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Developing a Video Game to Increase Intrinsic Motivation to Exercise

Abstract

This study sought to understand how to design an exergame to increase motivation for physical activity with regard to college students. The current research reports the findings of the initial phase of developing the exergame grounded in Self-Determination Theory. Two rounds of formative evaluation studies were conducted. In the first round, four focus groups were conducted to gain insights from the target population about their reception of the proposed exergame concept. In the second round, participants as a group played the game prototype that was developed based on the first round focus groups and provide feedback and suggestions in a focus group format. In addition, four participants played the game with a device that recorded their energy expenditure during game play on an individual basis and were interviewed after game play using the same questions used in the focus groups. The two rounds of formative evaluation confirmed many of the proposed design features. The design team also obtained valuable suggestions from the focus group participants on how to improve usability and playability of the game.

Developing a Video Game to Increase Intrinsic Motivation to Exercise

Introduction

A new policy at Lincoln University requires that students must not be obese to qualify for graduation (Landau, 2009). This controversial requirement reflects the national concern of the increased rate of obesity in college students. Individual differences in metabolism notwithstanding, obesity is commonly caused by a combination of a sedentary lifestyle and eating high caloric foods (Centers for Disease Control and Prevention [CDC], 2009). Lincoln University students are not alone in fighting the battle of the bulge. In its most recent report on physical activity, the CDC (2007) found that more than 40 percent of college-aged students fail to obtain the recommended amount of daily exercise.

To motivate college-aged students to engage in adequate amount of physical activity, innovative interventions may be necessary. One way to increase intrinsic motivation of physical activity is by making exercise as fun as another popular pastime for college students, namely, video games. A 2003 report by the Pew and Internet American Life Project found that 65 percent of college students play video games regularly (Jones, 2003). Game developers currently have created games to encourage people to engage in physical activity. For example, the Nintendo Wii debuted its Wii Fit game and innovative control pad specifically to encourage people to exercise in a fun way. These games, commonly known as "exergames," typically coordinate physical movement with onscreen activity. Research into exergames has shown that many are as physically demanding as traditional exercises, such as jogging on a treadmill (Maddison, Mhurchu, Jiang, Prapavessis, & Rodgers, 2007; Mhurchu et al., 2008). Studies have shown that when first introduced to children and teens, these types of games make a strong impact for the first couple of weeks. However, players ultimately become less interested in the game as time

progresses (Madsen, Yen, Wiasiuk, Newman, & Lustig, 2007; Maloney et al., 2008). This may be due, in part, to a loss of motivation to play the game over longer periods of time.

Self-determination theory suggests that the motivation to engage in an activity depends on a person's intrinsic and extrinsic motivations (Deci & Ryan, 1985; Frederick & Ryan, 1995; Ryan & Deci, 2000a, 2000b). Ryan, Rigby and Przybliski (2006) found that video game players need high levels of autonomy, competence, and relatedness—the factors that influence motivation—in order to fully enjoy playing a video game. In the case of the exergame players, it may be that they were no longer intrinsically motivated to play the games, because the game did not offer adequate levels of autonomy, competence, or relatedness. One of the ways to potentially address this shortfall of intrinsic motivation is to create an exergame that embeds strong self-determination theory elements.

The current research reports the findings of the initial phase of developing a self-determination theory grounded exergame for college students. Two rounds of formative evaluation studies were conducted. In the first round, four focus groups were conducted to gain insights from the target population about their reception of the proposed exergame concept. In the second round, participants as a group played the game prototype that was developed based on the first round focus groups and provide feedback and suggestions in a focus group format. In addition, four participants played the game with a device that recorded their energy expenditure during game play on an individual basis. These four participants were also interviewed after game play. Both rounds of focus group discussion questions and the interview questions were grounded on the self-determination theory. In this paper, we first review the literature on self-determination theory and its application in the physical activity domain as well as a framework of game usability that guides the design of the exergame. Then, we discuss the results of a series

of focus groups designed to better inform the creation process of an exergame. Finally, implications for future research are discussed.

<center>Literature Review</center>

Self-determination Theory

Self-determination theory (SDT) examines two types of motivations of people when they make choices: intrinsic motivation and extrinsic motivation. Intrinsic motivation is something that motivates a person internally, without external reward or consequences (Ryan & Deci, 1985, 2000a, 2000b). Simply put, it is doing something for the sake of doing it. It is the "inherent tendency to seek out novelty and challenges, to extend and exercise one's capacities to explore and to learn" (Ryan & Deci, 2000b, p. 70). Intrinsic motivation and self-determination theory has commonly been associated with sports (Deci & Ryan, 1985). "Sports provide an excellent opportunity to be self-determining, to get competence feedback . . . They are engaged in freely, and they afford one the chance to stretch capacities and build skills" (p. 313).

Extrinsic motivation is influenced by external factors, such as peers, society, or family (Ryan & Deci, 2000a, 2000b). Jogging to lose weight or lifting weights to look more attractive physically are examples. However, Ryan and Deci (2000) suggest that a continuum exists regarding the autonomy of extrinsic motivation, ranging from antipathy toward the activity to passive compliance to active personal commitment, and subsequent internalization of the activity's values. As an individual moves along the continuum, the motivation to perform a task becomes more internalized, or intrinsic (Ryan & Deci, 2000a, 2000b).

Deci and Ryan (1985) suggest there are three primary factors that encourage intrinsic motivation: autonomy, competence, and relatedness. People experience more self-determined (or internally controlled) types of motivation when the activities in which they participate make

them feel that they have autonomy (the power to make their own choices), competence (the ability to effectively perform the behavior), and relatedness (authentic social connections with others). In the context of physical activity, people's need for autonomy can be described as a desire to participate in exercise activities of their own will (Edmunds, Ntoumanis, & Duda, 2006). Sports, for example, offer participants a high level of autonomy in that they choose what to play and how to proceed in the game. Autonomy within a video game is how much choice players are given within the game design, such as how the environment responds to specific character actions (Ryan et al., 2006). Competency reflects the need that people have to be able to effectively produce their wanted outcomes and avoid undesired events. For example, in sports, as the participants practice, they become more accomplished at the task. They then feel more competent that they can achieve the practiced outcomes easier. Competence in a video game context is a need for challenges and feelings of effectiveness at meeting those challenges (Ryan et al., 2006). Ryan et al. (2006) suggested that this may be accomplished in games by providing challenges that allow players to learn and use new skills, as well as increasing in difficulty as the game progresses. They found that competence was one of the most important predictors of a satisfying game experience. Competence also includes the aspect of how easy the game is to learn and control over the hardware and software aspects of the game. Relatedness indicates the need of being connected to the activity and the feeling of being involved in a social environment. For example, in sports, players build strong relationships with their teammates, which bolsters their desire to perform well. Within the video game arena, players may build similar connections with the game environment as they see their actions directly affect the game surroundings. Players may also build social connections with the game characters, be it non-player characters or game characters controllers by other game players. The sense of relatedness lays the

groundwork for internalizing an activity, and helps a person transit from doing a task for external reasons to doing the task because of internal drive (Frederick & Ryan, 1995).

According to SDT, intrinsic motivation is at the core of partic ipation in sports (Frederick & Ryan, 1995). However, Ryan et al. (2006) suggest that intrinsic motivation also may explain the pull of video games, for which "like sport, most players do not derive extra-game rewards or approval" (p. 349). In fact, many players pay money to participate in sports and video games. Thus, the authors suggest that players are intrinsically satisfied and internally motivated to play video games. Like sports, video games meet the relevant criteria for SDT, with particular regard to the intrinsic motivation components. For example, Ryan et al. found that players who experienced higher level of autonomy *within* the game itself had much more positive experiences than those who played games that did not offer a great degree of autonomy within the game. In addition, Ryan et al. (2006) found that games that allowed for increased levels of competence provided more satisfactory experiences than games that did not allow for high levels of competence.

In summary, SDT examines the intrinsic and external motivational factors that thwart or encourage a person to perform an activity (Ryan & Deci, 1985, 2000a, 2000b). Intrinsic, or internal motivation, is completing a task for the pleasure or satisfaction of doing it. Extrinsic, or external, motivation is the performance of a task because of outside coercion. The level of autonomy, competence, and relatedness that a person has significantly influences intrinsic motivation. Like sports, video games are a prime medium for examination under SDT.

Game Usability

Although people may be intrinsically motivated to participate in a video game, the video game itself must support participation. If a game is too confusing, has too many errors, or is

difficult to control, players may abandon the game in favor of another activity. Usability is a crucial element in video games because of the range of complex information disseminated and the wide diversity of users interfacing with the video games (Crystal & Kalyanaraman, 2004).

Although there is no agreed upon definition of usability within any field, Jakob Nielsen (1993) has provided one of the most widely used definitions of usability for any system, whether it is a video game, Web site, electronic device, etc. Nielsen (1993) defines usability as comprised of the following five attributes. First, learnability indicates the ease with which a person may start to use the system. Similarly, efficiency emphasizes that a user can become highly productive using the system once the user is familiar with it. Third, memorability describes that a user should be able to use the system at the second time without re-learning everything again. The fourth attribute is errors, which denotes that the system should have a low error rate or easy recovery if the users make errors. In other words, the user feels a strong sense of control over the system. Finally, the system should provide a satisfying experience.

Until recently, the bulk of usability research has been conducted within the auspices of human computer interaction (HCI), specifically involving the Internet (Jørgensen, 2004). However, video game research has shown that a game that is highly usable will encourage players to involve themselves in the game (Jørgensen, 2004). Desurvire and Wiberg (2009) proposed the Heuristics of Playability framework that can be applied early in game development as well as aiding developers between formal usability/playability research during the development cycle. The game usability heuristics include three categories: game play (enduring play, challenge, strategy and pace, consistency in game world, goals, variety of players and game styles, and player perception of control); immersion (emotion connection, entertainment, humor, immersion, and story), usability and game mechanics (tutorial, status and score, feedback,

terminology, burden on player, screen layout, navigation, and error prevention). We used this general framework for game usability/playability evaluation. For the first round of focus groups included in this investigation, the purpose was to gain insights regarding a proposed exergame concept.

First Round Focus Groups

Sample Selection

An invitation to take an online questionnaire hosted on surveymonkey.com was sent to a random sample of 2,000 undergraduate students at a large Mid-western university. The questionnaire screened participants by assessing their physical activities. A total of 93 students filled out the questionnaire. The authors eliminated respondents who did not play video game and who were not insufficiently active based on the 2008 Physical Activity guidelines for Americans (U.S. Department of Health & Human Services [HHS], 2008). The International Physical Activity Questionnaire (IPAQ) (Ainsworth et al., 2000; Craig, 2003) was used to assess the frequency of physical activities.

Participants

Among the 32 qualified students, 16 (9 female and 7 male) attended one of the four focus group sessions: one focus group was comprised of all female participants, one was all male, and two had both male and female participants. The size of each focus group ranged from three to five participants.

Focus Group Procedure

All four focus groups were conducted during a two-week period from late October to early November, 2009. We used a professional room reserved for focus group and interview research, equipped with two cameras installed on the ceiling and two installed microphones. Upon arrival,

subjects were welcomed by two research assistants and signed consent forms indicating voluntarily participation in the focus group. One of the research assistants moderated all of the four sessions following a structured moderator's guide. The other research assistant took notes on a laptop and assisted in facilitating the discussion.

During the focus groups, participants were asked to share previous experiences and their receptions of video games that involved physical activities. The moderator then introduced the game, tentatively titled *Mount Olympus*. The following is the structured introduction of the game:

> The game character is a young adult in ancient Greece. The game is a fantasy role-playing game that immerses the player in a Greek world that is forming the foundations of politics, philosophy and the arts, while struggling with capricious and feuding gods. Players will rise through the citizenry by competing in athletic events, honing their skills before they face the warring gods on Mount Olympus. What distinguishes this game from other multi-player role-playing games, such as *World of Warcraft* or *Everquest*, is its incorporation of a dancepad and Wiimote. The player will guide his or her character physically by controlling the Wiimote. The athletic events that allow a player to advance will also be controlled through use of the Wiimote. We are currently designing the program for use on a personal computer; however, it may be adapted to the Wii in the future.

Participants were then instructed to take a moment to examine a set of handouts, which featured a screenshot of what the game might look like, an illustration of how physical activity would be incorporated into the game, and four different art styles modeled after off-the-shelf role-playing video games. The art styles ranged from cartoonish to heavily detailed. After

examining the handout, participants assessed their perceptions of the proposed video game. The focus group discussion questions are listed in appendix 1. The session lasted 60 to 90 minutes. Each participant received an honorarium of an Amazon gift certificate valued at $10 and was debriefed.

Data Analysis

Three authors first independently reviewed observer notes, moderator reports, and listened to the audiotape. Then each of the researchers summarized the findings, grouped similar responses together, and identified the emerging patterns and themes. Finally, one author compared and combined the findings.

Results

Reception of exergames. Most participants have played video games that incorporate physical activities either intentionally, such as the *Dance Dance Revolution* series, games that use the Sony Playstation Eye Toy and the Wii Fit, or unintentionally, such as *Guitar Hero* or *Rock Band*, which often encourage vigorous activity as a player advances. Most participants played regularly in high school; however, they have stopped playing video games in college because of busy schedules or game console inaccessibility. They liked these types of games because they required physical activity. Female student M1 said, "I played video games, getting the goals is nice. And it's fun and . . . easy to get started." Many of the contemporary games that incorporate exercise are fairly simple and do not have a steep learning curve. In the same group, female student D said, "I am so busy beating the game records that I don't focus on the sore muscles or sweating." Some female participants enjoyed the bright colors and upbeat music in the games. Female student E expressed, "Looking at the screen flashing the bright color is exciting." In another group, female student D said, "It is fun [to play these games], I enjoy

music, something that has a good beat." While female participants enjoyed the interactive game play, graphics, and music, unlocking new content and beating the records was more fun for male participants. Male student R said, "[For] DDR, the best feeling is to try new things, and the high score flash thing is really good (beating your own record)."

Some participants thought these types of games were fun, but most of the male participants found these games to be dull after playing for a while. Specifically, they criticized that these games often required repetitive movements. As male student D said, "You get sick of it and bored after a while." In the same group, male student E1 followed, "For *Guitar Hero*, the problem is that we ran out of content very quick, and you have to pay for [more]." In contrast, some female participants expressed their frustration with the affordances of the game controls. Female student M1 said, "I got really frustrated at Wii golf. I just did not know how to play it." In another group, female student M2 said, "I am not good at the control like the little buttons [on the *Guitar Hero* game controller], but I like the Wii controller—it's more natural."

Most participants also criticized games that only allow them to use certain parts of their body to play. Female student D said, "The (PS2) Eye Toy didn't do a very good job combining the upper and lower parts of the body. The idea is good, but the execution is awful." Male student E followed, "Wii [boxing] is not punching. It's like just shaking your hands. . . It's kind of pointless. Wii is not exercising . . . just swinging your arms. It should involve actual movements and stretching." Male student B responded, "There should be more variety of the actions in the games. . . I hope they can do more exercise [for] the lower body."

Reception of Mount Olympus. Focus group members were asked how the proposed exergame could increase their intrinsic motivation to engage in the game as a result of autonomous decisions, competence with the game, and relevance to their lives.

Autonomy. The participants felt that the game could provide autonomy if the game provides enough choices for the story unfolding and character development. Participants said they want the exergame to have an open environment and nonlinear storyline option. This will allow players to proceed at their own paces and choose whether or not to finish the linear storyline of the game. Female student M said, "This would be like choosing your path – being able to decide what you want to do first." They are not compelled to complete a series of tasks in a specific order to progress through the game. Having multiple options also would allow for replayability and giving players the sense that they control their own destiny, said one female student. Participants believed that the ability to choose among several options to complete a quest was strongly supported as a method to increase autonomy. Additionally, each of the various options should result in different rewards, such as cut scenes, hints, new character moves, or gear.

The option for a nonlinear storyline and open environment also lends itself to increased character development. One participant suggested that increasing the degree of customization of the character would establish an emotional connection, thus increasing a sense of control in the game. Participants favored allowing for some modification of the character (skin tone, gender, body shape, height, clothing, etc.). "Having a customizable character . . . someone more like me, [then] I can feel more involved [with the game]," said one female minority participant. However, most did not feel that avatar creation should be a primary aspect of the game or take up too much time. Both the men and women were interested in characters that are not highly sexualized or promote unrealistic body images. The female participants said they would be put off by a game in which the female characters were unrealistically voluptuous and scantily clad. Similarly, one male participant said he would prefer realistic male characters.

Competence. Focus group participants felt that the exergame would allow for feelings of competence by showing evidence of progress and increases in skill. Participants suggested that this may be accomplished by inclusion of a status bar to indicate increased skills or levels. Female student E said, "After every level you can see a screen to tell you the progress and what you have done." Male student B suggested a variety of ways to demonstrate competence, "The weapon choices, the ability to gain muscle, the visual aspect of getting scars, the actual training for the battle."

After initial selection of their avatars, the participants suggested that the avatars should reflect progress in the game. One male player said that the physical appearance of characters should represent how well they perform as well as their game history. He said, "If you are [engaged in] a battle, then you can use the muscles, like use your real muscles and reflect them on the character. If you get hit on the face, then you can have a scar on your face. If you heal yourself, you should have a bandage." Many of the video game players will not be in peak physical condition. One self-reported "heavier" male participant suggested that the game incorporate weight as a way to promote physical fitness. He said that seeing a character becoming thinner because of physical activity within the game might be motivating for the player.

The participants were in agreement about incorporating a tiered level of difficulty. Each level should be "hard enough, but not so hard for you to cry," as one male put it. Overwhelmingly, participants favored allowing players to choose how difficult the challenges will be when starting a game. This would allow those new to video games as well as expert-level players to engage in the game. One participant gave the example, "My brother probably can finish it in a week, but I will probably spend two months [to finish it]."

Another way for players to have increased feelings of competence and demonstrate mastery is to allow players to unlock special rewards, weapons, cut scenes, or levels by accruing points. Male student A said competence should be shown by gaining certain skills, "You can jump higher and higher and certain things have to be done before proceeding to further parts." Male student E said players should receive, "better incentives for hard levels, like unlocking a new character or sword." Another player added that expert players will feel increased competence by including additional rewards for playing the game at the most difficult skill level.

It is also important for players to feel that they have conquered certain skills. One member suggested that players new to the game should have difficulty controlling the game character until they earn a certain number of experience points. One participant suggested a very literal demonstration of competence by incorporating cheers from the computer-controlled crowd when a player is doing well, or boos when a player is doing poorly.

Another important aspect of demonstrating competence through usability is ensuring that the game controllers are easily controlled. Although participants were confident that the software component of the video game likely would be highly usable and not too difficult to master, they were less sure about the hardware elements. The proposed exergame will incorporate use of a dancepad as well as Wiimotes. One male participant said he was concerned that not all dancepads are made of equal quality. He said, "frustration with the pad could hinder people." Therefore, some users may not have an optimum experience because their dancepads do not register movement with the sensitivity of other dancepads. In addition, participants were concerned that simultaneous incorporation of a dancepad and haptic feedback enabled game controllers, such as the Wiimote, would represent a considerable learning curve for most video game players.

Relatedness. To connect with other people, participants suggested adding an online component to the game. During game play, participants suggested that certain challenges may require group effort.

Female student E said, "It could be like [*World of Warcraft*] and whatever time you are playing, you will always have someone else there."

Female student M1 said, "Maybe some kind of cooperative events, like you have to cooperate with others to save this person."

Male student M added, "Maybe it will be beneficial to do with other people. Your friends can give you their health or items"

To create relatedness with the computer generated characters, participants suggested allowing for team-based challenges in which non-player characters (NPCs) assist the player. One female player said, "It will be cool if you can direct the (computer) character where to go, or with the group or take the person in the group with you in the game."

Another suggestion for incorporating relatedness into the game is to include a separate set of actions that are specifically targeted as multiplayer. Because the suggested game is based in ancient Greece, most participants thought that the Olympic Games venue would be ideal for a multiplayer competition. Participating in this multiplayer event could earn players additional rewards in the single-player storyline.

Other Elements. The visual art style of the game could either increase autonomy and usability by being visually appealing and encouraging play or it could alienate players. Participants were asked to choose among four different art styles modeled after contemporary role-playing video games. The styles ranged from cartoonish to heavily detailed. Although participants did not all agree on one style, they strongly supported a style that was realistic, but

not too true-to-life or cartoonish. All of the focus group members were intrigued by a game that incorporated physical activity into a story. Although male participants were doubtful and thought the narrative was not quite believable, female participants were in favor of this "human drama" storyline and considered it to be motivating and immersive for the players.

Participants view the game as highly relevant and a satisfying way to incorporate physical activity into an otherwise sedentary activity. However, most were wary that the game would turn into a tournament style sports game, particularly with regard to the Olympic competitions. Male student A said, "I don't want it to be just exercise. I want stories and cut scenes, puzzles or (so-called mini-games)." A male suggested that the Olympic arena serves as a training stage or plays a minor role in a few of the levels. One male participant suggested that the games be optional or outside of the main, linear storyline.

Discussion

The first round of four focus groups was conducted to understand insufficiently active college students' receptions of the proposed exergame. These exploratory discussions also provided game designers guidelines to create the *Mount Olympus* exergame.

First, participants indicated a preference for a style that presents a middle ground between being too true-to-life or being too cartoonish. The design team of the *Mount Olympus* game will follow this feedback to create a not-too-real and not-too-childish art style.

Second, in terms of the game story and gameplay, participants agreed on the design of weaving ancient Greek mythology with physical activities, as well as mini-games, such as puzzles to allow players to exercise both physically and mentally. Being able to learn about Greek myths and history was exciting to these participants. This is an important issue for game designers when coping with different gender preferences and expectations.

Both male and female participants expressed their preferences for normal body images for their characters instead of highly sexualized or exaggerated body depictions, which are often seen in off-the-shelf video games. Allowing customization of certain character traits such as gender, skin tone, height, clothing, and body shape excited participants and was perceived as a way to increase game involvement. Moreover, participants suggested that the physical appearance of avatars change as the player progresses in the game, e.g., if the player performs well, the avatar should become more muscular; if the player gets injured, the avatar would show the injury. According to the above suggestions, the *Mount Olympus* exergame should have a realistic avatar body image, which allows players to customize certain physical traits and reflects what players have done in the game.

The fourth consideration in designing the exergame is the inclusion of evidence of progress beyond changes in the avatar. Participants indicated that they would feel more engaged in the game if they could see evidence of successful progression through the game. Tiered difficulty level and the option of choosing different difficulty level would be implemented in the game.

Focus group participants said that playing with another person, whether face-to-face or online, will give the game relatedness. A multi-player mode for players to compete or work together toward a common goal with another player will be ideal.

Using the whole body rather than just the arms or just the legs was also considered as essential by the participants. However, most of them were concerned about the ease of coordinating the dancepad and the Wiimotes. The design team particularly chose a dancepad with control keys that the players can step in a similar fashion as they walk or run so that the players do not need to constantly look down to check whether they are on the proper button.

Finally, focus group participants were concerned that the exergame will feel too much like

exercise – an activity that many try to avoid. Although the participants were excited to use body movements to navigate in the game, participants said they would quickly become dissatisfied with playing the game if it forced them to run or engage in activities that mimicked working out in a gym. The design of the exergame will incorporate game activities that require physical activity but avoid traditional exercises, such as running or sit-ups, as much as possible.

Based on the results of the focus group discussion, the design team developed a prototype of the *Mount Olympus* game. The purpose of conducting the second round of focus groups was to gauge self-determination features and evaluate usability and playability of the exergame prototype. Note that although the multiplayer feature was recommended by the focus group participants, due to limited resources, this feature was not implemented. Instead, another two features: assistive NPCs and ranked competition were added. The participants in the second round focus groups were asked how they perceived these two as relatedness-supportive features.

<div align="center">Second Round Focus Groups</div>

Participants

The same recruitment procedure used in round one was used. An invitation email was sent to a random sample of 2000 undergraduates and 54 responded. Among the 20 qualified students, 7 (2 female and 5 male) attended one of the two single-gender focus group sessions and 4 (2 female and 2 male) attended the individual interview sessions.

Focus Group and Interview Procedure

Both focus groups and four interview sessions were conducted in April 2010. During the focus groups, participants were first introduced to the back story of the game and invited to take turns playing the game prototype. Then the moderator opened the floor for discussion regarding the self-determination supportive features and the game usability and playability. The focus

group discussion questions are listed in appendix 2. The session lasted 60 to 90 minutes. During

the interview, the participants where first equipped with the portable metabolic analyzer, which

recorded their energy expenditure while playing. They played the game prototype for 15 to 20

minutes. The same questions used in the focus groups were adopted as interview questions. The

interview session lasted 60 minutes. Each participant received an honorarium of an Amazon gift

certificate valued at $10 and was debriefed.

Results

   Autonomy. Overall, participants favored the option for avatar customization and believed

that customization can increase autonomy. "If everyone has the same generic character, I don't

think people would play it as much if you could customize his face, how he speaks, his clothes or

actions," said male T. However, participants were split along gender as to how much

customization should factor into game play. Females felt that customization was essential to a

satisfying gaming experience. "When I play video games, half of the fun I have is building my

avatar" said female H. But male participants urged that avatar customization should be optional.

Most of the males suggested that building a character's exterior should come secondary to game

play. Male B summed up how he felt hard-core video game players feel about avatar

customization: "I really don't care what my character looks like as long as I can do everything."

   The more choices players are offered in the game, the greater the feelings of autonomy.

In addition to the option to customize avatars or not and control the gaming environment,

participants supported giving players different options of how to play the game. For example,

players should be allowed more than one way to defeat a game level. Due to limited resources,

the game is slated to have a linear narrative, meaning that players advance from one level to the

next in a sequential fashion. However, participants suggested that players' decisions should

affect how their characters progress along the linear path. For example, choosing to kill an innocent bystander would result in a slightly different path than helping that bystander. Another way to give more choice to game play would be through choosing how to increase character power. Throughout the game, players will be collecting treasure as rewards for game challenges. They will be allowed to "level up," or increase certain aspects of their characters by purchasing power from different Greek deities. For example, Athena will grant strength, Apollo will grant health, and Artemis will grant speed. Participants unanimously supported this option as a way to increase feelings of autonomy. One male participant said that it would increase autonomy because players will feel more responsible for their characters by choosing what they need. Overall, participants said that autonomy will be affected – positively or negatively – by the amount of choice a player has over his video game play. The more choice, the greater feelings of autonomy.

Competence. With regards to the video game *Mount Olympus*, participants felt that feelings of competence may be enhanced by successful completion of increasingly difficult challenges. The option of a tiered difficulty structure – easy, medium, hard – at the start-up screen and giving players the option to choose how difficult the game will be to play at the beginning were confirmed by the participants to support competence. Another way to accomplish increasingly difficult challenges is to have dynamic difficulty level adjustment for players. This means that after a player successfully completes a challenge, he or she will be given a more difficult challenge. Conversely, if a player is struggling, then the subsequent challenges will be easier. In general, females were receptive to this feature while males were firmly against this type of dynamic difficulty level adjustment. Male E provided a cautionary

note that some players may "game the system" by intentionally playing poorly, thus receiving easier challenges just to beat the game as quickly as possible.

The difficulty of the game is not the only way to increase players' feelings of competence. Another possibility is to include demonstrations of achievement through accumulation of points that may be spent according to the players' wishes. In the case of *Mount Olympus*, this would be accomplished through a heroism meter. Players would receive points that would increase their level of heroism. Participants indicated that this would positively affect their game playing self-efficacy. The heroism meter should be a reflection of how well a player handles the game and its challenges, said male T. Additionally, the meter may provide encouragement to do well in order to play competitively with friends. Although the game is not multiplayer, the heroism meter will provide motivation to beat another player's high heroism score. Focus group participants also suggested that the heroism meter should function as experience points, or a separate experience meter should be added so that the play will not have point deduction for failures.

Relatedness. Although *Mount Olympus* will not be a multiplayer game, players may still foster a connection to the computer-controlled game characters. Participants indicated that they thought this was very possible. However, the small preview they received did not allow them time to get a sense of connection to the computer-controlled characters. Most of the participants said the non-player controlled characters needed a back-story or reason for being there. In addition to providing a stronger narrative for these characters, participants felt that they would feel increased relatedness if the characters acted more lifelike. For example, they could have real voices instead of responding in text. They also could provide tips for game play rather than simply point out the right direction as they currently do. In sum, participants felt the computer-

controlled characters have a lot of possibility for increasing feelings of relatedness. However, they are not currently used to their full potential.

Another way to provide a sense of connection is through an asynchronous ranking system. This will allow players to play competitively albeit not simultaneously. In general, participants supported this idea. However, they said that whether it will effectively increase relatedness by instilling a sense of competitiveness depends on the individual nature of each player. Competitive people will feel a sense of connection with others by trying to beat high scores. Non-competitive people will not care. Regardless, the participants said it is a good feature because it will increase the positive game play experience for at least the more-competitive players.

Usability. With regards to the usability of the game, participants evaluated a variety of features of the game and input devices. First, in terms of navigation, most subjects perceived that the game menu was easy to follow. However, the current version of the game map was confusing. The compass and mini-map on the top left corners were difficult to see and thus not very useful. In addition, the NPC did not provide substantial help. For example, one of the NPCs would attempt to help the player through the level but only pointed out the absolute direction without the consideration of potential wall or barricades in the way. The level the players played, which was based in labyrinth, had many dead ends and few rewards which frustrated most participants. Participants suggested that the game map should be clearer, and the destination on each level should be particularly noticeable. Moreover, designers could use more memorable landmarks instead of similar wall paintings to help players to find the way. For example, one subject suggested that the designers could tactically put a falling statue that points the direction.

Second, despite fears from the initial focus group regarding the input devices, participants felt it was easy to learn how to control the Wii remotes and dance pad. Running and walking on the dance pad was intuitive. However, some players needed to look down to make sure they stepped on the right spots at times. In addition to the intuitive mapping of walking and running, participants suggested that there should be more actions using natural movements. For example, players should be able to shield their body using the natural guarding position instead of pulling the trigger on Wii motes. In addition, players should also physically pick up objects on the ground rather than automatic pick-ups.

Third, most participants did not feel fully immersed in the game environment. With regards to graphics, there were several annoying glitches. For example, the corner will block the view from certain angles. In one place in the game where the player had to battle spiders, several participants reflected difficulties to tell whether there were spiders on the character or not because the color was very similar to the background. More distinctive colors could be a good solution. Moreover, the environment could be brighter. As male participant E pointed out, "It doesn't need to be dark because we are in a cave. Like Diablo, it can still be bright." Participants also suggested that more blood should be added to the game to make better and realistic graphics.

Forth, the current game version provided very little feedback from the game or other NPCs. Participants preferred to have an overall tutorial and mini-tutorials when they encountered new traps, environment, and different functions. For example, when they first triggered arrow traps, other NPCs could provide a warning intertwined with game story for players to be familiar with the trap.

Fifth, regarding NPCs, participants perceived the current NPCs walked too slowly in the game. Designers should speed up the NPCs so that players would not lose their followers easily

if they ran in high speeds. NPCs could also be a part of the story so players could build connections with them and felt more engaged. Instead of displaying text on the screen when communicating with NPCs, a voice-over option should be consider because "I felt tired reading the text when playing the game", said male participant A.

The sixth category participants evaluated was the challenges in the game. Overall, participants all agreed that there should be more actions and enemies involved along the way. "More fighting and less [fewer] puzzles." Participants also preferred to have different mini-challenges such as spider stepping and lava-jumping. Due to the lack of challenges, participants perceived that the current version did not require various strategies to beat the game. When fighting the Minotaur, more special attacks should be provided for players to use instead of repetitive stabbing and blocking. Participants were also in favor of a proposed feature in which they would be allowed to customize their characters' special attacking abilities such as sacrificing treasures to different Greek Gods in exchange for such unique abilities.

Last, with regards to the goal and objective in the game, participants suggested that these could be more obvious. For example, the NPCs can tell the players what to do next in order to advance the game and story.

Energy expenditure. Four individuals were equipped with the portable analyzer, which measures their oxygen consumption during game play and thus estimated their energy expenditure. The preliminary analysis of the portable analyzer data indicated that playing the Mount Olympus game was equivalent to moderate level of physical activity, particularly when the players were immersed in the game. However, when the players felt lost in the game and did not know how to proceed, the physical activity level decreased.

Discussion

In summary, the game *Mount Olympus* seeks to increase intrinsic motivation of players by increasing feelings of competence, autonomy, and relatedness. The second round of focus groups and interviews confirmed that customization of avatar and providing choices on how to play the game and how to grow the character may foster autonomy. Focus groups participants also confirmed that the game will foster feelings of competence by giving players tiered levels of difficulty and allowing players to earn achievement points by successfully completing challenges. Without the multiplayer option, participants believed that it is still possible for players to have increased feelings of relatedness by giving non-player characters rich back-stories and allowing for asynchronous competition among game players. In addition, participants indicated that the non-player characters should be more assistive to provide tips and directions to the players.

The design team will also take suggestions from the participants to improve the usability and playability of the game. First, a quest system will be implemented to give players clearer goals and directions. Second, a tutorial will be added. Third, as most of the participants indicated that navigation in the game is confusing, landmarks and lighting changes will be added to guide exploration. Fourth, more on-screen feedback and feedback from NPCs via voice-over will be added.

Conclusion

This study sought to understand how to design an exergame to increase motivation for physical activity with regard to college students. This was accomplished by conducting focus group discussions to gain an understanding how to design a fun and engaging game with self-determination supportive features. The two rounds of formative evaluation—one with the game concept and one with the game prototype—confirmed many of the proposed design features. The

design team also obtained valuable suggestions from the focus group participants on how to improve usability and playability of the game.

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Appendix 1. Focus group discussion guide in first round

1. Based on what you've learned about the proposed game Mount Olympus, how easy or difficult do you think it would be to play the game?
2. What aspects of the game do you like most? 3. What aspects of the game do you like least? 4. What aspects of the game do you feel could be improved?
5. Show different art style, avatar, control scheme, etc. Which of those would you prefer to have in the game?
6. What do you like about the physical activities incorporated in the game? 7. What do you dislike about the physical activities incorporated in the game? 8. What types of activities should be included?
9. Based on the game concept, what aspects of the game may make you feel a sense of control and competence? What features do you think could be added to increase your feeling of control and competence? Competence means being capable and proficient in an area and being able to predict how well you will perform. For example, a football kicker may know exactly how far he can reliably kick a field goal. 10. What aspects of the game may make you feel that your actions are results of autonomous choice without external interference? What features do you think could be added to increase your feeling of autonomy? Autonomy means being responsible for your own behavior and not being influenced by outside sources or people. For example, an athlete might compete in a sport because she feels it will help her grow as a person. 11. What aspects of the game may make you feel that you are playing and exercising with other people? What features do you think could be added to increase your feeling of participating and involving in a social world while playing this game?
12. Do you have any additional comments you would like to share?

Appendix 2. Focus group discussion guide in second round.

1. Please tell the group your name and major. Share with us what you like or dislike about playing video games.
2. I want to begin discussing the game *Mount Olympus*. What aspects of the game do you like most?   3. What aspects of the game do you like least?   4. What aspects of the game do you feel could be improved?
5. Based on the game concept, what aspects of the game may make you feel a sense of control and competence? Competence means being capable and proficient in an area and being able to predict how well you will perform. For example, a football kicker may know exactly how far he can reliably kick a field goal.   Prompt: 5a. Do you feel that offering players the choice to change difficulty levels from easy, medium, and hard affects a player's feeling of competence?   5b. As a player progresses in the game, his character's development will be marked by a "heroism meter," which tracks how heroic the character is becoming. It will increase after successful completion of challenges and decrease when you die or are playing poorly. Will this affect how competent a player feels?   5c. The challenges through the game also will be mapped to the heroic meter so that a character who is very heroic will have more difficult challenges than one who is not doing so well. Is this an effective way to increase a player's sense of competence?
6. What aspects of the game may make you feel that your actions are results of autonomous choice without external interference? Autonomy means being responsible for your own behavior and not being influenced by outside sources or people. For example, an athlete might compete in a sport because she feels it will help her grow as a person.   Prompt   6a. One of the ways that we have tried to increase feelings of autonomy is by allowing players to customize their avatars, or characters. How would this sort of feature affect a game player's autonomy?   6b. Another way is to have control over the gaming environment, such as a choice in music volume. How would this sort of feature affect a game player's autonomy?   6c. Within the game play, players will have a choice in what they'd like to level up. For example, they may choose to donate treasure to different gods in return for different rewards. Athena would grant strength, Apollo grants health, and Artemis grants speed. Are these types of features effective in supporting feelings of autonomy?
7. What features of the game would make you feel a sense of relatedness? Relatedness is how connected you feel to other players or characters within the game itself and the gaming environment.   Prompt   7a. One of the things we've done to increase a sense of relatedness is to create supportive NPCs, or characters controlled by the computer, to act as healers, builders, or family to guide you through the game. How might this increase relatedness?   7b. Another thing that we will add is an asynchronous ranking system that shows how you are doing compared to other game players. Asynchronous means not playing at the same time. What we will do is to show the highest score as an on-screen ranking for other people

who are at your same difficulty, or heroism, level. How would this contribute to relatedness?
7c. How would a high-score table contribute to relatedness?

8. Is there anything you'd like to add related to autonomy, competence, or relatedness?

9. How easy or difficult do you think the game will be to beat?
10. Did you get bored at any point? If so, when and why?

11. Were the pace, strategy and difficulty correctly balanced? Or was one out of whack compared to the others? Why?
12. Were the game challenges positive experiences? Did they leave you wanting to quit out of frustration or want to play some more? Why?

13. How did the environment help you become immersed in the game? Immersion means feeling fully present within the game and losing track of your physical environment.

14. Did you have any trouble figuring out the controls/layouts or how to read the screen? If so, what gave you any difficulty?
15. Was it difficult to navigate through the game menu? Why?
16. How do you like the game input devices—Wiimotes, Nunchuk, and Dancepad? Is it easy and natural for you to interact in the game using these input devices? If not, why not?
17. Did the game provide feedback to help you figure out how to play? If not, what kind of feedback do you think are appropriate and necessary?

18. Is there anything additional you would like to add?