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Research Exposé:

Gamification and the determinants of the motivation to behave sustainably

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Abstract

Gamification is a technique that is becoming more and more used and that has enormous potential for encouraging individuals to enhance their pro-environmental behavior. AWorld and Eevie are two examples of mobile applications that have been created in recent years with this aim in mind. The purpose of this paper is to determine whether or not specific game elements that have been implemented in these kinds of applications have or do not have a positive impact on the satisfaction of basic psychological needs (autonomy, competence, and relatedness), as well as their impact on motivation in accordance with the self-determination theory (SDT).

In order to accomplish this objective, a survey will be developed and distributed online to app users in various European countries. The data gathered will then be evaluated using structural equation modeling to identify the trends.

The findings of this study may be useful to app developers in order to improve the efficiency of the gamification elements that they incorporate into their mobile applications, as well as to fill some of the gaps in the literature regarding gamification and its relationship with sustainability but also motivation and, as a result, behavioral modification.

Keywords: Sustainability, Gamification, Self-determination theory, mobile app, motivation, pro-environmental behavior, sustainability app

Table of Contents

List of Abbreviations

SDT	Self-determintion Theory
CET	Cognitive Evaluation Theory
SEM	Structural Equation Model
SmartPLS	Smart Partial Least Squares

List of Figures

List of Tables

1. Introduction

Many companies have expressed an increased interest in employing game features to motivate employees to act in specific ways and this enthusiasm has grown in recent years (Koivisto & Hamari, 2019). This technique is referred to as "gamification," and it is defined as the use of game design features (such as points, rules, challenges, rewards, and competitiveness) in non-game situations (Deterding et al., 2011). Since its conceptual genesis around 2011, it has attracted a significant deal of attention from academics and professionals alike (Hamari & Parvinen, n.d.). As a result, the worldwide gamification market was valued at USD 2.17 billion in 2017 and is expected to grow to USD 19.39 billion by 2023, according to industry research (Mordor Intelligence, 2018).

Gamification has been used in a variety of non-gaming contexts, including health (Alahäivälä & Oinas-Kukkonen, 2016; Hamari & Koivisto, 2015; Jones et al., 2014), education (Christy & Fox, 2014; Filsecker & Hickey, 2014a; Simões et al., 2013), work (Dale, 2014; Robson et al., 2016), crowd-sourcing (Lee et al., 2013; Morschheuser et al., 2017) , marketing management (Huotari & Hamari, 2017; Lucassen & Jansen, 2014; Xi & Hamari, 2019a) as well as science (Sørensen et al., 2016).

Most research and evaluations of empirical investigations on gamification have found that, in the vast majority of situations, gamification has a positive impact on motivation and behaviors (Hamari et al., 2014; Hamari & Koivisto, 2015; Sailer et al., n.d.-a; Su & Cheng, 2015). However, the literature on this subject is still scattered and there have been also practical failures which have brought many businesses to lose faith in the potential of gamification as a consequence. It is believed that 80 percent of existing gamified apps, particularly in the business area, fail to achieve their objectives as a result of ineffective design (Xi & Hamari, 2019b) Consequently, practitioners have begun to question the efficiency of gamification as a result of these concerns.

When it comes to understanding the motivating potential of games, the theory of self-determination (or SDT) and its sub-theories are frequently utilized as a theoretical framework (Deci & Ryan, 2000; Ryan et al., 2006). This theory posits that people's autonomous motivation increases when their basic needs of autonomy, competence and social relatedness are satisfied.

A substantial body of literature on gamification is emerging, although past research has suffered from significant limitations in terms of theory, empirical evidence, and methodological rigor. Prior studies have observed that, despite the suitability of motivational frameworks, such as self-determination theory (Deci & Ryan, 2000), to understand gamification effects, there is a lack of theoretical foundation to describe the motivational effects of gamification and that just a small number of studies are based on theoretical frameworks (Hamari et al., 2014; Johnson et al., 2016; Sailer et al., 2017; Seaborn & Fels, 2015). Moreover, by examining the current literature review another finding was that there is a lack of understanding of the impacts of the various game components, since most research have concentrated on studying gamification as a single idea (Johnson et al., 2016; Sailer et al., 2017).

Furthermore, there haven't been any studies that have tried to use the self-determination model in order to test the effect of game elements on the motivation for sustainability. So, the aim of this study is to fill the existing literature gap by trying to understand whether or not the use of specific gamification features (divided as achievement and social related elements) in mobile application, that are intended to make users improve their sustainable behavior, actually have an impact on motivation using SDT.

The finding of this research might also be useful to companies and app developers in order to understand which gamification features should be implemented in order to make their application increase the users motivation.

This study is structured as follows. The next part covers the theoretical framing, then there is the literature review, research model and hypothesis, methodology, expected contributions, chapters overview, work plan and references.

2. Theoretical Framing

2.1. Pro-environmental behavior

Early in the late nineteenth century, scientists raised alarm about carbon dioxide production, claiming that it could contribute to global warming. However, due to the actions of doubters and skeptics, as well as commercially driven policies, the warning has not always been heard, and greenhouse gas concentrations have been continuously growing over the last few decades (Eisenack & Reckien, 2013). Given that climate change is a global issue that cannot be fixed by any single person, it is critical to raise awareness and empower individuals to deal with it (Eisenack & Reckien, 2013).

Pro-environmental behavior includes actions that assist the environment, such as reforestation, recycling, energy saving, pollution reduction, and so on (Monroe, 2003; Steg et al., 2014). Kollmuss and Agyeman (2002) defined pro-environmental conduct as a behavior that actively reduces the negative environmental impact of an action (Kollmuss & Agyeman, 2002). As in another study by Wang X. and Yao X., pro-environmental behavior here is defined and described as "a range of voluntary personal acts that help the environment" (Wang & Yao, 2020).

According to Li et al. (2019) literature review, there are two types of factors that influence pro-environmental behavior: external and individual(Li et al., 2019). A possible external component to examine is social norms. Scholars disagree on the way in which these standards influence the behavior intention to recycle. According to certain research, social norms have a direct influence on self-reported behavior (Vining & B R E O, 1992). Several other research, however, have shown that social norms are typically less effective than personal beliefs and environmental identity, and that their impact may be mitigated by the fact that they are incorporated into an individual's personal norms system and therefore have an indirect effect (Bertoldo & Castro, 2016; Klöckner & Oppedal, 2011)

Another external aspect that has a significant influence on recycling habit is convenience. Indeed, a research done by Zhang et al. (2016) indicates that in China, a lack of recycling facilities is a significant impediment, and that increasing the accessibility would inspire residents to act. Indeed, "the percentage of people who recycled is over 25% higher in the scenario with easily accessible recycling facilities, compared to those with hardly accessible facilities" (Zhang et al., 2016).

And lastly also climate policies introduced by the governments are external factors that have been introduced in countries with various degrees of compulsion. Compulsory measures force emission reductions through technology or fuel legislation or financially penalize emissions to the point that many companies and households are obligated to decrease emissions. They do not mandate specific activities, but companies and people must pay emission charges (e.g., unit rates or permit prices) or invest in emission reduction technologies to minimize their charges as a result of these policies (Goulder & Parry, 2008). Instead of enforcing penalties for failing to comply, non-compulsory programs promote voluntary emission reductions. Direct government investments, subsidies for low-carbon technology purchases, and educational and informational activities are only a few examples. According to empirical survey research, citizens' support for carbon taxes and cap-and-trade policies is limited, but regulatory and voluntary programs are more popular (Drews & van den Bergh, 2016).

Demographic and psychological characteristics are included in the category of individual variables. Research on demographic factors indicates that women, highly educated young adults with a high level of wealth, married couples, and urban inhabitants had more environmental behavioral intentions (López-Mosquera et al., 2015).

Recent research has emphasized the role of psychological norms in predicting pro-environmental conduct, finding that they are typically more effective than external and demographic norms in predicting pro-environmental behavior (Li et al., 2019). Generally, these studies have concentrated on psychological variables such as attitudes, beliefs, subjective norms, and perched behavioral control (Li et al., 2019)

2.2. Sustainability and technology

The advancement of information technology has heralded the beginning of a new era of environmentally conscious behavior. Information technology, on the one hand, broadens the notion of pro-environmental behavior and aids people in the development of new patterns of behavior (Yang et al., 2018). New green lifestyles such as mobile payments, shared bicycles, and electronic receipts cannot be realized without the use of information technology as "enabler". But also when it comes to encouraging pro-environmental behavior, information technology serves as "accelerator." For instance, Tim et al. (2018) have demonstrated the significance of social media in promoting environmental sustainability (Tim et al., 2018). The

use of green information systems has been shown to be effective in influencing employees' environmentally responsible behavior at the organizational level (Corbett, 2013).

Another notorious technology in this context is Alipay and its embedded Ant Forest, a mobile platform based on information technology, serve as a "platform" for pro-environmental behavior. When used in conjunction with Alipay, a third-party payment service, a variety of low-carbon behaviors connected with mobile payment are made possible, such as taking public transportation and purchasing tickets online. Meanwhile, Alipay encourages pro-environmental habits through the use of a game called Ant Forest which helps people get into the habit of living a green lifestyle more quickly (Chen & Cai, 2019). Users' awareness of environmental preservation is instinctively heightened as a result of recording personal low-carbon actions carried out through Alipay, and they will eventually be rewarded by the planting of a real tree through the Ant Forest initiative. Therefore also in this case the technology works both as an enabler and accelerator.

2.3. Gamification

"The application of game design features in non-game contexts" is how gamification is defined (Deterding et al., 2011). In a literature review paper done by Hamari et al. (2019) it is said that since its development in 2010 gamification has gained more and more attention of practitioners and researchers but also of companies and organizations and it has been implemented in various fields such as: resource planning, intra-organizational communication and activity, science, government service and public engagement, crowdsourcing, commerce, exercise, health, education, environmental behavior, marketing and advertising and more (Koivisto & Hamari, 2019).

In previous studies, other outcomes of game elements have been identifies a part from entertainment. The most important ones are: increase in motivation, learning and social interaction (Galeote et al., 2021). Gamification promotes motivation by providing players with the perceptions of flow and immersion which absorb the player's focus entirely (Koivisto & Hamari, 2019). Games often elicit emotions of competence, autonomy, and relatedness in players (Rigby and Ryan 2011), which not only encourage player involvement but also have the potential to empower people to take action.

According to Piaget's ideas and cognitive constructivism in general, learning happens when the information gained through experience is absorbed and integrated (Powell and Kalina

2009). Giving hands-on experiences in actual or simulated environments, providing varying levels of abstraction and focusing on particular characteristics of reality, and adding opportunities for individual or group reflection are all ways in which games may help students learn better. Aside from that, challenges in games may be adjusted to the conditions of unique players, giving them with tailored instruction and feedback while still allowing them to fail with little repercussion (Plass et al 2015).

Third, games, whether they are multiplayer games or based on fictitious characters, are often used to encourage social interaction (Galeote et al., 2021).

This gamification advantages are gained through the careful design of gamification features (Hamari et al., 2014; Santhanam et al., 2016), which have been classified in different ways. Meaningful storylines, avatars, teammates, leaderboards, points, performance graphs, and badges are among the features that may be easily incorporated by game designers (Sailer et al., 2017). A taxonomy of gamification design components was proposed by Robinson and Bellotti, which included broad framing and general rules, resources and restrictions, social features, feedback and status information, and incentives (Robinson et al., n.d.). While the most often utilized gamification design features, according to Miller et al., include social interaction, challenges and quests, leaderboards, points and levels, and badges (Miller et al., 2016). Seven gamification design components were presented by Liu et al. (Liu et al., 2011): win conditions, social networks, rankings, challenges, prestige, medals, and incentives.

Kovisto and Hamari (2019) classify game elements into five groups, which are: achievemet/progression oriented, social oriented, immersion oriented, real world oriented and miscellaneous (Koivisto & Hamari, 2019). When looking over the reviewed literature, it seems that the use of different accomplishment or progression signaling affordances is the most popular method of gamifying diverse activities. The second most common method included social factors in a variety of ways such as features typical of social networks services including friending, like, status updates, comments, and profile pages. Gamification solutions that include leaderboards or other forms of social assessment foster a feeling of competitiveness among users and immersion-oriented attributes include the use of tales and narratives, avatars, virtual worlds, etc, although they were not as widely used as accomplishment and social features .

2.4. Gamification and motivation

It was not until 2016 that Mazur-Stommen and Farley (Mazur-Stommen & Farley, 2016) broadened the definition of gamification. According to them, gamification is essentially "approaching obstacles in order to tap into the psychology of motivation".

Extrinsic motives and internal motivations are the two types of motivations that lead to behavior change. Extrinsic motivation is characterized by the utilization of external stimuli to affect behavior, whereas intrinsic motivation is driven by one's own desires (van der Linden et al., 2015). According to Grossberg et al. (Grossberg et al., 2015), the points, badges, and leaderboards (PBL) system provides players with visible and immediate rewards and is a powerful motivation for them to change their behavior. Players feel more successful when their performance records are contrasted with the records of their peers, which leads them to keep or improve their current behaviors. On the other side, players may get demotivated if their personal score lags too far below the current world record (Chou Y., 2015).

Moreover apps that include game elements are rated more positively by the users compared to ones that rely only on information in order to promote a behavioral change (Beck et al., 2019).

A study by Douglas & Brauer (2021) highlighted that game elements have been applied to apps in order to promote pro-environmental behaviors (Douglas & Brauer, 2021). For example, in the context of energy reduction the use of phone applications such as "Powersaver Game" and "Reduce your juice" has led to a significant increase in energy saving and knowledge about the topic (Mulcahy et al., 2020). However some studies highlighted that in the long term the effect of this application diminishes and no difference is found between the energy usage of people who have been encouraged to use a gamified app and the control group one year after the beginning of the experiment (Wemyss et al., 2019).

Another example of phone application which incorporates gamification features and attempts to promote and motivate people to recycle is WasteApp. The app was successful in promoting recycling among users who saw the app as beneficial. However, participants' anticipation of a reward was adversely connected with user happiness, and there was no association between anticipation of a prize and recycling behavior. (Aguiar-Castillo et al., 2019).

2.5. Theory

<u>Self-determination theory (SDT)</u>

In the gamification context Self-determination theory (or SDT) is one of the most used ones in order to explain the impact that gamification features have on motivation.

SDT first distinguishes between extrinsic and intrinsic motivation. Intrinsic motivation refers to motivational factors that are built into a behavior, such as satisfaction, participation with an activity, or the activity's help promote cognitive and social growth (Deci & Ryan, 2000). Extrinsic motivation, on the other hand, refers to motivation that is external to the activity (Deci & Ryan, 2000) and is often generated from the conduct's results, such as incentives, penalties, or social pressure (Ryan & Deci, 2000).

Inside SDT there has shifted from an emphasis on intrinsic vs extrinsic motivation to a focus on autonomous versus controlled motivation. Controlled motivation is characterized by external regulations (people behave in order to earn tangible prizes or avoid penalties imposed by others) and introjected regulations (this type of motivation is linked to the ego and self-esteem because people behave to demonstrate their abilities or to avoid feeling guilty or humiliated), whereas autonomous motivation is characterized by identified/integrated regulations (people accept the importance of a behavior for them and therefore they accept it as their own) and internal regulations (individuals decide willingly by absorbing external regulations) (Bitrián et al., 2020).

To put it in another way, autonomous motivation is defined as "acting with complete volition and choice" (Deci & Ryan, 2008a). Controlled motivation, according to Deci and Ryan (2008), "involves responding in response to the sense of pressure and demand toward specific outcomes imposed by forces seen to be external to the self" (Deci & Ryan, 2008a).

Autonomous motivation is connected with better psychological well-being, persistence, and superior performance in a range of settings when compared to controlled motivation (Deci & Ryan, 2008a; Peng et al., 2012). Controlled motivation, on the other hand, is found to fade more quickly when the external control is removed (Richter et al., 2015). According to SDT researchers, autonomous motivation is the preferred kind of motivation whereas controlled motivation, as an unstable predictor of behavior, is the least preferred type of motivation (Deci & Ryan, 2008; Vansteenkiste et al., 2009).

A sub-theory of STD called cognitive evaluation theory (CET) also states that when people's basic psychological needs are satisfied, their motivation becomes more autonomous (Deci & Ryan, 2000). The three needs are autonomy (the need to be agentic, offer input, and self-endorse actions and beliefs), competence (the need to successfully engage with one's environment and produce desired effects and results), and relatedness (the need to feel linked to others). Individuals' self-determined motivation, psychological growth, and well-being are predicted to be promoted when these basic psychological requirements are met. When these requirements are not met, intrinsic interest and well-being are stifled, and ill-health and maladaptive outcomes are predicted (Deci & Ryan, 2000).

Gamification has already been applied to the self-determination theory in other studies (Bitrián et al., 2020, 2021; Kam & Umar, 2018; Mekler et al., 2017b; Mitchell et al., 2020; Perryer et al., 2016; Shi & Cristea, 2016; van Roy & Zaman, 2017, 2019b; Wang et al., 2021) It can be considered as an external regulator and therefore based on SDT that would make the users feel less autonomous and in some studies about gamification used in the context of education it has also been found that this might even reduce their internal intrinsic drive (Filsecker & Hickey, 2014b). However, when external motivational signals appeal to the actor's psychological needs, the external cues will be entirely internalized, resulting in autonomous motivation (Deci & Ryan, 2008a). This motivational process in which initial intrinsic motivation is overwritten by external regulations has been defined in research as the overjustification, undermining or corruption effect (Lepper & Henderlong, 2000; Weibel et al., 2010).

<u>Alternative theory</u>

The Octalysis Framework, created by Chou, is another theory used to investigate gamification and its link to motivation. It focuses largely on motivation and human-centered design, explaining the role and potential outcomes of gamified design. The framework is centered on eight mental core drives to describe the reason behind each human behavior, drawing influence from Fogg's B=MAP motivation model (a behavior change model that drives motivation, ability, and prompts as fundamental values) created in 2003. The eight drivers in the Octalysis framework are: Epic Meaning and Calling, Development and Accomplishment, Empowerment of Creativity and Feedback, Ownership and Possession, Social Influence (Chou Y, 2016).

3. Literature Review

In the literature review section the most relevant studies that are close to the topic analyzed in this one are summarized.

The research conducted in order to perform the literature review was done using Web of Science with the use of the following key words: "gamification", "self-determination", "theory", "motivation". The results were also refined in order to consider only articles and review articles starting from the year 2016. The research gave 119 results which were analyzed and in Table 1 are reported the most significant ones.

The articles that were also present in the reference of the ones that came out of the research were also considered in the table.

From the literature review it is possible to notice that the Self-determination theory has been widely applied in relation with gamification features in various contexts such as: education, sports, health, work, finance and more. Moreover the theory has been applied with different methods of research like experiment, qualitative and quantitative.

In most cases research have found a positive correlation between gamification elements and motivation but there have been some exception as well where the correlation was ambiguous or not significant, an example is the research by van Roy, R & Zaman, B (2019).

To conclude in the last raw of the table a paper by Decy & Ryan (2000) is found since it is one of the most cited in this paper and most of the SDT is based on that.

Table 1: Literature review

Title	Authors	Year	Method / Area	Content
Fostering authentic learning motivations through gamification: a self-determination theory (SDT) approach	Kam, AHT & Umar, IN	2018	Other Education	Provides a framework that can be used in order to asses the effect of different gamification tools on motivation in the education sector by using the SDT as a base. Does not make any qualitative or quantitative study in order to test whether the model works.
The Impact of Gamification on the Motivation and Performance of Engineering Students Through the Lens of Self-Determination Theory	Kim, E & Rothrock, L & Freivalds, A	2020	Experiment Education	Conduct an experiment in order to determine whether gamification is able to maintain student motivation throughout a whole semester and weather it positively or negatively affect intrinsic and extrinsic motivation.
Gamification in sport apps: the determinants of users' motivation	Bitrian, P & Buil, I Catalan, S	2020	Quantitative Sport	Provide and test a framework based on SDT in order to see the effect of three different game elements (achievement, social and immersion related) on autonomous motivation. The study concern sport apps. The results proved the connection between achievement related game elements and the satisfaction of the three basic needs and the one between social-related and the needs for relatedness and finally the one between immersion related and the need for autonomy and competence. Moreover, also the connection between gamification and autonomous motivation was proven correct.
Gamification and the impact of extrinsic motivation on needs satisfaction: Making work fun?	Mitchell, R & Schuster, L & Jin, HS	2020	Quantitative Work	Wants to see the impact of gamification applied in the workplace and its effects on employees' motivation. This study shows that when motivation is internalized that it has a positive effect on intrinsic motivation and behavioral intention.

Enhancing workplace motivation through gamification: Transferrable lessons from pedagogy	Perryer, C & Celestine, NA & Scott-Ladd, B & Leighton, C	2016	Review Many areas	Provide a summary of the literature about gamification and motivation and discusses its interaction with other psychological theory like the SDT or Four-Drive theory.
Towards understanding the effects of individual gamification elements on intrinsic motivation and performance	Mekler, ED & Brithlmann, F & Tuch, AN & Opwis, K	2017	Quantitative Gamification	Examines how points, leaderboards and levels impact on motivation of the users. By comparing the game elements with a control condition this study found that gamification did not significantly increase intrinsic motivation.
The Impact of Gamification-Induced Users' Feelings on the Continued Use of mHealth Apps: A Structural Equation Model With the Self-Determination Theory Approach	Wang, T & Fan, LY & Zheng, X & Wang, W & Liang, J & An, K & Ju, M & Lei, JB	2021	Quantitative Health	Examines the impact of gamification used in m-health apps on the intention to us. The model was also based on the Self-determination theory. And it was confirmed that gamification increases the continuous usage and feeling of autonomy, competence and relatedness.
Unravelling the ambivalent motivational power of gamification: A basic psychological needs perspective	van Roy, R & Zaman, B	2019	Quantitative and qualitative Education	See the effects of game design elements on motivation in educational settings. The findings indicate that game components in technology-supported learning settings have ambiguous motivating power, providing emotions of autonomy, competence, and relatedness in some instances while blocking them in others, with situational variables playing a significant role in this process.
Making finance fun: the gamification of personal financial management apps	Bitrian, P & Buil, I & Catalan, S	2021	Quantitative Finance	Integrates Technology Acceptance Theory and Self-determination theory in order to see the effects of gamification on the users of a financial app.

Gamification: Predicting the effectiveness of variety game design elements to intrinsically motivate users' energy conservation behaviour	Wee, SC & Choong, WW	2019	Quantitative Energy consumption	The research anted to predict the effects of a variety of game design elements on the energy conservation behavior in Malaysia. A positive correlation was found between gamification and intrinsic motivation according to the SDT.
The "What" and "Why" of Goal Pursuits: Human Needs and the Self-Determination of Behavior	Edward L. Deci & Richard M. Ryan	2000	Theory	Discussion of the Self-determination theory and explanation of its basic concepts. This theory is at the basis of most studies done about motivation and gamification.

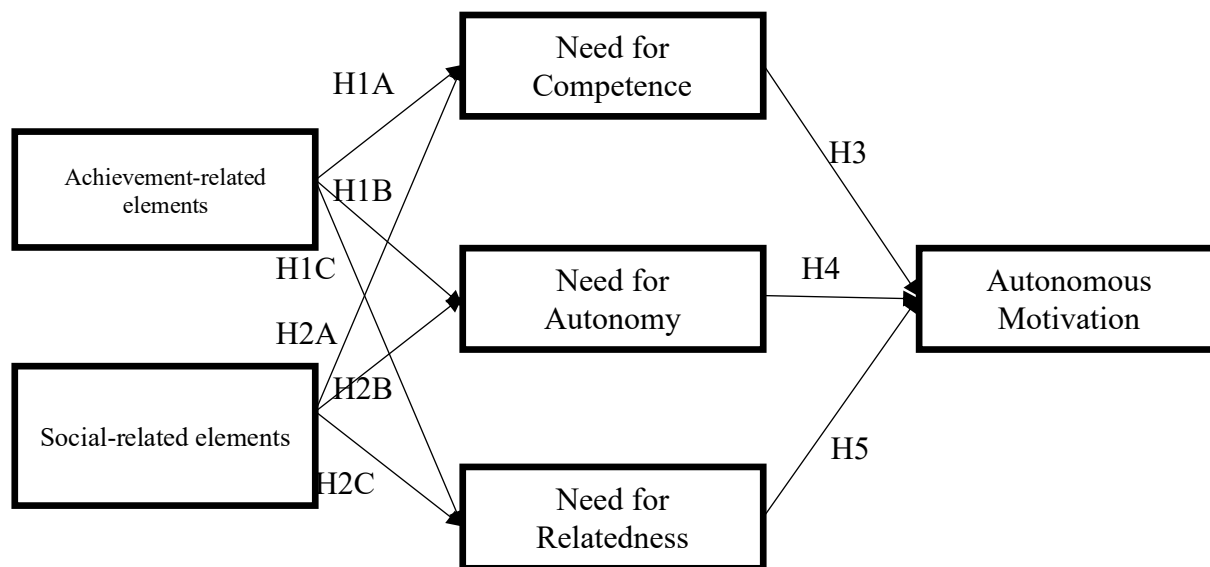# 4. Research Model and Hypotheses (or Research Propositions)

Figure 1: Model based on SDT

Koivisto and Hamari (2019) classify game aspects into three main categories: achievement-related elements, social-related elements, and player immersion-related elements (Koivisto & Hamari, 2019).

In gamification, achievement-based game components are the most often used. Examples include badges, points, leaderboards, virtual currency, progress meters, and varying degrees of difficulty (Koivisto & Hamari, 2019). The need for competence may be met via the use of points, performance graphs, badges, or leaderboards (Hense et al., 2014; Sailer et al., n.d.-b). Points give detailed feedback to the player about their activities. Visual representations of the player's improvement over time provide ongoing feedback. Badges and leaderboards track a player's activities and offer aggregate evaluation (Rigby & Ryan, 2011). Hence, it is mainly the reporting role of such gaming features that might induce emotions of competence, since it conveys the performance of a user's activities (Sailer et al., 2017). Moreover Sailer et al. (2017) revealed that badges, leaderboards, and graphics met the desire for autonomy by boosting the sense of work and generating relevance at the game level (Sailer et al., 2017). Finally, Sailer et al. (2013) discovered that leaderboards, which display a team's score, increased team members' sense of relatedness (Sailer et al., 2013).

Social game components include competition with others, teamwork, and social networking (Koivisto & Hamari, 2019). Previous research has shown that teammates' ties

improve people's desire to perform at their best, and competition with other teams has been shown to foster a feeling of connectedness (Peng et al., 2012).

For example, Van Roy and Zaman (2019) shown that group competition promotes the development of psychological demands such as competence, autonomy, and relatedness. On the other hand, Sailer et al. (2017) discovered that players in a game involving teammates had higher levels of social relatedness (Sailer et al., 2017).

They did not demonstrate this beneficial effect, however, in the case of the need for autonomy. Finally, Xi and Hamari (2019) revealed that social networking features such as cooperation, rivalry, and connection simplified the process of satisfying competence, autonomy, and relatedness needs (Xi & Hamari, 2019a).

Components of immersion include avatars, storylines, stories, and customization (Koivisto & Hamari, 2019). These factors were not considered for the purpose of this essay because the App in question does not make use of them.

Therefore we can make the following hypothesis:

H1. Achievement-related gamification elements are positively correlated to the satisfaction of the needs for (A) competence, (B) autonomy and (C) relatedness.

H2. Social-related gamification elements are positively correlated with the satisfaction of the needs for (A) competence, (B) autonomy and (C) relatedness.

According to self-determination theory, environments that meet fundamental psychological needs for competence, autonomy, and relatedness encourage autonomous motivation, which leads to improved psychological outcomes and well-being (Deci & Ryan, 2000).
Autonomous motivation can be defined as the one coming from the process of integrated regulation or that is intrinsic motivation (Deci & Ryan, 2000).
This connection has been established on several times. According to Ryan et al. (2006), games that allow players to feel competent, offer them autonomy, and allow them to form relationships with other players foster increased intrinsic motivation among the individuals involved(Ryan et al., 2006). According to Peng et al. (2012), in a study of fitness video games, game components that stimulate competitiveness and autonomy improve players' pleasure,

drive to continue playing, and willingness to spread the word about their favorite game (Peng et al., 2012).

On the contrary, game features that diminish the feelings of competence and autonomy, like negative feedback or controlling rewards, will lower intrinsic motivation (Deci et al., 1999).

Therefore we can make the following hypothesis:

H3. The satisfaction of the need for competence has a positive impact on autonomous motivation.

H4. The satisfaction of the need for autonomy has a positive impact on autonomous motivation.

H5. The satisfaction of the need for relatedness has a positive impact on autonomous motivation.

5. Methodology

5.1. Research design

This research will follow the structure of a quantitative study which allows for further investigation of the subject area, as well as the ability to repeat the study in the future.

The model chosen as a basis of the study is the Self-Determination theory which is one of the most prominent theories of human motivation and it answers to demands for further study into the impacts of gamification on users' motivation in the context of gamified applications.

5.2. Application domain

The application domain of this research is the set of gamified sustainable apps and the unit of investigation are app users.

5.3. Target sample description

The target sample of this study are the users of mobile applications aimed at helping its users to become more environmentally conscious and build pro-environmental behaviors and habits.

One of the most famous application in this context is AWorld. This app was also chosen by the United Nations in support of their campaign ActNow about individual actions for climate change sustainability. AWorld uses gamification features such as scores, rewards, leaderboards, feedback in order to help people keep track of sustainable behaviors such as energy waste, eating more sustainably, using recycled products and many more.

Another important feature of this app is that users can enter in teams and part take in challenges that are published periodically on the app. Moreover, the design of the app allows it to be completely integrated with the technological platforms of all companies and therefore for them it is possible to personalize the application for their employees.

Another application that is taken under consideration for the purpose of this study is Eevie. It can be integrated by organizations or groups of people as well and uses rankings as a gamification feature.

The survey will be distributed online in order to reach more easily a higher amount of people. The country of origin of the participants is not relevant, since it is not taken under

examination by this research but the survey might be translated from English also in Italian and French, in order to make it more easy for more people to answer.

Respondents will have to be both female and male and come from different age groups.

In order to determine the sample size the ten-times rule will be used therefore since the links of the model of this study are 9 at least 90 respondents will have to participate in the survey.

5.4. Data collection procedures

As was said previously the survey will be designed and distributed online mainly through social media. In fact, AWorld has an official page on both Instagram and Facebook with more than 7000 followers.

It might also be possible to contact through LinkedIn or Facebook the people that work in the companies that have already integrated the app in order to forward them the survey as well.

In order to build the survey seven-point measures derived from prior research were used to assess the model's constructs. Individuals' perceptions of game elements related to achievement, social aspects included in the apps will be assesed using Xi and Hamari's (2019) scales, which looks at the importance (1 not at all important, 7 very important) of users' interactions with each of the game elements (Xi & Hamari, 2019b). The fulfillment of the fundamental psychological requirements for competence and relatedness was also assessed, using questions from Xi and Hamari (2019) and the need for autonomy was measured using Standage et al (2005) (Standage et al., 2005; Xi & Hamari, 2019b). The items were graded on a seven-point Likert scale (1 strongly disagree and 7 strongly agree).

Finally, autonomous motivation was conceived by combining intrinsic and identifiable motivation, which were evaluated adapting the measurements proposed by Stendgal et al. (2015) on a seven-point Likert scale by Standage et al. (2005) (1 strongly disagree, 7 strongly agree) (Standage et al., 2005).

The items used can be seen in the following table:

Table 2: Items

Code	Item	Theory
Achievement related elements		
A1	The importance of interacting with badges/medals/trophies in the app	adapted from Xi and Hamari, 2019
A2	The importance of interacting with scores/points in the app	adapted from Xi and Hamari, 2019

A3	The importance of interacting with progress bars in the app	adapted from Xi and Hamari, 2019
A4	The importance of interacting with rankings/leaderboards in the app	adapted from Xi and Hamari, 2019
A5	The importance of interacting with increasingly difficult tasks in the app	adapted from Xi and Hamari, 2019
Social related elements		
S1	The importance of interacting with competition in the app	adapted from Xi and Hamari, 2019
S2	The importance of interacting with social networking features in the app	adapted from Xi and Hamari, 2019
S3	The importance of interacting with cooperation in the app	adapted from Xi and Hamari, 2019
Need for Competence		
C1	I think that I am pretty good when I use the app	adapted from Xi and Hamari, 2019
C2	I am satisfied with my performance when I use the app	adapted from Xi and Hamari, 2019
C3	I feel like an expert in the app	adapted from Xi and Hamari, 2019
C4	I feel like a competent person when I use the app	adapted from Xi and Hamari, 2019
Need for Autonomy		
A1	In this app I have different options	adapted from Xi and Hamari, 2019; Standage et al., 2005
A2	I feel free to use this app	adapted from Xi and Hamari, 2019; Standage et al., 2005
A3	I feel free to decide what activities to do in the app	adapted from Xi and Hamari, 2019; Standage et al., 2005
A4	When I use the app, it is because I want to use it	adapted from Xi and Hamari, 2019; Standage et al., 2005
Need for relatedness		
R1	When I use the app, I feel like other people care what I do	adapted from Xi and Hamari, 2019
R2	When I use the app, I feel supported by others	adapted from Xi and Hamari, 2019
R3	When I use the app, I feel that I am a valuable person to others	adapted from Xi and Hamari, 2019

R4	When I use the app, I feel that I am understood	adapted from Xi and Hamari, 2019
Autonomous motivation		
Intrinsic motivation		
IN1	I use the app because it is fun	adapted from Standage et al., 2005
IN2	I use the app because I like it	adapted from Standage et al., 2005
IN3	I use the app because it is interesting	adapted from Standage et al., 2005
Identified motivation		
ID1	I use the app because I would like to change my current behavior	adapted from Standage et al., 2005
ID2	I use the app because I want to improve my pro-environmental behavior	adapted from Standage et al., 2005
ID3	I use the app because I consider having a more pro-envirnmental behavior important	adapted from Standage et al., 2005

5.5. Data analysis procedures

One of the most used methods in this researches is the Structural Equation Model or SEM and the SmartPLS (Smart Partial Least Squares).

When the conceptual model, like in our instance, is complicated and contains numerous indicators and latent variables, as well as constructs with formative indicators, PLS is more appropriate than other techniques, such as covariance-based structural equation modeling (Chin, 2010; Hair et al., 2011). Furthermore, when the sample size is smaller it is more suitable (Reinartz et al., 2009).

6. Expected Contributions

6.1. Scholarly Contributions

There are several ways in which this study adds to the body of literature. First and foremost, it fills a gap in the present academic literature on gamification that has existed for some time. In fact, the academic community is currently learning about how gamification may be used with environmental themes and how it can be used to increase engagement on this issue (Ouariachi et al., 2020)

Studies that have been conducted so far appear to indicate positive relationships between various gamification features and intrinsic need satisfaction (Bormann & Greitemeyer, 2015; Peng et al., 2012; van Roy & Zaman, 2018); however, they paint a very partial picture in that most studies investigate either a very limited set of gamification features or only a portion of intrinsic needs (van Roy & Zaman, 2018) or they have concentrated on the notion of gamification as an all-encompassing term (Johnson et al., 2016; Sailer et al., 2017).

For example, in-game narration can help players see opportunities for meaningful choices and connections (Bormann & Greitemeyer, 2015); and weekly challenges, badges, and group competition can help users feel more autonomous, competent, and related (van Roy & Zaman, 2018).

Furthermore, several studies on gamification have been critiqued for lacking the use of proven tools in their research (Matallaoui et al., n.d.).

So the goal of this study is to gain a better understanding of how gamification enhances individual's motivation. In particular, this study is intended to empirically examine, using the self-determination theory, the impact of various game elements included in apps that are intended to help people to implement a more sustainable behavior, on the satisfaction of the three basic psychological needs of competence, autonomy, and relatedness, which will affect autonomous motivation.

6.2. Implications for Business and Society

In general, the findings of this study might be helpful to app developers in order to increase the efficacy of the game elements used in order to increase motivation or see what are the most effective.

It could also be interesting to make a comparison between the findings of game elements applied in fields other than the environmental one.

Finally, as was said in the beginning nowadays more and more people are becoming aware about the climate crisis and that suggests that the number of people interested in engaging a sustainable behavior is increasing but a conspicuous number of them then does not actually act following this intention and there have been some studies done in order to understand the reasons behind this behavior (Ceglia et al., 2015; Hanss et al., 2016; Peattie, 2010, p. 213). Therefore, it would be interesting to determine whether or not game elements can have an impact on the motivation to behave sustainably of individuals since that could potentially also lead to a change in their behavior.

7. Chapters Overview

Introduction

Theoretical Framing

       Pro-environmental behavior

       Sustainability and technology

       Gamification

       Gamification and motivation

       Theory

Literature review

Research model and hypotheses

Methodology

       Research design

Expected contributions

       Scholarly contributions

       Implications for business and society

Data analysis

Results

Discussion

Conclusion and future research

8. Work Plan

Table 3: Work plan

DEADLINES	OBJECTIVES
October the 3rd 2021	Exposée submission
End of october 2021	Survey and methodology development
Beginning of november 2021	Survey test and eventual modifications
November 2021	Data collection
November/december 2021	Data analysis
Beginning of january 2022	Conclusions and thesis submission

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