Fitness Gamification: Concepts, Characteristics, and Applications
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ABSTRACT
This paper reviews the findings of several studies and surveys that address the increasing popularity and usage of so-called fitness “gamification.” Fitness gamification is used as an overarching and information term for the use of video game elements in non-gaming systems to improve user experience and user engagement. In this usage, game components such as a scoreboard, competition amongst friends, and awards and achievements are employed to motivate users to achieve personal health goals. The rise in smartphone usage has also increased the number of mobile fitness applications that utilize gamification principles. The most popular and successful fitness applications are the ones that feature an assemblage of workout tracking, social sharing, and achievement systems. This paper provides an overview of gamification, a description of gamification characteristics, and specific examples of how fitness gamification applications function and is used.

Keywords
gamification, fitness, health, mobile applications,

INTRODUCTION
Gamification is defined as “an informal umbrella term for the use of video game elements in non-gaming systems to improve user experience and user engagement” (Deterding, O’Hara, Sicart, Dixon, & Nacke, 2011). One of the most popular uses of gamification is to transform a mundane, menial, or otherwise uninspiring task into one that engages users and actively encourages them to complete the needed task. A specific, and one of the most popular utilizations of gamification, is so-called “fitness gamification.” In this manifestation, users employ game components such as a scoreboard, competition amongst friends, and awards and achievements to motivate themselves to reach their personal health goals. The rise in “smartphone” ownership and usage has also increased the number of mobile fitness applications that utilize gamification principles. The most popular and successful fitness applications are the ones that feature an assemblage of workout tracking, social sharing, and achievement systems (Christensen & Prax, 2012). This paper provides an overview and description of gamification, analyzes the characteristics of fitness gamification that make it a viable and successful means of its specific purpose (improving personal fitness), surveys several mobile fitness applications that use gamified technology, and reaches a conclusion about the benefit and impact of mobile “gamified” fitness applications.

VIDEO GAMES AS A TOOL FOR HEALTH AND FITNESS
Mobile applications have taken the already popular concept of using video games for health and fitness applications and greatly expanded and popularized the concept and usage. Almost since their advent, the concept of using video games as tool or means for physical fitness activity has been recognized and employed. In a study conducted by Biddiss and Irwin (2010), it was found that eighty-three percent of children, ages eight to ten, have access to a video game console and highly value the time that they get to use it. Sensing this, technologically savvy parents are utilizing what the authors call “active video games” (AVGs) to use their children’s interest in video games to a healthy advantage. In the study, participants (who were 21 years old or younger) were measured while playing AVGS in ways that measured their energy expenditure, activity patterns, physiological risks and benefits, and enjoyment and motivation. While the results of the study were inconclusive with regard to how
much actual physical benefit AVGs provide when compared to traditional exercise, it was observed that children who play AVGs are generally healthier than those who either do not play AVGs or who exclusively play non-AVGs.

Some of the most popular and widespread examples of an AVG are Nintendo’s “Wii Fit” and “Wii Sports” games. These games feature several different fitness mini-games that are designed to improve the overall health or “fitness level” of a user if the product is used in a constant routine. Miyachi, Yamamoto, Ohkawara, and Tanaka (2010) set out in their study to determine the energy expenditure of users while playing Nintendo’s “Wii Fit” and “Wii Sports” series of games. A group of participants had their vital signs measured and analyzed while playing, and the authors found that while some of the exercises caused participants to expend the necessary amount of energy to constitute as “exercise,” many more of the mini-games did not. Based on the study, it appears that gamified exercises are best utilized as a supplement to a user’s exercise routine, not as a substitute. While “Wii Fit” may not yield a pure improvement to a user’s “fitness level,” it is possible that it does improve other physical abilities of a user. Nitz, Kuys, Isles, and Fu (2010) examined the effect that Wii Fit had on factors like balance, strength, and flexibility in women. The women in the study group were assessed both before and after they played Wii Fit at regular intervals over a 10-week period. Their findings showed that Wii Fit had a significantly positive effect on the listed factors in women. When used for purposes such as balance and flexibility, Wii Fit was a great success, and proved the value that AVGs can have on their users. These benefits stand in contradiction to many of the preconceived notions that some have about video games.

A common misconception about video games is that those who play them are non-athletic or otherwise unfit. This conception has led to many concerns about the overall health and fitness of children who play video games. However, this misplaced concern is not a new one. Perceived correlation between obesity in children and sedentary behaviors (such as watching TV and playing video games) has been an issue ever since the introduction of the television into homes many years ago. Kautiainen, Koivusilta, Lintonen, Virtanen, and Rimpelä (2005) developed a survey to research whether or not there is any truth to these accusations. In the study, 14-, 16-, and 18-year old boys were surveyed about their time spent watching TV, playing video games, and using the computer. They were also surveyed concerning their weight, BMI, family economic status, and exercise habits. The results of the surveys were that while TV and computer habits may exhibit correlation to overweight children, video games did not. While this study is certainly not definitive proof of the correlation and causation of video games and childhood obesity, it is indicative that caution should be used in making sweeping generalizations about the two.

Even video games that are not directly interacted in fitness activities can have a positive health effect on users, given the right criteria. Warburton et al. (2007) studied the effect that interactive video games (games that actively engage users with button sequences) combined with stationary cycling had on the health of participants. The authors compared results of the study to those of participants who used a stationary cycle only, and did not play interactive video games while exercising. While the results from a purely “health” standpoint were inconclusive, the authors did note that playing the interactive game while cycling made participants “want” to work out. They argue that this motivation is important in inspiring change. One of things that many mobile fitness gamification applications advertise is that their product will make the user “want to work out.” This 2007 study indicates that the video game element of “desire to play” is a real and viable motivation for users to utilize as they pursue their health and fitness goals.
OVERVIEW OF GAMIFICATION APPLICATIONS
Gamification, as it relates to health and fitness usage, includes a number of different applications and application genres that are already released and in widespread use; although, most users of the applications do not realize that they are participating in gamification. Some applications focus strictly on health, like Jane McGonigal’s “SuperBetter.” SuperBetter is a gamified application that is meant to assist in the recovery process of a user suffering from a concussion. The game provides goals for the player to reach and obstacles to overcome, providing positive encouragement along the way of recovery (Herger, 2013). Other applications, such as “Nike+” and “Nike Fuelband,” work alongside physical devices that a user wears on their person. Applications like “FitBit” help users monitor their workout data. These are the applications that make up the majority of the health and fitness gamified applications available to the public (Herger, 2013). Some applications are designed for a very specific group of users, such as “Chick Clique,” a gamified mobile health and fitness application designed to promote healthy lifestyle choices in adolescent/early-teenage girls. Results from the focus group for Chick Clique showed a positive impact in achieving the goal of promoting healthy choices in this specific target population (Toscos, Faber, An, & Gandhi, 2006).

The impact of the use of gamification-related applications is significant. According to Tate, Wing, and Winett (2001), the growth of the Internet user base has made the Internet a viable option for a “public health intervention.” The authors conducted a study to determine if the Internet was a viable tool for users interested in losing weight and becoming more fit. Participants in this study were divided into two groups. One group was given six months of an Internet education program, while the other group was given six months of Internet behavioral therapy. The study results indicated that those in the behavior therapy lost more weight than those in the education program. The behavior therapy group lost a mean of 8.8 lbs at the three-month checkpoint and 9.9 lbs after six months, while those in the education group lost a mean of 3.7 lbs at the three-month checkpoint and 3.5 at after six months (2001). While the behavior therapy group lost significantly more weight, the key point of the study’s findings is that both groups lost some weight. This observation points to the Internet and technologies that employ the Internet as being a viable option for attaining weight loss and other fitness goals.

In the years since scholars began documenting gamification, the phenomenon has grown exponentially. Anderson and Rainie (2012) polled several thousand Internet users about how they felt about gamification and where they felt that it was going in the future. Results of the survey indicated that participants believe gamification will be a huge part of the Internet experience in the coming years, but some will be hesitant if gamification becomes too highly integrated into new technologies. It is interesting to note that many participants in the study said that gamification would be integral for certain uses such as fitness and health. This observation shows that “Internet experts” already understand the benefit of using gamification to assist with their health and fitness goals.

THE SMARTPHONE FACTOR
Fitness gamification and other mobile health apps would not be nearly as prominent or enjoy the success that they have without the rise in smartphone ownership. Smartphones have become the “standard” for most mobile/cellular telephone users and are in widespread usage in developed countries. Their prevalence notwithstanding, there are certain barriers to entry for users with regards to using smartphones for health and fitness activities. These barriers may include the cost of the device, the cost of data plans, battery life, etc. For mobile gamification to become immensely successful and even more widespread, such barriers will have to be mitigated (Boulos, Wheeler, Tavares, & Jones, 2011). From the perspective of an
application developer, while having a base of users who utilize multiple mobile operating systems is optimal, it is integral to their success that they make their application(s) available on Apple’s App Store. The App Store has 170,000 active users, compared to the 30,000 of the Android Marketplace (Kim, Lee, & Son, 2011).

Price also plays a major role in the accessibility and user base of applications, and fitness applications are not exempt from this consideration. According to Kuittinen (2013), “paid app sessions are growing faster than free app sessions – by 44% vs. 33% between March 2012 and March 2013.” There is evidence to support the claim that apps priced at $0.99 or higher in the Apple “App Store” are considered to be more “trustworthy”; and in fact, users adopted health behavior changes more when using these paid apps than those who used apps priced as “Free.” The conventional interpretation of this finding is that when a user pays for an application with money, rather than downloading it for free, they are more “invested” in making sure that their money pays off and they get some return for their purchase (West et al., 2012).

**FITNESS GAMIFICATION SUCCESS**

There are a number of elements of gamification that indicate the success of this type of application. One of the many characteristics that users enjoy in fitness gamification is the ability to share their workout with online friends. This is referred to as “social sharing,” and it has a large impact in many gamified mobile applications. The most successful mobile health and fitness applications feature both a data-tracking component and a “social sharing” component, which allows users to post their workout data from their tracking application to their social media networks. The feedback that users receive from online friends motivates them to continue their workout plan. The ability to post workout data socially also inadvertently implements an “accountability” system for the user. If a user posts regularly about their workout, then stops exercising for an extended period of time, it was found that some users fear their friends realizing that they have stopped (Ahtinen, Huuskonen, & Häkkilä, 2010).

Another key component in making gamified fitness applications successful is the way in which the application tracks a user’s workout data. One of the most popular means of doing this is through “scorekeeping.” In many gamified fitness applications, such as the popular “Fitocracy,” each exercise or activity is worth a certain point value. The number of reps that a user does, or the amount of time that a user does a particular exercise, are assigned a certain number of points that is calculated for them in the application. This score can then be posted to the user’s various social media streams, as discussed earlier, or be used for certain in-game privileges, like a “higher level” or a badge/achievement (Moscaritolo, 2013). Another application that takes this procedure into effect is “GymSkill.” “GymSkill” is a mobile fitness application that was recently analyzed in great detail by Kranz et al (2013). Specifically, the application’s scoring system was analyzed to determine if GymSkill provides enough meaningful feedback for users to continue to use it in their workouts. GymSkill provides a wide variety of feedback mechanisms for the user, from graphs and charts showing a user’s physical improvements over time, to the more “conventional” scorekeeping. The study determined that GymSkill’s feedback was meaningful and constructive for users with regards to their health and fitness goals. Scorekeeping and social sharing work in tandem to provide a great user experience for those who utilize mobile fitness applications.

Perhaps the most prevalent video game function that is present in mobile health and fitness applications is the “achievement system.” It can also be argued that the achievement system is also the most important function of a gamified application. Preliminary studies have shown that those applications that include an achievement system, in addition to other gamified aspects, have a higher retention rate of users than those applications that do not (Baranyi, Lederer, & Grechenig, 2013). Fitz-Walter, Tjondronegoro,
and Wyeth (2011) conducted a study to determine with which features of gamified applications a group of users were most engaged. As part of the study, users were given access to an achievement system in a test application and a set of criteria to complete and log into the application to receive their “achievement.” The study found that all (100%) of the participants completed at least four of the 20 achievements, with roughly 82% of the participants completing 10 or more. An amazing 96% of users stated at the conclusion of the study that, “the achievement system added value to the...experience and that the achievement system was fun to use.” Other praises for the achievement system from the participants mention that the achievements were “such a fantastic twist,” “genuinely fun,” and that “unlocking the achievements made it [the application] interesting” (Fitz-Walter et al., 2011). A fun, interesting, and exciting achievement system goes a long way in determining how engaged users are with a gamified fitness application, and in turn, how long they will continue to use the application.

Similarly, with respect to sustainable user bases, convincing users to continue to utilize an application day in and day out is a trying task, especially when it comes to fitness applications. With this in mind, Campbell, Ngo, and Fogarty (2008) created a mobile fitness application called “Kukini,” which was designed specifically to encourage day-to-day use. At the beginning of this study, the authors cite previous examples of implementing game elements into health and fitness applications, but argue that the long term sustainability of these applications are not feasible. In other words, users end up abandoning the applications for the “next big thing.” The authors go on to explain the importance that socialization between users plays in keeping an active user base. They reference the popular massively multiplayer game “World of Warcraft” as a reference for this point. “World of Warcraft” players log on to the game nearly every day for rewards and to interact with online friends. “Kukini” is built around these principles. The study found that implementing these game elements into a mobile fitness application is a viable way to encourage long term use of the application. A majority of users in the Kukini study group continued to use the application day in and day out (2008). Sustainability is a key function that developers must consider when making their mobile fitness and health application.

**MOBILE FITNESS GAMIFICATION EXAMPLES**

Examples of mobile fitness and gamified fitness applications are many and varied; however, due to the immense popularity of the smartphone, the available applications can employ a wide variety of different approaches. Although each of the applications utilizes a different approach, technique, or “motivation,” the goal of each application is similar: an attempt to promote and encourage physical activity.

Buttussi, Chittaro, and Nadalutti (2006) investigated and analyzed how mobile trainers (those found in mobile phone applications) affect the workout and exercise patterns of users, specifically those that work out in open-air, outdoor environments. The trainer in this study is a virtual assistant codenamed “Evita.” Evita provides trail directions, visual demonstrations (on the screen) for different exercises, and positive encouragement and feedback to the user upon completion of the exercise. Results of the study on a sample group of users support the hypothesis a virtual trainer and mobile applications have a positive effect on users’ health and fitness. While virtual trainers are not an explicitly a video game-related concept (though virtual trainers do appear in “Wii Fit” [Miyachi et al., 2010]), it is important to note the variety found in fitness applications.

Another case study concerning the benefits of mobile fitness gamification comes from Brown, Chetty, Grimes, and Harmon (2006). The authors in this study developed a system to help college students maintain a healthy lifestyle. They developed a mobile fitness application that utilizes a camera so that users see
a visual representation of their changing body and a workout-tracking feature. The evidence of the study support the authors’ idea that seeing visual results and tracking workout routines and diets help raise awareness for college students to stay healthy. One element that makes this application unique is that in addition to the workout tracking feature, a diet tracking feature is also included. This application is unique in that most other gamified fitness applications only include a workout-tracking feature. Also unique to the application is the photo documentation feature. Very few applications include a feature such as this. According to the study, college students in this focus group who utilized the “photo tracking” feature were far more likely to continue making healthy lifestyle choices and encourage their friends to do the same than those who did not utilize the feature. This demonstrates that some of the most successful gamified fitness applications do not just do one thing; multiple features are utilized to provide the best user experience possible.

An example of a mobile fitness application that utilizes “real-world” technology is the popular running companion, “Nike+.” A small device is placed in the bottom of a user’s shoe, and it works in conjunction with a mobile application to track the intensity of a user’s running workout or how far the runner traveled. Kane, Simmons, John, Thompson, and Basset (2009) set out to determine how accurate Nike+ is when tracking running and walking workouts of users. Speed, distance, and energy expenditure were measured on users who ran and walked six miles on a treadmill. Results found that the Nike+ devices were fairly accurate when participants were running but less accurate when walking. It is important to note that even high quality technology will not be able to track a workout with complete accuracy. However, it is equally important to distinguish that while complete accuracy in tracking is a nice added feature, the real benefit of mobile gamified fitness applications is that they encourage their users to get up and exercise rather than remaining sedentary.

Mobile fitness applications are not limited strictly to exercise and fitness. Researchers at Georgia Tech developed a mobile game called “Order Up!” which used game-play to teach users about healthy food and eating habits (Grimes, Kantroo, & Grinter, 2010). Users in the study exhibited change as defined by the ‘Transtheoretical Model’, that is, “they improved their understanding of how to eat healthfully and engaged in nutrition-related analytical thinking, reevaluated the healthiness of their real life habits, formed helping relationships by discussing nutrition with others and started replacing unhealthy meals with more nutritious foods” (Grimes et al., 2010).

CONCLUSION
Gamification is a general, informal term for the use of video game elements in non-gaming systems to improve user experience and engagement. The specific application of gamification as described in this paper is its use as a means of encouraging and tracking physical activity and fitness. The foundation provided by the complementary nature of the physical fitness goals and characteristics of some video games has been expanded into the greatly expanded and expanding world of Internet application and smartphone applications. In this usage, users engage application components such as a scoreboard, competition amongst friends, and awards and achievements to motivate themselves to reach their personal health goals. A number of surveys and studies support the general conclusion that mobile fitness applications that use gamified technology are an increasingly popular and successful means of encouraging and tracking physical fitness activities and goals. More research is needed on the specific topic of applications that feature both a social sharing/scoreboard function and a workout-tracking function. The information shows that applications to include this were the most popular among users. Now that this is known, further research can be devoted solely to finding the tangible, statistical benefits of gamified fitness applications. With enough research, the
widespread use of gamified fitness applications could change the way that society views fitness and personal wellness.

REFERENCES


