uses only mobile technologies, and may not represent the impact of the use of larger scale installed technologies (i.e., presentation systems, desktop units, servers, etc.).

While we believe the present work is an important first step in looking at the impact of technology and technology use on impression formation, we also believe that it suggests a number of interesting future projects. Primary among these is the investigation of these

effects with larger technologies, particularly units where the technology itself is less physically apparent to the observer. In these contexts, mastery is more of an abstraction and it would be interesting to see what kinds of signals are important for target evaluations.

Our subjects in both of our studies were obviously male and female, but we had them in fairly unisex outfits (slacks and shirts). We believe it would also be useful to examine how clothing signals alter the impact of technology use; would skirts, dresses, or formal business attire make the gender stereotype reappear in spite of technology use?

Implications

Our findings offer important implications for users of technology as well as for anyone interested in understanding how impressions are formed. This research demonstrates that technology use can have a moderating effect on traditional gender stereotypes, meaning that the increasing proliferation of technology-present situations may well result in less gender stereotyping in the workplace. While we doubt that carrying a high-tech device will completely obviate gender stereotypes everywhere, our analysis indicates that they may be moderated in presentation situations where the technology is an important and appropriate tool.

Our research offers promise by demonstrating that women who exhibit competence when using technology are held accountable in a manner consistent with men. As a result, women will benefit from the increased successful usage, or perceived usage, of technology, which may help to alleviate the gender stereotypes that exist for technology use, when seen in an actual evaluative context.

REFERENCES

Abramson, P. R., Goldberg, P. A., Greenberg, J. H., and Abramson, L. M. 1977. "The Talking Platypus Phenomenon: Competency Ratings as a Function of Sex and Professional Status," *Psychology of Women Quarterly* (2:2), pp 114-124.

Anderson, N. H. 1966. "Component Ratings in IMpression Formation," *Psychonomic Science* (6), pp 179-180.

Anderson, N. H. 1968. "Likableness Ratings of 555 Personality-Trait Words," *Journal of Personality and Social Psychology* (9:3), pp 272-279.

Asch, S. E. 1946. "Forming impressions of personality," *Journal of Abnormal and Social Psychology* (41:3), pp 258-290.

Bagozzi, R. P., and Yi, Y. 1988. "On the Evaluation of Structural Equation Models," *Journal of the Academy of Marketing Science* (16:1), pp 74-94.

Bearden, W. O., Netemeyer, R. G., and Mobley, M. F. 1993. *Handbook of Marketing Scales: Multi-Item Measures for Marketing and Consumer Behavior Research*, (Sage Publications: Newbury Park, CA.

Bentler, P. M. 1992. "On the Fit of Models to Covariances and Methodology to the Bulletin," *Psychological Bulletin* (112:3), pp 400-404.

Berger, J., Conner, T. L., and Fisek, M. H. 1974. *Expectation States Theory: A Theoretical Research Program*, (Winthrop: Cambridge, MA.

Berger, J., Webster, M., Jr., Ridgeway, C. L., and Rosenholtz, S. J. 1986. "Status Cues, Expectations, and Behavior," in *Advances in Group Processes,* E. J. Lawler (ed.), JAI Press: Greenwich, CT.

Bodker, S., and Greenbaum, J. 1993. "Design of information systems," in *Gendered by Design,* E. Green, J. Owen and D. Pain (eds.), Taylor and Francis: London, pp. 53-63.

Bollen, K. A. 1989. "A New Incremental Fit Index for General Structural Equation Models," *Sociological Methods & Research* (17:3) February 1, 1989, pp 303-316.

Bonett, D. 2011. "Lecture Notes – Module 3: Within-Subjects Experiments [PDF notes]. Retrieved from Iowa State University: Statistical Design and the Analysis of Experiments on Blackboard: https://bb.its.iastate.edu.,").

Brewer, M. B. 1998. "Category-based vs. Person-based Perception in Intergroup Context," *European Review of Social Psychology* (9), pp 77-106.

California, J. A. S. o. S. 2009. "2009 National Survey: American Perceptions of Japan."

Carli, L. L. 1990. "Gender, Language, and Influence," *Journal of Personality and Social Psychology* (59:5), pp 941-951.

Carli, L. L. 1991. "Gender, Status, and Influence," in *Advances in Group Processes,* E. Lawler, B. Markovsky, C. Ridgeway and H. Walker (eds.), JAI Press: Greenwich, CT.

Cattell, R. B. 1966. "The Scree Test For The Number Of Factors," *Multivariate Behavioral Research* (1:2), pp 245-276.

Chaiken, S. 1987. "The Heuristic Model of Persuasion," in *Social Influence: the Ontario Symposium,* M. P. Zanna, J. M. Olson and C. P. Herman (eds.), Erlbaum: Hillsdale, NJ, pp. 3-39.

Chaiken, S., Liberman, A., and Eagly, A. H. 1989. "Heuristic and Systematic Information Processing within and beyond the Persuasion Context," in *Unintnded Thought,* J. S. Uleman and J. A. Bargh (eds.), Guilford: New York, pp. 212-252.

Chin, W. W. 1998. "Issues and Opinion on Structural Equation Modeling," *MIS Quartely* (22:1), pp vii – xvi.

Christman, L. A., and Branson, D. H. 1990. "Influence of Physical Disability and Dress of Female Job Applicants on Interviewers," *Clothing and Textiles Research Journal* (8:3) March 1, 1990, pp 51-57.

Cooper, J. 2006. "The digital divide: the special case of gender," *Journal of Computer Assisted Learning* (22:5), pp 320-334.

Cooper, J., and Weaver, K. D. 2003. *Gender and computers: Understanding the digital divide*, (Erlbaum: Mahwah, NJ.

Correll, S., and Ridgeway, C. 2006. "Expectation States Theory," in *Handbook of Social Psychology,* J. Delamater (ed.), Springer US, pp. 29-51.

Devine, P. G. 1989. "Stereotypes and Prejudice: Their Automatic and Controlled Components," *Journal of Personality and Social Psychology* (56:1), pp 5-18.

Diekman, A. B., and Eagly, A. H. 2000. "Stereotypes as Dynamic Constructs: Women and Men of the Past, Present, and Future," *Personality and Social Psychology Bulletin* (26:10) November 1, 2000, pp 1171-1188.

Ellemers, N., Spears, R., and Doosje, B. 2002. "SELF AND SOCIAL IDENTITY*," *Annual Review of Psychology* (53:1), pp 161-186.

Feeney, L. D. 2002. *The image problem: a content analysis of technology advertising and its portrayal of technology usage,* Dissertation, Widener University.

Fiske, S. T. 1980. "Attention and weight in person perception: The impact of negative and extreme behavior," *Journal of Personality and Social Psychology* (38:6), pp 889-906.

Fiske, S. T., Lin, M. H., and Neuberg, S. L. 1999. "The Continuum Model: Ten Years Later," in *Dual process theories in social psychology,* S. Chaiken and Y. Trope (eds.), Guilford: New York, pp. 231-254.

Fiske, S. T., and Neuberg, S. L. 1990. "A Continuum of Impression Formation, from Category-Based to Individuating Processes: Influences of Information and Motivation on Attention and Interpretation," in *Advances in Experimental Social Psychology,* P. Z. Mark (ed.), Academic Press, pp. 1-74.

Fornell, C., and Larcker, D. F. 1981. "Evaluating Structural Equation Models with Unobservable Variables and Measurement Error," *Journal of Marketing Research* (18:1), pp 39-50.

Foschi, M. 1996. "Double Standards in the Evaluation of Men and Women," *Social Psychology Quarterly* (59:3), pp 237-254.

Gefen, D., and Straub, D. 2005. "A practical guide to factorial validity using PLS-Graph: Tutorial and annotated example," *Communications of the Associations for Information Systems* (16), pp 91-109.

Gefen, D., Straub, D., and Boudreau, M. 2000. "Structural Equation Modeling and Regression: Guidelines for Research Practice," *Communications of Association for Information Systems* (4), pp 1-78.

Granié, M.-A., and Papafava, E. 2011. "Gender stereotypes associated with vehicle driving among French preadolescents and adolescents," *Transportation Research Part F: Traffic Psychology and Behaviour* (14:5) 9//, pp 341-353.
Greenwald, A. G., and Banaji, M. R. 1995. "Implicit social cognition: Attitudes, self-esteem, and stereotypes," *Psychological Review* (102:1), pp 4-27.
Hair, J. F., Anderson, R. E., Tatham, R. L., and Black, W. C. 1998. *Multivariate Data Analysis*, (5th ed.) Prentice-Hall, Inc.: Upper Saddle River, NJ.
Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., and Tatham, R. L. 2006. *Multivariate Data Analysis*, (6th ed.) Pearson Education Inc.: Upper Saddle River, NJ.
Hemwood, F. 1993. "Establishing gender perspectives on information technology: Problems, issues and opportunities," in *Gendered by Design,* E. Green, J. Owen and D. Pain (eds.), Taylor and Francis: London, pp. 31-52.
Hogg, M. A., and Terry, D. I. 2000. "Social Identity and Self-Categorization Processes in Organizational Contexts," *Academy of Management Review* (25:1) January 1, 2000, pp 121-140.
Horn, J. 1965. "A rationale and test for the number of factors in factor analysis," *Psychometrika* (30:2), pp 179-185.
Hu, L., and Bentler, P. M. 1999. "Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives," *Structural Equation Modeling: A Multidisciplinary Journal* (6:1), pp 1-55.
Hu, X., Lin, Z., Whinston, A. B., and Zhang, H. 2004. "Hope or Hype: On the Viability of Escrow Services as Trusted Third Parties in Online Auction Environments," *Information Systems Research* (15:3), pp 236-249.
Jones, E. E., and Goethals, G. R. 1987. "Order effects in impression formation: Attribution context and the nature of the entity," in *Attribution: Perceiving the causes of behavior,* E. E. Jones, D. E. Kanouse, H. H. Kelley, R. E. Nisbett, S. Valins and B. Weiner (eds.), Lawrence Erlbaum Associates, Inc: Hillsdale, NJ, England, pp. 27-46.
Jones, E. E., and McGillis, D. 1976. "Correspondent Influences and the Attribution Cube: A Comparative Reappraisal," in *New Directions in Attribution Research,* J. Harvey, W. Ickes and R. Kidd (eds.), Erlbaum: Hillsdale, NJ, pp. 290-420.
Kaiser, H. F. 1960. "The Application of Electronic Computers to Factor Analysis," *Educational and Psychological Measurement* (20:1) April 1, 1960, pp 141-151.
Kerlinger, F. N., and Lee, H. B. 2000. *Foundations of Behavioral Research*, (4th ed.) Cengage Learning: Belmont, CA.
Knupfer, N. N. 1998. "Gender divisions across technology advertisements and the WWW: Implications for educational equity," *Theory Into Practice* (37:1) 1998/01/01, pp 54-63.
Konrad, A. M., Ritchie Jr, J. E., Lieb, P., and Corrigall, E. 2000. "Sex Differences and Similarities in Job Attribute Preferences: A Meta-Analysis," *Psychological Bulletin* (126:4), pp 593-641.
Kriwy, P., Gross, C., and Gottburgsen, A. 2013. "Look Who's Talking: Compositional Effects of Gender and Status on Verbal Contributions at Sociology Conferences," *Gender, Work & Organization* (20:5), pp 545-560.

Liu, Y., Ginther, D., and Zelhart, P. 2001. "How Do Frequency and Duration of Messaging Affect Impression Development in Computer-Mediated Communication?," *Journal of Universal Computer Science* (7:10), pp 893-913.
Lohan, M., and Faulkner, W. 2004. "Masculinities and Technologies: Some Introductory Remarks," *Men and Masculinities* (6:4), pp 319-329.
MacCallum, R. C., Browne, M. W., and Sugawara, H. M. 1996. "Power Analysis and Determination of Sample Size for Covariance Structure Modeling," *Psychological Methods* (1:2), pp 130-149.
Macrae, C. N., Milne, A. B., and Bodenhausen, G. V. 1994. "Stereotypes as energy-saving devices: A peek inside the cognitive toolbox," *Journal of Personality and Social Psychology* (66:1), pp 37-47.
Maheswaran, D., and Chaiken, S. 1991. "Promoting systematic processing in low-motivation settings: Effect of incongruent information on processing and judgment," *Journal of Personality and Social Psychology* (61:1), pp 13-25.
Majchrzak, A., Beath, C., Lim, R., and Chin, W. 2005. "Managing client dialogues during information systems design to facilitate client learning," *MIS Quartely* (29:4), pp 653-672.
McCroskey, J. C., Holdridge, W., and Toomb, J. K. 1974. "An instrument for measuring the source credibility of basic speech communication instructors," *The Speech Teacher* (23:1), pp 26-33.
Mercier, E. M., Barron, B., and O'Connor, K. M. 2006. "Images of self and others as computer users: the role of gender and experience," *Journal of Computer Assisted Learning* (22:5), pp 335-348.
Morley, D. 2004. "Broadcasting and the construction of the national family," in *New Media Theory,* R. Allen and A. Hill (eds.), Routledge.
Moskowitz, G. B. 1993. "Individual differences in social categorization: The influence of personal need for structure on spontaneous trait inferences," *Journal of Personality and Social Psychology* (65:1), pp 132-142.
Myers, D. G. 2012. *Social Psychology*, (6th ed.) McGraw-Hill: New York.
Neuberg, S. L., and Fiske, S. T. 1987. "Motivational influences on impression formation: Outcome dependency, accuracy-driven attention, and individuating processes," *Journal of Personality and Social Psychology* (53:3), pp 431-444.
Nieva, V. F., and Gutek, B. A. 1980. "Sex Effects on Evaluation," *The Academy of Management Review* (5:2), pp 267-276.
Nunnally, J. C. 1978. *Psychometric Theory*, (2nd ed.) McGraw-Hill: New York.
Oakes, P. J., Haslam, S. A., and Turner, J. C. 1994. *Stereotyping and Social Reality*, (Blackwell: Oxford, UK & Cambridge, MA.
Oakes, P. J., Turner, J. C., and Haslam, S. A. 1991. "Perceiving people as group members: The role of fit in the salience of social categorizations," *British Journal of Social Psychology* (30:2), pp 125-144.
Perdue, C. W., Dovidio, J. F., Gurtman, M. B., and Tyler, R. B. 1990. "Us and them: Social categorization and the process of intergroup bias," *Journal of Personality and Social Psychology* (59:3), pp 475-486.
Petty, R. E., and Cacioppo, J. T. 1981. *Attitudes and Persuasion: Classic and Contemporary Approaches.*, (Brown: Dubuque, IA.

Petty, R. E., and Cacioppo, J. T. 1986. *Communication and Persuasion: Central and Peripheral Routes to Attitude Change*, (Springer-Verlag: New York.

Pinker, S. 2008. *The sexual paradox: Men, women, and the real gender gap*, (Scribner: New York.

Pugh, M. D., and Wahrman, R. 1983. "Neutralizing Sexism in Mixed-Sex Groups: Do Women Have to Be Better Than Men?," *American Journal of Sociology* (88:4), pp 746-762.

Pugh, M. D., and Wahrman, R. 1985. "Inequality of Influence in Mixed-sex Groups," in *Status, Rewards, and Influence,* J. Berger and M. Zelditch (eds.), Jossey-Bass: San Francisco, pp. 142-162.

Raykov, T., and Grayson, D. 2003. "A Test for Change of Composite Reliability in Scale Development," *Multivariate Behavioral Research* (38:2), pp 143-159.

Reynolds, K. J., and Oakes, P. J. 1999. "Understanding the Impression Formation Process: A Self-categorization Theory Perspective," in *Progress in Asian social psychology Theoretical and empirical contributions,* T. Sugiman, M.Karasawa, J. Lui and C. Ward (eds.), Kyoyook-Kwahak-Sa Publishing Company: Seoul, Korea, pp. 213-235.

Reynolds, K. J., and Oakes, P. J. 2000. "Variability in Impression Formation: Investigating the Role of Motivation, Capacity, and the Categorization Process," *Personality and Social Psychology Bulletin* (26:3) March 1, 2000, pp 355-373.

Reynolds, K. J., Turner, J. C., Haslam, S. A., and Ryan, M. K. 2001. "The Role of Personality and Group Factors in Explaining Prejudice," *Journal of Experimental Social Psychology* (37:5) 9//, pp 427-434.

Rose, A. J., and Rudolph, K. D. 2006. "A Review of Sex Differences in Peer Relationship Processes: Potential Trade-offs for the Emotional and Behavioral Development of Girls and Boys," *Psychological Bulletin* (132:1), pp 98-131.

Rudman, L. A. 1998. "Self-Promotion as a Risk Factor for Women: The Costs and Benefits of Counterstereotypical Impression Management," *Journal of Personality and Social Psychology* (74:3), pp 629-645.

Sherman, S. J., Crawford, M. T., Hamilton, D. L., and Garcia-Marques, L. 2007. "Social Inference and Social Memory: The Interplay Between Systems," in *The Sage Handbook of Social Psychology,* M. A. Hogg and J. Cooper (eds.), Sage: Thousand Oaks, CA.

Skowronski, J. J., and Carlston, D. E. 1987. "Social judgment and social memory: The role of cue diagnosticity in negativity, positivity, and extremity biases," *Journal of Personality and Social Psychology* (52:4), pp 689-699.

Skowronski, J. J., and Carlston, D. E. 1989. "Negativity and Extremity Biases in Impression Formation: A Review of Explanations," *Psychological Bulletin* (105:1), pp 131-142.

Tannen, D. 1990. *You just don't understand: Women and men in conversation*, (Morrow: New York.

Taylor, S. E. 1981. "The Interface of Cognitive and Social Psychology," in *Cognition, Social Behavior, and the Environment,* J. H. Harvey (ed.), Erlbaum: Hillsdale, NJ, pp. 189-211.

Turner, J. C., and Reynolds, K. J. 2008. *Blackwell Handbook of Social Psychology: Intergroup Processes*, (John Wuiley & Sons.

Wagner, D. G., and Berger, J. 1993. "Status Characteristics Theory: The Growth of a Program," in *Theoretical Research Programs: Studies in the Growth of Theory,* J. Berger and M. Zelditch (eds.), Stanford University Press, pp. 23-63.

Wagner, D. G., and Berger, J. 2002. "Expectation States Theory: An Evolving Research Program," in *New Directions in Contemporary Sociological Theory,* J. Berger and J. M. Zelditch (eds.), Rowman & Littlefield Publishers, Inc.: Lanham, MD, pp. 41-76.

Wajcman, J. 2004. *Technofeminism*, (Polity: Cambridge, MA.

Walther, J. B. 1993. "Construction and validation of a quantitative measure of impression development," *Southern Communication Journal* (59:1), pp 27-33.

Webster, J. 1993. "From the word processor to the micro: gender issues in the development of information technology in the office," in *Gendered by Design,* E. Green, J. Owen and D. Pain (eds.), Taylor and Francis: London, pp. 111-126.

Zwick, W. R., and Velicer, W. F. 1986. "Comparison of Five Rules for Determining the Number of Components to Retain," *Psychological Bulletin* (99:3), pp 432-442.

APPENDIX A

INSTRUMENT DEVELOPMENT

Instrument development involved two phases; an exploratory factor analysis followed by a confirmatory factor analysis. The exploratory factor analysis was run on data from Study 1 to identify relevant underlying constructs within the data that present themselves as salient characteristics for impression formation. Next, a confirmatory factor analysis was run on data from the second study to verify the factors identified through the exploratory factor analysis. In this section we describe the instrument development and leave the description of the experimental procedures (task, participants, manipulations, etc.) for the primary manuscript prose.

Various methods, items, and instruments have been developed to help measure impressions formed by subjects toward target individuals. One commonly used method involves subject ratings of targets based on individual descriptive adjectives. For example, the subject will rate how strongly he or she disagrees or agrees with the word "relaxed" as it applies to the target. Many different word lists have been developed for use in impression formation (Anderson 1968; Christman et al. 1990; McCroskey et al. 1974; Walther 1993). These instruments vary from an ad hoc list of words (Walther 1993), to words listed within constructs (Christman et al. 1990; McCroskey et al. 1974), and, ultimately, to an omnibus list of 555 different words (Anderson 1968). While a large list provides an exhaustive mechanism for measuring impression formation, the sheer magnitude of such a list is not tenable for use in this study due to time constraints and the potential for instrument fatigue. Further, we sought to focus the evaluation on adjectives that would reflect on the nature of the treatments' anticipated effects; that is, perceptions related to competence, intelligence,

decisiveness, and similar concepts related to technology use. For this reason, a new instrument is adapted and validated in tandem with the two studies in this research.

The vast word list from the impression formation literature was first narrowed to a shorter list for use in this research. This involved the researchers analyzing the words and adjectives in each list using a number of criteria. First, duplicate words were dropped between the lists as well as antonym words, with only one of the antonym pairs retained (for example *responsible* and *irresponsible*). Second, words were examined based on their understandability by the target demographic of the study (i.e. college students). Given the exhaustiveness of the lists as well as the dated nature of some of the words, many adjectives were removed if they were thought to have the potential to be confusing, ambiguous, or misinterpreted. Third, words were analyzed for their contextual parallel to the topics at hand (namely technology and gender). Those adjectives that did not pertain to the focus of the study were dropped. Based on these criteria, 34 words remained for use in the two studies (see the questionnaire in Appendix B).

For study 1, an exploratory factor analysis was performed using the selected adjectives. While some of the previous impression formation research has included adjective groupings associated with constructs (Christman et al. 1990; McCroskey et al. 1974), much of the prior literature associated with impression formation begins with word lists that are not associated with established factors (Anderson 1968; Walther 1993). Additionally, we determined that given the exploratory nature of a study of impression formation associated with technology use by a target user, it would be useful to not pre-define item groupings. Nevertheless, we did select items that we presumed would align with the important concepts

associated with impression formation such as competence, intelligence, and similar evaluative concepts.

Exploratory factor analysis provides a mechanism for aggregating items into common factors, which help to better explain the constructs that are affected by impression formation. Principal components analysis was chosen as the extraction method because its primary use is for data reduction as compared to principal axis factoring or maximum likelihood estimation extraction techniques. An oblique rotation method (covaramin) was first utilized to test for high interfactor correlation. Given that no interfactor correlations were above 0.36, this allowed for the use of an orthogonal rotation method (varimax), which assumes that the factors are uncorrelated and provides for a simpler interpretation of the factor solution. Running the PCA analysis with orthogonal rotation, we find that the factorability of the data is quite good with an overall Kaiser Measure of Sampling Adequacy (MSA) of 0.95 and each of the individual MSA values for each variable well above the 0.7 cutoff (the lowest being 0.87).

With the initial requirement met for factorability, next we determined the number of factors from the data. First, the Kaiser-Guttman rule (Kaiser 1960) would recommend extracting six factors given that there are six eigenvalues greater than the value of one (see Table 14). The percent variance explained is also quite high for a six-factor solution at 67%. Parallel analysis[12] (Horn 1965) in tandem with a scree plot (Cattell 1966) hints at a 6-factor solution (see Figure 4). The eigenvalue line and the randomized parallel analysis line cross

[12] Parallel analysis has been found in simulation studies using data sets with clear factor structure to work well for separating items into factors (Zwick et al. 1986).

between six and seven indicating a six factor solution as optimal, which also keeps three or more indicators per factor. For this reason, we decided to utilize a six-factor solution.

Table 14. Eigenvalues, differences, and proportional and cumulative variance explained for exploratory factor analysis

	Eigenvalue	Difference	Proportion	Cumulative
1	15.45	13.08	0.44	0.44
2	2.37	0.53	0.07	0.51
3	1.84	0.52	0.05	0.56
4	1.32	0.13	0.04	0.60
5	1.19	0.07	0.03	0.63
6	1.11	0.15	0.03	0.67
7	0.96	0.09	0.03	0.69
8	0.87	0.14	0.02	0.72
9	0.73	0.06	0.02	0.74
10	0.66	0.05	0.02	0.76

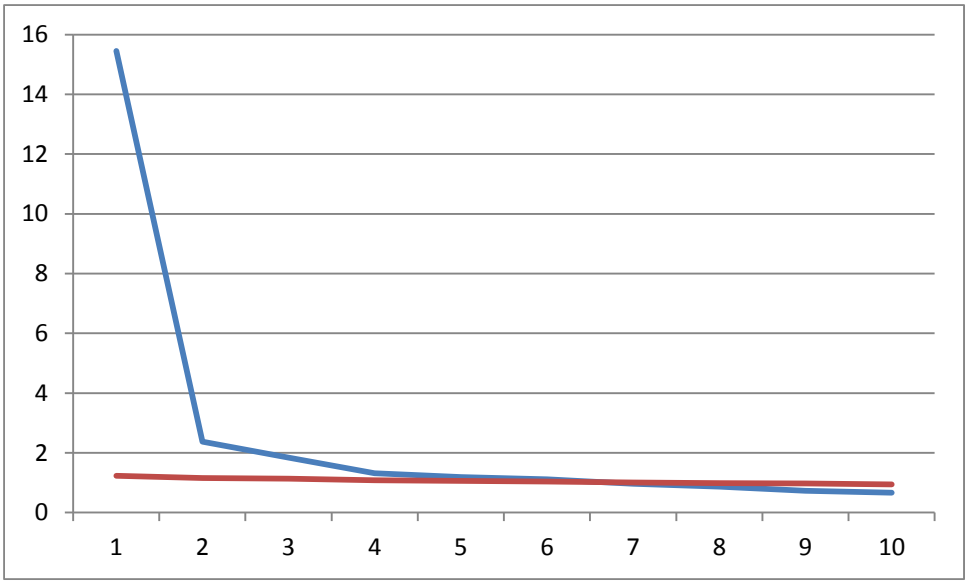

Figure 4. Parallel analysis and scree plot

Next, to assess the six-factor solution the residual correlation matrix, communalities, and uniqueness values were analyzed. The residual correlation matrix showed that very few values were close to zero, indicating an adequate solution. Next, the uniqueness values were

reviewed. Given that uniqueness values roughly correspond to reliability values, we would like to see these high (above 0.6) and the communalities low as these correspond to error variance. Two uniqueness values were found to be below 0.5 and were marked for further analysis in the next round of testing (see Table 15).

Table 15. Rotated factor solution, uniqueness, and communalities

	Professionalism	Character	Power	Sociability	Intelligence	Agressiveness	Uniqueness	Communalities
sociable	0.07	0.01	0.19	0.71	0.04	0.33	0.65	0.35
aggressive	-0.09	0.04	0.12	0.02	0.06	0.74	0.58	0.42
interesting	0.06	0.01	0.33	0.62	0.23	0.27	0.61	0.39
cooperative	0.20	0.42	0.03	0.55	0.11	0.10	0.54	0.46
experienced	0.27	0.12	0.07	0.27	0.76	0.15	0.76	0.24
friendly	0.31	0.26	0.03	0.71	0.20	-0.13	0.73	0.27
pleasant	0.28	0.20	0.09	0.77	0.16	-0.22	0.79	0.21
intelligent	0.34	0.41	-0.01	0.29	0.59	-0.15	0.74	0.26
honest	0.29	0.73	0.16	0.26	-0.13	0.04	0.72	0.28
close	0.30	0.30	0.06	0.16	-0.15	0.58	0.57	0.43
dependable	0.32	0.62	0.25	0.10	0.24	0.22	0.67	0.33
efficient	0.63	0.33	0.08	0.15	0.10	-0.03	0.54	0.46
professional	0.75	0.09	0.09	0.22	0.33	0.03	0.74	0.26
confident	0.57	0.13	0.12	0.19	0.15	0.23	0.47	0.53
logical	0.35	0.59	0.21	0.21	0.15	0.16	0.60	0.40
seriously-minded	0.65	0.34	0.16	-0.01	0.04	-0.11	0.57	0.43
businesslike	0.80	-0.01	0.11	0.04	0.19	0.05	0.70	0.30
effective	0.56	0.25	0.34	0.23	0.01	-0.08	0.55	0.45
consistent	0.56	0.13	0.34	0.21	0.00	0.03	0.49	0.51
strong	0.31	0.26	0.51	0.08	0.06	0.41	0.60	0.40
likeable	0.26	0.36	0.53	0.50	-0.15	0.09	0.76	0.24
responsive	0.17	0.30	0.61	0.24	0.11	0.15	0.59	0.41
decisive	0.31	0.14	0.63	0.12	-0.02	0.12	0.54	0.46
impressive	0.30	0.21	0.54	0.22	0.15	0.23	0.55	0.45
qualified	0.35	0.38	0.46	0.13	0.44	-0.09	0.70	0.30
expert	0.18	0.19	0.48	-0.14	0.61	0.15	0.71	0.29
important	0.11	0.30	0.63	0.06	0.29	0.00	0.59	0.41
reliable	0.11	0.70	0.42	0.04	0.20	0.01	0.71	0.29
attractive	-0.01	0.07	0.61	0.48	0.04	0.13	0.63	0.37
persuasive	0.06	0.28	0.38	0.18	0.26	0.52	0.60	0.40
sharp	0.24	0.44	0.23	0.15	0.33	0.42	0.61	0.39
successful	0.20	0.62	0.31	0.23	0.30	0.16	0.69	0.31
trustworthy	0.01	0.67	0.40	0.20	0.24	0.07	0.71	0.29
incompetent	-0.30	-0.31	-0.01	-0.20	0.02	0.45	0.43	0.57

Finally, the rotated factor loadings were analyzed and categorized along each factor. Three items were dropped due to not exceeding 0.5 on any of the six factors. Also, a fourth item was dropped due to strong cross-loading on two factors (0.53 and 0.50 respectively). The factors were also given names based on common themes among the items.

To further verify the proposed instrument, a confirmatory factor analysis was run on the data from the second study using the factors and items derived from the exploratory factor analysis run on the data in Study 1. The measurement model was evaluated using multiple fit criteria, specifically the comparative fit index (CFI), the Incremental Fit Index (IFI), the root mean square error of approximation (RMSEA), the standardized root mean square residual (SRMR), and the adjusted goodness of fit index (AGFI). Acceptable levels for each include CFI and IFI ≥ 0.90 (adequate) to 0.95 (superior), RMSEA ≤ 0.08 (good) to 0.1 (reasonable), SRMR ≤ 0.08, and AGFI ≥ 0.80 (Bearden et al. 1993; Bentler 1992; Bollen 1989; Gefen et al. 2000; Hu et al. 1999; MacCallum et al. 1996).

The measurement model included the six factors from the exploratory factor analysis including all 31 retained items. The first run of the measurement model indicated that the model did not fit the data well: χ^2 (390) = 1802.87, $p < 0.001$, CFI = 0.83, IFI = 0.84, RMSEA = 0.092, SRMR = 0.064, and AGFI = 0.69. Upon further investigation, we found that the Aggressiveness factor did not fit well with two of the three loadings below 0.5. Given that two of the three items were well below the recommended cutoff of 0.7 (Hair et al. 1998), the Aggressiveness factor was dropped from the analysis. Further, inspection of the parameters also revealed that one item under Professionalism (seriously minded), two items under Character (honest and dependable), and one item under Power (attractive) were also well below the recommended cutoff of 0.7. Considering content validity, seriously minded was deemed to be a confusing term and attractive did not seem to fit well under the construct of Power, so these two items were obvious candidates for removal. Conversely, both honest and dependable seemed to fit well under the concept of Character, but given the low values and the fact that Character had four other items belonging to the factor, both of these items

were dropped. Upon rerunning the measurement model, the model was found to fit the data well on most of the fit indices χ^2 (216) = 831.81, $p < 0.001$, CFI = 0.91, IFI = 0.91, RMSEA = 0.082, SRMR = 0.047, and AGFI = 0.80. The means, standard deviations, Cronbach's alpha, composite reliability, average variance extracted (AVE), and correlations of the measures are shown in Table 16.

Table 16. Measurement model statistics including means, standard deviations, Cronbach alphas, composite reliability, average variance extracted, and correlations, with the square root of the AVE along the diagonal

						Correlations				
	Mean	Std. Dev	Alpha	CR	AVE	Professionalism	Character	Power	Sociability	Intelligence
Professionalism	3.06	1.05	0.90 [CI=0.88,0.91]	0.89	0.58	0.76				
Character	3.10	0.98	0.84 [CI=0.82,0.87]	0.84	0.58	0.76	0.76			
Power	2.68	1.05	0.88 [CI=0.87,0.90]	0.88	0.59	0.76	0.70	0.77		
Sociability	3.17	0.96	0.86 [CI=0.84,0.88]	0.85	0.53	0.68	0.62	0.70	0.73	
Intelligence	2.89	1.13	0.80 [CI=0.76,0.83]	0.80	0.58	0.74	0.70	0.65	0.60	0.76

Evaluation of the quality of the measurement model included several tests of reliability and validity (Bagozzi et al. 1988; Fornell et al. 1981). Reliability was assessed by examining construct reliability (using Cronbach's coefficient alpha), and composite reliability. All values for Cronbach's alpha are above the recommended cutoff of 0.7 (Nunnally 1978), with the lowest value being 0.8. Composite reliability is an index that reflects the impact of error on the measurement scale and is widely used in reliability checks in SEM (Raykov et al. 2003). All the factors have a composite reliability above the recommended cutoff of 0.7 (Bagozzi et al. 1988; Bearden et al. 1993; Fornell et al. 1981) indicating high composite reliability for the measurement model.

Both convergent and discriminant construct validity were also tested for the measurement model. Convergent validity can be evaluated using the average variance extracted (AVE), and the factor loadings of the indicators for each factor. AVE, representing the amount of variance a construct captures from its indicators (Chin 1998), is recommended

to be higher than 0.5 to indicate good convergent validity (Chin 1998; Hu et al. 2004). All factors in the measurement model were found to have AVE values above the 0.5 cutoff (see Table 16). The literature suggests that factor indicator loadings should be at least 0.6 and ideally 0.7 or above, indicating that the latent variable is accounting for 50 percent or more of the variance of the observed item (Chin 1998; Hu et al. 2004). All factor loadings were found to be above the 0.6 cutoff, with only two items (a 0.69 indicator for Professionalism and a 0.67 indicator for Sociability) falling below 0.7, indicating good convergent validity (Hair et al. 2006).

Discriminant validity is assessed through examination of cross loadings of constructs by inspection of the square root of the AVE for each factor and then comparing this to the factor's inter-factor correlations. This square root value stands for the association of each of the factors to its respective items while correlations with the other factors indicate overlap of items among the constructs. Table 16 shows that the square root of the construct AVE values (along the diagonal) are equal to or higher than the correlations with the other constructs, indicating that each construct is more closely related to its own measure than to the measures of other constructs (Chin 1998; Gefen et al. 2005; Majchrzak et al. 2005). Taken together, the results of the measurement model demonstrate high reliability as well as satisfactory convergent and discriminant validity for the factors.

APPENDIX B

A Tablet PC[13] is a notebook or slate-shaped mobile computer. Its touch screen or graphics tablet/screen hybrid technology allows the user to operate the computer with a stylus, digital pen, or a fingertip instead of a keyboard or mouse. Typically, it can be held in one hand leaving the other to input data with a pen type stylus or a reduced size keyboard. They are usually designed to provide the user with computing and information storage and retrieval capabilities for personal or business use, such as taking notes, keeping calendars and address book information handy. Most Tablet PCs have one or more of the following features:

- Wireless connectivity to the Internet
- A pen or stylus interface with handwriting recognition
- Speech recognition and voice recording capabilities
- High-capacity storage using flash memory and hard disk drives
- Applications such a MS Word, Excel, and other types of PC-type software

Questions about Tablet PCs

Please answer the following questions about Tablet PCs	Strongly Agree					Strongly Disagree
1. Using a Tablet PC in my job/class would enable me to accomplish tasks more quickly.	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
2. Using a Tablet PC would improve my performance in my job or in my classes.	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
3. Using a Tablet PC in my job or in my class would increase my productivity.	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
4. Using a Tablet PC would enhance my effectiveness in my job or in my class work.	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
5. Using a Tablet PC would make it easier to do my work in my job or in my classes.	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
6. I would find a Tablet PC useful in my job or in my classes.	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
7. Learning to operate a Tablet PC would be easy for me.	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
8. I would find it easy to get a Tablet PC to do what I want it to do.	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
9. My interaction with a Tablet PC would be clear and understandable.	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
10. I would find a Tablet PC to be flexible to interact with.	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
11. It would be easy for me to become skillful at using a Tablet PC.	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
12. I would find a Tablet PC easy to use.	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
13. Do you expect that a Tablet PC would provide you with the precise information you need?	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
14. Do you expect that the information content provided by a Tablet PC would meet your needs?	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
15. Do you expect that a Tablet PC would provide you with output that seems to be exactly what you need?	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
16. Do you expect that a Tablet PC would provide you with sufficient information for your needs?	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
17. Does a Tablet PC provide accurate information?	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
18. Do you think the output of a Tablet PC would be presented in a useful format?	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒

[13] The same survey instrument was used for both studies with the term "Tablet PC" replaced with "PDA" in the first study.

19.	Is the information clear?	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
20.	Are Tablet PCs user friendly?	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
21.	Are Tablet PCs easy to use?	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
22.	Would you expect that you would get the information that you need from a Tablet PC in a timely manner?	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
23.	Do Tablet PCs provide up-to-date information?	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒

Please answer the following group of questions based on your feelings about your skills with Tablet PCs.

If I were asked to use a Tablet PC that I was not familiar with, I usually could perform tasks using such a device…

		Totally Confident					Not at all Confident
1.	if there was no one around to tell me what to do as I go	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
2.	if I had only the manual for reference	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
3.	if I could see someone else using it before trying it myself	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
4.	if I could call someone for help if I got stuck	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
5.	if someone else helped me get started	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
6.	if someone showed me how to do it first	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
7.	if I had a lot of time to complete the tasks for which the device was provided	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒

Please answer the following group of questions based on your feelings about your skills with these devices

	Please rate yourself on your confidence with using …	Totally Confident					Not at all Confident
8.	Video Conferencing Software	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
9.	A Personal Digital Assistant (Tablet PC)	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
10.	The Internet via mobile phone	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
11.	Voice via mobile phone	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
12.	Internet-based communications (e.g., chat)	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒

Please answer the following group of questions based on your feelings about Tablet PCs

	13. If you currently own a Tablet PC, check here and go to question 19 ❒	Strongly Agree					Strongly Disagree
14.	I will buy a Tablet PC in the next 6 months?	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
15.	If I possessed a Tablet PC, I would make extensive use of it?	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
16.	A Tablet PC would be very useful	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
17.	I would like to own a Tablet PC	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒

18. I want to use a Tablet PC	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒

If you answered questions 14-18, please go to the next page

	Strongly Agree					Strongly Disagree
19. I will make extensive use of my Tablet PC?	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
20. My Tablet PC is very useful	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
21. I like owning my Tablet PC	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
22. I want to use my Tablet PC	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒

Questions about the person who read the article

Please rate the individual who read the story about Tablet PCs.

The person who read the article is…	Strongly Agree					Strongly Disagree
1. Sociable	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
2. Aggressive	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
3. Interesting	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
4. Cooperative	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
5. Experienced	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
6. Friendly	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
7. Pleasant	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
8. Intelligent	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
9. Honest	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
10. Close	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
11. Dependable	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
12. Efficient	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
13. Professional	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
14. Confident	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
15. Logical	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
16. Seriously Minded	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
17. Businesslike	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
18. Effective	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
19. Consistent	1	2	3	4	5	6

	❒	❒	❒	❒	❒	❒
20. Strong	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
21. Likeable	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
22. Responsive	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
23. Decisive	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
24. Impressive	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
25. Qualified	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
26. Expert	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
27. Important	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
28. Reliable	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
29. Attractive	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
30. Persuasive	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
31. Sharp	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
32. Successful	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
33. Trustworthy	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
34. Incompetent	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒

Questions about the Article

Answer these questions based on the article that was read about Tablet PCs	Strongly Agree					Strongly Disagree
35. The article provided only positive information about Tablet PCs?	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
36. The article indicated that most users are satisfied with their Tablet PC?	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
37. The article indicated that most users find Tablet PCs easy to use?	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
38. The article indicated that most users think that Tablet PCs made them more productive?	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
39. The article indicated that most users would think that their Tablet PC helps them complete important business functions?	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
40. The article indicated that most users would think that their investment in their Tablet PC was worthwhile?	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒

41. When the article was read the person reading the article read the story from a _____

	Very Important					Not Very Important

42. How important was what was used to read the article in influencing your opinions?	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
	Strongly Agree					Strongly Disagree
43. Did what the person use to read the article help you understand the article?	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
44. Was it important to you that the person reading used this item to read the article?	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒

The person reading the article…	Strongly Agree					Strongly Disagree
45. Made a lot of mistakes	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
46. Had trouble reading the article	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒
47. Struggled with using the Table PC	1 ❒	2 ❒	3 ❒	4 ❒	5 ❒	6 ❒

Questions about Yourself

Age: _____ Sex: M F Collegiate GPA: _____

Highest Degree Earned: _____ #Years Professional Work Experience: _____

Major or Degree Program: _____

APPENDIX C

STUDY 1 SCRIPTS

Negative Bias

Japanese mobile Internet customers not happy with Tablet PCs

A recent survey by Gartner Group Japan has shown that the majority of the customers in Japan using Tablet PCs are unhappy with their devices.

The survey showed that 75 percent of the users are dissatisfied with the Tablet PC capabilities, and that the majority of dissatisfaction was with the interface.

In spite of the findings, however, Japan has built up a user base of more than 10 million people who use Tablet PCs, to lead the world in use of these devices.

Gartner said the two main reasons why users were dissatisfied was because of the lack of availability of quality products and difficulty of use. This is particularly surprising since the Japanese generally accept new technologies readily, in spite of their shortcomings.

65 percent of the respondents under 20 years of age voiced dissatisfaction with the user interface, and of respondents between the ages of 31 and 39 and over 50, the figure was nearly 60 percent. The main disadvantages cited by the respondents under the age of 20 centered on poor handwriting recognition and high costs. Respondents 20 and over voiced dissatisfaction with the content and performance of the device, such as 'the operating system's features are hard to use.'

The survey, conducted by the local subsidiary of Gartner Dataquest, also found that 68 percent of users found that their Tablet PCs were not making them more productive or efficient workers.

Gartner Group Japan expects that devices with greater functionality and better handwriting recognition will be available in the future. In spite of this, it is doubtful that these new technologies will help users to be more productive since these devices still lack many of the capabilities that help knowledge workers to improve their ability to complete important business functions. Most users said that they thought that their investment in a Tablet PC at this time was a foolish decision because of the shortcomings of these devices. For example, Rob Severson, a Tablet owner who works at Cromwell Products, Inc., indicated that, "I don't think anyone should invest in, or for that matter, bother using a Tablet PC because they reduce your productivity and are hard to use."

Now that I have told you about this survey by Gartner Group on Tablet PCs, please answer the questions about

these devices that you will find in the packet.

Positive Bias

Japanese mobile Internet customers happy with Tablet PCs

A recent survey by Gartner Group Japan has shown that the majority of the customers in Japan using Tablet PCs are happy with their devices

The survey showed that 75 percent of the users are satisfied with the Tablet PC capabilities, and that the majority of satisfaction was with the interface.

In line with the findings, however, Japan has built up a user base of more than 10 million people who use Tablet PCs, to lead the world in use of these devices.

Gartner said the two main reasons why users were satisfied was because of the availability of quality products and ease of use. This is not too surprising since the Japanese generally accept new technologies readily.

65 percent of the respondents under 20 years of age voiced satisfaction with the user interface, and of respondents between the ages of 31 and 39 and over 50, the figure was nearly 60 percent. The main advantages cited by the respondents under the age of 20 centered on handwriting recognition and low costs. Respondents 20 and over voiced satisfaction with the content and performance of the device, such as 'the operating system's features are easy to use.'

The survey, conducted by the local subsidiary of Gartner Dataquest, also found that 68 percent of users found that their Tablet PCs were making them more productive and efficient workers.

Gartner Group Japan expects that devices with greater functionality and better handwriting recognition will be available in the future. Given this, it is likely that these new technologies will help users to be more productive since these devices have many of the capabilities that help knowledge workers to improve their ability to complete important business functions. Most users said that they thought that their investment in a Tablet PC at this time was a wise decision because of the advantages of theses devices. For example, Rob Severson, a Tablet owner who works at Cromwell Products, Inc., indicated that, "I think most anyone should invest in and use a Tablet PC because they increase your productivity and are easy to use."

Now that I have told you about this survey by GartnerGroup on Tablet PCs, please answer the questions about these devices that you will find in the packet.

APPENDIX D

STUDY 2 SCRIPTS

Positive Bias (i.e. No Failure Condition)

[READ FROM TABLET PC]

Inventing the Tablet PC
by Suzanne Rossi, Microsoft Research

For over twenty years scientists have been dreaming about creating a real P.A.D.D., the slate device that the inhabitants of Star Trek used to record and access data as they moved around the starship Enterprise.

There have been attempts to duplicate it over the years, but the Tablet PC may be the first successful incarnation. Some of this is timing - consumers are demanding more from their computers, and they want what the Tablet offers. The other reason is research - years of hard work and data gathering have made the Tablet PC possible.

Tablet PC is an evolution of the portable PC. It takes the best from a standard laptop and adds features that make retiring your laptop one of the smartest ideas you've ever had. To start with, it uses multi-modal input - you can input with keyboard, pen, or voice. While you may be committing a social faux pas by burying your head behind a computer screen as you click on a keyboard during a meeting, you will feel perfectly comfortable taking notes in your own handwriting on the Tablet PC.

I will now review a few of the advantages and disadvantages of using Tablet PCs.

Tablet PC Advantages:

There are several advantages to using Tablet PCs.

- Portability —tablets are very slim and light compared to typical laptops and can easily be tucked under the arm like a book.
- Horizontal orientation — most tablet PCs do not interrupt line of sight since they lie flat on the table or in one's arms. This allows for better interaction in business meetings and conferences and also makes it easy for digital artists who wish to draw on a horizontal medium.
- Tablets have a more natural form of input — sketching and handwriting are a more familiar form of input than a keyboard and mouse, especially for people who are new to computers.

I will demonstrate how these actions work. If I open an MS Word document, for example, I can write my text in MS Word and have it recognize what I write.

[MAKE A GESTURE ON THE TABLET AS THOUGH YOU ARE WRITING ON THE SCREEN. ACT AS THOUGH YOU ARE SUCCESSFUL]

As I write my name it converts it to text. [WRITE ON THE SCREEN AND RESPOND AS THOUGH IT WORKS]

- Note-taking — taking handwritten notes at a class or conference increases productivity and retention of information. The notes can also be searched automatically if handwriting recognition is implemented.

[MAKE A GESTURE ON THE TABLET AS THOUGH YOU ARE WRITING ON THE SCREEN. ACT AS THOUGH YOU ARE SUCCESSFUL]

In this same MS Word document I can take notes and have it record my handwriting. As I write down my signature, it will keep it as my signature. There, it recorded my signature.

- Gesture recognition — gestures involve moving the pen in special patterns over the screen. This is a powerful way to increase efficiency. Many applications, or the operating system itself, can be programmed to respond in different ways to certain gestures created by the pen.

[MAKE A GESTURE ON THE TABLET AS THOUGH YOU ARE COMPLETING A SHORTCUT. ACT AS THOUGH YOU ARE SUCCESSFUL]

If I want to delete my signature, I can scratch out the text and it will be deleted. [MAKE A SCRATCH GESTURE ON THE TABLET] Ok, it deleted the signature.

- Digital Drawings — tablets are useful for drawing sketches. For many, this is one of the most important features of Tablet PCs.

[MAKE A GESTURE ON THE TABLET AS THOUGH YOU ARE DRAWING A SKETH ON THE SCREEN. ACT AS THOUGH YOU ARE SUCCESSFUL]

As I draw the picture, it records it in the Word document. It will be saved in the word document along with the text and handwritten words.

Tablet PC Disadvantages

There are also several problems with using Tablet PCs. These include…

- Higher cost — Tablet PCs cost roughly $300 more than their non-tablet counterparts.
- Screen size — the size of tablet PC screens currently peaks at 14.1 inches. However, some models make up for this with very high resolution (a higher pixel density per unit area).
- Input speed — maximum handwriting speed can be significantly slower than maximum typing speed.
- Screen damage risk - Because Tablet PC's are handled more than conventional laptops yet built on the frames of conventional notebooks, and because their screens also serve as input devices, many Tablet PC's run a higher risk of screen damage. PDAs carry some of the same risk.
- No built in optical drive (some Tablet PCs).

Now that we have told you about Tablet PCs, we would like for you to evaluate these devices. Please follow the instructions of the student assistant in the room to complete this session.

Negative Bias (i.e. Complete Failure Condition)

[READ FROM TABLET PC]

Inventing the Tablet PC

by Suzanne Rossi, Microsoft Research

For over twenty years scientists have been dreaming about creating a real P.A.D.D., the slate device that the inhabitants of Star Trek used to record and access data as they moved around the starship Enterprise.

There have been attempts to duplicate it over the years, but the Tablet PC may be the first successful incarnation. Some of this is timing - consumers are demanding more from their computers, and they want what the Tablet offers. The other reason is research - years of hard work and data gathering have made the Tablet PC possible.

Tablet PC is an evolution of the portable PC. It takes the best from a standard laptop and adds features that make retiring your laptop one of the smartest ideas you've ever had. To start with, it uses multi-modal input - you can input with keyboard, pen, or voice. While you may be committing a social faux pas by burying your head behind a computer screen as you click on a keyboard during a meeting, you will feel perfectly comfortable taking notes in your own handwriting on the Tablet PC.

I will now review a few of the advantages and disadvantages of using Tablet PCs.

Tablet PC Advantages:

There are several advantages to using Tablet PCs.

- Portability —tablets are very slim and light compared to typical laptops and can easily be tucked under the arm like a book.
- Horizontal orientation — most tablet PCs do not interrupt line of sight since they lie flat on the table or in one's arms. This allows for better interaction in business meetings and conferences and also makes it easy for digital artists who wish to draw on a horizontal medium.
- Tablets have a more natural form of input — sketching and handwriting are a more familiar form of input than a keyboard and mouse, especially for people who are new to computers.

I will demonstrate how these actions work. If I open an MS Word document, for example, I can write my text in MS Word and have it recognize what I write.

[MAKE A GESTURE ON THE TABLET AS THOUGH YOU ARE WRITING ON THE SCREEN. ACT AS THOUGH YOU ARE SUCCESSFUL]

As I write my name it converts it to text. [WRITE ON THE SCREEN AND RESPOND AS THOUGH IT WORKS]

- Note-taking — taking handwritten notes at a class or conference increases productivity and retention of information. The notes can also be searched automatically if handwriting recognition is implemented.

[MAKE A GESTURE ON THE TABLET AS THOUGH YOU ARE WRITING ON THE SCREEN. ACT AS THOUGH YOU FIRST ENCOUNTER SOME DIFFICULTY BUT THEN RECOVER]

In this same MS Word document I can take notes and have it record my handwriting. As I write down my signature, it will keep it as my signature. [WRITE ON THE TABLET] Oh, wait, it converted it to text. Wait, let me change the settings in this document. Ok, let me try again. [WRITE ON THE TABLET] Oh no, it converted it to text again. I'll try this one more time. [WRITE ON THE TABLET] OK, that time it worked.

- Gesture recognition — gestures involve moving the pen in special patterns over the screen. This is a powerful way to increase efficiency. Many applications, or the operating system itself, can be programmed to respond in different ways to certain gestures created by the pen.

[MAKE A GESTURE ON THE TABLET AS THOUGH YOU ARE COMPLETING A SHORTCUT. ACT AS THOUGH IT DOES NOT WORK AND THEN GIVE UP]

If I want to delete my signature, I can scratch out the text and it will be deleted. [MAKE A SCRATCH GESTURE ON THE TABLET] Ok, it's not working. I'll try one more time. [MAKE A SCRATCH GESTURE ON THE TABLET] Ok, I give up, I can't make this work! I will just read the rest of these features so that I don't have other problems with this demonstration.

- Digital Drawings — tablets are useful for drawing sketches. For many, this is one of the most important features of Tablet PCs.

Tablet PC Disadvantages

There are also several problems with using Tablet PCs. These include…

- Higher cost — Tablet PCs cost roughly $300 more than their non-tablet counterparts.
- Screen size — the size of tablet PC screens currently peaks at 14.1 inches. However, some models make up for this with very high resolution (a higher pixel density per unit area).
- Input speed — maximum handwriting speed can be significantly slower than maximum typing speed.
- Screen damage risk - Because Tablet PC's are handled more than conventional laptops yet built on the frames of conventional notebooks, and because their screens also serve as input devices, many Tablet PC's run a higher risk of screen damage. PDAs carry some of the same risk.
- No built in optical drive (some Tablet PCs).

Now that we have told you about Tablet PCs, we would like for you to evaluate these devices. Please follow the instructions of the student assistant in the room to complete this session.

CHAPTER 5: CONCLUSION

The objective of this research is to provide insight into the intersection of psychology and information systems. This was carried out through the use of three papers which provided research on psychology and information systems in three separate areas of psychology; specifically personality psychology, counseling psychology, and social psychology.

The first paper provided a comparison of the Big Five personality indicator and the Myers Briggs cognitive style indicator in the area of virtual team work. A new scale to measure preference for working in virtual teams was developed and validated for this research. Findings show that while cognitive style displays greater predictive power with regard to preference for working in virtual teams over working alone, personality displays greater predictive power with regard to preference for working in virtual teams over working face-to-face.

The second paper utilized the Social Cognitive Career Theory model measuring interest of students in majoring in information technology. The study measured high school students in order to gain a greater understanding of the relationship of the predictors of intent to major before the students have made more substantive decisions after entering college. The results show that both self-efficacy and outcome expectations lead to interest in IT, but only interest and outcome expectations lead to greater intention to major in IT.

Finally, the third paper looks at the impression formation process in relation to mobile technology use. A two-study approach was used to both develop and validate a measure of impression formation as well as thoroughly investigate the research question. The results

show that when users are speaking about technology, the presence of the technology interacts with the gender of the target and the bias of the message with impressions of men differing between technology use/disuse while women do not differ across the technology use dimensions. Specifically, impressions of men are lower when technology is present as compared to not present when the target speaks negatively about the technology. Conversely, impressions of men are higher when technology is present as compared to not present when the target speaks positively about the technology. In comparison, impressions of women are lower when they speak negatively about technology and higher when they speak positively about technology. The findings of the second study confirm those of the first study, implying that the use of technology mitigates biases in impressions of men and women.

REFERENCES

Asch, S. E. (1946). Forming impressions of personality. *The Journal of Abnormal and Social Psychology, 41*(3), 258.

Ausburn, L. J., & Ausburn, F. B. (1978). Cognitive styles: Some information and implications for instructional design. *ECTJ, 26*(4), 337-354.

Bandura, A. (1986). *Social foundations of thought and action*. Englewood Cliffs, NJ: Prentice-Hall.

Brewer, M. B. (1998). Category-based vs. person-based perception in intergroup contexts. *European review of social psychology, 9*(1), 77-106.

Correll, S. J., & Ridgeway, C. L. (2006). Expectation states theory. In J. Delamater (Ed.), *Handbook of social psychology* (pp. 29-51): Springer.

Costa, P. T., & MacCrae, R. R. (1992). *Revised NEO Personality Inventory (NEO PI-R) and NEO Five-Factor Inventory (NEO FFI): Professional Manual*: Psychological Assessment Resources.

Dawis, R. V., & Lofquist, L. H. (1984). *A psychological theory of work adjustment: An individual-differences model and its applications*. Minneapolis: University of Minnesota Press.

Devine, P. G. (1989). Stereotypes and prejudice: their automatic and controlled components. *Journal of personality and social psychology, 56*(1), 5.

Feist, J., Feist, G. J., & Roberts, T.-A. (2009). *Theories of Personality* (7th Ed.). Boston: McGraw-Hill.

Fiske, S. T., & Neuberg, S. L. (1990). A Continuum of Impression Formation, from Category-Based to Individuating Processes: Influences of Information and Motivation on Attention and Interpretation. In P. Z. Mark (Ed.), *Advances in Experimental Social Psychology* (pp. 1-74): Academic Press.

Greenwald, A. G., & Banaji, M. R. (1995). Implicit social cognition: attitudes, self-esteem, and stereotypes. *Psychological review, 102*(1), 4.

Heppner, P. P., Cooper, C., Mulholland, A., & Wei, M. (2001). A brief, multidimensional, problem-solving psychotherapy outcome measure. *Journal of counseling psychology, 48*(3), 330.

Heppner, P. P., Wampold, B. E., & Kivlighan, D. M. (2008). *Research design in counseling* (3rd ed.). Belmont, CA: Thomson.

Holland, J. L. (1959). A theory of vocational choice. *Journal of counseling psychology, 6*(1), 35-45.

Holland, J. L. (1997). *Making vocational choices: A theory of vocational personalities and work environments* (3rd ed.). Odessa, FL: Psychological Assessment Resources.

Jung, C. G. (1921). *Psychological Types*. Princeton, NJ: Princeton University Press.

Krumboltz, J. D., Mitchell, A. M., & Jones, G. B. (1976). A Social Learning Theory of Career Selection. *The Counselling Psychologist, 6*(1), 71-81.

Lent, R. W. (2005). A Social Cognitive View of Career Development and Counseling. In S. D. Brown & R. W. Lent (Eds.), *Career Development and Counseling: Putting Theory and Research to Work*. New York: Wiley.

McElroy, J. C., Hendrickson, A. R., Townsend, A. M., & DeMarie, S. M. (2007). Dispositional factors in internet use: personality versus cognitive style. *MIS Quarterly*, 809-820.

Mitchell, L. K., & Krumbolt, J. D. (1996). Krumboltz's Learning Theory of Career Choice and Counseling. In D. Brown & L. Brooks (Eds.), *Career Choice and Development* (3rd ed.). San Francisco: Jossey Bass.

Mitchell, L. K., & Krumboltz, J. D. (1990). Social learning approach to career decision making: Krumboltz' theory. In D. Brown & L. Brooks (Eds.), *Career choice and development* (2nd ed., pp. 145-196). San Francisco: Jossey-Bass.

Myers, D. G. (2012). *Social psychology* (6th ed.). New York: McGraw-Hill.

Myers, I. B., & Myers, K. D. (1998). *Myers-Briggs Type Indicator Form M*. Palo Alto, CA: Consulting Psychologists Press, Inc.

Panko, R. R. (2008). IT employment prospects: beyond the dotcom bubble. *European Journal of Information Systems, 17*(3), 182-197.

Perdue, C. W., Dovidio, J. F., Gurtman, M. B., & Tyler, R. B. (1990). Us and them: social categorization and the process of intergroup bias. *Journal of personality and social psychology, 59*(3), 475.

Phares, E. J., & Chaplin, W. F. (1997). *Introduction to Personality* (4th ed.). New York: Longman.

Shaw, J. D., Duffy, M. K., & Stark, E. M. (2000). Interdependence and preference for group work: Main and congruence effects on the satisfaction and performance of group members. *Journal of Management, 26*(2), 259-279.

Sherman, S. J., Crawford, M. T., Hamilton, D. L., & Garcia-Marques, L. (2007). Social inference and social memory: The interplay between systems. In M. A. Hogg & J. Cooper (Eds.), *The SAGE handbook of social psychology* (pp. 45-67). Thousand Oaks, CA: Sage.

Super, D. E. (1957). *The psychology of careers*. New York: Harper & Row.

Super, D. E. (1981). A developmental theory: Implementing a self-concept. In D. H. Montross & C. J. Shinkman (Eds.), *Career development in the 1980s: Theory and practice* (pp. 28-42). Springfield, IL: Thomas.

Super, D. E. (1990). A life-span, life-space approach to career development. In D. Brown & L. Brooks (Eds.), *Career choice and development: Applying contemporary theories to practice* (2nd ed., pp. 197-261). San Francisco: Jossey-Bass.

Vondracek, F. W. (2001). The developmental perspective in vocational psychology. *Journal of Vocational Behavior, 59*, 252-261.

Vondracek, F. W., Lerner, R. M., & Schulenberg, J. E. (1986). *Career development: A life-span developmental approach*. Hillsdale, NJ: Erlbaum Associates.