

# Persuasive Health Games

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## ABSTRACT

Obesity and being overweight has become an increasing trend in America's society over the last decade. This disease is not only affecting adults, but children as well. This statistic continues to rise due to controllable and uncontrollable factors, including poor nutrition and unfortunate medical conditions. Researchers have turned to persuasive technology in the form of health games to attack the "Battle of the Bulge." These games fall into three different categories: exergames, casual games and serious games. Our paper will explore these three types of technology and the effect they intend to have in turning America into a healthier place.

## Author Keywords

Persuasive technology; health games; casual games; exergames; serious games;

## ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

## INTRODUCTION

Nearly 70% of American adults are overweight within half of that percentage being considered obese; an alarming 17% of America's children (ages 2 to 19) are also considered obese [1]. The unfortunate overweight issues plaguing the country are due to numerous factors: uncontrollable reactions due to medications and diseases [2], a decrease in physical activity, and unmonitored caloric intake, amongst others [3]. While the side effects to certain medications and diseases cannot be avoided, some of the illnesses could be prevented if Americans decided to take care of their health before it becomes a problem. Media and the accelerated rate of the advancement of technology can be partly to blame for the lackadaisical attitude of our society; hours are spent on laptops, video game systems, and in front of the television that ends up taking away any available hours that could be used to exercise. Gone are the days when children would beg to play outside with their friends; instead they can be found battling them head-to-head on the Xbox One or texting them on their cell phones. The laziness of Americans has also contributed to our poor health

decisions. The readily attainable burgers and fries are large contributors to the overindulgence in bad calories [4]. The fast food giants are masters of persuasion which contributes to the aforementioned obesity epidemic the country is facing. They use inexpensive pricing and bright colors to persuade Americans to continue to eat out at an alarmingly unhealthy rate.

Just as Wendy's and McDonald's can influence Americans to behave a certain way, so can technology. Persuasive technology is defined as using technologies to influence or persuade a person's behavior or thought process in a non-forceful way [5]. Technologies have been created to assist with the obesity-causing factors mentioned previously. Strides have been made in developing technology to facilitate preventive health care, encourage physical activities, and monitor dieting/food intake in the form of games. These health games have been categorized into three types: exergames, casual games, and serious games.

## RELATED WORK

### The Transtheoretical Model (TTM)

The transtheoretical model is a behavior change theory, which is the premise of persuasive technologies. It is composed of five stages of change, ten processes of change, decisional balance, self-efficacy and temptation. The five stages include precontemplation, contemplation, preparation, action, and maintenance. These stages are used to classify where the individual is as they are undergoing their change. The processes of change take place within the stages and include dramatic relief, consciousness raising, self-re-evaluation, environmental re-evaluation, social liberation, helping relationships, self-liberation, counter-conditioning, stimulus control as well as reinforcement management. The former five are prevalent in the first two stages, with the latter being dominant in preparation, action, and maintenance. Decisional balance deals with the advantages and disadvantages of one changing their behavior, while self-efficacy is a measure of one's confidence while undergoing their change [6]. Temptation plays a role once the individual has already changed and will most likely be prevalent in the maintenance stage. TTM is primarily seen being used in regards to someone changing their diet and/or levels of physical activity [7].

## HEALTH GAMES

### Exergames

Exer-gaming (Exercise-gaming) is a new and very exciting form of physical activity that seamlessly blends sensor technologies (cameras, body sensors and hand held remotes) and video gaming technologies in such a way that you are required to 'move' to fully interact and best experience the exergame. Furthermore, they can help to motivate participants; by responding to specific player actions and challenging them at each level of expertise, thus encouraging children to continue playing the game. The type of workout you receive will depend on the game, and often into the energy you put into playing. There are different exergaming categories such as camera exergaming, rhythm exergaming, exergaming machines, workout exergaming and sensory exergaming. Exergaming can be enjoyed by anyone, as there are games to suit people of any gender, ability, fitness level or age. Games consist of different levels, so even beginners can enjoy the games. They are accessible in many forms such as online, in arcades or at home. [8]

### Examples

Many games that incorporate the use of dance as a major gameplay mechanic, often using the dancing of a player to trigger on-screen events in the game itself, are excellent examples of such games designed for fun but incorporating physical exercise. [9]

- A very popular example of this form is DDR (Dance Dance Revolution): - Players stand on a "dance platform" or stage and hit colored arrows laid out in a cross with their feet to musical and visual cues. Players are judged by how well they time their dance to the patterns presented to them and are allowed to choose more music to play to if they receive a passing score.
- Kinect for Xbox 360: -Based around a webcam-style, it enables users to control and interact with their console/computer without the need for a game controller, through a natural user interface using gestures and spoken commands. Multi- and single-player games include boxing, volleyball, kung fu, track and field, soccer and more.
- PlayStation Move: -Employing a camera and a motion controller remote, this gaming console offers exercise game titles for single and multi-player play, including beach volleyball, disc golf, archery, dance, table tennis, kickboxing, and more.
- Nintendo Wii Fit: -Featuring multi- and single-player games, including skateboarding, hula, kung fu, skiing, dance games, and more, the Wii Fit uses a balance board and remote, both of which translate real life movement into game play.

### How Do They Compare?

Both the Xbox Kinect by Microsoft and Sony's PlayStation Move use motion-detection to give you more options for controlling and interacting with games than are possible with a basic gamepad. The PlayStation 3 Move uses two pieces of technology: a wand controller and a camera. The camera detects the position and movement of the wand to determine what you're doing with it. Steering wheels, blasters and other controllers are available with built-in wands for specialized games like racing games and first-person shooters. By contrast, the Xbox 360 Kinect uses only one piece of technology. It's a motion and depth sensor that also responds to voice commands. It uses skeletal tracking and face recognition, essentially making your body the game controller [10]. The quality in graphics and gameplay is determined by each individual game, not the controller. Both the Xbox Kinect and PlayStation Move support up to four players, assuming the game you select has a multi-player mode. To have two to four players playing simultaneously with the Move, you need a separate hand-held controller for each player. The Kinect, of course, doesn't require controllers. For the Wii, all the motion-control magic is in the remote. An accelerometer tracks movement, while an IR sensor monitors the positioning of lights emitted by the sensor bar. Its motion-sensing abilities weren't so great at first; initially, your movements with the Wiimote were reflected only approximately in games with gestures and broad motions [10]. The Wiimote is not as responsive as you might expect, but it does add more interactivity. The Xbox controller is nice for those who are familiar with gaming and want to just sit down and have fun. The Wii is more focused upon casual or new gamers, and includes many easy-to-use and family-friendly games. Xbox is better if you want to play shooters or games centered around online gaming and communication. The Wii's biggest weakness is its graphics; unlike the PlayStation 3 and Xbox 360, the Wii doesn't display high-definition content. While Kinect and PlayStation Move are both very new, the Wii has been around since 2006, and it has developed a very large library in that time.



Fig. 1 Images of the Xbox 360 Kinect, Playstation Move and Nintendo Wii [11]

### Advantages

The primary benefits of exergames is that they assist in calorie burning and weight loss. They also can help improve coordination and body movements. Exergaming helps to decrease stress levels and allow for an aerobic workout (which has cardiovascular benefits), all while having fun. The variety that exergames offers leads to more benefits. For children who are not talented at sports, this provides a way for them to get exercise without the pressure to perform on a sports team. For kids who do not have many friends around and whose parents are too busy to play sports with them, it provides with them with the opportunity of still being active by playing against virtual players. It's also an option for kids who find other forms of fitness training boring.

Social and cognitive benefits are also produced by engaging in exergames. Online exergaming communities offer a place where gamers can meet and compete. Exergaming can be played when kids have their friends over. It can also be a family activity, facilitating family bonding, because exergaming has options for all ability levels and ages. Playing against other people promotes competition and therefore offers more of an incentive to exercise. Cognitively, these games have a very positive effect on executive functioning as well as on attention, working memory, planning, multi-tasking and problem solving skills. This can be particularly beneficial to seniors, as it helps delay dementia and improve cognitive skills [9]. For example, cognitive benefits of iDANCE range from better ordering and sequencing skills to pattern recognition and higher overall competence level [12].

### Casual Games

Casual games are another form of persuasive technologies used to increase one's knowledge about health. They differ from typical video games due to their simplistic nature; they are easy to learn and use. The time required to play or complete a normal level also differs from the video game genre. Rounds or levels on video games can take up to two hours to complete whereas casual games can be completed in less than ten minutes [13].

### Examples

One mobile casual game developed specifically for adults is entitled "OrderUp!" created by members of the School of Interactive Computing at Georgia Institute of Technology

[13]. This game was created when researchers realized the lack of nutrition-based games targeted for adults. This game specifically targeted African Americans in the Southeastern part of the U.S. due to the problems endured by this demographic when it comes to their diet and health. The user acts as a server in a restaurant and has to suggest the healthiest menu option out of three randomized choices to the customer. The healthiest option is determined by a health value using nutritional data, such as fat, cholesterol, fiber, sodium content, and etc. The gamer is given feedback after their choice has been in the form of a stoplight; green for the best choice, yellow for the next best choice and red for the unhealthiest option. The gamer has six seconds to serve their customer before he/she left angry. The team at Georgia Tech deployed their game to 12 African Americans in the Atlanta area and overall found that "OrderUp!" helped the gamers engage in processes of change. Some particular processes identified were: consciousness rating (they became more aware of good and bad nutrition), self-evaluation process (they documented that they began to think before the order their meals) as well as the helping relationships process (they discussed the game and nutrition with co-workers and family) [6,13].

Another casual game that has been created to assist in proper nutrition training is "Lunchtime [7]". This mobile game is similar to the idea of "OrderUp!" in terms of the design feature; the user once again has to choose the healthiest meal option out of a list of three. However, this is a multiplayer slow casual game. The term slow essentially just eliminates the time restriction on making a decision; this was done so that the gamer could have time to reflect and gather as much information as they could about the food options before making a decision. The game consists of ten rounds where the user and friends pick a restaurant from a list, as well as their health goal. They have an option of five: manage weight, manage diabetes, manage blood pressure, build muscle, and general well-being. This allows for the game to be personalized to different health issues different gamers could actually be facing. The game ends after ten rounds and the player with the highest score wins; 10 points are awarded to the player picking the healthiest choice (also based on a similar health value as mentioned above), then 5 points the next best choice, and 2 to the last. The evaluation (a study was ran with six participants) showed that it accomplished the researchers' original goals of facilitating learning, reflection and attitude change. They



Fig 2a-c: a) Initial instruction screen for "OrderUp!" b & c) Screens displaying meal options as well as total health score, the player's name and the timer [13].

also noticed that their gamers encountered similar processes of change as the “OrderUp!” participants.

Casual games have also been explored in other areas not related to diet/nutrition. “Cytarius” was a casual computer game developed to educate children and teenagers about cancer health [14]. It straddles the serious/casual line because of its use of a narrative to convey the information about different cancers and the variety of treatment options. The gamer is given the tasks of strategically protecting two planets, which represent leukemia and tumors, by blasting the invaders with weapons, simulating the treatment options. The game and its graphics was found to be more enjoyed by younger children than the older teenagers. 80% of the participants’ parents thought the game would be a useful to technique to introduce the scary issue of cancer in a more kid-friendly way.

#### How Do They Compare?

K. Gerling et. al [14] listed some important characteristics essential for all casual games: usability, accessibility, positive feedback, high game responsiveness, and an appeal to large audiences. These three casual games all demonstrated usability, accessibility and responsiveness, but they differed in terms of feedback and its appeal to a large group of users. “OrderUp!” overly simplistic stoplight feedback was not favored by the users [13]. We believe it diminished its level of possible persuasiveness by not telling the user why the choice was an unhealthy one. In comparison, “Lunchtime”, gives feedback at the end of each round, with a comparison of each of the three choices’ health values. This allows the user to see why their choice was incorrect and what choice should have been made and why. Also “Lunchtime” did the best job of appealing to the widest group of people; all mobile users. “OrderUp!” targeted African American adults living in the Southeastern part of the United States. The food options reflected that and offered soul food options, such as collard greens. “Cytarius”, while it intended to educate cancer and cancer-free youth, the researchers found that it primarily appealed to younger children. In order to broaden the appeal of these games in particular, the researchers could make multiple versions of the game for different cultures, in the case of “OrderUp!”, or have customization features and implement a level selector for “Cytarius” that would change the graphics and information given based on a player’s age [14].

#### Advantages

The ability for games to be completed so quickly makes casual games exceptional candidates for cell phones and other mobile devices. These types of games can be played while traveling or on a lunch break without the need to be tied down to a desktop machine. The age range for mobile device users is ever increasing, so casual games are an excellent way to disperse information for people of all ages, from toddlers to senior citizens. The easy-to-learn, easy-to-

play aspects of these games also add to the amount of people that casual games can reach. Though the ones discussed were targeted to certain group, casual games have the potential and ability to reach all demographics.

#### Serious Games

As discussed in the “Origins of Serious Games” paper, serious games are designed for educational, healthcare, defense, art, religion, corporate training, and advertising purposes [15]. While there are other options for educating people on the healthy food choices, serious games provide expanded educational entertainment for the player. The goal is to train the players slowly throughout the game and eventually change the player’s health behavior. The training is provided in a slow process of levels or objectives, adding small amounts of additional health behaviors along the way. These games try to keep the attention of the players, which are mostly aimed for teens and children.

#### Examples

“Pyramid Pile Up” is a serious game that slowly introduces which food groups are healthier choices. The game starts out by placing different food groups with the healthy choices as the foundation of the pyramid and the less healthy on the top. As the levels continue, the gamer has to determine which foods are better by reading the nutrition facts on the products and choosing the foods that are low in fat and sugar. The game keeps the attention of the gamer by keeping a move count and a score. There is also a “Chompie”, a creature out to eat your food, that you must crush with the unhealthy food to keep them from eating all of your pyramid [16].



Fig 3. Screenshot from “Escape from Diab” [17]

Another serious game, “Escape from Diab”, shows a world where everyone eats junk food and no one exercises. When the main character (the gamer), who is a star athlete and healthy person, wakes up in the city. He must convince others to join him in his mission to escape diab and return to a healthy lifestyle, but to do so he has to first get them to

make healthy choices. This game has a learning and interactive design. It has a deep storyline to keep the gamer's interest and shows the importance of healthy living. The only way to escape and win the game is by choosing to live the healthy lifestyle by eating vegetables and fruit as well as exercising [17].

An older serious game is "Packy and Marlon" developed and implemented in 1997. This game was analyzed in a clinical trial with positive results. This game was developed to try and help children manage their diabetes by teaching the children to monitor blood sugar, manage food intake, and provide insulin. The number of cases where these children had to go to the hospital due to a glucose crisis decreased by 77% compared with the group who did not play the game [18].

#### *How Do They Compare?*

These games ("Pyramid Pile Up", "Escape from Diab", and "Packy and Marlon") all try to accomplish the same goal of increasing a healthier lifestyle. They all differ however in gaming style, targeting goal, and when they were developed. "Pyramid Pile Up" and "Escape from Diab" are both games that were recently developed and used, while "Packy and Marlon" was developed in the late 1990's. Even though "Packy and Marlon" is older, it is a good example of positive results of serious games. It proved in the paper by Brown et al that there is a connection between serious games and the gamer's real world development.

Also, "Pyramid Pile Up" and "Packy and Marlon" are focused on connecting with younger children. The game style is easier to use with a variation in difficulty level as the game progresses. Both of these games are goal or level based within the difficulty levels, while "Escape from Diab" is more focused on storyline. It is intended to hold the gamer's attention longer with a distant end goal of winning the game by escaping the city.

There is also a difference in targeting goals between the three games. "Pyramid Pile Up" is trying to teach the gamer how to choose healthy foods. The user has to learn how to group the foods into categories and compare them. "Escape from Diab" is developed to also promote a healthy life, but it is promoting the dangers of too much junk food mixed with inadequate exercise. Lastly, "Packy and Marlon" is more specific in the health benefits by targeting children with diabetes. It is focused on helping only these children make healthier and possible life changing decisions.

#### *Advantages*

Serious games are designed to have either a storyline that allows the user to immerse themselves into the game, have many levels that vary in difficulty, or have a specific purpose type (such as health, art, education, etc.) [15]. All of which require the gamer to play the game for more than a couple of minutes to achieve a higher score, win the game,

or accomplish the task at hand. The benefit of serious games for the gamer comes from the gradual learning curve. There is a longer game design that requires the gamer to slowly learn the health choices. Without the learning, the game cannot be won. The goal of this process is to instill the healthy choices by slowly introducing the information to the gamer instead of just telling them a large amount of information at the beginning.

#### **CONCLUSION**

We discovered that each type of game successfully promoted better health, yet they differed on their means of doing so. Casual games are better suited for those on the go because of their ability to be adapted to mobile devices and do not require much time and attention. However for serious and exergames, more time is required. The narratives and story lines immersed in serious games necessitates the gamer's attention. Without investing longer periods of time (more than ten minutes), exergamers would reap no benefits of the technologies. Because of the attention needed along with other factors, some games are more suitable for some ages than others. For example, kids would probably lean more towards exergames than serious games because they are more entertaining and less educational. Older adults may appreciate the knowledge given by serious games, whereas casual games can suit the widest range of individuals.

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