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An Empirical Study of Social Networking Behavior Using Diffusion of Innovation Theory

Alan Peslak

Wendy Ceccucci

Patricia Sendall
Merrimack College, sendallp@merrimack.edu

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Alan Peslak
arp14@psu.edu
Information Sciences & Technology
Penn State University
Dunmore, PA 18512 USA

Wendy Ceccucci
wendy.ceccucci@quinnipiac.edu
Information Systems Management
Quinnipiac University
Hamden, CT 06518 USA

Patricia Sendall
patricia.sendall@merrimack.edu
Management Information Systems
Merrimack College
North Andover, MA 01845 USA

Abstract

Online social networking (SN) has gained enormous popularity in the last ten years with users numbering in the millions. There are an equal number of males and females who use social networking and there is no difference in ethnicity; Caucasians, African-American and Hispanic adults are equally likely to use these sites. This paper studies social networking behavior using Rogers (1995) model of human behavior known as Diffusion of Innovation (DI). Specifically, findings reveal that behavioral compatibility (COMP) with social networking, relative advantage (RA), complexity (CMPX) and ease of trying (TRY) are positively associated with intention to use social networking. In addition, findings confirm that intention influences use of social networking. A review of gender shows little difference between diffusion influences on intention. The modified DI model provides a good fit with the overall data and can be used to predict and understand the usage of social networking.

Keywords: Diffusion of Innovation, DI, Social Networking, factor analysis, multiple regression analysis, structural equation modeling.

1. INTRODUCTION

Social networking websites connect people with others who share similar interests. According to Nielsen, people spend twice as much time (22.7%) using social networking sites (SNS) as compared to any other online activity (NielsenWire, 2010). Further, social networking is displacing other forms of online communication. E-mail usage fell from 11.5% in June 2009 to 8.3% in June 2010. In addition, instant messaging usage declined 15% last year (Ostrow, 2010).

This article is an attempt to understand social networking behavior. The manuscript will explore social networking behavior using the Rogers (1995) model of human behavior known as Diffusion of Innovation (DI). According to Rogers (1995) important characteristics of an innovation include:

- Relative Advantage (RA)--the degree to which it is perceived to be better than what it supersedes
- Compatibility (COMP)--consistency with existing values, past experiences and needs
- Complexity (CMPX)--difficulty of understanding and use
- Trialability (TRY)--the degree to which it can be experimented with on a limited basis
- Observability (VI)--the visibility of its results

These factors influence intention to use a new technology and its diffusion into societal behavior. Rogers' (1995) diffusion of innovation theory uses these factors as a basis for modeling intention and subsequent behavior. Our study first reviews existing literature on both social networking and Diffusion of Innovation and then applies Rogers' model to understand and predict social networking intention and behavior.

2. SOCIAL NETWORKING

Professional networking began as a way for business professionals to meet and greet others in their fields, whether it was to market oneself, market a product, or just share a common interest. With Internet technology as an aide, it didn't take long for online social networking to catch on. Online social networking is not a recent phenomenon, however. Many believe that it began with Facebook and MySpace. Interestingly, the term was coined in 1954 by social scientist J.A. Barnes (Social Network, 2010). In the early 1980's, Bulletin Board Systems (BBS) services began to gain popularity. These were text-only exchanges for people who had common interests, ranging from hobbyists to academics. The popularity of BBSs lasted from the 1980's well into the 1990's. At the same time, CompuServe allowed users to share files online, and to access news and events. Various email systems enabled users to exchange ideas and to share files. American Online (AOL) emerged with member-created communities, which provided searchable member profiles where users could list personal information which was accessible to others. Some would say that Classmates.com was the first true online social networking site that came onto the scene in 1995, followed by SixDegrees.com in 1997. SixDegrees allowed users to create profiles and groups with a function that enabled the user to search for friends. In 2002, social networking site Friendster was launched, followed by LinkedIn and MySpace in 2003 (Nickson, 2009). From 2003 onward, many new social networking sites (SNS) were launched (boyd & Ellison, 2007). Facebook was unveiled in 2004 but was not fully available to the public at-large until 2006, the same year Twitter was introduced (Nickson, 2009). In July 2010, Facebook had reached 500 million users (Wortham, 2010).

There are a variety of definitions for this phenomenon. According to boyd & Ellison (2007), social network sites are defined as,

> "… web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system. The nature and nomenclature of these connections may vary from site to site." (pg. 211)

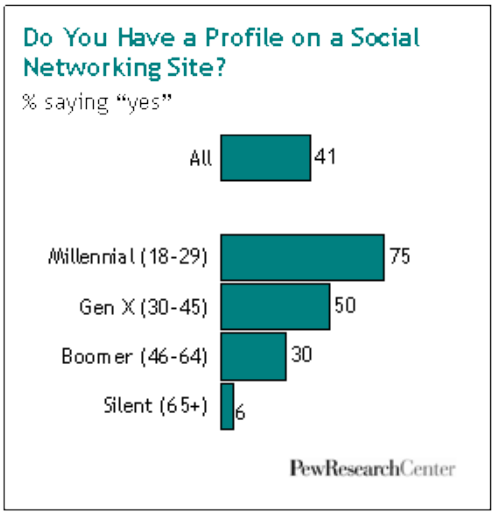
Wikipedia defines a social network as,

> "… a social structure made up of individuals (or organizations) called 'nodes,' which are tied (connected) by one or more specific types of interdependency, such as friendship, kinship, common interest, financial exchange, dislike, sexual relationships, or relationships of beliefs, knowledge or prestige" (Social Network, 2010, para 1).

According to the Pew Internet and American Life Project, young people are much more likely to use social networking sites than older adults. However, Lenhart (2009) found that 35% of American adult Internet users maintain a profile on an online social networking site. This is a four-fold increase since 2005. Teens are generally twice as likely to have profiles on social networking sites. A year later, as depicted in Figure 1, 41% of adults surveyed aged 18 – 65+ reported having an online social networking profile (The Millennials, 2010). Seventy-three percent (73%) of wired American teens use social networking websites, up from

55% in November 2006 (Lenhart, 2010). Surprisingly, given the adult population, there are a greater number of adults using online social networking as compared to the total number of teens (Lenhart, 2009). According to the 2009 study, the breakdown of adults who maintain an online profile is as follows:

Figure 1. Adults with Online Social Network Profile in 2010



Source: Pew Research Center (2010)

Online social networking is much more prevalent than professional online networking. Most people use social networking sites to keep up with current friends (89%), make plans with friends (57%) or to meet new friends (49%) (Lenhart, 2009). Facebook is currently the most regularly-used online social network among adults (73%), followed by MySpace (48%), Twitter or similar services (19%), and LinkedIn (14%) (Lenhart, 2010).

Many users maintain multiple profiles, particularly when they utilize social networks for both personal and professional applications. Fifty-one percent (51%) of social network users have two or more profiles compared to 43% of the users who have only one online profile. Eight-three percent (83%) of the respondents with multiple profiles maintain them on different sites so that they can keep up with their friends who have profiles on various sites (24%) and to keep their personal and professional profiles separate (19%) (Lenhart, 2009).

According to Lenhart, Purcell, Smith and Zickuhr (2010), approximately 80% of teens from lower income families (those earning less than $30,000 annually) are more likely to use online social networks than teens from wealthier households (70%). Both boys and girls visit social networking sites equally. Patterns of behavior are similar in the adult online community; an equal percentage of adult men and women visit social networking sites. There is no difference in ethnicity; Caucasians, African-American and Hispanic adults are equally likely to use these sites. However, those who have at least some college education (50%) are more likely to utilize these sites compared to adults who have a high school degree or less (43%). Thelwall (2008) found that female users of MySpace tend to be more interested in friendship and males more interesting in dating.

Although we are spending more time using SNSs, Birnie and Horvath (2002) found that, "online social communication appeared to complement or be an extension of traditional social behavior rather than being a compensatory medium for shy and socially anxious individuals." (para. 1). Lewin (2008) asserts that teens that socialize on SNSs are given "the technological skills and literacy they need to succeed in the contemporary world." (para 2)

Business has jumped on the social networking and social media bandwagon. According to SocialMediaExaminer.com, "…about 77 percent of business-to-business firms use Facebook, and 83 percent of business-to-consumer firms are using it in some way." (Campbell, 2010, para 7). In a 2010 study conducted by MerchantCircle, more than 50% of the respondents said that they planned to create or maintain a social-networking presence compared to 41% in the first three months earlier. In addition, merchant adoption of location-based services is growing rapidly – up from 25% in March 2010 to 32% in July 2010 (Swartz, 2010).

In a 2008 study conducted by DiMicco, et. al, internal enterprise-level use of social networking tools "enables a new method of communication between colleagues, encouraging both personal and professional sharing inside the protected walls of a company intranet." (pg. 711). The authors supported the use of internal SNSs, particularly given that the next generation of employees, the Millennials, have used SNSs as their foremost means of communication.

3. DIFFUSION OF INNOVATION

Diffusion of Innovation (DI) theory is a theory of communication and adoption of new ideas

and technologies. There are numerous studies on IS implementation using diffusion of innovation theory in the IS literature; three are widely cited: Rogers (1995); Kwon & Zmud (1987); and Tornatzky & Fleischer (1990). Rogers' model has been frequently cited and is well established in the diffusion theory literature. Rogers defines innovation as "an idea, practice, or object that is perceived as new by an individual or other unit of adoption." (Rogers, 1995). He defines diffusion as "the process by which an innovation is communicated through certain channels over time and among the members of a social system." In other words, the diffusion of innovation evaluates how, why, and at what rate new ideas and technology are communicated and adopted.

Rogers identified five factors that strongly influence whether or not someone will adopt an innovation. These factors are: relative advantage, complexity, compatibility, trialability and observability. The relative advantage is the degree to which the adopter perceives the innovation to represent an improvement in either efficiency or effectiveness in comparison to existing methods. The majority of studies have found that the relative advantage is significant (Teo & Tan, 2000; Premkumar & Ramamurthy, 1995). Ilie, et. al (2005) found that relative advantage was significant for men, but not for women.

The complexity is the degree to which the innovation is difficult to understand or apply. The compatibility refers to the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters. Premkumar and Ramamurthy (1995) in one application found that the greater the complexity the slower the rate of adoption. Ilie, et al (2005) found when referring to instant messaging women placed more importance on the ease of use than did men.

Trialability refers to the capacity to experiment with the new technology before adoption. Observability or visibility refers to the ease and relative advantage with which the technology can be seen, imagined, or described to the potential adopter.

Rogers identified four main elements that affected the adoption of innovation: (1) the innovation, (2) communication channels, (3) time, and (4) the social system. The innovation is the new product or service. The communication channel is the means by which messages are transmitted from one individual to another. Time refers to the amount of time it takes to adopt the new innovation. The social system is the set of interrelated units that are devoted to joint problem-solving, to accomplish a common goal (Rogers, 1995).

4. HYPOTHESES

Diffusion of innovation is thus an important model for technology adoption (Ilie, 2005; Teo, 2000; Remekumar, 1995) As a result of our literature review, we propose two research hypotheses that will be tested. The hypotheses focus on determining whether the diffusion of innovation model will fit SN behavior and use. In addition, Ilie, et al (2005) have proposed gender differences in instant messaging DI factors. We have reviewed our variables to test for gender differences in social networking to better understand SN intentions and behavior.

H1: Rogers' Diffusion of Innovation Model will have a significant fit with Social Networking intention to use and actual behavioral usage.

H2: Social Networking based on Diffusion of Innovation will have significant gender differences.

5. METHODOLOGY

A survey was prepared and pretested with a small group of students at one northeastern US university. The survey was modified based on preliminary testing and administered to 198 students at a three small Northeast US universities. The survey was a comprehensive survey of Social Networking behavior. A subset of this study included specific questions that developed into Diffusion of Innovation factors.

For each of the relevant factors, survey questions modeled prior research. Visibility, compatibility, relative advantage, complexity and intention factor questions were modeled after Ilie, et al. (2005), and behavior questions were based on common usage terminology and software piracy behavior factors in Woolley and Eining (2006). Trialability questions were inspired by He, Dun, Le, Fu (2005). The questions used to develop the factors are presented in Appendix 1. Software used in the study were SPSS 17.0 and AMOS 17.

6. RESULTS

The first step was to analyze the survey results and develop a structural equation model for the variables and latent variables. The factors

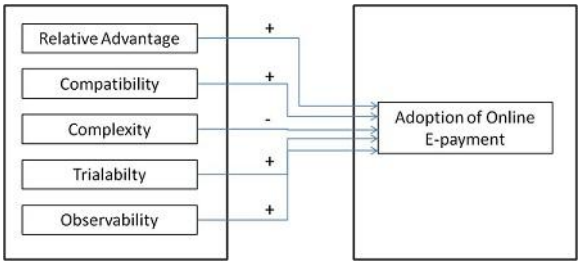
tested were relative advantage, complexity, compatibility, trialability, visibility, use intention, and behavior.

For relative advantage (RA) the six questions (as shown in appendix 1) were analyzed to determine whether SN was seen as providing an advantage to the user. All the other factors were analyzed in a similar fashion.

Hypothesis One

In order to test hypothesis one, the basic Rogers' diffusion model as well as modifications by Ilie, et. al (2005) were reviewed. The first attempt at developing a model for diffusion of social networking was to use the model as proposed by Rogers. The basic model as proposed by Rogers is illustrated in figure 2 (He, Duan, Fu, & Li, 2006).

Figure 2. Roger's Theoretical Model



Ilie et. Al (2005) measured the factor influence on user intention. This is the method used in our model. Most technology behavior models such as Technology Acceptance Model (Davis, 1989) and Theory of Reasoned Action (Ajzen and Fishbein (1980), measure factor effect on user intention, and then intention effect on behavior. Our model proposed was thus to use our questionnaire to develop the five latent variables of visibility, relative advantage, complexity, compatibility, and trialability and their effect on the intention latent variable. The last stage of the model was to measure intention effect on the behavior latent variable. All latent variables were developed within AMOS 17.0 and are fully illustrated in the model graphs. Though some questionnaire variables are difficult to read in the graphic model (appendix 2), all can be referenced to appendix 1.

The results of the model are illustrated in appendix 2 and the corresponding regression weights are in appendix 3. All factors shown are significant at $p<.01$ except visibility (VI) and relative advantage (RA). Relative advantage is significant at $p < .10$, which is generally sufficient for social science research. Visibility is not significant at even $p < .10$ and thus needed to be excluded from our equation.

The second model then started with taking out visibility. Note that all factors have a significant influence on intention at $p < .01$ except for relative advantage which is still significant at $p < .10$. Fit measures all suggest an acceptable fit, The Chi square divided by degrees of freedom is 1.831 which is well below the minimum acceptable 3.0 and RMSEA is .065 which is also well below the minimum acceptable of .08 (Moore, 2000).

This model is a good fit for the data and represents a usable model of social networking intention to use. These are prime indicators that the model fits (Moore, 2000). Total R squared for the four latent variables to intention, which represents the percentage of variance explained by the model is .480. This means that approximately one half of the adoption of SN into an intention to use SN is explained by the model.

Appendix 4 shows the standardized regression weights for each variable in the model. The largest effect was found to be compatibility. Compatibility with lifestyle influenced intention to use social networking nearly twice as much as the second most important factor, ease of trial. Lack of complexity was the next most important of the four factors and least important was relative advantage.

Overall hypothesis one was supported. A modified diffusion of innovation model was a good fit to predict social networking intention and behavior.

Hypothesis two

Ilie, et. al (2005) suggested that there were differences between diffusion of innovation factors on user intention based on gender for use of instant messaging. Our second hypothesis explores this question for social networking intention. Due to sample size limitations, separate SEM analysis based on gender could not be performed. In order to analyze this we performed three separate regression analyses on five specific questions from our study (one for each of the four factors and one for intention). Our study found little difference between males and females (Appendices 5 - 8). Separate regression analyses were performed for both males and females. In both scenarios the R2 or amount of explained variance was between .419 and .347. For both genders, the same

variables were significant at $p < .10$, relative advantage, trialability, complexity, and compatibility. The only significance changes were relative advantage and complexity, which were significant at $p < .01$ for males but only at $p < .10$ for females. Also relative importance was a bit different for males versus females. For males effectiveness was more important than compatibility. This was reversed for females. Overall though, the second research hypothesis was rejected. There was no significant difference between genders in our factors influencing IM. Both genders can use the model for prediction of intention.

7. IMPLICATIONS, LIMITATIONS, AND DISCUSSION

Overall, the results indicate general support for DI theory for the adoption of a communication technology, specifically social networking. It has been proposed that social networking provides unique advantages over other electronic communications methods such as email. But despite these advantages, Social Networking is used less frequently in business. Understanding the factors associated with intention and behavior associated with Social Networking suggests areas that can be focused on to increase Social Networking usage. A limitation of the study is the use of students. The study could be replicated with older individuals, but the students of today will become the employees of tomorrow so the limitation may not be as significant as first proposed.

It was found that compatibility, complexity, trialability, and relative advantage were all significant factors influencing the use of social networking. The growth in social networking use by students has been fueled by a social circle incentive. Those in the group have more social interaction and pressure exists to belong to this communication circle. This can expand through wider usage by the sampled population.

The most significant results are that use of social networking is being used primarily due to:

- Compatibility with user's lifestyle,
- Lack of complexity or simplicity of use,
- The ability to try the technology easily
- The benefits and performance advantages that it can provide

This has important implications for practitioners. For businesses and organizations, there are fewer users and fewer pressures to use SN. Clearly though, concerted efforts on the part of management to both use and encourage the use of SN can increase intention to use SN and should be undertaken. Education in schools and in the workplace on the benefits, advantages, and details of Social Networking is suggested to allow further penetration of this useful technology and improve overall communications. This could have significant positive cost and productivity improvements for businesses and organizations. In our study, intention to use was found to be a significant factor influencing actual behavior. This is also supported in the literature. As proposed in the original Ajzen and Fishbein model (1980), intention to use Social Networking is positively associated with use of social networking. Many researchers (Gupta & Kim, 2007; Shimp & Kavas, 1984; Tarkiainen & Sundqvist, 2005) have supported this relationship. Since our overall objective is to study and improve overall behavior, it was important that this relationship was established. It was found that visibility was not a significant factor in the intention to use social networking. This is probably related to the concept of Social Networking as a solitary activity. Others do generally not see people in "act" of social networking, so visibility is not important. Finally, the study also found little difference between male and female usage. The model can safely be used for both genders.

8. CONCLUSION

Overall this study has provided significant factors that influence and model social networking intention and behavior. We see this as the start of an exploration of ways to increase and improve penetration of this valuable communications technology. Studies can be undertaken to confirm these findings with larger and more diverse sample groups, but preliminary findings suggest that social networking does adhere to the modified diffusion of innovation model and is thus subject to efforts to improve behavior through attention to the significant influencing factors of compatibility, complexity, trialability, and relative advantage. The authors welcome efforts to assist in this research.

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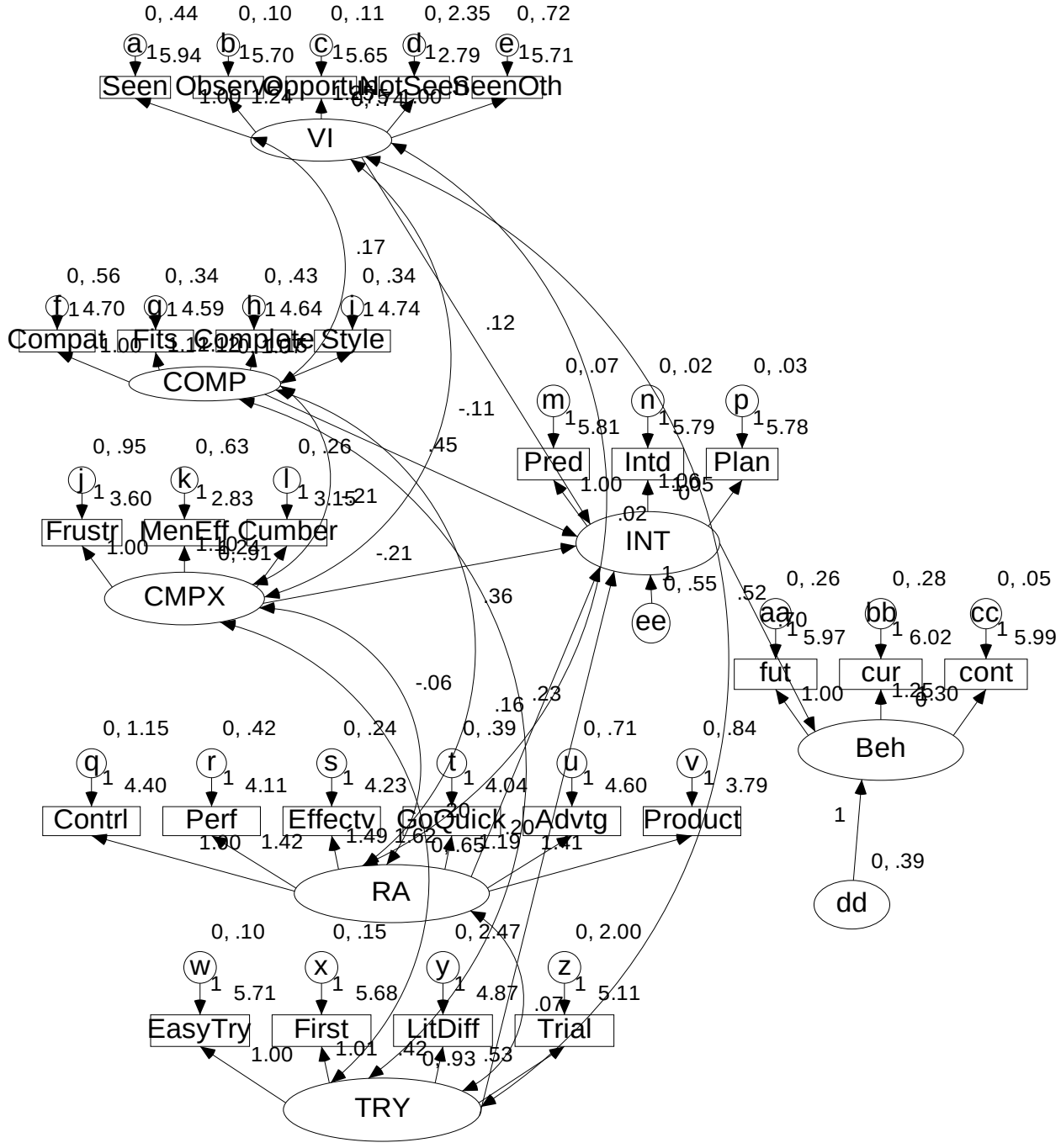
Appendices

Appendix 1. Survey questions and Factor Components

CMPX	Social networking is frustrating.	Frustr
CMPX	Social networking requires a lot of mental effort.	MenEff
CMPX	Social networking is cumbersome.	Cumber
COMP	Social networking is compatible with how I communicate.	Compat
COMP	Social networking fits well with how I like to communicate.	Fits
COMP	Social networking is completely compatible with my current situation.	Complete
COMP	Social networking fits my style.	Style
RA	Social networking allows me to exercise greater control over my life.	Contrl
RA	Social networking improves my performance.	Perf
RA	Social networking improves my effectiveness.	Effectv
RA	Social networking allows me to accomplish my goals more quickly.	GoQuick
RA	Social networking provides an overall advantage to me.	Advtg
RA	Social networking improves my productivity.	Product
VI	I have seen many people social networking.	Seen
VI	It is easy to observe others social networking.	Observe
VI	There is plenty of opportunity to see others social networking.	Opportun
VI	I have not seen many others social networking.	NotSeen
VI	I have seen others social networking.	SeenOth
TRY	It is easy to try Social networking.	EasyTry
TRY	It is easy to first do Social networking.	First
TRY	I had little difficulty using Social networking on a trial basis.	LitDiff
TRY	There is low financial risk in trying Social networking.	Trial
BEH	I plan to use social networking in the future.	fut
BEH	I currently use social networking.	cur
BEH	I will continue to use social networking.	cont
INT	I think it is a good idea to buy things over the Internet.	GIdea
INT	I see myself buying things over the Internet.	SeeMy
INT	I like the idea of buying things over the Internet.	Idea
INT	I would buy things over the Internet.	Would

Appendix 2. Diffusion Model



Appendix 3. Standardized Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
INT	<---	VI	.119	.097	1.226	.220	par_18
INT	<---	COMP	.446	.076	5.844	***	par_19
INT	<---	CMPX	-.209	.073	-2.878	.004	par_20
INT	<---	RA	.160	.090	1.783	.075	par_21
INT	<---	TRY	.200	.090	2.227	.026	par_22
Beh	<---	INT	.702	.059	11.909	***	par_23
Seen	<---	VI	1.000				
Observe	<---	VI	1.242	.085	14.628	***	par_1
Opportun	<---	VI	1.253	.086	14.553	***	par_2
Compat	<---	COMP	1.000				
Fits	<---	COMP	1.124	.083	13.604	***	par_3
Complete	<---	COMP	1.122	.086	13.081	***	par_4
Style	<---	COMP	1.147	.084	13.635	***	par_5
Frustr	<---	CMPX	1.000				
MenEff	<---	CMPX	1.099	.120	9.165	***	par_6
Cumber	<---	CMPX	1.240	.133	9.333	***	par_7
NotSeen	<---	VI	-.752	.153	-4.909	***	par_8
SeenOth	<---	VI	1.003	.103	9.771	***	par_9
Contrl	<---	RA	1.000				
Perf	<---	RA	1.421	.169	8.418	***	par_10
Effectv	<---	RA	1.493	.171	8.729	***	par_11
GoQuick	<---	RA	1.617	.188	8.608	***	par_12
Advtg	<---	RA	1.191	.156	7.643	***	par_13
Product	<---	RA	1.407	.180	7.833	***	par_14
EasyTry	<---	TRY	1.000				
First	<---	TRY	1.009	.060	16.786	***	par_15
LitDiff	<---	TRY	.423	.135	3.126	.002	par_16
Trial	<---	TRY	.531	.122	4.345	***	par_17
Pred	<---	INT	1.000				
Intd	<---	INT	1.056	.025	42.870	***	par_24
Plan	<---	INT	1.054	.025	41.644	***	par_25
fut	<---	Beh	1.000				
cur	<---	Beh	1.248	.069	18.191	***	par_26
cont	<---	Beh	1.303	.061	21.362	***	par_27

Appendix 4 Final Model Standardized Regression Weights

			Estimate
INT	<---	COMP	.454
INT	<---	CMPX	-.192
INT	<---	RA	.119
INT	<---	TRY	.244
Beh	<---	INT	.758
Compat	<---	COMP	.810
Fits	<---	COMP	.894
Complete	<---	COMP	.870
Style	<---	COMP	.897
Frustr	<---	CMPX	.698
MenEff	<---	CMPX	.796
Cumber	<---	CMPX	.919
Contrl	<---	RA	.602
Perf	<---	RA	.870
Effectv	<---	RA	.925
GoQuick	<---	RA	.902
Advtg	<---	RA	.751
Product	<---	RA	.778
EasyTry	<---	TRY	.963
First	<---	TRY	.913
LitDiff	<---	TRY	.246
Trial	<---	TRY	.334
Pred	<---	INT	.968
Intd	<---	INT	.990
Plan	<---	INT	.987
fut	<---	Beh	.883
cur	<---	Beh	.916
cont	<---	Beh	.986

Appendix 5 Female Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.589[a]	.347	.310	.780

a. Predictors: (Constant), It is easy to try social networking., Social networking requires a lot of mental effort., Social networking is compatible with how I communicate., Social networking improves my effectiveness.

Appendix 6. Female Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.579	.689		3.743	.000
	Social networking requires a lot of mental effort.	-.116	.068	-.166	-1.707	.092
	Social networking improves my effectiveness.	.136	.070	.189	1.946	.056
	Social networking is compatible with how I communicate.	.226	.075	.293	3.013	.004
	It is easy to try social networking.	.345	.089	.373	3.875	.000

a. Dependent Variable: I intend to use social networking.

Appendix 7 Male Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.682[a]	.465	.436	.939

a. Predictors: (Constant), It is easy to try social networking., Social networking improves my effectiveness., Social networking requires a lot of mental effort., Social networking is compatible with how I communicate.

Appendix 8. Male Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.329	.823		1.615	.111
	Social networking requires a lot of mental effort.	-.234	.087	-.241	-2.677	.009
	Social networking improves my effectiveness.	.307	.091	.321	3.359	.001
	Social networking is compatible with how I communicate.	.287	.092	.301	3.113	.003
	It is easy to try social networking.	.413	.118	.314	3.506	.001

a. Dependent Variable: I intend to use social networking.