

Videogames and Sustainability

How Gaming Actions Can Potentially Contribute To Less Waste Actions

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Abstract

This thesis is based on the assumption that the challenge of waste management needs to be addressed within the sustainability framework where society takes part in the solution. People's beliefs, attitudes and values are what, ultimately, make people behave the way they do. Therefore this thesis intends to study a potential way of changing these worldviews towards more sustainable ones by utilizing a common cultural practice; namely, the act of playing videogames. The study will be focused in the U.S. since the country is placed as the world's leader of waste production, and it ranks among the top ten consumers of videogames globally.

Videogames have had varying impacts on society and studies about their potential contribution to the sustainability science field have emerged in the past decade. Despite this, little research on their effectiveness or potential uses has been done. Accordingly, within this research, a literature review of such impacts and potentials was conducted, and a quasi-experimental study was carried out among a group of U.S. citizens. The study was designed based on the TORE model, an intervention-based behavioral model designed to influence people's attitudes, employing a game called *Garbage Dreams*. The videogame was played in two different contexts using the computer as a platform. The participants were U.S. citizens with no special expertise on the environmental or videogames field between the ages of 11 to 79. Data was gathered, through observations and mainly by three surveys: previous to the game experience, after the game was played and a follow-up survey sent days later.

The study found that a videogame has the potential to be considered a tool for addressing people's attitudes towards the challenge of waste management; it demonstrated that a videogame was an enjoyable medium for presenting the topic of interest and it was capable of providing new knowledge to the players. However, the results are inconclusive as to whether or not participants effectively applied the knowledge gained to their daily lives. It is suggested that further studies be performed and include other videogame platforms such as the mobile phone, which was found to be the most used among study participants.

Keywords: waste management, videogames, platform, sustainability science, TORE model, attitudes

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Table of Contents

Abstract	III
1. INTRODUCTION	1
1.1 AIM AND SCOPE OF THE STUDY.....	3
1.2 RESEARCH QUESTIONS	3
1.2.1 Main Question	3
1.2.2 Sub-questions.....	3
SECTION 1: Background	3
2. How the Videogame Industry has Influenced society - A Brief History	3
2.1 Videogames and Culture.....	4
2.2 Videogames and the Economy.....	5
2.2 Game Studies as Research Field and the Emerging of Serious Games Initiatives	6
2.3 What games are and their theories.....	8
SECTION 2: Videogames and Sustainability.....	9
3. Potential of using videogames for Sustainable Development	9
3.1 Cases.....	13
3.1.1 Japan: Ecoland.....	13
3.2.2 London: Evil Bin.....	14
3.2.3 United States : FloodManager	15
SECTION 3: The Case Study “Garbage Dreams”	16
4. Methodology of the Study.....	16
4.1 Description.....	16
4.1.1 The participants/respondents.....	17
4.1.2 TORE Model	18
4.1.3 The Game “Garbage Dreams”	19
4.2 Results	21
4.2.1 Face to face context	21
4.2.3 Post-survey	23
4.3 Online context.....	24

4.3.1 Pre-surveys	25
4.3.2 Post-surveys	26
4.4. Control Group	28
4.5 Follow up	30
4.6 Discussion and Findings	31
4.6.1 Limitations	36
4.7 Conclusion	37
REFERENCES	39
APPENDIX A	39
APPENDIX B	47
APPENDIX C	52

Figures

Figure 1. Game cycle according to Silva (2013)	11
Figure 2. TORE Model. (Ham, 2007).....	18

Tables

Table 1. Description of Empirical Study	16
Table 2. Main Events of game industry.....	45

Images

Image 1. "Starve your bin" publicity	14
Image 2. Screen Shots of Garbage Dreams Game	20

Graphs

Graph 1. Results pre- survey face to face context	23
Graph 2. Face to Face context post-surveys results.....	24
Graph 3. Online Pre-surveys' Results.....	26
Graph 4. Online context pre & post survey results.....	28
Graph 5. Results from control group participants	29

Graph 6. Results from follow up respondents	30
Graph 7. Follow up survey results about recycling	31
Graph 8. Level of effectiveness responded by Control Group & Participants who responded follow-up survey	32
Graph 9. Results of Follow up and control groups	33

1. INTRODUCTION

Western society is currently living in a capitalistic system where the progress of a country is based on consumerism and often measured by the market value of the goods and services produced in it - GDP. This system is encouraging people to acquire the “buy and discard” mentality which is resulting in the generation of massive amounts of solid waste (Ho, 2002).

The United States is the world’s leader of waste production (Malone, 2006) producing around 2 kg (4,43 pounds) of solid waste per capita per day (Environmental Protection Agency [EPA], 2011). Despite accumulating at least 250 million tons per year, it recycles less than half of this production and sends the rest to landfills and incinerators or “combustion with energy recovery” as the Environmental Protection agency calls it (EPA, 2011, p.3). This is an alarming situation because the U.S. Census Bureau (2010) projects the population to increase to 400 million people by the year 2050, and while being only 5% of the world’s population, the U.S. is consuming 30% of its resources (Trauger, 2003). Where is all of this waste going to go? Simple math easily establishes that this trend is not sustainable and some changes are going to have to occur (Dennis Meadows, Jorgen Randers, & Donella Meadows, 2004).

Waste management, while not identified as one of the main global sustainability challenges, is a complex challenge that the society currently faces. This needs to be approached within the sustainability framework. The solution to the waste generation problem has to go beyond technicalities like incineration and landfills (Šrot, 2010). Burning or burying the waste is not a long-term solution. Human and natural systems are fundamentally connected (Dennis Meadows et al., 2004) and so, waste generation is a problem that should be addressed acknowledging the socio-ecological interconnections (Šrot, 2010). Society is exceeding the planet’s limit, which, according to Meadows, is always caused by the same events: growth, acceleration and rapid change (Dennis Meadows et al., 2004). Therefore it is believed that “humanity is the main driver of change at the earth system scale” (Rockström, Folke, Snyder, & Walker, 2009, p. 2).

Studies have found that people’s culture, values and behavior are responsible for consumerism trends (Trauger, 2003). Thus if there is a way that could potentially influence people’s behavior towards a more sustainable one, and shift the direction from the “buy and discard” mentality

to a “less waste” mentality, it is time to explore it. We are getting to a tipping point where our planet cannot stand more unfavorable conditions (Rockström et al., 2009). There is an urgent call for solutions and new ways of facing our sustainability issues.

Popular cultural practices like gaming might be part of a solution. Since the U.S. is part of the top ten buyers of videogame consoles and computer games (“Top Ten Countries”, 2006) and had, by the year 2012, its citizens spending more than 100 hours per person per year playing games (Stevenson, 2013), it seems worthwhile to study the intersection of videogames and its potential to deal with the issue of waste generation, which should be considered a sustainability challenge.

Investigations related to videogames have been carried out for years (López & Fabricatore, 2012). One of the earliest studies about games was made by Johan Huizinga in the 1950’s, since then changes within the way we understand games have occurred and various definitions of what a game is have emerged. Jesper Juul (2003) built a definition taking into account a long tradition of game research (Huizinga, 1955; Caillois, 1961; Suits, 1970; Avedon & Sutton Smith, 1981; Crawford, 1981; Kelley 1988; Salen & Zimmerman 2003) and so his definition will be used for the purpose of this thesis: “a game is a rule-based formal system with a variable and quantifiable outcome, where different outcomes are assigned different values, the player exerts effort in order to influence the outcome, the player feels attached to the outcome, and the consequences of the activity are optional and negotiable” (Juul, 2003, p.5)

Games have been influencing our society (McGonigal, 2011) and so, in the last decade game studies have become a new discipline and a serious research field (Aarseth, 2001). As games have come to influence society, game movements and initiatives like “Serious Games” and “Games for Change” have led to videogames designed within real world situations with the purpose of bringing social good and awareness to different levels of society, including issues related to sustainability. There are theories that affirm that videogames have unique persuasive powers (Bogost, 2007) but there is little research on their effectiveness (Lavender, 2008) and potential uses of their outcomes. Consequently, this thesis will present a case study of the potentials that videogames could have in the attempt to shift the way a group of U.S. citizens behave towards solid waste. It will also explore the assumption that the game’ initiatives and theories could be the starting point and part of the solution to current sustainable challenges.

Accordingly, the thesis is divided in three main sections: first, a short history of videogames and their impact on culture, including the emergence of ludology and serious game initiatives; secondly, the potential use of videogames in sustainability and three cases where videogames have been applied, and third, the methodology of the case study together with the results and discussion.

1.1 AIM AND SCOPE OF THE STUDY

The study aimed to explore the possibility of video games being part of the solution to sustainability challenges and it focused specifically on attempting to change United States citizen's behavior towards the challenge of waste generation. The participants in the case study were a group of U.S. citizens with no special knowledge on waste, no special interest on environmental issues and no expertise in videogames or any related profession, whose ages varied from 11 to 78.

The study was accomplished with available videogames found on the internet and it does not intend to promote or criticize any particular game.

1.2 RESEARCH QUESTIONS

1.2.1 Main Question

How can serious videogames potentially be used for changing the way of how United States citizens behave towards the waste they produce?

1.2.2 Sub-questions

In order to facilitate the response to the main question, the following sub-questions are posed:

What kinds of knowledge, if any, are videogames capable of conveying to its players?

To what extent can videogames be a tool for dealing with a waste management strategy?

SECTION 1: Background

2. How the Videogame Industry has Influenced society - A Brief History

Games are not a new invention. Games have been a part of culture before computers and digital media were invented. They have been around for a long time, according to some, even as long as mankind (Huizinga, 1955). When the "computer revolution", starting in the 1950's

(Zenon W. Pylyshyn, 1989) games and game-related activities went into the digital world and today the game industry is a billion dollar business (Rishe, 2011). It has grown (and still is) at such a rapid pace that its revenues tripled between 1994 and 2005 - US\$5 billion to US\$15 billion, respectively (Wilson, 2012).

Such success has a fascinating trajectory behind it, so much so that it has reached the level of serious academic study. The emergence of new technologies has changed the way societies interact with one another on many levels, including the way we play games (appendix A shows main events within the videogame industry). In order to better understand how videogames have influenced society, some significant factors will be presented below, along with the introduction to game studies as a research field and the serious game movements that have consequently emerged.

2.1 Videogames and Culture

Videogames have addressed issues that were considered taboo fifty years ago, such as homosexuality, gender perceptions and gender divisions; videogames have had also the power of creating strong networks and new industries, bringing jobs to people in less developed countries, and discovering new ways of trading goods and services.

The issue of homosexuality is still a controversial topic in some countries. This issue was first addressed in the game *The Orion Conspiracy* in 1995, with the story of a parent dealing with his son having a gay relationship. It caused some controversies but it was the first time that homosexuality was tackled in “less prejudiced way” (Donovan, 2010); nowadays role playing games allow the characters to have homosexual relationships as is the case of *“Dragon Age II”*. Such games have brought up discussions among “straight” players, as well as, homosexual players who are revealing their feelings about the stereotyped perception society has about them (Kuchera, 2011).

Another issue being addressed in videogames has been the perception of women. The videogame *Tomb Raider*, launched in 1997, and its character Lara Croft represented women as “heroes”, which was not common in games back in the 90`s (Donovan, 2010). Lara Croft was a unique character, she arrived just when “girl power” was emerging and marked the breakthrough in the representation of women within the game space itself (Kennedy, 2002). In addition to this, videogames have also tackled the case of gender division. This was first addressed within the Multi-User Dungeon – MUD- games, where it was acceptable that male

players played as females (Donovan 2010). The designers of such games wanted the players to free themselves from the constraints of the real world and allowed them to define the atmosphere of the game (Donovan, 2010). Since that time, female players have increased significantly, where 14% of players were believed to be female in 1987, (Donovan, 2010) by 2011 the percentage was 42% (M.H Phan, 2012). Also worth noting, a study made by the UK's Nottingham Trent University in 2008 found that 54% of men and 68% of women who played multiplayer online games had characters of the opposite sex.

Videogames have been addressing serious issues, and nowadays games are no longer seen as something only children do. Some stereotypes of the past are gone, and women make up as large a part of the gaming community as men do. According to the Entertainment Software Association (ESA) report in 2008, the average age of gamers was 35, 40% of gamers were women and 44% of online game players were women (-ESA, 2008). In the United Kingdom 59% of 6 to 65 year olds play one form of video game or another; in the United States and many Asia and western countries, there are now more video game players than non-video game players (Juul, 2010). The emergence of social networks and virtual games has brought a new variety of adult play communities, some being an extension of non-digital forms of play and others being completely new to the "playscape" (Pearce, 2009).

2.2 Videogames and the Economy

Videogames have also brought income to some players as they started trading items for real money (Heeks, 2008). Massively Multiplayer Online Role Playing Games –MMORPGs- have the ability to keep thousands of players immersed in a game for hours. In 2007 *The World of Warcraft* had more players than the population of Sweden, and like the country, the game has its own culture and language (Corneliussen, 2008). Players of this game could easily play 20 or more hours a week (Utz, Kai, & Tonkens, 2012). Such invested time, ultimately led to the creation of a new industry: *the gold farming industry*. This industry is defined as "the trading of virtual world currency, items, and services for real money" (Heeks, 2010, p.6) and is an example of early online employment or "cyber-work" – in less developed countries (Heeks, 2008). By 2004 the global trade in virtual games was estimated to be at least \$100 million USD (Donovan, 2010); it is large enough to be called an economic sub-sector employing tens of thousands of people in less developed countries (Heeks, 2008). It has been operating in countries like China or Mexico, and it is estimated that, by the year 2008 workers were earning an average of \$145 USD per month (Donovan, 2010).

The arrival of the internet also helped with the introduction of the online distribution of videogames, which led to the creation of online stores like Apple's iTunes (Donovan, 2010) and eBay (Heeks, 2008). It boosted the confidence of small game companies and they started thinking about the shareware business model in terms of creating downloadable games, and thus making those games available to a broader audience (Donovan, 2010). Finally, the advent of the internet also gave the *independent movement of games* (Indie games) the "green light" they were waiting for.

The development of game communities, game culture and social networks has captured the attention of academics and while the game industry grew, a new research field was built. Game research as a serious field entered the scene.

2.2 Game Studies as Research Field and the Emerging of Serious Games Initiatives

Professor Eugene Provenzo marked the start of the academic study of video games with research on gender and violence and the release of his book "*Video Kids: making sense of Nintendo*" in 1991 (Donovan, 2010; Espejo, 2003). Within ten years, games were considered seriously by academics and scholars (Aarseth, 2001) and the term Ludology, which describes the study of games in general and video games in particular (Frasca, 2003), emerged for the first time at the Digital Arts and Culture Conference at Brown University in that year, 2001 (Surdyk, 2008).

Therefore, 2001 is considered to be "year one of Computer Game Studies as an emerging, viable, international, academic field" (Aarseth, 2001). Since then different studies have taken place and different categories of games, game movements and subgroups have emerged, such as: Serious Games, Persuasive Games and Games for Change initiatives.

Serious games are a sub-domain of the videogames development and have grown more popular in the last decade (Bogost, 2007). Serious games were first mentioned in the book *Serious Games* by Clark C. Abt (1975) and since then variety of definitions of what serious games are have existed. The majority of them agree that serious games are intended to be used for purposes other than just mere entertainment (Susi, Johannesson, & Backlund, 2007) but this does not mean that, as Clark has stated, "serious games are not or should not be entertaining" (Bogost, 2007, Loc. 767). The serious games movement started in 2002 with the foundation of the Serious Games Initiative (SGI) by the Woodrow Wilson Center in Washington D.C. ("Serious Game Initiative", n.d). The intention was exploring the productive links between the electronic game industry and the public sector challenges with the purpose of giving

guidance to the creation of new policies (in education, training, health, and public policy projects) by involving the use of videogames. Serious games overlap with other domains like, e-learning, edutainment, game-based learning, and digital game-based learning (Susi, et al. 2007). These terms have some distinctions but in the end are created and used for the same purpose. The term “Serious Games” can be defined as “games that engage the user, and contribute to the achievement of a defined purpose other than pure entertainment (whether or not the user is consciously aware of it)” (Susi, et al. 2007, p.5).

In 2003, the Persuasive Game Studio was founded by Ian Bogost. Bogost argues that the act of changing attitudes could be carried through general processes or computational processes in particular, and this is what he called “procedural rhetoric” (Bogost, 2007). He also contends that persuasive games “are videogames that mount procedural rhetoric effectively” (Bogost, 2007, Loc 656). Lavender has constructed a good definition based on Bogost’s work; he defines persuasive games as “games that have as their primary goal the changing of users’ attitudes. These changes may increase the probability of behavior change given contingencies of unconstrained choice and social situation” (Lavender, 2008, p.6); there are three domains to which persuasive videogames are related: politics (i.e: *The activism, the public policy game*), advertising (i.e: *Xtremme Errands*) and learning (i.e: *Element*) (Bogost, 2007).

Following such developments, in 2004 another subgroup emerged: Games for Change, an initiative-based subgroup that has as a goal of raising awareness and inspiring action. Games for Change is helping individuals and organizations develop and use video games to tackle real world issues like climate change, food scarcity and war conflicts (Potel & Schreiner, 2008). It aims to benefit from the entertainment and engagement of the players to generate social good, allowing direct investments into new projects. Its mission is: “Catalyzing Social Impact Through Digital Games” (“Games For Change Mission”, 2013).

Games for Change has its own annual festival that has become a very important event within the game industry, and the largest gaming event in New York City. It brings together different stakeholders such as game developers, the general public, civil society, academia, the gaming industry and media (“Games For Change Mission”, 2013), for the purpose of “exploring the use of digital games to advance organizational missions and societal change” (Sawyer, 2004). In 2007, the festival gave special attention to grassroots gaming and virtual activism, and awarded prizes to the best games based on three categories (Potel & Schreiner, 2008):

Category of Awareness with the game *Ayiti: The Cost of Life*; Category of Transformation with the game *Peacemaker*; and Category of Social-commentary/art with the game *The Arcade Wire: Oil God* (“Our Games”, 2013).

2.3 What games are and their theories

Part of the studies that started this new research involved defining the word “game” itself. According to the definition given by Jesper Juul presented in the introduction: “a game is a rule-based formal system with a variable and quantifiable outcome, where different outcomes are assigned different values, the player exerts effort in order to influence the outcome, the player feels attached to the outcome, and the consequences of the activity are optional and negotiable” (Juul, 2003, p.5); games are based on six key qualities:

1. **Rules.** Games are ruled based.
2. **Variable, quantifiable outcome.** Games give outcomes that can be measured.
3. **Valorization of outcome.** The different potential outcomes can be categorized as positive or negative.
4. **Player effort.** Player exerts effort in order to influence the outcome.
5. **Player attached outcome.** A player will be a winner and be happy as a positive outcome or a player can be a loser and for that reason unhappy as a negative outcome.
6. **Negotiable consequences.** The same game can be played with or without real-life consequences.

In addition to this, I would like to add two of the characteristics put forward by McGonigal (2011) that were not mentioned in the qualities expressed by Juul and should be considered a part of all games as well. Those are:

7. **Goals:** specific outcome players work to achieve.
8. **Voluntary participation:** all the players know and accept the goals and rules of the game.

With such features being established by different game researchers, there are theories being developed in order to explain the success and engagement of the games. Research by McGonigal states the planet is collectively spending more than three billion hours a week gaming (McGonigal, 2011). What are the impacts of such gaming and why people keep playing them are some of the top subjects studied by game researchers.

One of the most interesting theories argued by game designer Jane McGonigal is that games give people four powerful motivations; these are four intrinsic rewards society is craving (McGonigal, 2011):

1. Satisfying work
2. The experience or the hope of being successful
3. Social connection
4. Meaning

Ian Bogost also has a theory. He states that videogames have unique persuasive powers, since digital technology has the ability to create representation of processes, they are a good tool for creating imaginative worlds (Bogost, 2007).

Adding to this, game designer, Will Wright, states in an interview made in 2008, that videogames are amplifiers of the imagination of players, which, he said, might be one of our cognitive tools and one of the most important characteristics of humanity (Seed Media Group, 2009). By using imagination people can create and visualize different scenarios of basically anything and even “simulating the world” he affirms. Videogames allow players to see the whole system and to explore and learn without harming anyone or anything, therefore players and designers can test those models created in their imagination and test them through videogames. This feature is really useful for understanding complex problems, such as those that sustainability science deals with, as is the case of waste generation. The section below is intended to introduce such potentials and some of the applications they have had in the field of sustainability.

SECTION 2: Videogames and Sustainability

3. Potential of using videogames for Sustainable Development

The term sustainable development goes hand in hand with the term complexity (Ness, 2011), human and natural systems are fundamentally connected as social-ecological systems (Vervoort, Kok, van Lammeren, & Veldkamp, 2010) and thus the dynamics and interactions among these two systems became complex. Complexity is one of the challenges that sustainability science has to deal with; in order to build a sustainable future we must study and

take into account the complex dynamics that characterize the world in which we live (López & Fabricatore, 2012).

Sustainable development has become a mainstream concept therefore there is the need to apply it in practice and ensure its viability (Kronenberg & Berger, 2010). There are researchers that agree on systems thinking and systems practice tools being of great help for supporting the transition to a sustainable society (Kronenberg & Berger, 2010). This is because of the challenges that humans possess in understanding and communicating the socio-ecological system (Vervoort et al., 2010) , which are: (1) Systems thinking is by no means a cognitive strategy that pervades all of society (2) People do not generally make non-linear future projections (3) Multi-scale thinking does not come naturally to human beings (4) People are to a large degree bound to their implicit perspectives and worldviews (set of beliefs, attitudes and values). These challenges must be overcome because it is the delay in the perceptions and responses that is bearing the planet to its limits (Dennis Meadows et al., 2004). Most of the current social and environmental problems that society faces are the result of very short-term thinking; people do not see an immediate response to their actions therefore they are not emotionally affected. Our brains have not been trained to detect risk with delayed impacts (Samuelson, 2012), i.e. the association between waste incineration and its relation to pollution and human health.

World challenges are not simple, therefore there is a growing need for tools that promote systems thinking and critical thinking which, as Tilbury and Wortman expressed in their book, “can help us to ask the right questions and look at problems so that we can perceive the world in a broader way” (Tilbury & Wortman, p. 86, 2004). This type of thinking would help tackle people’s worldviews, which consist of a set of beliefs, attitudes, and values (Dennis Meadows et., 2004) that, ultimately, make people behave the way they do.

Consequently, it is argued that videogames have the potential to facilitate sustainability learning since they have been designed taking into account complexity; they are “complexified systems” (López & Fabricatore, 2012). Games are able to engage players in multiple tasks simultaneously, and ask players for a “problem-solving” performance in order to overcome those unpredicted events that appeared in the game. Also it is argued that humans are more capable of processing information if it is presented in a visual way; visual communication Vervoort explained, has three potential effects: 1) Cognitive 2) Affective and 3) Behavioral (Vervoort et al., 2010).

In the case of videogames, it has been proven that the engagement and motivation that they provide to their players benefit the development of cognitive skills like reasoning, memorization and planning and, also facilitate the acquisition of knowledge such as facts, procedures and concepts (Silva, 2013). Players will learn these things because they will need them in order to keep playing the game and end with successful results. In videogames, players can be in control of the ideas that are being visualized, they have the option of seeing things in a different perspective and are able to go back and re-examine what has been done (Vervoort et al., 2010). Videogames are a system and a process in itself, they have the potential of generating new practices and meanings (Malaby, 2007) creating an experiential constructivist learning environment for the player (Whitton, 2012). This is the cycle:

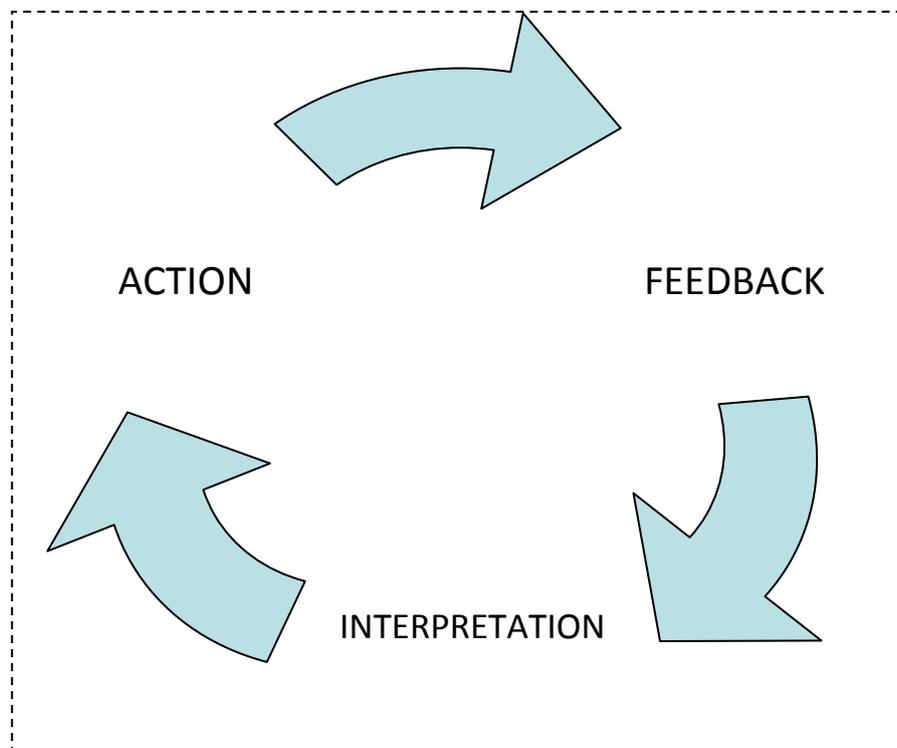


Figure 1. Game cycle according to Silva (2013)

Below are the steps of a common gaming experience according to Lopez & Fabricatore (2012):

- 1) Identify or define a goal to accomplish in the game
- 2) Plan how to achieve it (relying on problem-solving, decision making and creativity)
- 3) Put into practice the plan which requires knowledge and skills learned in previous stages

- 4) Obtained final outcome. According to the outcome players can set new goals or plan new strategies for next time

Since videogames give the players immediate outcomes, players can instantly see how their decisions impacted the results of the game, which allows them to redefine or quit their initial plan (López & Fabricatore, 2012). Videogames let players explore different solutions in a safe scenario allowing them to see how their strategy would work solving a specific problem (López & Fabricatore, 2012). The Digital Games and Research Association – DiGRA - states that “games are powerful for creating shared understanding of social problems”(Swain, p. 2 2007), and the fact that videogames can be played more than one time allows the players to reflect, adapt, accept failure and go back to implement their new strategies (López & Fabricatore, 2012) giving them an understanding of the whole system. Therefore it can be stated that videogames encourage learning through failure because players can make mistakes when applying their strategies and not have external consequences (Whitton, 2012). This situation helps players develop the following skills (Hopper, 2009):

- Become empowered learners
- Effective problem solvers
- Successful gamers with in-depth understanding.

In addition, Jane McGonigal (McGonigal, 2011) argued that some videogames encourage players to apply:

- Ecosystem thinking
- Pilot experimentation
- To take a long view

All of which are main features required when dealing with sustainability challenges. There is a clear need for an artificial environment where policies, theories and practices could be developed and tested before being applied in reality (Wachovicz et al. , 2002). Therefore according to the features offered by videogames, they could be a good tool to use when dealing with complex problems. Some videogames require complex decisions, which are often based on partial knowledge so, as an interactive media, players have the chance of experiencing interaction with each other, discussing the subject of the game in a broader

sense, and exchanging ideas that can be applied later in the game. This might facilitate participatory scenarios and the decision making process since it will help different stakeholders to understand challenge to be tackled. In Wachovicz's work, it is stated that games are proven to be useful in formulating spontaneous solutions by stakeholders in a spatial planning process (Wachovicz et al. 2002).

3.1 Cases

3.1.1 Japan: EcoIsland

EcoIsland is a persuasive computer-based system designed in 2010 by Chihiro Takayama, a Master's student at Waseda University in Tokyo, Japan, and Vili Lehdonvirta, a PhD student at Helsinki Institute for Information Technology in Finland. Their study was published in a psychology journal in 2011 with the title: "Designing Persuasive Applications to Motivate Sustainable Behavior in Collectivist Cultures".

EcoIsland was created with the aim of decreasing CO2 emissions and helping families shift to a more sustainable way of living. The study was run during the end of the year 2007 and the beginning of 2008. It was run among six families interested in environmental activities with participant age ranging from 15 to 58. The main objective of the game was to save a virtual island from rising sea levels by decreasing the amount of self-reported greenhouse gases that each household emits in the real world. Each household owned a virtual island, and each member of the family had an avatar able to report activities in the game. Each household set the amount of greenhouse gas to be reduced, if they fail to reduce the emissions enough, the sea level around the island rises corresponding to the excess of the emissions (immediate feedback). Participants could report their own green activities via their mobile phones or PC web browsers. On the phones or browsers, users have a list of activities that reduce the emissions. Activities included daily actions such as taking a short shower, turning down the air heater, using public transportation or bike instead of car, turning off lights that were not in use, etc; by reporting such activities, players earned *EcoPoints* that allow them to sell or buy offers for emission rights on a marketplace or they can also be used to buy virtual items and decorate the island. Also, after reporting activities, the sea level reacts accordingly letting players know how safe their islands are. The families could see other family's islands and their activities.

Here are some of their results of the experiment:

- Target reduction of CO2 emissions was fixed to 6 % of the average Japanese CO2 emissions
- Majority of family members expressed an increase of knowledge about green activities;
- Their strategies promoted double-barreled effects: 1) cooperation with other participants, and 2) competition between them.
- Some participants felt motivated to act just to save the virtual island, but not for actual ecological reasons.

The authors see the need for further exploring the subject, taking into account families with different profiles and over a longer period of time. They would like to extend their studies and strategies, taking into account individualist societies.

3.2.2 London: Evil Bin

Mobile marketing agency Incentivated created a casual game to be played on mobile phones for the campaign “Starve your bin” in 2008-2009. The mobile game was used to support the recycling campaign in London by engaging players and reinforcing recycling messages.

The main goal of the game was to “starve the bin” by putting recyclable materials into the recycle bin and not in the trash (evil bin). One of the slogans for marketing the game was “Don’t let him win! No glass, no cans, no paper! (See image 1).



Image 1. "Starve your bin" publicity

The game was built as a java application and just by texting BIN to a specific number players were redirected to the link and allowed to download the game for free. The application also allowed players to share their results via social media. Players would receive points for every item caught, the game would be over if the evil bin ate three recyclable items.

The results, according to the Incentivated sheet fact (“Mobile Game”, n.d), showed that:

- The game was requested 18.000 times in the first six months
- Over 400% increase of visitors to the website for the first six month
- 71% of participants agreed with being encouraged to recycle
- 78% said that it raised their awareness of the issue
- 64% said they now recycle more
- Recycle rate increase from 18% in 2005-06 to 25% in 2008-09

3.2.3 United States : FloodManager

The Association of State Floodplain Managers (ASFPM) in partnership with PlayGen, a serious game and gamification developers’ studio, have developed *FloodManager*. It is a computer simulation game designed for teaching and reinforcing basic floodplain management principles to groups of local development decision makers.

The goal of the game is to keep the city safe from the flooding effects by taking the role of the manager and making some important decisions. The game gives the game-players a 40 year time frame before the game is over. It also gives players the option of choosing the state and county where the player currently lives and gives them the virtual town he/she would be in charge of.

A seminar called “Experience a Town at Risk” was held in Philadelphia in September of 2012 with the purpose of “stimulating discussion and thought on building a more resilient community through the wise use of mitigation techniques and sound floodplain management practices”. It also aimed to generate a better understanding of the impacts that different decisions can have on a community’s growth while managing the floodplains (ASFPM, 2012). Unfortunately there were no results available online by April 2013. It is listed in the cases because I consider it a great initiative and a good example of the use of videogames as tools for dealing with natural resource management. The game can be accessed through the following link: <http://playgen.com/play/floodmanager/>.

The section below will describe the empirical study carried out March 2013 for the purpose of this research.

SECTION 3: The Case Study “Garbage Dreams”

4. Methodology of the Study

The act of play is a social practice and can be understood in terms of the meaning people invest in it (Dey 1993). Therefore, since qualitative research intends to study “social phenomena” (Silverman, 2006), a qualitative approach was deemed the most appropriate for this study. The experiment was a case study involving the game *Garbage Dreams* and it is described and analyzed in this section.

4.1 Description

Table 1. Description of Empirical Study

<i>Strategy</i>	Case study: Garbage Dreams gaming experience	Since it allows the evaluation of a social phenomenon (Hale, 2012) in this case, the act of playing video games.
<i>Design</i>	Quasi-experimental	Used in order to measure the impact of a particular intervention. The gathering of data was done by three different surveys: Pre, post and follow up surveys that were employed in the target group. A control group was also taken into account responding to only one survey.
<i>Approach</i>	Deductive	Since the study is not planning on creating new theories, this approach allows for testing some of the previous ones.
<i>Theory</i>	TORÉ Model	Is an extension of the EROT framework that advocates that for any communication to be successful, it must be <i>enjoyable</i> to the audience, <i>relevant</i> to what they already know and care about, <i>organized</i> for easy processing, and it must communicate a <i>relevant theme</i> (Sam H. Ham 2007).
<i>Participants</i>	A group of U.S. citizens of ages between 10 and above.	Because the U.S. is the world’s leading country in waste production.

The main purposes of the experiment/intervention were to see how people would respond to a videogame challenge and to see if there was new knowledge or attitudes generated among the players while playing the game *Garbage Dreams*, afterwards, and in the long term. The design was based on the TORÉ model (Thematic, Organized, Relevant and Enjoyable) proposed by Sam H. Ham that was presented in the World Heritage Conference in Vancouver 2007.

The intervention was conducted in two different settings, although initially it was not designed to be that way, it is worth nothing because results have a slight difference depending on the context in which the game was played.

The context in which the experiment/intervention was originally planned was a small group with restrictive time where interaction and communication between players was required. Participants were asked to bring their computers and have internet accessibility. In order to reach a larger audience and due to suggestions from participants who wanted to share their experience with their friends and family members, the game and surveys were also conducted and distributed through the internet.

Three questionnaires (see appendix B) were distributed to 16 participants: the first one was given before playing the game and the purpose was to identify their interest towards videogames and their knowledge on recycling practices and interest in regards to the topic; the second one was given after the participants had completed playing the game; and the third one was distributed 10 days after the experiment was conducted.

A control group has been also taken into account. This group consisted of 9 participants that have not been exposed to the game, only one questionnaire was distributed to them, and it will allow to see if there was a lasting impact among players or change of perceptions in the target group (Toolbox, 2010).

4.1.1 The participants/respondents

Participants of the experiment/intervention were regular U.S. citizens with no special knowledge on waste, no special interest on environmental issues and no scientific expertise on videogames or any related profession. Professions among participants included, teachers, students, lawyers, photographers, bankers and retirees, among others. The number of participants for the face to face context was 9 and for the online context 6 (although 12 attempted to do it but did not finish for technical reasons). The range of ages goes from 11 years old to 78 and in total there were 8 males and 7 females that participated. The control group consisted of 9 participants between the ages of 24 and 70. Participants were randomly selected from a population of respondents to a call for research participation as well as people the initial participants recruited on behalf of the study. The online and control group participants, were reached through the internet using online surveys (appendix B), and were also people with no special background on waste management, environmental issues or videogames.

4.1.2 TORE Model

Since the TORE model is an intervention-based behavioral model and was designed to influence people's attitudes, this seemed to be the ideal model to use in this study. This model has been developed by Sam H. Ham, a professor and director of the Center for International Training and Outreach-Department of Conservation Social Sciences in the University of Idaho. The model is based on the EROT framework (Enjoyable, Relevant, Organized, Thematic), presented for the first time in his book *Environmental Interpretation* in 1992, and on a century of cognitive research and persuasive communication research. The framework was redefined in the early 2000's and renamed the TORE Model of thematic interpretation. Ham advocates that when a topic is effectively presented to (i.e. interpreted for) people, it is likely to incite thinking and elaboration. He also affirms that there are three possible ways in which people can be influenced to effect behavior change: 1) Changing an existing attitude 2) Reinforcing an existing attitude 3) Bringing a new attitude that did not exist there before (Ham, 2007). Figure 2 shows a causal model of how things would work in a given scenario. For the purpose of this study, the strongly relevant theme is the one presented in the game: waste and recycling practices (box a), that should bring interest and motivate players to think and make meaning of what is being played (box b & c). According to players' existing beliefs, one of the three outcomes mentioned above would occur (box d) resulting in influence on people's attitudes (what they care about, or what they like or dislike) in regards to the theme that was presented in the game (box e). If such attitudes are strong enough they would have the potential to lead to consistent behavioral choices (box f).

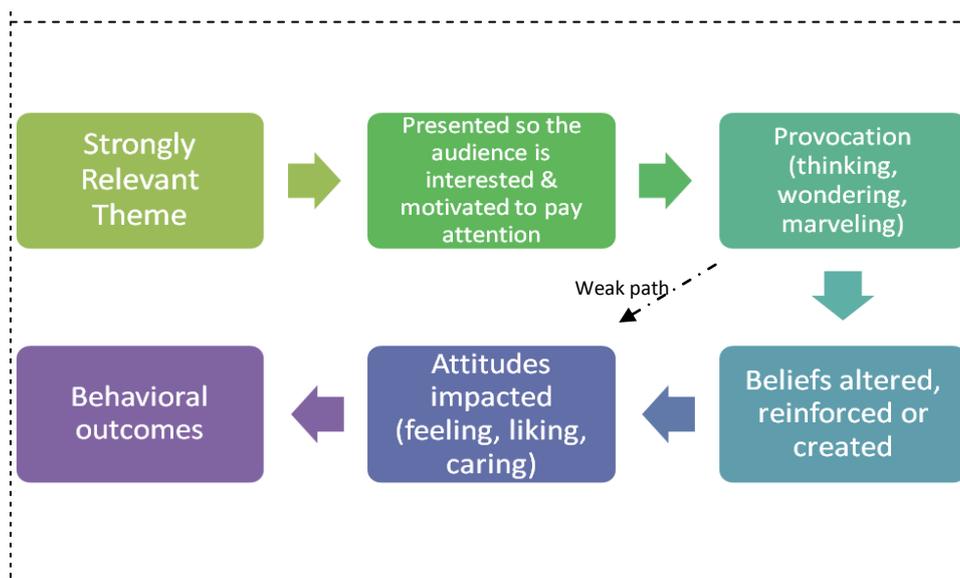


Figure 2. TORE Model (Ham, 2007)

4.1.3 The Game “Garbage Dreams”

It is a casual, serious-game (web-based) designed based on a documentary about the waste pickers in Egypt who are called *Zaballeen* (Arabic for waste pickers). According to the game, *Zaballeens* recycle 80% of the solid waste collected in Cairo. So the *Garbage Dreams* game challenges the players to recycle as much as they do or better. The game was nominated in the category of “Transmedia” during the Games For Change Awards in 2011 (“Games for Change Awards”, 2011).

The game will be described using the 8 qualities of a game described earlier in section 1.

1. Rules:

- Players have 8 months to play, each month takes around 3 minutes.
- The game gives 3 different options to perform while playing: 1) Upgrade – this option lets the player buy different recycle factories, trucks, start education campaigns, hire new workers, etc 2) Expand – if player has enough money he/she might click this option to expand to different neighborhoods 3) Recycle – this option allows the player to start sorting the garbage and processing the materials to start earning money.
- From the start, the game gives the player one goat to process the organics, a paper factory and some money to do your first upgrades.

2. Variable, quantifiable outcome: The game shows the player the income per month as well as the upkeep per month. Each item purchased or campaign has a value. With no money, player cannot upgrade or pay landfill fees.

3. Valorization of outcome: The final outcome is the final recycling percentage which is categorized as positive or negative according to how close they were to the *Zaballeens’* real percentage rate in Cairo – 80%.

4. Player effort: Players need to think of strategies and best ways to perform during the 24 minutes that the game provides.

5. Player attached outcome. Player will be a winner if they pass the 80% score and feel satisfied. Game also allows for sharing in the different social networks.

6. **Negotiable consequences.** The same game can be played as many times as the player wants with or without real-life consequences.
7. **Goal:** The stated goal of the game is to achieve as high a city-wide percent recycling rate as possible in 8 months.
8. **Voluntary participation:** All the players know and accept the goals and rules of the game.



Instructions



Home screen



Recycling screen

Image 2. Screen Shots of Garbage Dreams Game

4.2 Results

There were three main topics that the surveys intended to examine: 1) "Relation" between the participants and the videogames 2) Interest and knowledge on the topic of waste management and recycling 3) Knowledge gained from the gaming experience (learning outcomes).

The results will be shown within their different contexts: face to face and online contexts. Although quantity is not the interest of the study, some graphs are being utilized to better show the trends and results of the study.

4.2.1 Face to face context

Number of participants: 9

Range of ages: between 78 and 11 years old.

Gender distribution: 5 males and 4 females.

Most of the participants brought a laptop to the activity and they possessed a mostly positive attitude towards it. The younger attendants were more enthusiastic because of the fact that they were allowed to be on their computers for nearly two hours, while the older attendants were more interested in participating because of the fact that they were contributing to research.

The experiment was planned to last about two hours and rewards were given to those that performed the best. In order to start the discussion and introduce the topic of waste to the participants, a short casual game called *Zero Waste*, made by the National Science Foundation, was used; it took only five minutes to perform and a discussion related to waste facts was held after the game. Then, having raised the topic of waste, 25 minutes were given to perform *The Garbage Dreams Game*; first by themselves and shortly after, another 25 minutes were given, this time to play the game by teaming up with a partner.

The game is self-instructed so participants had the chance to see a short simulation of how to play. Young participants seemed to understand the rules and their role in the game while older adults seem to have trouble understanding the instructions and some quit playing. Results from surveys are shown below.

4.2.2 Pre-survey

1) Participant & Videogames

The pre-surveys (appendix C) showed that all the participants have played video games in the past, only two of them do not currently play; the main platforms for those that currently play

are the smart phone, followed by the videogame console (Nintendo, X-box, etc) and computer, only one participant affirmed to be playing on a tablet. The average time that they used to play, when they do, is around one to three hours.

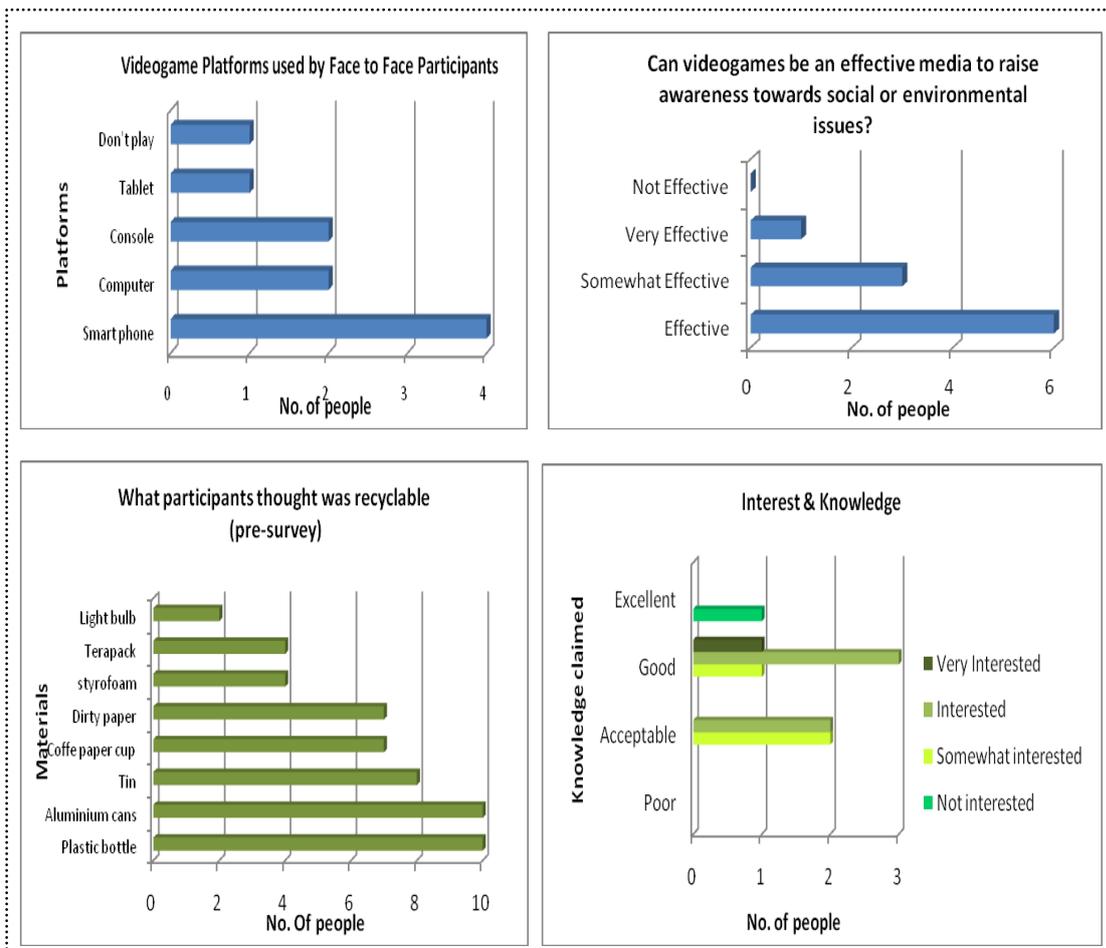
Participants seem to agree with the fact that videogames can be an effective media for raising awareness towards a social or environmental issue; one participant stated that they were very effective, while others marked them as effective or somewhat effective (see graph 1).

2) Interest and knowledge in the topic of recycling

One participant affirmed to be very interested in the topic while another stated he/she was not interested in it. The rest of the participants confirmed to be interested or somewhat interested.

In reference to knowledge regarding recyclable items, all of the participants agreed in considering plastic bottles and aluminum cans as recyclable; among those non-recyclable materials that were asked, most participants agreed in considering dirty paper and paper coffee cups to be recyclable items; half of them agreed that styrofoam was recyclable and some others marked light bulbs as a recyclable item as well. Most of the participants consider themselves to have an acceptable or good level of knowledge about recycling; only one considered to have an excellent level (see graph 1).

While playing the game, participants seem engaged and enjoying it. The younger participant's performance had the highest recycling percentage in the time given and discussions regarding strategies were exchanged among some players; issues regarding the cost of materials, addition of bins, education campaigns and landfill rates were raised.



Graph 1. Results pre-survey face to face context

4.2.3 Post-survey

1) Participants and Garbage Dreams Game

The majority of participants rated the game as good or excellent and enjoyed playing it, the older participants (one being the one person that quit) rated the game as poor and affirmed not to have enjoyed playing it. Also their opinions regarding the effectiveness of videogames to raise awareness seemed to have varied among some participants (see graph 2).

2) Interest & knowledge in the topic of recycling

The survey showed that interest towards the topic of recycling had increased among all female players, while the interest stayed the same among the male players. Some participants that had indicated they felt games to be an effective or somewhat effective media for raising awareness seemed to have changed their opinions in a positive manner.

Some participants seemed to have changed their opinion regarding the level of knowledge they have about recycling; some kept their opinion of “acceptable” or “good”, but others that thought it was acceptable, now rated their level as good and vice-versa.

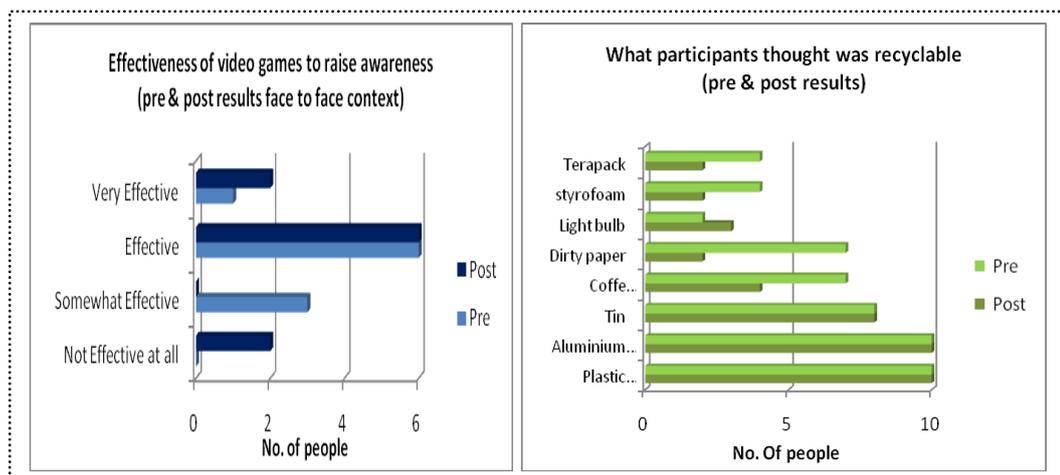
3) Learning outcomes

Most of participants agreed to have learned a fact, here are some common answers:

- Recycle cost management
- Tetrapack is not recyclable, needs some upgrades.
- Tin can be recycled

The survey asked them to explain some of the strategies they used in the game, here are some of their answers:

- *Focus on high value items and expand to high income*
- *Upgrade more, rather than expand*
- *Expand so you have more to choose from and use aluminum bin*
- *There was one participant that seemed to have learned that Styrofoam could be recycled.*



Graph 2. Face to Face context post-surveys results

4.3 Online context

Number of participants: 6

Range of ages: between 26 and 48

Gender distribution: 3 males and 3 females

4.3.1 Pre-surveys

1) Relation between participants and video games

The pre-survey showed that 4 of the 6 participants currently play video games and the main platform that they use to play is the video game console (Nintendo, x-box, etc), and the smart phone; one respondent affirmed to play on a tablet.

There is one respondent that thinks videogames are not an effective media for raising awareness towards a social or environmental issue and another that marked them as being somewhat effective. The rest of the participants seem to agree with the fact that videogames can be an effective media for raising awareness towards a social or environmental issue.

2) Interest and knowledge in the topic of recycling

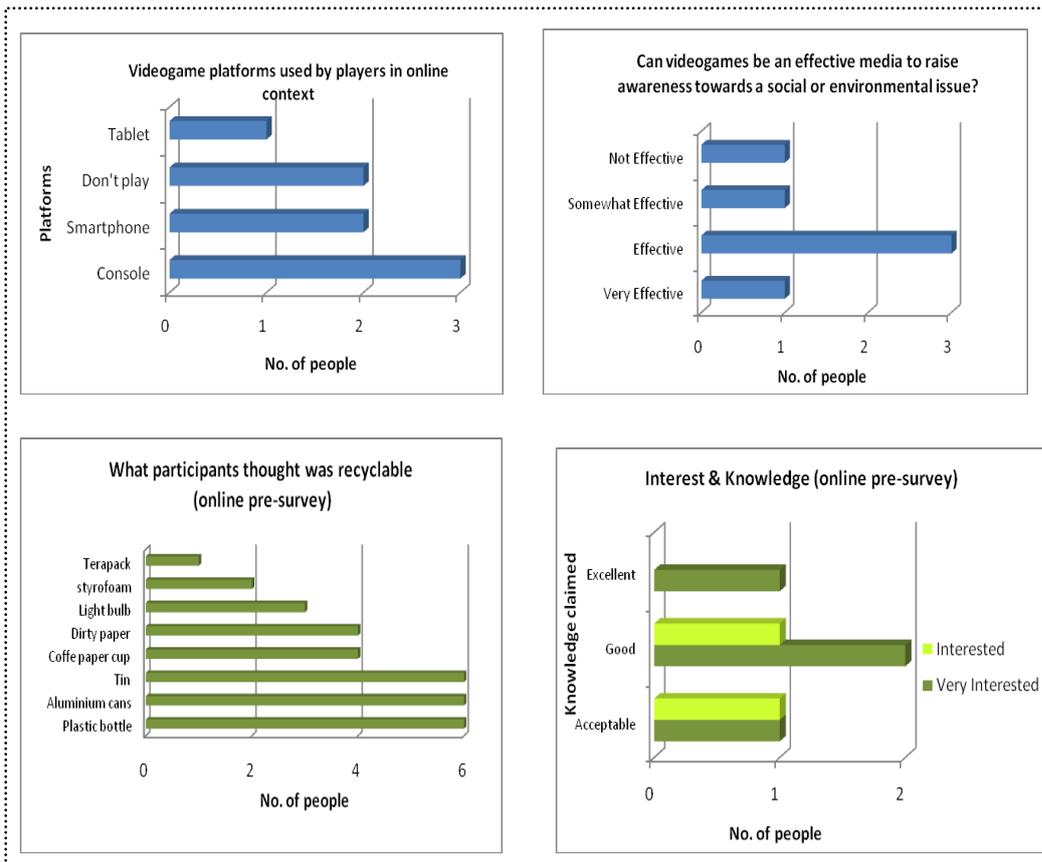
All Participants reported to be very interested or interested towards the topic of recycling.

Regarding the items that they consider as recyclable, participants agreed in considering plastic bottles, aluminum cans and tin as recyclable.

Among those non-recyclable materials that were asked, most of participants (4) agreed in considering dirty paper and coffee paper cups to be recyclable items; others (3) agreed on light bulbs as being recyclable as well, two participants marked styrofoam and one marked tetrapack containers.

Participants that affirmed to be interested in the topic considered themselves to have an acceptable or good level of knowledge about recycling. The one respondent that rated themselves as having an excellent level of knowledge on the topic, also affirmed to be very interested in the topic.

Only one respondent does not recycle at home; when questioned about what they do with an empty plastic bottle, the majority picked the answer: "save it and throw it in a recycle bin". Regarding the final destination of their waste, only two respondents seem to know where their waste goes. The graph below shows the results.



Graph 3. Online Pre-surveys' Results

4.3.2 Post-surveys

1) Relation between participants and Garbage Dreams Game

All the participants rated the game as good and affirmed to have enjoyed playing it. Some answers regarding the effectiveness of video games to raise awareness seemed to have changed in a positive manner.

2) Interest and knowledge in the topic of recycling

The interest towards the topic has stayed the same in the majority of the participants; two males affirmed that their interest had increased.

Those participants that believed their level of knowledge was excellent or acceptable dropped to good and poor after having played the game.

Regarding the items that they considered as recyclable, all participants marked plastic bottles, aluminum cans and tin; tetrapack packages was the next item they marked followed by coffee paper cups; styrofoam and light bulbs were also considered recyclable by one of the participants.

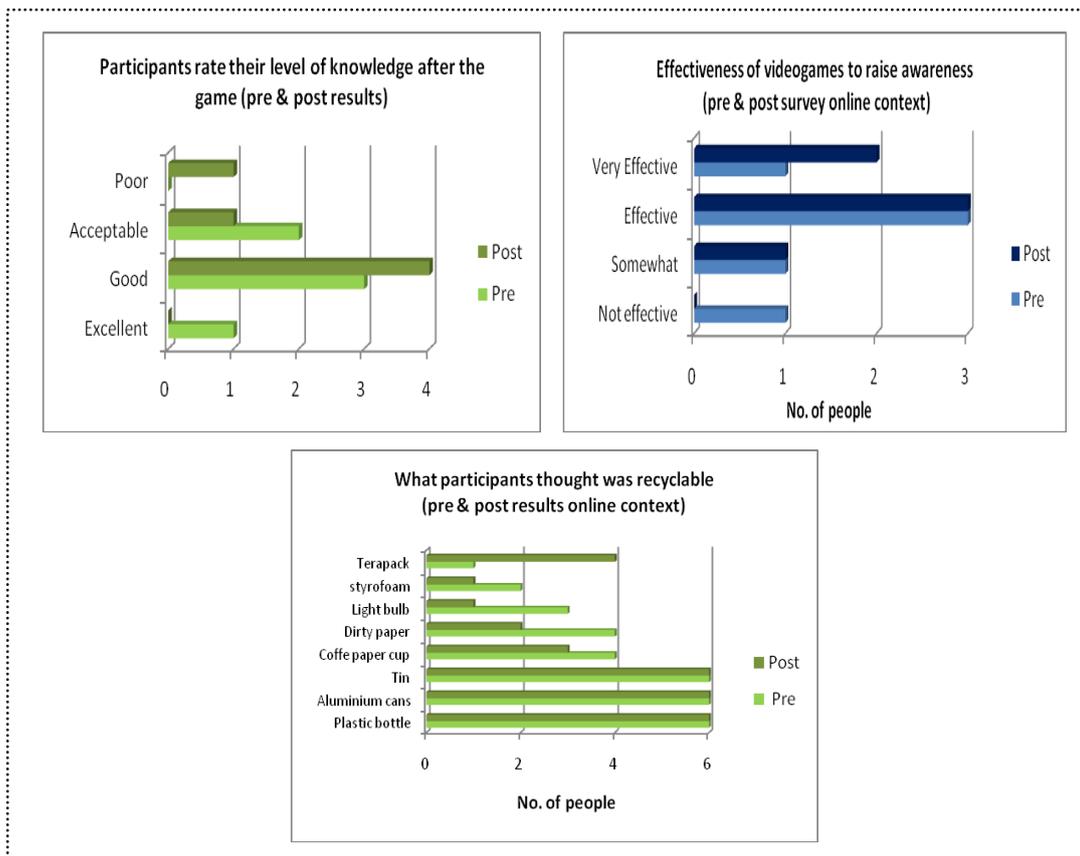
3) Learning outcomes

All participants agreed on having learned something through the game, here are some of their answers:

- *Plastic bags are difficult to recycle because they jam up the machine.*
- *Tetrapack is more expensive to recycle but it can be recyclable at some point.*
- *Light bulbs contain a lot of metals in them.*

And below some of their strategies and percentages are shown:

- *My strategy was to get all of the recyclable bins to be able to recycle more and send less to landfills. Also spending money on education in my city to raise awareness and get more recycling done. Percentage: 12%*
- *..think I could do better if I did it again, the first couple of months I couldn't tell what things were. Percentage: 23%*
- *Tried to get as many types of things to recycle but did not have enough money to do it fast enough. Percentage: 11%*
- *To buy glass or plastic bins first could help. I was not able to expand. Percentage: 9%*



Graph 4. Online context pre & post survey results

4.4. Control Group

The control group was reached through online surveys (appendix B).

Number of participants: 9

Range of ages: between 24 and 70

Gender distribution: 5 males and 4 females

1) Relation between respondents and videogames

The majority of the respondents affirmed to have played videogames before and also declared to currently play games; only one respondent stated not to have played before and that respondent does not currently play.

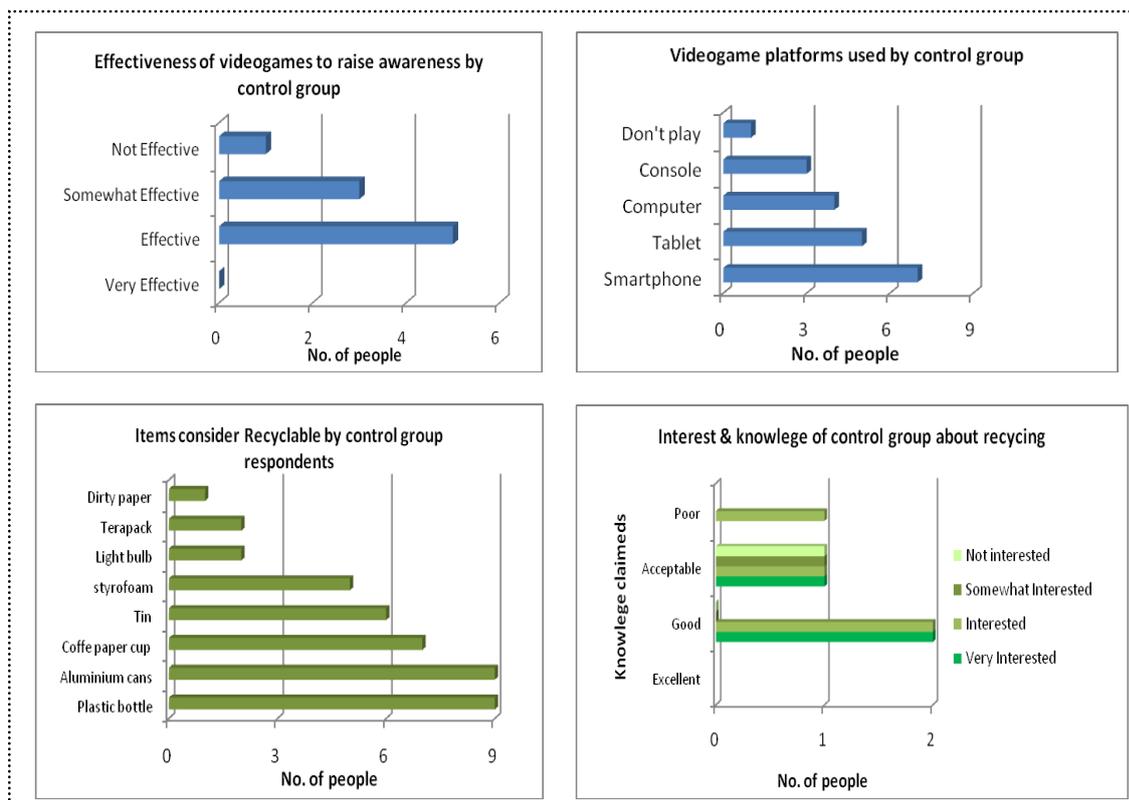
The main platforms the respondents use to play videogames are the smart phone and the tablet (ipad, kindle etc) and the majority agreed to be using it at least 2-3 times a week.

Regarding the effectiveness of videogames to raise awareness towards and environmental or social issue, the majority of respondents seem to think that videogames are effective; only one respondent believes videogames are not effective at all for such purpose.

2) Interest and knowledge in the topic of recycling

The respondents stated they were interested or very interested on the topic, there was only one who responded not to be interested; regarding their level of knowledge, one, among all the respondents, rated their level as poor, the others rated themselves as good or acceptable. The majority of the respondents that claimed to be interested or very interested in the topic also rated their level of knowledge as being good (see graph 5).

Concerning the items that can be recyclable, all the respondents agreed with plastic bottles and aluminum cans to be recyclable; tin and coffee paper cups were the next popular answers followed by styrofoam. A small minority marked dirty paper and light bulbs as recyclable items (see graph 5).

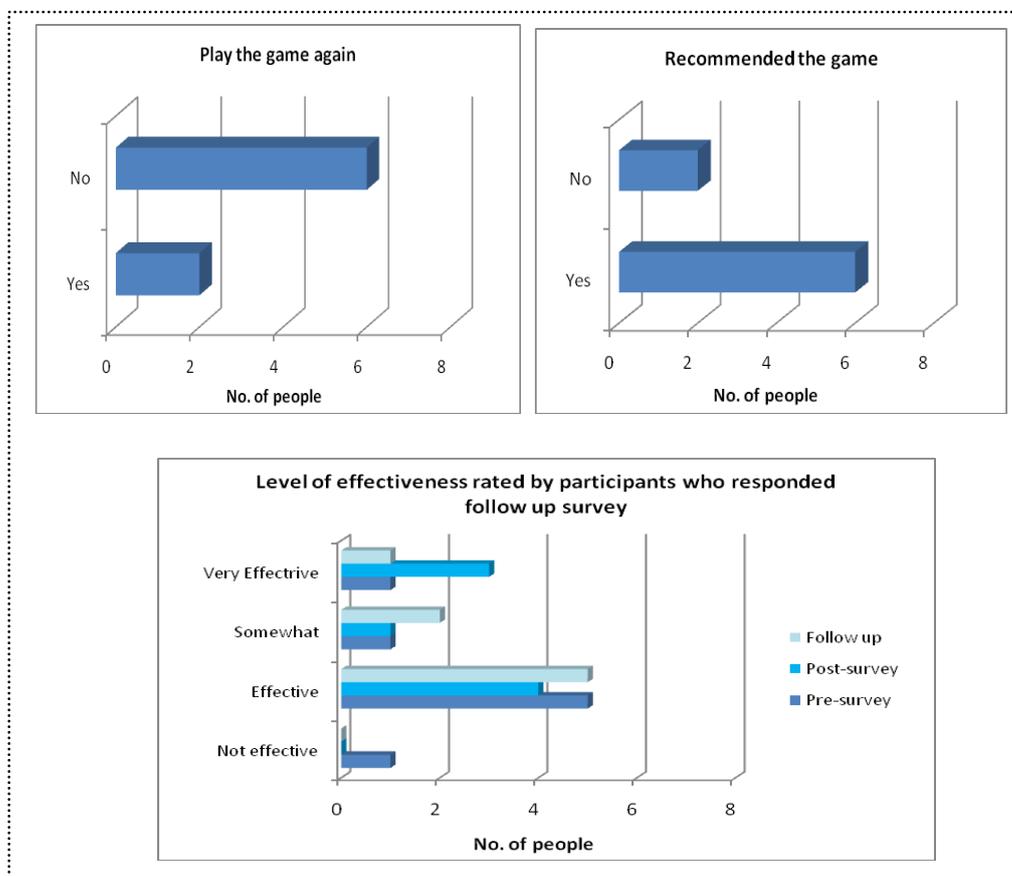


Graph 5. Results from control group participants

4.5 Follow up

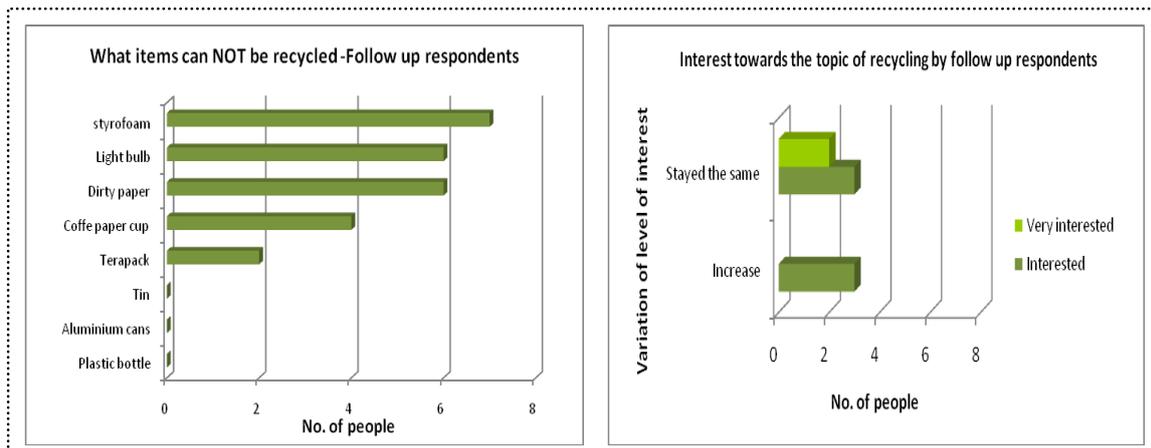
One of the purposes of the study was to see if the videogame would impact participants for a longer term, therefore follow up surveys were given to them ten days after they have played. The surveys were sent through the internet and 8 of participants between the ages of 23 and 79 responded.

This survey showed that, some of the participants have played the game *Garbage Dreams* again and have improved their scores and strategies; a large majority have recommended the game to others and more than half of the respondents believe that videogames are effective media for raising awareness; 3 of the 8 participants were consistent with their earlier answers while others have changed their opinions (see graph 6).



Graph 6. Results from follow up respondents

When participants were asked about their interest towards recycling, the majority stated their interest stayed the same while others affirmed their interest increased (see graph 7); in regards to the recyclable items, 6 of the follow up respondents agreed with styrofoam not being recyclable as well as light bulbs and dirty paper, with 5 of the respondents agreeing.



Graph 7. Follow up survey results about recycling

Some participants had positive responses to the question Have you changed any of your attitudes towards recycling? These are some of the answers:

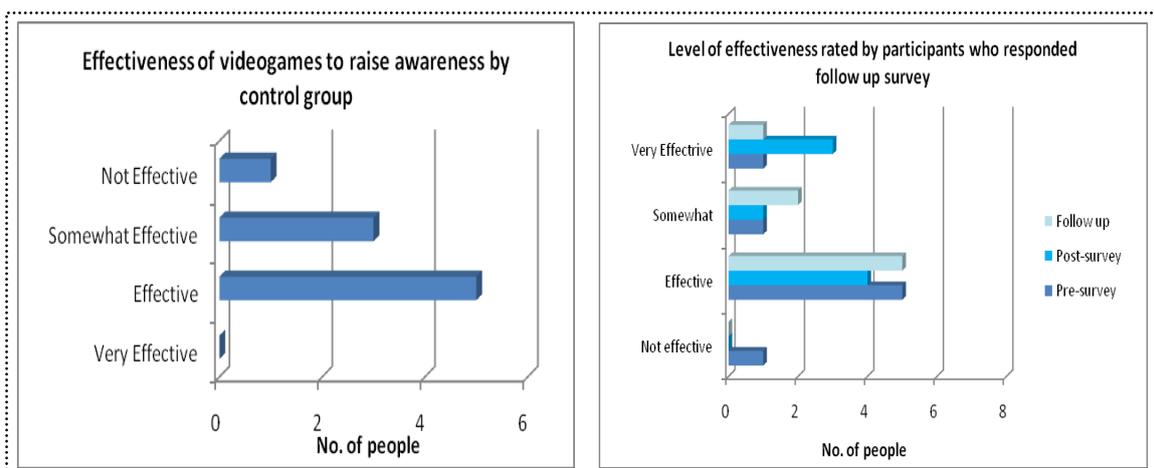
- *It got me thinking about recycling organic material*
- *Stopped recycling tetrapack*
- *Thought about starting a compost*
- *I still recycle as much as possible*

4.6 Discussion and Findings

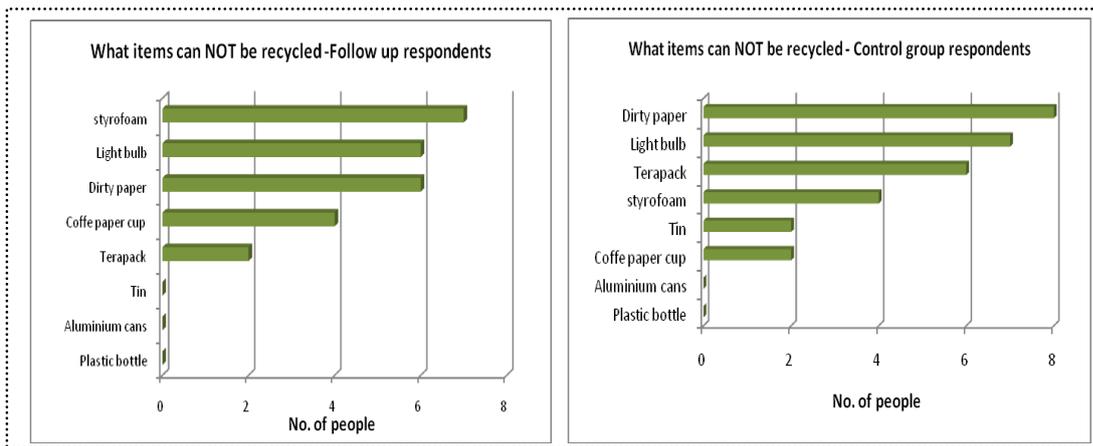
Garbage Dreams is a serious game designed with purposes other than mere entertainment. This videogame was mainly used as the main tool for increasing people's interest and influencing players' attitudes towards the sustainability challenge of waste management. Since the study was based on the TORE model, the discussion will touch upon the potential impacts that playing the game *Garbage Dreams* brought to the players attitudes (changed them, reinforced them or created new ones).

Regarding the relation between participants and videogames, results showed that all participants (including all three groups: online, face to face context and control group) had knowledge about videogames, and possessed positive attitudes towards playing videogames; all but one participant affirmed to have enjoyed playing *Garbage Dreams*, which illustrates that the game was an enjoyable tool and fun way of communicating the subject of matter as the TORE model suggested. Part of this model advocates that if a subject is presented in a way that is enjoyable and organized, then the likelihood of attitudinal change is higher.

Taking into account that participants were not experts on the subject of waste management, the discussions held in the face to face context, as well as from the learning outcomes presented above, suggests that the participants were able to learn facts and concepts related to recycling strategies presented in the game. This observation supports the belief that a gaming experience could be a potential tool when planning and designing waste management strategies for a local community. The game was an enjoyable experience that raised discussion and made people think about the matter from a different perspective. These results seem to support what is stated by Vervoort *et al.*, videogames are a potential interactive tool for participatory process among stakeholders (Vervoort et al., 2010). Although participants were not experts, results showed that in general they were interested in the topic of recycling and already had some beliefs about what could be recycled; but results from the pre-surveys and control group, suggest that the participants held incorrect beliefs. Thus, the game served as a reinforcement of people’s interest towards the topic and as a way of conveying new knowledge. This was one of the statements argued in section two; namely, that videogames have the potential of being an educational tool as well as facilitators for people to process information and retain it for a longer period of time (Silva 2013). As results showed in the study, there was a clear immediate knowledge gain in the short term, right after the game was completed, and some of that information was retained in the longer term. When comparing the “follow up” responses with the control group responses it can be deduced that the gaming experience made an impact on some of the participant’s beliefs towards both videogames and the topic of recycling.



Graph 8. Level of effectiveness responded by Control Group & Participants who responded follow-up survey



Graph 9.Results of Follow up and control groups

Adding to this, one respondent affirmed to have changed one of their behaviors which is one of the potentials argued in the work of Vervoort et al., among other researchers. This participant has played the game several times after it was introduced in the intervention. It seems that the participant had followed the steps mentioned by Fabricatore & Lopez and had been able to see how the whole system worked in the game, thus he claimed to have changed his game strategies and achieved a score of more than 90% of solid waste collection. Most of the participants did not know what a tetrapack was and through the game they were able to see what the packages look like as well as learn about the need for special technology to recycle them. Therefore, knowing this, the above participant declared that he had stopped separating tetrapack in his recycling bin at home. This result could be interpreted in a positive and negative way, one is to affirm that the game Garbage Dreams had the potential of changing some of the players' attitudes for the better; the other is to acknowledge that the game has potentially imparted wrong information to the player because such technology could be available in the area. From this it can be concluded that, for purposes of attempting to change people's attitudes in a community, either games should be specially designed for the specific area (like the flood manager game) with accurate facts or, games should be guided by a local expert in the topic as a complement of the game experience. This person would be able to mediate discussions and answer questions raised by participants. Similar to the study mentioned by Nilsson (Nilsson, 2010), where she posed the importance of involving the teacher on mediating activities as a complement of the game experience and as a way of reaching the full potential for learning offered in the game.

A guided gaming experience could be a potential option, but from my experience in U.S. culture, face to face interaction is becoming a challenge. This seems to be due to a strong

socio-technological connection that makes people want to deal with everything in a digital way; in fact, this was reflected on the replies from the online-context and control group surveys. As Wood et al. argued “Internet is a good medium to carry out gaming research” (Wood, et al. 2004) which is supported by responses obtained in the online context. There were more participants attempting to participate than in the face to face context, as well as, faster responses with more detailed answers. Additionally, participants can play the game within a familiar environment, at their own pace and their comments and answers can remain anonymous, which can help with the honesty of the answers. Not having “group pressure” and a time limit can contribute to participants being more involved in the game experience. This could lead to the assumption that the context where the game is played matters (Nilsson 2010), when players play in their regular environment as they would normally do, their experience and level of engagement could be different than those that had to play in the face to face context.

Regarding attitudes towards the subject of waste management and recycling, participants seem to care and be interested in it; some even rated their level of knowledge as being excellent. However, when they were asked about the recyclable items, pre-survey results as well as control group results showed that most of participants failed categorizing them. When comparing the results of control group and follow up results, it seems that the *Garbage Dreams* game has brought a new attitude about certain materials. Styrofoam, for example, is a common material used in the U.S., it is usually used with take-out food, as trays for different food products or as plates when having a gathering, among other uses. This material is not biodegradable and usually not accepted in the recycle facilities, but according to the results from the pre and control surveys of this study, people believe this material to be recyclable. Though, one of the main accomplishments of the game experience was to bring this new knowledge and changing such beliefs; as the graph 9 shows, a majority of “follow-up” respondents categorized it as a non-recyclable item. Although it is not to be assumed that this shift will affect the future behavior of the players, it is surely a first step towards awareness.

In terms of gender representation, the group was balanced and there were no significant differences to highlight regarding their behavior or responses; both genders were equally engaged although the only players that affirmed to have played again were both males, reporting to have improved their scores in their next plays. Concerning age differences, there is an observation to be made. In the face to face context it was observed that the older

players, while having a positive attitude towards the game, were having a difficult time understanding the rules and their role in it. One of the oldest participants gave up and left the activity, excusing himself as “being too old for that”. On the other hand, the youngest participants understood the rules and finished ahead of others and with a very good score. But the challenge with such young participants is keeping them focused on the content that the game wants to address, they get too engaged with winning and so, lose the learning purpose of it. This too supports one of the findings made by Nilsson (2010), where she argues that “students need to consciously relate the game play to a learning purpose” (Nilsson, 2010, p.77). Since participants are not all students or the same age, a good strategy and a recommendation for next studies, could be pairing younger with older participants motivating them to an exchange of (technological) knowledge as well as to discussions about the topic being addressed by the game. Although such observations could not be made for the online context, none of the respondents affirmed in their surveys to have had a non-enjoyable experience with the game. This may be due to what Wood et al.’s work suggested when discussing the reasons for the internet being a good medium to carry out gaming research; the paper argued that “gamers that use the internet are usually proficient in using it” and so it is less likely to find participants in the online context having the same difficulty as the ones at the face to face context. Even though there were some technological issues (that will be explained in the next section), it was good having explored the gaming experience within the two contexts. This study illustrated that a videogame and the online way of spreading and addressing a sustainable matter might be a good tool to consider in the future.

Adding to this, there is another factor to be taken into account, the game platforms. Responses from the three different groups expressed the smart phone and the tablet to be common platforms for playing games. This fact agrees with the statement made by Linderoth “Smartphones are already an everyday technology” (Linderoth, 2009, p. 12) and might facilitate the gaming experience due to the fact that people are familiar with such devices. And so, pervasive games might be a good way to involve people in serious gaming. Montola defined pervasive games as games that no longer take place in certain time or location, where the players inhabit a game world that is present within the ordinary world (Montola 2009). Such games are also known as immersive games or alternate reality games. In such games, the player interacts with reality and updates the moves and an impact is made immediately to the network. The fact that a majority of participants affirmed to have shared the *Garbage*

Dreams game with others, offers evidence that an online videogame could be a potential tool for spreading social or environmental awareness.

4.6.1 Limitations

Platform & Videogame

The number one limitation of the study was to find an appropriate videogame. In order for the videogame to be a good tool for the study, it had to fulfill certain characteristics such as:

- Be relevant to the topic of interest: waste and waste management
- Easy accessibility to the public: free download or web-based
- Had to have low to intermediate levels of difficulty

A lot of videogames about recycling exist but most of them are too simple and do not include waste management as a whole. *Garbage Dreams* seemed to be ideal, since it was easy to access, the topic was presented in a relevant manner based in real waste management experiences, it was challenging and easy to play. The limitation was that it could only be played on one platform: the computer. Some participants, mostly from the online context, could not finish their attempt to participate in the study due to the fact that the game was not available on the tablet. This did not happen in the face to face context because people were informed about the platform to be used. But another limitation was found within this context. The game required an internet connection in order to be played, so the location where the game activity was going to be performed had to have a strong network to support all the players at the same time. In the face to face context there were some computers that had trouble opening the game. And this caused the activity to be delayed and participants to start losing interest.

Participants

Since is an independent research it was difficult to find people willing to participate. Because of this the target group that made up the face to face context was small, and a second context (the online) had to be made. Therefore some of the participants that were call for participation were people that knew me and my interests and so, there is the possibility of them being positively biased in their answers.

Another limitation of the research being independent was that, the results basically depended on participants' willingness. As a result, the responses on the "follow up" surveys took long time to return and ultimately not all the participants did it.

Data

The way the data was gathering was decided according to the study design. Even though surveys are not commonly used in qualitative studies, they were a practical method of collecting data pre and post the experience. Surveys were also useful when expanding the research to the online context. Survey Monkey was the website that was used, which worked fine with some minor problems. Since the online context was not planned from the beginning the surveys used were not exactly the same as the ones used for the face to face context, some questions were removed. The face to face context included questions that I found participants did not understand, so those were taken out.

4.7 Conclusion

Having explored the early days of videogames and their impacts in society, and after seeing the results of the gaming experience with *Garbage Dreams*, this study concludes that a videogame is capable of bringing new knowledge to players and could be considered a tool for presenting a waste management strategy to a community. Depending on the type of videogame, the knowledge will vary. Some videogames will give players knowledge of certain processes (i.e. how to fly an airplane), others will bring facts (i.e. percentage of recycled paper in a country) and others will present players with new concepts (i.e. perception of women). In the case of *Garbage Dreams*, participants seemed to have obtained new knowledge, such as facts about recyclable and non-recyclable materials, a glimpse of the cost of a waste management plan, and it also changed perspectives for some regarding the use of videogames for serious purposes. Although there were some attitudes changed, this study cannot tell whether or not participants effectively applied the knowledge gained.

Videogames have a great potential to deal with sustainability challenges. It is just a matter of choosing the right platforms and the right games to play. It is also essential to identify the audience that the game is attempting to reach. The games should be enjoyable and relevant for the public. For a local community in a country like the United States, I would suggest further studies exploring a game experience in the mobile phone platform. This would help avoiding some of the technological limitations mentioned above. Smart phones are common phones for people to own in the U.S. and mobile applications are in frequent use. These mobile applications have many advantages for game research: they can be designed using information and facts of the actual area, they can reach a variety of people, and they promote participatory actions allowing people to share their experiences with others. Mobile

applications also allow interaction between the game- world and the real-world and so, people can actually make a real impact by sharing their performances with others and bringing new ideas, which ultimately will encourage and motivate other participants to engage with a sustainability issues.

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Ludography

Computer Platform

Ayiti -The Cost of Life, <http://ayiti.globalkids.org/game/>

Coca-cola recycler (Facebook game)

Garbage Dreams, <http://www.pbs.org/independentlens/garbage-dreams/game.html>

Flood Manager

Free Rice, <http://freerice.com/#/english-vocabulary/1400>

McDonalds Videogame, <http://www.mcvideogame.com/index-eng.html>

The Zero Waste Game, http://www.kidsciencechallenge.com/year-four/zw_game.php

The Great Green Webgame, <http://go.ucsusa.org/game/>

Smart Phone Platform

Doodle trash

Face the waste

Green Ocean Garbage Patch

NYC Recycle more, waste less!

Recycle Hero

SURGE Sustainable roof

APPENDIX A

Some of the main events that have impacted the game industry throughout the years:

Table 2. Main Events of game industry

Year	Game Genre and Platforms	Impacts in Society
1958	Computer & games first went hand in hand with "Tennis for two"	Willy Higinbotham "managed to make a scientific instrument attractive for a nonscientific audience, by obscuring its complexity and making it easy to manipulate"(Goldstein, 2005).
1971	<i>Computer Space</i> . First mass produced game with a coin slot was produced (Wolf, 2012).	Was installed in a bar and it was the start of the Arcade Era (Donovan 2010) .
1972	<i>Odyssey</i> . World's first game console (Wolf 2012).	Revolutionary device because it could be connected to a TV.
1972	Educational games entered the scene. The first to enter the schools in the US was <i>Oregon Trail</i> (Sigmund Tobias, 2011).	New way of teaching was introduced to society.
1976	New game platforms were created: first home computer created by the Apple Computer Company (Donovan 2010); and first handheld device (Caoili, 2008).	The creation of the computer was the start of the "computer revolution" which is still on-going and is the driving force of the ever increasing sophistication of videogames (Goldstein, 2005). Handheld device was revolutionary because allowed people to carry their games in their pockets.
Late 70's and beginning of 80's	War games (<i>Civil war</i>) and flight simulators (<i>Flight Sim</i>) were introduced to the computer world.	<i>Flight Sim</i> had been used by the USAF in WWII to train more than 500,000 pilots(Donovan 2010).
Late 70's	New concept of gaming was brought with the release of <i>Dungeon & Dragons</i> and <i>Alakabeth</i> : role-playing games.	This genre would impact the way we currently play games.
1982	Atari made <i>Pac-man</i> available for play on its consoles (Donovan 2010).	It opened the market for non-violent games and <i>Pac-man</i> became the first character that was merchandised outside the area of the videogames (Wolf 2012).
1986 and 1989	"Nintendo Revolution" started with the release of <i>Super Mario Bros</i> and <i>Tetris</i> which was the breakthrough for "puzzle" games (Goldstein, 2005).	Proved that complexity and violence were not necessarily instruments of a good game.

Mid 80's	Emergence of God Games or System Simulation games and the Multi-User Dungeon Games (MUD)	Games started to become "serious" and had topics related to politics, wars and simulation of cities. New culture appeared: The virtual culture.
1989	Released of SimCity. It simulated the construction and management of a city.	Reshaped the way games were being presented, players did not win or lose and it emphasized in creation instead of destruction. It was recognized as an educational tool, and was used in more than 10 thousand classrooms ("The history of simcity", 2013).
1990's	Another game platform appeared: Mobile Phones. <i>Snake</i> , a casual game, was the first game available.	Introduced the idea of having three features together: communication, gaming and mobility. Since then mobile phone technology has been in constant development and multiple other games have been released.
Early 1990s	Accessibility to the internet for the public. Massively Multiplayer Online Role Playing Games (MMORPG) started to become popular (Heeks, 2008). Some of the games: <i>Ultima Online</i> (1997) <i>EverQuest</i> (1999) and <i>The World of Warcraft</i> (2004)	The MMORPG created a cultural revolution among the "game community" and have since built a kind of participatory "global playground" where complex play communities and social networks* have been formed and are allowed to dynamically interact with each other, in real time (Pearce, 2009).
Mid 90's	Virtual pet games (<i>Petz series & Tamagotchi</i>), and music and dance games were released (<i>Dance Dance Revolution</i>).	Dance games were used to tackle obesity problems in the state of Virginia (Donovan 2010).
2000	The game <i>The Sims</i> was launched.	Players were allowed to upload their games for others to see, so they decided to use the game as a way of self expression (Donovan 2010).
2004	Virtual social network <i>Facebook</i> was created.	Promotes a participatory culture and social serious games have been taking advantage of it. This network has more than a billion monthly users as of December 2012 (facebook.com, 2013)

APPENDIX B

Online Surveys

Pre-survey

1. Demographic information

Gender:

Age:

Occupation:

Country:

2. Do you currently play video games?

Yes

No

3. If yes, on what device do you usually play video games? (you can choose more than one option):

Computer

Tablet (Ex. Ipad, kindle)

Smart phone

Video game console (Ex. Nintendo, play station, :c)

Portable game console (Ex. Nintendo DS)

Other (specify)

4. When you play video games, how much time (per day) do you spend playing?

10 to 15 minutes

4 to 8 hours

1 to 3 hours

more

5. Do you think video games can be an effective media for raising awareness towards a social or environmental issue?

Very effective

Not effective

Effective

Not effective at all

Somewhat effective

6. How interested are you in the topic of recycling?

Very interested

Somewhat interested

Interested

Not interested

7. What level of knowledge about recycling do you think you have?

Excellent

Good

Acceptable

Poor

8. Which of the following items you consider as recyclable? (you can choose more than one option)

Plastic bottle

Tetra pack packages

Light bulb

Styrofoam

- Coffee paper cups
- Aluminium cans

- Tin (ex. tuna cans)
- Dirty paper

9. When you have an empty plastic bottle you:

- Save it and reuse it
- Throw it in the first trash can you find
- Save it and throw it in a recycle bin

Other (specify)

10. Do you recycle at home?

- Yes
- No

Post-survey

1. Demographic information:

Age:

Occupation:

Country:

2. How would you rate the game "Garbage Dreams"?

- Excellent
- Good
- Acceptable
- Poor

3. Has your interest towards the topic of recycling:

- Increased
- Stayed the same
- Decreased

4. Which of the following items you consider as recyclable (you can choose more than one option):

- Plastic bottle
- Light bulb
- Coffee paper cups
- Aluminium cans
- Tetra pack packages
- Styrofoam
- Tin (ex.tuna can)
- Dirt paper

5. After playing the game, how effective do you think video games are for raising awareness towards social or environmental issues?

- Very effective
- Effective
- Somewhat effective
- Not effective
- Not effective at all

6. Did you enjoy playing the game?

- Yes
- No

*

7. Did you learn anything new through the game? If yes, please specify

8. Do you know where the waste goes in the place where you live? (after being thrown in the garbage can)

If yes, please specify

9. After playing the game, how would you rate your level of knowledge about recycling?

- Excellent
- Good
- Acceptable
- Poor

10. What was your final percentage, and what was your strategy?:

Follow Up Survey

1. Demographic Information:

Gender:

Age:

Occupation:

2. Have you played the game "Garbage Dreams" again?

- Yes
- No

3. If yes, what was your highest percentage and strategy?

4. Since participating in the activity, have you changed any of your attitudes towards recycling? If so, please explain.

5. Which of the following items can NOT be recycled:

- Plastic bottle
- Tetra pack packages
- Coffee paper cups
- Tin (ex tuna cans)

- Light bulb
- Styrofoam
- Aluminium cans
- Dirt paper

6. Have you recommended the game "Garbage Dreams" to someone else?

- Yes
- No

7. After being part of the activity, do you think games can be effective for raising awareness towards social and environmental issues?

- Very effective
- Effective
- Somewhat effective
- Not effective
- Not effective at all

8. After being part of the activity, have your interest towards the topic of recycling:

- Increased
- Stayed the same
- Decreased

Control Group Survey

1. Demographic information:

Gender:

Age:

Occupation:

Country:

2. Have you ever played a video game?

- Yes
- No

3. Do you currently play video games?

- Yes
- No

4. In what of the following platforms do you usually play games? (you can choose more than one option)

- Computer
- Smart phone
- Portable game console (Nintendo DS, PSP)
- Tablet (Ipad, kindle)
- Video game console (x-box, nintendo, playstation, etc)

Other (please specify)

5. How often do you play video games?

- Every day
- 2-3 times a week
- Twice every month
- Once a month
- Less

6. Do you think video games can be effective media for raising awareness towards a social or environmental issue?

- Very effective
- Not effective

- Effective
- Somewhat effective
- Not effective at all

7. How interested are you in the topic of recycling?

- Very interested
- Interested
- Somewhat interested
- Not interested

8. What level of knowledge about recycling do you think you have?

- Excellent
- Good
- Acceptable
- Poor

9. Which of the following items you consider as recyclable? (you can choose more than one option)

- Plastic bottle
- Light bulb
- coffee paper cups
- Aluminium Cans
- Tetrapack packages
- Styrofoam
- Tin (ex. tuna can)
- Dirty paper

10. Do you know where does the waste go in the place where you live? (after being thrown in the garbage can)

APPENDIX C

Face to face Surveys

Pre-Survey

Demographic Information

Name or nickname: _____ Age: _____ Gender: _____

Occupation: _____ Country of Origin: _____

Please circle one option on the following questions unless otherwise specified:

- 1) What level of knowledge about recycling do you think you have?
a) Excellent b) Good c) Acceptable d) Poor
- 2) How interested are you in the topic of recycling?
a) Very interested b) Interested c) Somewhat interested d) Not interested
- 3) Circle your level of agreement with the statement *“Solid Wastes can be used for good in the hands of those who use them properly”*
a) Strongly agree b) Agree c) Not agree d) Strongly disagree
- 4) Which of the following items you consider as recyclable (You can circle more than one option):
a) Plastic bottle b) Light bulb c) Coffee paper cups d) Aluminium Cans
e) Tetrapack packages f) Styrofoam g) Tin (ex. tuna cans) h) Dirty paper
- 5) When you have an empty bottle of water you:
a) Save it and reuse it b) Throw it in the first trash can you found
c) Save it and throw it in a recycle bin d) None of the above
- 6) What do you do with your old batteries? : _____
- 7) Do you have recycle service at home? a) Yes b) No
- 8) Do you recycle at home? a) Yes b) No
- 9) Do you use a reusable coffee cup?
a) Yes b) No c) Sometimes

10) What of the following game platforms do you have? (You can circle more than one option):

- a)** Computer **b)** Smart phone **c)** Portable game console (Nintendo DS, PSP)
d) Tablet (Ipad, kindle) **e)** Video game console (x-box, Nintendo, Playstation, etc)

11) Have you ever played a video game? : **a)**Yes **b)**No

12) Do you currently play video games?: **a)**Yes **b)**No (if your answer is no please go to question 18)

13) How often do you play video games? Circle one option:

- a)** Every day **b)** 2-3 times a week **c)** Twice every month
d) Once a month **e)** Less

14) When you do play video games, how much time (per day) do you spend playing? :

- a)** 10 to 15 minutes **b)** 1 to 3 hours **c)** 4 to 8 hours **d)** more

15) On what device do you usually play games (you can circle more than one option):

- a)** Computer **b)** Smart phone **c)** Portable game console (Nintendo DS, PSP)
d) Tablet (Ipad, kindle) **e)** Video game console (x-box, Nintendo, Playstation, etc)

16) What games do you play? : _____

17) Do you share your scores with your friends in social networks?, circle one option:

- a)** Yes **b)** Sometimes **c)** No

18) Do you think video games can be an effective media for raising awareness towards a social or environmental issue?

- a)** Very Effective **b)** Effective **c)** Somewhat Effective
d) Not effective **e)** Not effective at all

19) Would you play a game if you knew you could be rewarded with real money?

- a)** Yes **b)** Maybe **c)** No

Comments

Thank you!

Name or nickname: _____

First link: Zero Waste Game

First score: _____

Second Score: _____

Interesting Fact:

Second Link: Garbage Dreams Game

Your own score: _____

Score as a team: _____

Strategy:
