

An examination of the acceptance, adoption, and diffusion of smartphone devices  
with senior citizens.

By

James M. Reneau

A dissertation idea paper submitted in  
partial fulfillment of the requirements for the  
Degree of Doctor of Philosophy  
in  
Computer Information Systems

Graduate School of Computer and Information Sciences  
Nova Southeastern University

February 3, 2012

## Abstract

This proposed research will look at the process of the diffusion of an innovation in the context of smartphones with American senior citizens. The previous research in diffusion, or spread of a technology, has been rich but much of it does beyond the original acceptance of a new idea. This ethnographic study will collect data on the entire cycle of diffusion, including discontinuance of use after adoption, and will validate the data using the Innovation Diffusion Theory (IDT) and the Senior Technology Adoption and Acceptance Model (STAM). It is anticipated that recommendations to modify the STAM to include discontinuance will be created after the complete analysis of the questionnaire responses.

## Table of Contents

<b>Abstract</b>	<b>ii</b>
<b>Table of Contents</b>	<b>iii</b>
<b>List of Figures</b>	<b>v</b>
<b>Index of Tables</b>	<b>vi</b>
<b>Background / Introduction</b>	<b>1</b>
<b>Problem Statement</b>	<b>2</b>
<b>Dissertation Goal</b>	<b>4</b>
<b>Research Questions</b>	<b>5</b>
RQ1	5
RQ2	5
RQ3	5
RQ4	5
<b>Relevance and Significance</b>	<b>7</b>
Why is there a problem	7
What are the benefits of solving the problem	8
Consequences if this research is not undertaken	8
How will this research add to the knowledge base	9
<b>Brief Review of the Literature</b>	<b>11</b>
Overview	11
Technology Diffusion and Acceptance	11
Innovation Diffusion Theory (IDT)	11
Technology Acceptance Model (TAM)	13
Unified Theory of Acceptance and Use of Technology (UTAUT)	15
Senior Technology Adoption and Acceptance Model (STAM)	16
Commentary on Technology Acceptance Models	17
Questionnaires and Data Collection	18
<b>Barriers and Issues</b>	<b>20</b>
The Survey/Questionnaire	20
Acceptance of the Proposed Changes to STAM	20
<b>Approach</b>	<b>22</b>
Questionnaire	22
Disseminating Questionnaire	23
Validating Questionnaire Responses	23
Identifying Users' Motivations	24
Recommendation of Changes to STAM	25

**Milestones 26**

- Milestone 1: Proposal and Institutional Approval 26
- Milestone 2: Questionnaire Created, Tested, and Ready to Deploy 27
- Milestone 3: Data Collected 28
- Milestone 4: Questionnaire Results Compiled 28
- Milestone 5: Recommendations Developed 29
- Milestone 6: Final Report 29

**Resources 30**

- Pool of Seniors 30
- Prize, Payment or Inducement 31
- Web Server Space and Software 31
- Statistical Software for Compiling the Results 32

**References 34**

## List of Figures

Illustration 1: Diffusion of Innovation Curve (Rogers, 2003) 12

Illustration 2: Technology Acceptance Model - TAM (Davis, Bagozzi, & Warshaw, 1989) 14

Illustration 3: Unified Theory of Acceptance and Use of Technology - UTAUT (Venkatesh, Morris, Davis, & Davis, 2003) 15

Illustration 4: Senior Technology Adoption and Acceptance Model - STAM (Renaud & van Biljon, 2008) 16

## Index of Tables

Table 1: Summary of Milestones 26

## Background / Introduction

Seniors have been slower to accept smartphones as the primary mobile communication device into their daily lives than the rest of the adult population in the United States (Smith, 2011). This research will look at the adoption, rejection, and consequences of the diffusion of this technology in their lives. It will then make recommendations to modify one of the current technology acceptance models to include the discontinuance of use after original adoption, as an integral part of overall acceptance of an innovation in a social group.

In a May 2011 survey of American adults (n=2,277), it was found that 35% of respondents stated that they had a smartphone. The adoption rate varied significantly for seniors (11%, n=637) from the rate of adoption of American adults aged 30-49 (45%, n=581) (Smith, 2011). This difference is indicative of the widely accepted “generation-gap” in the access and use of digital technology (van Dijk, 2005).

This research will examine the adoption and diffusion of smartphones in the senior community. The examination will take the form of a questionnaire to validate the Senior Technology Adoption and Acceptance Model (STAM) and Rogers' (2003) Innovation Diffusion Theory (IDT). Through this validation and comparison of these two models it is expected that recommendations for changes to STAM will be developed and a deeper understanding of technology adoption, especially in seniors, will be gained.

## Problem Statement

The literature on the acceptance and diffusion of technology is a rich and varied topic that has been researched for more than 60 years. A vast majority of this research, greater than 99%, has been on the positive aspects and not on the unintended or undesirable consequences of the diffusion of innovations (Sveiby, Gripenberg, Segercrantz, Eriksson & Aminoff, 2009). This pro-innovation bias has permeated the current research and has created a rather myopic belief that the use of technological advances are usually if not always better than prior ways of accomplishing the same task (Rogers, 2003).

In many of the current technology acceptance models, the subsequent discontinuance of use of a technology after the initial acceptance is not integrated into them (Davis, Bagozzi, & Warshaw, 1989; Venkatesh, Morris, Davis, & Davis, 2003; van der Heijden, 2004; Renaud & van Biljon, 2008). These models, that permeate the research on technology adoption and diffusion, may lead researchers and developers into a belief that diffusion should always be faster rather than slower, that adoption should be by all members of the social group, and that discontinuance of use should not be happening (Rogers, 2003).

This research will look at a specific social group (seniors) in the current diffusion of a technology (smartphones) and question why and/or why not the technology is being rejected, adopted, and discontinued. It will attempt to take the Senior Technology Adoption and Acceptance Model (STAM), and extend it to

include the user's decision to stop using a technology after they initially accepted and/or adopted the innovation.

It is anticipated, by the researcher, that this addition to the current understanding of how technology is diffused in the context of seniors and smartphones can be generalized to seniors with any technology and even to a more general population. This would give future diffusion and technology adoption researchers a better understanding of the entire diffusion life-cycle.

## Dissertation Goal

The goal of this research is to gain a better understanding of the STAM, as proposed by Renaud & van Biljon (2008), in the context of American seniors. It is through this better understanding that an attempt to identify and define a change in the STAM to describe the discontinuance of a technology after it has been adopted and/or accepted.

The goal above will be accomplished by measuring and analyzing responses of seniors, to questionnaires, throughout the diffusion process of smartphones. The collected data will allow for a better understanding of the entire adoption cycle with a special focus on the discontinuation of use. Factors and influences, both intrinsic and extrinsic, for these phenomena will also be identified in the research.

## Research Questions

### **RQ1**

Using the Senior Technology Acceptance & Adoption Model (STAM) as a guide, which components of that model (user context, perceived usefulness, intention to use, experimentation and exploration, ease of learning and use, and confirmed usefulness) or other technological issues are causing roadblocks in seniors moving from just accepting smartphones to full adoption?

### **RQ2**

Using Roger's Innovation Diffusion Theory (IDT), where are seniors on the Diffusion Curve of smartphone diffusion and what specific factors could be introduced to the social grouping to bend the curve and encourage the move toward full adoption?

### **RQ3**

Being cognizant of the rejection or discontinuance of smartphone technology in seniors once it has been adopted, what conditions influenced their decision to start using and then later stop using the innovation?

### **RQ4**

Based on the results of the previous research questions, how should the

An examination of the acceptance... 6

STAM be modified to include the discontinuance of use after it has been accepted and/or adopted by users?

## Relevance and Significance

This section will discuss the problem and goals of the research by answering several questions. These questions include: why the problem exists, benefits of solving the problem, and what can be done to solve the problem.

### **Why is there a problem**

Going back to the beginning of diffusion research there has been a significant pro-innovation bias in much of the work that has been done in the field (Rogers, 2003; Sveiby, Gripenberg, Segercrantz, Eriksson, & Aminoff, 2009). This bias has been the consequence of influence of funding sources (both governmental and industry), by researchers focusing on successful and rapid diffusions, and by researchers selecting innovations that “look intellectually interesting” (Rogers, 2003, p. 111) to them. This bias has influenced research in three significant ways: 1) that much more research has been done and more written about rapid and successful diffusions; 2) more study has been done about acceptance rather than rejection of new technology; and 3) we do not have a complete understanding of why technologies are discontinued (Rogers, 2003).

This research will use the context of a rapid and apparently successful diffusion of a technology to probe more deeply into the rejection and discontinuance of smartphone use in the population of American seniors. This

probe will be made using questionnaires that will attempt to gain an understanding of “why” smartphones have or have not been adopted and subsequently have or have not been discontinued.

### **What are the benefits of solving the problem**

The pro-innovation bias, even though it may be justified, keeps researchers from fully understanding the motivation and real needs of the end users (Rogers, 2003). In the context of this proposed research, the primary benefit is the adjustment of the STAM model to highlight the motivation of seniors when they decide to stop using an innovation.

In a more general sense, beyond the diffusion of smartphones, this change will remind and encourage future researchers to ask the probing “why” questions in the diffusion of other technologies with seniors. Also, a potential benefit of this research would be the applicability to diffusion of technologies to other social groups.

### **Consequences if this research is not undertaken**

It just seems to be human nature to want something to be true if we passionately believe it is for the best. It is these times when researchers and policy makers are at the most risk of falling into a logical fallacy. These can

include the belief that everything must go as planned, self-deceit, self-contradiction, and putting data or findings in a false light (Glor, 2003).

This proposed research will add to the current body of knowledge and modify a model for technology acceptance so that it specifically reminds future researchers of the potential fallacy and positive bias they may have toward a technology. Bias, defined as “a particular tendency or inclination” (bias, n.d.), can be helpful as it will allow for simplification of a problem by eliminating extraneous information. As a knife cuts both ways so can a bias as it inadvertently removes an important area of research.

### **How will this research add to the knowledge base**

There are several areas in which this proposed research will add to the current state of knowledge. These areas include: (a) validating the STAM in the context of American Seniors, (b) making additions to STAM for the discontinuance of use, and (c) adding to the currently sparse literature on what happens after initial diffusion.

The STAM model was originally created based on a study of South-African seniors with the diffusion of plain mobile phones, not smartphones (Renaud & van Biljon, 2008). The model must be validated for the American senior population before any suggestions for extending it can be made.

While this research will attempt to validate STAM in a different social-

grouping with a different technology, it will also make recommendations to make the model more useful for future researchers. This validation and modification will help to make the model more generalizable in the senior community.

The third and probably the most important area of knowledge that this proposed research will add to will be a heightened awareness to the phenomena of discontinuance after adoption of an innovation. There has been much work in the field of diffusion but the research of why a technology is rejected subsequent to adoption has not had the same level research (Rogers, 2003; Sveiby, Gripenberg, Segercrantz, Eriksson, & Aminoff, 2009). The huge gap in the research that exists will not be filled by any single dissertation or research project, but any change to help remind future researchers of the pro-innovation and other biases they may have. This is of vital importance not only to seniors and the STAM model but to all diffusion research will all groups.

## Brief Review of the Literature

### **Overview**

Seniors, as their lives and daily situations change, often experience a lack of social interaction. This isolation can be moderated through the use of social media and e-mail. The adoption of this technology is being slowed by many seniors' apprehension toward the technology and vendors'/designers' lack of attention to the special needs of this population (McMurtrey, McGaughey, Downey & Zeltmann, 2010). The diffusion may also be slowed by a deficiency of direct communication about the possible benefits of the technology.

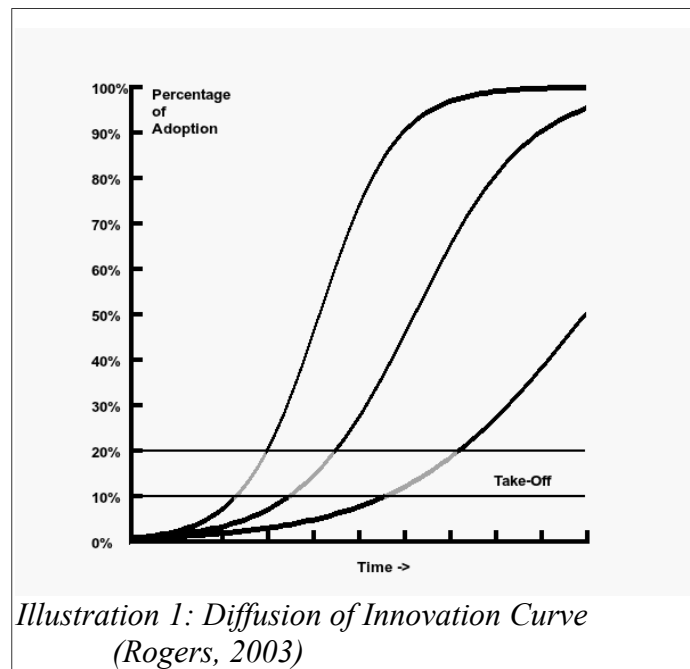
### **Technology Diffusion and Acceptance**

In this section will be a discussion of the diffusion, adoption, and acceptance of technological innovations. Much research has been done in this area but there appears to be no single perfect model to predict the human users willingness to use a new technology. Even harder to understand is the mechanism of how an innovation is fully adopted by the social system.

#### *Innovation Diffusion Theory (IDT)*

Technology, no matter how good it is, needs to be communicated to potential users in a positive light. A good definition of technology is: a method or device (or both) that reduces the chances of failure in performing a task (Rogers,

2003). A technology needs to be seen as creating an advantage, in some aspect, before it will be adopted. This process of communicating the advantages of an innovation between members of a social group, over a period, is known in the literature as *diffusion* (Rogers, 2003). A social group with communication can be as small as a single family discussing a technology over the supper table or as large as the entire global community sharing ideas through advertising through the mass-media.



Adoption has typically seen to follow an “S Curve” with one axis representing the saturation percentage in the population and the other axis

representing time. The Perl curve  $y = \frac{L}{1 + Ae^{-Bt}}$  is a commonly used

mathematical expression to draw this type of behavior (Co, 1999). It has been seen that, typically, once an innovation has reached a saturation point of 10 to

20% of a social group it begins to diffuse on its own accord, this is called the “take-off”. Take-off may occur because the uncertainty of usefulness is diminished as the invention becomes accepted into the social framework, as users get a chance to give it a try, and as the technology becomes more visible in their lives (Rogers, 2003).

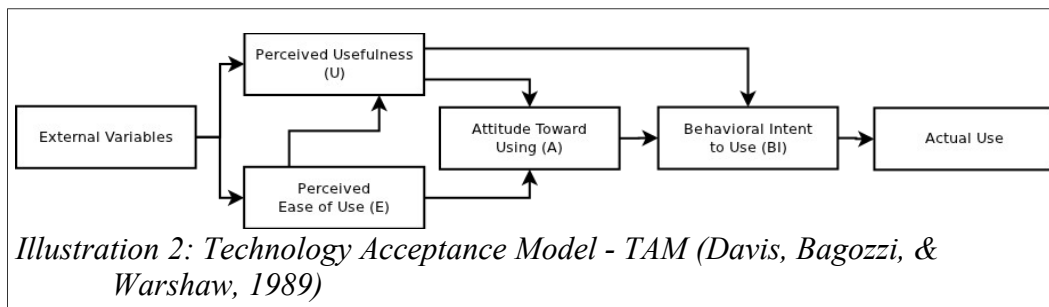
Rogers (2003) also discussed the need of researchers in this field to be cognizant of their potential to a pro-technology bias when trying to understand diffusion. He believes that this bias is a direct result of influence by change agencies and that successful diffusions leave an easily accessible body of knowledge for researchers to study. Several strategies are covered to overcome the tendency to this biased view. They include but are not limited to: a) research earlier in the diffusion process; b) questioning the innovation's inevitable success; c) looking at the broader context of the innovation in the context of the social group; and d) research to understand individuals' motivations for adoption, rejection, and re-invention of an innovation.

#### *Technology Acceptance Model (TAM)*

In a group of studies dating back many decades (Davis, 1989), it was shown that user self-reported usefulness of a software system correlated very strongly to the same users saying that they would use the software if it were available to them. Ease of use was also found to correlate significantly to current use and self-predicted future usage, but it was not as strongly correlated as

usefulness.

Using these findings and other sources of research Davis developed the Technology Acceptance Model (TAM). This model as shown and validated states that a user's Behavioral Intent (BI) to use a system is a direct combination of their Attitude (A) toward using the system and their perception of Usefulness (U) of that system. (Davis, Bagozzi, & Warshaw, 1989)



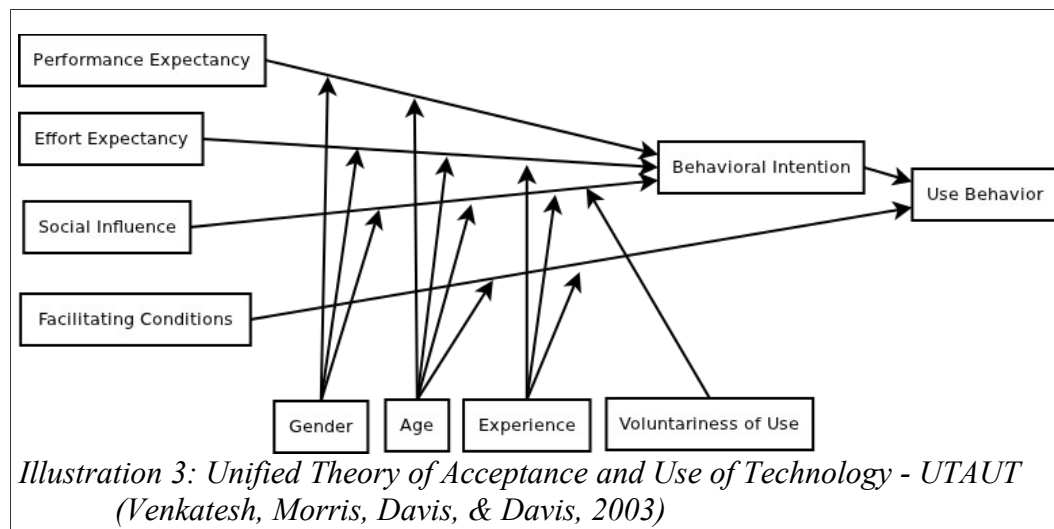
A limitation of the TAM is that it only looked at an organizational usage of technology. External forces like: employer and supervisor demands, feelings of other co-workers, and personal performance in the workplace have a driving effect on the entire model (Davis, Bagozzi, & Warshaw, 1989).

When the desire to use a system is for self indulgence or entertainment of the user, TAM has been shown to break down. In a 2004 report, van der Heijden surveyed hedonistic users of a computer system and found that usefulness was not as strongly correlated to predicted future use as ease and pleasure derived by the usage. His research and findings point to an important difference between technology systems used for pleasure and those used solely for functionality. He goes on to suggest that “if people reject a utilitarian system, system developers may want to add hedonic features” (van der Heijden, 2004, p. 701). This is not

dissimilar to Mary Poppins singing that “A spoonful of sugar helps the medicine go down” (Walt Disney Productions, 1964).

*Unified Theory of Acceptance and Use of Technology (UTAUT)*

In the Unified Theory of Acceptance and Use of Technology (UTAUT) model, the researchers attempted to create a more universal model for describing how usage is influenced by looking at four determinants that describe the user's intent, tempered by four different demographic and environmental factors (Venkatesh, Morris, Davis, & Davis, 2003). This model was developed by merging eight different technology use models into a single descriptive model. They are: 1) Theory of Reasoned Action; 2) the TAM; 3) the Motivational Model; 4) the Theory of Planned Behavior; 5) a model combining the TAM and the Theory of Planned Behavior 6) the Model of PC Utilization; 7) the IDT; and 8) the Social Cognitive Theory (Venkatesh, Morris, Davis, & Davis, 2003, p. 425).



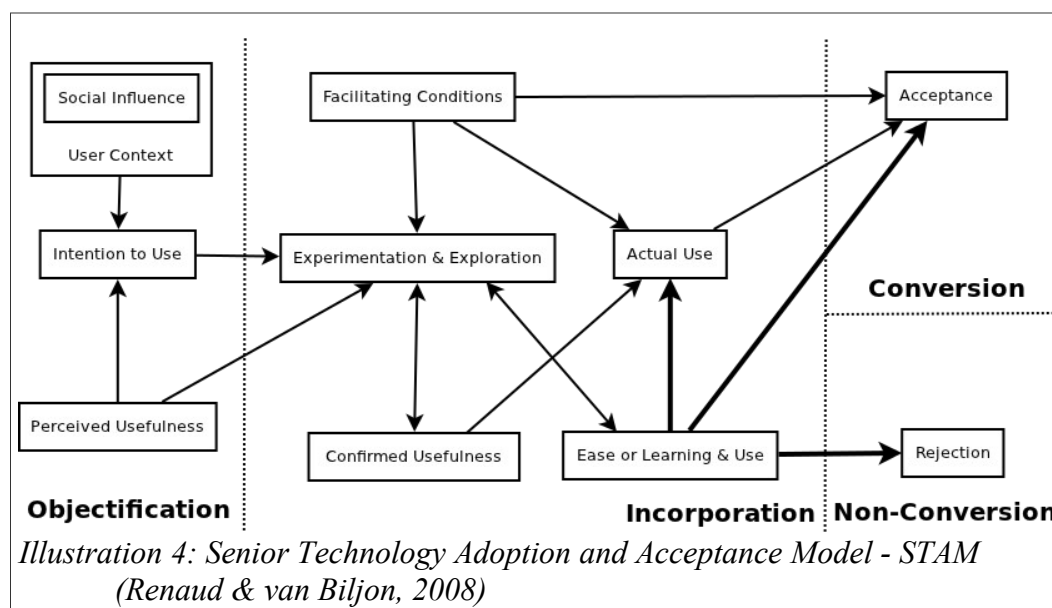
*Illustration 3: Unified Theory of Acceptance and Use of Technology - UTAUT (Venkatesh, Morris, Davis, & Davis, 2003)*

The UTAUT model described much of the variation in the user's intent to

use a technology and appeared to do a better job than any one of the theories that were used in the creation (Venkatesh, Morris, Davis, & Davis, 2003). The ability to generalize this model to a more inclusive population, from the corporate environment where it was developed and tested, has not been shown.

*Senior Technology Adoption and Acceptance Model (STAM)*

Renaud & van Biljon (2008) propose a new model called the Senior Technology Adoption and Acceptance Model (STAM) for understanding rejection, basic use, and fully embracing a technology in a senior population. The STAM model differs greatly from the Technology Acceptance Model (TAM) because this model ends with the adoption of a technology and not just accepting it. Another way this model is different is that external social influence is also included in the process.



The concept of acceptance, the full embracing of a technological

innovation, includes more than regular use. It may include a concept known as “re-invention”. Re-invention occurs when a user self innovates with a technology to use it in a way that was not originally communicated as it was diffused in the social group (Rogers, 2003). The user will create their own unique and new to them version or configuration of the technology and use it in an innovative and self discovered way.

Abraham Maslo's long standing theory of the hierarchy of needs suggests that every human is motivated by the same desires for physiological comfort, safety, love and belonging, esteem (both internal and external) and self-actualization (Daniels, 2000). Even though STAM was original used to describe diffusion in a population of South-African seniors, the ubiquity of base human needs should allow the model to be equally applicable to other populations.

#### *Commentary on Technology Acceptance Models*

A limitation found in almost all of the technology acceptance models discussed in the review (Rogers, 2003; Davis, 1989; Davis, Bagozzi, & Warshaw, 1989; Venkatesh, Morris, Davis, & Davis, 2003; van der Heijden, 2004) was that technology acceptance was a binary conclusion. With the complexity of modern systems, it is difficult to make such an absolute decision. A user may be a “power user” of some features and totally ignore other common features. Only the STAM model included two categories of usage: 1) adoption; and 2) acceptance (Renaud & van Biljon, 2008). In a study with seniors and regular mobile phones that did

not explicitly offer a model for technology acceptance, three clusters of users were identified: 1) explorers; 2) basicians; and 3) minimalists (Lee, 2007).

### **Questionnaires and Data Collection**

This brief review of questionnaires and survey methods to explore technology acceptance and adoption, looks at three different uses of questionnaires: 1) Davis's (1989) single questionnaire; 2) Kurniawan, Nugroho, & Mahmud's (2006) starting small and expanding; and 3) Lee's (2007) work of refining her population.

Davis (1989) used twelve questions, with a 1-7 Likert-like scale, on questionnaires to gain an understanding, in corporate and university settings, of: 1) usefulness; 2) ease of use; and 3) if they did use or would use the software if it were available. The four questions in each of the three areas were selected and refined from a larger list of questions. The reliability (internal consistency) of the questions were tested by calculating the ratio of the sum of the variance between the questions and the variance of the total instrument,  $\alpha = \left(\frac{k}{k-1}\right)\left(1 - \frac{\sum s_i^2}{s_r^2}\right)$ , this is also known as Cronbach's alpha (Bland, 1997).

Kurniawan, Nugroho, & Mahmud (2006) used a two-prong approach in trying to gain an understanding of older people's use and issues with mobile phones. They used a combination of qualitative and quantitative methods. First, they held a focus group with seven participants and asked open-ended questions

to elicit conversations about problems, benefits, and desired features in mobile phone technology. After the focus group, the researchers created a qualitative instrument to balance and more broadly validate and understand what was learned. An on-line questionnaire with Likert-like questions was distributed and 100 seniors participated in the survey.

Other research using more than one questionnaire/survey instrument, like in Lee (2007), reversed the order used by Kurniawan, Nugroho, & Mahmud (2006). Lee used a widely distributed questionnaire, in a first phase, to gain an understanding of usage, quality, and how they acquired the technology. A convenience sampling of individuals at local AARP chapter meetings and regional senior centers were asked to complete and redistribute a questionnaire about mobile phone usage. In total, 154 seniors responded from a total of 20 states. In the questionnaire she identified three distinct groups of users: 1) explorers – regular users of most of the available features, users who have accepted (Renaud & van Biljon, 2008) the technology; 2) basicians – users of some of the features, some of the time; and 3) minimalists – rare users of only the most basic features, basic adoption (Renaud & van Biljon, 2008). In the second part of the research twelve of the original respondents, representing all three groups, were interviewed to collect usage stories, discuss barriers to technology, and provide recommendations for future change.

## Barriers and Issues

There are very few barriers to the successful completion of this proposed research. The only significant barriers to the completion of the proposed research would be the a) the inherently difficult task of creating a statistically valid and unbiased questionnaire; and b) getting enough willing participants to complete the survey. The more difficult barrier to overcome, with this proposed research, will be the future acceptance of the findings themselves.

### **The Survey/Questionnaire**

The most difficult part of this proposed research will be creating the survey mechanism. Asking people about their current usage patterns of a technology seems to be an easy task compared to asking them the “why” questions that will elicit a deeper understanding of adoption, rejection and discontinuance.

### **Acceptance of the Proposed Changes to STAM**

The proposed changes will ask future researchers to look at more than just the beginning of the cycle of adoption. These proposed changes to STAM will illuminate the life-cycle of adoption and remind that adoption is not a terminal event. After looking at the models that are discussed in this paper this continuance of the process has not been researched and is not included in the

current literature. This lack of direct inclusion in acceptance models may be attributed to the pro-innovation bias and that the positive and negative aspects of innovation are typically not included in the same research (Sveiby, Gripenberg, Segercrantz, Eriksson, & Aminoff, 2009).

## Approach

To restate from above, the goal of this research is to gain a better understanding of the STAM and to identify and make modifications of the model to describe the rejection, acceptance, and discontinuance of a technology. The goal will be accomplished by a process of four major steps: 1) creating a questionnaire; 2) eliciting responses to questionnaire; 3) validating the questionnaire results to the STAM and IDT models ; and 4) identifying the influences on seniors discontinuing usage of smartphones and recommending changes to STAM to better describe the phenomenon.

### **Questionnaire**

A detailed questionnaire will be created to probe responses of seniors throughout the diffusion process of smartphones. The questionnaire will be divided into sections for individuals who have a) not adopted; b) rejected adoption; c) adopted and currently use; and d) adopted and discontinued use. This division will allow for focused questions to seniors throughout the adoption process.

Questions will be asked to gain a better understanding of:

- social influences (friends, family) to explore, reject, adopt, or discontinue use of the technology,
- intention to use the technology before actual use,

- perceived and confirmed usefulness before and during use,
- facilitating conditions and communication,
- experimentation (trying the technology) and research (finding out more) done by the user,
- how long the pre-adoption stage lasted,
- what applications and frequency of use (parts of the technology cluster) are/were being used for the adopters (both current and discontinued users),
- reasons and influences on the decision to discontinue use.

### **Disseminating Questionnaire**

Once the questionnaire is completed a process of disseminating the questionnaire will begin. A combination of soliciting responses in local senior centers and directly with seniors on-line will be used to gain an appropriate number of responses in each of the categories. Responder categories will in a minimum include seniors who have: not adopted the technology, rejected it, adopted and currently use, and lastly adopted and discontinued use.

### **Validating Questionnaire Responses**

Many researchers in many fields of study consider the work of Everett Rogers, in his book *Diffusion of Innovations*, to be a seminal and compelling source when researching the adoption of technologies (Vanderslice, 2000). The first activity in the questionnaire analysis process will be to understand the data in

the context of classical diffusion research. This includes identification of the impact of social norms, opinion leaders, communication channels, and consequences in the diffusion of smartphone technology.

The questionnaire responses will also be analyzed in light of a second model, STAM. This second model was created specifically to look at acceptance and diffusion in the demographic of seniors. While STAM was created to describe diffusion of a different technology on the African continent, it appears to be a sound model for American seniors. This research will, before recommending changes, validate this model in a different social setting.

### **Identifying Users' Motivations**

Rogers states “We should increase our understanding of motivations for adopting innovation.” (Rogers, 2003, p.115). He elaborates that this rarely researched area, while difficult, will illuminate “why” people act the way they do toward an innovation. The proposed questionnaire will be used to ask users more than their usage patterns and will attempt to distinguish the thought process a user goes through in making their personal decision. These decisions will range from the deferment of investigation through full acceptance. Additionally, many of the internal reasons and external forces for moving away from an innovation after actual use or adoption will be identified.

### **Recommendation of Changes to STAM**

Once the questionnaire has been compared to the two current theories, IDT and STAM, and an understanding of why individuals respond and act the way they do toward an innovation, this research will potentially suggest changes to the STAM to better describe a more complete description of the actual diffusion of a technology. It is believed, by this researcher, that discontinuance of use must be included in the model. This new construct will allow the model to better represent what actually happens and to bring a discussion of the pro-innovation bias and the complete cycle of innovation into future research.

## Milestones

The approach outlined each of the major steps in achieving the goals of this research. Many of these tasks will be worked on in parallel but there are certain check points that arise throughout this process. These milestones represent a summary of the estimated number of hours to complete the work described and another estimate to the number of weeks this can be accomplished within.

Milestone	Description	Estimate	
		Hours	Weeks
1	Proposal and Institutional Approval	120	12
2	Questionnaire Created, Tested, and Ready to Deploy	120	12
3	Data Collected	20	12
4	Questionnaire Results Compiled	80	8
5	Recommendations Developed	40	4
6	Final Report	120	12
*	<b>Total</b>	<b>500</b>	<b>60</b>

*Table 1: Summary of Milestones*

### Milestone 1: Proposal and Institutional Approval

The first hurdle for this research topic to overcome will be the creation of the Dissertation Proposal and for Institutional Research Board (IRB) approval of

the details of the human subject research. This paper will act as the precursor material to the Proposal document with the addition and removal of material, as directed in the *Dissertation Guide*.

The research in question will disseminate questionnaires to seniors who will voluntarily respond to the questions asked. The questions should not need to ask specific detailed questions that may be used to personally identify individual respondents to collect the data needed. The questionnaire may ask for optional contact information after explicit consent of a respondent. With this data gathering the process of IRB approval should not be difficult.

The proposal will include a listing of research-based questions that the developed questionnaire will attempt to answer. What the questionnaire will collect and how collection will be accomplished also be included in the proposal process. The actual survey document will be created and tested after the proposal is approved.

### **Milestone 2: Questionnaire Created, Tested, and Ready to Deploy**

As part of the Proposal and approval of the IRB a questionnaire methodology and process will be created. This questionnaire will be of an adaptive nature and ask questions specifically directed to the respondent based on where they are in the diffusion process. This adaptive nature of a questionnaire is not a difficult process to create and manage on-line, but it may make the instructions on a paper questionnaire difficult for the respondent. It is for this

reason the questionnaire should be an on-line/computer based survey.

The development and testing for validity of the final questionnaire will be fully completed before it is advertised and released to the research population. Special care will be taken to design the questionnaire, as recommended in the literature (Lohr, 2010), to make the questions specific, simple, and unbiased.

This milestone will be reached once the questionnaire has been proofed, tested with a small population of seniors, and made ready for full scale deployment.

### **Milestone 3: Data Collected**

After deployment and when the questionnaire has been out long enough to get the needed number of responses the data collection will be complete. Additional advertising and potential on-site delivery of the questionnaire may be required to reach a significantly large selection of individuals who are willing to volunteer the time required for this process.

### **Milestone 4: Questionnaire Results Compiled**

When the questionnaires delivery is deemed complete, based on either limited time or sufficient quantity of responses, an analysis of the collected data will begin. Open-ended questions will be read for content and coded into the database based on the content of the response. The actual categories and responses from the open-ended questions will not be identified until the

questionnaires have been completed to reduce the risk of bias in analysis.

### **Milestone 5: Recommendations Developed**

Once the data has been collected, the development of the three sections identified in the approach will begin. This process will use the data and the research to compare the questionnaire results to Roger's IDT and the STAM models. Data collected will be used to identify user's internal and external reasons for adoption, rejection, and discontinuance of the technology. And lastly, recommendations for minor changes and/or additions will be made to the STAM based on the results found in this research.

### **Milestone 6: Final Report**

The final milestone will be the completion and subsequent approval of the proposed dissertation report.

## Resources

The resources needed will be: 1) a pool of seniors to take the questionnaire; 2) a prize, payment, or some type of inducement to encourage participation; 3) Web hosting and software to deliver the on-line version of the questionnaire; 4) statistical software to analyze the results. Each will be covered below.

### **Pool of Seniors**

FIVCO Service Agency (FSA), Grayson, KY, runs the senior centers in five Eastern-Kentucky counties. In a meeting with the Executive Director, Barbara Brown, (September 2011) to discuss having access to the populations of the centers for this research, she said that was interested in the project. She further stated that other researchers have used the population of the centers and that she would help me any way she could. Director Brown also has direct contacts in the KY Department of Aging Services and with other regions and stated that she would also help with those. In a phone conversation on 2011-11-22 with Dr. Cohen and Dean Ackerman, they stated that there was a center for seniors that they have worked with in FL.

These initial contacts into the senior community would certainly be a good starting point for the pool of respondents. If additional responses are required to reach a statistically significant population then a process of searching out senior

service and fraternal organizations, like the AARP, would be required. At the present the specific number of responses, in each of the categories and/or overall, has not been determined.

### **Prize, Payment or Inducement**

It may be necessary for a large number of responses to collect the data required to do this proposed research, and incentives have been shown to increase the participation rate in survey collection (Lohr, 2010). A specific reward of a few dollars may be a sufficient incentive for some seniors for completion of the survey but as the number of respondents increase the cost of the honorarium and administration of it could become difficult to manage. Additionally this type of payment would require a survey taker to divulge personal information for payment process.

Another potential method for inducement would be to include an opt-in process in the questionnaire that would enter a respondent into a drawing for one or more prizes like: gift cards, free technology products, or other items of value. This opt-in process would only require an email and/or basic contact information from the non-winners. Of the two possibilities, the second would be the preferred incentive method by the researcher.

### **Web Server Space and Software**

LimeSurvey currently is the highest ranked (by downloads) Open-Source

survey software at <http://www.sourceforge.net>. LimeSurvey is a flexible, free, and easy-to-use survey engine for the Web. Features include: multiple surveys, unlimited questions, question and section logic, anonymous and non-anonymous modes, printing of survey, and export of the results to many formats ("Limesurvey", 2011). RENEJM Enterprises, Inc., a corporation wholly-owned by the researcher, has given permission to use Web server space and the Internet connectivity to host the questionnaire and software. Presently a test copy of LimeSurvey is loaded and running on the RENEJM server and experimentation with test questionnaires has begun.

SurveyMonkey also appears to be a viable choice for disseminating the on-line survey. To create the customized delivery process of this research, a paid package potentially costing as much as \$780.00 per year would be required ("SurveyMonkey Plans and Pricing", 2012).

### **Statistical Software for Compiling the Results**

Software like the Libre Office Calc and Gnumeric Spreadsheet offer functions to perform many common statistical functions, including: standard deviation, chi square test, confidence, ANOVA, and correlation (Libre Office. 3.4.4, Gnumeric 1.10.17). Both of these applications are open-source and readily available for most common computing platforms.

Another potentially viable choice would be **R**. **R** is a very widely used, open source, programming language that is based on the **S** statistical computing

language. **RCommander** is a GUI for the **R** language that was originally designed to be used in an introductory college statistics course. The functionality is not limited to this set of basic operations because of the extensible nature of the **RCommander** and its reliance on the full R language and code base to actually perform the calculations. (Fox. 2005)

In addition to the free and open-source applications listed above the same and similar features can be found in products like Excel and SPSS (“Excel 2010 features and benefits”, 2012; “IBM – SPSS Statistics Standard”, 2012). Significant licensing and support fees apply to these commercial closed-source applications.

## References

- bias. (n.d.). *Dictionary.com Unabridged*. Retrieved January 08, 2012, from Dictionary.com website: <http://dictionary.reference.com/browse/bias>.
- Bland J.M., Altman D.G. (1997). Statistics notes: Cronbach's alpha. *BMJ* 1997;314:572, DOI: 10.1136/bmj.314.7080.572.
- Co, H. C. (1999). *The growth curve*. Unpublished manuscript, Technology and Operations Management, California Polytechnic and State University, San Luis Obispo, California. Retrieved from <http://www.csupomona.edu/~hco/MoT/03bGrowthCurve.ppt> on 2011-11-24.
- Daniels, V. (2000). *Maslow summary*. Informally published manuscript, Psychology Department, Sonoma State University, Rohnert Park, CA. Retrieved on 2012-01-19 from [http://www.sonoma.edu/users/d/daniels/maslow\\_summary.html](http://www.sonoma.edu/users/d/daniels/maslow_summary.html).
- Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*. 13(3), 319-340.
- Davis, F. D., Bagozzi, R. P., & Warshaw, P.R. (1989). User Acceptance of Computer Technology: A Comparison of Two Theoretical Models. *Management Science*, 35(8), 982-1003.
- Excel 2010 features and benefits*. (2012, January 17). Retrieved from <http://office.microsoft.com/en-us/excel/excel-2010-features-and-benefits-HA101806958.aspx>.
- Fox, J. (2005). The R commander: A basic-statistics graphical user interface to R. *Journal of Statistical Software*, 14(9).
- Glor, E. (2003). Innovation traps: Risks and challenges in thinking about innovation. *The Innovation Journal: The Public Sector Innovation Journal*. Retrieved from [http://innovation.cc/scholarly-style/glor\\_innovation-traps.pdf](http://innovation.cc/scholarly-style/glor_innovation-traps.pdf) on 2012-01-04.
- Gnumeric Spreadsheet (Version 1.10.17) [Computer software]. USA: The GNOME Project.
- IBM – SPSS Statistics Standard*. (2012, January 17). Retrieved from <http://http://www->

01.ibm.com/software/analytics/spss/products/statistics/stats-standard/.

Kurniawan, S., Nugroho, Y., & Mahmud, M. (2006). A study of the use of mobile phones by older persons. In *CHI 2006 - Work-in-Progress* (pp. 989-994). Montréal.

Lee, Y. S. (2007). *Older adults' user experiences with mobile phones: identification of user clusters and user requirements* (Doctoral dissertation, Virginia Polytechnic Institute and State University, Blacksburg, Virginia).

Libre Office (Version 3.4.4) [Computer software]. The Document Foundation.

*Limesurvey*. (2011, November 10). Retrieved from <http://docs.limesurvey.org/tiki-index.php>.

Lohr, S. (2010). *Sampling: Design and analysis*. (2 ed.). Boston, MA: Brooks/Cole.

McMurtrey, M., McGaughey, R., Downey, J., & Zeltmann, S. (2010, March). Seniors and information technology: much ado about something? Paper presented at 2010 Southwest Decision Sciences Institute conference, Dallas, TX. Retrieved from [http://www.swdsi.org/swdsi2010/SW2010\\_Preceedings/papers/PA130.pdf](http://www.swdsi.org/swdsi2010/SW2010_Preceedings/papers/PA130.pdf)

Renaud, K. & van Biljon, J. (2008). Predicting technology acceptance and adoption by the elderly: a qualitative study. In Botha, R., & Cilliers, C. (Eds.), *Proceedings of the 2008 annual research conference of the South African Institute of Computer Scientists and Information Technologists on IT research in developing countries: riding the wave of technology*. New York: ACM. Doi: 10.1145/1456659.1456684.

Rogers, E.M. (2003). *Diffusion of innovations*. 5 th ed. The Free Press, New York.

Smith, A. Pew Internet & American Life Project. (2011-07-11). 35 % of American adults own a smartphone. Washington, DC: Pew Research Center. Retrieved on 2011-09-22 from <http://www.pewinternet.org/Reports/2011/Smartphones.aspx>.

*SurveyMonkey Plans and Pricing*. (2012, January 17). Retrieved from [http://www.surveymonkey.com/pricing/?ut\\_source=header](http://www.surveymonkey.com/pricing/?ut_source=header).

- Sveiby, K., Gripenberg, P., Segercrantz, B., Eriksson, A., & Aminoff, A. (2009, June). *Unintended and undesirable consequences of innovation*. Paper presented at XX ISPIM Conference: the Future of Innovation, Vienna.
- Walt Disney Productions (Producer), & Stevenson, R. (Director). (1964). *Mary Poppins* [Motion Picture]. United States: Buena Vista Distribution Company.
- van der Heijden, H. (2004). User Acceptance of hedonic information systems. *MIS Quarterly*, 28(4), 695-704.
- Vanderslice, S. (2000). Listening to Everett Rogers: Diffusion of innovations and WAC. *Language and Learning Across the Disciplines*, 4(1), Retrieved on 2012-01-19 from <http://wac.colostate.edu/llad/>.
- van Dijk, J. A. G. M. (2005). *The deepening divide: Inequality in the information society*. Thousand Oaks, CA: Sage Publishing.
- Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27(3), 425-478.