Motivational Effects on Users’ Engagement with Exergames to Encourage Exercise

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ABSTRACT
The following report explores the motivational factors that influence a person’s decision to engage in exergames as a form of physical activity. The findings of this research question may influence our project, focused on exergames, in terms of acceptance from the user and the long-term commitment to its use. During the research, themes emerged from different types of motivation, the strongest being competition, enjoyment and intrinsic motivators. Other identified motivators were self-esteem building, game design and relatability to the real world. The report will also look at seniors as a segment of the population to compare the motivational factors with the generalized factors, as catering exergames for the elderly is a possible avenue for the group’s exergame project. Encouraging the use of exergames as a method of exercise could encourage physical activity and reduce health risks of those unmotivated to engage in traditional forms of physical activity.

INTRODUCTION
Exergames are technologies used to engage the user to do exercise while participating in a game. There could be potential merits of users adopting exergames as a form of exercising over traditional forms of exercising. These benefits include the ability to exercise from their home and through the use of points and scoreboards, the creation of an immersive gaming environment for the user.

Motivation is the explanation as to why a particular person completes an action. The motivator of the action is difficult to identify as different motivators influence people of different backgrounds and characteristics. However, the various motivators to encourage engagement in exergames can be identified through the common themes identified in various research papers.

Intrinsic motivators are motivators that have emerged from the subject and are not influenced by external sources, such as money or pressure from other people. This form of motivation is critical as the long-term use of exergames depend on a person’s ability for a self-motivated approach to engaging in the available games to gain rewards they seek. These rewards could be to reach specific targets or health-related, and are dependent on the person.

Exergames have the potential to cater for all segments of the population in terms of age. Children can be encouraged to stay active while participating in a fun, immersive environment. Physical activity is important for this segment as it can lower the risk of health risks later in life such as type 2 diabetes [3]. The exercise also encourages healthy, active habits while growing up. Seniors are another segment of the population that can benefit from participating in exergames. Exergames have been identified as a rehabilitation method and also discourage health risks such as stroke [8]. A common threat to the elderly’s health is falling, with over 50% of those over 80 years old having at least one fall a year. Exergames can aid with balance and reduce the fear of having falls in the future [8].

GAMING STYLE
A study conducted by Macvean et al. revealed that there were three approaches to the way in which users interacted with the exergames. These approaches describe a goal of the user during play, these being either point, self-improvement or enjoyment focused [3].

Point Focused
The first of these approaches was a point-oriented style, where users would attempt to maximize their points using minimalistic efforts [3, 6]. This involved choosing the easier levels or games that offered lots of points without exerting too much energy or work. These styles were adopted when the user is competing against another player, among a group of known friends or global scale. Although this method may seem effective to maximize points, it deters the user from the exercise component of the exergames. Reducing the challenge of the game can lead to boredom, this is consistent with flow theory [6]. If the player’s interest in the game falls too much from their minimal playing style, the long term usage of engagement in the exergame may suffer.

Uzor deduced that scores were a powerful motivator, and attributed this gaming element to be the prime motivator for long term engagement in exergames. Scores are also an indication for the use to acknowledge their progress obtained through use of the exergames [8]. Other research concluded that while points are a strong motivator, they cannot be the sole motivator as not all users will respond to
them positively [3, 7]. There was also little evidence to support that game metrics, such as points and leaderboards, have any effect on intrinsic motivation [4]. However, players that are exposed to game metrics, such as points and leaderboards, put in more effort than those playing the same game with no game metrics [4]. Players aiming to maximize scores could result in minimal effort meaning that this minimal level of effort should be appropriate for the user’s physique to ensure the exergame is providing the required level of exercise [7].

To nurture the long-term engagement in exergames, the method in which the player is able to obtain points should be identified as well as any minimal effort strategies with the potential of the player. The player should not be able to obtain maximum points via a method that offers little challenge and engagement to the user as it will not encourage the user to engage in this form of exercising in the future.

**Competition**

Competition is a strong motivator that was observed in studies when participants were engaging in exergames [3, 8]. The presence of scores and leaderboards provides motivation for competitive users to compare their obtained scores with other users [7]. The comparison of their score with other players provides initiative for users to obtain higher scores than those they are competing with. Some find competition when competing on a wider scale, competing against others that are part of a global leaderboard, in attempt to obtain the greatest scores. Other participants found competition against a small circle and were motivated by the competitiveness of comparing their scores with this circle. The background and personal traits of the user must be considered when determining what context of the exergame this user will compete in [3].

Although the competition was a strong motivator for many participants, it cannot be concluded to be a motivator for all users [3]. Some users do not show any impulse towards a competitive element. Therefore, the background of the participant must also be considered to determine if this method of motivation is appropriate. Some characteristics, such as low performers, have a negative approach to competition as their efforts are not recognized on the global or even more intimate scale that they are competing in [3]. Players that are not strongly motivated by competition find their motivation for the use of exergames through alternative sources of motivation.

**Enjoyment**

Another playing style is that obtained for purely enjoyment [3, 6]. Teixeira et. al concluded that an enjoyment component has an effect on intrinsic motivation [7]. This playing style usually results in the player mimicking the avatar and completing the activity to obtain the greatest levels of enjoyment. However, a barrier to this type of play is empathy, the user’s ability to relate to the on-screen character. This barrier can be reduced as the player is mocked through the use of mimicry [6]. Therefore, the mimicry must be appropriate for both the player to mimic the avatar and the character mimicking the player. When compared to the point-orientated style, the player exerts much more effort and movement. This difference in behavioral playing styles shows the influence of the context of their motivators.

**Social**

The experiment conducted by Macvean enabled participants to choose their mini-game as an individual. However, some participants choose to engage in the same mini-game and begin at the same time. This method of play created a sense of cooperation where players have a social factor during engagement [3]. Some users even feel a social element is more important than gaining points or having the opportunity to win during the exergame [3, 5].

**Self-Improvement**

A powerful playing style is self-improvement, where the player attempts to improve themselves in a particular area or wishes to improve their performance in an exergame. In terms of the three playing styles, this gaming style is focused more on the individual’s wants and needs and therefore is most closely related to intrinsic motivation.

The user is not improving their performance for other reasons, other than their desire to advance or better themselves. Players with greater intrinsic motivators lead to a greater commitment to physical activity [7]. The implementation of an obvious relation between the effort exerted by the user and the increments in the point level is essential for the users with specific goals of enhancing their performance [7].

**Self-Efficacy**

Self-efficacy is the confidence that a player has in their capabilities to reach the goals that they have set for themselves. High achievers can be described as having high-efficacy. Macvean credits self-efficacy to be an influential role in the success of a particular activity being accepted and adopted by a particular individual [3]. During a study to identify motivational factors, conducted by Macvean, some participants wanted a challenge motivator and chose to participate in the exergames in which they wanted to improve in. In these cases, a personal best score was obtained, and this score became the score to improve upon each session of engagement. The nature of creating goals is credited to players who possess high levels of self-efficacy. These players are also willing to play the exergames on levels higher than the levels they know they can easily win on. However, the players that had low self-efficacy often choose the easier levels of the games, even if they had previously won on a higher level. This behaviour shows low self-efficacy and the need to gain success from the game, perhaps for a self-esteem boost or for a sense of achievement [3]. People that engage in exercise to avoid
the feeling of guilt, often have low efficacy, and this mentality does not lead to long term commitment to exercising [7]. Furthermore, it is difficult to change this mentality in people who are not motivated towards the goal of exercising [7]. However, the use of an exergame could be a method of encouraging these types of people to engage in physical activity [6]. The way in which personal goals are set relates to the self-efficacy of the player. Players with higher self-efficacy often set themselves higher goals that they wish to obtain than those with lower self-efficacy.

Self-Esteem
Self-esteem is the confidence that a person has within their evaluation of their worth. A self-esteem boost is the good feeling obtained from reaching a goal set for oneself. Self-esteem is often affected by the player’s performance and can be influenced by praise from others, leading to a self-esteem or ego boost [3]. When a user has created a goal for themselves to complete, this has the potential to boost their self-esteem and skills.

There is evidence to suggest that players have different levels of self-esteem, and these levels have an effect on the way in which the player experiences the game. Players who possess higher self-esteem have greater enjoyment and exert greater effort into the game. Players with low self-esteem can react negatively to competitive and cooperative environments if their performance is low, as they are not receiving a self-esteem boost from participating in the game [2].

Self-improvement is a powerful motivator as it addresses the needs of intrinsic motivation. There is evidence to support that intrinsic motivators are essential for the long-term engagement in exergames [7]. Both the levels of efficacy and self-esteem that the user possesses is influential on the level of potential for the long-term commitment of the exergame of a form of physical activity.

SENIORS
Conducting research on how to make exergames appealing for senior citizens is an interesting area as the elderly's expectations and usage of the exergames are different to that of children and adults. These differences in usages can be explained by the different goals of the senior citizens, physical capabilities and experience with technologies. International guidelines for seniors outline that physical activities can diminish the risk of loss of physical movement and falls [5]. There is sufficient evidence to suggest that rehabilitation has a significant impact on reducing the risk of falls. In the United States, approximately 33% of the population over 65 years old fall at least once a year, and 50% of those 80 and above. [8] Physical activities that can reduce the risk of falls consists of balance and muscle strength training. Addressing this segment of the population is important as exergames present an opportunity to motivate senior citizens to engage in more physical exercise. This opportunity presents substantial health benefits such as rehabilitation after stroke and motor impairments, as well as enhancing concentration and general well-being and healthiness. Specially catered exergames could be created to encourage seniors to participate in types of exercises that may increase balance and reduce the risk of falls.

Exergames presented to the senior citizens would need to yield acceptance from the users as well as motivation to use them over time [5]. Nawaz conducted a usability test on several exergaming systems that conducted appropriate exercises fit for the seniors, these exercises involved stepping and cognitive activities. During the experiment, all of the participants agreed that there were likely benefits from using the exergames [5]. This result contrasts with a similar study in which no exergames were used, only home modifications. The result of participants from that there was a lack of believe that the exercises the participants engaged in would reduce their risk of falling [1]. This contradiction shows that the exergames are perceived as more beneficial and results in the users having greater confidence.

Engagement
The experiment conducted by Uzor compared the use of engaging with exergames with a group completing the same exercises that were in a booklet. Uzor identified the main elements of engagement to be interactivity, competition through game scores and increased confidence [8]. The average exercises completed each week from the exergame group never fell below the minimum suggested requirements during the 12-week program. However, the booklet group fell below the minimum requirements after just four weeks. This difference indicates that the engagement factor had an influence over the participation rate of the users [8]. The favoured exergames for this study were the ones that were humorous and conducted in a natural setting environment.

Lack of Feedback
During the experiment conducted by Nawaz, participants commented on the desire for more feedback on their way of performing the actions [5]. These results were similar with that obtained by Uzor [8]. In some instances, players were unsure if they missed points due to their method of performing the action or if it was due to their timing, this led to frustration.

A study conducted by Uzor used a virtual physiotherapist to give instructions and demonstrate the required activity [8]. Some of the participants credited their levels of engagement to this element. They enjoyed the presence of the virtual assistance and had greater self-confidence that they were able to see the activity they were to complete and ensure they were correctly completing the action.
Social Element
Participants in an exergame usage study commented on how they would feel comfortable telling friends and family that they were engaging in exergames as a form of physical activity [5]. The participants also wanted to utilize the game in a social setting by engaging and playing with other seniors and their grandchildren.

The most desired types of activities related to everyday activities, the elderly enjoyed apple picking and walking through nature scenes [5].

Music
A motivational factor that identified from an exergame usage study was the use of music. The music used should mimic the amount of intensity that the participant is engaging [5]. For example, slower music at the beginning of the exergame that builds up to a faster pace as the user is engaging in greater intensity during the physical activity.

Health
Overall, it was concluded that engaging in the exergame enabled most of the participants to feel more confident against the risk of falling, the remaining participants did not feel less confident, instead remained their level of confidence [8]. The participants also felt the exergames were more encouraging and motivated them to engage in more exercises at home.

Conclusion
The suggested social needs are consistent with the enjoyment and point-oriented styles of play, as these gaming styles include the use of competition and collaborative play with other players. Motivational factors involved the immersive factors and the health benefits that the elderly were able to have confidence in while participation. Uzor created the most dominate motivator to the elderly was points, to aid long term engagement [8].

A concern that emerged during this experiment was the issue that most of the participants had a small living space.

The experiment was conducted in an area set up specifically for the experiment. This issue with the lack of space could encourage the desirability of the Oculus Rift as it is a virtual reality headset and in terms of the hardware apparatus, it takes up little space.

SUMMARY
This article explores the motivations found within the three types of gaming styles identified by Macvean et. al [3].

Players within these different domains are motivated by competition, enjoyment and collaboration, and self-improvement. The research articles reveal some contrast in terms of the most dominate motivational strategy determined in that research project. For example, Uzor concluded that points were the most powerful motivator, whereas Teixeira et. al deduced that intrinsic motivators were essential for long term engagement [7]. Therefore, it can be concluded that, ideally, the exergame should accommodate for these three playing styles and the different motivation strategies that they possess. A common theme among all playing styles was that the motivation of a particular user depends upon their characteristics and personal qualities, including self-efficacy and embracement of self-esteem. The motivations of the seniors segment do further enhance the scale of motivators as there were some differences that emerged.

The seniors were more motivated by their level of confidence in whether the exergames had the potential to improve their health. Other motivators included the engagement and the social element that the exergames had the potential for. In comparison to the general study, the elderly have a different set of criteria that they require in order to adopt exergames for the future.

To conclude, an ideal version of a motivating exergame would include the ability to compete with other users on a global or more intimate scale, this would involve the use of points, also appealing to self-improvement focused players. The ability to obtain points would be in relate to their amount of effort to ensure the user is not exerting minimal effort for maximising their points. The game should involve a social element, for players motivated by collaborative play.

An exergame focused on engaging the elderly should involve appropriate feedback and corrective feedback when points are lost. The games should include the option for collaborative play to improve social use.

FUTURE WORK
A conclusion of this literature review what that there is no dominant motivational strategy for encouraging the long-term use of exergames as a physical activity. Therefore, further research would need to be conducted in creating a solution to an exergame that are applicable to motivational influences of different users. It may involve the use of customization through assessment of the user's characteristics, a choice from the user or the combination of all motivators. Motivational differences were compared in terms of general motivators and the elderly's motivators. However, more characteristics could be compared such as greater age segmentation, gender and ethnicity. This is consistent with Teixeira et al.'s statement that further research is needed to identify the effect that personal characteristics, such as age, gender, health conditions have on the weight of the motivational factors [7].

REFERENCES


