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VERIFYING THE APPLICATION OF ONLINE GAMIFICATION METHODS TO INTRODUCE PRO-ENVIRONMENTAL BEHAVIOR

Master's Thesis

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EXECUTIVE SUMMARY

The goal of this thesis is to validate whether online gamification methods can be used to introduce pro-environmental lifestyle. Human activities have since the Industrial Revolution had an increasingly destructive impact on the biosphere, which has started to endanger the environment and our existence as a species. Awareness of the situation is increasing, but real actions to combat the problem are not, as environmental activists lack the knowledge and tools to drive the necessary individual behavioral change. At the same time, the emergence of the internet has created a mass medium which has proven to be very effective in altering individuals' habits. One of the newest and most potent methodologies to spark behavioral change is gamification, which implies using game design elements in non-gaming context. Due to a vast gap between the academic and commercial practitioners' world, little research has been so far done regarding gamification, and the results of these studies have not been implemented to create effective products. This research tried to bridge this gap and validate the use of gamification to drive pro-environmental behavior change, by deploying an experimental prototype which was developed based on Eric Ries' Lean Startup ideology and Yu-kai Chou's Octalysis gamification framework. In addition, a pretest-posttest survey was conducted to investigate the impact of using the prototype. The minimal prototype proved to be effective in acquiring and engaging new members by growing its user base 8.5 fold. More than one fourth of registered members became engaged users and continued to use the gamified product throughout the experiment. The pretest-posttest survey results indicated that engaging with the prototype did in fact change the users' behaviors towards a more sustainable lifestyle, moderate pro-environmental increases were detected in both respondents' attitudes and concrete undertaken everyday activities. The study concludes that gamification is an effective methodology to introduce pro-environmental behavior and presents an array of insights and suggestions to continue the research. The prototype created for the thesis acts as a platform upon which further developments can be made.

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1. INTRODUCTION

1.1 Context

1.1.1 The Current State of the Environment

Ever since the developments of the Industrial Revolution, human actions — to which we refer to as progress — have for the first time in history become the main driver of global environmental change (Steffen, Crutzen, McNeill, Ambio, 2007, 36, 614–621). While we most certainly welcome cultural and technological advances, there is a growing concern that some of our newly adopted environment-shaping activities may be causing more harm than is currently perceived by the public at large, and they may lead to detrimental or even catastrophic results for large parts of the world (Rockström, 2009).

An aggregate study was undertaken by M. Wackernagel *et al.* in the beginning of the century, where data from governmental sources was used to create comprehensive measures of human impact on the biosphere in the preceding four decades (2007). The paper implied that as our economy depends on Earth's natural capital which provides us all ecological services and resources, living within the regenerative capacity of the biosphere is needed for sustainability — failure to do so would eventually result in depletion of the capital stock. To measure the extent to which humanity satisfies this requirement, the researchers translated human demand on the environment into the area required for the production of foods and other goods, together with the absorption of waste. Their calculations provided evidence that humanity's load corresponded to 70% of the capacity of the global biosphere in 1961, exceeded it in 1980s and grew to 120% in 1999 (see *figure 1.1*). This continually increasing overshoot expresses the extent to which human area demands exceed nature's supply, meaning that in 1999, one point two Earths were required to regenerate what its population had used. The study also discussed that as the human demand on nature changes, so does the nature's supply in result of many factors, such as innovations in

technology. Yet in order to restore sustainability, it would not be a sufficient but still an essential requirement to level our demand with the planet's generative capacity.

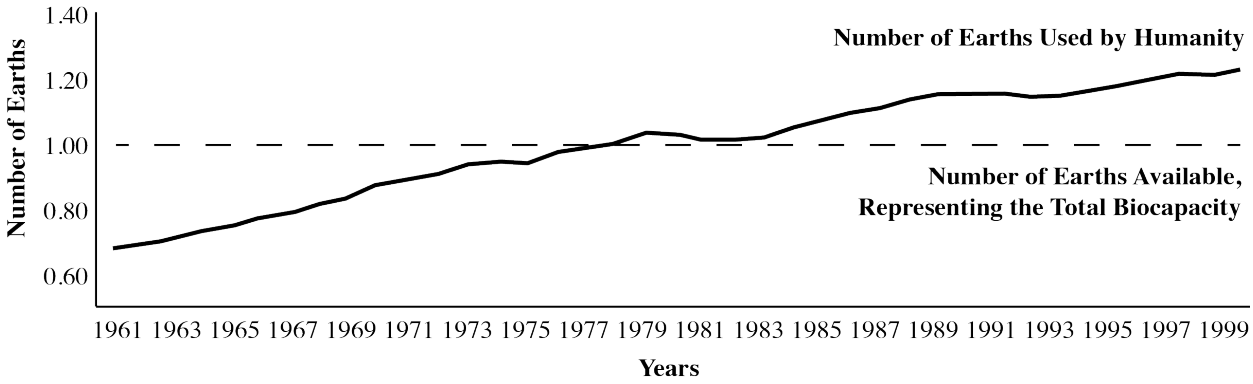

Figure 1.1 "The number of Earths used". Reduction of negative human impact can be witnessed during the 1970s oil crisis and the recession in 1980s. *Source:* Wackernagel *et al*., 2007, 4

Not to base the whole portrait of the situation on one, albeit conclusively aggregated study, it is worthwhile to include another more recent investigation. In 2009, an international group of researchers led by J. Rockström proposed a framework based on nine "planetary boundaries" (2009), which define the safe operating space for humanity with respect to the Earth's systems associated with the planet's biophysical subsystems. These boundaries are selected based on thresholds which, if crossed, could generate unacceptable environmental change, and are defined by a critical value of several control variables, such as carbon dioxide concentration. Crossing them would start to dramatically affect Earth's subsystems, such as the monsoon system, which could result in potentially disastrous and irreversible consequences for humans. Despite taking a conservative approach, the researchers found that humanity may soon approach the boundaries for global freshwater usage, excessive land use, ocean acidification and interference with the global chemical cycles. Even more troublesome, three boundaries — climate change, rate of biodiversity loss and interference with the nitrogen cycle — have already been crossed. The paper states that consequences of these overshoots can already be seen in the accelerating rates of sea level rise and loss of ice from Greenland and West Antarctic ice sheets. The extinction rate of species is estimated to be 100 to 1000 times more than what could be considered normal, up to 30% of all mammal, bird and amphibian species will be threatened with extinction by the end of this century. Marine ecosystems are shifting, the Baltic Sea has

seen periods of anoxia caused by excessive nutrients, which potentially explains the extinction of marine life in the area.

These direct consequences of excessive human activities, which we are only starting to witness, will eventually start to threaten our societies and challenge our developed lifestyle, if not survival. Yet, as serious as they already might be, these issues today remain, in the most part, out of our sight and as such are not easy to comprehend. Other than the degraded quality of seafood and the proliferation of hazardous algae transforming seawater dangerous to approach for local beach-goers around the Baltic Sea, we are not confronted with the mass extinction of species or melting of ice sheets in our everyday lives. What we perhaps can witness is the accumulation of waste materials. The UK Government has announced (Grice, 2010) that by 2018, the country will run out of landfill sites due to the excessive amount of leftovers of consumerist behavior which do not get recycled. Analysts from Lets Do It! World movement have estimated (2012) that a global total of more than 100 million tons of illegal garbage can be found in the wild.

1.1.2 Individual Impact and the Will to Change

While much of the change to return to a sustainable *status quo ante* is necessary on the government and industry level, a paper published by G. Bennett and F. Williams (2009) explains that individual transition to a pro-environmental behavior is not only of equal, but even greater importance. Industry and government are eventually led by individuals, their beliefs and values, and they respond to those of the society. Furthermore, the impact of an individual using a product oftentimes presents a much larger effect on the environment than the company that had produced the product. As an example, the manufacturer of mass consumer products Unilever estimates that 93% of the carbon emissions over the lifecycle of a bottle of their shampoo in the US is generated by consumer use (Unilever, 2009), only 5% is attributed to materials and just 2% to distribution.

Although the negative impact of individual consumerist behavior to the environment is substantial and, as we can conclude from the research introduced in the previous section, continuously growing, there is also promising evidence of growing citizen initiative to pursue a pro-environmental lifestyle. A survey conducted in the US in 2012 by Shelton Group boldly suggests that sustainability is becoming a norm in the country.

The research divides the national market into three segments (Shelton Group, 2012):

1. Actives, 20% of the population, are attitudinally pro-environmental, regularly engaged in green purchases and sustainable behaviors.
2. Seekers, 33% of the population, are defined by their search for more environmentally friendly product alternatives. Although less engaged than the first group, seekers are displaying an increasing interest in the subject.
3. Skeptics, 47% of the population, are the least pro-environmentally oriented. Those who have adopted green habits are rather driven by cost savings.

As we can see, more than half of the Americans portrayed in the survey display a pro-environmental mentality. The paper also suggests that sustainable behaviors are emerging as a new definition of what is socially acceptable.

Yet we are presented with troublesome evidence that consumers' knowledge, values and attitudes do not in reality correspond with their actions. Many studies have confirmed this phenomenon, often dubbed as the "green gap". In 2011, OgilvyEarth ran an extensive qualitative and quantitative investigation (Bennett, Williams, 2011) on the subject in the US and China, the two largest emitters of greenhouse gases (as stated by the paper). They found that "in fact 79% of Americans characterize themselves as "somewhere in the middle" when it comes to living a green lifestyle". Further analysis uncovered that altogether 82% of the US citizens have pro-environmental beliefs, yet only 16% are dedicated to fulfilling these intentions. A slightly more profound explanation is presented in *table 1.1*.

Fully understanding why the green gap exists has proven to be a complicated task, as after a number of studies carried out in the last four decades and several models proposed — one of which we just briefly introduced — a commonly accepted concise or even thorough resolution is still non-existent. What have been defined by now, though, are commonly referred reasons and barriers, well documented in a paper by A. Kollmuss and J. Agyeman which makes references to hundreds of studies conducted in the field. The scholars state that including all the possible reasons for the green cap in one model would render it so complex it would lose its practicality or even meaning, and as such they discuss factors that have been established as having influence on the models of pro-environmental behavior. The external factors are: *demographic*, such as gender and education; *institutional*, indicating the requirement for necessary infrastructure; *economic*, referring that people may make purchasing decisions using a 50% or higher interest rate; *social and cultural*, indicating the importance of cultural norms. The internal factors are:

motivation, conscious and unconscious, altruistic values are hypothesized to be often covered up by immediate motives; *environmental knowledge*, which only plays, as previously explained, a minute role in behavior; *values* and *attitudes*, which are surprisingly found to have a very small impact on pro-environmental behavior; *environmental awareness*, defined as understanding the impact of human behavior on the environment; *emotional involvement*, referring to the extent to which we have an affective relationship to the natural world; *locus of control*, representing an individual's perception whether he or she can bring about change through his or her own behavior. Based on those factors, the researchers established the following barriers, reasons for a green gap: lack of knowledge; old behavior patterns; negative or insufficient feedback; lack of external possibilities and incentives, internal incentives, environmental consciousness; existing knowledge contradicting environmental values and learning. (Kollmuss & Agyeman, 2002) Needless to say, those barriers need to be targeted in order to drive pro-environmental behavior. They are interconnected, many even conflicting and competing, and as such addressing one would as well influence the others.

%	**Segment**	**Traits**
16	Super Greens	See problems and yet remain optimistic, willing to lead the way, believe in local and individual efforts to make the difference.
33	Upper Middle Greens	Believe in problems, likely to act upon them. Motivated by altruistic and future benefits, their responsibility to preserve the planet for upcoming generations.
33	Lower Middle Greens	Inclined to see problems as hype, actions mainly influenced by personal and immediate benefits, such as saving money.
18	Green Rejectors	Antisocial, pessimistic, disconnected from community, feel that their sustainable efforts would not bear results, see green movement as geared for "wealthy" and "trendy"

Table 1.1 OgilvyEarth's segmentation of the US citizens, based on survey respondents' perception of how green they are, taking into account several variables, such as attitudinal questions

The previously described paper by OgilvyEarth guides attention to a fact confirmed by social sciences that *au contraire* to popular belief, attitudes and beliefs are shaped by behaviors; behaviors drive belief systems more than the other way around, and actually represent one of the most effective ways of changing people's mental programs (Hofstede, 1996). This simple yet

radical shift in emphasis might explain why the majority of environmental campaigns — which, as a rule, target first and foremost people's knowledge, beliefs and values — bear minimum results. More importantly though, it suggests an new kind of approach, which has thanks to technological advances become today more feasible than ever before.

1.1.3 The Rise of Captology

B.J Fogg discusses that throughout the evolution of the computer, we have now "entered an era of persuasive technology, of interactive computing systems designed to change people's attitudes and behaviors" (Fogg, 2002, 1). Fogg coined the term "captology" (see *figure 1.2*) to represent the study of computers and persuasive technologies, and recognizes that the proliferation of persuasive technology truly started with the emergence of the internet. We can argue that most social websites today have built their success based on captology, and as such have confirmed the technology's potential to influence people and change their behavior.

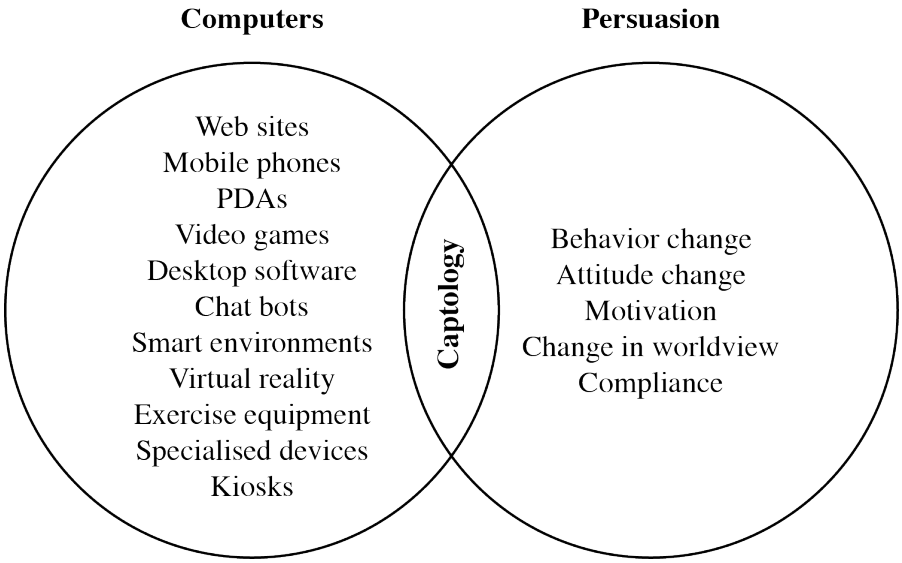

Figure 1.2 Fogg's captology describes the area where computing technology and persuasion overlap. *Source:* Fogg, 2002, 5

The previously introduced research by OgilvyEarth suggests that the first step towards closing the green gap is about people beginning to perform everyday green activities and experience them in a positive way. This behavior leads to forming favorable opinions of the pro-

environment movement, and as it becomes personal and enjoyable, people begin to integrate it into their habitual lifestyles.

1.2 Background

1.2.1 Play and Game

Video game industry could be held responsible as so far being the biggest and most evident implementor of captology. In order to understand why it is so and to better apprehend the theory discussed in the following sections, it would be necessary to start by introducing the underlying principles of play and game.

Today's common definitions of "play" and "game" tie back to Caillois' concept of *paidia* and *ludus*. While paidia ("playing") denotes a free-form, improvisational combination of behaviors, ludus ("gaming") expresses playing structured by rule systems and a competition towards clearly defined goals (Caillois, 2001).

Play is an activity associated with the feeling of enjoyment and shared by humans and animals alike (Brown, 2008). Building upon the research of many psychologists, it has become a public conception that play is not just a recreational action, but has a key role in the mental development of a human being. Play is defined by four critical characteristics (Garvey, 1990):

1) play is pleasurable, enjoyable, positively valued by the player;
2) play has no extrinsic goals, its motivation are purely intrinsic — it could be said it is the enjoyment of means;
3) play is spontaneous, as opposed to being obligatory, it is freely chosen by the player;
4) play involves some active engagement from the player.

Game is set apart from play by the fact that it is based on commonly agreed upon rules, it is play with a definite structure. As the notion of a game in our thesis refers principally to computer games, we refer to Crawford, the author of two highly influential video game design books, in our definition of a game: it is a challenging, interactive goal-oriented activity, in which players interfere (and compete) with each other and game agents (2003)(see *figure 1.3*).

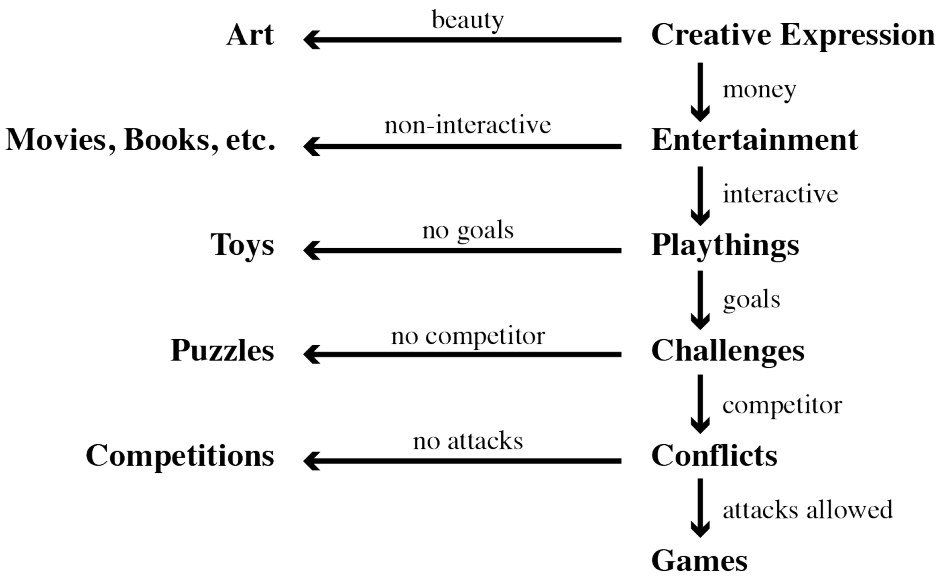

Figure 1.3 Crawford's taxonomy of creative expressions. *Source:* Crawford, 2003, 6

The history of video games dates back as far as the technology they can be played on. Since the period they were created and engaged with by scholars in research facilities, games have played an ever increasing part in the development of computing technology. It is observed, that along the increase of processing power, there has been a concurrent growth of the percentage of that power which is dedicated to presentation, rather than computing. As the success of today's video games is heavily dependent on their visual appeal, the gaming industry has become one of the major drivers of hardware development. In the US, videogame industry represents one of the fastest growing sectors of the economy. According to a 2012 report published by The Entertainment Software Association, the total revenue of the industry in 2011 was 24.75 billion dollars, video games were played by 67% of the US households, average player was 30, game purchaser 35 years old and played eight hours per week. 47% of all players were, surprisingly enough, female. As we can deduce from the statistics, the industry has created very effective means of customer acquisition and engagement (Entertainment Software Association, 2012).

Our lives — survival, existence and evolution — are driven by physiological and psychological needs described by Maslow in his infamous hierarchy of needs theory (Maslow, 1954). In order to nudge humans to fill those needs and distinguish positive behavior, our brains are equipped with a neurotransmitter associated with pleasant feelings, named Dopamine. This chemical is administered to our brains, and thus a pleasurable feeling created once we have

engaged in an activity which fulfills a need, such as drinking a glass of water in case we are thirsty. For the higher placing, psychological needs in Maslow's scheme, it is however not that easy to always determine the positive action that would initiate the dopamine releasing process. It is in fact dependent on each person, and what he or she has personally qualified as being a "successful" action.

Hejdenberg argues that in modern society it is difficult to get a good measurement of the result of our actions. As the options are so plentiful, the boundaries between right and wrong are not always so clear, meaning we often lack the necessary feedback whether we have done something well (2005). We can add to that the notion, that progress is today mostly achieved by collective effort, in which each individual plays often not more than just a small role, which again makes one's personal impact hard to comprehend. We can assume that this tendency is also one of the main reasons behind the flourishing of video games, which — if fact along with all types of games — have been equipped with mechanics to provide players the feeling of achievement.

Yet there is much more to the affirmative and even addictive nature of games than just the sense of accomplishment. Mihaly Csikszentmihalyi has described the notion of “flow” as “the state in which people are so involved in an activity that nothing else seems to matter; the experience itself is so enjoyable that people will do it even at great cost, for the sheer sake of doing it” (1997) Flow is now commonly believed to represent the optimal human experience. Curtiss Murphy from Alion Science and Technology discusses that as flow is about intrinsic motivation — the joy of doing — it is widely accepted to be one of the fundamental reasons behind people playing games, and for game designers, the main question is how long they can keep players in the flow (2011). The state of flow is described by four requirements, which Murphy has explained in relation to video games:

1) Clear tasks — player is aware of what he or she needs to do.
2) Feedback — player gets constant feedback on his or her actions, performance and progression towards fulfilling the goals. Typical feedback mechanisms, which show the outcomes of player actions, include: a scoring system; a way of tracking progress on goals (9 of 10 things); comparative statistics (high scores); an end-of-level debrief; growth indicators (50% through a cooking skill); and failure outcomes.
3) Balanced, attainable goals — the tasks have to be simultaneously challenging yet achievable, and remain so throughout the game. Player learns and evolves during the

process of the game (which is another engaging element in itself) and to keep him or her in the state of flow, the game industry has created an array of techniques, such as: chapter based systems; dynamic difficulty adjustment; simplicity and transcendence; use of failure and repetition; player adjustable difficulty; and expansive use of self-guided tutorials.

4) Concentration — the player has to be able to concentrate on the game itself, the game should not contain distractions such as intrusive story elements or complicated user interface.

1.2.2 Gamification

The definition today commonly accepted for the term "gamification" is proposed by Detering, Dixon, Khaled and Nacke who describe it as "the use of game design elements in non-game contexts" (2011). The core concept behind gamification is based on the notion that as the video game industry has over the years developed methods which display unparalleled ability to engage and motivate players (some of them introduced in the last section), then it would only be logical to assume that using those proven methods in other experiences could potentially render them more engaging as well.

Gamification methods can be applied in many areas other than just online products and services (see appendix 1 for a couple of examples), evangelists of the field propose implementing it to improve the functionality of educational systems, personal healthcare and even to liven the mundane daily lives of office workers (McGonigal, 2012).

Foursquare (https://foursquare.com) is widely considered as the first remarkable success story of implementing gamification. Foursquare's early success of engaging millions of users in just matter of months came from leveraging functionalities based on game mechanics, such as check-ins, leaderboards, mayorships and social network broadcasting, which all addressed user's social motivations. Vittra Telefonplan is a school in Stockholm that is built around motivation rather than discipline (Lanks, 2012). The school achieves this by, among other methods, rewarding students with "lightning bolts" which increase their "energy" when they collaborate and learn, and decrease it when they meet "monsters" of Facebook and YouTube. Not all successful implementations of game design elements are that obvious though. Often times they represent a lot more subtle yet incredibly powerful mechanics, as is the case with Facebook,

Twitter, eBay, Wikipedia, Groupon and many other established enterprises. We will introduce the basics of those mechanics in later paragraphs of this section.

Gamifying the user experience does most certainly not solve fundamental business problems, it is not a magical cure to a malfunctioning system. In contrast, it should be considered as a supplementary enhancement to a platform that already provides meaningful content and interaction to its users. Gabe Zichermann and Christopher Cunningham explain that gamification is well suited to promote certain aspects of online products, such as *engagement* — represented by the metrics of recency, frequency, duration, virality, ratings — and *loyalty* (2011), which are crucial elements of gaining and keeping market share in the modern social online environment where the old mass media marketing techniques have become ineffective.

At the same time, while not academically documented, there is a growing dissent in the online industry towards gamification (Bocska, 2012). It is disregarded as a yet-another passing trend and a buzz word overused by self-proclaimed field experts, showing similar traits to the trivial fast growth of "social marketing" in the end of the last decade. Yet it is very important to understand that much of this contempt is aimed at the abuse of the term itself, rather than the ideology and methodologies it presents.

The more constructive critique discusses that the real problem lays in the fact that the implementation of gamification is more often than not a very shallow one. Gartner estimates that 80% of all gamification implementations will fail to meet their business goals by 2014 due to bad design (2012). As it is technically relatively easy to implement gamification methods to existing platforms, we are seeing a trend where means justify the end — creating a "points, badges, leaderboards effect" where those most prominent methods are implemented to a product in hope of easily gamifying the experience and without giving further thought to the psychological principles underlying them.

While the definition of gamification implies using "game design elements", we currently lack a clearly specified definition of the latter itself. A game design element is a rather broad classification and could indicate anything from the user interface design patterns to game design principles and heuristics.

As gamification is a relatively new methodology, there are not many models or frameworks around yet which we could refer to. One has been lately proposed by Yu-kai Chou, a pioneering practitioner of the field. He defines gamification quite broadly as "human-focused design" and calls his framework "Octalysis" (2013).

It is based on thorough analysis of gamification implementations and revolves around eight core "drives" (*ibid:* 2013):

1) Epic Meaning and Calling — engages player in belief that he or she is doing something for altruistic reasons or was "chosen" to play. Such player is for instance engaged in mentoring and community-oriented activities (Wikipedia, Open Source projects). This core drive is responsible for creating the feeling of having an advantage over the others.
2) Development and Accomplishment — addresses the notion of making progress, developing skills, eventually overcoming challenges and earning trophies for meaningful actions.
3) Expression of Creativity and Feedback — engages player in a creative process where he or she has to repeatedly try to understand challenges, evaluate the obstacles and try different combinations of solving them. Player needs a way to express creativity and be able to see the result of his or her creative actions.
4) Ownership and Possession — refers to the notion of wanting "something", and exploits the need to increase its quantity and quality. The author argues this to be the driving force behind virtual goods and "collection" games.
5) Social Pressure and Envy — incorporates the social motivations, such as: mentorship, acceptance, social responses, companionship, as well as competition and envy.
6) Scarcity and Impatience — engages player's need for something because he or she can not have it. A highly successful example of this drive in use is the Appointment Dynamics method, which allows player to engage with some content or activity only after a specified time period.
7) Curiosity and Unpredictability — refers to the notion of wanting to find out what actually happens. While this drive is generally harmless, it is also stated to be the primary factor behind gambling addiction.
8) Loss and Avoidance — refers to the avoidance of something negative happening, such as losing previous work or admitting the insignificance of previous deeds upon giving up on something.

While Chou's relatively novel framework lacks, as of today, a more thorough academic analysis and even somewhat incorporates unproven theories (see *figure 1.4*), we can clearly see how his

proposed *drives* align with the gaming psychology we introduced earlier. As such, we believe it to be, if nothing more, a good comprehensive synthesis of gamification methodologies.

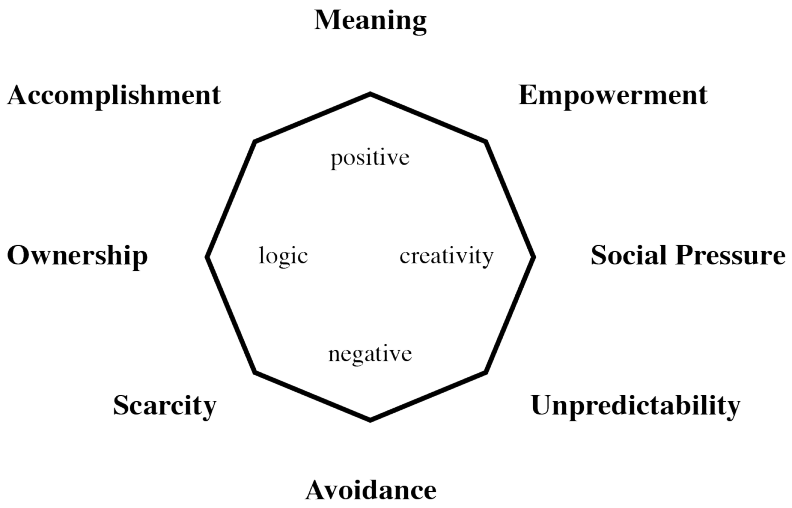

Figure 1.4 "Octalysis" gamification framework model by Chou. The drives on the right side are considered "right brain drives", representing creativity, self-expression, and social aspects, the ones on the left are considered "left brain drives", being more about logic, calculations, and ownership. While there is no scientific evidence to the popular right/left side of the brain classification, the framework does provide a good way to describe and group different game design elements.

Another angle for framing gamification, which Chou has actually adopted in a further development of "Octalysis", is presented by Kevin Werbach (2013). He presents the concept of "player journey", a conceptual path the player follows through the game, which has a beginning, a middle and an end, preferably bound by some sort of progression. He brings out four concrete stages of the journey, which represent his notion of gamification principles, formed around player's experiences and perspectives: *identity* — player getting to and signing up to the game, creating his or her "profile"; *onboarding* — introducing the player to the game mechanics, nudging to use them; *scaffolding* — iterating the onboarding phase from simple to more complex as the player progresses; and *the path to mastery* — teaching players new skills by giving them more choices, actions, abilities, so that they would become motivated to master them. Chou's implementation of the player journey is a bit more game-centric and as such perhaps even more practical. As an example he has expanded the "identity" principle to deal

more with discovering the product in the first place, and replaced “the path to mastery” with a classical gaming term *endgame*, which refers to player’s experience once the game’s main progression mechanics has culminated (has reached “maximum level”).

We can conclude that gamification represents persuasive design which takes into consideration human psychological traits and industry-proven methodologies to address them. Its is a mixture of different sciences — such as anthropology, psychology, human-computer interaction, to name a few — and perhaps even art. We might even go as far as to say that its function is to exploit our weaknesses and needs to nudge us into a new kind of behavior, and keep us tethered once there. While this might raise questions of ethics and righteousness, the function of this thesis is not to questions the methods, but rather their effectiveness to address issues described in the Context section.

1.3 Gap

1.3.1 The Lack of Knowledge

14:45–15:30	Presentation: Dr Leandro Herrero — Viral Change — How to Use it in Changing the World?
17:30–18:00	Presentation: What Tools do We Have?
09:30–11:00	Workshop: LDIW2013 Awareness: Doing things in the 21st century way — the tools that we can use.
11:30–13:00	Workshop: 1000 Days' Plan: Rethink/Education and awareness

Table 1.2 Excerpt of the original Lets Do It! World Conference program

During the first three days of February 2013 we observed an international community of around 300 environmental activists at the Lets Do It! World Conference. The participants formed a representative group of environmentally conscious and active citizens from multiple cultures around the globe, who have been engaged in tangible activities to organize large scale environmental campaigns (cleaning-up events) and promote sustainability. At the conference, the participants attended presentations and workshops, in which the most topical issues of environmental sustainability were discussed. Our observation ascertained a clear theme common amongst the majority of attendees: what could be the next steps after cleaning-up campaigns and how to engage more people in environmentally friendly lifestyle (to avoid the necessity of

organizing clean-up campaigns again in the future). In the many discussions held (see *table 1.2*), personal experiences were explained and proposals made, but it became clear that the community has a strong wish, but in reality lacks the knowledge of how to engage larger groups of people and shape their behavior.

Dr. Avner de-Shalit elaborates that environmental activists are naturally idealistic, they are willing to sacrifice time and energy for topics ranging from animal welfare to preservation of beauty spots. Their psychology is simple: by feeling that they know what is right, their goal is to pursue justice. In this, they express a misconception of the democratic political environment in which they operate. Democracy is a regime of compromise, it is not a system through which ideals and values can be realised, but instead a mechanism which allows people who hold different ideals and values to find a way of living together (2001). This misconception together with others pointed out by de-Shalit, such as the lack of understanding their target audience and using the wrong language, may explain why many environmental campaigns result in failure.

> "In response to the energy crisis in the 1970s, many large-scale information campaigns were implemented across the United States in the hope that enhancing the knowledge of the public with regard to energy problems would change their attitudes to be more pro-environmental, which would lead naturally to change in behaviours. While it may seem intuitive that one's behaviour should be strongly linked to one's attitude, the disappointing results of the information campaigns together with several studies (Lehman & Geller, 2004; McKenzie-Mohr, 2000; Costanzo et al., 1986) demonstrated that behaviour and attitude are in fact weakly correlated. For example, Geller's study (1981) showed that homeowners who had attended an intensive 3-hour workshop on residential energy conservation acquired a better understanding and a more pro-environmental attitude, but were no more likely to engage in the pro-environmental behaviours discussed during the workshops than those who had not attended the workshop."(University of Toronto Sustainability Office, 2006, 1)

Change of behavior is a complex topic, frequent underestimating of which is well described in the above introduction to a paper published in 2006 by University of Toronto Sustainability Office. The authors also bring out that the lack of knowledge is only one of the influential factors which prevent behavior change. There are, in fact, many activity-specific internal — such as lack

of knowledge — and external — which are restrictions imposed upon the surrounding world — barriers that prevent us from adopting a pro-environmental lifestyle. Evaluations of environmental programs (Kassirer, McKenzie-Mohr, 1998) have shown that most program developers have not identified and as such not addressed those barriers, thus it is only logical to assume that their campaigns have resulted by large in failures.

1.3.2 Existing Research on Gamification and Pro-Environmental Lifestyle

In 2011, ROI Research, together with the Recyclebank initiative, published a white paper Gaming For Good, in which they referred to leveraging online social gaming to incent positive eco-friendly behaviors offline (ROI Research, 2011).

Recyclebank, a startup company rewarding customers with coupons and discounts for taking small, everyday green actions, created an online game named Green Your Home Challenge, based on the belief that they could nudge people towards sustainability in a fun and educational environment. Participants were encouraged to repeatedly visit the game, in which they could interact with sequentially opened rooms of a virtual home, learn how to be environmentally conscious and take sustainable actions throughout their own home. Users were provided with simple, easy to take steps, could track their status on a leaderboard and a number of prizes were offered to the winners.

> "The game served as the platform for educating and rewarding participants for green behaviors, and in order to have an impact, had to be structured so that participants wanted to come back to earn more points, and in the process learn more about how they can have a positive environmental impact. The structure of the game and content was also designed to demonstrate to participants that having an impact does not necessarily require drastic changes in behavior – by taking small steps, and encouraging others to do the same, there can be a large collective impact." (*ibid:* 2011, 4)

A pretest-posttest survey was conducted on the participants and various usage statistics gathered to provide analysis of the success of the campaign and understand the offline impact of the gamification strategy. The primary goal of the project was to prove the concept that an educational gaming strategy could serve as an extension to Recyclebank's overall customer value proposition.

The specific objectives were to measure the effectiveness of employing gamification strategies and tactics in order to:

1) encourage participants to do their part through small green actions,
2) increase levels of engagement,
3) drive new member acquisition.

In conclusion, the Green Your Home Challenge was successful in employing gamification techniques to have an impact in sustainable behavior and increased the level of eco-friendly activity of participants.

Increases in the key site activity metrics were registered in usage statistics. Survey data demonstrated increases in the percent of respondents stating they are very/extremely committed to taking actions that have a positive impact on the environment, and increases in the percent of respondents saying it is very/extremely important to pursue a pro-environmental lifestyle. 97% of participants replied that the experience increased their knowledge about how to help the environment. Those earning higher amounts of points in the game had a 26% increase in saying they are very/extremely knowledgeable about specific green actions, compared to a 0.9% increase for those who had earned no points. 58% of participants surveyed stated they are very/ extremely likely to take additional green actions in the future as a result of participating in the challenge. As for specific actions, it is worthwhile to bring out a 44% increase in people who started turning off the lights, a 36% increase in users who stated to have installed CFL/Eco bulbs and a 32% increase in respondents who promised to be conserving water and energy.

Visiting statistics proved that the participants continued to be engaged over the course of the experiment as new content became available. A total of 25% of all participants visited the game three or more times. 84% of survey respondents were of opinion that online games/ contests are a good way for companies to inform and educate customers, and 86% displayed extreme likeliness to participate in similar games in the future.

Based on the results of the experiment, several recommendation were given for further improvements. The most notable of them was to implement an impact tracker that would provide consumers with a view into the collective influence their actions have on a larger scale, as they had stated to be feeling good about helping the environment. Having an overview of the impact would have increased the good feeling of doing their part. The conductors also recommended to implement a clear connection between the product and social channels such as Facebook, and a

section where participants could upload their content. There was a direct correlation between the level of engagement and uploading of user generated content.

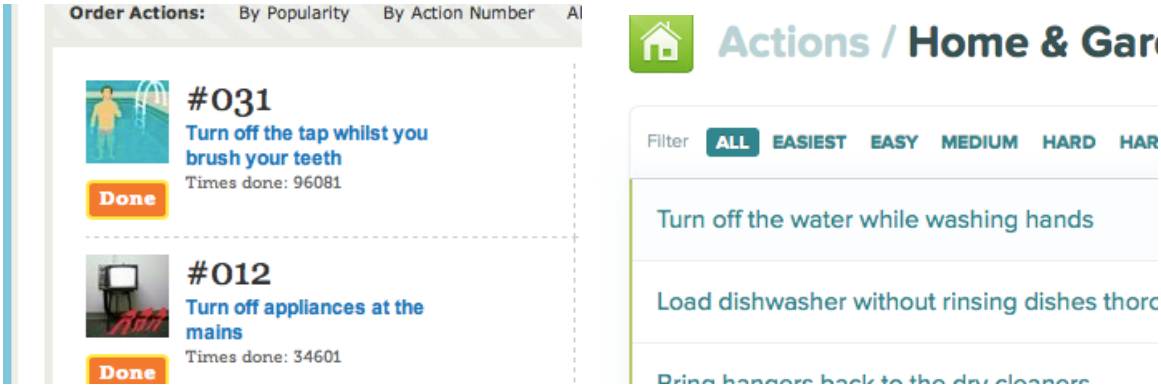

Figure 1.5 Screenshots of sections of Practically Green and We Are What We Do Action Tracker. The two products use gamification methods with the intent to increase pro-environmental behavior. Only one of them has implemented a superficial impact tracker, neither provide options for user generated content or deeper social media integration. They represent a typical points-badges-leaderboards design and lack any continuous engagement mechanics.

Recyclebank has, as of today, engaged over four million customers and has incorporated gamification as one of their main strategies. Yet it remains an exceptional example, as multiple similar online products that have emerged recently have adopted none of the recommendations described in the previous paragraph. Even worse, they seem to have fallen victims to the basic fallacies of gamification discussed earlier (see *figure 1.5*).

As we can see, promising research has been done in the fields of promoting sustainable behavior, gamification and even the two combined. Yet we are witness to a situation where little of the results of these studies actually gets applied in the real world practice.

One of the assumably prominent reasons for this situation is described by Sebastian Deterding *et al*., who state that there exists a broad implementation of gamified applications on the one hand and a rich yet disconnected body of research on the other, but what is lacking for the next step towards is the integration of these diverse research endeavors (2011).

1.4 Problem Statement

Online applications have long proven their capability to change their users' behavior, yet virtually none of this enormous potential has so far been intentionally or effectively used to alter the fate of our planet's ecosystem by introducing individual pro-environmental behavior change. This is partly due to the vast complexity of the behavior-altering topic, but a certain amount of the fault can as well be attributed to the fact that environmental activists simply are not aware of the tools at their disposal. While the research on gamification in environmental context has shown auspicious results, it is far for being complete — au contraire, the results from current studies have been left hanging in the air. The need to further elaborate on the topic is impending.

The problem the thesis at hand addresses concerns further investigating the implementation of gamification methods in creating pro-environmental behavior change. The following study builds upon the Gaming For Good project, and constructs on its resulting recommendations. Yet it can not be regarded as its direct continuation, as the aim of this thesis is to more emphasize on validating some of the previously described core concepts of gamification, more specifically those summarised in Chou's "Octalysis" framework. The experiment conducted by ROI Research Inc. relied strongly on the carefully prepared and presented content (videos, interactive and Flash learning mechanics), which undoubtedly affected its outcome. While not condemning or disregarding these results, it is our wish to provide answers less dependent on specific content and to more thoroughly investigate the impact of gamification methods themselves. While not deriving from the environmental context, we hope that this approach provides more universal and easily applicable insight.

1.5 Purpose and Aim

The aim of this thesis is to validate a set of online gamification methods and their suitability to engage individuals in a more environmentally friendly lifestyle. We hope to reach conclusions which would lead to concrete solutions and suggestions that would a) provide a starting point for further research and b) provide insights for further development of the prototype application which is developed for the purpose of this thesis. This application could represent a meeting point in which scientific approach is continually used to evaluate a consumer product. As the author of this thesis associates closely with the pro-environmental activist community of the Lets

Do It! World, it is our hope to share the gained insights and educate the sector about the possibilities provided by gamification to engage individuals in a sustainable lifestyle.

In addition, in hope of further bridging the gap between the academic and commercial practitioners' world, we use an experimentation method — described in the further sections — which has already proven its capability to apply scientific research in a "real world" scenario and has grown a rapidly increasing number of followers in the startup industry. Furthermore, we are encouraged in this by the notion that this approach bears high similarity to Mika Oja and Jukka Riekki's proposal of an ubiquitous framework for evaluating persuasive applications and games (Rautiainen *et al.*, 2011, 133-140).

1.6 Research Questions

The main questions we will try to provide an answer to are:

1) Is a sustainability-themed gamified application capable of captivating users?
2) Which game design elements, that have proven to be successful behavior-changers in other fields, could be implemented in this application?
3) Would this application be capable of changing users' real "offline" behaviors towards more environmentally friendly lifestyle?

1.7 Method

1.7.1 Overview of the Methods Used

Two complementary methods will be used to try to answer the research questions: we conduct an experiment using a prototype product, and perform a pretest-posttest survey with the participants of the experiment. The experiment lasts for ten days, during which prototype usage statistics is collected and participants' behavior observed. The pretest-posttest survey is used to learn about the impact of the trial on the participants' behavior and regard towards environmentally friendly lifestyle.

1.7.2 Hofstede's Strategies for Operationalizing Constructs About Human Mental Programs

The need to use several methods at once is well described by Geert Hofstede, who states that social studies — as which the thesis at hand certainly classifies — will always be subjective, as

opposed to physical sciences. In the latter, there are usually definitions, on which there is virtual consensus among researchers, for the intangibles. But social study explores systems at a much higher level of complexity, the researching of which calls for simplification of models, a process inevitably subjective. (1993)

As a solution to some merit, Hofstede proposes to "use at least two measurement approaches as different as possible (with different error sources) and only go ahead if we find convergence in their results." (*ibid:* 1993, 17) He presents the four different types of research methods in a table (see *table 1.3*) and proposes to use approaches described in cell one in conjunction with any of the other cells, preferably number three or four.

words	1. interviews questionnaires projective tests	2. content analysis of speeches discussions documents
deeds	3. laboratory experiments field experiments	4. direct observation use of available descriptive statistics
	provoked	natural

Table 1.3 Hofstede's Four Available Strategies for Operationalizing Constructs About Human Mental Programs. *Source:* Hofstede, 1993, 17

Hofstede also brings out the "Heisenberg effect", which is, according to the researcher, inevitably contained by provoked behavior and expresses when the researcher interferes with the behavior observed during experimentation. This means that the subject's behavior can not be extrapolated to occasions where the researcher is not present, and thus the research would result in inaccurate outcome. To combat the effect and ensure validity, our experiments will be conducted in a way that the conductors would have minimal to zero contact with the participants. As such, the majority of respondents will be introduced to the system by other participants, they will receive no concrete background information about the experiment or any instructions for further development.

1.7.3 Ries' Minimum Viable Product

The experimental prototype for this thesis uses, as explained in the previous section, both cell three and four mechanics proposed by Hofstede. To construct such a prototype, we adopt Eric Ries's description of the "Minimum Viable Product" (MVP).

Eric Ries introduces an approach named "Lean startup" for launching products and businesses, which provides a "new way of looking at the development of innovative new products that emphasizes fast iteration and customer insight, a huge vision, and great ambition, all at the same time."(2011, 20) The approach is based on the concept of validated learning through scientific experimentation, which is a method for knowingly measuring progress and starting to collect valuable customer feedback from the very early stages of product development.

At the core of Lean Startup model is the Build-Measure-Learn feedback loop. The application of this scientific method begins by defining "leap-of-faith" assumptions, core hypothesis to test. In our case, we hypothesize the suitability of gamification methods to introduce environmentally friendly lifestyle. We assume that our product environment is not only engaging, but also sort of a self-sustainable platform generating it new user base by itself — thus representing a value hypothesis and a growth hypothesis, as instructed by Ries. Once the assumptions have been set, it is time to enter the Build phase as quickly as possible with a minimum viable product. Ries explains the MVP as "that version of the product that enables a full turn of the Build-Measure-Learn loop with a minimum amount of effort and the least amount of development time. The MVP lacks many features that may provide essential later on." In a way creating a MVP demands for extra work, as we also need to include mechanics to measure its impact. The Build phase is followed by Measure-Learn sections, in which we gather data and make conclusions. The entire loop is represented in *figure 1.6*.

According to Ries, the advantage of this methodology to, for example more traditional market research, is that by building an simple product, a company can gather more accurate data about customer demand by observing real customer behavior rather than ask hypothetical questions. It puts the company in a position to interact with real customers and learn about their needs, and allows itself to be surprised when customers behave in unexpected ways, revealing information the company might not have known to ask about.

By using this methodology, we can build an experiment which provides a clear quantifiable outcome: either our target group engages with the product or not. It puts us into the

position to both observe and interact with the participants, essentially providing a possibility to add qualitative measure to complement the planned quantitative pretest—posttest methodology introduced in the next section.

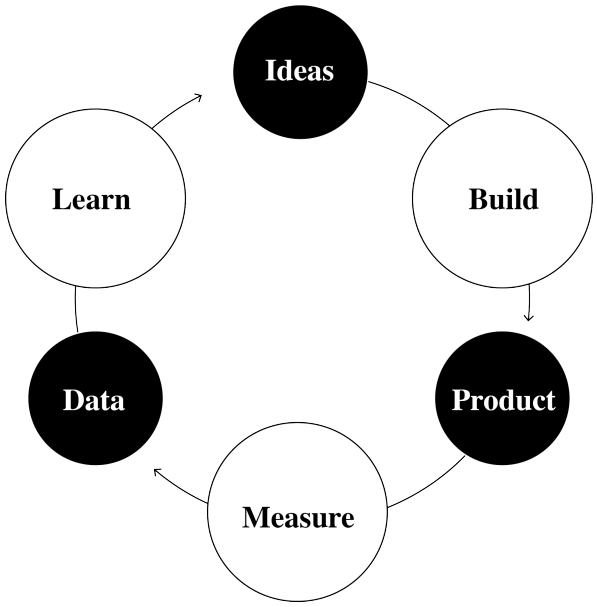

Figure 1.6 Eric Ries' Build-Measure-Learn feedback loop. The principle is to iterate through the loop in minimal time possible during the product development period. *Source:* Ries, 2011, 75

1.7.4 Pretest—Posttest Survey Design by Dimitrov and Rumrill

To learn about the impact of prototype usage, a method proposed as *Randomized control-group pretest-posttest design* by D. M Dimitrov & P. D. Rumrill is used. They state that "This kind of design is widely used in behavioral research, primarily for the purpose of comparing groups and/ or measuring change resulting from experimental treatments (2003, 159-165)". The design consists of two overlapping surveys which the participants have to complete before and after a treatment, in our case, engagement with the prototype product. By comparing the results of both surveys, changes in participants' behavior can be detected. As such, the method exhibits all the necessary traits to be suitable for the current thesis.

Following the design, a control group of participants is set up of those subjects who have answered the first questionnaire but have no engagement with the prototype itself. The need to set up a control group is well described by Earl R. Babbie. He states that setting up a control group increases both the internal validity of the experiment by guarding against the effects of the experiment itself — the so-called Hawthorne effect, where the fact that participants are

participating in the survey influences their answers — and also external validity, by guarding against any effects outside the prototype experiment which might affect the results of the posttest survey (2012).

1.8 Scope and Limitations

The methodology of using a Minimum Viable Product is rather restrictive by nature, as it implies on developing a prototype which only includes bare minimal functionality essential for the product to offer some value, and operate at all. As such, several limits have been set to the design of our experimental environment:

- Only a number of complementing game design elements will be implemented which are essential to provide a complete experience for the participants, such as an interactive tutorial, Appointment Dynamics, points and levels, progression, achievements, visual feedback and leaderboards, personal avatar (profile) creation.
- The prototype will only be usable as a standalone application in web browsers. In our modern mobile society, such a restriction would present a barrier for a product such as ours to become widely adopted and successful. As such, the results are expected to be more conservative than they would be in a “real world” scenario.
- The prototype will only contain enough content to sustain one to two weeks of “game play”. This time frame should allow to gather enough data to provide meaningful insights.

With the exception of the control group, the posttest survey participant group will consist of people who have engaged with the prototype, meaning that the amount of participants in the survey will be directly related to the ability of the prototype to engage users. Should the platform fail to captivate members, it would become meaningless to complete the pretest-posttest survey.

2. METHODOLOGY

2.1 Experiment Using a Minimum Viable Product

2.1.1 Procedure and Overview

Based on Chou's and Werbach's theoretical framework of gamification methods and keeping in mind the previous research by Recyclebank, a prototype web application was designed, the objective of which was to change its user's daily habits towards a more environmentally friendly lifestyle. A fully operational testing environment was then developed based on that design and an experimental trial conducted to validate our set design hypothesis and as such provided answers to the questions set by the current thesis.

The prototype was set up as a closed invitation-only environment. 30 participants were initially invited to take part in the experiment and asked to use the platform for the time period of at least one week. In addition, they were provided a feature to invite new participants to the testing environment.

Throughout the experiment, page view data per each participant was collected among other statistics that helped us analyse the engagement of gamification methods used in the product. A pretest-posttest survey (see section 1.2) was conducted to measure the impact prototype usage had to the participants' views and behavior towards a more environmentally friendly lifestyle. In addition, Google Analytics pageview data was gathered to accompany the other results.

2.1.2 Prototype Design

The ideology behind the prototype product was to become a "trainer" application — similar to that of a real life personal sports trainer — that would guide the user on a path of adopting a more environmentally friendly lifestyle. It would do that by asking participants to take on challenges, via fulfilling of which they would become introduced and adopt more

sustainable daily habits. Those tasks would be ordered ascendingly and grouped together in levels by their difficulty of execution — some assignments were easier to accomplish, others necessitated more effort and a bigger shift in personal values and behavior. Participants started with the easiest exercises, and by completing each task, gained points. Upon collecting a certain amount of points, the user reached a new level and unlocked more challenging tasks which were unavailable before.

Throughout the process of completing and unlocking new challenges, participants received continuous feedback on their individual environmental impact, which was calculated by multiplying the impact value of each task and the number of days since the user had accepted the assignment. By completing set objectives in real life, the participants would decrease their consumption of electricity and water, their role in producing emissions of carbon dioxide gasses and production of waste materials. Average European usage and behavioral statistics were gathered for each topic and average daily impact was calculated for each task. For example, a task could have been described by how many plastic bottles are trashed on average each day by every individual, and thus how big the daily impact would be if that individual were to stop using plastic bottles altogether.

By achieving certain predefined amounts of savings, for example one kilowatt hour of electricity or 100 liters of water, participants received achievement badges. The badges illustrated the value of savings by interpreting what the described amount could represent in more tangible terms, such as cups of tea, hours of television viewing or driving kilometers in public transport. The aim of achievements was to use the classical gamification method to make the product experience more meaningful.

Participants were also able to compare their personal, home town’s and neighborhood's impact statistics with those of the other users. They were encouraged to share their given promises, progress and achievements with their friends via Facebook social network. Each participant received a personal profile page, where they could show off their impact statistics, ongoing and completed tasks and received achievements.

To keep participants from forgetting their accepted challenges, the prototype environment would send each user reminder emails when their tasks were completed, and asked them to come back and report their success.

2.1.3 Prototype Content and Features

The content for the prototype — tasks, their descriptions and impact values — were gathered from online services which provide similar content, such as Practically Green, Action Tracker by We Are What We Do and One Small Act by NBCUniversal. Missing impact values were scraped and calculated from various reports. All content was reviewed for veracity by the representatives of the Lets Do It! World network. In total, 25 tasks were assembled and divided into three difficulty levels. Each level also carried a descriptive title, which were in the ascending order: 1) Seeker, 2) Doer, 3) Enthusiast.

The testing environment was hosted in public online environment with a commercial virtual server service provider Virtuaal.com under the domain name the1000days.org. All the functionalities, with the exception of the logging in form and user profiles, were hidden from unregistered users. The functionalities of the prototype were:

- Invitation only registering of new users, logging in, creating and editing personal profiles. Participant's name, e-mail address, location and optionally an image and description were collected.
- Generation of a personal invitation code and link for each participant, which allowed them to invite new users to the platform. This functionality enabled the virality mechanic and implemented Chou's adoption of the identity principle, as by inviting new people to the platform, the inviters were encouraging them by actively expressing their approval of the system. Number of successful invitees was shown to each user for feedback.
- Displaying user dashboard page, where the participant could join new tasks, see the progress of accepted challenges, report completed tasks and get a quick overview of personal impact, progress, achievements, friends list and the personal invitation code (see *figure 2.1*).
- Displaying tasks available at current level, the next level and completed tasks. The content of higher level tasks was hidden before reaching these levels to introduce the mechanic of discovery of the Curiosity and Unpredictability drive, and follow the scaffolding principle. All tasks were described by a call-to-action (a title), descriptive text explaining the necessity of this action and its impacts, the challenge's difficulty level, duration time of either one, 24, 48 or 72 hours, daily impact, the resource in question, the task's type and the number of users who had already accepted the challenge.

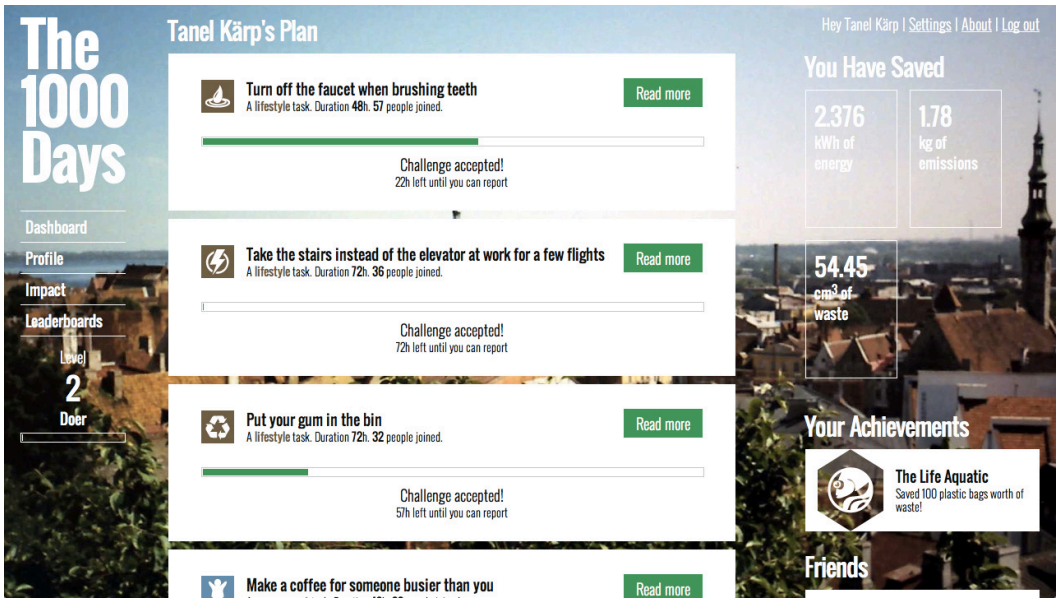

Figure 2.1 Participant Dashboard displaying accepted tasks, impact and gained achievements

- Tasks were of different types, which described their content and what kind of activity they expected from the participant: a) lifestyle, b) office, c) engagement, d) guerilla, e) improvement.
- Joining tasks. After joining, a timer would start counting down the hours left to complete the task. Upon completion, a participant had 24 hours to report the task as successfully completed. Failing to report in that time frame would result in resetting the task. This was the core Appointment Dynamis mechanic of gamifying the prototype, relying on the Scarcity and Impatience, as well as Loss and Avoidance drive.
- User reporting whether they had filled the task or not once the task timer had ended. Upon reporting a task, participants were asked to optionally submit a photo proof of their successful completion of the challenge, which gained them double the amount of progress points. It also further introduced the mechanic of creativity, as some challenges required a creative approach to be captured on picture.
- Awarding points for completing tasks and calculation of participant level from the amount of points earned. The number of points needed to reach next level increased with each advancement. Tasks awarded either one, two or three points for completion, depending on their duration. Level two required four points to complete, level three required 20 points, which translated to roughly one to two days and four to five days of

game play. Participants were also hinted of further levels, but level four required in total 160 points to gain, which was more than could be gained by completing all of the content present in the prototype.

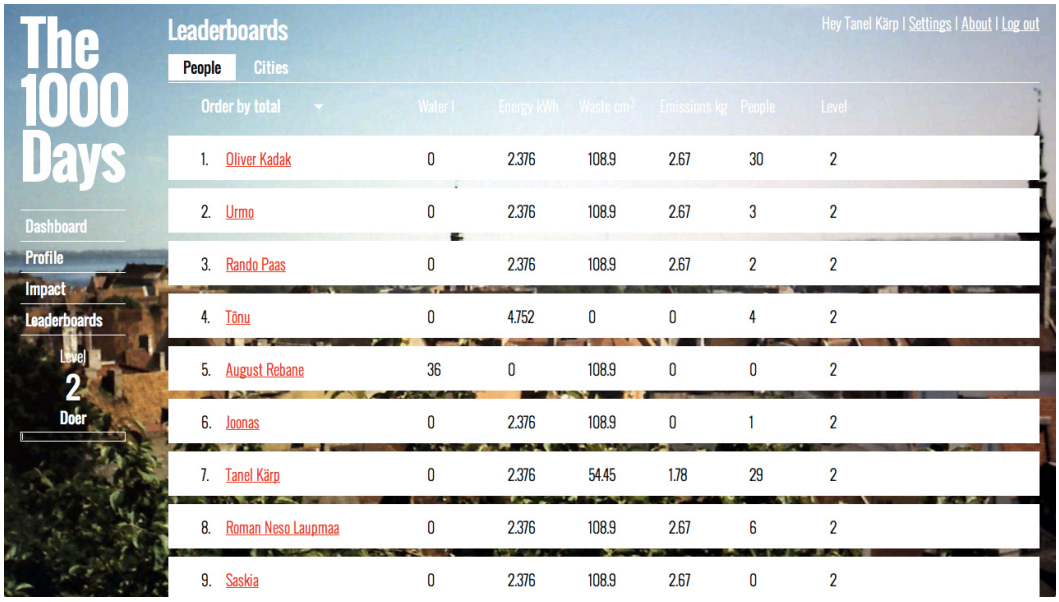

Figure 2.2 The number of successful invitations was used as one of the metrics in calculating ranking to inspire participants to invite new people

- Calculating and displaying the user's total impact by each resource: water in liters, energy in kilowatt hours, waste in cubic centimeters and carbon dioxide emissions in kilograms. This functionality presented a meaningful implementation of the Epic Meaning, Feedback and Accomplishment drives, as it represented user progression in real life values rather than virtual points.
- Displaying a leaderboard of all users joined, their home cities' and neighborhoods' cumulative impact; ordering them by the type of impact resource or points gained (see *figure 2.2*). The main implementation of Social Pressure drive and one of the basic gamification methods, grouping users together by their home location provided also an elementary implementation of the co-operation mechanics.
- Displaying user profiles showcasing their name, location, level, picture, description, achievement badges, impact by resource, currently active and completed tasks together with their uploaded pictures, and friendship status for logged in users over level two (see *figure 2.3*). The profile mechanic depended among others on the Loss and Avoidance

drive (similarly to Facebook), as upon quitting the application the user would effectively "leave behind" all this visual representation of his or her accumulated progress, impact and accomplishments (pictures).

- Participant profiles would at first only display the most essential information. Once user gained new levels, he or she also unlocked new profile customisation features, such as adding titles, a profile picture and a description. The goal was to present the profile as something the participant owned and could improve upon advancing, thus addressing the Ownership and Possession drive.

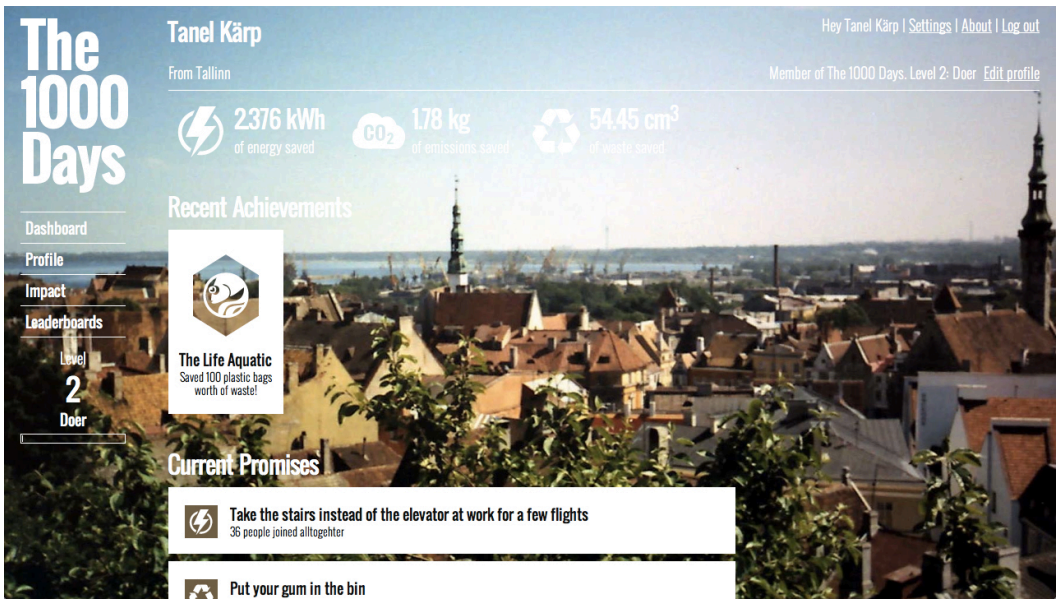

Figure 2.3 An example of a Profile page, where iconography and clear big visuals were used to create pleasing aesthetics

- Commenting on tasks. Users could add comments to all challenges available to them. In addition to the Social Pressure and Envy drive, this functionality addressed epic meaning and to some extent the endgame principle, as users could swank their accomplishments and also share tips to guide other users.
- Calculating the sum of user impact and rewarding achievements accordingly. There were in total 11 possible achievements. Each achievement was described by its name, badge picture, description and a custom title given to its recipient. After reaching level three, participants could add a title to their name, which would then be shown in front of their name. The achievements represented real life tangible comprehensive values, such as

"Saved a big bath full of water" or "Saved as much emissions as a small tree filters in one year", connecting this basic Ownership drive gamification mechanic also with the Feedback drive and helping the users better understand their actual impact. Badges' design gave a visual hint of user's subject of interest and which resource of the four available they are addressing the most.

- Generating Facebook social network sharing buttons with automated content and displaying them once a participant had joined a task or gained an achievement. The Facebook Wall post generated by pressing the button contained a link to the user's profile, the achievement badge for achievements, and a description of the action which resulted in the generation of the button.
- Generating and storing page view numbers and dates per each user. This data was later used for prototype usage analysis.

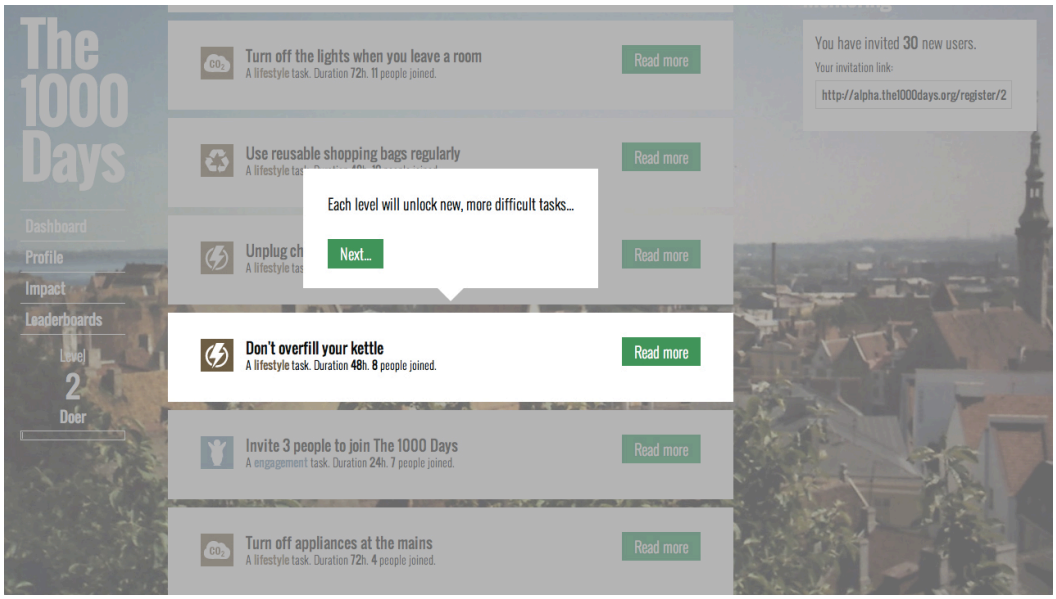

Figure 2.4 A tutorial mechanism was introduced to guide participants through the adoption phase.

- Displaying an interactive tutorial for newly joined participants. The tutorial consisted of a welcome message, a guide on how to join the first action, how and when to report back, how the system of progression, gaining levels, unlocking new content and features work and hinted at which type of features the participant can unlock. The tutorial was displayed once after the first login as an interactive overlay on the Dashboard page and in

addition to short texts contained screen captures of different functions (see *figure 2.4*). This basic game design mechanic represented the implementation of the onboarding principle.

- Displaying collective impact of all the participants. Although user's impact was present on their dashboards, a special impact page was also implemented which in addition to participant's own impact also calculated and displayed that of the whole user base, as well as displayed all the achievements users had unlocked (see *figure 2.5*).

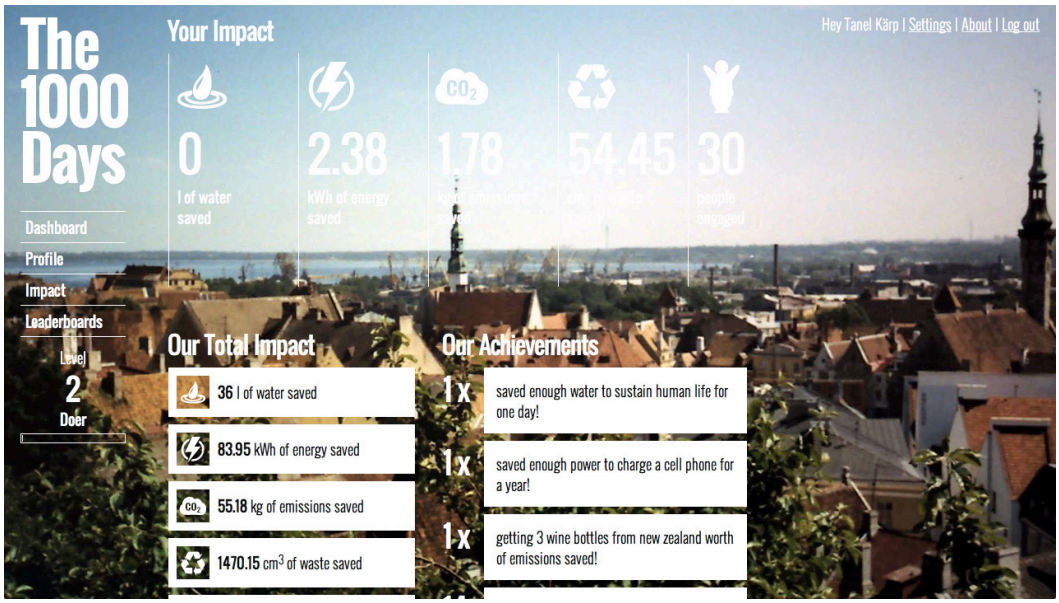

Figure 2.5 A special impact page was implemented to gather data whether participants were interested in following the impact of the whole group

- In addition to content, unlocking new features of the prototype by reaching new levels. The new features were:

  Level two:

  - Friends list: participants could add other level 2 users as "friends" and see links to their profiles on their Dashboards.
  - Adding pictures to their profile pages. These pictures would also act as avatars in other sections of the page.

  Level three:

  - Adding a descriptive text to participants' profiles.

    - Adding titles to participants' names. Titles to select from were rewarded by gaining achievements, each achievement unlocking one new title.
- Sending an automatic e-mail warning to participants who had a task pending reporting as completed and the reporting time of which was running out in the next two hours. Users could opt out from the notification via their profile settings page.

2.1.4 Participants in Study

Initially, 30 participants were selected amongst the members of the global Let's Do It! World network and asked to use the prototype for a time period of at least one week. They were citizens who were aware of the ecological problems facing the environment and had a certain willingness and ability to act. Aged 24-45, they had continuous and unrestricted access to the internet and felt confident using the medium. All the participants had various views towards their relation to environmentally friendly living, some defined themselves as very aware, whilst others only somewhat aware of the topic.

This selection of participants described the would-be first target group of potential users for the product once it would be launched for commercial use. The product would be designed specifically for this target group. As such, getting input specific to this group was essential, as only then would it be valid for making focused design decisions for further development.

As the initial participants were given a possibility to invite new users to the platform, the number of participants in the survey was expected to grow throughout the duration of the experiment. Although we had limited to no control over the selection of those new participants, this implementation simulated a real world scenario of engaging new users through an already existing user base and also gave us additional valuable input on the characteristics of those new users.

These new additional participants, who had been invited by their contacts rather than the conductors of the experiment, did not receive any kind of instructions regarding the experiment itself and as such their prototype usage statistics represented an even more accurate reading on the research questions.

The particular number of 30 initial participants was selected based on several considerations. First, it was regarded to provide a sufficient amount of data should the invitation principle of new participants result in failure. At the same time, it provided an initial constraint to the number of new possible participants invited to the system. A concurrent influx of too many

new users could have presented a hazard to the stability of the prototype, and as such a more deliberate addition of participants was preferred.

2.1.5 Statistical Procedures Used

Throughout the experiment, statistical pageview data was collected in the prototype. This data featured an amount of how many times each specific page had been visited, at what time and by which participant. Some gamification methods were specifically divided — perhaps counterintuitively to user experience logic — into separate prototype pages to best monitor their usage. Summing the data helped us detect and map the most popular (and thus what could be considered as engaging) and less used features of the testing environment. Grouping the results by individual participants helped us find possible patterns in feature usage, such as if certain components were used in conjunction with each other or the opposite. By grouping the results by time we could determine the frequency at which each page was visited and its fluctuation in popularity.

For greater insights, page view data was coupled with each user's generated content, from which we could account the number of challenges each participant had completed, invitations made, level reached, comments inserted and pictures added when reporting tasks as completed.

For additional data, Google Analytics visitor tracking was embedded to the prototype. Whilst we relied on prototype generated data for page visit statistics, Google Analytics provided additional details, such as which devices were used to access the prototype, through which channels new visitors reached the environment and how many non-logged in guests visited the product.

2.2 Pretest–Posttest Survey

2.2.1 Procedure and Context

A pretest–posttest survey was used to analyse the impact of the usage of the experimental product. The test consisted of a questionnaire in which the subject's opinion towards environmentally friendly lifestyle was inquired together with a short description of his/her execution of sustainable everyday habits. By asking the same questions before and after the

experiment, it was possible to compare the results and track any changes that may or may not have occurred.

The survey consisted of five single, multiple and matrix of choice questions and a single text box where the participant's e-mail address was enquired to connect the answers with the prototype users (see appendix 3). The five questions addressed the following subjects:

1. How environmentally conscious the participants considered themselves to be;
2. If they saw themselves living a more environmentally friendly lifestyle in the future;
3. How acquainted they were with several topics of sustainability, such as recycling materials, saving water and conservation of energy;
4. The participants' preconceptions of environmentally friendly lifestyle, described with keywords such as expensive, unpopular, fashionable;
5. If the participants were intentionally engaged in any of the preset environmentally friendly activities that matched with those presented in the prototype.

2.2.2 Materials

An online polling service SurveyMonkey was used to conduct the survey. SurveyMonkey offered several necessary features such as an aesthetically pleasing and easy to use answering page to help maximise the number of participants, random ordering of answer choices to increase the credibility of answers and the creation of multiple links that directed to the same survey, by which the answers could also be filtered. The latter functionality enabled to use the same questionnaire for both pretest and posttest, active user and control groups, but analyse their answers either as one set of data or separately, depending on the analysis. SurveyMonkey provided powerful result analysis, filtering and comparing tools, which met the requirements of this thesis.

The content prepared for the prototype was used as material for some of the questions' answer choices to provide impact insights about specific aspects of environmentally friendly lifestyle which the prototype addressed.

2.2.3 Participants in Study and Assembling the Control Group

Prior to disclosing the prototype, an invitation to participate in the survey was sent to the members of the Let's Do It! World network and several people in the current thesis' author's network of connections who had displayed interest in the topic of environmental sustainability.

See section 1.1.4 for the explanation of this particular selection of subjects. Based on the answers, 30 people were chosen to participate in the prototype testing (see section 1.1) that followed the survey. New participants who were invited to the prototype later were also asked to take the survey via a call-to-action message in the prototype environment itself.

After the period of two weeks of prototype testing, an invitation to take the survey again was sent to all the participants who had completed the first survey. Depending on whether a participant had engaged with the prototype, he or she was appointed either to the Active User or Control group.

2.2.4 Statistical procedures used

Responses to the survey from before and after the prototype experiment were compared side-by-side to detect changes in the subjects' answers. To provide validity of the answers in the context of the goals set by this thesis, only the answers of those participants who had completed both the first and second survey were taken into account for most analysis.

As the takers of the survey could be directly linked with their prototype accounts via the e-mails they had provided, all the data gathered from the prototype could also be used in analyzing the survey data.

To analyse the impact of using the prototype, active users' responses were compared against those of the Control group. Changes were referred to on group basis, rather than evaluating individual responses.

3. RESULTS

3.1 Usage Survey from the Minimum Viable Product

3.1.1 User Adoption

Initially, 30 participants received an invitation to the prototype environment. In 14 days, the number of registrants joining the platform through invitations grew to 256, presenting a 8.5-fold increase and a median daily registration rate of 18 people. The number of registrations per each day are presented in figure 3.1.

In total, 60 participants, 23% of the whole user base, tried to engage new people and managed to lead them to the application's registration page. 50 of them succeeded, half of them invited more than three new members, and 15 invited more than five. During the two week period, registration pages gathered all together 780 unique pageviews, making the conversion rate — the percentage of visitors who eventually conducted our desired action — of this monofunctional page, which did not contain anything but a signup form, a surprising 32.8%.

The results present several surprising findings. The first one being the overall number of participants joined, which far surpassed our initial expectations. In fact, several adjustments had to be done to the programming of the application throughout the experiment in order to better accommodate the growing user base.

Secondly, we can see that new user registrations occur as clearly defined spikes in figure 3.1, the first and biggest one surprisingly being on the very first day of the experiment. This indicates that users might actually be more prone to share such an environment for intrinsic motivations, rather than for extrinsic ones. We make this assumption on the basis that participants were nudged by the product to invite new members only when reaching level two, which took them minimum two days to achieve, meaning no such external motivation was present on day one. Yet, the fact that spikes occur in more or less in interval of two or three days

does clearly indicate that implemented gamification mechanics successfully drove new member acquisition.

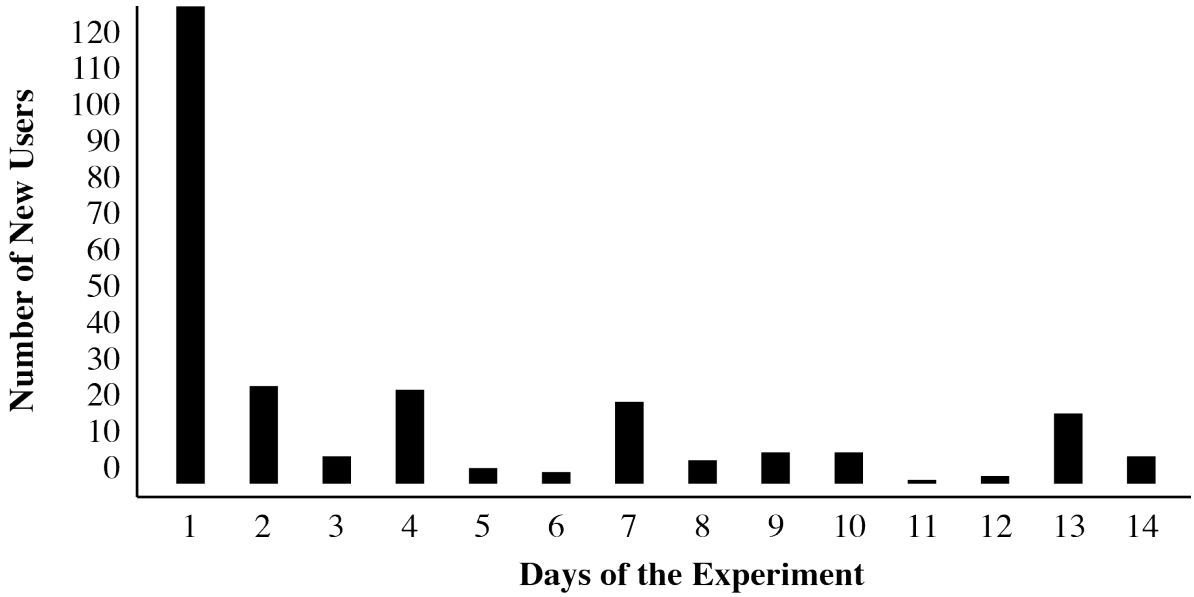

Figure 3.1 Number of new user registrations per day.

3.1.2 User Engagement

94 participants, 37% of the total number of users, engaged in and completed at least one task the application provided. 70 of them completed at least three tasks and had reached level two by the end of the two week experiment, 34 users or 13% of the total registrants represented the most active group by reaching level three (see *figure 3.2* for more detailed results). It is important to remember that all participants did not engage the product from the start of the trial, and thus may have not had the time to achieve high scores, but were actively engaged with the product.

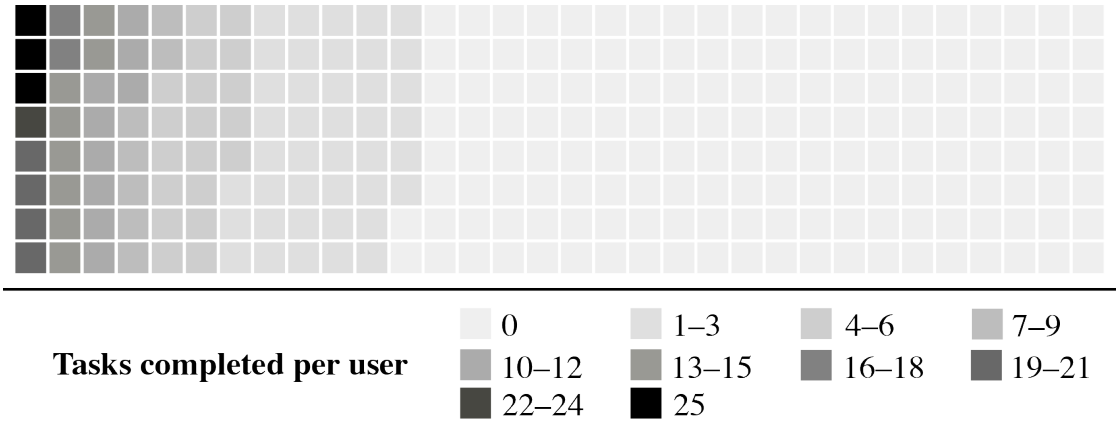

Figure 3.2 Number of tasks completed per each registered user by the end of the experiment

Page view statistics show similar results in terms of engagement. 23 users visited the environment on two days and 71 on three and more days. As such we can conclude that around 70 users, 27% of all registrants, engaged in at least some sort of meaningful interaction with the product. We will refer to them from now on as "Engaged Users" to facilitate further analysis. Number of active users on day-by-day basis is represented in *figure 3.3*.

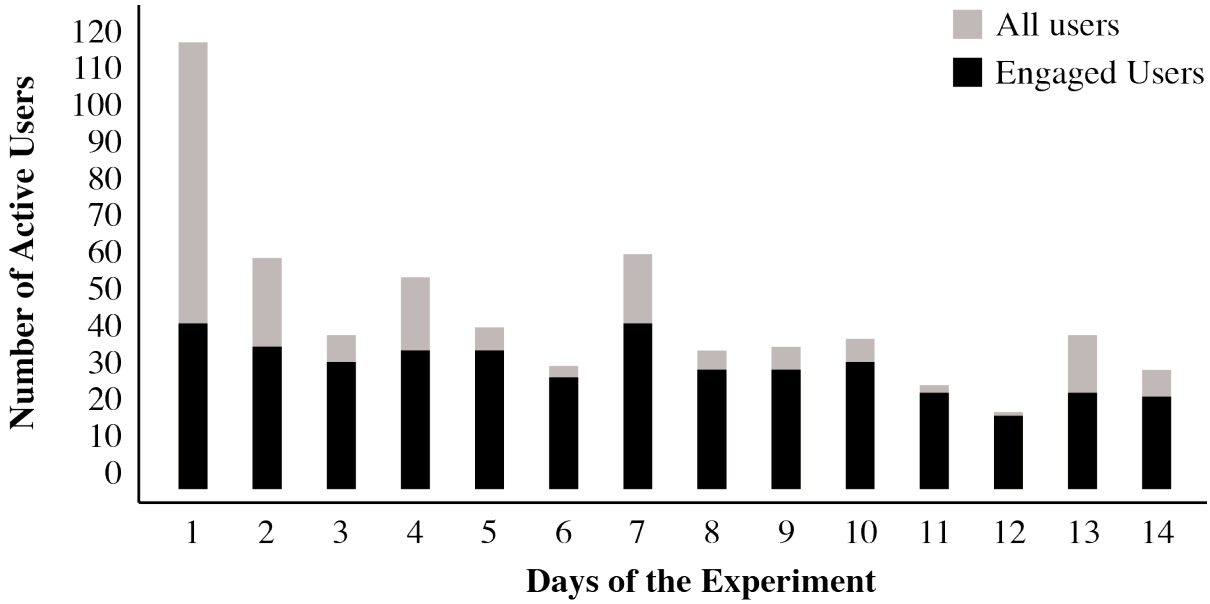

Figure 3.3 Number of users who visited the product by each day of the experiment.

For increasing the validity of these results in the context of representing a "real world" situation (as opposed to a controlled experiment), it must be noted that out of the 30 initial participants of the experiment, only 14 are included in the final Engaged Users group and just nine reached the maximum level of three.

7768 page views were registered in total in two weeks, 6643 or 86% of those by Engaged Users. This translates to about 474 active user page views in day and implies that the average active participant loaded on average seven pages per day.

The most visited page was, without surprise, Dashboard, which was the first page users landed on after logging in and served most of the possible interactions. Out of all Engaged Users' pageviews, Dashboard formed 57%, Leaderboards 15%, other users' Profiles 11%, personal Profile five and Impact four percent. The rest of loadings were divided among the

About, Logout / in and Register pages. Detailed overview of the number of pageviews on each day is plotted on *figure 3.4*.

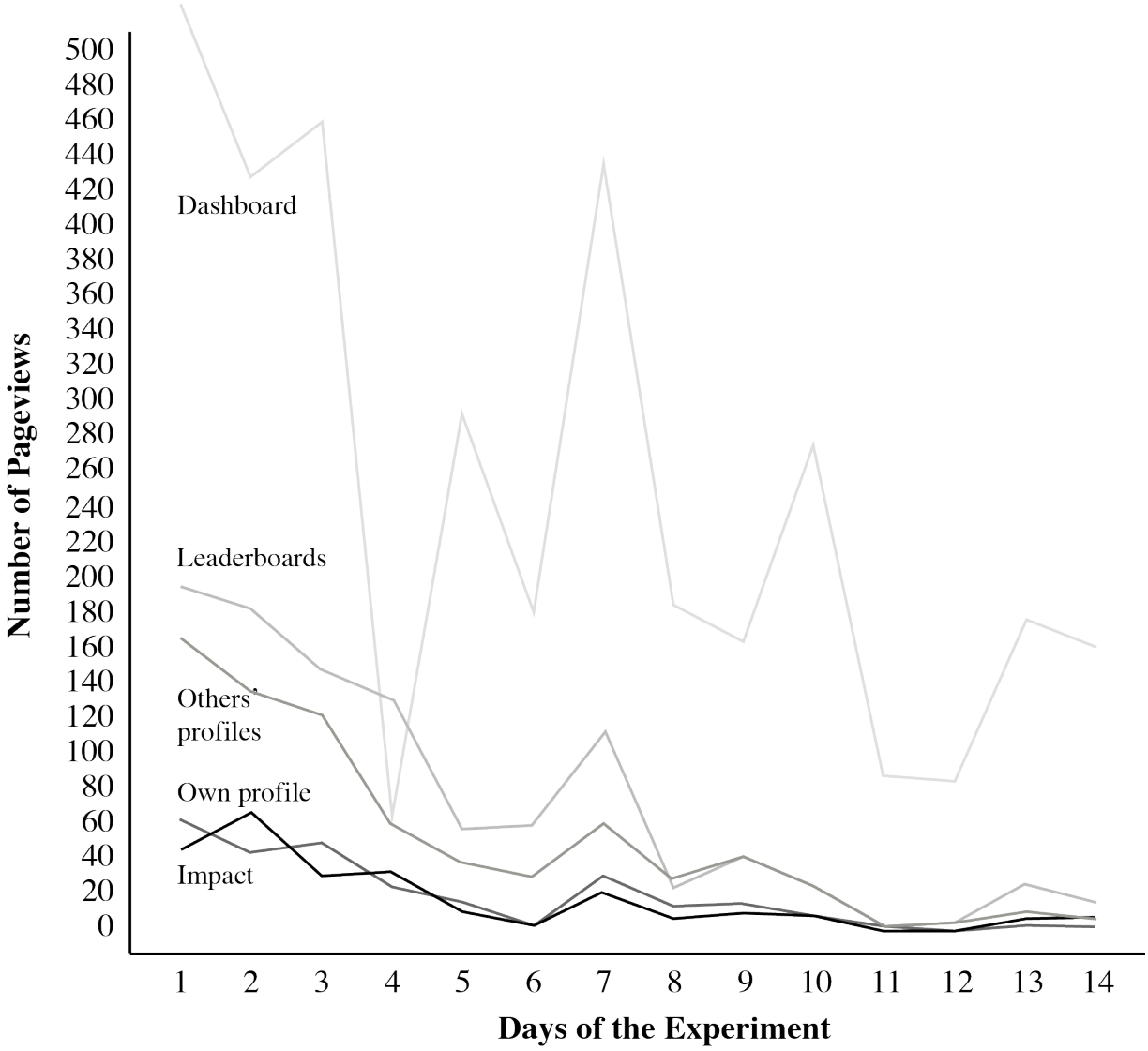

Figure 3.4 Number of Engaged Users' visits per main pages on each day. Steep drops in the last days are also noticeable due to our strict achievement-based definition of active users, which excludes from statistics the visits from possibly active participants who joined in the later days of the experiment. In addition, the design of the experiment did not expect the active users to visit the prototype every or even every other day, so the distribution of visits to different days is highly anticipated and explains the spikes which occurred on days when new groups of users joined the prototype.

In order to analyze which sections of the prototype appealed to participants at different engagement levels, it is first needed to divide them into groups based on their activity: group one consists of registered users who did not accept any tasks, group two is compiled of users who completed one to two tasks, group three represents users who completed more than three tasks but did not reach level three, and group four gathers the most active users who completed enough tasks to achieve level three. When comparing page viewing activities of those groups (see *figure 3.5*), we can note a clear connection between user activity and social features of the prototype — for group one, others' profiles are the least visited pages representing just 3% of total pageviews, for group four they are the second most visited pages at 12% of total pageviews. It is also interesting to find that group three displayed twice as much interest to Impact page than the other groups and was in general the most active in visiting different pages of the product. This phenomenon might imply, among many other things, that group three had the most interest in learning about pro-environmental behaviors and as such used the platform to its fullest, and yet did not make as fast progress as the presumably already more environmentally conscious participants in group four.

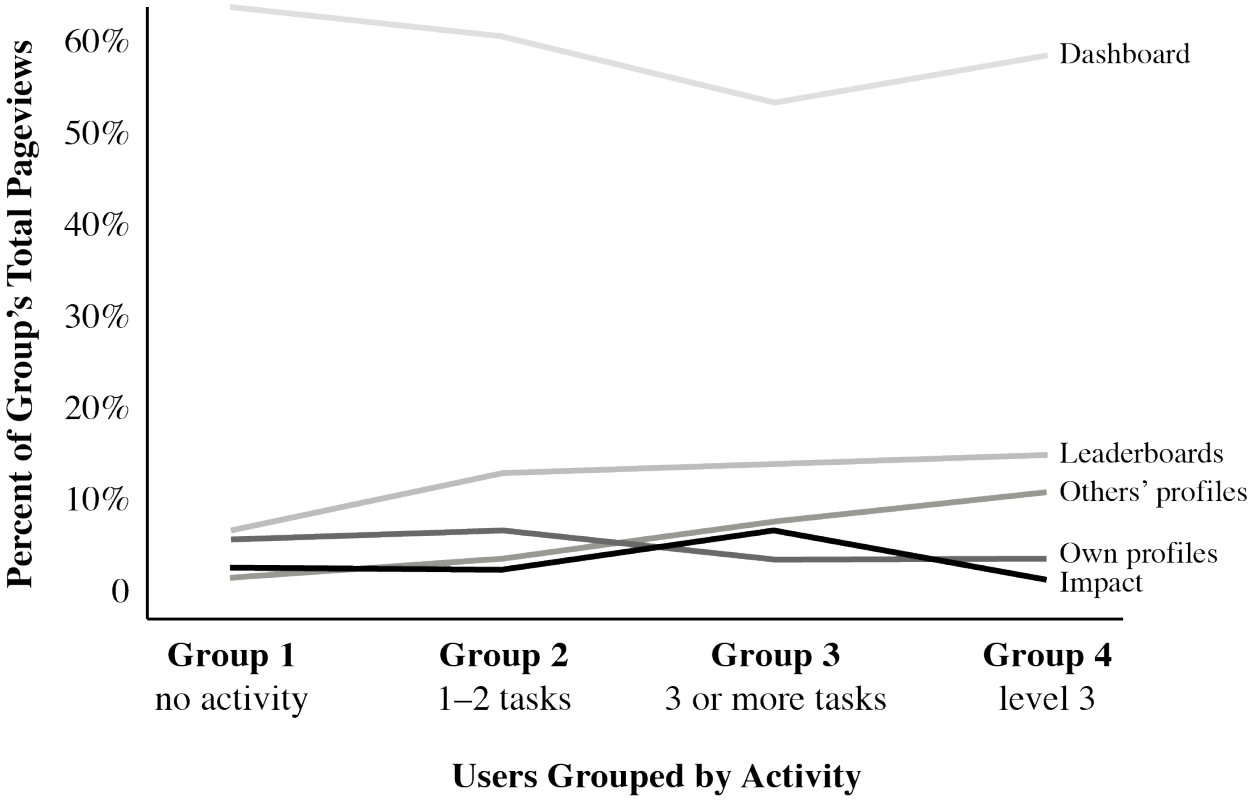

Figure 3.5 Users' visiting behavior of main pages

Among the Leaderboards pages, 27% of views, 281 in total, were registered in City and Neighborhood sections, denoting a small yet considerable importance of regional rankings.

Regarding the Impact page, it is necessary to point out a flaw in the the experiment design which prevented gathering of useful data. User's overall impact was represented on the Impact page, but as well on the Dashboard, which most probably reduced participants' motivation to visit the Impact section as they had already received their feedback immediately after logging in. The only unique information presented on the Impact page was the accumulated impact of all users. As such, visiting statistics for this particular section provide us some insight about the implemented feedback functionality, but do not provide us as clear understanding of the effectiveness of the implementation as they could.

Another intriguing and insightful metric to analyse is the number of times when users reloaded their Dashboards. Dashboard implemented heavy use of progress bars that denoted the accepted tasks' completion timers, and were updated only on each page load. Regular reloading and visiting of Dashboard would as such indicate a strong interest in the progress the user is making. By defining "reload" as a page load that occurs in an interval of less than an hour, without visiting any other pages in between, and subtracting all page loads related to accepting and completing tasks or commenting, a total of 1067 reloads of Dashboard were registered, consisting 14% of all pageviews of the prototype. If we divided that number to all the 94 users who accepted and completed a task, we could estimate an average of 11.4 reloads per user. It would, of course, be premature to claim that all of those participants engaged in this behavior, but this statistic presents nevertheless a strong indicator that users were checking their progress frequently.

A total of 925 challenges were accepted. 631 of them were completed successfully, 92 were still in progress by the end of the experiment and 202 had failed due to users not reporting them as completed at the right time (see *figure 3.6*). 98 tasks, 16% of all the completed ones, were supplemented with "proof" images upon completion. Surprisingly, 28 participants, more than one third of the Engaged Users group, had been motivated enough to go through the rigorous process of taking and adding a photo to a completed task. When analyzed through the lenses of previously defined groups, we can conclude that group four was the most active in adding images, uploading them to 17% of all completed tasks, group three added images to 12% of tasks and group two to 11% (see *figure 3.7*).

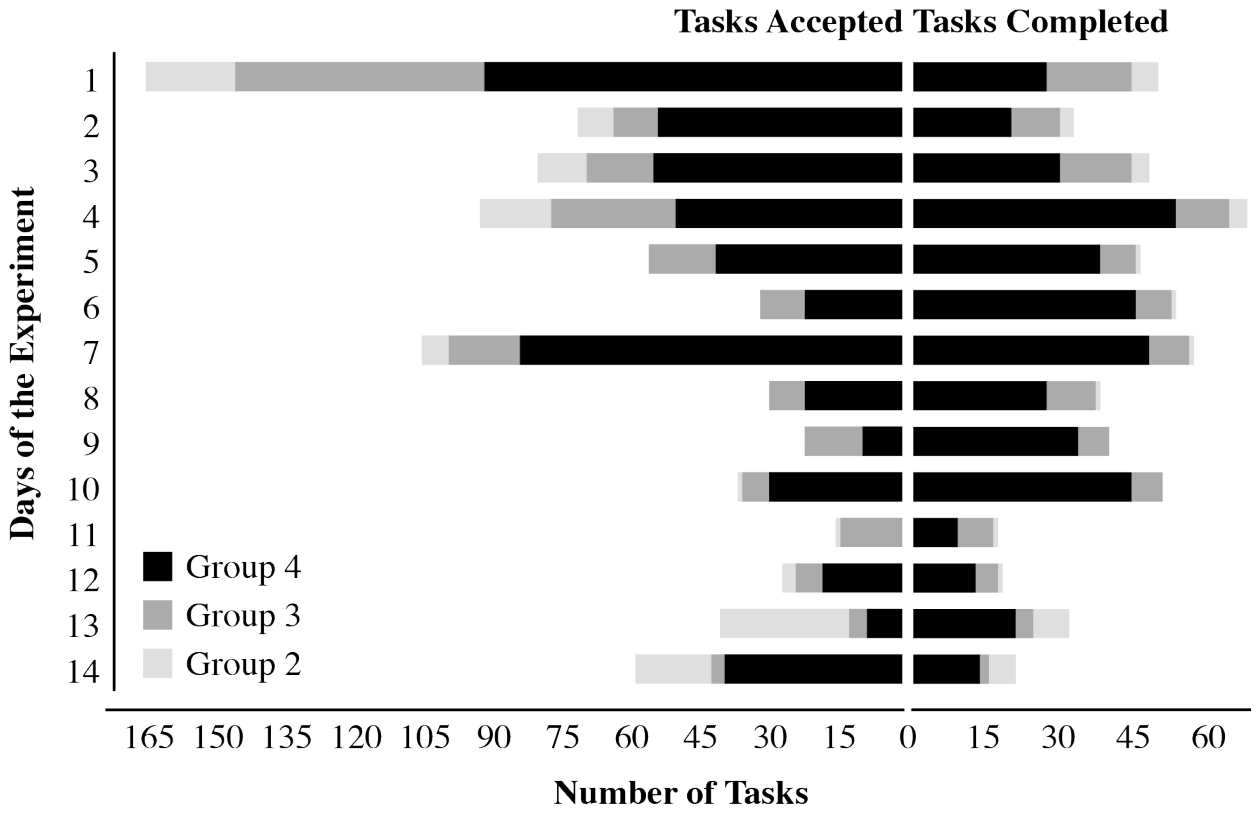

Figure 3.6 Accepted and completed tasks throughout the duration of the experiment, differentiated by user groups presented on *figure 3.5*. Completion patterns prove our preliminary observation that most active users had progressed through most of the content by the end of the experiment. Increasing activity of group two proves the previously presented estimation that the real engagement with the prototype was actually bigger than might be evident from our previously employed rigorous analysing method, which is based on how much content the participants had completed by the end of the experiment.

A total of 71 comments were posted by 25 participants — 36% of active users — to 21 challenges, 84% of the whole tasks content available throughout all three levels. Preliminary text analysis concludes that the general theme of the comments was rather about expressing personal behavioral patterns, actions and achievements such as “I always put gum in the bin :)” or “Yesterday I went up to the 16 foot floor WOW!!!”, than the topic of sustainability itself. Some discussions regarding how to complete the tasks started to emerge as well. Due to a design flaw of the prototype functionality, users were not able to comment on tasks after finishing them,

which probably reduced the overall engagement of the comment system by a great margin. Curiously, this design feature allowed for gathering another kind of critical insight which will be introduced in the discussion section.

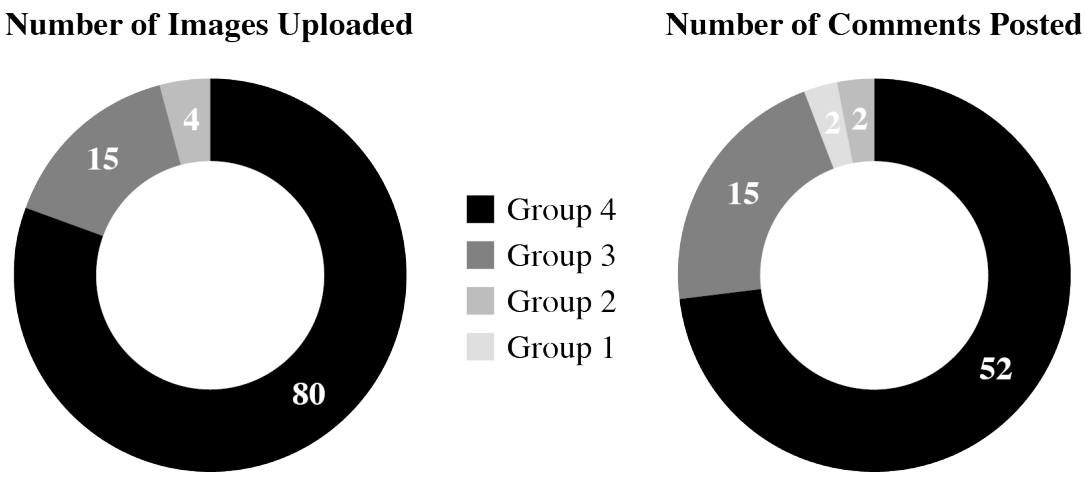

Figure 3.7 The usage of user content generation features by groups combined based on user activity.

Whilst not our primary objective, some qualitative data was received as well during the experiment. Several participants communicated their ideas, questions and wishes related to the product. Common theme in the feedback was a wish for better accessibility options, such as a native mobile application or better Facebook integration. More environmentally savvy participants often found it counterintuitive to accept "challenges" for behaviors they were already engaged in. They either saw the accept-confirm mechanic as redundant in their case, or felt as they would have been "cheating" when competing against less pro-environmental users. Whilst not our primary target group, accommodating for the more advanced segment of users is a necessity for the viability of the product and will be discussed further in the corresponding section.

3.2 Key Findings From the Pretest–Posttest Survey

3.2.1 Overview of the Responses and Defining Groups

In total, 49 individuals completed both the pretest and posttest survey. 100 people took part in the pretest, but the answers of those who did not complete the second survey are excluded from

the following analysis in order to provide valid results. 35 of the respondents completed more than three tasks in the prototype, eight between one and three and six did not complete any tasks. Based on this distribution, the participants who exhibited the most activity are allocated to group one, group two consists of participants who had limited contact with the prototype content, and those who did not engage with the experiment constitute the control group.

In the following analysis, the pretest–posttest results are compared against each of the above groups to survey the impact the prototype usage may or may not have caused. For the sake of clarity, the answers from group one and the control group are represented graphically, important observations of the answers by group two are introduced without visual complements. The unfortunate small amount of members in the control group may reduce the quality of comparison, though it must be remembered that the primary function of this group is to discover how the answers changed for respondents who had no continuous contact with the prototype in the two week period, and as such helps to understand the overall accuracy of the answers. For example, we do not expect very big changes in this group's pretest and posttest answers, but if they do occur, they might indicate a poorly worded question or perhaps too similar answer choices.

3.2.2 Analysis of the Responses

When enquired how environmentally conscious the respondents considered themselves to be, we could observe a clear shift towards a pro-environmental self image for group one (see *figure 2.8*). 66% of the participants see themselves as "quite" conscious in the posttest, as opposed to 43% in the pretest. This increase comes mainly from the respondents who had before answered "somewhat". Identical pattern emerges for group two as well, while the answers from the control group are in large part unchanged. A somewhat surprising find is that for group one, the popularity of answer choice "very" decreases nearly twofold in favor of "quite". One possible explanation for this phenomenon could imply that as the participants got more acquainted with the prototype content, they were introduced to new aspects of the sustainability domain which might have broadened their understanding and perception of the topic. Yet this assumption should not be overemphasized, as a similar answer pattern can be seen in the control group as well. What becomes undoubtedly evident though, is that engaging the prototype indeed brought about a considerable positive change in pro-environmental awareness.

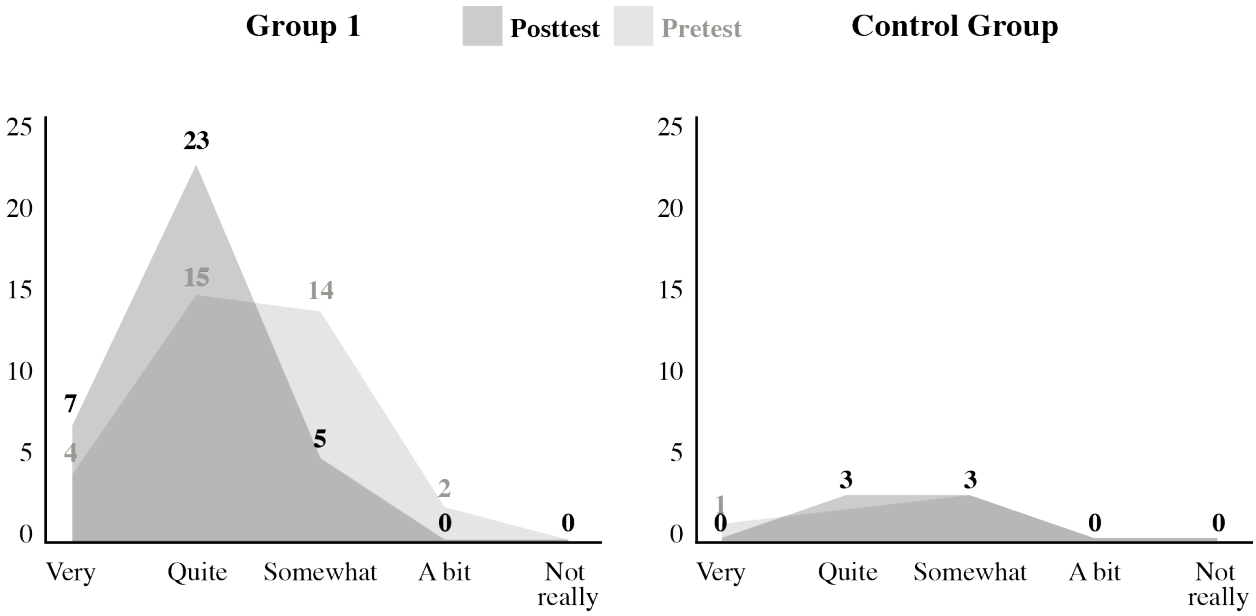

Figure 3.8 Group one and control group pretest-posttest answers to the question "how environmentally conscious do you consider yourself to be?"

The participants of group one were already rather keen on pursuing a more pro-environmental lifestyle before the experiment, this readiness increased even further by the posttest: the number of respondents who gave either "maybe" or "no" answers to the question whether they see themselves living a more environmentally friendly lifestyle decreased from 13 to eight (see *figure 3.9*). 34% of the respondents stated they saw where they have room for improvement before the experiment, 54% chose this answer in the posttest. Fluctuations in the control group responses were again relatively small, denoting one respondent choosing a "maybe" answer over a "yes", but those two concrete answer choices in question were of similar nature. Responses of group two were similar to those of group one, with the difference that two respondents changed their answer from "yes, if there is encouragement" to "yes, I see where I have room for improvement", suggesting that those participants might have been not contented with the prototype's functionality and offering. Overall, the responses to this question still validate our previous conclusion that engaging the prototype for two weeks did drive pro-environmental attitude. The increase in the answer choice "I see where I have room for improvement" merits special attention, as it implies that the participants became more aware of their personal impact and/or methods of improving it.

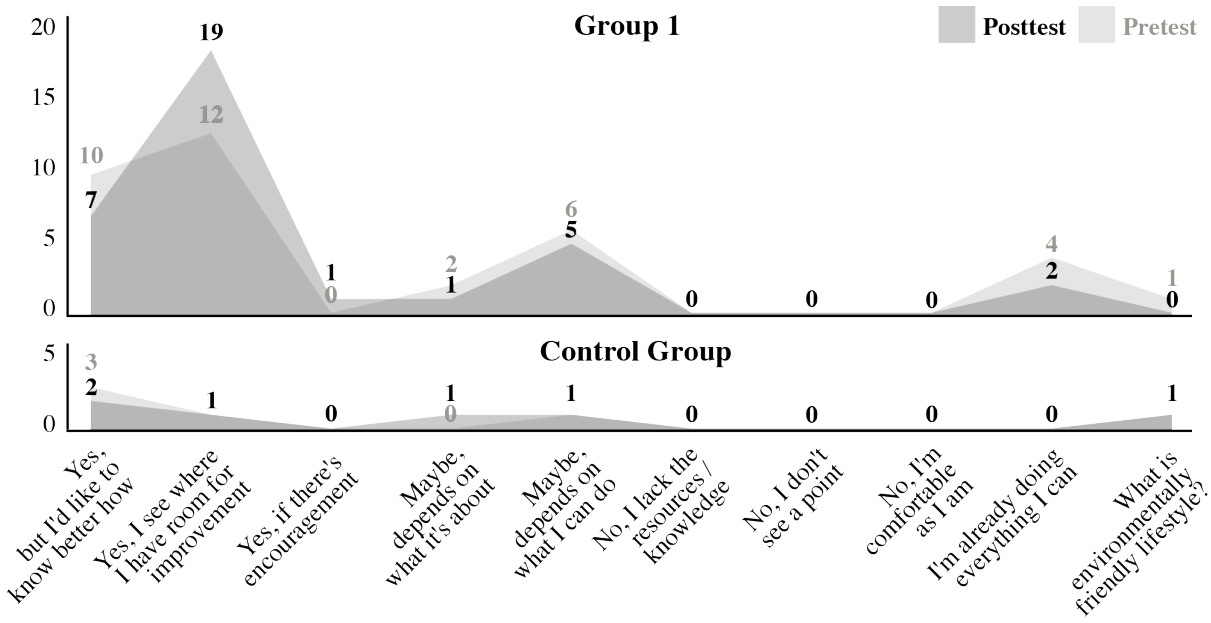

Figure 3.9 Group one and control group pretest-posttest answers to the question "do you see yourself living a more environmentally friendly lifestyle in the future?"

The next question enquired more specifically how much the participants were contributing to various aspects of pro-environmental lifestyle. A connection could be observed between the prototype engagement and the amount of environmental contribution: members of group one were already rather active during the pretest, group two and control group slightly less. This phenomenon serves as proof to the notion that the already more green-minded individuals had greater engagement with the prototype, and/or that they progressed through the content faster. Still, for both group one and two, a clear tendency towards a more pro-environmental behavior can be detected based on survey answers (see *figure 3.10*). For group one, none of the respondents chose "do not know anything" or "not contributing" answers in the posttest on topics which were treated in the prototype. Whereas "part of regular lifestyle" and "intentionally contributing" formed on average 48% of the answers in pretest, their percentage grew to 65% in the posttest. The biggest change could be observed for the question "reducing the consumption of stuff", where 80% of respondents claimed to be at least intentionally contributing in the second survey, compared to 57% in the pretest. For group two, the claimed change towards more pro-environmental behavior was even bigger, 39% of this group was at least intentionally contributing according to pretest and 63% according to posttest. As an insightful side note, "healthy diet and lifestyle" was the biggest domain in pretest for group two, and the only one in

which more than 50% of the participants were intentionally engaged in the beginning. The difference for control group answers could be best described as being erratic. It is the only group in which the answer choices would in some cases indicate a decline in pro-environmental behavior, and an increase in others. This group seems to describe the middle ground of sustainable habits. Overall, the similarity of this question's answer patterns — especially those of group one and two — to those discovered in previous queries provides a strong basis for trusting their authenticity. Although the control group responses indicate that the amount of positive increase should be regarded with caution, one can not disclaim the obvious evidence that engaging with the prototype enhanced the participants' acquaintance with environmental lifestyle .

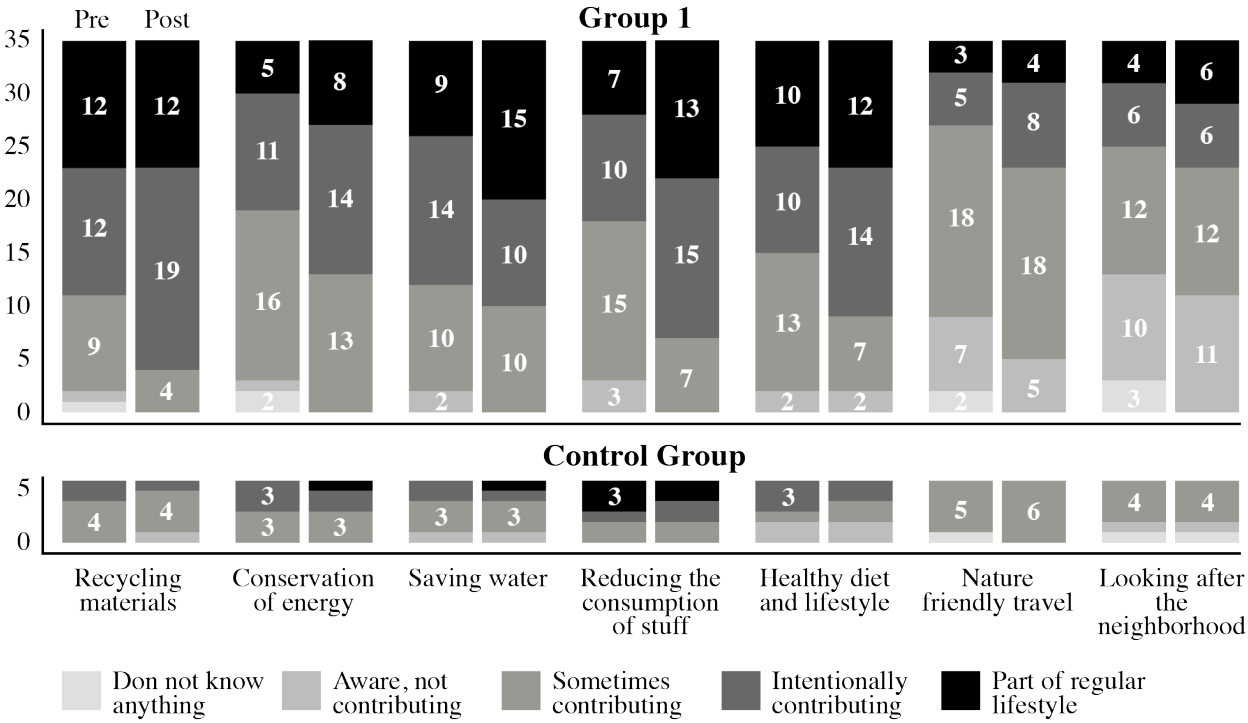

Figure 3.10 Group one and control group pretest-posttest answers to the question "Of the following topics, how acquainted are you with…"

In the following question, the participants were asked to select adjectives which in their mind best described environmentally friendly lifestyle. In general, the respondents in all groups preferred rather positive options, such as "possible", "natural" and "saving money" (see *figure 3.11*), and only minor alterations in those beliefs were detected in the pretest-posttest survey. Contrary to our expectations, the changes in the answers seem to indicate a motion towards a

more critical view of the subject: 14% of the respondents renounced their opinion that environmentally friendly lifestyle is possible, 9% more than in pretest claimed that is is not enough or not saving money. The possible reasons for this change might include the descriptive content that accompanied the prototype's tasks, which might have developed a sense of overwhelmingness.

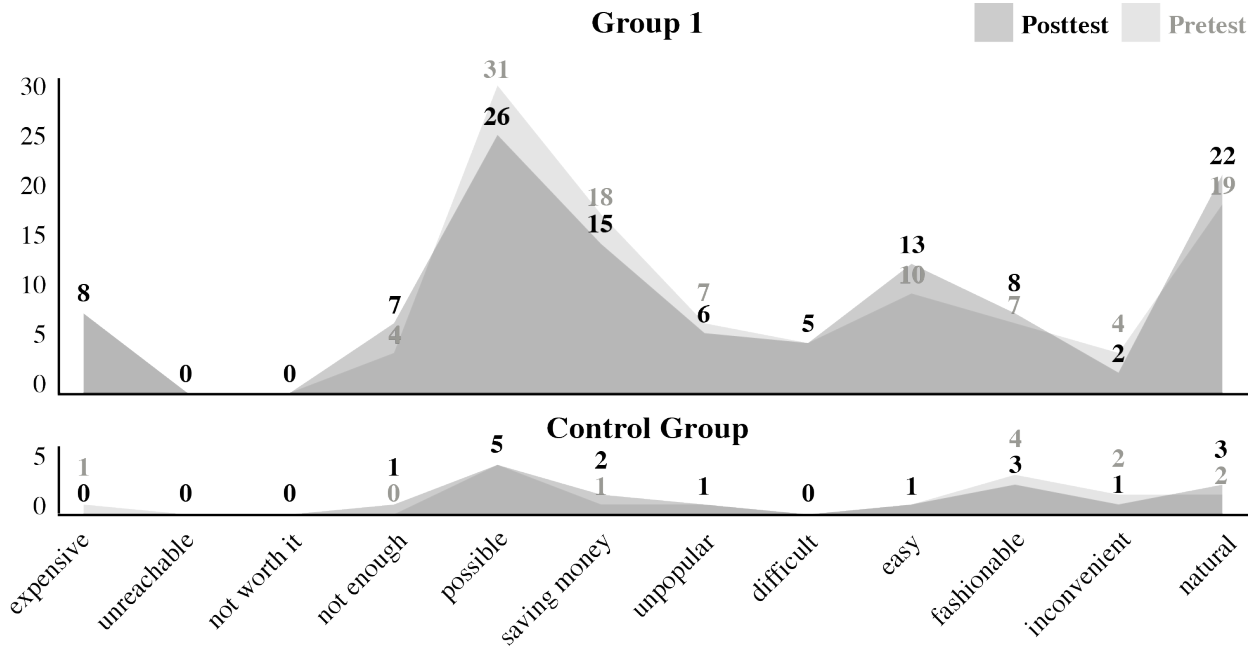

Figure 3.11 Group one and control group pretest-posttest answers to the question "In your mind, environmentally friendly lifestyle is…"

Already in the pretest, all three participant groups displayed high engagement in the 17 pro-environmental activities which were presented as answer choices to the last question of the survey, enquiring about the sustainable actions the respondents were conducting in their everyday lives. Some of those answer choices were also present as tasks in the prototype. In group one, the participants were on average engaged in 10.6 activities in the pretest and 11.7 in the posttest. For group two, those indicators were 9.9 and 10.9, and for control group 8.8 and 8.5 (see *figure 3.12*). The biggest changes were registered for the action "Turned down thermostat and water heater", which increased from 40% of the participants conducting it to 55%. This was one of the concrete tasks present in the prototype (see appendix 2). It can be observed that the concrete actions which were represented in the prototype are also those which display the biggest engagement growth in the survey. Overall, out of 17 actions, three sustain their number of doers,

11 gain new doers and three are engaged less in group one. In control group, 10 actions sustain, four lose and three gain doers. The decrease in the number of doers for three actions in group one and the high fluctuation of control group responses might indicate, among other matters, that the respondents came into contact with information which changed their conception regarding topics in question. It is highly unlikely that 20% of the participants decided to sign up for paper bills during the experiment, but they might have learned about the services and possibilities which would allow them to switch entirely to e-bills, and as such discovered that they are currently contributing less than "would be expected" by the prototype environment. Similar effect might affect the other answers as well, reducing the amount of change registered. This survey question could provide more accurate results if only concrete pro-environmental actions were used as answer choices, reducing the possibility of misinterpretation.

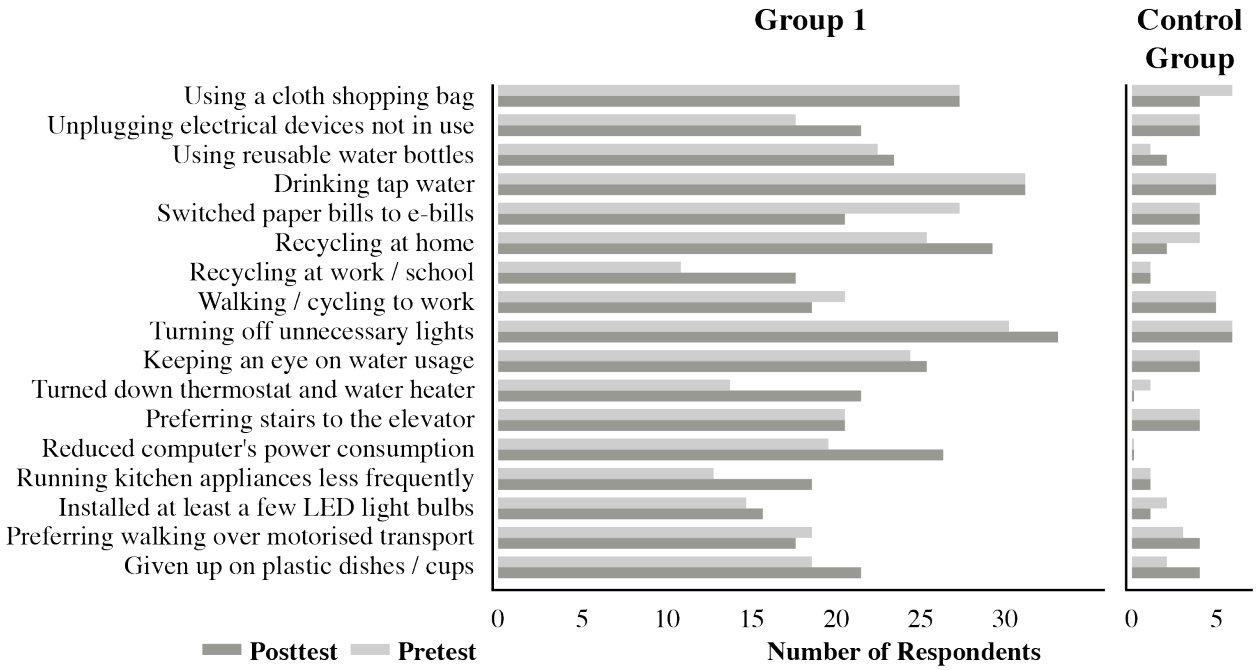

Figure 3.12 Group one and control group pretest-posttest answers to the question "Are you intentionally engaged in any of the following activities?"

4. DISCUSSION

Both the prototype usage statistics and pretest-posttest survey results seem to indicate that our assumptions regarding the usefulness of gamification in enhancing user application engagement and introducing a more pro-environmental lifestyle are correct.

The start of the prototype experiment was characterized by an unexpectedly high amount of new user registrations. In total, the initial participant group of 30 individuals grew 8.5 fold to 256 users by the end of the trial. Although inviting new users was initially largely driven by rather intrinsic motivations — which might indicate a healthy interest towards the application's value proposition —, regular growth of the userbase proved that implemented gamification methods also nudged users into sharing invitations. Integrating new member engagement mechanics into the overall progression system proved to be responsible for continuous growth after the initial opening boost of registrations. We can conclude that a viral mechanic to encourage inviting new users should be integrated deeply into the system.

37% of the registrants engaged at least once with the prototype and 27%, based on task completion and visiting statistics, continued to use it throughout the duration of the experiment. It is difficult to objectively estimate whether this should be considered as a "successful" or a "negative" indicator compared to other online services, as there are no industry standards or commonly agreed upon evaluation methods or medians which we could refer to. In the field of mobile software products, it has been observed that on average, out of all users users who have downloaded an application or game, 31% open it again after the first day, 14% keep using it for at least seven days and 5% for 30 days (Weber, 2013). While the contexts of web and mobile applications are very different, these observations do provide some insight to in which calibre the expected result could be. But compared to the previous experiment conducted by ROI Research and Recyclebank (see section 1.3.2), the survey at hand shows a modest 2% increase in the amount of users who returned to the product repeatedly, which allows us to state that gamification methods have again proven to be effective in captivating new members.

The pretest-posttest survey design proved to be a legitimate method of gathering insight regarding the change in user attitude and behavior. Although it did, in some cases, bear unexpected results and reverse motions to what had been expected (described in section 3.2.2), clearly defined patterns emerged which allow to make comprehensive conclusions. All survey questions indicated that the participants who engaged with the prototype developed a more pro-environmental attitude. A 22% increase in respondents who considered themselves as "quite" environmentally conscious was registered, together with, for example, a 23% growth in individuals who deliberately contributed to reducing their consumption of materials. While those results do not convey as big changes as the previous study by ROI Research, they do indicate a considerable impact on the users. It must be also remembered that the current experiment was two times shorter in duration, involved participants who in majority already displayed pro-environmental traits, and most importantly, employed considerably less educational content as it was more oriented towards validating game design mechanics. The conclusion from these results would indicate that game design elements can be successfully used to alter individual environmental behavior, but they should be coupled with educational materials to increase efficiency. Fogg claims that the simultaneous presence of three factors is necessary in order to alter behavior: sufficient *motivation*, *ability* and an effective *trigger* (2009, 1). Our experimental platform provided the trigger and extrinsic motivation (and assumed the presence of intrinsic, see section 2.1.4) but lacked the ability factor — the prototype's tasks only stated what should be done, but not how to do it. For future developments, our suggestion would be to include both instructional materials and a functionality that would allow more advanced users to share guidance on how they accomplished the tasks. The latter would a) provide a social endgame mechanic addressing multiple "Octalysis" drives and b) reduce the need to gather and provide localized content, as it would be generated by the users themselves.

In further employment of the pretest-posttest design, it would be suggested to better integrate the survey with the prototype to secure a bigger number or respondents, especially if there are gamification mechanics in place which could be exploited to nudge members into completing the survey. In addition, more attention should be given to the selection of answer choices for questions, especially those regarding concrete behaviors the participants were engaged in, to avoid misinterpretation and provide more accurate results. It is believed that at least some of the results were affected by a situation where respondents became more aware of

the topics treated in the prototype and came to conclusion that they were not engaged in certain behaviors after all, although they had stated to be in the pretest.

Contrary to expected results, an small increase in critical attitude towards the environmental topic was detected in the posttest survey results. This phenomenon could be caused by the content presented in the prototype, which in most part depicted the current state of the biosphere and the negative effects of human activity, perhaps creating an overwhelmingly dire image to some participants. Concurrently, as the number of prototype users and thus as well the accumulated impact statistics were relatively small, they may not have provided convincing evidence that the small individual actions could bear enough impact to make a change. To reduce this effect, it would be suggested to possibly avoid using large intimidating statistics in task descriptions, and further emphasize the importance and effectiveness of embracing the individual lifestyle changes.

The functionality of the experimental prototype was designed based on Chou's "Octalysis" framework and Werbach's gamification principles, the main consideration was to implement all the drives and principles which the two practitioners described. In the case of the "Octalysis" framework, the objective was to find game design elements which would create a balance of the drives described by Chou (see *figure 1.4*). As the pro-environmental context creates inevitably an altruistic theme (Epic Meaning), the game mechanic Appointmentment Dynamis from the opposite side of the model was referred to when creating the core functionality of the prototype. Appointment Dynamics provided a method of engaging participants continuously, as they were asked to return to the environment in temporal intervals in order to complete and accept new tasks. It proved also to be a good choice to validate gamification methods, as due to its restrictive nature it is rarely used in non-gaming context and could be considered as a "hardcore" mechanic.

As the observation that 14% of all prototype pageviews were registered from users checking their progress by refreshing the Dashboard page, and the overall rather successful nature of the experiment imply, the mechanic proved to be effective. Yet it can not be overlooked that according to qualitative feedback, it also represented a barrier for some users. It is not viable to design a system which would be congenial to all individuals. As such we would conclude by suggesting future developments of this prototype to retain the mechanic in order to provide clear focus and differentiate from similar services, but consider analyzing its deterring features and refining it accordingly.

Based on visiting statistics, leaderboards and other users' profiles proved to be engaging game design elements, making up 26% of all registered pageviews and confirming the importance of social motivations and drives in such a product. Inversely, very low usage of personal profile customization options — such as adding an image, title or description — indicates that the participants did not assimilate their profiles to the extent expected and the implementation of this gamification method was unsuccessful. The reasons behind this failure might include: a) the duration of the experiment was too short for the users to develop a connection with their profiles; b) too little customization options were presented at the beginning to provide a solid foundation for further development; c) the customized profile features were not displayed sufficiently outside the Profile pages.

The pretest-posttest survey indicated that the already more pro-environmental participants were more active in the prototype than the less informed. These individuals could represent the "Active Greens" segment described in the OgilvyEarth research (see section 1.1.2), characterised by their enthusiasm, which would also explain their high activity in the prototype (in both completing tasks and adding accomplishment images). Separate mechanics and functionalities need to be implemented for those users. Whilst they would not be the primary target group for an application such as described in this thesis, they would still probably be — due to their positive, active and trendsetter attitude — amongst the very first to engage in the product, as demonstrated by the experiment. They would thus act as evangelists of the platform and play a key role in new member acquisition. As such, they need to be accommodated — separately from the other user segments — and proven the effectiveness of the system.

The drop of visiting and engagement statistics in the last days of the experiment can be read as proof of the captivity of gamification methods. By that time, most of the active users had finished all the available tasks, and the prototype design did not offer them any new content regarding the endgame principle, which would have kept the participants engaged. This conclusion refers to the evaluation of gamification methods by Zichermann and Cunningham, who state that replacing user's intrinsic motivation with the extrinsic could severely decrease the former and make him or her heavily dependent on the latter. Meaning that when participants engaged in the prototype, their initial behavior, which was assumably at least partially based on their wish to become more environmentally friendly, decreased and was replaced by a wish to progress in the gamified environment itself. The prototype might have increased the effect

because it relied, as previously described, heavily on gamification mechanics and did not provide enough meaningful or educational content on environmental topics.

Our cautiously strict method of analysing the usage data and the fact that the product did not require users to be engaged with it every day contributed to fluctuating visiting statistics. Still, a big decline in usage in the latter days can not be attributed entirely to the loss of motivation, because after reaching and completing level three, the participants were provided with very little useful functionalities and thus no real reason to return to the environment. The main persistent features were counters which daily calculated and presented the total environmental impact of users' actions. As such we can conclude that such a simple implementation of the impact feedback mechanic proved to be unsuccessful in terms of captivity. Participants were not interested enough in the numbers to be returning to the environment.

Yet the theory presented in the Introduction section discussed that clearly seeing the amount of impact one's actions result in and understanding his or her placement in the "greater scheme of things" should bear motivating consequences. As such we propose that a more thorough implementation of the feedback mechanic would be needed, that would not just present the numbers, but place them in context with other variables, not only the results of other users. As the numeric presentation of the impact proved to be unappealing, a more visual representation should be considered. In addition, a weekly report mechanic could be used to deliver those impact statistics to users via email or social media channels. As there is reason to believe that those reports would be including potentially inspirational results, they should be compiled in a manner in which could be easily shared, specially on the social media, to generate further attention to the product. Some kind of public acknowledgement or award system could accompany the previously described, although we would strongly suggest against introducing further achievements or badges, as they should only be earned for meaningful actions during the scaffolding process when completing in-application challenges.

Ries' methodology of developing a minimum viable product and surveying its usage statistics proved to be a viable method for validating our assumptions regarding the usage of gamification methods. Building a prototype for gathering captivity data alone did provide a number of obstacles. Decisions that were counterintuitive in usability and business perspective had to be made in order to gain better insights on user behavior. As an example, endgame mechanics were excluded in the prototype for the purpose of measuring whether user loyalty is influenced by such a situation where extrinsic motivation provided by gamification stops. By

confirming that this indeed was the case, we could provide a convincing argument that this kind of mechanics are essential for a gamified application to gain traction, but their continuous integration is needed to retain the users for a longer period of time. Based on these insights, new iterations can now be created based on the same code base used for the prototype — significantly reducing the amount of development time needed — to validate the various suggestions proposed throughout this section.

One might be inclined to enquire why is it necessary to keep the users engaged once they have completed all the tasks and therefore have adopted a more pro-environmental lifestyle. They would act as role models and ambassadors for attracting new members. Their active presence alone could be considered as social proof that the product is a healthy ecosystem, their generated content (see above) could function as educational material for beginners. It would be suggested to also add endgame mechanics that would give the individuals who have completed all (or most of the) levels the functionality to add new tasks to the system, which then other members could accept. This functionality would strengthen their feeling of owner- and mentorship, allow them to express their trendsetter attitude and again help to generate new content to the system.

In order to for a newly adopted behavior to become habitual, it is estimated that on average an individual must perform the behavior for a time period of 66 days (Lally, Jaarsveld, Potts, Wardle, 2010). The experiment's duration was 14 days, an active participant completed his or her chosen set of tasks in seven to ten days. As such we can not estimate how many of those newly adopted behavioral patterns indeed became part of the participant's lifestyle. We propose that as the prototype displayed the ability to change habits for two weeks, then extending this period to nine weeks would be the matter of improving the existing or implementing new corresponding game design elements to retain a continuous flow of extrinsic motivation.

To further increase user retention rate (in web and mobile marketing context, a rating which describes how often visitors return to the application), two further developments could be made to better integrate the application with user's online media exploitation habits. Firstly, it would be beneficial to provide the same experience and content via native applications for mobile devices. In order for the product to become a "personal trainer", it has to be available for the user at all times, present in the personal application ecosystem the user has created for him or herself. This development was also one of the most recurring requests in the qualitative feedback received from our experiment participants.

Secondly, it would be suggested to more thoroughly integrate the product with the most popular social networks. A native Facebook application could serve as an extension to the website functionality, or replace it altogether. Comparing the usage and behavioral change statistics for such Facebook and web application would provide interesting insight, as the core Appointment Dynamics gamification method used in our product is heavily exploited by most successful Facebook games.

5. CONCLUSION

The purpose of the research at hand was to validate the application of online gamification methods to introduce offline pro-environmental behavior. A study was conducted which observed 256 participants engaging with a prototype product, and collected pretest-posttest survey answers from 49 respondents who had various amounts of contact with the prototype. The results of both methodologies indicated that an online environment which is designed based on game design elements can be considered as a viable option for introducing a more environmentally friendly lifestyle.

Registration, usage and visiting statistics indicated that a sustainability-themed gamified application is indeed capable of captivating users. The platform which could only be accessed when logging in, and joined via invitations, increased its initial user count of 30 individuals 8.5 fold to 256 members in a two week period. 27% of the registered users had continuous engagement with the prototype, which lasted while the environment provided new gamified content to engage with.

The prototype was developed based on Yu-kai Chou's "Octalysis" gamification framework and Kevin Werbach's concept of player journey. Game design elements such as an epic theme, Appointment Dynamics, interactive tutorial, points, levels, leaderboards, incremental progress and feedback proved to be successful in captivating users. Other methods, such as player avatar (profile) and feedback on impact did not prove to be as successful as expected. It was concluded that the latter would still be an essential part of such a product, but it would have to be implemented in way that would provide visually appealing feedback from the user's point of view — it would have to present the user's impact in a personal, comprehensive and perceptible manner. It was also concluded that game design elements which address the endgame principle of player journey are essential for the product to succeed. Taking into consideration the active trendsetter characteristics inherent to individuals with pro-environmental traits, these

game elements would mainly include functionalities which enable and drive mentoring and creating user generated content.

Responses to the pretest-posttest survey indicated that engaging with the prototype did change the users' behaviors towards a more environmentally friendly lifestyle, at least for the duration of the experiment. A 22% increase in respondents who considered themselves as "quite" environmentally conscious was registered, as well as numerous increases in concrete behaviors which the users had adopted while being engaged with the prototype, such as reducing the power consumption of home appliances. It was also noted that the impact of the prototype would have been bigger if more educational material was included in the platform, indicating that the gamification methods should be coupled with a carefully composed and unintimidating material regarding environmental topics.

In general, the impact and effectiveness of applying gamification is perhaps sometimes overestimated by the enthusiasts of the field. We are definitely in favor of popularising the fairly novel methodology. It is evident that much discussion and research is probably still to follow, as gamification has shown without a doubt enormous potential to bring about change. This potential will probably first be exploited by the marketing industry, but it is essential that other areas — that could benefit from its merits — would follow. Campaigning for pro-environmental lifestyle is one of those domains that needs to be introduced to the methodology. This thesis is an attempt to do just that. We have validated the effectiveness of gamification, as well as provided insights to some of its core mechanics, their shortcomings and also presented an array of suggestions for further improvements.

We acknowledge that further research is needed to survey the long term impact of such a gamified experience to individual pro-environmental lifestyle. A study with a bigger number of participants would be a logical continuation once the lessons from the current thesis have been implemented in the prototype. An increased number of users would allow to conduct A/B testing on separate features of the platform, which would allow to gain insights about those individual features.

Pretest-posttest survey provided — in addition to the overview of the platform's impact on users — invaluable feedback to better understand the prototype itself. Methodologies such as this one should be deeply integrated with the user's product experience to enable continuous flow of insight. Startup industry in general could benefit enormously by adopting similar methods of scientific enquiry.

By acting as instructed in the previous paragraphs, we would in effect be applying Ries' Build-Measure-Learn feedback loop to our product. This could potentially lead to creating a service which would be used by a vast amount of people. In fact, this would be an end in itself: as the individual contributions are relatively small, it would be essential to attract as big user base as possible for the product to fulfill its altruistic purpose.

Yet the question remains whether small individual behavioral changes bear enough influence to reverse the humanity's damaging processes and change the seemingly dire fate of Earth's biosphere. It is beyond doubt that the accumulation of those small deeds could result in a remarkable amount of impact, but a few critics are of opinion that individuals who have adopted some of those pro-environmental behaviors are deluded into thinking that this is a sufficient contribution and are not likely to increase it. Those claims do not have any valid scientific proof, *au contraire*, the rigorous work done on exploring the methods of promoting sustainability seems to imply otherwise. Behavior drives attitudes, and it is of utmost importance to accompany the behavior-changing methodologies (gamification) with educational ones, so that the shift would eventually be made for the right cause — not for personal gain (i.e., saving money), but for the well-being of humanity. Ultimately it is not just the small deeds that will make the difference, but the overall pro-environmental change of culture — values, motivations and attitudes — that ensues those behavioral developments.

REFERENCES

Steffen, W., Crutzen, P. J., McNeill, J. R., *The Anthropocene: are humans now overwhelming the great forces of* nature — Ambio 2007, 36, 614–621.

Rockström, J. *et al.*, *A safe operating space for humanity* — Nature, 24.09.2009, 461, 472-475

Wackernagel, M. *et al.*, *Tracking the ecological overshoot of the human economy*, 2002

Grice, A., *UK warned it will run out of landfill sites in eight years,* http://www.independent.co.uk/news/uk/home-news/uk-warned-it-will-run-out-of-landfill-sites-in-eight-years-2021136.html (08.07.2010)

Let's Do It! World, *Let's Do It! World Cleanup 2012 Invitation Program,* 2012, unpublished

Bennett, G., Williams, F, 2009, *The Red Papers: Mainsteam Green*, unpublished

Unilever PLC,*Sustainable Packaging,* http://www.unilever.com/images/sd_Sustainable_Packaging (2009)

Shelton Group, 2012, *The Social Norming Tipping Point*, unpublished

Hofstede, G, 1996, *Culture's Consequences: International differences in work related values*, London: SAGE Publications

Fogg, B.J., 2003, *Persuasive Technology: Using Computers to Change What We Think and Do,* San Francisco, CA: Morgan Kaufmann Publishers

Caillois, R., 2001, *Man, Play, and Games*, Urbana, Chicago: University of Illinois Press

Brown, S., *Play is more than fun*, http://www.ted.com/talks/stuart_brown_says_play_is_more_than_fun_it_s_vital.html (5.2008)

Garvey, C., 1990, *Play*, Cambridge, MA: Harvard University Press

Crawford, C., 2003, *Chris Crawford on Game Design*, San Francisco, CA: New Riders

Entertainment Software Association, 2012, *Essential Facts About the Computer and Video Game Industry: 2012 Sales, Demographic and Usage Data*

Maslow, A., 1954, *Motivation and personality,* New York, NY: Harper.

Hejdenberg, A., *The Psychology behind Games*, http://www.gamasutra.com/features/20050426/hejdenberg_01.shtml (26.04.2005)

Csikszentmihalyi, M., 1997, *Finding Flow*, New York, NY: Basic Books

Murphy, C., 2011, *Why Games Work and the Science of Learning*

Deterding, S., Dixon D, Khaled R, Nacke L., 2011, *From Game Design Elements to Gamefulness: Defining "Gamification"*

McGonigal, J., *Gaming can make a better world*, http://www.ted.com/talks/jane_mcgonigal_gaming_can_make_a_better_world.html (02.2012)

Lanks, B., *School Without Walls Fosters A Free-Wheeling Theory Of Learning*, http://www.fastcodesign.com/1665867/school-without-walls-fosters-a-free-wheeling-theory-of-learning (23.01.2012)

Zichermann, G. & Cunningham, C., 2011, *Gamification by Design*, Sebastopol: O'Reilly Media

Bocska, S., *Gamification Pitfalls: Badge Fatigue and Loyalty Backlash*, http://www.gamification.co/2012/09/12/gamification-pitfalls-badge-fatigue-and-loyalty-backlash/ (12.09.2012)

Garnter Group, *Gamification: Engagement Strategies for Business and IT*, http://www.gartner.com/technology/research/gamification/ (27.11.2012)

Chou, Y., *Octalysis: Complete Gamification Framework* http://www.yukaichou.com/gamification-examples/octalysis-complete-gamification-framework/ (12.04.2013)

Werbach, K., *Gamification course on Coursera by Kevin Werbach*, https://www.coursera.org/course/gamification (*s.a*)

De-Shalit, A., *Ten Commandments of How to Fail in an Environmental Campaign* — Environmental Politics, Spring 2001, Volume 10, 111-137

University of Toronto Sustainability Office, 2006, *A Review of Community Based Social Marketing Research for the Reduction of Energy Consumption*

Kassirer, J., & McKenzie-Mohr, D., 1998, *Tools of change: Proven methods for promoting environmental citizenship*, Ottawa: National Round Table on the Environment and the Economy

ROI Research Inc., 2011, *Gaming For Good, A White Paper by ROI Research Inc*

Deterding, S., Sicart, M., Nacke, L., O'Hara, K., Dixon, D., 2011, *Gamification: Using Game Design Elements in Non-Gaming Contexts*, 7–12.05.2011, Vancouver, BC, Canada.

Rautiainen, M. *et al*., 2012, *Ubiquitous Framework for Creating and Evaluating Persuasive Applications and Games* — In: Grid and Pervasive Computing Workshops, Berlin: Springer Berlin Heidelberg, 133–140

Hofstede, G., 1993, *Cultures and Organizations: Software of the Mind* — Administrative Science Quarterly, March 1993, 38, 132–134

Ries, E., 2011, *The Lean Startup*, London: the Penguin Group

Dimitrov, M. & Rumrill, D., 2003, *Speaking of Research: Pretest-posttest designs and measurement of change* — Work, 2003, 20, 159–165

Babbie, E., 2012, *The Practice of Social Research*, Independence, KY: Cengage Learning

Weber, R., *Think Tracking DAUs Is Enough? Then You're Not Getting Your Whole Mobile Story*, http://nativex.com/mobile/think-tracking-daus-is-enough-then-youre-not-getting-your-whole-mobile-story/ (09.02.1013)

Fogg, BJ., 2009, *A Behavior Model for Persuasive Design* — Persuasive '09 Proceedings of the 4th International Conference on Persuasive Technology, 2009, Article no. 40

Lally, P., van Jaarsveld, C. H. M., Potts, H. W. W., & Wardle, J., 2010, *How are habits formed: Modelling habit formation in the real world* — European Journal of Social Psychology, 40, 998-1009

APPENDICES

Appendix 1 A Sample Table of Products and Services Implementing Gamification Methods

Giving and keeping promises

Name	Address	Description
stickK	http://www.stickk.com/	Helps to set and fill goals
Beeminder	https://www.beeminder.com/	Helps to set and fill goals
Epic Win	http://www.rexbox.co.uk/epicwin/	A gamified to-do list
Mint	https://www.mint.com/	Gamifies the personal budget
SuperBetter	https://www.superbetter.com/	Helps to recover from illness or injury
Payoff	https://www.payoff.com/	Helps to pay off depts

Coaching, Motivating and Tracking

Fitocracy	https://www.fitocracy.com/	Virtual sports trainer
Nike Plus	http://nikeplus.nike.com/plus/	Virtual sports trainer
Zombies Run	https://www.zombiesrungame.com/	Running from zombies trainer
SickKids Pain Squad	http://www.campaignpage.ca/sickkidsapp/	Tracks young cancer patients' welfare
Zamzee	https://www.zamzee.com/	Virtual sports trainer for kids
Fig	http://fig.com/	A mobile wellness guide
HighScore House!	http://highscorehouse.com/	Teaches kids household tasks
Ecoinomy	http://www.ecoinomy.com/	Pro-environmental behavior changer for businesses
Practically Green	http://www.practicallygreen.com/	Teaches pro-environmental living
Leafully	https://leafully.com/	Tracks energy usage footprint
MyEnergy	https://www.myenergy.com/	Tracks home utility usage
One Small Act	http://www.greenisuniversal.com/play/one-small-act/	Teaches pro-environmental living
TaskRabbit	https://www.taskrabbit.com	Task and errand service
Action Tracker	http://www.actiontracker.org.uk/	Teaches pro-environmental living

Discovery

Tumblr	http://www.tumblr.com/explore	Gamifies blog discovery
Foursquare	https://foursquare.com/	Location finder
Crowdtap	http://crowdtap.com/	Gamified market research
Crowdrise	http://www.crowdrise.com	A fundraising service

Learning and Improving

Treehouse	http://teamtreehouse.com/	Teaches web development
RecycleBank	https://www.recyclebank.com/	Teaches pro-environmental living
Khan Academy	https://www.khanacademy.org/	Online learning environment
Opower	http://opower.com/	Tracks energy usage
CitéGreen	https://www.citegreen.com	Teaches pro-environmental living

Appendix 2 A Sample Table of Prototype Content Tasks

Title	Description	Resource	Level
Turn thermostat down by one degree	Turning down your thermostat is one of the simplest and most effective actions you can take to protect the environment and reduce your energy bills. According to the U.S. Department of Energy, you can save energy in the colder months by setting your thermostat to 20°C (68°F) while you're awake and setting it lower overnight or while you're away from home. By dialing your thermostat down 10° to 15° (-12.2°C to -9.4°C) for 8 hours, you can save about 5 to 15 percent a year on your heating bill. Keep in mind that these percentages will be greater in milder climates and less where it's truly freezing. So the question becomes: how low can you go. Try for four degrees (-15.5°C). More? Go for it. Not only do you save energy, but also you reduce the release of greenhouse gases and you save non-renewable resources.	energy	1

Use reusable shopping bags regularly	We all use reusable bags daily — purses, computer bags, backpacks. But when it comes to shopping bags, we collectively reach for paper and plastic. According to the Worldwatch Institute, nearly 3 billion plastic bags are used each day in China alone — an unfathomable number. And although they are technically reusable and recyclable, only a small percentage of them actually are. Either way, a plastic bag in a landfill takes about 1,000 years to break down, according to multiple sources. A United Nations Environment Programme (UNEP) report found that over 80 percent of marine litter is plastic — namely plastic bags and plastic bottles.	waste	2
Run dishwasher only when it is full	If an average dishwasher uses between 15 and 22 liters of water per cycle, the amount of water used every month adds up pretty quickly. By waiting until you have a full load, you can conserve water and put a significant dent in your monthly water usage, which will translate to more dollars in your pocket. It can also reduce your electric bill; heating dish water to hot is costly.	water	3

Appendix 3 Pretest–Posttest Survey Questions and Answer Choices

Question 1: How environmentally conscious do you consider yourself to be? (single choice)

- Very
- Quite
- Somewhat
- A bit
- Not really

Question 2: Do you see yourself living a more environmentally friendly lifestyle in the future? (single choice)

- I'm already doing everything I can
- Maybe, depends on what I can do
- Maybe, depends on what it's about

- No, I don't see a point
- No, I lack the resources / knowledge needed
- No, I'm comfortable as I am
- What is environmentally friendly life style?
- Yes, but I'd like to know better how
- Yes, I see where I have room for improvement
- Yes, if there's encouragement

Question 3: Of the following topics, how acquainted are you with… (matrix of choice, only one answer per row. Options: 1) Don't know anything, 2) Aware, not contributing, 3) Sometimes contributing, 4) Intentionally contributing, 5) Part of regular lifestyle)

- Recycling materials
- Conservation of Energy
- Saving Water
- Reducing the consumption of stuff
- Healthy diet & lifestyle
- Nature friendly travel
- Looking after the neighborhood

Question 4: In your mind, environmentally friendly lifestyle is… (multiple choice)

- unreachable
- difficult
- natural
- unpopular
- fashionable
- not worth it
- expensive
- not enough
- easy
- saving money
- inconvenient
- possible

Question 5: Are you intentionally engaged in any of the following activities? (multiple choice)

- Running kitchen appliances less frequently

- Using reusable water bottles
- Switched paper bills to e-bills
- Installed at least a few LED light bulbs
- Recycling at home
- Walking / cycling to work
- Using a cloth shopping bag
- Keeping an eye on water usage
- Recycling at work / school
- Preferring walking over motorised transport
- Drinking tap water
- Preferring stairs to the elevator
- Reduced computer's power consumption
- Turning off unnecessary lights
- Given up on plastic dishes / cups
- Unplugging electrical devices not in use
- Turned down thermostat and water heater

SUMMARY IN ESTONIAN

Käesoleva lõputöö teemapüstituseks on seatud küsimus, kas internetis kasutatavate *gamificationi* meetoditega on võimalik mõjutada indiviidide harjumusi juurutamaks loodussõbralikku eluviisi. Alatest tööstuslikust revolutsioonist on inimtegevus põhjustanud biosfäärile üha suurenevat kahju, mis on hakanud ohustama lisaks looduskeskkonnale ka meie ellujäämist liigina. Teadlikkus olukorrast on kasvamas, ent tegevused probleemi lahendamiseks mitte, kuna keskkonnaaktivistidel puuduvad nii teadmised kui vahendid et ühiskonnas vajalikke käitumisharjumuste muutusi esile kutsuda. Samal ajal on aga internet kui meedium üha enam tõendamas oma efektiivsust mõjutada suurte rahvamasside käitumist. Üks uusimaid ja mõjuvõimsamaid meetodeid harjumuste muutmiseks on *gamification*, mis hõlmab endas mängudisaini elementide kasutamist mitte mängu kontekstis. Akadeemilise ja praktiseerijate maailma eraldatuse tõttu on seni *gamification*it vähe teaduslikult käsitletud, ning nende uurimuste tulemused pole leidnud kasutust toodete loomisel. Antud uurimus üritas neid kahtle maailma lähendada ning tõestada, kas *gamification* on efektiivne meetod juurutamaks loodussõbralikumat käitumist. Selleks loodi eksperimentaalne prototüüp, mis põhines Eric Ries'i Lean Startup ideoloogial ning oli disainitud kasutades Yu-kai Chou *gamification*i meetodite mudelit. Samuti viidi läbi eel-eksperimentaalne uurimus mõõtmaks kuidas prototüübi kasutamine mõjutas katses osalenute käitumist. Loodud prototüüp osutus efektiivseks vahendiks uute osalejate kaasamisel, kasvatades oma esialgse liikmetekogu 8,5 kordseks. Rohkem kui neljandikust registreerunutest said aktiivsed liikmed, kes jätkasid prototüübi kasutamist terve eksperimendi vältel. Eel-eskperimentaalse uurimuse tulemused viitasid, et prototüübi kasutamine muutis tõepoolest osalenute harjumusi. Mõõdetav oli nii varasemast rohkem loodussõbralik suhtumine kui ka reaalsete igapäevaste tegevuste arv, mida katses osalenud nüüd loodussõbralikumalt ette võtsid. Uurimus järeldab, et gamification on efektiivne meetod jätkusuutlikumate harjumuste loomiseks ning tutvustutab tervet rida tähelepanekuid ja ettepanekuid uurimuse jätkamiseks. Antud lõputöö raames valminud prototüüpi saab aga käsitleda kui platvormi mille põhjal edasisi arendusi luua.