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THE USE OF TECHNOLOGY TO FACILITATE WEIGHT LOSS: CREATING A
HEALTHY VIRTUAL ENVIRONMENT

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ABSTRACT

Background: This study focuses on creating an applicable solution to obesity. The Center for Disease Control and Prevention releases an annual report that shows an exponential rise in the number of individuals in the United States that are considered to be obese. Many researchers believe that an individual's health is a product of the geographical and behavioral environments that they live in. What is new to these studies is that through the use of the Internet an individual is no longer confined to one geographical location.

Over the past decade virtual environments have been created that provide users access to the positive influences and support systems that may not exist in their physical environment.

Results: The results of a classical comparative analysis identify a relationship between the qualities an individual needs to improve their physical health and behaviors which contribute to the motivational "pull" of massively multiplayer online role-playing games. The relationship that is shared by individuals participating in either a weight-loss campaign or online gaming is the motivation to participate in real-world and in-world *character development*.

Conclusion: The use of a hybrid virtual environment that combines massively multiplayer online role-playing game (MMORPG) with a Weight Loss Virtual Environment (WLVE) can promote motivation towards character development and provide a potential solution to obesity.

TABLE OF CONTENTS

ABSTRACT	i
Chapter 1: Introduction	1
Chapter 2: Literature Review	3
2.1 Obesity epidemic in the United States	3
2.2 Obesity as a product of environmental influences	6
2.3 Behavioral Modification for Weight Loss and Maintenance	11
2.4 Virtual Network's Contribution to Weight Loss	12
2.5 Motivations for Play in Online Games	14
2.6 The Motivational Pull of Video Games: A Self-Determination Theory Approach	16
2.7 Final Statement	19
Chapter 3: Methodology	21
Chapter 4: Comparative Analysis	23
4.1 Define Weight Loss Virtual Environments (WLVEs)	23
4.2 Define Massively Multiplayer Online Role-Playing Games (MMORPGs)	24
4.3 Analysis	24
4.4 Improving Physical Health vs. Intrinsic Motivation to Play Video Games	25
4.5 Contrast	28
4.6 Linking the Concepts	31
Chapter 5: Discussion	32
5.1 Hypothetical Design of Experiment	35
5.1.1 Suggested MMORPG and WLVE Environments	35
5.1.2 Suggested Automated Recording Devices	35
5.2 Postulated Experiment	38
5.2.1 Design	39
5.2.2 Variables	41
5.2.3 Expected Challenges	42
5.2.4 Results	44
5.3 Medical Professionals' Opinions	45
5.3.1 Physician 1:	45

5.3.1 Physician 2:	46
5.3.1 Physician 3:	47
<i>5.4 Response to Medical Professionals' Commentary</i>	48
5.4.1 Response to Physician 1:	48
5.4.2 Response to Physician 2:	48
5.4.3 Response to Physician 3:	49
<i>5.5 Future Directions</i>	49
Chapter 6: Conclusion.....	51
6.1 References.....	52
Academic Vita	55

CHAPTER 1: INTRODUCTION

In the United States, over 112,000 people die annually from obesity-related health conditions (Mokdad et al., 2000). While attempts have been made by many Americans to improve their health, researchers and the Center for Disease Control and Prevention (CDC) expect to see this number continue to increase in the future. The use of a hybrid environment that combines a Massively multiplayer online role-playing game (MMORPG) with a Weight Loss Virtual Environment (WLVE) can foster motivation towards character development and provide a possible solution to obesity.

Medical professionals have known for decades that the basic conditions for good personal health are a balanced diet and regular physical activity. However, in a complex world researchers are finding that basic conditions are providing less and less to solving issues like obesity. To ameliorate this issue researchers have been attempting to identify the specific factors that negatively influence an individual's personal health. Several studies suggest that two of these factors are the geographical and behavioral environments where one lives. These environments have been shown to strongly influence one's decisions ranging from the types of foods available in the local grocery store to the typical portion size of a family meal (Booth et al., 2001).

Using this study as a foundation we agree that these environments influence individuals but through the Internet they are no longer limited to the influences that exist in a single environment. If an individual is made aware of an environment that is negatively affecting their health then a virtual world could provide an outlet to a positive environment.

Some overweight individuals may benefit from entering a positive environment dedicated to health and weight loss such as WLVEs. These environments are niche social networks built to provide their users with the tools and positive social support necessary to improve their personal health (e.g. Weightwatchers.com or Livestrong.com). These environments proved to be successful in many cases because they offer users support in developing many of the qualities researchers believe to be essential for weight loss.

Personal health improvement is an important theme in our study because the behaviors needed to motivate an individual to improve their personal health are similar to the motivations that exist for gamers attempting to improve a character or avatar within an MMORPG. These games have been identified as some of the most addicting video games that exist today. Researchers have specifically identified the three characteristics within gamers that contribute to their intrinsic motivation to improve their character, these characteristics are: *autonomy*, *competence*, and *presence*.

This shared goal of personal improvement or real-world character and in-world character development will be evaluated in a classical comparative analysis. The results of this analysis will help us design a hypothetical experiment that can be used to show if the concept of a hybrid environment can be used as a possible answer to obesity.

CHAPTER 2: LITERATURE REVIEW

2.1 OBESITY EPIDEMIC IN THE UNITED STATES

After 20 years of research obesity is still one of the major health issues afflicting the United States. In the last two decades obesity in adults aged 20 and older has doubled. Even worse, as of 1982 the levels of obesity in children and teens ages 6-19 has tripled (Ogden et al., 2006). Each year data models predicting future trends of the obesity epidemic are collected by the Center for Disease Control and Prevention's (CDC) by the Behavioral Risk Factor Surveillance System (BRFSS). In a report the CDC released to the general public, it is stated that:

“In 2008, only one state (Colorado) had a prevalence of obesity less than 20%. Thirty-two states had prevalence equal to or greater than 25%; six of these states (Alabama, Mississippi, Oklahoma, South Carolina, Tennessee, and West Virginia) had a prevalence of obesity equal to or greater than 30%.” (Center for Disease Control and Prevention, 2008)

This means that in just 10 years the United States population has moved approximately 10 percentage points higher on the obesity scale. (See Figures 1 and 2) It is well known that obesity is a serious risk to an individual's health. It is linked to a number of serious chronic disorders including hypertension, hyperlipidemia, diabetes, osteoarthritis and the number one killer in obesity related deaths, heart disease (Flegal et al., 1998). Obesity brings these significant health risks to almost half of United States

adults resulting in research designed to uncover new ways to reverse this trend. Articles are published or posted daily on new research, diets, fads, tips and tricks but what need to be addressed and understood by the common individual are the consequences of obesity as well as methods for prevention.

Obesity Trends* Among U.S. Adults BRFSS, 1998

(*BMI ≥ 30 , or ~ 30 lbs. overweight for 5' 4" person)

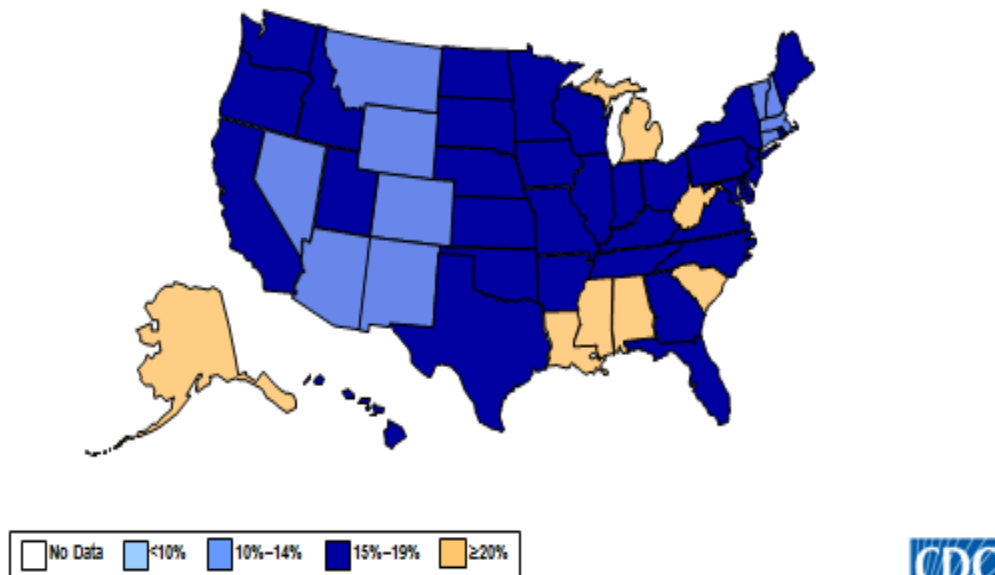
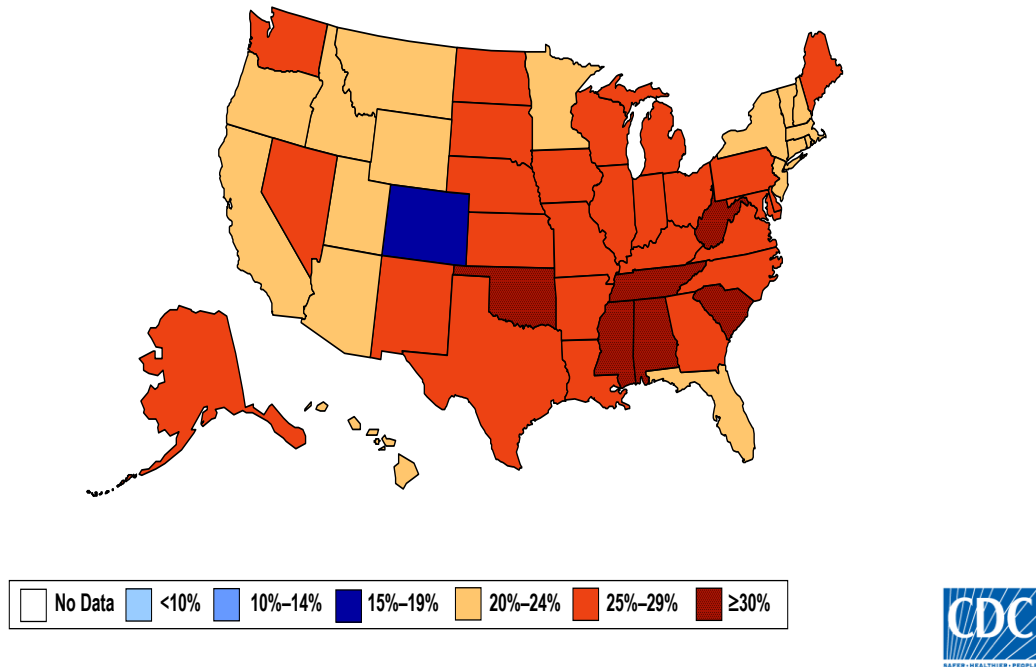


Figure 1: United States map color-coded to represent states percentage level of obesity in 1998 (Center for Disease Control, 2008)

Obesity Trends* Among U.S. Adults BRFSS, 2008

(*BMI ≥ 30 , or ~ 30 lbs. overweight for 5' 4" person)



Source: Behavioral Risk Factor Surveillance System, CDC.

Figure 2: United States map color-coded to represent states percentage level of obesity in 2008 (Center for Disease Control, 2008)

In Figures 1 and 2 the upward trend of obesity in the United States from 1998 to 2008 is shown by using a color coded map. The index at the bottom of both figures shows which percentage range is assigned to each color. These ranges are the percentage of adults in the United States who are classified as obese or have a Body Mass Index (BMI) greater than or equal to 30. For years the BMI calculation has been one of the most commonly used techniques for identifying a person's ideal body weight, the formula for calculating this is shown in Table 1.

The growth in obesity can clearly be seen by comparing the CDC diagram from 1998 to than in 2008 (Figure 1); 15%-19% of adults in the United States had a BMI greater than or equal to 30 or were classified as obese in 1998, compared to 25%-29% in 2008 (Figure 2).

Table 1: Shows the calculation for BMI as well as explanation of the formula results (National Heart Lung and Blood Institute).

$$BMI = \left(\frac{\text{Weight in Pounds}}{(\text{Height in Inches}) \times (\text{Height in inches})} \right) \times 703$$

BMI Categories:

- Underweight = <18.5
- Normal weight = 18.5-24.9
- Overweight = 25-29.9
- Obesity = BMI of 30 or greater

2.2 OBESITY AS A PRODUCT OF ENVIRONMENTAL INFLUENCES

The simple guidelines prescribed for proper weight loss and maintenance are “calories in” or food consumption equals “calories out” or physical activity and waste. But as many have found during their own personal struggles with weight loss or maintenance there are a great deal of confounding variables that complicate this simple equation.

Each year the CDC releases a ranking of the healthiest and unhealthiest cities in the United States. This annual report is an excellent way to remind people in this country that there is a direct linkage between obesity and the environment which you live in. The 2008 report highlighted Burlington Vermont and Huntington West Virginia as the

healthiest and unhealthiest cities in the United States. The healthy report card received by Burlington can be attributed to its physically active culture of hiking, skiing, biking, and the citizens' emphasis on community involvement and parks improvement (Fox News, 2008). The unhealthy report card received by Huntington, WV is in part a reflection of its unhealthy culture filled with poor food choices and sedentary lifestyles.

By successfully developing these rational behaviors towards healthfulness Burlington, the healthiest city in the United States, has helped to validate what many scholars say is a key factor in an individual's personal health. The reality is that environmental forces can either positively or negatively influence the decisions individuals make towards their personal well-being.

There is growing agreement among researchers and healthcare professionals that the obesity epidemic is driven by our environment rather than simply individuals' genetic predisposition for weight gain. Granted there are many varying forces driving the BMI statistics upward but where you live geographically and the culture in which you live can arguably have a stronger influence on your behavior and consumption habits (Hill et al., 2003). In the 21st century the United States' culture has evolved into one that is always "on the go." Accompanying this mentality has been the replacement of many healthy and traditional behaviors that existed in the past with unhealthy ones. For example sit-down dinners have been replaced with fast food, yard work has been replaced with desk work, and playing outside with the kids has been replaced by hours spent in front of the television.

Former Secretary of Labor Robert Reich mentions one rationalization of this shift in culture in his book "The Future of Success". He takes note of the change in the

working culture of the United States today by stating that "...Work is organized and rewarded in the United States in a manner that induces harder work." Individuals are rewarded for their productivity and the only way to increase an individual's reward is to increase their productivity (Reich, 2001). This mindset has been weaving itself into the cultural fabric of the United States to record levels of productivity with the unanticipated consequences of larger waistbands. The growing obesity numbers allow us to assume that typically when the average American is faced with a choice between non-health related incentives like potential job promotions and health-related incentives like the choice to exercise, prepare a healthy meal, or spend time educating themselves on the topics related healthy behavior, the non-health related incentives usually win.

The transformation of the nation's collective mentality on productivity and work is only a small piece of the obesity epidemic. The negative influences that we have been inheriting from our geographical and cultural environments also need more attention. It is believed that the influences that come from these environments strongly effect our decisions and attitudes towards personal health. The geographical or physical environment in which an individual is influenced by is identified as an individual's home state or town.

As mentioned before in the study performed by the CDC, where you live in the United States is one of the primary factors contributing to this country's struggle with obesity. The landscape in which an individual lives determines the distance and convenience of certain municipal amenities. Some of the amenities of a geographical environment that can influence one's health and fitness levels are the quality grocery stores, access to restaurants/fast food chains, quality of fitness centers, adequate bike

paths, and clean parks and recreation centers. Another factor that can influence ones health is the need to use a motor vehicle to get from place to place.

The constraints that a geographic or physical environment places on an individual are arguably the most challenging factors to overcome simply because your environment is your home. Fortunately, researchers have determined that the physical environment in which one lives is not the only problem. We are also strongly influenced by the cultural and behavioral environment that exists within our geographical setting. A study published in 2001 tries to draw attention to the strong influence an environment has on shaping one's behavior and character (Booth et al., 2001). This belief can be tied back to the topic of obesity by saying that if an individual lives in an unhealthy community typically they will inherit the unhealthy traits of that community, further perpetuating the cycle of unhealthy behavior through generations.

An individual's family members are the root of many of their cultural and behavioral influences in terms of health and fitness. Throughout adolescence children develop by emulating the behaviors of their parents, siblings, and friends. Typically in a household the parents set a standard for what kind of foods are eaten in the house, how much time is allowed in front of the television or playing video games, and if there is any encouragement to participate in physical activity. These are some of the primary behaviors that contribute to a healthy lifestyle and as mentioned before many of the positive influences toward health and fitness have been removed from our culture by the demand for productivity.

Sarah Booth and her team are trying to identify the behaviors and lifestyle characteristics that are related to chronic disease and obesity (Booth et al., 2001). They

do so by categorizing these traits into what they call behavioral leverage points; proximal and distal. The authors define a primary or proximal leverage point as, “the immediate controller of a given influence on physical activity or eating patterns within a behavioral setting” (Booth et al., 2001). The example they used to simplify this concept is one’s family. The family is a proximal leverage point that controls behavior by directly influencing the type of foods and portion size of meals consumed. A parent is typically the one who makes purchasing decisions at the grocery store and also plays a role in the promotion of physical activity.

The other type of behavioral influence mentioned by Booth is a distal leverage point. These indirect influences are factors that an individual encounters in their geographic environment. The grocery store is an example of a distal leverage point that is referenced by Booth. The quality or type of grocery store in your area is a distal leverage point because the owners indirectly influence the purchases you make simply by their choices and quantities of products they stock their shelves with. Recalling the example of the healthiest and unhealthiest cities, it is safe to assume that the quality and variety of products that are stocked in grocery stores located in Burlington Vermont would be better in terms of nutrition than those found in a Huntington West Virginia grocery store. Distal leverage points like these are more difficult to control due to the geographical constraints (Booth et al., 2001).

2.3 BEHAVIORAL MODIFICATION FOR WEIGHT LOSS AND MAINTENANCE

As many people have found, weight loss is a struggle that takes time and determination to conquer. Even more challenging is the task of maintaining that weight loss and preventing lost weight from being regained. Certain behavioral factors associated with weight loss and maintenance have been identified that help us gain an understanding on this struggle. The definition of weight maintenance used in this study involves an intentional weight loss that has subsequently been maintained for at least six months.

The generic recommendation for weight loss is eating healthfully and increasing one's physical activity. While applying this concept provides benefits, research has found that additional factors exist that can be associated with weight loss and maintenance. These factors include an internal motivation to shed pounds, consistent social support, improvement with coping and stress management abilities, self-efficacy, assuming responsibility of one's life and educating oneself on healthy habits (Elfhag and Rossner, 2005)

Another subsequent activity that has shown to be beneficial for weight loss is self-monitoring. Non-automated self-monitoring can include the tracking of several different metrics of performance such as body weight, food intake, caloric expenditure, miles ran, and many others. The collection of this data has been shown to improve a person's chances at successful weight loss and maintenance (Wing and Hill, 2001). A challenge that some have had to face is that over time self-monitoring begins to decline. However, there is potential for change with the budding development of automated health collection devices.

It has been suggested that the behavioral characteristics mentioned above should continue to be investigated due to the strong effect they have on weight loss. A lack of these positive behavioral characteristics could be attributed to the types of proximal leverage points that exist in an individual's behavioral environment. The negative behaviors that exist instead can be damaging for an individual attempting to improve on these foundational factors needed for weight loss.

In many cases the proximal leverage points that are discussed in the study done by Booth come from an individual's social groups (Booth et al., 2001). If an individual is trying to transition to a healthier lifestyle, the networks of people they surround themselves with are extremely important (Wing and Hill, 2001). In some geographical environments an individual may also be limited to the variety of people with whom they can associate. This geographical constraint may have been an unavoidable issue in the past, but through the use of the Internet the opportunity to find people who share common goals is no longer an issue.

2.4 VIRTUAL NETWORK'S CONTRIBUTION TO WEIGHT LOSS

Virtual Networks have evolved a great deal over the past 20 years (King and Moreggi, 1998). They originally started in the form of message boards where members of support groups like Alcoholics Anonymous or groups for the terminally ill could congregate by escaping the confines of their geographic location by using the Internet. Since then, virtual networks have rapidly evolved into the social networking sites we know today like Facebook, MySpace and Twitter. Although many years have passed since these social media giants were released there is no doubt that they will continue to evolve to meet the ever growing expectations and demands of the virtual community.

While these integrated social networks and technologies capture the majority of Internet users there are still hundreds of social networks that exist today that focus their market on certain niche topics like dating, depression and weight loss. These networks are able to provide many of the same psychological benefits of the original support groups but now they offer their users newer features and means to communicate like instant messaging and video chats.

Considering all the research done on this topic there is a lack of empirical evidence on the effectiveness of virtual networks to produce successful outcomes. That being said, many of the articles cited in this document have contributed a great deal of evidence that demonstrates that there is some form of benefit to the members of virtual communities. The common psychological benefit mentioned in many studies is the notion of “personal empowerment”. This concept is a combination of several factors, including the ability to make personal decisions, exercise critical thinking and to access relevant information and resources (Wallerstein, 1992). Personal empowerment is believed to be a multidimensional concept which influences individuals on the spiritual, social, organizational, economic, political and psychological levels (Berton, 1994).

Dr. George Demiris links the concept of personal empowerment to personal health in his 2005 study by stating “[it] can be perceived as an enabling process through which individuals or groups take control over their lives and begin managing their disease” (Demiris, 2006). Azy Barak of the Department of Counseling and Human Development suggests that online support groups have been created to promote well being, a sense of self control, self confidence, feelings of more independence, social interactions, improved feelings, and potentially to foster personal empowerment.

These findings are important to this research because they establish the fact that online support groups or niche social networks can provide an individual with the skills necessary to become empowered and initiate a successful weight loss and maintenance campaign.

2.5 MOTIVATIONS FOR PLAY IN ONLINE GAMES

Massively multiplayer online role-playing games (MMORPGs) are known as one of the most addicting styles of video games in the market today. Researchers have immersed themselves into these virtual environments to try and understand what makes these games so popular.

One researcher has developed a model that suggests the answer is a combination of ten motivational subcomponents which he has been able to group into three primary components. The three major components that make up this model are achievement, social, and immersion. On the following page Table 2 highlights these categories.

Table 2: Components that contribute to motivations to play video games (Yee, 2006)

<i>Achievement</i>	<i>Social</i>	<i>Immersion</i>
Advancement Progress, Power, Accumulation, Status	Socializing Casual Chat, Helping Others, Making Friends	Discovery Exploration, Lore, Find Hidden Things
Mechanics Number, Optimization, Tinkering, Analysis	Relationships Personal, Self-Disclosure, Find and Give Support	Role-Playing Story-Line, Character History, Roles, Fantasy
Competition Challenging Others, Provocation, Domination	Teamwork Collaboration, Groups, Group Achievements	Customization Appearances, Accessories, Style, Color Schemes Escapism Relax, Escape from Real Life, Avoid Real-Life Problems

Achievement Component

Advancement: The desire to gain power, progress rapidly, and accumulate in-game symbols of wealth or status

Mechanics: Having an interest in analyzing the underlying rules and system in order to optimize character performance

Competition: The desire to challenge and compete with others

Social Component

Socializing: Having an interest in helping and chatting with other players

Relationship: The desire to form long-term meaningful relationships with others

Teamwork: Deriving satisfaction from being part of a group effort.

Immersion component

Discovery: Finding and knowing things that most other players don't know about

Role-playing: Creating a persona with a back-ground story and interacting with other players to create an improvised story

Customization: Having an interest in customizing the appearance of their character

Escapism: Using the online environment to avoid thinking about real life problem

2.6 THE MOTIVATIONAL PULL OF VIDEO GAMES: A SELF-DETERMINATION THEORY

APPROACH

The participation in video games has become one of the fastest growing past-times in the United States. This is shown by the approximately one billion dollars of annual revenue from the video game producer Activision Blizzard Inc, the maker of popular games like World of War Craft and GuitarHero (Google Finance, 2009).

MMORPGs for years have been the topic of discussion between researchers in various fields of study. There is a great deal of anecdotal evidence telling of the games addictiveness and negative impact on an individual's personal life and relationships. Unfortunately the discussion regarding the positive impacts that MMORPGs and video games have been overshadowed by the negatives. But these gaming environments have provided the opportunity for researchers, specifically physiologists, to investigate what makes these games so addictive. What is their motivational "pull"?

In Table 5, Yee 2006 attributed a player's motivation to their choice of focusing time on three separate types of play. The first motivation is achievement, which is identified by players who are attracted to mastery, character development, competition, or gaining power within the game. The social players are drawn to the environments because they have the ability to interact with others and develop relationships. Players that are looking to immerse themselves are driven to play by their desire to escape real-life problems, engage in role-play, and to be part of the story (Yee, 2006). Other researchers attributed the motivation to play to similar psychological "pulls" specifically autonomy, competence, and presence. These factors are what leads to the player's enjoyment and the potential for future game play (Ryan et al., 2006).

To determine the motivational “pull” of video games researchers have used the Social Determination Theory (SDT). This concept is a general theory of human motivation. By applying this theory researchers try to determine what kind of choices an individual would make if their behavior was self-endorsed and self-determined (Deci and Ryan, 2002). With video games researchers attempt to specify factors that either facilitate or undermine the intrinsic and extrinsic motivations of gaming. The intuition behind intrinsic and extrinsic motivation can be explained through the concept of one’s participation in sports. Most sports players do not derive extra game rewards or approval, their desire to play exists simply because they enjoy playing. The extra rewards like money and fan support are considered extrinsic motivators (Frederick and Ryan). This is comparable to video gamers who play these games because they are intrinsically satisfying (Malone and Lepper, 1987)

In support of the SDT, researchers applied the Cognitive evaluation theory (CET) that looks how contextual factors like rewards, punishments, or deadlines effect intrinsic motivation (Deci and Ryan, 2002). In relation to video gaming researchers were able to define a number of the conditions that enhance a person’s intrinsic motivation including a sense of autonomy, competence and presence. All of these can provide support to intrinsic motivation whereas factors that diminish perceived autonomy, competence, or presence undermine intrinsic motivation (Ryan et al., 2006).

The concept of *autonomy* being one of the primary factors of motivation is an important quality of MMORPG’s because it draws players to the games. Autonomy in the SDT concerns a sense of volition or willingness when doing a task (Deci and Ryan, 2002). When an individual takes part in an activity that interests them or provides them

with personal utility the result is an increased sense of autonomy. Game developers incorporate this concept when they design their interface so that the player finds it to be fluid, non-controlling, and dynamic. Conversely, if the player feels as if they are constrained by the environment or that one's sense of choice or control has been limited, this tends to lead to a weakened a sense of autonomy (Deci et al., 1999)

In a study done by Ryan, Rigby, and Przybylski, it was discovered that autonomy was in fact enhanced by the design of the game provided that it offered a significant amount of flexibility to the players in terms of movement, strategies, and the ability to choose overall tasks and goals (Ryan et al., 2006).

The second major factor that researchers attribute the popularity of video games to is *competence*. This relates to the need for a challenge and feelings of efficacy (White, 1959). CET also proposes that through the opportunity to acquire new skills or abilities to be optimally challenged or to receive positive feedback for others are two ways in which one can experience competence. The results of the study done by Ryan, Rigby, and Przybylski show that an increased sense of competence will lead to an increase in intrinsic motivation and the desire to continue playing (Ryan et al., 2006).

Applying the idea of perceived competence into a video game requires the designer to develop an environment in which game controls would seem logical or intuitive, as well as the notion of ongoing optimal challenges and positive feedback being applied to the game's storyline. This paper demonstrated that perceived competence is among the most important forms of satisfaction provided by games because an individual perceives the virtual gaming environment as a place in which they can feel accomplished and in control (Ryan et al., 2006).

The final piece to intrinsic motivation in gaming comes from the idea of *presence* or the sense that one is within the game world as opposed to experiencing oneself as a person outside the game manipulating controls or characters (Lombard and Ditton, 1997). This is believed to be achieved both by the intrigue of the story line as well as a realistic graphic environment. Lombard and Ditton go on to define presences as the illusion of non-mediation, meaning that a person perceives and responds to the content of a particular medium as if the medium were not there citing the concept of “flow” (Csikszentimihalyi, 1990).

Research has established that both game enjoyment and preference for future play were significantly accounted for by psychological satisfaction. What developers may consider incorporating in the future are games that provide users with an attractive way to become physically involved while still being immersed in the virtual gaming environment. Richard Ryan says it best by stating, “A widely valued and discussed construct in the gaming industry is that of presence of providing the player with a sense of non-mediated “immersion” in a game environment.” This could be reached by creating a system that uses both the body and the mind.

2.7 FINAL STATEMENT

This collective research identifies that the geographical and cultural environment an individual is a part of directly influences the physical health of an individual. Models supporting this concept have been published in scholarly journals like *Science Magazine* and *Nutrition Review*. In addition, other research proposes that individuals who use the Internet to escape their current environments and join a virtual network find empowerment to achieve their goals. The nature of the Internet allows users to find new

influences that extend far beyond geographical boundaries. Lastly this review identifies the factors of MMORPGs that augment intrinsic motivation to continue participating in the gaming environment.

Together these findings can be used to help reverse the growing obesity trend in the United States. In the past various studies have made attempts to link weight loss and technology together primarily through the use of Weight Loss Virtual Environments or Physician-patient oriented networks. In the following sections this research will take a much different approach to weight loss and the use of technology by looking at a relationship that is shared between both environments.

The approach that this study will take is that the solution to weight-loss can be found by combining Weight Loss Virtual Environments with MMORPGs. The thinking behind this concept is that within these two virtual environments individuals who would like to become healthier and individuals who play MMORPGs are pursuing a similar goal which is *character development*. The individuals that want to become healthier are seeking to develop themselves or their “Real-World Character” with the support of a virtual environment, and individuals who play MMORPGs are seeking to develop their avatar or “Virtual Character”.

CHAPTER 3: METHODOLOGY

In order to design a hypothetical experiment that postulates an improved setting for an individual trying to lose weight by combining MMORPGs and Weight Loss Virtual Environments (WLVEs) a connection needs to be made between the two environments. The connection we are hypothesizing is that an individual's motivation to use either one of these environments is derived from shared goal of character development. This hypothesis can be supported by conducting a *Classical Comparative Analysis* structured to follow a suggested format presented by Harvard University's Kerry Walk (Walk, 1998).

The proposed Classical Comparative Analysis is made of up four parts: *hypothesis, frame of reference, grounds for comparison, and the linking of the two concepts by comparing and contrasting certain characteristics*. The hypothesis, frame of reference and grounds for comparison will be identified in Table 3 on the following page. We have also identified in Table the features we will be comparing in our analysis.

Table 3: Identifies the suggested parts of a Classical Comparative Analysis.

Part	Description
Hypothesis	A hybrid environment that combines an MMORPG with a WLVE can foster motivation toward character development, and provide us with a solution to obesity.
Frame of Reference	The idea of comparing these two environments may at first appear to be counterintuitive. On one side of the spectrum, the development of a character within a MMORPG environment promotes an inactive lifestyle, which to have success in the game requires long periods of time seated in front of a computer or television monitor. This differs from an individual wanting to lead healthier lifestyle by entering into a weight loss environment; they would like to immerse themselves into an active lifestyle that promotes less time spent seated in front of the computer or television, and more time spent outdoors or in a gym.
Grounds for Comparison	Through referencing existing research, we identified several shared characteristics that draw users to MMORPGs as well as the healthy behaviors that users want to develop through the use of WLVEs. In addition, the suggested analysis requires us to include contrasting characteristics as well. The criteria are shown in Table 4

Table 4: Characteristics for comparison and contrasting analysis

Comparison	
Healthy Behaviors for Weight Loss	Motivational “Pulls” to MMORPGs
Personal Empowerment	Autonomy
Competence/Efficacy	Competence
Support Networks	Relationships building within game
Contrast	
Promotes Physical Activity	Requires lots of sitting
Source of motivation comes from real-world results	Source of motivation comes from virtual world results
Real-world time	In-world time

CHAPTER 4: COMPARATIVE ANALYSIS

The preliminary research for this study identifies that there are two environments that can influence an individual's health: geographical and behavioral (Hill et al., 2003). For an individual trying to improve their physical health, negative influences that come from these environments can have a discouraging effect on one's real-world character development. Fortunately there are virtual environments on the Internet that allow individuals to navigate around the geographical challenges as well as escape the behavioral influences that are directing the individual's choices.

WLVEs were created to provide their users with a medium in which they can learn and strengthen behaviors that are associated with successful weight loss and management. The variety of these environments ensures that anyone with the desire to improve their health can be equipped with the proper tools and information to do so. MMORPGs on the other hand have been developed for individuals who have the desire to be entertained by a video game or experience life in a virtual world. In order to analyze these two virtual worlds and where they overlap it is important to define both of them individually.

4.1 DEFINE WEIGHT LOSS VIRTUAL ENVIRONMENTS (WLVEs)

This study defines a WLVE as any environment on the Internet that has been created to help an individual improve their physical fitness and health. This study focuses on the environments used by its members to track food consumption, fitness metrics, and current weight. A few examples of the websites that match these criteria are WeightWatchers.com, Livestrong.com, Dailyburn.com, and Traineo.com. All of these

sites offer their users personal logging functionalities, as well as offering their users various resources for health and weight loss education. A third feature that many of these WLVEs offer that draws attention from researchers is the ability to socialize with other members, to build relationships, and create groups dedicated to supporting one's goals.

4.2 DEFINE MASSIVELY MULTIPLAYER ONLINE ROLE-PLAYING GAMES (MMORPGS)

An MMORPG can be described as a computer role-playing game in which a large number of players interact with one another within a virtual world. The most commonly played MMORPG in 2008 was World of Warcraft which netted 11.5 million subscribers (Billzard Entertainment, 2008). The MMORPGs craze started in the late 1990s with the development of games like Diablo, Ultima Online and Everquest (Koster, 2002). Since the release of these original games dozens of researchers have attempted to uncover not only how to improve on them, but also how to carry its addictive qualities over to other facets of life (Griffiths, 2000).

4.3 ANALYSIS

The focus of this analysis is to identify similarities between WLVEs and MMORPGs that promote character improvement. These environments both use the Internet and because of this there are many generic characteristics that already exist. One characteristic that is important for character development is anonymity, which enables users to protect their identities. This feature provides us with an observable behavior that researchers call the *disinhibition effect*. The disinhibition effect is a behavior observed in virtual communication when individuals say or do things they would not normally in a face-to-face world (Barak et al., 2008). Relating this to our virtual environments this

enables users to learn by asking questions that may embarrass them or seek emotional support where they may be lacking it in their physical world.

It is important to this study to build on the generic commonalities that WLVEs and MMORPGs inherit from their platform to find more complex relationships which can help us unearth their potential. What follows will help define one of those intricate relationships by comparing the types of behaviors that are needed for an individual to improve their physical health and the behaviors in which psychologists have called the motivational “pull” to gaming.

4.4 IMPROVING PHYSICAL HEALTH VS. INTRINSIC MOTIVATION TO PLAY VIDEO GAMES

The behaviors that researchers believe need to be present to improve one’s physical health are the same behaviors that make video gaming so addicting. A study published in 1992 introduces the concept of personal empowerment which, as mentioned earlier is identified as an increase in an individual’s perception of his or her own power and strength (Wallerstein, 1992). This concept is elaborated on further in a later study applying the concept to personal health. The 2006 study says that personal empowerment can be perceived as an enabling process through which individuals or groups take control over their lives and managing their” [affliction] (Demiris, 2006). This is comparable to a personal sense of autonomy, one of the factors that psychologists say heightens a video gamers’ motivation to play.

The Social Determination Theory (SDT) evaluates factors that facilitate intrinsic motivation. In this theory autonomy is considered an individual’s sense of volition or willingness to engage in a task (Deci and Ryan, 2002). There is an obvious linkage that exists between personal empowerment and autonomy. It has been shown that autonomy

is one of the many behaviors that researchers have identified to be a medium toward personal empowerment. This enables us to apply these concepts in saying that intrinsic motivation is the overarching quality that best leverages empowerment and autonomy.

The commonalities between the behaviors needed to lose weight and the behaviors that facilitate intrinsic motivation extend further with an individual's perception of *competence*. This awareness to one's abilities can be identified by the individual's increased feelings of efficacy as well as their need to be challenged. This means that an individual takes pleasure in knowing they can complete a certain task but continuously seeks to be challenged. In terms of weight loss an individual can acquire an increased sense of competence as they maintain a consistent fitness regimen or diet. As the individual improves upon their workout techniques and becomes more familiar with equipment their sense of efficacy increases and directly leads to an increase in self-empowerment.

Competence has been found to be a powerful motivating factor in gaming as well. When a player becomes more familiar with the game's controls their perception of competence increases, triggering an intrinsic motivation to continue or return to playing (Ryan et al., 2006). In addition, this feeling of efficacy that an individual experiences while playing the game influences the aspiration to improve their in-world character or experience levels which can be viewed by others in the MMORPG social networks. The ability to increase one's status within their virtual community through increased competence prompts an intrinsic response to continue improving. This desire to advance one's social status through achievement is one of the primary reasons why players return to the game (Yee, 2006).

Social support and influences are the final factors this study will compare. The influences on a person's attitude toward healthy behavior have been identified by researchers as one of the primary causes of obesity (Hill et al., 2003). Researchers have also linked the relationships that one builds within an MMORPG as one of the most powerful motivations to game. This social networking feature offered by virtual worlds creates an alternative solution to the belief that weight loss is a result of your environment.

The social support you receive in a WLVE is the feature that provides you the option to choose a new group of behavioral and cultural influences. When interacting with a WLVE the support you get from your peers allows you to reprogram yourself the way you want and surround yourself by people who can educate, guide, and encourage you to keep on a healthy path. The removal of negative influences is an essential aspect of weight loss.

The results of Nick Yee's research on motivations (shown in Figure 3) for gaming ranks the social aspect of MMORPGs as one of the three primary factors that enhance ones motivation. His findings revealed that many people participate in this style of gaming because they are drawn to the relationships they built within the virtual environment as well as the rewarding feeling of being part of a team (Yee, 2006). This again shows that MMORPGs offer the players a quality that some health researchers identify as imperative for an individual to successfully lose weight.

4.5 CONTRAST

The qualities that provide motivation to players of MMORPGs and the behaviors that an individual needs to leverage in order to improve their physical health have been elaborated on in the previous section. The shared connections create a strong argument that these two environments could offer a solution to obesity for many people. In addition, the contrasting qualities can provide a useful understanding of what can be done as well.

The fundamental differences that placed these two topics on opposing ground for so many years could be the reason why researchers have not approached the obesity epidemic from this angle previously. The difference is that being physically healthy requires an individual to pay close attention to their diet and participate in some form of physical activity at least three to four times a week. Achieving a certain level of success in the MMORPG environment requires a majority of the player's time seated in front of a computer or television monitor.

Another important difference that was derived from the literature review and comparison section is the assumption that if an individual is participating in either real-world or in-world character development there must exist a motivation to do so. The distinction can be determined by reviewing the source of the motivation "pull" that an individual gets from playing MMORPGs or gets from improving their level of physical health.

When a player is participating in a video game the motivation to keep playing comes from the input and output communication with the interface. For example, while playing an MMORPG a gamer successfully completes a task which leads to him

receiving a “level up”. This leads to an increase in perceived autonomy and competence from the interaction with the virtual environment which in turn encourages him to continue playing. The motivation to play comes from the real time feedback the gamer receives from the MMORPG.

In contrast, while an individual is participating in a weight loss campaign with the support of a WLVE the motivation does not come from the input and output interaction with the virtual environment. Instead, the motivation comes from the individual’s real-world environment in the form of pounds lost, improvements in perceived appearance, or a gain in strength and stamina. The interaction with the WLVE is a supplement to the true motivation of the physical environment by providing the user with additional metrics to track their success like calories consumed, miles ran, or improvements in strength and fitness.

This notion is derived from the theory of *presence* within a virtual environment (Ryan et al., 2006). Again, presence in a gaming sense is defined as the sense that one is *in* the gaming environment navigating their character as opposed to experiencing oneself as a person outside the game manipulating controls (Lombard and Ditton, 1997). It is apparent that weight loss results do not come from immersing yourself in the WLVE. Rather, the results come from physical activity, good nutrition, and healthy behaviors. The interaction with the WLVE is used to keep track of the user’s progress, provide social support, and to educate. The results that are shown in the WLVE are the achievements of the individual’s physical self not the achievement of a virtual character.

Time is another element that helps differentiate character development in real and virtual worlds. Virtual world character development is a process that provides instant

feedback on the characters development. If an individual completes a task with their character there is an immediate reward for that achievement. There is not the same result in real-world development because if an individual eats healthy foods and exercises the results may not be realized for several weeks, if at all. The lack of immediate results is perhaps one of the most challenging aspects of improving physical health.

When evaluating other time related differences between real and virtual worlds there are additional factors that appear to give the virtual world development an advantage. An example of this is the time required for an individual to recover. In real-world development if an individual is exercising properly they are using more energy than normal and breaking down muscle tissue in order to build it back up and become stronger. In order for an individual to benefit from a regimen of physical activity they must rest and recover from that activity before they are at full strength again.

When an individual is gaming within a virtual world their physical self does not use a great deal of energy. This allows gamers to play for extended periods of time without tiring. In addition, the gamers' in-world character experiences minimal fatigue and if they do, it can be cured by short periods of rest or health charms placed within the game. The ability to develop an in-world character for extended periods of time is something that cannot be done in the real world because an individual's body can be overworked and without time to recover could potentially cause harm to the individual.

4.6 LINKING THE CONCEPTS

Now that these two concepts have been compared, we will link the two together by asserting that many of the characteristics that make MMORPGs addicting are convincingly similar to the characteristics that an individual needs to lose weight. All of the qualities mentioned in this analysis are in some way interwoven, whether one leads to the other or there is a conditional relationship that is shared between the two through an individual's motivation to develop either their Real-World or In-World character.

As a suggested solution for the obesity epidemic we can use these motivations for character improvement developed both in the real world and in the virtual world, and apply them to a hybrid virtual environment. Through the use of automated recording technologies the users will receive continuous feedback on their performance. This constant interaction will allow the user to create a new character, one that exists both in the real and the virtual world.

The discussion portion of this paper is to follow. This section outlines a hypothetical virtual environment that encompasses the characteristics of both MMORPGs and WLVEs to produce a suggested solution for reducing the level of obesity in the United States. This hypothetical environment will help bridge the gap between gaming and weight loss by building upon the idea that while participating in an MMORPG an individual's in-game characteristics are influenced by real-world behaviors.

CHAPTER 5: DISCUSSION

The results of the comparative analysis demonstrate that an individual's motivation for character development is fostered by the behaviors researchers believe an individual requires to improve their physical health and the qualities of MMORPGs that increase one's intrinsic motivation to play. We can use these findings to create a postulated experiment that should offer us a possible solution to the growing levels of obesity in the United States.

Technology and obesity have long been united in a conversation that argues the former causes the latter. For decades people have used technology as a way to engineer physical activity out of our daily lives. Stairs have been replaced by elevators, bicycles by cars, and flag football by "Madden Football". To compensate there have been technologies developed to help individuals lose weight like the treadmill, heart rate monitor, and the newly introduced "WiiFit". The more prominent technological advancements have resulted in a decline in American's level of physical activity. The process of engineering out physical activity has directly led to the rapid growth of obesity levels in the United States where today approximately twenty-five to thirty percent of adults aged 20 years or older are considered overweight (Hill et al., 2003).

Researchers have investigated hypotheses for decades trying to discover a breakthrough that could lead to reversing the rapid climb of obesity levels. While many fields of study have made great strides in the biological process of weight loss, others are making attempts to identify the psychological motivators that also play an integral role in the weight loss process. In addition, many who study environments believe that a person

can be influenced either positively or negatively by the geographical and cultural environments in which they live (Hill et al., 2003). This provides an opportunity to take an interesting approach towards weight loss because in the days of the Internet, no longer are individuals confined by the influences of their geographical space.

This new approach suggests that through the fusing of physical and virtual environments, the creation of a hybrid environment would augment an individual's motivation to develop their personal health. By leveraging automated recording devices, an individual's constant connection with this environment could be a potential solution to the obesity epidemic. This idea of constant feedback from the automated recording technologies allows individuals to see the consequences of their actions, something that has been identified by the *Precaution Adoption Process* as a cause of unhealthy behaviors like smoking and overeating (Weinstein, 1988).

The Precaution Adoption Process theorizes that when individuals make decisions specifically health related they cannot make an association between the action and its consequence, because the consequence is typically not realized until later on in life (Weinstein, 1988). The ability to track one's behaviors and to immediately link those actions to some variety of consequences will be an important component to the success of this designed experiment. To gain perspective on this hybrid environment Figure 3 describes a virtual gaming environment that ties real-world characteristics to the individual's in-world character.

Figure 3: Describes a scenario in which a gamer's real-world health is linked to a MMORPG

Consider a future situation with a young adult named Andrew. Andrew is a physically fit gamer, six foot tall, 180 pounds, able to run two miles at a constant eight minute and thirty second per mile pace, and can complete 20 bench press repetitions of his body weight. These statistics are considered to be healthy characteristics for a young adult. Everyday Andrew tracks his weight, activity levels, calorie consumption, and other fitness criteria using innovative technologies. He does this not only because it is one recommended way to maintain a healthy lifestyle, but he is also part of an innovative gaming revolution where the individual's real-world qualities influence their in-world characters traits.

This gaming revolution has inspired users to become healthier because gamers like Andrew now gain an advantage over their less healthy opponents. This is because a gamer's performance in the virtual environment would change based on their day-to-day behavior which is monitored using automatic recording technologies. For example, if the individual did not get eight hours of sleep, attributes like stamina or health would be negatively affected within the MMORPG.

Other metrics that are recorded include Andrew's food consumption habits. If he consumes too many calories one day or eats too much greasy food, then Andrew's virtual character (avatar) will exaggerate the real-world consequence by becoming sluggish within the virtual environment. The only remedy for this consequence is a visit to the gym or a twenty-four hour refresh time.

While some gamers avoid this style of gaming because of its limitations there are many people like Andrew who appreciate the motivation to become healthier as well as ability to see within the hybrid environment how his real-world actions have consequences.

5.1 HYPOTHETICAL DESIGN OF EXPERIMENT

5.1.1 SUGGESTED MMORPG AND WLVE ENVIRONMENTS

This experiment requires the creation of a virtual environment that combines the characteristics of an MMORPG and a WLVE. The tone box above is used to help create a mental picture of this environment. To create this system we must consult several game developers, designers, and gamers to be sure we incorporate all of the necessary components that make up a MMORPG that people would be interested in playing. The WLVE interface will need to be developed and incorporated as well, making sure that all of the data that the devices records can be uploaded and viewed within the interface.

5.1.2 SUGGESTED AUTOMATED RECORDING DEVICES

It has been shown that daily logging of calorie consumption, body weight, and other metrics provide support to individuals participating in a weight loss or weight maintenance program (Wing and Hill, 2001). Many researchers suggest that manual recording is sufficient, but in a technologically adept world the ability to log this data through the use of automated recording devices is now becoming possible. This hypothetical experiment will focus on three existing technologies that automatically record certain metrics that will be relevant to the virtual gaming environment.

Fitbit

The Fitbit is an automated recording technology that was unveiled in September 2009. The user would need to clip this device somewhere on their torso between their waist and chest and the device automatically records bio-information on their day-to-day activity levels. The user must then connect the device to the Fitbit virtual user interface,

where the device will upload the data and the user can manually enter additional data (Fitbit Inc., 2008). The Fitbit device and interface collects the data from the user that can be used in this experiment as shown in Table 5.

Table 5: Fitbit device metric recordings (Fitbit Inc., 2008)

Fitbit Metrics	Automatic Record or Manual Record	How Metric is Determined
Basal Metabolic Rate (BMR)	Automatic	Calories Burned
Estimated Energy Requirements(EER)	Automatic	Estimation of daily caloric needs based on: Height, Weight, Age and Gender
Activity Level	Automatic	Determined by caloric expenditure per 5 minute increment
Body Weight	Manual	Entered from Bathroom Scale
Sleep Efficiency	Automatic	Through changes in heart rate and movement a user's body makes during the night Fitbit determines how long it took you to fall asleep, how many times you woke up throughout the night and the actual time you were asleep vs. the time you were in bed.
Activity Log	Manual	User assigns activities to specific levels caloric expenditure (see Activity Level)
Calorie Consumption	Manual	User can either select foods within the Fitbit Database which already have the Nutrition Facts added, or manual enter the food they ate and nutrition facts.

Nike+

Nike+ Sports Kit is a product that came on the market in 2006. In a strategic alliance with Apple Inc., this sports kit includes the Nike+ sensor which the user placed in or on top of their shoe and the Apple receiver which is plugged directly into the user's iPod. Since then Nike and Apple have both made upgrades to these products in the form of the Nike+ Sports band which provides the same functionality but requires no iPod. On

Apples end they began incorporating the Nike+ receiver built into their iPods a standard production method (Nike Inc., 2009).

The function of the sensor and receiver is to track user data when the user is participating in a running or walking workout. The sensor, which is placed inside or on top of the shoe, receives a signal from the impact of the user's foot on the ground and sends a signal to the receiver either within the iPod or Nike+ Sports band. The receiver then returns this information to the user in the form of; elapsed time, distance traveled, pace, and calories burned.

When the user is finished with their workout they simply plug the Nike+ receiver into their computer and the device automatically uploads this data onto Nike's user interface. The Nike user interface is structured in the form of a social network, where the user has their own profile, but can also network with others to form groups for support as well as organize competitions between other members (Nike Inc., 2009).

The Wi-Fi Body Scale

The Wi-Fi Body Scale is a device that improves upon a product that is in about every home in the country; the bathroom scale. This device has all the same capabilities of existing bathroom scales including measuring body weight, BMI, Fat Mass, and Lean Mass. Where this product varies is in its use of Wi-Fi technologies to automatically record these statistics onto their online interface. The automatic recording of these metrics now prevents people from cheating and recording the wrong weight. For any researchers trying to perform an experiment for weight loss, this device will be an excellent way to improve on the accuracy of recording (Withings, 2009).

5.2 POSTULATED EXPERIMENT

In this section we propose a set of experiments that seek to understand the extent to which a hybrid environment can help an individual improve their physical health. This experiment will observe three groups of human participants. Each group will be required to interact with the hybrid environment in a different way. The interactions with the environment are highlighted in Table 6, but what follows is an explanation of how we identified these variables.

As we examined an individual's possible interactions with this environment we were able to identify four pure strategies (See Table 6). The fourth strategy has been omitted because if an individual chooses "not to tie performance to weight loss" and "not to play" there is no observable action. With the remaining three strategies we will be able to compare our results from the group that "ties performance to weight loss and plays" and the group that "does not tie performance to weight loss and plays" both to the group that simply "does not play".

Table 6: Outlines the study groups assigned tasks. These tasks also serve as a way to display the variables that make up our propositions

Groups	Assigned Task (All groups will use the three recommended recording devices)
Group 1 (P and T)	Play MMORPG and tie real-world performance to in-world character
Group 2 (P and Not T)	Play MMORPG but do not tie real-world performance to in-world character
Group 3 (Not P)	Do not play the game

With the strategies we have identified we can now generate two propositions that will help to determine the feasibility of this hybrid environment.

Proposition 1: An individual that participates in a hybrid environment where real-world health metrics influence in-game characteristics will experience the same or greater physical health improvements than an individual who does not play the game.

Proposition 2: An individual that participates in a gaming virtual environment but does not link their real-world health metrics the game will experience the same or worse results in terms of physical health than an individual who does not play the game.

5.2.1 Design

To postulate an experiment that examines multiple scenarios we must create three separate study groups. This study's size and duration were determined by a similar weight loss study that was done in 2001 which recommended a sample size of forty participants divided evenly into two groups and monitored over a sixteen month time frame (Matvienkoa and Lewis, 2001). We will use a sample size of sixty participants divided equally among our three study groups. Over this sixteen month time frame all of the participants will be given the recommended devices identified above. The recommended devices will automatically record the individual's metrics and will then be uploaded to our environment for us to track. These metrics will help determine the extent of an individual's improvement.

We believe that if a group of individuals that share a common goal of improving their physical health participate in our gaming hybrid environment where real-world performance influences an in-world character's capabilities they will see either the same or greater results than someone who does not participate in the game. Conversely, we believe that if a similar group of individuals with a shared goal of improving their physical health participate in only the virtual gaming environment but do not tie their real-world performance to their in-world character's capabilities they will experience the same or worse results than the original group. The final group will use the automated recording technologies to track their progress but do will not play the game. This group will provide a control for us to compare these propositions against.

It is also important to this study to form groups of individuals from various backgrounds. While these groups will share a common goal of improving their physical health, the participants will need to be selected from a variety of personalities and experience levels in terms of nutrition, fitness, and technological savvy. By not selecting a specific generation or community we can determine if the hybrid virtual environment is a feasible solution for individuals who differ in age, gender, experience, etc.

Communities to Target:

1. Current Health Status
2. Knowledge of physical health and fitness
3. Gaming Experience
4. Must have a shared goal to improve their physical health
5. Gender
6. Age

Once the study groups have been created they will all be educated on a required nutrition and fitness regimen as well as a crash course on the three technologies they will be using for this study. Separately, Groups 1 and 2 will be given a tutorial on the MMORPG game they will be required to play. Group 1 will also be shown how to link their physical qualities collected by the recording devices to their in-world character

5.2.2 Variables

While many of the metrics from this study will be used to inspire motivation, we will also need to identify specific quantitative variables used by medical professionals to determine if the hybrid gamers, the virtual gamers, or the non-gamers present any improvement or deterioration in their physical health. The metrics that a typical family practitioner records during a patient's office visit are *weight*, *blood pressure*, *total cholesterol*, and *blood sugar*. These same metrics will be collected by a medical professional prior to the start and at the end of this program. In addition to physician's metrics, the participants will be required to manually log the following information into the study's online interface.

Supplemental metrics that will be recorded by all groups:

1. Calorie consumption
2. Activity log
3. Mood

5.2.3 EXPECTED CHALLENGES

One of the primary challenges we are expecting is the attitude of the participants towards the gaming portion of this study. It will be important to consult video game designers to ensure we create a MMORPG that leverages the qualities that drive intrinsic motivation to play like autonomy, competence, presence, and a means to build relationships. But, because we have a diverse pool of participants there may still be cases where the users do not enjoy the game. This is why we have structured this study around a weak ordering, because if the game is not enjoyable for the participants we may find that regardless of the association we have made within the hybrid environment, if no one wants to play the game it will not matter that the characters real-world qualities are linked to their in-world characters.

Another anticipated challenge that may arise during the course of this study is the possibility that the addictive qualities of the gaming environment may overpower the positive addiction we are attempting to create. There is potential that an individual enjoys playing the game so much that they disregard the goal this study intends to help the participants achieve. We may find that some participants became more interested with in-world character development and spent more time developing their in-world character's abilities in order to compensate for the limited abilities they received from their real-world character.

The final challenge that we consider to be of major concern is the potential for participants to spoof the data that the automatic recording devices will be tracking. While these devices are a great way to generate data that can be used to track an individual's progress, there are ways to trick the devices into recording inaccurate information. One

example we have identified is that a participant has a physically fit individual step onto the *Wi-Fi Body Scale* so that their participant's in-world character could inherit the fit individual's healthy qualities like lower percent body fat and healthier BMI. These false recordings would result in a dramatic increase in their avatar's abilities within the MMORPG. This is a possible scenario, but it is our hope that the participants take this study seriously and do not attempt to spoof the technologies to benefit their own results.

Over the course of sixteen months all of the participants of this study will be encouraged to follow the recommended health and fitness regimen in an attempt to improve the physical health of their "real-world character". We have equipped them all with what we feel to be three excellent technologies but there is still a factor which we have not identified in this experiment that will help the individuals become healthier.

The missing factor is a social networking feature which will be created so that the sixty participants can provide one another will emotional support, educate one another on lessons learned, and challenge each other to fitness related competitions like most miles ran in a week, healthiest eater, or largest percentage of weight loss. All of these features will be offered to provide additional motivation to improve their personal health.

For the majority of this project we as the investigators would like to take a *hands off* approach and let the majority of the educating and motivation come from the interaction of the participants with one another. We hold this mentality because once the study is over they will not have a team of researchers to push them towards their goals they will only have the motivations and influences that they receive from their new environment.

5.2.4 RESULTS

Success in this study will be determined by the improvements of the standard metrics that the physician recorded at the beginning, eight month mid-point, and end of the study; *weight, blood pressure, total cholesterol, and blood sugar*. We will also be able to track the data collected by the automated recording devices daily as supplementary metrics of success.

Table 7: Shows the predicted outcomes of this study

Groups	Predicted variations in metrics (weight, blood pressure, total cholesterol, and blood sugar)
Group 1 (P and T)	<i>Overall Improvement in Group 1 Metrics</i> \geq <i>Overall Improvement in Group 3 Metrics</i>
Group 2 (P and Not T)	<i>Overall Improvement in Group 2 Metrics</i> \leq <i>Overall Improvement in Group 3 Metrics</i>
Group 3 (Not P)	Benchmark

While the results collected by our physician will help us prove if our theory is correct or not, they will not answer the question of why the participants displayed the same, better or worse results between the three study groups.. To do this we must analyze the supplementary metrics that track the participant’s behaviors on a daily basis as well as administering a survey to the participants that will provide feedback about the hybrid environment, the MMORPG, and the automatic recording devices.

If we find that our propositions are correct it will tell us a great deal about the intrinsic motivations that come from linking an individual’s real-world traits with an in-world character’s qualities. As we have mentioned, the ability to create an instant connection to the consequences of an individual’s poor health choices, could be vital.

5.3 MEDICAL PROFESSIONALS' OPINIONS

In an attempt to estimate the usefulness and applicability of this concept, we reached out to three physicians all with different levels of experience and backgrounds. Each physician was asked by email to read drafts of this document and provide their professional opinions on this concepts strengths and weaknesses. These professionals have experience dealing with overweight patients and can provide a great deal of insight on to this study.

Table 8: Outlines medical professionals' background.

	Specialty	Typical Patient Age Group (approximate range)
Physician 1	General Practitioner	30-70
Physician 2	Emergency Medicine	All Ages
Physician 3	Military Flight Surgeon	22-30

5.3.1 PHYSICIAN 1:

- Addressed a concern about the study using addiction as a driver of motivation. This type of “positive” addiction may produce the desired results, but typically when dealing with any kind of addiction; some part of an individual’s life, whether physical or psychological, receives less attention.
- The hybrid environment developed in this study may appeal only to a specific type or generation of people. Physician 1 has struggled with some patients for years to become more active. Many of his patients in the 40 to 70 year old range are less inclined to change their behavior.

- Believes this is an inventive way to attract younger people to weight-loss. In the future, Physician 1 believes a product like this could be used by insurance companies to determine the rates and individual receives based of their metrics recorded within the hybrid environment.

5.3.1 PHYSICIAN 2:

- Physician 2 believes the introduction of a new environment for individuals to escape to, is an innovative idea. By leveraging the Internet, you can allow users to find an environment that best suits them.
- There is strong support in the medical field for anonymity. The use of a screen name helps to prevent embarrassment or shame that may accompany the idea of going to a gym
- The 'health score' concept is motivational and competitive so that it is not just the losing weight that offers a 'reward' it is a competition with other people, similar to the NBC's The Biggest Loser.
- Physician 2 suggests the inclusion of aerobic or cardiac fitness measurements. Some of the suggested metrics include maximal oxygen consumption (VO2 max), stress test, or a 'step test' (as many steps as you can do in a minute) to measure at home, or something similar.
- Instead of total cholesterol do the LDL and HDL separately. Physician 2 recommends this distinction, because LDL should go down with improving health while the HDL should go up with increased aerobic fitness

5.3.1 PHYSICIAN 3:

- Medically, health professionals discuss healthy weight loss in terms of 1-2 lbs per week, which patients may not always see immediately. Hence the rise of the “fad diets” which promise 10-20 pounds per week or “instant results.” At times these diets deliver, but deliver in such a way that it is not sustainable. Providing a way for people to “see the results” that come from maintaining a sustainable healthy lifestyle, would ultimately be better for them.
- The need to use metrics in conjunction with pounds lost is an important feature. The goal for Physician 3’s overweight troops is not necessarily the weight loss but a healthier lifestyle (which in turn will lead to the weight loss).
- Physician 3 suggests that this environment could provide benefits to individuals, in that people do not link current conditions with later health. From a military perspective, he states, “How do I convince a pilot that it is in his best interests to ground him for a week to start a medication for blood pressure, when he doesn’t feel it?” High cholesterol, high blood pressure, and to some extent diabetes are illnesses related to obesity and for the most part do not make you feel ill yet if left untreated lead to early death.
- The design for the experiment appears to be sound. Physician 3 believes the environment could provide a positive solution to obesity, but this study would need the numbers to make a statistical analysis worthwhile. However, it should not change the results too much if the study needed to be bigger.
- The idea of offering a way to see tangible “instant results” in a virtual environment to mirror slower longer term results in real life is a creative one.

- Similar to Physician 1, it is believed that this would focus on a younger population, but there needs to be a successful starting point in order for a focus on health to trickle through generations.

5.4 RESPONSE TO MEDICAL PROFESSIONALS' COMMENTARY

5.4.1 RESPONSE TO PHYSICIAN 1:

The commentary received from Physician 1 takes an interesting angle on the concept of leveraging an environment that encourages addicting behavior. The physician believes that while this could provide positive results there is potential for an individual to develop an unintended addiction directed at achieving unrealistic goals. This is something that will need to be considered when trying to harness a behavior like addiction.

Physician 1 also mentions a limitation surrounding a target audience. In dealing with patients that are part of an older generation and may not have an interest in participating in a gaming environment or even a health improvement campaign. This is something to consider, but to determine the overall and long term success of this study all age groups should be incorporated into the study.

5.4.2 RESPONSE TO PHYSICIAN 2:

This physician has a kinesiology and nutrition background, so they has a strong understanding of the importance for measuring an individual performance. Physician 2 provides the idea for measuring more scientific metrics like VO2 Max as well as the specific LDL and HDL cholesterol levels. Statistics like this would be an excellent addition to this study. Specifically, VO2 Max could potentially provide excellent ways to

bench mark aerobic health. At this point in time, technologies that measure these metrics are not a feasible option, but there is potential for this in the future.

5.4.3 RESPONSE TO PHYSICIAN 3:

This professional's commentary provided our study with an excellent analogy to compare with to help highlight the importance of consistent monitoring. Physician 3 works with pilots in the military so his patients' health is constantly being monitored with special equipment while in flight as well as routine check-ups on the ground. The metrics are recorded help prevent a pilot or his crew members from experiencing a medical emergency in flight. Physician 3 asks how he can convince a pilot that he needs to be grounded when he does not feel ill. This is comparable to a person who is overweight. A person who is categorized as obese has an increased risk of health complications, but they do not necessarily feel sick.

Physician 3 estimates that providing an individual with a way to connect their unhealthy behaviors with the potential health risks that they may or already developed.

5.5 FUTURE DIRECTIONS

If the outcome of this hypothetical study provides us with positive results, the concept of a hybrid environment will see a great deal of attention from researchers in various fields. One of the biggest developments that could come out of this is an environment that can offer physicians with a more accurate profile of their patients' lifestyle. If a physician has access to view their patients' profile before an office visit, they could make the experience more valuable to the patient as well as more efficient for the doctors because they do not need to spend time prodding their patients for "semi accurate" information about their personal health habits.

Creation of newer types of recording devices may also be a result of this study. The Fitbit is arguably one of the most innovative devices on the market today in terms of automated recording of an individual's physical health. With more attention being drawn towards this topic, researchers may develop less invasive ways of recording some of the metrics which we typically still need physician or nurse to do today such as cholesterol or blood pressure screens.

One device we believe would provide a great deal of benefit to an environment like this is a way to automatically record calorie consumption. While health professionals suggest that keeping track of food consumption can lead to improved success rates, it is extremely difficult to keep an accurate log. Some software programs and smart phone applications have been developed to make this task easier, but there is still much room for improvement.

This environment could also spark an interesting discussion about new behaviors that we might find within the MMORPG environment. Currently, the experienced gamers who spend the most time playing video games have an advantage against other players. There are many cases of individuals thinking, "How is this person beating me? They probably just play this game all day." In an environment where a real-world character's health habits and attributes are translated into a video game, this will no longer be an issue. Individuals who are in better physical health will have a well deserved advantage over the experienced gamer in this case since they will have an in-world character that is in better health.

CHAPTER 6: CONCLUSION

The goal of this study was to identify a potential solution to the obesity epidemic through the use of technology. While the causes of obesity vary across individuals, many researchers believe there is one dominant driver shared by all. The cause is identified in this study as the influences that are inherited through the environment in which we live. This study has used the concept of environmental influence on personal health to suggest that the creation of a new healthy virtual environment could provide valuable contributions to improving personal health.

Through a classical comparative analysis we have identified similarities between the qualities needed for weight loss in the physical environment and the qualities that motivate gamers to play MMORPGs in a virtual environment. This relationship shows that the development of these behaviors is driven by an intrinsic motivation for character development. The individual is making efforts to improve their personal health in the real world while trying to develop the strength and abilities of their avatar in the virtual world.

An environment that takes a hybrid approach offers a solution to obesity by leveraging the common goal of character development. The feedback received using innovative technologies paired with the positive influences available in a virtual setting create an ideal setting for achieving a sustainable healthy lifestyle.

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