

12-5-2016

# “Hey, Nice Run!” Exploring Motives for Smartphone Exercise App Use

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# “Hey, Nice Run!” Exploring Motives for Smartphone Exercise App Use

Micheal S. Fuller, PhD

University of Connecticut, 2016

The rapid pace at which smartphone applications are currently diffusing through society have made them a very popular form of media. Smartphone applications (commonly referred to as apps) allow users the ability to complete a variety of media functions such as receive news updates, sport scores, view television programs, and listen to the radio. Exercise apps are a sub category of smartphone apps which allow users to monitor their exercise progress through the Global Positioning System included in most smartphones. To date, the motives for exercise apps have not been examined within the framework of Uses and Gratifications. This essay outlines a study designed to address user motives for exercise app use. Gratifications for competition, self-monitoring, informational and emotional social support are proposed. This essay proposes a model for exercise app use that includes uses and gratifications, self-efficacy and technology clusters. Study findings provide partial support of the hypothesized path model identifying the role of self-monitoring and personal goal achievement in smartphone exercise app use.

“Hey, Nice Run!” Exploring Motives for Smartphone Exercise App Use

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A Dissertation

Submitted in Partial Fulfillment of the

Requirements for the Degree of

Doctor of Philosophy

at the

University of Connecticut

2016

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2016

APPROVAL PAGE

Doctor of Philosophy Dissertation


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## Acknowledgments

The adage “It takes a village to raise a child” is, I feel, also applicable to PhD students. Below is the village I would like to thank.

**Cynthia Stewart.** Thank you for handling all of the administrative work for me and the department.

**Carolyn Lin.** Thank you for accepting me into the program and giving me a shot, teaching Comm 1100.

**Diana Rios.** Thank you for your help in navigating the departmental political landscape. And thank you for jumping in to be a reader for my dissertation, last minute. I appreciate your helpful comments

**Saraswathi Bellur.** I only worked with you briefly, yet I appreciate the helpful feedback you gave me on my dissertation proposal and for your help with my survey questions.

**Josh Fishlock.** Thank you for all things DIY and our lunch time discussions.

**Stephen Stifano.** Thank you for your willingness to engage in theory building discussions and methodological approaches to research, at any time. And for your willingness to share tips, notes and insights. Lastly, thank you for the seamless data collection of Comm 1000 students, this made my dissertation much easier.

**Kivy Weeks.** Thank you for your kindness and your willingness to help, anytime. And for your statistical acumen.

**Rory McGloin.** Thank you for Comm 1100 help and feedback and for your great example of hard work. Thanks for being one of the readers for my dissertation and for your helpful insight.

**Alice Vexler.** Thank you for supporting and listening to the graduate students as we traveled the Comm 1100 road. It was a pleasure working with you.

**Jeff Farrar.** Thank you for our many and varied discussions and for your help with public speaking. I enjoyed working with you.

**Kristine Nowak.** Thank you for recognizing that I could do better. And for helping me recognize what I wanted to study. I am so thankful for our discussions. Thank you for your help, I am unable to adequately express how much it meant to me. I really felt lost, that I had no direction in my research focus, but you helped me find my way. You have a unique gift. Thank you! (For those students who may be reading this and who are lacking direction in their studies, talk with Kristine, she will help you figure it out)

**Kate Kurtin.** Thank you for our discussions on parenting and travel. I appreciate your example of hard work.

**Alex Mercer** you were the best office mate ever! I appreciate your example, your passion for teaching and the love you have for your students. I am not surprised you won the university wide GA teaching award!

**Carolyn Lagoe.** Thank you for your passion of research and statistics and your willingness to help with statistics. And your beautiful way of writing. You are a wonderful example of a dedicated researcher. The field of science is much better, because of you.

**Chris Clemens.** Thank you for your friendship, for your passion for teaching and the care you had for your students. Generations of students will benefit from the education they will receive at your hands. I learned much from you and am thankful that I had you on most of this doctoral student journey.

**Mike Miller.** Thank you for your never-ending willingness to help me or anyone in the graduate program. You really helped with my transition to becoming a doctoral student. Thank you for your SEM skills, your insight aided (saved) my dissertation analysis. You are truly one of the great ones.

**Leslie Snyder.** Thank you for your amazing theory building class, it really helped shape me as a researcher and a consumer of research. Thank you for your prompt and helpful feedback. And for our discussions on health and exercise. Do you remember that time I did an Ironman triathlon during the school year? And that I almost passed out in your class because I hadn't fully recovered? Thank you for recognizing this and stopping your lecture, to make me eat some food.

**Ross Buck.** There are many reasons why so many students want to work with you. For me it was your patience and encouragement, your vast knowledge and your love of teaching and your love of research. Thank you. Thank you. Thank you.

**Mark Hamilton.** Thank you for baby turtles, and baby turtles with machine guns (my personal favorite), chocolate cheese, car porn, your creative test questions, the sociology of science and the beauty of Hamiltonian path models (For me it's the color pink, which is also a strong indicator of a true Hamiltonian path model). For your willingness to help and for your candid assessment(s) of my progress. I appreciate all of your guidance as I advanced through my education at UConn.

**David Atkin.** Thank you for your unfailing belief in me. For the encouragement and feedback, you've given me, especially after my comps. I really struggled after this. Thank you for your positive attitude and your willingness to help. You are an amazing scholar and advisor! I earned this PhD in large part, because of you. I am grateful for all of your help over the past seven years.

**Harold and Diane.** You are the best parents I could have asked for. Thank you for your continued support, encouragement and unconditional love!

**Ella, Phineas and Hazel.** Remember: “That which we persist in doing, becomes easier to do, not that the nature of the thing has changed but that our power to do has increased.” (Ralph Waldo Emmerson). Also, see below.

**KDPF.** I’m yours. And if we are faithful and endure to the end, will be, eternally.



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## **Chapter One: Introduction**

The rapid adoption of smartphones has led to the development of mobile software applications (Azar, Lesser, Laing, Stephens, Aurora, Burke, & Palaniappan, 2013), simply known as apps. These apps run on smartphone devices that have internet connectivity capabilities. Devices that run apps include the iPhone and Google-based android OS smartphones. Consumers can download apps for their respective operating systems at Google Play or the App Store. Both of these services, which launched around 2008, boast over 1 million different apps and consumers have downloaded nearly 60 billion apps from each site since their inception (Ingraham, 2013; Rowinski, 2013). Both Google Play and the App store have over 20 different app categories, which cover areas such as news, games, sports, weather, social networking, education, finance, health, and others (Cheng, 2012).

Research on motives to use exercise apps has received limited scholarly attention, despite the fact that 28% of app users aged 18-29 have downloaded at least one health and fitness app (Purcell, 2011). Several studies that have examined exercise app use (CF Cowan, Van Wagenen, Brown, Hedin, Seino-Stephan, Hall & West, J. 2012; Breton, Fuemmeler, & Abrams, 2011; Rabin & Bock, 2011), did not examine the motives for their use. Motives for the use of exercise apps may or may not be the same as motives for news apps or game-based apps. Consequently, it is important to understand the process of exercise app use, examine why some utilize this technology and what gratifications they receive (Weiss, 2013).

One potentially useful theory that can be used to understand the motives of exercise app use, is Uses and Gratifications theory (U&G). The perspective can enhance our understanding of audience uses of communication technologies such as the internet, (Ruggiero, 2000; Sundar & Limperos, 2011) mobile phones, tablet devices and smartphone apps (Weiss, 2013). U&G allows scholars to examine “mediated communication situations via a single or multiple sets of

psychological needs, psychological motives, and communication channels, communication content and psychological gratifications within a particular or cross-cultural context” (Lin, 1996, p. 574). The U&G framework provides researchers with a flexible theoretical approach that is vital, as scholars attempt to understand and stay in front of quickly developing and ever faster changing communication technologies (Ruggiero, 2000; Rubin, 2009). Furthermore, researchers have noted the explanatory power of U&G, especially in the examination of new media motives (Lin, 1996; Ruggiero, 2000). Consequently, the U&G theory appears well-suited to explain the motives of those who use smartphone exercise apps.

Another theory which may help explain exercise app use is the diffusion of innovations theory (DOI). DOI (Rogers, 2003) has frequently been combined with U&G theory. This is consistent with Rogers’ (2003) recommendation to examine the role motives play in the diffusion process, suggesting that motives may play an important role in the innovation-decision process. Chang, Lee, and Kim (2006) contend that even though the two theories explain dissimilar aspects of new media adoption, these aspects are complementary. While DOI addresses the adoption of new media, U&G focuses on the degree of media use (Chang, Lee & Kim, 2006). In light of the symbiotic relationship between U&G and DOI, DOI variables will be incorporated into the hypothesized model to explain exercise app use.

One recent trend, which lends itself to exercise app use, is the rise of the quantified self-movement. The quantified self-movement is essentially where individuals or groups of people meet formally, informally or virtually, to measure some (generally health-related) aspect of themselves (Singer, 2011). For example, quantified self-practitioners may track exercise, REM sleep, diet, mood, fatigue, chronic illness/pain and many other biological and physiological

functions (Singer, 2011). The objective of the quantified self is to collect personal data and analyze the data to improve health and behavior (Singer, 2011).

An important component of the quantified self is the ability to collect and monitor data. This idea of self-monitoring is not new, as collegiate and professional athletes have been collecting performance data and analyzing it for decades (Singer, 2011). Singer (2011) suggests the rise of the quantified self-movement is driven in part by the wide range of inexpensive data collection tools now available to the average consumer (e.g., wearable technology in the form of a GPS watch, heart rate monitor or a pedometer). The Zeo is a device that tracks the sleep patterns of a user (Singer, 2011). Given the advances in digitization, these devices are relatively inexpensive and as the technology progresses, prices will continue to drop; this will make it easier for those so inclined to self-monitor. Consequently, self-monitoring may play an important role in exercise app use.

Another factor that may influence the use of smartphone exercise apps is self-efficacy. Self-efficacy is the confidence a person has in their ability to accomplish some activity or task. Thus, the greater the self-efficacy, the higher likelihood the activity or task will be accomplished despite difficulties (Bandura, 1997; 1986). Self-efficacy has been shown to influence a variety of CMC based behaviors, ranging from internet use (Eastin & LaRose, 2000) to online search motivations and behavior (Lin & Associates, 2015). The current study will examine exercise app self-efficacy and exercise self-efficacy and how these concepts, in turn, influence exercise app use.

The model of this study will be informed by uses and gratifications, self-efficacy and basic needs as explicated in the EGrats scale. Hypothesis and research questions will be derived from current literature. Additionally, this dissertation will examine gratifications of competition,

self-monitoring, informational and emotional social support and the role that DOI variables play in the use of exercise apps as well as the role of narcissism in exercise app use and the potential health outcomes stemming from their use.

## **Chapter Two: Literature Review**

### **Self-Efficacy**

Bandura (1986) defines self-efficacy “as people’s judgments of their capabilities to organize and execute a course of action required to attain designated types of performances” (p. 391). It is important to note that this definition does not consider the actual skill a person has but rather what a person believes they can do with their present skill or skills (Bandura, 1986). Thus, a person who has extensive experience performing a specific task would have high self-efficacy related to the performance of that task. Similarly, other researchers submit that self-efficacy involves “beliefs about personal ability to perform behaviors that bring desired outcomes” (McAlister, Perry & Parcel, 2008, p. 171). Self-efficacy is an important concept because, if a person does not believe they have the competency to perform a given behavior--such as exercise or using a smartphone exercise app--they are less likely to undertake the behavior. Thus, if a person can improve their self-efficacy related to the performance of a desired task, they can improve their belief in the ability to perform the task and are more likely to achieve the sought-after outcome.

Self-efficacy has been used in health interventions and technology based research, both of which are relevant to the present discussion, given that exercise apps are health-related and rely on technology to work. Research suggests that improvements in self-efficacy lead to increased exercise, a healthier diet and weight loss (Annesi, 2012). Research suggests these results apply to a variety of demographics, including older adults (Conn, Burks, Pomeroy, Ulbrich, & Cochran, 2003; McAuley et al, 2003), and women (Wadsworth & Hallam, 2010; Conn et al, 2003), university students (Song, Peng & Lee, 2011; Magoc, Tomaka, & Bridges-Arzaga, 2011) and sedentary adults (Carr, et al, 2012).



**Exercise history and exercise self-efficacy.** Exercise history, which is defined as how long a person has been consistently exercising, is related to exercise self-efficacy. Benisovich, Rossi, Norman, and Nigg (1998) define exercise self-efficacy as a person's belief that s/he can perform the necessary actions to achieve the goal of exercise performance (Note, this definition was adapted). Consequently, as exercise history increases, that is the longer a person has been consistently performing a given exercise, the higher their exercise self-efficacy will be (Annesi, 2012).

Concerning technology and its relationship with self-efficacy, research has shown the important role that self-efficacy plays in internet use. For example, Eastin and LaRose (2000) found a positive relationship between internet use and self-efficacy. Other researchers have studied a variety of internet tasks and the role self-efficacy plays in these tasks. For example, Wirth, Rifon, LaRose, and Lewis (2008) found self-efficacy to be essential in guarding teens against online scams and fraud, to the point that teens whose self-efficacy improved concerning the identification of online fraud were more likely to respond appropriately to fraudulent scam attempts.

Self-efficacy was also found to be an important predictor in the following technology based circumstances: use of computer based health information (Hong, 2002), using the internet to search for information related to those with health issues (Kalichman, Cherry, Cain, Kalichman, M., Eaton, Weinhardt, & Benotsch, 2006), in the process of seeking online information (Hong, 2006), health engagement (Lee, 2008), internet skills and self-efficacy (Livingstone & Helsper, 2010; Lagoe & Atkin, 2015), using the internet to monitor physical activity (Carr et al., 2012), and online search motivations and behavior (Lin et al., 2015). Kim, Jun, Han, Kim, M., and Kim (2013) suggest that greater self-efficacy was related to a stronger

attachment with mobile apps. Based on the concept of self-efficacy and the findings discussed above, the following hypothesis is proposed:

H1: Exercise experience will be positively related to exercise self-efficacy.

**Smartphone exercise app self-efficacy.** Given the importance of self-efficacy for internet skills, self-efficacy appears to play a dynamic role in smartphone app use (e.g., Kim, et al, 2013) and by extension, smartphone exercise app use. The present study seeks to understand the role that smartphone exercise app self-efficacy plays on exercise app use. Again, self-efficacy is defined as *what a person believes s/he can accomplish through smartphone exercise app use* (Note, this definition was adapted from Lin et al.'s (2015) definition of internet self-efficacy because of the similarities between the internet and exercise apps). We assume that the dynamics underpinning self-efficacy influences in Internet use will also translate to smartphone exercise app use due to their similarities. Drawing from the research and theory reviewed above, it is proposed that:

H2: Exercise App self-efficacy will be positively related to exercise app use.

Due to the relative newness of smartphone exercise apps and the limited research on this technology, scholarly studies appear to be silent on the relationship between exercise self-efficacy and smartphone exercise app use. Thus, the following research question is proposed:

RQ4: How does exercise self-efficacy influence exercise app use?

## **Emotional Needs**

The idea that emotions can influence media use has received much scholarly attention and was an early research focus within the uses and gratifications framework. Early studies identified emotional needs as a potential gratification for media use, for example watching TV for emotional release (Katz, Blumler & Gurevitch, 1974; Rosengren, 1974). Indeed, the role of

emotions in media use can be seen and is consistent with the uses and gratifications framework (Katz, Blumler & Gurevitch, 1974). Rosengren's (1974) U&G process model begins with basic needs, of which he identifies emotion as a potential need (Although there are other needs, see Rosengren, 1974) which can influence the media selection process.

While Bartsch, Mangold, Viehoff, and Vorderer, (2006), suggest that emotions themselves may be a gratification, which they refer to as emotional gratification(s) and these may influence media use. In other words, the desire to feel a particular emotion drives media use selection. For example, a person who wants to feel happy may seek out a specific type of media, be it a movie, podcast or television show, to experience the emotion of happiness. Building on this research, Bartsch, Vorderer, Mangold, and Viehoff, (2008), identified seven emotional gratifications across three factors. The first factor pertained to entertainment and included fun and thrill gratifications. By contrast, the second factor was related to experiencing sad and tender feelings in entertainment and consisted of the being moved gratification. The third factor included thought-provoking experiences, vicarious emotional experiences, social sharing of emotions, and acting out emotions.

Mood management theory has also examined the importance that emotion plays in media use. This theory suggests that people use media to maximize pleasant emotional states and minimize unpleasant emotional states (Zillman, 2000). Zillman (2000) suggests a variety of emotions, including emotions typically considered negative emotions such as fear and sadness, can lead to pleasure for media users. The key, according to Zillman (2000) is the role of arousal, which he suggests most users prefer in moderate amounts of arousal for a satiated state. Thus, users who are over aroused, would find it pleasant to decrease arousal through their media

selection and those who are under aroused would find pleasure by increasing arousal through their media choice.

Building on mood management research, Greenwood (2010), found emotion to be a powerful influence, even a driver of media selection. The study compared sad vs. happy participant's media selection. The results suggest that sad participants were more likely to choose dark comedy or social drama, whereas happy participants were more likely to choose an action adventure movie or slap stick comedy. Greenwood (2010) also found significant gender differences, such that men showed a preference for action, dark comedy and suspense. While women showed a preference for romantic genres regardless of mood.

Based on the theory and research reviewed above, pertaining to the role of emotion in media use, it is proposed:

H3: Emotions will predict motives to use smartphone exercise apps.

### **Uses and Gratifications Theory**

The goal of Uses and Gratifications (U&G) theory identifies the reasons why people use mass communication media like radio, television, and newspapers. Uses and gratifications theory has been utilized to explain the use of new media technology such as cable television (LaRose & Atkin, 1991), the Internet (Johnson & Kaye, 2003), mobile phones (Wei, 2001), social network sites (Papacharissi & Mendelson, 2011; Hunt, Atkin & Krishnan, 2012), smartphones (Wei, 2008), and mobile applications (Wei, Karlis, & Haught, 2012; Weiss, 2013).

Uses and Gratifications theory suggests that people use media to meet a variety of psychological and social needs (Katz, Blumler, & Gurevitch, 1974). These needs generate expectations for media use. Rubin (2009) contends that media use is based on needs, motives, psychological and social environment, functional alternatives to media, and the consequences of

behavior. U&G assumes that people actively use media to meet their needs and that media use is goal directed (Katz et al, 1974). This assumption works well with media that are interactive (Ruggiero, 2000; Sundar & Limperos, 2011), such as the Internet, computers, mobile phones, and smartphones. U&G theory has been frequently utilized in research examining new media and communication technologies. This theory is thus well-suited to explain the needs and gratifications sought by users, as well as the results of their behavior (Rubin, 2009; Ruggiero, 2000; Lin, 1996; Palmgreen et al, 1985). The next subsections will briefly review relevant uses and gratifications literature among new technology and identify four potential motives of exercise app use.

**Smartphone apps.** Recent uses and gratifications research examining apps has uncovered a new gratification: constant availability (Wei, Karlis & Haught, 2012). Similarly, convenience was found to be an important gratification of smartphone use (Wei, Karlis, & Haught, 2012; Weiss, 2013). Additional smartphone gratifications have been identified such as entertainment, and information seeking (Christiansan & Prax, 2012; Wei, Karlis, & Haught, 2012; Weiss, 2013).

The limited scholarship on exercise app use and app use in general has led to a conflicting demographic profile of the typical user. General diffusion studies suggest that early adopters are typically Caucasian, male, more affluent and more educated than later adopters (Rogers, 2003). Some research on apps appears to support this profile (c.f., Rabin & Bock, 2011; Duggan, 2013). For example, Duggan found that users 18-29 year, those with higher income and those with a higher education level were more likely to download smartphone apps.

Yet other research suggests a different profile for a typical user (see Weiss, 2013; Duggan, 2013). For example, Duggan (2013) in what appears to be contradictory findings,

found the percentage of African Americans (60%) who download apps was significantly different from their Latino and Caucasian peers at 52 and 48 percent, respectively. This trend seems consistent when considering health-related app downloads, with fifteen percent of African Americans compared to seven percent of Caucasians downloading a health app (Purcell, 2011). Furthermore, Duggan (2013) did not find a significant difference between the percentage of females and the percentage of males who download apps.

Additionally, this disagreement in the literature may also affect the demographic profile of users who have high app self-efficacy and the motives for using exercise apps. To wit, those who use apps more frequently would have a higher app self-efficacy, while the motives of a typical user of exercise apps remain largely unknown. Although diffusion work suggests that income might normally be a predictor of technology adoption (e.g., Rogers, 2003), more recent work suggests that certain apps may be a “poor man’s” substitute for nonmedia (e.g., health spa) substitutes (Atkin et al., 2015). This discrepancy may therefore influence the profile of those who have high app self-efficacy, those that use apps and their motives. Given the vagaries and scarcity of research addressing self-efficacy and e/mHealth technology adoption (e.g., Ma & Atkin, 2016), the following research questions are proposed:

RQ1a: What influence will gender have on app self-efficacy?

RQ1b: What influence will education have on app self-efficacy?

RQ1c: What influence will age have on app self-efficacy?

RQ1d: What influence will income have on app self-efficacy?

RQ2a: What influence will gender have on exercise app use?

RQ2b: What influence will education have on exercise app use?

RQ2c: What influence will age have on exercise app use?

RQ2d: What influence will income have on exercise app use?

In addition to the above research questions, this study proposes four motives for exercise app use: self-monitoring, competition, informational social support, and emotional social support. It appears that none of these motives have been examined in the context of exercise app use within the uses and gratifications framework. Explanations for why these motives have not been studied may include the relative newness of exercise apps and the unique technological affordances offered by exercise apps, relative to news or game apps. Justification for incorporating these motives into the current study follows.

**Self-monitoring.** This essay's view of self-monitoring will differ from self-monitoring theory, which is concerned with the control of facial expressions, hand movements, vocalics, and body posture in order to behave appropriately in a given social setting, i.e., impression management (Snyder, 1974; 1979; 1987). Rather, the focus will be more consistent with health behavior and health intervention research, where participants monitor some type of health parameter or outcome. For example, Helsel, Jakicic and Otto (2007) found the process of self-monitoring to be important in assisting with physical activity, weight loss, and changing eating habits among diabetics. Similarly, Ayabe, Brubaker, Mori, Kumahara, Kiyonaga, Tanaka and Aoki (2010) found that patients with chronic disease conditions increased their physical activity as they monitored the amount of time they spent exercising. Carels, Darby, Rydin, Douglass, Cacaiapaglia and O'Brien, (2005) found that consistent self-monitoring of exercise was associated with fewer difficulties and greater exercise and weight loss.

Perhaps the need to self-monitor health-related metrics has never been greater given the obesity epidemic in the United States. The percentage of overweight and obese adults in the United States is just over 69%, while nearly 35% percent of adults in the United States are

considered obese (Ogden, Carroll, Kit, & Flegal, 2014). Overweight and obese adults suffer higher incidences of chronic health issues when compared to their healthy peers, including heart disease, type-2 diabetes, hypertension, cardiovascular disease, asthma, hyperlipidemia, and arthritis (Must, Spadano, Coakley, Field, Colditz, & Dietz, 1999; Mokdad, Ford, Bowman, Dietz, Vinicor, Bales, & Marks 2003). Beyond the health-related issues of obesity, the monetary consequences of obesity are steep. Finkelstein, Trogdon, Cohen and Dietz (2009) estimated that obesity related costs in 2008 were over 147 billion dollars. In spite of this ominous figure, research indicates small changes to BMI can bring big rewards. For example, decreases in chronic diseases, even with a modest loss of 5% of total body weight (Blackburn, 1995) and for every one-unit decrease in BMI, health care costs decrease by 4 % (Wang, McDonald, Bender, Reffitt, Miller, & Edington, 2006). One method for decreasing BMI is through consistently exercising, which has been shown to be a vital factor in weight loss, weight loss maintenance and overall health (Wing, Papandonatos, Fava, Gorin, Phelan, McCaffery, & Tate, 2008; Shin, Jang & Pender, 2001).

Smartphone exercise apps may provide benefits for users who want to monitor some exercise-related metric, such as tracking the distance, speed and time of a workout and being able to save the workout and review it in the future (Rabin & Bock, 2011). Benefits of using exercise apps may include 24-hour access to exercise tracking and health information allowing the user to exercise when convenient. Many apps have online support communities where users can post their workouts and receive feedback from other users (Carr, Dunsiger, Lewis, Ciccolo, Hartman, Bock, Dominick. & Marcus, 2012). Additionally, exercise apps have the ability to provide a more individualized user experience and allow greater ease in self-monitoring. This may lead to higher levels of self-efficacy which leads to more beneficial health outcomes



(Wantland et al., 2004). Lastly, exercise apps provide the ability to self-monitor and obtain health and exercise information, independent of location (Breton, Fuemmeler, & Abrams, 2011). Consequently, exercise apps may help those who are looking to improve their health through exercise, by allowing users to monitor their speed, distance and duration of their exercise in an effort to help them achieve their exercise goals.

The self-monitoring capabilities of exercise apps not only benefit the overweight and obese population, but also those who exercise consistently and meet or exceed the exercise amount recommended by the Centers for Disease Control. This might include, for instance, people who train for and compete in running and multisport events. To see the potential for self-monitoring of this group, one need only examine the number of running and multisport participants in the United States. According to [runningusa.org](http://runningusa.org) in 2013, over 19 million participants finished a running race, across all distances. The figure includes a record-breaking 541,000 marathon finishers up from 353,000 in 2000 (Marathon Report), 1,960,000 half marathon finishers, up from 492,000 in 2000 (Half Marathon Report), while the 5k distance was the most popular, with over 8 million finishers. Also of note, in 2013, women participated more than men for all distances except for the marathon (2015 State of the Sport). Women accounted for 61% of half marathon finishers, 59% of 10k finishers and 58% of 5k finishers (2015 State of the sport). Men accounted for 57% of marathon finishers (2015 State of the sport).

This trend of increasing participation appears to apply at longer running distances also. According to Ultra Running, in 2013, 69,000 runners were involved in ultra-marathons (a race longer than a marathon, typically the shortest ultramarathon distance is 50km); this number was up from just over 15,000 in 1998. Other popular ultramarathon distances include 50M, 100km and 100M, though longer distance races do exist. In 2013, the most popular ultramarathon

distance was 50km, with over 35,000 finishers. This was followed by the 50 mile, distance with nearly 16,000 finishers. The 100-mile distance had over 6,000 finishers, while the 100km distance had roughly 2,000 finishers.

The sport of triathlon has also seen substantial growth. According to USA Triathlon, the governing body for triathlon in the United States, in 2014 there were over 4,300 sanctioned events, compared to 1,500 in 2007. Even the Ironman distance has seen steady growth, beginning with the first race in 1978, with 15 participants. In 2015 there were 11 Ironman events held in the United States (with an additional 28 races held globally), allowing for almost 35,000 participants to compete in a 2.4 mile swim, 112 mile bike ride and a 26.2 mile run (Ironman.com). Essentially, there are a lot of people doing a lot of exercise that need some way to track the exercise.

Obviously, the obese and endurance athletes are not the only groups of people who self-monitor the amount of exercise they complete. The argument here is that, given the widespread availability of exercise apps and the large number of people who may want to track their exercise, self-monitoring may play an important role in the motives for exercise app use. The proposed framework will define exercise app self-monitoring as the *ability of users to monitor or record their exercise performance using an exercise app, in order to achieve a predetermined goal or objective and monitor the predetermined goal or objective in real time*. This definition of exercise app self-monitoring was adapted from Fogg (2003).

Smartphone apps allow for the self-monitoring of a variety of exercise-related metrics. Augemberg (2012) identified six key categories for physical activities: miles, steps, calories, repetitions, sets, and METs (metabolic equivalents). Most exercise apps allow for the tracking or recording of exercise-specific information identified by Augemberg (2012), such as distance

covered, time spent exercising, pace/rate/speed, and with the appropriate sensors, additional others like heart rate, cadence (how fast a person pedals, in revolutions per minute), and wattage (power output while cycling). Fogg (2003) contends that for a technology to be effective for self-monitoring, it should work in real time, giving users feedback on their location and progress on their goal/task. Additionally, for an app or other technology to be effective for self-monitoring, Fogg contends “the goal is to eliminate the tedium of measuring and tracking performance or status” which “makes it easier for people to know how well they are performing the target behavior” (2003, p. 44). Millington (2014) argues that digitization allows the process of data collection to be automated, thus freeing users of the burden to monitor their exercise.

Accordingly exercise apps appear to meet the criteria outlined by Fogg (2003), as many exercise apps automate the data collection process. The use of exercise apps generally requires minimal user input (beyond the initial app download), also consistent with Fogg’s (2003) criteria. Actual use typically involves opening the app, pressing the start button when the user begins exercise, and pushing the stop button when exercise is complete. While the exercise is occurring users can see their progress in real time or “live,” simply by looking at their device screen. Once exercise is complete, users can review their performance. Rabin and Bock (2011) found that the ability of users to track their exercise was very important to app users. Consequently, it appears that self-monitoring may be an important motive for exercise app use; more formally:

H4: Self-Monitoring will positively influence exercise app use.

**Competition.** Competition has been under examined as a motive for media use within the framework of uses and gratifications. This section will outline why competition may be a relevant motive in using exercise apps. We first examine the role of competition in the use of

media. Next, competition based within the context of endurance sports will be addressed. The final section addresses how competition is possible through exercise apps.

***Competition through media.*** Competition has rarely been examined within the uses and gratifications framework. However, this was found to be an important motive in listening to radio talk shows (Herzog, 1940; 1944). More recently Sherry and Lucas (2003) found competition to be important among video game genre of physical enactment, which includes: shooters, fighters, sports and racing-speed games. A follow up study found a significant gender difference for the motive of competition among video game players, with males indicating competition as a more significant motive for video game use than females (Sherry & Lucas, 2004).

Competition through exercise app use can occur in some types of exercise apps, particularly those that gamify exercise. Much like video games, users of this type of exercise app earn points for challenges and for a bout or session of exercise. Furthermore, users advance through levels within the app as points accumulate. Fitocracy ([www.fitocracy.com](http://www.fitocracy.com)) is an example of this type of exercise app, which awards points for the amount of exercise a user completes, based on how far they travel during exercise, the speed at which the exercise was performed (where relevant, i.e., it would be difficult to time each repetition of a bench press), duration of exercise, and number of repetitions. For example, a person may receive 2,500 points for completing a half marathon, or 100 points for doing 50 push-ups. The user's point total is listed on their profile for others to see.

Thus, users can compare point totals to and with each other. Furthermore, a user's most recent exercise and point total are posted in the feed--similar to the news feed in Facebook--making this visible to other users (see Figure 1). Users can also undertake challenges such as

completing their first triathlon or bench pressing their body weight. Users receive points for completing the exercise(s) while working towards the challenge and bonus points when the challenge has been achieved (see Figure 2 for examples of challenges). Accumulating points allows users to “Level-Up,” meaning they advance or move up within the app. Levels begin with users advancing rapidly, only a few hundred points for each level, and progress to harder levels, which require 25,000 points or more to advance levels. As users complete exercise, achieve challenges, and advance in level, this information is posted in the feed, thus allowing for competition (see Figure 1).

***Competition through endurance sports.*** Masters and Ogles (1995) found competition to be an important motive for marathon runners with differing experience levels. Their findings suggest those who had run three or more races indicated competition as a key motive, while runners who had only completed two races were motivated by performance improvement. This may indicate that those who have been exercising longer could identify competition as a stronger motive than less experienced exercisers. LaChausse (2006) found motives for cyclists to differ based on gender; men were more likely to be motivated by competition than women. Similarly, Ingledew and Markland (2008) found competition to be an important motive among office workers who were involved in a work place-based exercise program.

Obviously, there are many motives for exercise (cf. Masters & Ogles, 1995; Markland & Ingledew, 1997; Ingledew & Markland, 2008) and these motives can vary across gender (see LaChausse, 2006; Conn, et al., 2003) and age (see McAuley, Jerome, Marquez, Elavsky, & Blissmer, 2003; Conn, et al., 2003). This study does not claim to address all of them. The argument here is that competition is relevant for the present discussion because of the technological affordances of exercise apps. That is, exercise apps allow users to compete with

each other because the competition is easy to use; the user simply begins the exercise app at the outset of exercise and stops the app when exercise is complete. Another technological affordance of competition through exercise apps is that it is time independent, a user can compete against another user on the same course, hours, days, months, even years ahead or behind others. Finally, competition through exercise app use can also be virtual, the competition takes place in the real world, but is compared virtually through the wireless capabilities of the smartphone. Thus an app user could race a bike route in 2016, but be competing against the route record holder (for example King of the Mountain (KOM) or Queen of the Mountain (QOM) in Strava) who achieved the course record in early 2014.

Strava (see, [www.strava.com](http://www.strava.com)) for example, is a GPS enabled exercise app that focuses on endurance events such as running and cycling. This app tracks a user's exercise through a smartphone's GPS receiver. As the user performs exercise, the app records the information and compares the results to a database of other Strava users who have completed the same course. Courses range from fractions of a mile up to dozens of miles in length. This allows users to compete against other users independent of time, on these courses and achieve statuses such as "King of the Mountain" (KOM) or "Queen of the Mountain" (QOM). King/Queen of the Mountain is the fastest user of a given course, for particularly difficult climbs, descents and other noteworthy sections. (This competition is automatic and occurs when the user begins recording their exercise). If a person becomes KOM/QOM or loses the KOM/QOM title, the app automatically informs the person. If a person is not KOM/QOM, Strava will inform the person of their rank, relative to KOM/QOM, for example 2<sup>nd</sup> place through 10<sup>th</sup> place.

Based on the theory and findings reviewed regarding competition, the following hypothesis is proposed:

H5: Competition will positively influence exercise app use among males

### **Informational Social Support**

House (1981) suggested that informational support (i.e., advice or information that facilitates problem solving) is a form of social support. Herzog (1940; 1944) found advice seeking to be an important motive for radio listening. Similarly, Walther and Boyd (2002) found informational support to be an important use of the internet, which was made possible by the ability to receive or provide support anytime. More recently, Choi and Chen (2006) identified the role of informational support among Chinese immigrants. His findings suggest that the more recent the immigration and the fewer social contacts in the new country, the more frequently the immigrants sought information via computer mediated communication. (See Figure 3 for an example of potential informational social support in an exercise app).

### **Emotional Social Support**

House (1981) also defined emotional social support, suggesting that it's comprised of actions that convey esteem. Walther and Boyd (2002) similarly suggest that emotional support is given through expressions of caring, compassion, empathy and concern. Examples of emotional support include "statements of affection, emotional understanding, and statements geared towards relieving pain and stress" (Walter & Boyd, 2002, p.6). This type of support may be important to exercise app users, especially among those who may be struggling with exercise, such that an encouraging comment or gesture may be all that is needed to provide support. Indeed, recent exercise app research has identified the importance of users being able to communicate with each other to gain social support (Breton et al, 2011) and to comment on and follow other users' workouts (Carr et al, 2012). Given the theoretical dynamics on informational and emotional support outlined above, the following hypotheses are proposed:

H6: Informational social support is positively related to exercise app use.

H7: Emotional social support is positively related to exercise app use.

### **Diffusion of Innovations**

The diffusion of innovations perspective (DOI) claims that potential adopters move through a five stage process as they consider adopting or using some innovation. Stage one is the knowledge phase when a person first learns about the innovation and how it functions (Rogers, 2003). The second stage is persuasion, in which an individual develops an attitude towards the innovation. The potential adopter decides to reject or adopt the innovation in the third stage. The fourth stage consists of innovation implementation, when the adopter uses the innovation on a regular basis. The last stage is decision confirmation, when the individual decides to continue or discontinue innovation use. Key antecedent variables that influence the adoption process are gender, age, and economic status (Rogers, 2003). Another key variable in the adoption process which is relevant to explaining exercise app use involves technology clusters.

**Technology clusters.** Rogers (2003) identifies technology clusters as an element(s) of a technology that users perceive as being related, like wireless connectivity of a laptop and mobile phone. Furthermore, Rogers contends that technologies that are adopted during the same time period are often symbiotic in nature (Rogers, 2003). Thus, the more technological devices a person owns, the more likely they will adopt new innovations. Earlier adopters of technology typically include those with higher incomes and men (Rogers, 2003).

Use of technologies that are functionally similar has been shown to predict adoption and use of technology (Atkin, 1993; Vishwanath & Goldharber, 2003). For example, Leung and Wei (1998) examined the use of technology clusters in the context of mobile phone adoption and



found those who owned fewer technologies were less likely to adopt mobile phones. In addition, Lin (2009) identified a positive role of technology clusters in predicting the adoption of online radio. Similarly, media ownership was shown to predict cell phone adoption (Vishwanath & Goldharber, 2003). Vishwanath et al. (2009) found technology clusters influenced PDA adoption by physicians. Lastly, Hunt, Lin and Atkin (2014) found that technology clusters predicted the use and frequency of sending photo messages. Consequently, technology clusters or the use of similar technologies is likely to influence the use of smartphone exercise apps.

Recently, technology clusters have been measured by summing the total number of similar technologies possessed by a participant (Vishwanath, 2010). The response options are 1-yes or 0-no and include the following technologies: a phone with Internet capabilities, a phone that records or plays video, a phone that allows social networking site access, a digital audio player, and a wireless computer.

One potential issue with Vishwanath's (2010) scale is that a smartphone can do all of the things identified in the scale. Smartphones allow users the ability to access the Internet, which enables SNS use. Smartphones can record and play both audio and video as well as audio files such as MP3's. Lastly, one could argue that a smartphone is a wireless computer, allowing users the ability to create and edit office documents, send/receive email and give presentations. Consequently, the present study proposes an updated technology cluster. The updated technology cluster will ask participants if they have: a laptop, a tablet device such as an I-Pad, an e-reader such as a Kindle, and a digital audio player such as an I-Pod.

**Exercise technology cluster.** In addition to this updated technology cluster, this essay proposes an exercise technology cluster. Rogers (2003) argues that when an innovation is adopted, technologies are often interdependent, thus those who use exercise apps may also use

other exercise-related technologies. Relevant exercise based technologies to be included in exercise technology clusters include: a GPS based watch such as a Garmin, Nike or Timex; a wearable activity monitor such as a Fitbit or Jawbone; a pedometer; and a heart rate monitor. Given the above review of these technology cluster dynamics, the following hypotheses are proposed:

H8: Technology clusters will be positively related to exercise app use.

H9: Exercise technology clusters will be positively related to exercise app use.

### **Narcissism**

Parallel research examining social networking sites has studied the role played by personality dimensions such as the big five. While researchers have failed to find a major role of personality traits in the use of social network sites (e.g., Langstedt, 2013), scholars have expanded their search beyond the big five to other personality traits, consistent with the clarion call of Ross and colleagues (2009). One of these traits is narcissism, which recent research suggest plays a role in the motives for SNS use. For example, Krishnan and Atkin (2014) found a sub-dimension of narcissism, vanity, to play a significant role in SNS use. This suggests that SNS use fulfils the need for social approval which is important for those who are vain. Buffardi and Campbell (2008) found narcissism to be related to the number of friends and the number of wall posts between friends through SNS use. The number of wall posts is illustrative of a technique where users can receive social approval, which is important for narcissists. Given the similarities of exercise apps and SNS (insofar as both modalities allow users to create a profile, post pictures, upload workouts and comment on the workouts of friends) the following hypothesis is proposed:

H10: Narcissism is positively related to exercise app use.

## **Well-Being**

The final component of this model involves the inclusion of a measure of well-being. This brings the present essay beyond the common behavioral studies within the uses and gratifications framework, to examine potential outcomes of exercise app use. Recent measures of well-being have shifted from a negative, disease based approach to a positive outcome approach (Bann, Kobau, Lewis, Zack, Luncheon, & Thompson, 2012). Consequently, the present study will employ the Public Health Surveillance Well-Being scale designed by the Centers for Disease Control (Bann et al, 2012). This scale includes 10 items that assess well-being across three dimensions: mental, physical and social functioning. Given the importance of regular exercise, it is plausible that exercise app use will be positively related to physical well-being. Nevertheless, app use might be a remedy for those who feel less fit. So owing to these countervailing tendencies—and the scarcity of work on exercise app use generally--this connection will be posed as the following research question:

RQ5: What is the relationship between exercise app use and well-being?

The research questions and hypothesis are illustrated in Figure 4.

## **Process Model**

The proposed hypothesized model is identified in Figure 4. The crux of this model involves the uses and gratifications process, which is identified by the three light blue boxes. This process will be discussed first despite its location in the latter part of the model. The U&G sequence begins with basic needs, as outlined by Rosengren (1974), which in this study is measured by the emotion variables contained in the Egrats scale (Strizhakova, Kang, & Buck, 2007). . Basic needs can include a variety of psychological and biological needs, including

emotional needs. These needs can, in turn, influence the motives or the reasons a user decides to use a specific media. The path from basic needs to motives is hypothesized as H3a-f.

In particular, the motives variable is identified by the second light blue box in the U&G process. The motives of exercise app use are the focus of this study as they may be important in helping scholars understand why exercise apps are selected for media use. Motives vary at the individual level and by the type of media selected; motives then drive media use, identified by the final light blue box in the U&G process (e.g., Atkin, Lin, & Hunt, 2015; Hunt et al., 2014; Lin, 1998; Rosengren, 1974, Rubin, 2009). The path from motives to media use is identified in Hypothesis 4-7. Extending from the U&G process is the path from the media use variable to the health outcome variable (identified as RQ4), which attempts to connect media use to wellbeing.

The other variables in the process model begin with demographics identified in the blue box. Beginning with the demographics of sex, education, income and gender, we extend RQ1a-d to exercise app self-efficacy and RQ2a-d to exercise app use. Exercise experience, in the purple box, predicts exercise self-efficacy (H1) in the red box. In turn, the influence of exercise self-efficacy on exercise app use is identified by RQ3, while the path from exercise app self-efficacy predicts exercise app use (H2). In turn, diffusion variables, the lavender box, exercise technology clusters, technology clusters (H8-9) will directly influence exercise app use, consistent with DOI (Rogers, 2003). Finally, narcissism will predict exercise app use (H10).

## **Chapter Three: Methodology**

### **Survey Procedures**

The data was obtained through survey questionnaires, which were administered electronically through Qualtrics, a survey-hosting site. Participants were recruited from a large lecture communication course. Participants were given research credit for their participation. Those students who did not wish to participate in this study but wanted research credit were given an alternative assignment. Data was collected in December 2014, following study approval by the university's institutional review board.

### **Sample Justification**

The most recent research on mobile app use suggests that young adults ages 18-29 download more apps and use them more frequently than other age groups (Purcell, 2011). Also, Purcell (2011) showed that 28% of the 18-29-year-old age group downloaded at least one health app. This includes apps that are used for counting calories and tracking exercise. Additionally, app users tend to be younger, wealthier, and more educated than those who do not use apps (Purcell, 2011). These demographic markers reflect the general student population at the university where the research was conducted. Consequently, this convenience and purposive sample was justified.

### **The Sample**

The survey questionnaire yielded 393 complete surveys. The average age of participants was 19. The sample was comprised of 207 females or 52.7 percent and 186 males or 47.3 percent. "Caucasian" was the most prevalent ethnic background category selected by study participants, at 73 percent, followed by Asian at 14.8 percent, Hispanic at 5.1 percent, African American at 3.3 percent, with Mixed Race at 2 percent. The remaining 2 percent which was

comprised of the American Indian, Pacific Islander and Other categories. Average household income was \$100,000 per year.

Sample participants used smartphone exercise apps an average of two to three times a month ( $M=2.48$ ,  $SD=1.5$ ). Each use lasted an average of just over thirty minutes ( $M=2.46$ ,  $SD=1.4$ ). Fitness apps ( $M=3.68$ ,  $SD=2.2$ ) and running apps ( $M=3.44$ ,  $SD=1.9$ ) were the most popular, followed by walking apps ( $M=2.6$ ,  $SD=2.0$ ) and cycling apps ( $M=1.95$ ,  $SD=1.5$ ).

**Power.** A power analysis was conducted using G\*Power 3.0.10 computer software (Faul, Erdfelder, Lang, & Buchner, 2007). For an effect size of 0.1, which is consistent with similar U&G studies, the sample needed a minimum of 254 participants. The final sample size of this study was 393, which met the minimum criterion for statistical power.

## Measures

The measures for this study relied on previously established scales adapted from several studies. Competition scales were adapted from Masters and Ogles (1995) and Markland and Ingledew (1997). Competition through video games was adapted from Sherry and Lucas (2003). Informational and emotional social support scales were adapted from Choi and Chen (2006). An exercise app self-monitoring scale was also developed. In addition, an updated technology cluster was created based on items from Vishwanath (2010). An exercise technology cluster scale was developed and adapted from Vishwanath (2010). The scale for narcissism was taken from the Narcissism Personality Index-16 (NPI-16) (see Ames, Rose & Anderson, 2006). The EGrats scale was adapted from Strizhakova, Kang and Buck (2007). The well-being scale was adapted from Bann and colleagues (2012). Each scale will be discussed in more detail below.

**Competition.** Three different measures were utilized, the first two aimed at measuring competition through physical activity and the last one, for measuring competition through media.

The first scale was adapted from the competition subscale of Motivations to Exercise Inventory from Markland and Ingledew (1997). The scale had high reliability ( $\alpha = .93$ ) ( $M=4.22$ ,  $SD=1.4$ ) and had a response range from 1-strongly disagree to 7-strongly agree. Items include “Because I like trying to win in physical activities,” “Because I enjoy competing,” “Because I find physical activities fun, especially when competition is involved,” and “Because I enjoy physical competition.” The second scale, competition video game, was taken from Sherry and Lucas (2003) --consisting of four items--and had a robust reliability of  $\alpha = .88$  ( $M=3.77$ ,  $SD=1.36$ ). The scale had a response range from 1-strongly disagree to 7-strongly agree. Items include: “I like to play to prove to my friends that I am the best,” “When I lose to someone, I immediately want to play again in an attempt to beat him/her,” “It is important to me to be the fastest and most skilled person playing the game.” “I get upset when I lose to my friends.” The last scale examines competition with self, or as identified by Master’s and Ogles (1995), personal goal achievement. The scale consists of six items and had a reliability  $\alpha = .93$  ( $M=4.98$ ,  $SD=1.35$ ). The scale had a response range from 1-strongly disagree to 7-strongly agree. Items include “To improve my speed,” “To compete with myself,” “Try to become faster,” “To push myself beyond my current limits,” “To see if I can beat a certain time” and “To make my body perform better than before.”

**Informational social support.** This scale is taken from Choi and Chen (2006) and contains three items. Reliability was solid, with  $\alpha = .85$  ( $M=3.98$ ,  $SD=1.4$ ). The scale had a response range from 1-strongly disagree to 7-strongly agree. Participants were asked “Why do you use exercise apps?” and were provided the following responses, including: “Seek information to better understand a situation,” “Seek advice about a crisis”, and “Seek suggestions about how to deal with a personal problem.”

**Emotional social support.** This scale was taken from Choi and Chen (2006) and contains three items. Reliability was good with  $\alpha = .79$  ( $M=3.6$ ,  $SD=1.38$ ). The scale also had a response range from 1-strongly disagree to 7-strongly agree. Participants were asked “Why do you use exercise apps? to: “Seek encouragement,” “Share your private worries and fears,” and “Seek someone to listen to you.” Participants responded to each question using a 1-7 Likert scale, from strongly disagree to strongly agree.

**Exercise app self-monitoring scale.** The present study created a new scale to measure the importance of being able to track one’s progress in “real time” while exercising, through the use of an exercise app. This scale was designed to address the real-time or live component of exercise app use.

To address validity concerns, this scale included a response range from 1-7 (strongly disagree to strongly agree) with a mid-point of “neither agree nor disagree.” By providing multiple response categories, a wider degree of variation can be measured among participants, thus increasing validity (Fowler, 2009). Also, multiple questions were asked using different question forms, which should have increased the validity of the measurement process (Fowler, 2009).

The proposed scale contained twelve items across three sub-scales designed to address the real time component of exercise self-monitoring. Each scale contained four items and which could be modified to include other activities. The first sub-scale, called *distance*, addresses distance covered while exercising and includes: “I like to see how far I’ve gone while running/biking/walking,” and “I like to see how far I’ve gone.” The second scale, *speed*, is designed to measure the rate or speed of exercise and includes: “I like to see how fast I am running/walking/biking,” and “While exercising I like to see how fast I am going.” The last



scale, *duration*, is designed to measure how long a person has been exercising and includes: “I like to see how long I have been running/walking/cycling,” and “I like to see how long I have been exercising.”

However, to make the self-monitoring scale more useful for measuring other activities--such as cross country skiing, stand up paddling and roller blading--the general exercise app self-monitoring scale was created. Being able to track a variety of exercises may be important and relevant, as the Strava app can track 18 additional activities beyond the standard running and cycling (Strava.com, activity search). The general self-monitoring scale included three items for measuring self-monitoring, regardless of the activity. The items included “I like to see how far I’ve gone,” “When I exercise, I like to see my speed,” and “I like to see how long I have been exercising.” A CFA was run on the general exercise app self-monitoring scale, in AMOS 22. Results indicated solid model fit with a RMSEA of .054. Alpha reliability was high with an alpha of .85. (M=5.55, SD=1.16).

**E Grats Scale.** This scale was taken from Stirzhakova et al. (2007). This scale was used because it represents basic human emotions, regardless of context. The EGrats scale had 38 items, of which 18 were relevant to the present study. Participants were asked “I feel \_\_\_\_ after I have engaged in physical activity” for all 18 items, which comprise six subscales. Response range is 1, not at all, to, 7, very much.

The *negative prosocial* scale included “Ashamed,” “Embarrassed,” and “Guilty.” The scale reliability was solid ( $\alpha = .82$ ; M= 2.1, SD = 1.1).

The *negative individualism* scale included “Angry” and “Arrogant.” The scale reliability was acceptable, with  $\alpha = .72$  (M=2.5, SD=1.35).

The *positive individualism* scale included “Happy,” “Satisfied,” and “Confident.” The scale reliability was strong, with  $\alpha = .88$ . (M= 5.6, SD= 1.06).

The *positive prosocial* scale included “Proud,” and “Triumphant.” The reliability of this two item scale was  $\alpha = .70$  (M=5.1, SD=1.3).

The *reptilian power* scale included “Vigorous,” “Energetic,” and “Powerful.” Reliability was borderline with  $\alpha = .67$ . (M=4.98, SD= 1.13). A CFA was conducted and indicated *vigorous* had a low factor loading of .505. While powerful and energetic had much higher factor loadings, .895 and .894 respectively. *Vigorous* was removed from the scale and a second CFA was performed on the reptilian power scale. The outcome indicated the best model fit occurred once *vigorous* was removed from the model, as identified by goodness of fit measures, a RMSEA=.078, CFI=.942. Consequently, vigorous was dropped from this scale due to the low factor loading and to improve model fit. The alpha reliability of the two item scale improved to .84 (M=5.4, SD=1.2). One potential explanation for the poor loading of *vigorous* is that study participants may be unfamiliar with the definition of vigorous.

The *reptilian sex* scale included “Erotic,” “Aroused,” and “Sexy.” Reliability was good with  $\alpha = .82$ . (M=3.14, SD=1.5).

**Exercise app use.** This scale contained seven items, which were summed to form a composite scale. Question 1 asked participants “How often do you use exercise apps?” Responses included 1) Once per month, 2) 2-3 times per month, 3) Once per week, 4) 2-3 times per week, 5) 4-5 times per week, 6) 6 or more times per week. Question two asked participants “How much time do you use an exercise app each session?” Responses included: 1) 0-15 minutes, 2) 16-30 minutes, 3) 31-45 minutes, 4) 46-60 minutes, 5) 1-2 hours, 6) 2 hours or more. Questions 3-6 asked participants how often they used the following exercise app types (categories

adapted from The Apple App Store, 2014), “running app,” “cycling app,” “walking app,” and “fitness app.” Responses included 1) Never, 2) Several Times a Year, 3) Once a Month, 4) 2-3 Times a Month, 5) Once a Week, 6) 2-3 Times a Week, 7) 4-6 Times a Week, 8) Daily.

Reliability for exercise app use scale was good,  $\alpha = .75$  ( $M=16.6$ ,  $SD=7.1$ ).

**Technology cluster.** Participants were asked which of the following items they own. Participants selected 0 for an item they do not own and 1 for an item they own. The items were summed to form the technology cluster variable. Participants were asked: Which of the following items do you own? “A laptop,” “a tablet device such as an iPad,” “an e-reader such as a Kindle,” and “a digital audio player such as an iPod.” The scale’s reliability was poor,  $\alpha = .25$  ( $M=3.1$ ,  $SD=.65$ ). An EFA indicated a two factor solution with a tablet computer and an E-reader loading on the first factor. Reliability analysis of this first factor did not improve much,  $\alpha = .28$  ( $M=4.0$ ,  $SD=.91$ ). Laptop computer and digital audio player loaded on a second factor. Reliability analysis of the second factor showed minimal improvement,  $\alpha = .50$  ( $M=2.16$ ,  $SD=.98$ ). Due to the poor reliability of the updated technology cluster scale, this scale was removed from the analysis.

**Exercise technology cluster.** Participants were asked which of the following items they use. Responses range was 1, never to 5, very frequently. The items were summed to create an exercise technology cluster score, with scores between four (if participants did not use any items) to 20 (if participants used all of the items frequently). Which of the following items do you own? “a GPS based watch such as a Garmin, Nike or Timex,” “a Fitbit or Jawbone,” “a pedometer,” and “a heart rate monitor.” The scale’s reliability was solid, with  $\alpha = .80$  ( $M=6.70$ ,  $SD=3.25$ ).

**Narcissism.** The Narcissism Personality Index-16 (NPI-16) from Ames, Rose and Anderson (2006), is a shortened version of the NPI-40 (Raskin & Terry, 1988), with an alpha = .70. The 40 item scale has better reliability (.83 compared to .70) than the 16 item scale. Due to the length of the complete survey, the risk of participant fatigue was believed to be a greater threat to this study. Consequently, the 16 item scale was used. Non-narcissism items were scored as 1, and narcissism items scored as 2. Items were summed to produce a scale score between 16 to 32. However, the NPI scale produced an alpha of .42. This scale was removed from the analysis due to poor reliability.

**Well-Being scale.** This scale was taken from the Public Health Surveillance Well-Being Scale, developed for the CDC by Bann, Kobau, Lewis, Zack, Luncheon, and Thompson (2012). This scale is comprised of ten items and addresses physical, mental and social functioning. Questions 1-3 included: “I am satisfied with my life,” “My life has a clear sense of purpose” and “Most days I feel a sense of accomplishment from what I do.” Response range was from 1, strongly disagree to 5, strongly agree. Questions four and five included “How much of the time in the last 30 days have you felt cheerful?” and “How much of the time in the last 30 days have you felt hopeless?” Responses range from 1 (none of the time) to 5 (all of the time). Question five was reverse-coded. Questions 6-8 asked participants to indicate “on a scale of 1 to 10 how satisfied you are with each of the following items, where 1 means very dissatisfied and 10 means very satisfied, your family life, your social life and your energy level.” Question nine, “In general would you say your health is: Poor, Fair, Good, Very Good, Excellent?” Question ten, “In the past 30 days, for about how many days have you felt very healthy and full of energy? \_\_\_\_\_. None/ zero days. Don’t know.” Alpha was .70 (M=62, SD=13.9).

**Exercise self-efficacy scale.** This scale contained six sub-scales with three items each and was derived from Benisovich, Rossi, Norman, and Nigg (1998). Participants were asked how confident they were in their ability to exercise under a specified condition. The responses for this scale ranged from 1=Not at all confident, 2=Somewhat confident, 3=Moderately confident, 4=Very confident and 5=Completely confident. For example, the first question would read, “I am \_\_\_ confident in my ability to exercise when I am under a lot of stress”.

The first sub-scale, *negative affect* includes: “I am under a lot of stress,” “I am depressed” and “I am anxious.” Alpha was .82. (M=2.72, SD=.95).

*Excuse making*, the second sub-scale included: “I feel I don’t have time,” “I don’t feel like it” and “I am busy.” Reliability analysis indicated an alpha of .86. (M=2.3, SD=.96).

*Must exercise alone*, the third sub-scale, had a solid reliability (alpha=.86; M=3.27, SD=1.1). The following items were included: “I am alone,” “I have to exercise alone” and “My exercise partner decides not to exercise that day.”

The fourth sub-scale, *inconvenient to exercise*, contained the following items: “I don’t have access to exercise equipment,” “I am traveling,” and “My gym is closed.” The reliability of this scale was solid, with an alpha of .85 (M=2.48, SD=1.02).

*Resistance from others*, the fifth sub-scale, also demonstrated solid reliability, with an alpha of .87 (M=2.87, SD=1.1). Items in this scale included: “My friends don’t want me to exercise,” “My significant other does not want me to exercise,” and “I am spending time with family or friends who do not exercise,”

The last sub-scale, *bad weather*, contains the following items: “It’s raining or snowing outside,” “It’s cold outside,” and “The road or sidewalks are snowy.” Scale reliability was solid, with an alpha of .94 (M=2.68, SD=1.16).

**Exercise app self-efficacy scale.** This scale was adapted from Lin and Associates (2015), and included the following items: “I am confident in my ability to use smartphone exercise apps,” “I am confident in my ability to learn how to use smartphone exercise apps,” “I am confident in my ability to find help with my smartphone exercise app,” and “I am able to find help with smartphone exercise app if I have a problem.” Response range was from 1, strongly disagree to 7 strongly agree. This scale had high reliability with an alpha of .94 ( $M=21.7$ ,  $SD=5.0$ ).

### **Data Analysis**

Palmgreen and colleagues (1985) identified limitations of common statistical methods used to examine uses and gratifications research. Contending that while “such first-generation multivariate procedures as factor analysis, multidimensional scaling, multiple regression, and canonical correlation have been employed, the great majority of investigations have been concerned with only limited portions of the general model” (p. 36). The U&G research trend at that time was to limit the number of variables examined in a study, often to just bivariate relationships with controls in place. Consequently, researchers missed opportunities to fully understand the complete media use process with the various elements integrated into the complete theoretical model.

To address this limitation, Palmgreen et al. (1985) argued for future U&G studies to incorporate large multivariate models that utilize several categories of variables outlined by the U&G theory “that specify the complex relationships among these variables in a priori fashion” (p.36). This study followed the recommendation of Palmgreen et al. (1985) and examined three categories of uses and gratifications variables, a priori: needs, motives and media use. A fourth category emerged during model re-specification: perceived solutions.

Rosengren (1984) reasoned that second generation multivariate modeling techniques such as structural equation modeling allowed for the testing of such complex models, thus underscoring the recommendation of Palmgreen and colleagues (1985) to improve U&G measurement modeling. Based on the recommendation of Palmgreen and colleagues (1985), this study utilized structural equation modeling to examine the relationships among variables. Using SEM allows researchers the ability to simultaneously test total, direct, and indirect effects (Kline, 2011). Accordingly, SEM offers a complete picture of the theoretical process under examination. Consequently, hypothesis and research question testing were performed using SEM in AMOS 22, utilizing maximum likelihood estimation. The procedure used in this study for structural equation modeling is discussed in the subsequent section.

### **SEM Procedure**

The data was analyzed in a two-step process outlined by Anderson and Gerbing (1988). First, the measurement model was specified, estimated, and evaluated using confirmatory factor analysis. Next, the structural model was estimated and evaluated. This process was helpful because it could accommodate complex models that have six or more latent variables. Complex models are difficult to estimate and obtain a solid fit (Stephenson & Holbert, 2003). Given that this study included seven latent variables, it was appropriate to use the two step method. These two steps are discussed below beginning with the measurement model.

**Measurement model.** Following data collection, confirmatory factor analysis (CFA) was performed on each measure using AMOS 22.0. CFA allows for analysis of a priori measurement models where both the number of factors and their relationship to the indicators are specified (Kline, 2011). CFA considers the relationship of indicators and their error terms, latent variables

and their error terms, and the relationship between latent variables and the indicators (Kline, 2011). The CFA measurement model provides for a solid reliability estimate of measures.

Following the CFA, scales were examined to determine if items needed to be trimmed. This involves removing items that load poorly on the underlying factor. Generally, items that have values of .50 or less are considered poor, while values above .70 are solid items. Poor items were removed and the measurement model was examined for goodness of fit. Root Mean Square Error Approximation is one measure of fit. Browne and Cudeck (1993) indicate that a value of .05 suggests a good fit, while values  $\geq .10$  indicate a significant problem. If the measurement model indicated a good fit, the analysis moved onto the structural model, where relationships between variables were analyzed using structural equation modeling.

**Structural model.** The structural model tested the hypothesized relationships among variables as indicated in Figure 4. The structural model was examined for goodness of fit. If the model had poor fit, which is common in SEM (Holbert & Stephenson, 2003), the model was re-specified. This involved removing non-significant paths from the structural model and, if necessary, adding theoretically justified paths that were not included in the initial hypothesized model.

The present study proposed twenty-five different relationships in the form of hypotheses and research questions that were tested. If analysis were conducted using regressions, this would result in 25 significant tests, one for each proposed hypothesis or research question. As the number of significance tests increases, so does the likelihood of a false-positive, even when using a stricter p value. The use of structural equation modeling in this study limits the probability of Type I error (from conducting too many significance tests) by simultaneously examining all proposed direct, indirect, and total effects.



## Chapter Four: Results

### Hypothesis and Research Question Testing

The first hypothesis predicted that exercise history would be positively related to exercise self-efficacy. H1, which predicted Exercise Experience would be positively related to Exercise Self-Efficacy, received partial support, with Exercise Experience predicting the Exercise Alone subscale of Exercise Self-Efficacy ( $\beta=.32$ ,  $p<.001$ ). H3, which predicted Emotion would be positively related to Motives for exercise app use, also received partial support, as Positive Individualistic Emotion and Reptilian Power predicted self-monitoring ( $\beta=.34$ ,  $p<.001$  and  $\beta=.17$ ,  $p<.001$  respectively). H3 also received additional support, with positive prosocial emotion predicting personal goal achievement ( $\beta=.23$ ,  $p<.001$ ). H5, which predicted Motives would be positively related to Exercise App Use, received partial support as Personal Goal Achievement predicted Exercise App Use ( $\beta = .34$ ,  $p<.001$ ). H9, which predicted that Exercise Technology Cluster would predict Exercise App Use, received support ( $\beta=.32$ ,  $p<.01$ ). RQ3 sought to determine the role Gender played in Motives, finding a significant relationship between Gender and Self-Monitoring,  $\beta=.16$ ,  $p<.001$ , partially answering the second research question. Lastly, RQ4 examined the relationship between Exercise Self-Efficacy and Exercise App Use, results show that the Exercise Alone scale predicted Exercise App Use, ( $\beta=.14$ ,  $p<.001$ ), partially answering RQ4.

Despite the support observed here for several hypothesis and research questions, the initially hypothesized model (see Figure 2, Appendix A) had poor fit, with a RMSEA of .132, CFI of .369. The model was respecified by deleting statistically non-significant paths, non-significant variables and adding theoretically or conceptually justified paths. The next section details the respecification process.

**Deleted paths.** Exercise app self-efficacy approached significance as a predictor of exercise app use ( $\beta = .095$ ,  $p = .053$ , ns.), failing to support Hypothesis 2. Because of the non-significance and small effect on exercise app use, exercise app self-efficacy was removed from the hypothesized model.

Conceptually, it did not make sense to retain the weather sub-scale of exercise self-efficacy on exercise app use (see RQ3, hypothesized model). This variable was statistically significant ( $\beta = .25$ ,  $p < .001$ ) yet its influence on exercise app use was difficult to interpret, i.e., when the weather was bad, a person was more likely to use an exercise app. These concepts seem unconnected and their relationship appears to be dubious. Furthermore, current literature is silent on the relationship between exercising in poor weather and exercise app use. Consequently, the weather sub-scale was removed from the model.

The remaining four sub scales of the exercise self-efficacy scale on exercise app use were not significant. The negative affect sub scale ( $\beta = .009$ ,  $p = .84$ , ns.), excuse-making sub scale ( $\beta = -.024$ ,  $p = .60$ , ns.), inconvenient to exercise sub scale ( $\beta = .036$ ,  $p = .41$ , ns.) and resistance from others sub-scale ( $\beta = -.013$ ,  $p = .77$ , ns.). These sub-scales for exercise self-efficacy were removed from the hypothesized model.

The paths from Negative prosocial ( $\beta = .002$ ,  $p = .97$ , ns), negative individualistic ( $\beta = .06$  with  $p < .160$ , ns.) and Reptilian sex ( $\beta = -.047$ ,  $p = .310$ , ns) emotions to Goal Achievement (H3a) were not significant and were removed from the hypothesized model.

Negative prosocial ( $\beta = .06$ ,  $p = .29$ ), positive individualistic ( $\beta = .11$ ,  $p = .12$ , ns.) and the positive prosocial paths ( $\beta = .076$ ,  $p = .24$ , ns.) to competition (H3b) were not significant. These three paths were removed from the hypothesized model.

Negative prosocial ( $\beta = .11$ ,  $p = .61$ , ns.), positive individualistic ( $\beta = -.008$ ,  $p = .92$ , ns.) and positive prosocial ( $\beta = .08$ ,  $p = .23$ , ns.) variables on video game competition (H3c) were not significant and these paths were removed from the hypothesized model.

Positive individualistic ( $\beta = .03$ ,  $p = .71$ , ns.) and positive prosocial ( $B = .06$ ,  $p = .34$ , ns.) variables to informational social support (H3d) were not significant and were removed from the hypothesized model.

Additionally, the influence of positive individualistic ( $\beta = .03$ ,  $p = .67$ , ns.), and positive prosocial ( $\beta = -.003$ ,  $p = .90$ , ns.) variables on emotional social support (H3e) were not significant and were removed from the hypothesized model.

Negative prosocial ( $\beta = -.019$ ,  $p = .76$ , ns.), negative individualistic ( $\beta = .01$ ,  $p < .81$ , ns.) and positive prosocial ( $\beta = .035$ ,  $p = .56$ , ns.) emotion variables on self-monitoring (H3f) were not significant and were removed from the model.

Self-monitoring did not predict exercise app use ( $\beta = .034$ ,  $p = .46$ , ns.), failing to provide support for Hypothesis 4, thus necessitating the removal of the self-monitoring variable from the hypothesized model. However, this variable was re-conceptualized as a perceived solution variable based on the modification indices in Amos and based on theory as identified in Rosengren (1974). Consequently, self-monitoring was moved so that it followed emotion variables (as initially proposed) and proceeded motives variables (differing from the hypothesized model), specifically, proceeding the goal achievement variable. Self-monitoring in this new location significantly predicted personal goal achievement ( $\beta = .53$ ,  $p < .001$ )

The re-conceptualization of self-monitoring led to the removal of a statistically non-significant path. The positive prosocial emotion variable ( $\beta = -.053$ ,  $p > .3$ , ns.) was not a significant predictor of self-monitoring after the re-conceptualization of the self-monitoring

variable. Consequently, the path from the positive prosocial variable to self-monitoring was removed from the hypothesized model.

Competition did not predict exercise app use ( $\beta = .04$ ,  $p < .49$ , ns.), thus, Hypothesis 5a did not receive support. The competition variable was removed from the hypothesized model. Removing the competition variable from the model also removed two statistically significant variables on competition. Reptilian sex ( $\beta = .13$ ,  $p = .01$ ) and reptilian power ( $\beta = .16$ ,  $p = .01$ ) significantly predicted competition. As the competition variable, did not drive exercise app use, it did not make sense to retain the competition variable or any of the paths leading to and predicting this variable. Consequently, competition was removed from the hypothesized model, along with the reptilian sex and reptilian power paths that led to competition.

The competition video game variable on exercise app use was not significant ( $\beta = -.03$ ,  $p < .60$ , ns.), failing to support Hypothesis 5b. Thus, the competition video game variable was removed from the hypothesized model. The removal of this variable from the model led to the removal of two statistically significant paths from reptilian sex ( $\beta = .16$ ,  $p < .01$ ) and reptilian power ( $\beta = .16$ ,  $p < .05$ ) to the competition video game variable. Like the competition variable addressed in the previous paragraph, the competition video game variable and the two significant paths leading to this variable, were removed from the model.

Informational Social Support on Exercise App Use had a standardized beta of .018, which was not statistically significant ( $p < .73$ , ns). Hypothesis 6 did not receive support. Informational social support was thus removed from the hypothesized model. This necessitated that three statistically significant paths leading to informational social support also be removed. Negative prosocial ( $\beta = .16$ ,  $p < .01$ ), reptilian sex ( $\beta = .11$ ,  $p < .05$ ) and reptilian power ( $\beta = .15$ ,

$p < .05$ ) significantly predicted informational social support. These three paths and the informational social support variable were removed from the model.

Emotional Social Support on Exercise App Use had a standardized beta of  $-.001$ ,  $p < .98$ , ns. Therefore, Hypothesis 7 did not receive support. Emotional social support was removed from the hypothesized model. The removal of the emotional social support variable led to the deletion of three statistically significant paths from emotion variables to the social support variable. Negative prosocial, ( $\beta = .19$ ,  $p < .01$ ) reptilian sex ( $\beta = .19$ ,  $p < .001$ ) and reptilian power ( $\beta = .15$ ,  $p < .05$ ) significantly predicted emotional social support. The three paths from these variables to emotional social support along with the emotional social support variable were removed from the model.

The path from tech cluster to exercise app use was not significant, as the tech cluster variable was dropped from the analysis due to poor scale reliability ( $\text{Alpha} = .25$ ). Thus Hypothesis 8 did not receive support.

The path from the narcissism variable (NPI) to exercise app use was not significant ( $\beta = -.005$ ,  $p = .93$ , ns.), thus failing to support Hypothesis 10's expectation of a relationship between narcissism and exercise app use. With only one causal path emanating from the narcissism variable, this variable was removed from the model.

For RQ1a-d, the paths from sex ( $\beta = .075$ ,  $p = .130$ , ns.), income ( $\beta = .004$ ,  $p = .931$ , ns.) and education ( $\beta = -.031$ ,  $p = .530$ , ns.) to exercise app self-efficacy were not significant. These paths were removed from the hypothesized model. While race ( $\beta = .18$ ,  $p < .001$ ) was a significant predictor of exercise app self-efficacy, this path was deleted when the exercise app self-efficacy variable was removed (see Hypothesis 2).

The paths from sex ( $\beta = -.027$ ,  $p=.55$ , ns.), income ( $\beta = -.016$ ,  $p=.719$ , ns.), education ( $\beta = -.082$ ,  $p=.066$ , ns) and race ( $\beta = -.07$ ,  $p=.116$ , ns.) to exercise app use were all non-significant, which provided an explanation to RQ2a-d. These paths were removed from the hypothesized model.

The path from biological sex to self-monitoring was significant, ( $\beta = .16$ ,  $p=.001$ ), which provided an explanation for RQ3a. The path from sex ( $\beta = -.02$ ,  $p=.52$ , ns.), to emotional social support was not significant, which provided an explanation for RQ3b, this path was removed from the model. The path from sex ( $\beta = .10$ ,  $p=.62$ , ns.), to informational social support was not significant, which provided an explanation for RQ3c, this path was also removed from the model. The path from sex ( $\beta = .06$ ,  $p=.39$ , ns.), to competition was not significant, which provided an explanation for RQ3d, this path was also removed from the model. The path from sex ( $\beta = .08$ ,  $p=.31$ , ns) to personal goal achievement was not significant, which provided an explanation for RQ3e, this path was also removed from the model. The path from sex ( $\beta = .09$ ,  $p=.25$ , ns.), to competition video game was not significant, which provided an explanation for RQ3f, this path was also removed from the model.

Lastly, the path from exercise app use to the health outcome variable, GenPHSWB, was not significant ( $\beta = .08$ ,  $p=.115$ , ns), answering RQ 5. Thus, the health outcome variable was also removed from the model.

Removing the paths identified in the above section in addition to the re-conceptualization of the self-monitoring variable, improved the fit of the re-specified model, CFI=.968, RMSEA=.052,  $\chi^2 = 49.90$ ,  $df=24$ ,  $p=.001$  (see Figure 5). This indicates a good fitting model based on the recommendations of Browne and Cudeck (1993), who contend that a RMSEA of .05 indicates a good model fit.

## Chapter Five: Discussion

The rapid pace of diffusion of mobile apps, which took less than five years to reach 100 billion downloads (Ingraham, 2013; Rowinski, 2013), the trend for measuring and tracking health information, and with nearly a quarter of smartphone owners downloading a health and fitness app (Purcell, 2011), this study attempted to identify the uses and gratifications of smartphone exercise apps. A hybrid model of Uses and Gratifications theory, self-efficacy, and diffusion of innovations was used to examine exercise app use. Furthermore, this dissertation attempted to go beyond the uses and gratifications theory and looked at health outcomes from media use and considered the role of narcissism in media use. Lastly, this study attempted to deviate from traditional methods employed in uses and gratifications studies, simple bivariate relationships, (Palmgren, et al, 1985) by using structural equation modeling to examine the complex gratifications process. The results of this study, which will be discussed in additional detail below, showed that several hypotheses received support while others did not. Given the limited studies on exercise app use and even fewer studies on this topic framed by uses and gratifications, this dissertation may be viewed as a starting point for future research.

Hypothesis 1 predicted that *exercise experience* would predict *exercise self-efficacy*. This predicted path received partial support with *exercise experience* predicting the *exercise alone* sub-scale of the self-efficacy variable. Thus, the more exercise experience a person has, the more likely they are to exercise, even if this means they must exercise alone. Consequently, a person who has a lot of exercise experience will not let exercising alone be a deterrent to accomplishing their exercise goals. This seems consistent with the literature on self-efficacy (Bandura, 1986; 1997).

Hypothesis 2 predicted *exercise app self-efficacy* would predict *exercise app use*. When controlling for other variables this relationship failed to receive significant support. This seems surprising given the recent results of similar research which found self-efficacy to be important in media use (Kim, Jun, Han, Kim, M., & Kim, J. Y., 2013). One possible explanation for why exercise app self-efficacy may not be relevant to those who use exercise apps, is that participants of this study know how to use smartphone apps, perhaps making the relationship between self-efficacy and exercise app use, moot.

Hypothesis 3 considered *emotional needs* and their relationship to motives of *exercise app use*. This hypothesis received partial support, as *positive prosocial emotion* predicted *personal goal achievement*. While *self-monitoring* was initially conceptualized as a motive, it was later re-conceptualized (see the following paragraph) as a perceived solution variable. Because of the initial conceptualization of self-monitoring, the role of emotion in self-monitoring is considered in this section. Specifically, *reptilian power* and *positive individualistic* emotions predicted *self-monitoring*.

Hypothesis 4 proposed that *self-monitoring* would predict *exercise app use*. This hypothesis did not receive support. However, the modification indices of the hypothesized model suggested that *self-monitoring* should precede the motive variables, specifically a direct path to *personal goal achievement*. Upon closer examination, the *self-monitoring* variable appears to fit the description of what Rosengren (1974) described as a perceived solution variable. Rosengren (1974) suggests that a perceived solution is simply a way of solving a problem, acknowledging that a problem(s) can be solved in other ways besides media use. In his theoretical model, Rosengren (1974) contends that perceived solution variables follow basic need variables and precede motive variables. Conceptually, moving the *self-monitoring* variable



between the emotion variables and the motive variables made sense and was justified based on theoretical model discussed in Rosengren (1974).

Hypothesis 5a suggested that *video game*-like competition would predict *exercise app use* among males, consistent with the findings of Sherry and Lucas (2004; 2003). This hypothesis failed to receive support. One possible explanation for this may relate to the structure of exercise apps. Some could more closely resemble video games and have a more game-like interface while others do not, such as those exercise apps which simply track exercise. This study did not differentiate between the various exercise app types.

While Hypothesis 5b examined the relationship between exercise based *competition* on *exercise app use*. This study attempted to extend the findings of LaChausse (2006), Masters and Ogles, (1995), Markland and Ingledew, (2008; 1997) which found competition to be important for participants of endurance sports such as running and cycling, to the use of smartphone exercise apps. This hypothesis also failed to receive support.

Lastly, Hypothesis 5c, proposed that competition with self or *personal goal achievement* would influence *exercise app use*. This hypothesis did receive support, with *personal goal achievement* predicting *exercise app use*. This result appears to be consistent with the findings of Masters and Ogles (1995) and extends the use of their *personal goal achievement* scale to smartphone exercise app use. This finding also supports the contention of early mass media researchers which claimed that media users were aware of their media use and that media use was goal driven (for example, Rosengren, 1974; Katz, et al, 1974).

Hypothesis 6 examined the relationship between *informational social support* and *exercise app use*. This hypothesis was derived from the research of Walter and Boyd (2002) and Chen and Choi (2006) who identified the role that informational social support plays in the use

of the Internet. This study attempted to extend the role of informational social support derived from the Internet to the use of exercise app use. This hypothesis did not receive support. One potential explanation may stem from this study not differentiating the types of exercise apps. Some apps offer more of a social network site interface and feel such as Fitocracy (see Figure 1), and may be better suited to providing informational social support, when compared to other exercise apps that are used predominantly for exercise tracking.

Hypothesis 7 predicted *emotional social support* would influence smartphone *exercise app use*. This relationship was based on the work of Breton and colleagues (2011) and Carr and colleagues (2012), who identified the importance of exercise apps in (1) providing a means whereby users can communicate with others to receive support and (2) being able to comment on other member's exercise activities. This hypothesis did not receive support. Similar to Hypothesis 6, this study did not ask participants which exercise apps they used, which could have led to the lack of support for Hypothesis 7.

Hypothesis 8 considered the relationship between an *updated technology cluster* on exercise app use. The concept of *technology cluster* is based on the research of Rogers (2003; 1997; 1995). While the scale for this study attempted to update the technology scale of Vishwanath's (2010), to make it more relevant for exercise app use. This hypothesis did not receive support. Poor scale reliability of the updated technology cluster scale necessitated the removal of the scale from the study. Additionally, the items contained within the technology cluster scale may not have been relevant to a study of exercise apps. The scale could have been strengthened with a consideration of technology-related to exercise, which is discussed in the next paragraph.

Hypothesis 9 predicted smartphone *exercise-app use* based on the use of related exercise technology. The concept of *exercise technology clusters* was an attempt to extend Roger's (1995) technology cluster to the study of exercise app use. This hypothesis was statistically significant, providing additional support for Rogers (1995) technology cluster and building on recent studies that have found similar results (see Atkin, 1993; Vishwanath & Goldharber, 2003; Leung & Wei, 1998; Lin, 2009; Vishwanath et al., 2009; Hunt, Lin & Atkin, 2014). This result suggests that as technology becomes increasingly specialized, technology clusters should be updated to reflect this specialization. The technology cluster that has been typically used in the past (which included items such as: a phone with Internet capabilities, a phone that records or plays video, a phone that allows social networking site access, a digital audio player, and a wireless computer) appears to be no longer applicable given the specialized nature of emerging technology. Researchers should examine current technology cluster scales and if these scales appear to deviate too far from the concept of technology cluster as explicated by Rogers (1995), when compared to the innovation under examination, researchers should consider creating their own scale which more precisely reflects the qualities of the examined innovation.

Hypothesis 10 considered the relationship between *exercise app use* and *narcissism*. This relationship was derived from the research of Krishnan (2014) as well as Buffardi and Campbell (2008), which found narcissism related to different types of social network site use. This hypothesis did not receive support. The narcissism scale had poor alpha reliability and was dropped from the analysis. The poor reliability may stem from the use of the Narcissism Personality Index-16 (NPI-16) from Ames, et al., (2006), a shortened version of the NPI-40 (Raskin & Terry, 1988). The shorter scale used in this study had a lower reliability,  $\alpha = .70$  (Ames, Rose, & Anderson, 2006) compared to the 40 item which has an alpha of .83 (Raskin &

Terry, 1988). The 16 item scale was chosen in lieu of the 40 item scale in an effort to limit participant fatigue posed by the length of the study survey.

RQ1 examined the role of demographic variables, *age*, *income*, *sex* and *education* on *exercise app self-efficacy*. This was posed as a research question to address the apparent discrepancy in the literature, with the diffusion literature suggesting that generally, affluent, more educated males are earlier adopters (Rogers, 2003). Although early research on apps suggests a different adopter profile (CF Weiss, 2013; Duggan, 2013), the final model indicated that none of these demographic variables was a significant predictor of exercise app self-efficacy.

One potential explanation may stem from the ubiquity of smartphones, such that everyone owns one. Thus, income, sex, and education may not influence exercise app self-efficacy, as all of the study participants owned smartphones and are highly efficacious in their use, including exercise apps. Another potential explanation stems from the homogeneity of the study sample, particularly with regard to education and age, which may have negated the potential relationship that these two variables have on exercise app self-efficacy. Thus, older study participants--those who do not use smartphones or use smartphone apps--may predict exercise app self-efficacy. Finally, the diffusion of smartphone apps may be further along in the diffusion process, indicating demographic differences between adopters and non-adopters would no longer be relevant in predicting adoption, as these differences tend to dissipate as innovations diffuse (Rogers, 2003).

RQ2 examined the role of *income*, *sex*, *education* and *age* on *exercise app use*. Similarly, RQ2 was posed to examine apparent disagreements in the research literature. Analyses did not show any significant relationships between demographic variables and exercise app use. These

results may also be explained by the homogeneity of the study sample and by the late stage of diffusion for exercise apps.

RQ3a-f examined the influence of biological sex on motives to use smartphone exercise apps. Only one relationship was significant, which was female sex predicted self-monitoring. All other relationships were non-significant. One potential explanation for this result is that females are perhaps more motivated to exercise than the males of this study, for a variety of societal, environmental, and social influences.

RQ4 considered the role that *exercise self-efficacy* played on *exercise app use*. While there is plenty of research indicating the importance of self-efficacy in exercise, (see Bandura 1997; Benisovich, Rossi, Norman, & Nigg, 1998; Whipple, Kinney, & Kattenbraker, 2008) to date exercise self-efficacy has not been connected to exercise app use. Thus, the research question was purely exploratory. One of the exercise self-efficacy subscales, *must exercise alone*, significantly predicted exercise app use. The significance of this subscale may stem from those who exercise alone and thus take their phone in case of an emergency or getting lost. If their phone is with them, their thought might be to track their exercise since they have a phone, and thus use an exercise app. Another possible explanation is that those who exercise alone, for whatever reason (e.g., exercise partner is too slow/fast) use exercise apps to track their goals, consistent with Hypothesis 5c of this study.

The other five subscales--including; *bad weather*, *inconvenient to exercise*, *negative affect*, *excuse making* and *resistance from others*--did not significantly predict exercise app use. While the literature on exercise self-efficacy identifies the importance of being able to exercise during bad weather, when it is inconvenient, when a person receives resistance from others, when a person has negative feelings toward exercise and to overcome excuses (see Benisovich,

Rossi, Norman, & Nigg, 1998), the present study could not connect these sub-scales to exercise app use.

RQ5 examined the relationship between *exercise app use* and *general well-being*. This research question was based on the idea that those who exercise are generally healthier and feel better than their non-exercising peers, and that exercise app use equals exercise. The results of the analysis did not find a significant relationship between exercise app use and general wellbeing.

### **Strengths**

This study broke new ground on several research areas. To our knowledge, this study was the first to examine the motives of smartphone exercise app use within the uses and gratifications theory. While other studies have examined the motives of app users (e.g., Wei, Karlis, & Haught, 2012), this study went beyond the general health app category and looked specifically at smartphone exercise apps, extending the empirical research examined by uses and gratifications theory. Other contributions, which will be addressed in the next few paragraphs, include the development of a self-monitoring scale, an exercise app self-efficacy scale and an exercise technology cluster.

The self-monitoring scale created by this study, containing three items, had an alpha of .85, indicating solid reliability. As consumers increase their exercise app use and use them for non-traditional activities such as Nordic skiing, kite surfing, stand up paddling, or inline skating, the self-monitoring scale may prove useful to end users interested in monitoring these activities. Additionally, as the exercise technology market expands to wearable tech, the self-monitoring scale may provide insight into the uses and gratifications of as yet unstudied, and even undeveloped technology.

Additionally, this study added to the literature by developing and receiving support for an exercise app self-efficacy scale. This four item scale was adapted from Lin and Atkin (2015), and had high reliability with an alpha of .94 ( $M=21.7$ ,  $SD=5.0$ ). This scale could prove useful as researchers continue to examine and explore the motives, uses and gratifications of new technology, especially those technologies related to exercise.

Lastly, this study broke new ground through the creation of and found empirical support for an exercise technology cluster scale, which was predictive of exercise app use. This scale was based on the contention of Rogers (2003) which suggests that technology adopters typically use technology that is similar to the examined innovation. This study found that participants who used exercise apps also used a GPS watch, a heart rate monitor, a pedometer and some type of wearable exercise technology such as a Fitbit. These four items comprise the exercise technology cluster and may be useful in examining future technology focused on tracking exercise.

### **Theory Building.**

Recently, the Uses and Gratifications theory has been utilized to explain two technological revolutions brought on by 1. the Internet and 2. mobile phones. Arguably, a third revolution may be occurring, one involving the rampant use of mobile apps. Cheng (2012) suggests the mobile app is the process of this era, with the potential “to influence consumers in a similar fashion as Microsoft Office” (p. 49). Additionally, given that app sales are projected to reach \$26 billion in 2013 with 102 billion downloads (Cheng, 2012), Cheng may indeed be correct.

To improve the Uses and Gratifications theory and to make it more useful for future researchers, this study attempted to address a common criticism related to uses and gratifications

research: the frequent use of bivariate relationships (Palmgreen et al, 1985). This study provided support for a complex, theoretically based, causal model, consistent with the call of Palmgreen and colleagues (1985). Specifically, this study found support for a four variable uses and gratifications causal model. These variables and their relationships were identified a priori, another recommendation by Palmgreen et al (1985). The causal process begins with basic needs, which in this study was identified as emotions. The basic needs variable led to perceived solutions variable, which led to motives variable, which in turn ended with media use. Four additional variables of the study were significant predictors of the outcome variable and enhanced the predictive powers of the final model. These variables included sex, which drove self-monitoring. Exercise technology clusters which predicted media use. And a two variable causal chain of exercise experience which led to the exercise alone variable, and in turn this chain predicted media use.

Another critique, related to the use of bivariate or simple theoretical models, is the statistical tools used frequently in uses and gratifications research, such as correlation or simple regression. Methodologically, this study followed the recommendation of Rosengren (1984) to utilize more complex statistical tools, such as structural equation modeling, when measuring and examining the complex media selection process. The results of this study provide support for this call, indeed with widespread availability of statistical tools such as SPSS, and easy access to scholarly studies, researchers may have no excuse to not utilize complex causal models and similarly complex statistical tools like structural equation modeling to examine the media use process. Future uses and gratifications research should continue to build on complex multivariate causal models to better understand the media use process.



Based on the theoretical support discussed in the two previous paragraphs, it appears Uses and Gratifications theory is well-suited to examine state of the art technology, consistent with Ruggiero, 2000. Scholars should continue to utilize this theory to understand the uses of mobile apps (Weiss, 2013). This is especially important as the mobile app landscape continues to change, new apps are added each day, and new categories of apps emerge. In the App store, users can find twenty-three different app categories. Scholars need to examine these to see if the apps are representative of the category. For example, there is currently not an exercise category; these apps are located under health and fitness. With so many different app categories, scholars should examine gratification differences among them (Weiss, 2013). This study attempted to address this deficiency by suggesting exercise apps may provide different gratifications when compared with apps from other categories, such as news and games. Results provide support for a multifaceted model of exercise app adoption and use that can supplement conventional approaches focused on sociodemographics.

For example, the participants in this study were emotionally driven, which in turn led to the desire to self-monitor exercise. The results suggest this desire for self-monitoring had a larger purpose, to keep track of exercise goals or to achieve exercise based goals. And it was this causal sequence that drove exercise app use, that was center stage, so to speak. While the contribution of typical demographic variables was barely in the periphery, with only female sex predicting self-monitoring and even then, the contribution to the overall model was small.

Understanding the needs, motives, and gratifications of smartphone exercise apps may lead to a better understanding of communication and media use, at the macro level. Scholars may try to understand the long term societal implications associated with smartphone exercise app use. What are the issues associated with demographics? Does the digital divide influence the

exercise app society as well? While the mobile exercise app society continues to change, and as scholars seek to address individual and global level use, U&G theory is well positioned to examine media use dynamics (Rubin, 2002).

### **Limitations**

An important limitation of this study is the study sample. And this despite the study sample of college students being an important target for technology use (Atkin, 1993) and heavy users of apps according to recent research (see Purcell, 2011). Study participants were all about the same age with a narrow standard deviation, this narrow age range may not accurately reflect all exercise app users. Similarly, study participants were predominantly Caucasian and had roughly the same amount of education. This narrow range for sociodemographic markers may not reflect the typical demographic profile of exercise app users and limits the generalizability of study findings.

### **Future Research Directions**

Future research should seek out a sample population that uses exercise apps more frequently than the participants of this study. Exercise app use of this study population, average age of 19.3 years, predominantly Caucasian, was lower than expected, with participants using exercise apps an average of three times per month for about 35 minutes per use. This raises several questions about exercise apps and this study population. First, are there users who utilize exercise apps more frequently than three times per month? If so, what is their demographic makeup and how do their motives differ from those of college age users?

Second, the data of this study suggests that there is a difference between downloading an exercise app and actual exercise app use. This seems to contradict a recent Pew Report (Duggan, 2013), which suggests that smartphone users in the college age demographic are some of the

heaviest users of apps, with 77 percent of this age group downloading apps, compared to the next age group, at 59 percent. Granted, the Pew Report (Duggan, 2013) did not ask about exercise app use, only downloads. Nevertheless, if exercise app downloads do not equal exercise app use, what are the motives of users who download exercise apps? And how do they differ from the motives of those users who actually utilize exercise apps?

Additionally, study participants used related exercise technology--such as a GPS watch, a pedometer, a heart rate monitor and wearable health tech--less than expected. A GPS watch was the most frequently used exercise technology, with a mean of 1.89, SD=1.23, on a five-point scale. Thus, study participants rarely use a GPS watch. Similarly, if there is a demographic that uses exercise apps more frequently, would they also use related exercise technology more frequently? The diffusion of innovations suggests yes. Nevertheless, researchers should continue to pursue the link of exercise technology clusters with exercise app use, as empirical support for this relationship may expand the understanding of the motives, the uses and the gratifications of users.

Future research on smartphone exercise app use should consider differences among the large variety of exercise apps. One difference that could be explored is that of data collection, i.e., automated, compared to manual. This could involve apps that allow users to track and self-monitor their exercise automatically, such as Strava and Map My Run, compared with those that require the user to manually enter their exercise information once complete, such as Fitocracy. What are the motives of Fitocracy app users? If they are unable to self-monitor their exercise, why are they used? Are they utilized because some apps are more optimal for socializing? If so, then perhaps the motives for those who utilize smartphone exercise apps that require manual entry would be similar to the uses and gratifications of social network sites.

## References

- Anderson, J.C., & Gerbing, D.W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin*, 103 (3), 411-423.
- Annesi, J. J. (2012). Self-regulatory skills usage strengthens the relations of self-efficacy for improved eating, exercise, and weight in the severely obese: Toward an explanatory model. *Behavioral Medicine*, 37, 71-76.
- Atkin, D. J. (1993). Adoption of cable amidst a multimedia environment. *Telematics and Informatics*, 10, 51-58.
- Atkin, D. J. (2002). Convergence across media. In C.A. Lin & D.J. Atkin (Eds.), *Communication technology and society: audience adoption and uses* (pp.23-41). Cresskill, NJ: Hampton Press.
- Atkin, D., Hunt, D., & Lin, C.A. (2015). Diffusion theory in the new media environment: Towards an integrated model of technology adoption. *Mass Communication & Society*, 18, 623-650.
- Atkin, D. J., Jeffres, L. W., & Neuendorf, K. A. (1998). Understanding internet adoption as telecommunications behavior. *Journal of Broadcasting & Electronic Media*, 42(4), 475-490.
- Atkin, D. J., Neuendorf, K. A., Jeffres, L. W., & Skalski. (2003). Predictors of audience interest in adopting digital television. *Journal of Media Economics*, 16 (3), 159-173.
- Augemberg K. (2012). Building that Perfect Quantified Self App: Notes to Developers, Part 1. Retrieved from: [www.measuredme.com/2012/10/building-that-perfectquantified-self-app](http://www.measuredme.com/2012/10/building-that-perfectquantified-self-app)
- Ayabe, M., Brubaker, P. H., Mori, Y., Kumahara, H., Kiyonaga, A., Tanaka, H., & Aoki, J. (2010). Self-monitoring moderate-vigorous physical activity versus steps/day is more Effective in chronic disease exercise programs. *Journal of Cardiopulmonary Rehabilitation and Prevention*, 30 (2) 111-115.

- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Freeman.
- Bann, C., Kobau, R., Lewis, M., Zack, M., Luncheon, C., & Thompson, W. (2012). Development and psychometric evaluation of the public health surveillance well-being scale. *Quality Of Life Research*, 21(6), 1031-1043.
- Bartsch, A., Mangold, R., Viehoff, R., & Vorderer, P. (2006). Emotional gratifications during media use – An integrative approach. *Communications: The European Journal Of Communication Research*, 31(3), 261-278.
- Bartsch, A., Viehoff, R., & Mangold, R. (2010). Emotional Gratification in Media Use: Exploring Experiential and Functional Types of Entertainment Gratification. *Conference Papers -- International Communication Association*, 1.
- Bartsch, A., Vorderer, P., Mangold, R., & Viehoff, R. (2008). Appraisal of emotions in media use: toward a process model of meta-emotion and emotion regulation. *Media Psychology*, 11(1), 7-27.
- Bechara, A., Damasio, H., Damasio, A.R., & Lee, G.P. (1999). Differential Contributions of the Human Amygdala and Ventromedial Prefrontal Cortex to Decision-Making. *Journal of Neuroscience*, 19, 5473-5481.
- Benisovich, S. V., Rossi, J. S., Norman, G J., & Nigg, C. R. (1998). A multidimensional approach to exercise self-efficacy: Relationship with exercise behavior and attitudes towards exercise. Paper presented at the Annual Meeting of the New England Psychological Association, Boston, MA.

- Blackburn G. (1995). Effect of degree of weight loss on health benefits. *Obesity Research*, 2, 211s–216s.
- Breton, E.R., Fuemmeler, B.F., & Abroms, L.C. (2011). Weight loss-there is an app for that! But Does it adhere to evidence informed practices? *Translational Behavioral Medicine*.
- Bonds-Raacke, J., & Raacke, J. (2010). MySpace and Facebook: Identifying dimensions of uses and gratifications for friend networking sites. *Individual Differences Research*, 8(1), 27-33.
- Buck, R. (1985). Prime theory: An integrated view of motivation and emotion. *Psychological Review*, 92, 389-413.
- Buck, R. (1988). *Human Motivation and Emotion* (2<sup>nd</sup> ed.). John Wiley and Sons, Inc.
- Buck, R. (1999). The biological affects: A typology. *Psychological Review*, 106(2), 301-336.
- Buffardi, L., & Campbell, W. (2008). Narcissism and social networking web sites. *Personality and Social Psychology Bulletin*, 34(10), 1303-1314.
- Campbell, D. T., & Stanley, J. C. (1963). *Experimental and quasi-experimental designs for research*. Chicago, IL: Rand McNally.
- Carels, R. A., Darby, L. A., Rydin, S., Douglass, O. M., Caccaiapaglia, H. M., & O'Brien, W. H. (2005). The relationship between self-monitoring, outcome expectancies, difficulties with eating and exercise, and physical activity and weight loss treatment outcomes. *Annals of Behavioral Medicine* 30 (3) 182-190.
- Carr, L. J., Dunsiger, S. I., Lewis, B., Ciccolo, J. T., Hartman, S., Bock, B., Dominick, G., & Marcus, B. H. (2012, July 23). Randomized Controlled Trial Testing an Internet Physical Activity Intervention for Sedentary Adults. *Health Psychology*. Advance online publication. doi: 10.1037/a0028962

- Chang, B., Lee, S., & Kim, B.S. (2006). Exploring factors affecting the adoption and continuance of online games among college students in South Korea: integrating uses and gratification and diffusion of innovation approaches. *New Media & Society*, 8(2), 295-319.
- Cheng, C. W. (2012). The system and self-reference of the app economy: The case of angry birds. *Westminster Papers in Communication & Culture*, 9(1), 47-66.
- Choi, A., & Chen, W. (2006). Online Social Support and Intercultural Adaptation. *Conference Papers -- International Communication Association*, 1-29.
- Conn, V.S., Burks, K.J., Pomeroy, MS., Ulbrich, S.L., Cochran, J.E. (2003). Older women and exercise: Explanatory concepts. *Women's Health Issues*, 13, 158-166.
- Cowan, L.T., Van Wagenen, S.A., Brown, B.A., Hedin, R.J., Seino-Stephan, Y., Hall, P.C., & West, J. (2012). Apps of steel: Are exercise apps providing consumers with realistic expectations? A content analysis of exercise apps for presences of behavior change theory. *Health Education Behavior*, 17 September 2012.
- Crocker, L., & Algina, J. (1986). *Introduction to classical and modern test theory*. Florida. Harcourt Brace Jovanovich.
- Duggan, M. (2013). *Cell phone activities 2013*. Retrieved from <http://www.pewinternet.org/2013/09/19/cell-phone-activities-2013/>
- Faul, F., Erdfelder, E., Lang, A.G., & Buchner, A. (2007). G\*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, 39, 175-191.
- Ferrer, R. A., Fisher, J. D., Buck, R., & Amico, K. R. (2011). Pilot test of an emotional education intervention component for sexual risk reduction. *Health Psychology*, 30(5), 656-660.

- Fogg, J. (2003). *Persuasive Technology: Using Computers to Change What We Think and Do*. Morgan Kaufman Publishers, San Francisco, CA.
- Fowler, F. J., Jr. (2009). *Survey Research Methods (4<sup>th</sup> ed.)*. Thousand Oaks, CA: Sage Publications.
- Fox, S., and Duggan, M. (2012). Mobile health 2012. Half of smartphone owners use their devices to get health information and one-fifth of smartphone owners have health apps. Pew Internet & American Life Project.  
<http://pewinternet.org/Reports/2012/Mobile-Health.aspx>
- Finkelstein, E.A., Trogon, J.G., Cohen, J.W., & Dietz W. (2009). Annual medical spending attributable to obesity: payer-and service-specific estimates. *Health Affairs*. 28(5)822-31.
- Helsel, D. L., Jakicic, J. M., & Otto, A. D. (2007). Comparison of techniques for self-Monitoring, eating and exercise behaviors on weight loss in a correspondence-Based intervention. *Journal of the American Dietetic Association*, 107 (10) 1807-1810.
- Hunt, D., Atkin, D., & Krishnan, A. (2012). The Influence of Computer-Mediated Communication Apprehension on Motives for Facebook Use. *Journal of Broadcasting & Electronic Media*, 56(2), 187-202.
- Hunt, D., Atkin, D., & Lin, C. (2014). Communicating social relationships via the use of photo messaging. *Journal of Broadcasting & Electronic Media*, 58 (2), 234-252.
- Hurt, H. T., Joseph, K., & Cook, C. D. (1977). Scales for the measurement of innovativeness. *Human Communication Research*, 4, 58-65.
- Ingledeu, D.K. & Markland, D. (2008). The role of motives in exercise participation. *Psychology and Health*, 23, 807-828.



- Ingraham, N. (2013). Apple Announces One Million Apps in the App Store. Retrieved from:  
<http://www.theverge.com/2013/10/22/4866302/apple-announces-1-million-apps-in-the-app-store>
- Ironman.com (n.d.). Events. Retrieved from:  
<http://www.ironman.com/events/triathlon-races.aspx?d=ironman#axzz3o0AXFNey>
- Johnson, T J., & Kay, B. K. (2003). A boom or bust for democracy: How the internet influences Political attitudes and behaviors. *Harvard International Journal of Press/Politics*, 8(3), 9-34.
- Joo, J. & Sang, Y. (2013). Exploring Koreans' smartphone usage: An integrated model of the Technology acceptance model and uses and gratifications theory. *Computers in Human Behavior*, 29, 2512-2518.
- Kalichman, S. C., Cherry, C., Cain, D., Pope, H., Kalichman, M., Eaton, L., Weinhardt, L., & Benotsch, E.G. (2006). Internet-based health information consumer skills intervention for people living with HIV/AIDS. *Journal of Consulting and Clinical Psychology*, 74 (3), 545-554.
- Kahneman, D. (2003). A Perspective on Judgment and Choice: Mapping Bounded Rationality. *American Psychologist*, 58, 697-720.
- Katona, Z., P.P., Zubcsek, & M., Sarvary, (2007). Network effects and personal influences: the diffusion of an online social network. *Journal of Marketing Research*, 48, 425-443.
- Katz, E., Blumler, J, & Gurevitch, M. (1974). Utilization of mass communication by the individual. In J. Blumler & E. Katz (Eds.), *The uses of mass communication: Current perspectives on gratifications research* (pp. 19–34). Beverly Hills, CA: Sage.

- Kaye, B. K., & Johnson, T. J. (2002). Online and in the know: Uses and Gratifications of the Web for political information. *Journal of Broadcasting & Electronic Media*, 46(1), 54-71.
- Kenny, D.A., & McCoach, D.B. (2003). Effect of the number of variables on measures of fit in structural equation modeling. *Structural Equation Modeling*, 10, 333-351.
- Kingsley-Hughes, A. (2011, July 6). iOS gaming is where the money's at for mobile developers, *ZDNet*. Retrieved from <http://www.zdnet.com/blog/hardware/ios-gaming-is-where-the-moneys-at-for-mobile-developers/13561>
- Kline, R. B. (2011). *Principles and practices of structural equation modeling* (3<sup>rd</sup> ed.). NY: The Guilford Press.
- Krishnan, A. & Atkin, D. (2014). Individual differences in social networking site users: The interplay between antecedent variables and the subsequent effect on level of activity. *Computers in Human Behavior*, 30 (November), 111-118.
- LaChausse, R.G. (2006). Motives of competitive and non-competitive cyclists. *Journal of Sport Behavior*, 29, 4, 304-314.
- Lago, C. & Atkin, D. (2015). Health anxiety in the digital age. *Computers in Human Behavior*, 52 (November), 484-491.
- Leung, L., & Wei, R. (1998). Factors influencing the adoption of interactive TV in Hong Kong: implications for advertising. *Asian Journal of Communication*, 8 (2), 124- 147.
- Leung, L., Wei, R., 1999. Who are the mobile phone have-nots? Influences and consequences. *New Media and Society* 1 (2), 209–226.

- Li, X. (2013). Innovativeness, personal initiative, news affinity and news utility as predictors of the use of mobile phones as news devices. *Chinese Journal of Communication*, 6(3), 350-373.
- Lin, C.A. (1998). Exploring personal computer adoption dynamics. *Journal of Broadcasting & Electronic Media*, 42, 95-112.
- Lin, C.A. (2004). Webcasting adoption: technology fluidity, user innovativeness, and media substitution. *Journal of Broadcasting & Electronic Media*, 48(3), 446-465.
- Lin, C.A. (2009). Exploring the online radio adoption decision-making process: Cognition, attitude, and technological fluidity. *Journalism & Mass Communication Quarterly*, 86(4), 884-899.
- Lin, C.A., & Associates. (2015). Ethnicity, the digital divide and uses of the Internet or health information. *Computers in Human Behavior*, 51, 216-223.
- Ma, T. & Atkin, D. (in press). User generated content and credibility evaluation of online health information: A meta analytic study. *Telematics & Informatics*, posted online at <http://www.sciencedirect.com/science/article/pii/S0736585316302556>
- Markland, D. & Ingledew, D.K. (1997). The measurement of exercise motives: Factorial validity and invariance across gender of a revised Exercise Motivations Inventory. *British Journal of Health Psychology*, 2, 361-376.
- Masters, K.S., & Olges, B.M. (1995). An investigation of the different motivations of marathon runners with varying degrees of experience. *Journal of Sport Behavior*, 18, 69-80.
- Masters, K.S., Ogles, B.M., & Jolton, J.A. (1993). The development of an instrument to measure motivation for marathon running: The motivations of marathon scales (MOMS). *Research Quarterly for Exercise and Sport*, 64, 134-143.

- McAuley, E., Jerome, G. J., Marquez, D. X., Elavsky, S., & Blissmer, B. (2003). Exercise Self-efficacy in older adults: Social, affective and behavioral influences. *Annals of Behavioral Medicine* 25(1): 1-7.
- Millington, B. (2014). Smartphone apps and the mobile privatization of health and fitness. *Critical Studies in Media Communication*. 31(5), 479-493.
- Mokdad, A.H., Ford, E.S., Bowman, B.A., Dietz, W.H., Vinicor, F., Bales, V.S., & Marks, J.S. (2003). Prevalence of obesity, diabetes, and obesity-related health risk factors, 2001. *Journal of the American Medical Association* 1; 289 (1):76–9.
- Must, A., Spadano, J., Coakley, E.H., Field, A.E., Colditz, G., & Dietz, W.H. (1999). The disease burden associated with overweight and obesity. *Journal of the American Medical Association*. 27;282 (16):1523-1530.
- Ogden, C.L., Carroll, M.D., Kit, B.K., & Flegal, K.M. (2014). Prevalence of childhood and adult Obesity in the United States, 2011-2012. *JAMA*, 311(8), 806-814.
- Palmgreen, P., Wenner, L. A., & Rosengren, K. E. (1985). Uses and gratifications research: The past ten years. In K. E. Rosengren, L. A. Wenner, & P. Palmgreen (Eds.), *Media gratifications research: Current perspectives* (pp. 11-37), Beverly Hills, CA: Sage.
- Papacharissi, Z., & Mendelson, A. (2011). Toward a new(er) sociability: uses, gratifications and social capital on Facebook. In S. Papathanassopoulos (Ed.), *Media perspectives for the 21st century* (pp.212-230). London: Routledge.
- Papacharissi, Z., & Rubin, A. M. (2000). Predictors of Internet use. *Journal of Broadcasting and Electronic Media*, 44 (2), 175-196.
- Park, N., Kim, Y., Shon, H., & Shim, H. (2013). Factors influencing smartphone use and dependency in South Korea. *Computers In Human Behavior*, 29(4), 1763-1770.

- Park, N., & Lee, H. (2012). Social implications of smartphone use: Korean college students' smartphone use and psychological well-being. *Cyberpsychology, Behavior, And Social Networking*, 15(9), 491-497.
- Purcell, K. (2011). *Half of Adult Cell Phone Owners have Apps on their Phones*. Retrieved From: <http://www.pewinternet.org/2011/11/02/half-of-adult-cell-phone-owners-have-apps-on-their-phones/>
- Rabin, C., & Bock, B. (2011). Desired features of smartphone applications promoting physical activity. *Telemedicine and e-Health* 17(10), 301-303.
- Rogers, E. M. (1995). *Diffusion of Innovations*, Fourth Edition. New York: Free Press.
- Rogers, E. M. (1997). Diffusion of new media: new directions. *Mass Communication Review*, 24(1/2), 75-81.
- Rogers, E. (2003). *Diffusion of Innovations, Fifth Edition*. The Free Press, A Division of Simon & Schuster Inc.: New York, NY
- Rogers, E. (2004). A prospective and retrospective look at the diffusion model. *Journal of Health Communication*, 9, 13-19.
- Rosengren, K. E. (1974). Uses and gratifications: A paradigm outlined. In J. G. Blumler & E. (Eds.), *The uses of mass communications: Current perspectives on gratifications research* (pp.269–286). Beverly Hills, CA: Sage.
- Rowinski, D. (2013). Google Play Hits One Million Android Apps. Retrieved from: <http://readwrite.com/2013/07/24/google-play-hits-one-million-android-apps#awesm=~omkwAyuNCCXDYB>

- Rubin, A.M. (2009). Uses and gratifications perspective on media effects. In J Bryant & M.B. Oliver (Eds.), *Media effects: Advances in theory and research* (pp. 165-184). New York, NY: Routledge.
- Sheldon, P. (2008). The relationship between unwillingness to communicate and students' Facebook use. *Journal of Media Psychology*, 20, 67-75.
- Shin, Y., Jang, H., & Pender, N.J. (2001). Psychometric evaluation of the exercise self-efficacy scale among Korean adults with chronic diseases. *Research in Nursing and Health* 24 68-76.
- Singer, E. (2011). The Measured Life. Retrieved from:  
<http://www.technologyreview.com/featuredstory/424390/the-measured-life/>
- Singleton, R. A., Jr., & Straits, B. C. (2005). *Approaches to Social Research* (4<sup>th</sup> ed.). New York, NY US: Oxford University Press.
- Snyder, M. (1974). Self-monitoring of expressive behavior. *Journal of Personality and Social Psychology*, 30, 526-537.
- Snyder, M. (1979). Self-monitoring processes. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 12, pp. 85-128). New York: Academic Press.
- Snyder, M. (1987). *Public appearances/public realities: The psychology of self-monitoring*. New York: Freeman.
- Stephenson, M.T, & Holbert, R. L. (2003). A Monte Carlo simulation of observed versus latent variable structural equation modeling techniques. *Communication Research*, 30 (3), 332- 354.
- Strizhakova, Y., Kang, Y., & Buck, R. (2007). Assessment of Emotional Gratifications: Development of the EGRATS Scale. *Media Psychology*, 10(1), 91-112.

Ultrarunning.com. (n.d.). Participation. Retrieved from:

<http://www.ultrarunning.com/featured/2013-ultrarunning-participation-by-the-numbers/>,

USA Triathlon.org (n.d.). Demographics. Retrieved from:

<http://www.usatriathlon.org/about-multisport/demographics.aspx>

Verkasalo, H., López-Nicolás, C., Molina-Castillo, F. J., & Bouwman, H. (2010). Analysis of users and non-users of smartphone applications. *Telematics & Informatics*, 27(3), 242-255.

Vishwanath, A., Brodsky, L., & Shaha, S. (2009). Physician adoption of personal digital assistants (PDA): testing its determinants with a structural equation model. *Journal of Health Communication*, 14, 77-95.

Vishwanath, A., & Goldhaber, G. (2003). An examination of the factors contributing to adoption decisions among late-diffused technology products. *New Media & Society*, 5(4), 547-572.

Wang, F., McDonald, T., Bender, J., Reffitt, B., Miller, A., & Edington, D.W. (2006). Association of healthcare costs with per unit body mass index increase. *Journal of Occupational and Environmental Medicine* 48, 668-674.

Wei, R. (2001) From Luxury to Utility: A Longitudinal Analysis of Cellphone Laggards. *Journalism and Mass Communication Quarterly* 78(4): 702–19.

Wei, R. (2008). Motivations for using the mobile phone for mass communications and entertainment. *Telematics and Informatics*, 25, 3-46.

Wei, R., Karlis, J., & Haught, M.J. (2012). Apps, apps, and more apps: A uses and gratification study of app use. (2012). *Conference Papers -- International Communication Association*, 1-25.

- Weiss, A. (2013). Exploring news apps and location-based services on the smartphone. *Journalism & Mass Communication Quarterly*, 90(3), 435-456.
- Wejnert, B. (2002). Integrating models of diffusion of innovations: A conceptual framework. *Annual Review of Sociology*, 28, 297-326.
- Whipple, K., Kinney, J., & Kattenbraker, M. (2008). Maintenance of physical activity among faculty and staff in a university settings. *The Health Educator*, 40(1), 21-28.
- Wing, R. R., Papandonatos, G., Fava, J. L., Gorin, A. A., Phelan, S., McCaffery, J., & Tate, D. F. (2008). Maintaining large weight losses: The role of behavioral and psychological factors. *Journal of Consulting and Clinical Psychology*, 76, 1015-1021.
- Womble, L.G., Wadden, T., McGuckin, B.G., Sargent, S.L., Rothman, R.A., & Krauthamer-Ewing, E.S. (2004). A randomized controlled trial of commercial internet weight loss program. *Obesity Research* 12, 1011–1018.
- Zillmann, D. (2000). Mood Management in the context of selective exposure theory. In M. F. Roloff (Ed.), *Communication Yearbook*, 23, pp. 103-123). Thousand Oaks, CA: Sage.



## Appendix A.

Table 1.

*Variables: Means, SD's and Reliabilities (N=393)*

<b>Variable</b>	<b>M</b>	<b>SD</b>	<b><math>\alpha</math></b>
Competition	4.22	1.4	0.93
Competition Video Game	3.77	1.36	0.88
Personal Goal Achievement	4.98	1.35	0.93
Informational Social Support	3.98	1.4	0.85
Emotional Social Support	3.6	1.38	0.79
Exercise App Self-Monitoring	5.55	1.16	0.85
Exercise App Use	16.6	7.1	0.7
Technology Cluster*	4	0.91	0.25
Exercise Technology Cluster	6.7	3.25	0.8
Narcissism*	22.93	6.63	0.49
Well Being	62	13.9	0.7
<b>EGRATS Sub-Scales</b>			
Negative Prosocial	2.1	1.1	0.82
Negative Individualism	2.5	1.35	0.72
Positive Individualism	5.6	1.06	0.88
Positive Prosocial	5.1	1.3	0.7
Reptilian Power	5.4	1.2	0.84
Reptilian Sex	3.14	1.5	0.82
<b>Exercise Self-Efficacy Scales</b>			
Negative Affect	2.72	0.95	0.82
Excuse Making	2.3	0.96	0.86
Must Exercise Alone	3.27	1.1	0.86
Inconvenient to Exercise	2.48	1.02	0.85
Resistance from Others	2.87	1.1	0.87
Bad Weather	2.68	1.16	0.94

Note:\*Variables were dropped from the final model due to poor scale reliability.

Table 2.  
Results of Confirmatory Factor Analysis for Motive Variables (N=393)

Item	1	2	3	4	5	6
To improve my speed	<b>0.79</b>	0.18	###	0.17	0.05	0.27
To compete with myself	<b>0.85</b>	0.17	0.14	0.15	0.01	- 0.09
Try to become faster	<b>0.86</b>	0.19	###	0.16	0.06	0.19
To push myself beyond my current limits.	<b>0.86</b>	0.13	0.11	0.18	- 0.01	- 0.20
To see if I can beat a certain time.	<b>0.79</b>	0.16	0.03	0.25	0.10	0.02
To make my body perform better than before.	<b>0.81</b>	0.11	0.12	0.21	0.05	- 0.22
Because I like trying to win in physical activities	0.17	<b>0.82</b>	0.14	0.00	0.23	0.07
Because I enjoy competing	0.17	<b>0.89</b>	0.08	0.02	0.20	0.01
Because I find physical activities fun, especially when competition is involved	0.26	<b>0.86</b>	0.06	0.14	0.12	- 0.03
Because I enjoy physical competition	0.24	<b>0.85</b>	0.06	0.10	0.17	0.05
Seek encouragement	0.15	0.05	<b>0.71</b>	0.14	0.11	0.02
Share your private worries and fears	- 0.02	0.06	<b>0.61</b>	###	0.11	0.68
Seek someone to listen to you	- 0.09	0.13	<b>0.64</b>	###	0.12	0.61
I like to see how far I've gone	0.30	0.03	0.10	<b>0.82</b>	- 0.05	- 0.18
When I exercise I like to see my speed	0.38	0.02	0.01	<b>0.77</b>	0.11	0.18
I like to see how long I have been exercising	0.27	0.08	0.10	<b>0.84</b>	- 0.08	- 0.04
I like to play to prove to my friends that I am the best.	0.05	0.60	0.22	###	<b>0.55</b>	0.11
When I lose to someone, I immediately want to play again in an attempt to beat him/her	0.05	0.58	0.16	###	<b>0.60</b>	- 0.05
It is important to me to be the fastest and most skilled person playing the game.	0.06	0.54	0.12	###	<b>0.69</b>	0.08
I get upset when I lose to my friends.	0.08	0.30	0.11	0.04	<b>0.82</b>	0.06
Seek information to better understand a situation?	0.04	0.13	###	0.08	0.05	<b>0.78</b>
Seek advice about a crisis?	0.02	0.11	0.18	0.04	0.10	<b>0.85</b>
Seek suggestions about how to deal with a personal problem?	0.03	0.09	0.19	###	0.04	<b>0.86</b>
Eigenvalues	7.74	4.40	3.00	1.30	0.93	0.78
Proportion of Variance Explained	0.33	0.2	0.1	0.1	0.04	0.03

Note: Total variance explained is 78.12%. 1= Personal Goal Achievement, 2=Physical Competition, 3=Emotional Social Support, 4=Exercise App Self-Monitoring, 5=Competition Video Game, 6=Informational Social Support.

Table 3.  
*Results of Confirmatory Factor Analysis Egrats Scale (N=393)*

Item	1	2	3	4	5	6
Ashamed.	<b>.849</b>	.085	-.306	.170	-.018	.020
Embarrassed.	<b>.826</b>	-.031	-.293	.069	-.087	.002
Guilty.	<b>.707</b>	.107	-.086	.308	-.248	-.042
Happy.	.096	<b>.782</b>	-.127	-.167	.284	-.046
Satisfied.	.083	<b>.780</b>	-.247	-.100	.291	-.039
Confident.	.007	<b>.789</b>	-.289	-.007	.197	.020
Angry.	-.183	.121	<b>.828</b>	.230	.029	.009
Arrogant.	-.033	.205	<b>.822</b>	.122	-.131	.044
Proud.	-.145	.065	-.142	<b>.781</b>	.099	.097
Triumphant.	-.212	.030	-.117	<b>.681</b>	-.089	.511
Vigorous.	.054	.143	.024	.024	<b>.505*</b>	.178
Energetic.	.404	.040	-.196	-.117	<b>.792</b>	.141
Powerful.	.537	.125	-.161	-.004	<b>.674</b>	.144
Erotic.	.028	.106	.029	.225	.054	<b>.872</b>
Aroused.	-.057	.076	.068	.177	.010	<b>.882</b>
Sexy.	.219	.099	.021	-.046	.040	<b>.780</b>
Eigenvalues	5.530	2.833	1.261	.945	.770	.660
Proportion of Variance	.368	.190	.084	.063	.050	.044

Note: Total variance explained is 79.8%. \*Item was removed from scale. 1=Negative Prosocial. 2=Positive Individualism. 3=Negative Individualism. 4=Positive Prosocial. 5= Reptilian Power. 6= Reptilian Sex.

Table 4.  
*Results of Confirmatory Factor Analysis for Outcome Variables (N=393)*

Item	1	2
I am satisfied with my life	<b>0.824</b>	0
My life has a clear sense of purpose	<b>0.736</b>	0.055
Most days I feel a sense of accomplishment from what I do	<b>0.725</b>	0.037
How much of the time in the last 30 days have you felt cheerful?	<b>0.765</b>	0.036
How much of the time in the last 30 days have you felt hopeless?	<b>-0.465</b>	0.028
Your family life	<b>0.556</b>	-0.072
Your social life	<b>0.738</b>	-0.056
Your energy level	<b>0.776</b>	0.08
In general would you say your health is:	<b>0.555</b>	0.129
In the past 30 days, for about how many days have you felt / very healthy and full of energy? ...	<b>0.709</b>	0.05
How often do you use exercise apps?	0	<b>0.769</b>
Running App	0.095	<b>0.745</b>
Cycling App	-0.054	<b>0.571</b>
Walking App	-0.106	<b>0.65</b>
Fitness App	0.068	<b>0.763</b>
How much time do you use an exercise app each session?	0.11	<b>0.55</b>
Eigenvalues	4.88	2.72
Proportion of Variance Explained	0.305	0.17

Note: Total variance explained is 47.5%. \* Item was removed from scale. 1=Well Being. 2=Exercise App Use.

Table 5.

*Results of Confirmatory Factor Analysis for Exercise Self-Efficacy (N=393)*

Item	1	2	3	4	5	6
It's raining or snowing.	<b>0.87</b>	0.086	0.18	0.15	0.209	0.179
It's cold outside.	<b>0.87</b>	0.121	0.104	0.167	0.212	0.169
The roads or sidewalks are snowy.	<b>0.868</b>	0.063	0.133	0.177	0.201	0.142
I am alone.	0.07	<b>0.828</b>	0.073	0.166	0.157	0.227
I have to exercise alone.	0.058	<b>0.894</b>	0.166	0.098	0.023	0.121
My exercise partner decides not to exercise that day.	0.182	<b>0.719</b>	0.312	0.252	0.026	0.27
I don't have access to exercise equipment.	0.04	0.238	<b>0.785</b>	0.146	0.179	0.247
I am traveling.	0.284	0.083	<b>0.761</b>	0.134	0.233	0.112
My gym is closed.	0.144	0.198	<b>0.799</b>	0.088	0.221	0.206
I am under a lot of stress.	0.183	0.134	0	<b>0.737</b>	0.237	0.084
I am depressed.	0.134	0.138	0.161	<b>0.805</b>	0.151	0.155
I am anxious.	0.143	0.171	0.175	<b>0.83</b>	0.147	0.09
I feel I don't have the time.	0.192	0.012	0.252	0.332	<b>0.749</b>	0.058
I don't feel like it.	0.217	0.157	0.181	0.153	<b>0.795</b>	0.193
I am busy	0.266	0.053	0.218	0.172	<b>0.812</b>	0.121
My friends don't want me to exercise.	0.167	0.316	0.244	0.132	0.113	<b>0.809</b>
My significant other does not want me to exercise.	0.17	0.223	0.174	0.134	0.153	<b>0.862</b>
I am spending time with friends or family who do not exercise.	0.445	0.146	0.26	0.156	0.161	<b>0.609</b>
Eigenvalues	7.93	2.05	1.48	1.34	0.87	0.85
Proportion of Variance Explained	0.44	0.114	0.082	0.075	0.048	0.046

Note: Total Variance explained is 80.57%. 1= Bad Weather. 2= Must Exercise Alone. 3= Inconvenient to Exercise. 4= Negative Affect. 5= Excuse Making. 6= Resistance from Others.

Table 6.

*Results of Confirmatory Factor Analysis for Exercise Technology Cluster (N=393)*

Item	1
A GPS enabled watch (for example a Garmin or Nike)	<b>0.677</b>
A heart-rate monitor	<b>0.841</b>
A Fitbit or jawbone	<b>0.782</b>
A pedometer	<b>0.791</b>
Eigenvalue	2.402
Total Variance Explained	60.03

Table 7.

*Results of Confirmatory Factor Analysis for Smartphone Exercise App Self-Efficacy (N=393)*

Item	1
75. I am confident in my ability to use a smartphone exercise app.	<b>0.899</b>
76. I am confident in my ability to learn how to use a smartphone exercise app.	<b>0.899</b>
77. I am confident in my ability to find help with my smartphone exercise app if I have a problem.	<b>0.918</b>
78. I am able to find help with a smartphone exercise app if I have a problem.	<b>0.896</b>
Eigenvalues	3.262
Total Variance Explained	81.55

Feed
You
Track
Knowledge
Coaching
Connect
Leaders

Search for users or groups

# bike2run

6475 pts to Level 36

Husband, father, student, triathlete and mountain biker.

[Read More](#)

35 Level	265,875 Total Points	7 Followers	6' 2" Height	♂ Gen der
-------------	-------------------------	----------------	-----------------	--------------

About
Feed
Activities

Looking good today! Tell us what you're up to.

bike2run tracked Workout for 1,093 pts Today

*Figure 1* A screenshot of Fitocracy, illustrating the game like interface with Level and point total. Notice the most recent workout indicating the user just earned 1,093 points.



The screenshot shows the Fitocracy app interface. At the top, there's a navigation bar with tabs: Feed, You, Track, Knowledge, Coaching, Connect, and Leaders. A search bar is on the right. Below the navigation bar, the 'You' tab is active, showing a sidebar with links to Groups, Achievements, Quests, and Performance. A purple banner with a robot character says 'Make a Robot's Day! Become a Fitocracy Hero Learn More >'. The main content area shows statistics: 11 Achievements, 16 Quests, 287 Workouts, 0 Challenges, 329 Props Received, and 8 Groups. Below this is the 'Achievements' section with 10 circular icons representing different milestones. The 'Friends' section is partially visible at the bottom.

Category	Count
Achievements	11
Quests	16
Workouts	287
Challenges	0
Props Received	329
Groups	8

**Achievements**

Achievement Name	Activity	Level
Let's Get Outta Here	Cycling	1
These Legs Don't Stop	Cycling	2
Splishy Splashy	Swimming	1
Profile Complete	Profile Complete	1
Hello There!	Post to Community	1
Fist Bump!	Props Received 10 Props	1
P. Fitty	Props Received 50 Props	1
Feeling The Love	Props Received 100 Props	1
I Seem to be Lost	Running	1
Hallowed Harrier	Running	2
The Shadow of Hermes	Running	3

**Friends**

Name	Bio	Following

*Figure 2* A screenshot of the Fitocracy App, showing the achievements this user has earned. Some are related to the use of the app, such as completing their profile. While others are based on exercise, for example, the Hallowed Harrier achievement indicates the user has run 1000km in their lifetime.

Connect
Leaders
Search for users or groups

sciencedenton said in [Couch to 5K](#) Jul 9, 2015

Just finished Week 1! After several attempts at getting W1D1 done, I found my stride and blasted through it, including doing W1D2 twice. Question is, should I go right on to W2D1 or do W1D3 once more for conditioning? I'm not feeling particularly winded at the end of the W1 runs, and I'm peaking at 167 bpm.

Comment
 Prop
 Share

[BostonBob27](#), [TeamEsteve](#), [Sulphie](#), [Sheyla](#) and 2 others propped this.

[TheLostCause](#) If you can finish all the running intervals without stopping, go on to W2. Believe me, every day that follow will definitely assist you on your conditioning. Lol

3 Props • Give Props • 2mo ago

marziotta said in [Couch to 5K](#) Jul 7, 2015

Kneeling push ups are not in for the challenge? Does anybody get offended if I do them and track them as regular push ups?

Comment
 Prop
 Share

[Angle](#) propped this.

[6 older](#) comments

Figure 3. This screenshot is a potential example of informational social support. The user *sciencedenton* is seeking information about how to proceed with a 5k training plan. While the user *TheLostCause* responds to *sciencedenton*'s request for information.

Figure 4. Hypothesized Model of Exercise App Use.

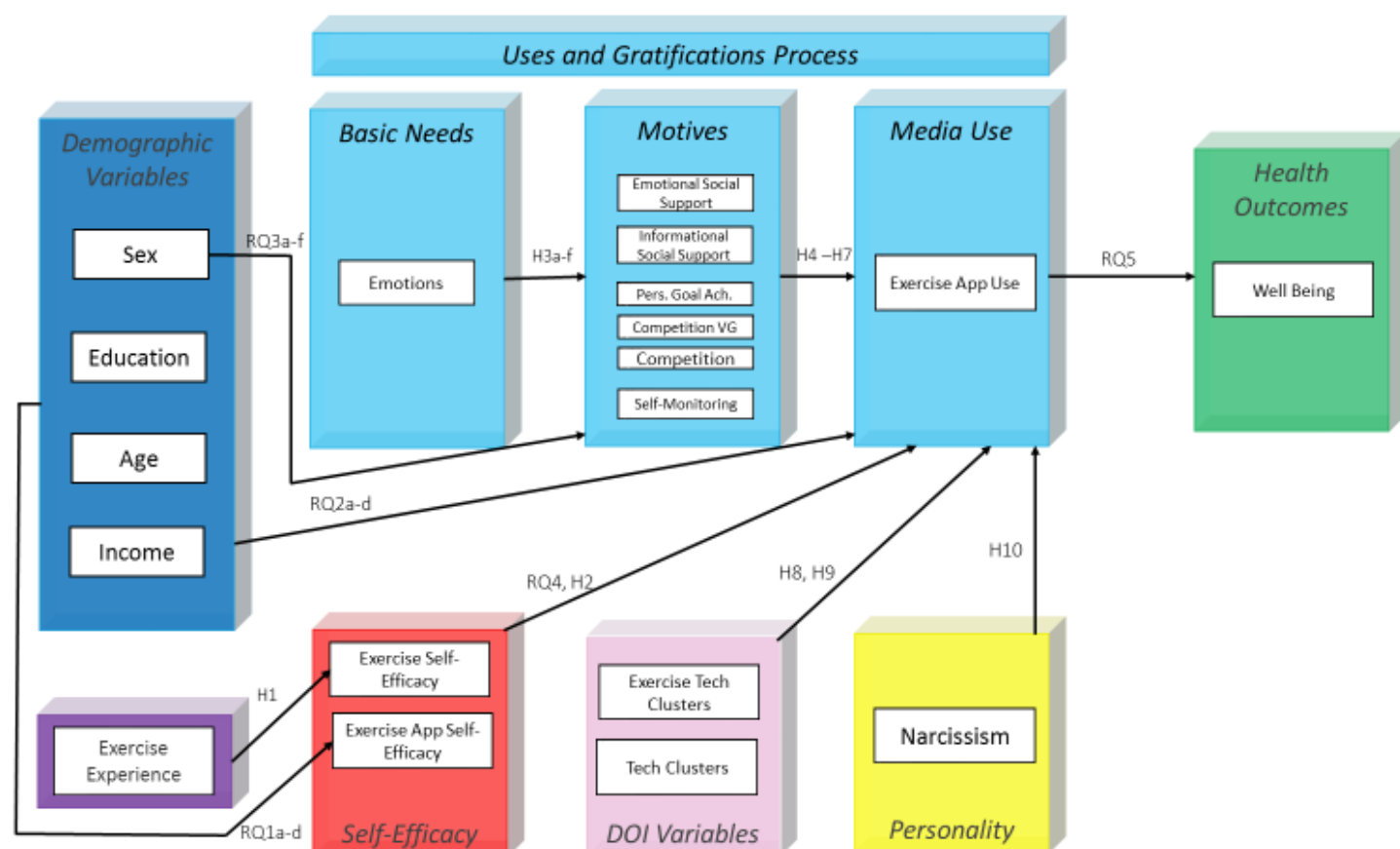


Figure 4. This is the research model for this study illustrating all of the hypothesis and research questions. This model had poor fit, RMSEA= .132, CFI=.369.

Figure 5. Respecified Model of Exercise App Use.

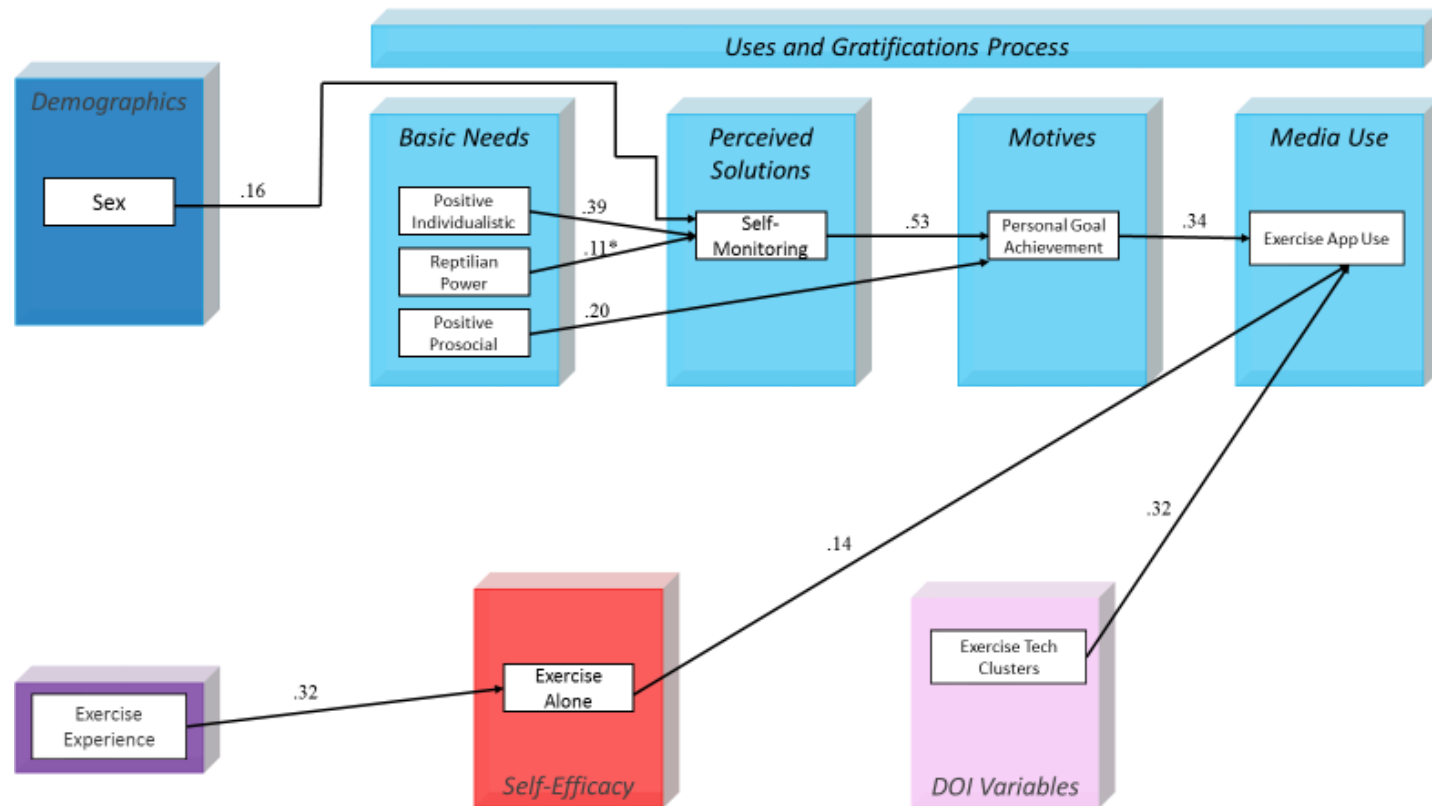


Figure 5. The respecified model indicated strong measures of fit, CFI=.968, RMSEA=.052,  $\chi^2 = 49.90$ ,  $df=24$ ,  $p=.001$ . All paths significant at  $p<.001$ , except \* where  $p<.05$ .

## Appendix B: Scales

*Goal Achievement Scale:* Adapted from Masters and Olges (1995)  $\alpha = .85$ .

1. To improve my speed
2. To compete with myself
3. Try to become faster
4. To push myself beyond my current limits.
5. To see if I can beat a certain time.
6. To make my body perform better than before.

*Competition Scale:* Adapted from Markland and Ingledew (1997).  $\alpha = .95$ ,

7. Response range, 1) strongly disagree to 7) strongly agree.
8. Because I like trying to win in physical activities
9. Because I enjoy competing
10. Because I find physical activities fun, especially when competition is involved
11. Because I enjoy physical competition

*Competition Scale:* Adapted from Sherry and Lucas (2003).  $\alpha = .86$ ,

12. I like to play to prove to my friends that I am the best.
13. When I lose to someone, I immediately want to play again in an attempt to beat him/her
14. It is important to me to be the fastest and most skilled person playing the game.
15. I get upset when I lose to my friends.

*Informational Social Support Scale:* Adapted from Choi and Chen (2006).  $\alpha = .93$ .

Response range, 1) strongly disagree to 7) strongly agree.

16. Seek information to better understand a situation?
17. Seek advice about a crisis?
18. Seek suggestions about how to deal with a personal problem?

*Emotional Social Support Scale:* Adapted from Choi and Chen (2006).

Response range, 1) strongly disagree to 7) strongly agree

19. Seek encouragement
20. Share your private worries and fears
21. Seek someone to listen to you

*Proposed Exercise App Self-Monitoring Scale*

Response range, 1) strongly disagree to 7) strongly agree.

- 22. I like to see how far I've gone while running
- 23. I like to see how far I've gone while riding a bike
- 24. I like to see how far I've gone while walking
- 25. I like to see how far I've gone
- 26. I like to see how fast I'm running
- 27. I like to see how fast I'm riding a bike
- 28. I like to see how fast walking
- 29. When I exercise I like to see my speed
- 30. I like to see how long I have been running
- 31. I like to see how long I have been walking
- 32. I like to see how long I have been riding a bike
- 33. I like to see how long I have been exercising

*E Grats Scale.* Buck (2004), Response range 1-7, Not At All-Very Much.

I feel \_\_\_\_ after I have engaged in physical activity”

- 34. Ashamed.
- 35. Embarrassed.
- 36. Guilty.
- 37. Happy.
- 38. Satisfied.
- 39. Confident.
- 40. Angry.
- 41. Proud.
- 42. Arrogant.
- 43. Triumphant.
- 44. Disgusted.
- 45. Sad.
- 46. Vigorous.
- 47. Energetic.
- 48. Powerful.
- 49. Erotic.
- 50. Aroused.
- 51. Sexy.

How often do you use the following items? (1=Never, 2=Rarely, 3=Sometimes, 4=Somewhat frequently, 5=Very frequently)

- 52. A laptop
- 53. A tablet computer such as an I-Pad
- 54. An e-reader such as a Kindle
- 55. A digital audio player such as an I-Pod
- 56. A GPS enabled watch (for example a Garmin or Nike)
- 57. A heart-rate monitor
- 58. A Fitbit or jawbone
- 59. A pedometer

### *Exercise App Use Scale*

Please choose the best answer that reflects your use of exercise apps.

- 60. How often do you use exercise apps? a) Once per month. b) 2-3 times per month c) Once per week. d) 2-3 times per week. e) 4-5 times per week. f) 6 or more times per week.
- 61. How much time do you use an exercise app each session? a) 0-15 minutes. b) 16-30 minutes. c) 31-45 minutes. d) 46-60 minutes. e) 1-2 hours. f) 2 hours or more.
- 62. How often do you use the following types of exercise apps on your phone? (1=Never, 2=Rarely, 3=Sometimes, 4=Somewhat frequently, 5=Very frequently)
  - a. Running app
  - b. Walking app
  - c. Cycling app
  - d. Fitness app

NPI-16. (Ames, Rose & Anderson, 2006).

Read each pair of statements below and place an “X” by the one that comes closest to describing your feelings and beliefs about yourself. You may feel that neither statement describes you well, but pick the one that comes closest. **Please complete all pairs.**

- 63. ☐ I really like to be the center of attention  
☐ It makes me really uncomfortable to be the center of attention
- 64. ☐ I am no better or no worse than most people  
☐ I think I am a special person
- 65. ☐ Everybody likes to hear my stories  
☐ Sometimes I tell good stories
- 66. ☐ I usually get the respect I deserve  
☐ I insist upon getting the respect that is due me
- 67. ☐ I don't mind following orders  
☐ I like having authority over people

68. \_\_\_ I am going to be a great person  
\_\_\_ I hope I am going to be successful
69. \_\_\_ People sometimes believe what I tell them  
\_\_\_ I can make anybody believe anything I want them to
70. \_\_\_ I expect a great deal from other people  
\_\_\_ I like to do things for other people
71. \_\_\_ I like to be the center of attention  
\_\_\_ I prefer to blend in with the crowd
72. \_\_\_ I am much like everybody else  
\_\_\_ I am an extraordinary person
73. \_\_\_ I always know what I am doing  
\_\_\_ Sometimes I am not sure of what I am doing
74. \_\_\_ I don't like it when I find myself manipulating people  
\_\_\_ I find it easy to manipulate people
75. \_\_\_ Being an authority doesn't mean that much to me  
\_\_\_ People always seem to recognize my authority
76. \_\_\_ I know that I am good because everybody keeps telling me so  
\_\_\_ When people compliment me I sometimes get embarrassed
77. \_\_\_ I try not to be a show off  
\_\_\_ I am apt to show off if I get the chance
78. \_\_\_ I am more capable than other people  
\_\_\_ There is a lot that I can learn from other people

*Smartphone Exercise App Self-Efficacy Scale.* Adapted from Lin and Atkin (2010).  $\alpha = .90$

Response range, 1) strongly disagree to 7) strongly agree.

79. I am confident in my ability to use a smartphone exercise app
80. I am confident in my ability to learn how to use an exercise app
81. I am confident in my ability to find help with my smartphone exercise app if I have a problem
82. I am able to find help with an exercise app if I have a problem



*Exercise Self-Efficacy.* Adapted from Benisovich, Rossi, Norman, and Nigg (1998).

This part looks at how confident you are to exercise when other things get in the way. Read the following items enter in the box the number that best expresses how each item relates to you in your leisure time. Please answer using the following 5-point scale:

- 1 = Not at all confident
- 2 = Somewhat confident
- 3 = Moderately confident
- 4 = Very confident
- 5 = Completely confident

Negative Affect (.852)

- 83. I am under a lot of stress.
- 84. I am depressed.
- 85. I am anxious.

Excuse Making (.829)

- 86. I feel I don't have the time.
- 87. I don't feel like it.
- 88. I am busy

Must Exercise Alone (.869)

- 89. I am alone.
- 90. I have to exercise alone.
- 91. My exercise partner decides not to exercise that day.

Inconvenient to Exercise (.773)

- 92. I don't have access to exercise equipment.
- 93. I am traveling.
- 94. My gym is closed.

Resistance from Others (.853)

- 95. My friends don't want me to exercise.
- 96. My significant other does not want me to exercise.
- 97. I am spending time with friends or family who do not exercise.

Bad Weather (.837)

- 98. It's raining or snowing.
- 99. It's cold outside.
- 100. The roads or sidewalks are snowy.

*Exercise Experience*

- 101. How long have you been exercising regularly (4-6 times per week, 30 minutes per session)?

I don't exercise regularly

0-3 months

4-6 months

- 7-11 months
- 1-2 years
- 2-3 years
- 3-4 years
- 4-5 years
- More than 5 years

*Public Health Surveillance Well-Being (PHS-WB) Scale*

In this section, there are a number of statements with which you may or may not agree.

For each statement listed, please indicate whether you personally agree or disagree with it using a scale where 1 means “strongly disagree,” 2 means “somewhat disagree,” 3 means “neither agree nor disagree,” 4 means “somewhat agree,” and 5 means “strongly agree.”

If you don’t understand a statement or it is not applicable to you, please leave that row blank.

- 102. I am satisfied with my life
- 103. My life has a clear sense of purpose
- 104. Most days I feel a sense of accomplishment from what I do
- 105. How much of the time in the last 30 days have you felt cheerful?
- 106. How much of the time in the last 30 days have you felt hopeless?

Please tell me on a scale of 1 to 10 how satisfied you are with each of the following items, where 1 means “very dissatisfied” and 10 means “very satisfied.”

- 107. Your family life
- 108. Your social life
- 109. Your energy level

Select one response for the following question

- 110. In general would you say your health is: Excellent, Very Good, Good, Fair, Poor.
- 111. In the past 30 days, for about how many days have you felt very healthy and full of energy? \_\_\_\_\_. None/ zero days. Don’t know.

*Demographic Information*

- 112. What is your gender?  
Male  
Female
- 113. What is the highest level of education you have completed?  
Elementary school only  
Some high school, but did not finish  
Completed high school  
Some college, but did not finish  
Two-year college degree / A.A / A.S.  
Four-year college degree / B.A. / B.S.  
Some graduate work  
Completed Master’s degree / MBA / JD  
Advanced Graduate work / MD / DMD / DDS / Ph.D.

114. Would you describe yourself as:
- American Indian / Native American
  - Asian
  - Black / African American
  - Hispanic / Latino
  - White / Caucasian
  - Pacific Islander
  - Mixed Race
  - Other
115. What do you expect your 2014 family income from all sources before taxes to be?
- Under \$25,000
  - \$25,000 - \$39,999
  - \$40,000 - \$49,999
  - \$50,000 - \$74,999
  - \$75,000 - \$99,999
  - \$100,000 - \$124,999
  - \$125,000 - \$149,999
  - Over \$150,000
116. What is your age? \_\_\_\_\_