

Thesis (UAS)

Information and Communications Technology

Game Technology

2018

Toni Laaksonen

# GAMIFICATION IN AN END- DEVICE LIMITED ENVIRONMENT

**TURKU AMK**   
TURKU UNIVERSITY OF  
APPLIED SCIENCES

Toni Laaksonen

# PELILLISTÄMINEN PÄÄTELAITE- RAJOITETUSSA YMPÄRISTÖSSÄ

Pelillistäminen, eli videopeleistä tuttujen elementtien liittäminen arkipäivän tilanteisiin, on ollut kasvava bisnestrendi tällä vuosikymmenellä. Oikein toteutettuna pelillistäminen kasvattaa käyttäjien motivaatiota sitoutua pelillistettyyn tuotteeseen tai palveluun. Alkeellisia pelillistämisen muotoja on ollut olemassa jo viime vuosisadan alusta lähtien, mutta nykyään erilaisten päätelaitteiden käyttö pelillistämässä on kasvanut digitalisaation ja älylaitteiden suosion myötä. Pelillistämisuunnittelijan tulee tietää mahdolliset pelillistämisen esteet, jotka vaikuttavat suunnittelu- ja kehitysprosessiin.

Tämä opinnäytetyö tutkii pelillistämiseen vaadittavia pelielementtejä, motivaatiotekijöitä, sekä pelillistämistä rajoittavia tekijöitä. Lisäksi se käy läpi älypuhelin- ja mobiililaajakaistojen levinneisyyttä, sillä useat pelillistetyt tuotteet ovat sidoksissa älypuhelinsovelluksiin. Opinnäytetyön käytännön osiossa tutkitaan, miten pelillistämistä voidaan hyödyntää kauppojen kassoilla ja kuinka toteuttamiskelpoinen kyseinen toimenpide olisi. Tätä varten kehitettiin EPOS-demo, jonka tehtävänä oli mallintaa pelillistetyn kassakoneen toimivuutta. Demon kehityssuuntaa ohjasivat pelillistämisen teoria sekä palaute kaupan alan ekspertiltä ja opinnäytetyön tilaajalta.

Kauppojen kassojen pelillistämiseen liittyy joukko haasteita, jotka vaihtelevat muun muassa kauppoittain ja ikäryhmittäin. Tutkimuksessa lähdettiin liikkeelle oletuksesta, että kaupan työntekijän skannausnopeus on työn tehokkuutta mittaava päätekijä, mutta tosiasiaa näin ei aina ole. Yleisesti voidaan todeta, että uutena alana pelillistämiseen käytettyjä päätelaitteita on tutkittu melko vähän, ja useat alan tutkimukset koskevat pelillistämisen motivaatiopuolta tai pelillistämiseen liittyvää dataa. Sama pätee muiden kauppaketjujen pelillistämiprojekteihin, ja kyseisiä projekteja ei joko ole tai julkisesti saatavilla oleva tieto on vähäistä. Tästä huolimatta löytyy monia tilanteita, joissa päätelaitteiden on mukauduttava pelillistämisen käyttöympäristöön tai käyttäjäkuntaan, ja tämä näkyy usein myös päätelaitteissa tai niiden poissaolossa.

## ASIASANAT:

pelillistäminen, päätelaite, ydinvietti, pelielementit, pelimekaniikat

BACHELOR'S THESIS (UAS) | ABSTRACT

TURKU UNIVERSITY OF APPLIED SCIENCES

Information and Communications Technology | Game technology

2018 | Total number of pages: 47

Supervisor: Principal Lecturer Mika Luimula, Adj.Prof.

Toni Laaksonen

# GAMIFICATION IN AN END-DEVICE LIMITED ENVIRONMENT

Gamification, the insertion of video game elements into everyday life situations, has been a growing business trend in this decade. If implemented correctly, gamification increases the motivation of users to engage with the gamified product or service. Primitive forms of gamification have existed since the beginning of the last century, but nowadays the usage of various end-devices has grown thanks to digitalization and the popularity of smart devices. A gamification designer must know the potential barriers for gamification, which affect the planning- and designing process.

This thesis explores game elements and motivational factors required for gamification, as well as factors restricting gamification. The adoption rates of smartphones and mobile internet connections are also examined, because many gamified products are tied to smartphone applications. The practical part of this thesis explores the possibility of gamifying store checkouts and the viability of such operation. For this purpose an EPOS demo was developed, which was used to model the functionality of a gamified cash register. The development of the demo was guided by gamification theory and feedback from an expert in the market industry and the commissioner.

The gamification of store checkouts comes with a group of challenges, which vary between stores and age groups among others. The research started from a premise that the scanning speed of a cashier is the defining factor for the cashier's efficiency, but in reality this is not always the case. It can be stated generally that as a new industry the end devices used for gamification have not been researched much at all, and many gamification research articles discuss the motivational aspects of gamification or the data used for it. The same goes for gamification projects undertaken by other store chains, and these projects either do not exist or the publicly released data regarding them is very sparse. Even so, there are many situations where the end devices have to accommodate for the gamified operating environment or userbase, and this can usually be seen in the end devices or lack of such devices.

KEYWORDS:

gamification, end device, core drives, game elements, game mechanics

# TABLE OF CONTENTS

<b>1 INTRODUCTION</b>	<b>6</b>
<b>2 GAMIFICATION IN GENERAL</b>	<b>7</b>
2.1 Game Elements	7
2.2 User Motivation and Core Drives	9
2.3 History	11
2.4 Markets and the Future	12
2.5 Ethics	13
2.6 Legality Issues	15
2.7 Common Criticism	16
<b>3 DESIGNING AND IMPLEMENTING A GAMIFIED SYSTEM</b>	<b>18</b>
3.1 Implementing Usable Data to Game Mechanics	18
3.2 Expanding the Core Drives	19
3.2.1 Common Design Failures	20
3.2.2 White Hat Drives and Black Hat Drives	20
3.2.3 Intrinsic Versus Extrinsic Motivation	21
3.3 User Participation	22
3.3.1 Smart Devices	22
3.3.2 Mobile Internet Access	23
3.4 Workplace Conditions Affecting End-Devices	24
3.4.1 Restrictive Work Equipment	25
3.4.2 The Lack of Mobile Internet	26
<b>4 EPOS DEMO</b>	<b>28</b>
4.1 The Problem and the Proposed Solution	28
4.2 Overview	28
4.3 General Description	29
4.4 Gamified Elements	30
4.5 Structure	32
4.5.1 Data Storing	32
4.5.2 User Interface and Interactions	33
4.5.3 Webcam Functions	34
4.6 Proof of Concept and Minimum Viable Product	35

4.7 The Opinion of an Expert	35
4.8 Proposed Changes for the Demo	38
4.9 Development- and Testing Plan Proposal	39
<b>5 CONCLUSION</b>	<b>42</b>
<b>REFERENCES</b>	<b>43</b>

## GLOSSARY

App	Short for application. Typically refers to publically available smartphone programs.
Big Data	Extremely large data sets which are usually too large for traditional data-processing software to work with.
CSV	Comma-separated Values, a type of text file.
Digitalization	The process in which data gets converted into digital form.
End device	PC, laptop, phone or any other type of consumer device.
EPOS	Electronic Point of Sale. A place or a device where a retail transaction is completed.
Game Dynamics	User behavior patterns that result from game mechanics.
Game Elements	The combination of game mechanics and game elements.
Game Mechanics	Methods of user interaction with a game.
Gamification	Application of game-design elements and game principles in non-game contexts.
Gamified System	Any product or service that has been gamified.
MVP	Minimum viable product, a version of a product that has enough features to be sold as a product for early adopters.
Smart Device	Small devices that can interact with the user and other smart devices.

# 1 INTRODUCTION

As video games become ever more popular in the modern society, the need to gamify services and products is growing exponentially. Adopting familiar features from video games into real life situations has proven to improve the commitment of users to a service or a product, therefore seeing the gamified product more favorably.

The world is digitalizing at an amazing pace meaning that more products and services are made accessible for smart devices like smart phones and tablets. Researching gamification, developing it, and investing in it has become inevitable for any adequately sized company. The term 'gamification' has been around since the last decade, but even though technological appliances fitting in pockets have become more common during this millennium gamification is not new as a concept. Different kinds of bonus cards, membership perks, and customer points have been an integral part of the consumer culture even before video games were invented in 1970's.

Implementing gamification has several variables the designer should be aware of. This thesis explores how the scarcity or lack of end devices affects the user experience and interactions, and what kind of situations, places, or environments may limit the availability of potential end devices. Whether a gamification designer should aim for a modern internet based system or an older implementation is not always clear.

Examining strictly the relationship between gamification and end-devices is not a simple task. Designing good gamified systems also depends heavily on understanding basic human needs and knowing what motivates employees and customers.

Gamification is always dependent on the underlying host system, and therefore it is good to know the current trends when it comes to electronics ownership and public internet access.

## 2 GAMIFICATION IN GENERAL

Gamification is a process where game design elements are used in non-game contexts to improve the motivation and activity of users (Deterding;et al., 2011). In this case game elements are a combination of game mechanics and game dynamics. Game mechanics define the user actions that are available to the player, while game dynamics are behavior patterns that result from these mechanics (Hunicke;et al., 2004). Gamification is in its core human-focused design, which in contrary to function-focused design is more concerned about the humans using the system than just seeing them as cogs which are part of a bigger machine (Chou, 2015a). In contrast to traditional marketing campaigns, gamification attempts to change how people behave rather than how they think (Schrape, 2014). However, it is important to note that gamification is not the main product itself, but it is tacked on to an existing product or a service to enhance it (Bunchball).

There is a clear line between games and gamification, and the two terms are similar for a reason. Gamification derives its elements from video games but tries to achieve a completely different goal with them (changing of behavior) while still using the same set of rules to guide the user towards a desired outcome. Gamification merely borrows elements from video games. It cannot really be confused with a full-fledged game due to the missing gameplay elements and common practices found in most video games. (Deterding;et al., 2011)

### 2.1 Game Elements

For the purposes of this thesis, any product or service which has gamification applied to it is referred as a gamified system.

In *Are We Playing Yet? A Review of Gamified Enterprise Systems* (Augustin, 2016) the authors identify six common game mechanics and dynamics that were implemented in applications by ten companies they researched. These mechanics and dynamics are feedback, goals, badges, point systems, leaderboards, and user levels.

Feedback is closely tied to the other mechanics on the list because the user needs to be informed if and when he has gained points, badges, or after completing events giving him a sense of achievement and progress.

Goals define what is possible and desirable in a gamified system. They guide the user towards a certain set of behavior by providing him with constant new content and challenges. Goals usually come in a form of a list, which clearly describes the requirements for said goals and progression towards them. Some goals may even require multiple people to complete and others may have time limitations. The former can improve the sense of community while the latter provides extra challenge.

Badges can be also regarded as achievements and in some cases the two are indistinguishable. They are either visible or hidden trophies granted from taking or completing actions outside the core activities. Collecting badges motivates the user to collect all of them by exploring the possibilities the gamified system provides, but some users may be discouraged if they cannot get the badges or already have all of them.

Points, as in any game, are a measure of progression. Completing goals earns the user points, and their amount usually correlates to the difficulty of said task. Point systems can be tied to user levels where a new level is reached upon a specific point threshold. In addition to granting feedback to the user, reaching higher user levels can be made more desirable by granting badges on certain level milestones. For example, the digital video game platform Steam does this by raising the user's Steam level after the user has collected enough badges or just being registered for a number of years. The last mechanic in this list, leaderboards, can be used to rank and share measurable characteristics between users. Various video games make leaderboards of various measurable variables, but in this case the main quantifiable action of the host system is the one that would end up as a leaderboard. User points and levels can also be formed into a leaderboard. Leaderboards can be a great way of motivating the user base through competition while also providing a sense of community, but the difficulty of getting to the top or the openly competitive environment may cause anxiety in some users. This can be circumvented by providing users with weekly and monthly boards or grouping users up in departments or groups to compete against other similar groups.

(Augustin, 2016)

Some of these elements work better with digitalized setups and some don't need anything digital at all. Leaderboards, points, and badges are relatively simple to implement even with a system that has no connection to smart-devices. Instant feedback is hard to make to work without a device that can produce the required feedback from user action. As an example of a simple gamified setup, a telemarketer company could use non-digital gamification with their employees. The leaderboard tracking the sales does not have to be anything more than a whiteboard where employees draw lines after con-



firming successful sales with a supervisor. The board could then be wiped every Monday morning to make it a weekly leaderboard. Most accomplished employees could get extra incentives as rewards such as phones or cruise tickets. This kind of system would be a very simple one that works with bare minimum necessities and is easy to implement and use.

## 2.2 User Motivation and Core Drives

When discussing why something becomes gamified and how it works, it all comes back to the users' motivation. Motivation is the driving force behind all humans and the reason they do what they do. A skillful gamification designer should arguably have a basic grasp on psychology to understand what drives the userbase and how to enkindle their motivation to engage with the business. With motivation being the key factor, it is important to note that some businesses cannot or should not be gamified for one reason or another. Investing huge amounts of money into gamification is not necessary if the motivation is there already and the target user already takes up the tasks and performs well on their own accord. Gamification is particularly good tool to encourage people to take up optional tasks, but it can also be used to make a mandatory task more productive. This does not mean that anything and everything can or should be gamified. If incentives are offered for filling reports or lists, the user may get sloppy in temptation for an easy reward. In dangerous worksites this would affect the workplace safety too. Tasks that require high amounts of skill or concentration, or tasks that involve human lives should never be gamified. Trying to make a heart surgeon work faster with gamification is a bad idea if there ever was one.

Different people are arguably motivated by different incentives, but overall there are innate basic drives that make us motivated to reach certain goals. Video games are particularly good at appealing to these drives. Yu-Kai Chou's Octalysis maps the most common drives for player motivation. There are eight main motivators that Chou calls Core Drives. (Chou, 2015a)

Epic meaning and calling describes the feeling a player has when he feels like he is doing something great or he was particularly chosen to do so, but which can also derive from 'beginner's luck'. Chou argues that this manifests as the player's initiative to maintain or help community projects.

Development and accomplishment is the player's inner motivation to make progress.

Chou bundles developing skills and overcoming challenges under this drive and emphasizes challenge in gathering badges and trophies. This is one of the easiest Core Drives to design and gamify.

Empowerment of creativity and feedback is the process where a player tries to figure something out, uses his creativity to solve the problem, and gains feedback on how he performed. Chou describes these drives as 'evergreen' which takes some responsibility away from the designer and trusts the players' inner creativity to make the activity engaging.

Ownership and possession makes us want to own something, and as a consequence make it better and own more of it. Chou points out the importance of virtual currencies and the innate human need to own wealth as the major driving factor. The feeling of ownership can be boosted by making what the player owns highly customizable.

Social influence and relatedness is dependent on people's need for social interactions and acceptance, but also encompasses competition and envy. The other factor, relatedness, means our habit of favoring familiar things, people, and events, which produces the feeling of nostalgia.

Scarcity and impatience takes advantage of us wanting something we cannot have, and therefore making us think about it more. Many mobile games use this method in a form of time gated content to appear more desirable.

Unpredictability and curiosity is the same drive which compels someone to finish a book or any other kind of good story. Not knowing what will happen next engages our brains, but Chou reminds that this is also the drive behind gambling. To put it simply, irrational actions that produce unpredictable results spark curiosity in players.

A bit different from other Core Drives is loss and avoidance. Chou describes this drive as the avoidance of negative things and fear of losing positive ones. Players take actions on their own accord if it seems they may lose work, time, or money, but also to avoid negative feelings like frustration and regret. Players more likely take up chances that are "fading away" to be sure not to lose the opportunity to do so forever. (Chou, 2015a)

The eight Core Drives can be further divided into subcategories, but that will be covered later in chapter 3. Chou states that not all of the Core Drives have to be present in gamification, but the ones that are should be implemented really well. Gamification is not the only context Core Drives can be applied to, and simple everyday phenomena like flash sales or marketing in general utilizes certain Core Drives to make an impulse purchase more likely. Advertising slogans like "Gather them all" appeals to ownership

and possession. "Buy before they are sold out!" appeals to scarcity and impatience. The American phenomenon of Black Friday is a huge annual event which takes advantage from one or two Core Drives (avoidance and scarcity with a side of social interactions too), but most hobbies or pastimes utilize them as well. Collecting stamps (or just collecting anything really) happens because of the Core Drive Ownership and Possession. On the internet tweeting or updating Facebook status are correlating to the need of social influence and social interactions.

### 2.3 History

While the exact time and place where gamification started is debatable, most people on the industry credit Nick Pelling for coming up with the term in 2003. He coined it as part of his consulting firm Conundra Ltd, but this first iteration of gamification was more video game focused (Pelling, 2011). Conundra's original website from 2004 tries to sell gamification as "evolving devices into entertaining platforms" and "sourcing, adapting or co-developing games and entertainments". After this the term briefly was lost into history but started to gain attention again around 2010 according to Google trends (Google, 2018).

Even before the term was invented, the principles behind gamification were not completely unknown. One of the greatest contributors to it has been Charles Coonradt and his book *The Game of Work*. It came out in 1984; eleven years after he had opened his consulting firm of the same name. Coonradt wanted to find out why people who found their work dreary still performed well when it came to their hobbies, even if working had the extra incentive of salary. He soon developed his five principles: clearly defined goals, better scorekeeping and scoreboards, more frequent feedback, a higher degree of personal choice of methods, and consistent coaching. This list of principles aligns surprisingly well with the previous notions about gamification mechanics and motivation. Even before The Internet and more than 20 years before the dawn of handheld electronics Coonradt successfully pinpointed the problem: "When performance is measured, performance improves". He argued that increasing the frequency of feedback and illustrating it in charts and graphs improves greatly both quantity and quality of job performance. (Kroguer, 2012)

Services even older than *Game of Work* have been around for decades, centuries even. The first appearances of systems that are even relatively close to gamification

were reliant on radically different things than modern pocket-sized end devices. Most notable of the early gamifiers is Sperry & Hutchinson Company, which started their Green Stamp program in 1892 (Hatala, 2013). The idea was simple: customers received S&H stamps when they purchased S&H products and could then exchange them into products they wanted in S&H redemption centers, which totaled over 600 at their peak. This example from history shows clearly, that a well-designed gamification system does not need fancy electronics to work. In the age of the smart phones digitalizing some parts of the system is sometimes desirable, necessary even, but history has told us that fancy electronics are not necessary for successful gamification. In Finland the S-card and Plus-card customer programs are a fine example of long lived primitive gamification.

## 2.4 Markets and the Future

Gamification is, for all means and purposes, a marketing buzzword (Schrape, 2014). A new technology-savvy generation is growing up with access to latest technology around the clock. Entering gamified situations in real life should not feel like an unfamiliar event for these people, and they have the ability to quickly catch on with the situation involving scores and leaderboards. It is almost inevitable that gamification is rising in the wake of social media and smart devices, not to forget the steady growth of video games from a fringe hobby into an 18.4 billion US dollars industry (Statista, 2017b).

According to Research and Markets the global worth of gamification was 1.65 billion dollars in 2015 (Research and Markets, 2016). The same site estimates that by 2020 the market has grown to 11.1 billion dollars. P&S Market Research estimates that gamification reaches market value of 22.9 billion dollars by 2022 (P&S Market Research, 2016). P&S tributes the growth to people's growing investment in social media and the widespread adoption of digital entertainment. Combined with the fact that gamification is shown to achieve concrete results through better motivation and engagement, future speculations for gamification look bright.

Gamification is more ubiquitous than it seems at a first glance. Huge international companies like Coca-Cola Company and Microsoft have tried it with varying success. The users of DevHub that finished building their site increased from 10% to 80% thanks to gamification methods (Takahashi, 2010). An American retail company Target added a small minigame for cashiers which gave immediate feedback about the optimal time it

takes to scan a product. It was received well by the cashiers (Rimon, 2015). Ford Canada gamified their learning portal leading to engagement and customer satisfaction rising (Hein, 2013).

Most discord that can be found online about gamification's supposed financial downfall comes from early 2010s, and time has shown that most of these accusations were wrong or exaggerated. Still, it is best to keep in mind that bad design can destroy any project and that markets are erratic by nature. We only ever hear of the grand successes while failed gamification attempts are buried in history.

## 2.5 Ethics

Gamification by its nature aims to change human behavior, so it is obvious that some may feel concerned about the many ethical problems such system poses. Due to its psychological nature, there have been concerns of using gamification to exploit the users. Usually if something can be exploited, it will be exploited. Gamification is still a young business, having been around less than a decade (depending when we deem it to have actually started), so it is confident to say we have not seen the worst of it by a long shot. When the video game industry started over 40 years ago we didn't have to think the ethical implications of loot boxes, pre-launch DLC, or microtransactions. Taking into account the recent controversies with loot boxes which have even spurred several politicians to comment on the situation (regarding gambling and child exploitation), it wouldn't be surprising to see bad gamification practices tried in the decades to come. That is if gamification ever makes it into main stream, and even video games took over 40 years to do so.

The ethics-related problems of gamification are close in kind with corporate ethics, which covers ethical principles and problems in business environments. One of the most quoted reports on the subject was written by Tae Wan Kim in 2015. He tackles briefly certain problems regarding exploitation and manipulation while offering solutions to both problems. (Kim, 2015)

Usually in the case of gamification the company benefits way more from the process than the user, but it is important to note that this is not ethically wrong. Business transactions and barter rarely go even when the benefits of both involved parties are examined. If a job seeker has a chance to work in a gamified environment, should he be paid

extra for it or is it a justifiable reason to cut his pay? Kim says it is hard to say one way or another when measuring gamification with the lens of 'fairness'. Overall, a gamified system must not treat its user as a mere tool. The basic nature of human beings must be respected, which manifests in corporation life as minimum wage or safety standards. In developed western countries this is the norm, and exploitation through coercion or deception rarely happens. There are some other pitfalls gamification can fall into, but it is highly dependent on the individual user. Kim uses an example where the gamified system and rewards are used by an adult userbase, but the system itself is designed as unnecessarily childish. This may signal to some adults, usually reasonably so, that their intelligence is being offended resulting in a negative user experience. A solution to this problem is studying how the gamified system is interpreted. Conducting inquiries and interviews on the intended userbase well before the system comes out is advisable. (Kim, 2015)

The core idea of gamification is to change how the user behaves, so it is incredibly easy to argue that gamification is manipulative by its very nature. Kim talks about 'justificatory quality' which measures the moral incentive behind an action. People take certain actions for certain reasons, but is it a problem when they take a moral action out of non-moral reasons? If the user acts not because the act itself was desirable, but instead out of the expectation for a reward, it would mean that the users lose the sight of the actual reason behind the act that makes it desirable in the first place. Kim calls this mental process 'bullshitification', a decision-making process where the game mechanics detach the user from the reason why their decision is desirable in the first place. A solution could be to have the users go through what Kim calls 'solemn time' where they learn about the wider ramifications of their jobs, and how it impacts and contributes to society. (Kim, 2015)

The man that was mentioned in chapter 2.2, Yu-Kai Chou, admits that gamification is indeed manipulation, but argues that the negative connotations that are linked to the term are exaggerated. Small gestures of manipulation are constantly present in everyday life, like when using words "please" and "thank you". Acts of manipulation like these are expected, even encouraged and taught. In Chou's view manipulation in gamification is completely acceptable, if it achieves in turning the workplace into "more interesting and engaging (as opposed to paying employees more)". He presents a simple litmus test to check whether a gamified system is ethical:

1. Is there full transparency on gamification's intended purpose?
2. Does the user implicitly or explicitly opt-in to the system?

In short, the gamified system must have no hidden agenda, the end goal must be clear to the user and opting into it must be voluntary. If the user misses opportunities or if there are negative consequences for those who ignore the system, then the system can be said to have problems which are ethics-related. People who don't care about the system will not sign up anyway, and gamification mainly works to convince those who sit on the fence. (Chou, 2015b)

## 2.6 Legality Issues

Gamification related legal issues, unlike other subjects we've discussed so far, are not too well documented. As a bottom line, same legal restrictions apply to gamification as video games. Most legal disputes vary between countries, but even so most are related to labor laws, data privacy, banking, or constitutional laws.

For any sort of leaderboard or point system to work, the gamified system needs to gather and store data about the users. The users have to agree with the terms of service where the purpose and usage of data collection and usage are defined. If the user does not want to have data gathered on him, he should be able to decline. In European Union the gamified system has to justify its purpose for data collection and what the data is used for, and it has to be in line with the privacy laws. Data that is not necessary should not be collected if the same end goal can be reached with less data, and the data that has been collected for one purpose should not be used for another (for advertizing for example). If the data can be linked to a specific individual, the system must have an explicit permission to do so. (Allen, 2016)

While a well-designed gamified system does not usually involve money or other types of virtual currency, some may do so and therefore banking laws start to apply to the system. Most important thing is to map how the virtual currency is acquired, how is it used, when can it be used, and who uses it. After that the owner and maintainer of the gamified system must sort out taxing, transactions, revenue, service fees, and accountancy. If the system is used outside the country of the owner company, additional regulations kick in regarding currency exchange, cash reserves, and money laundering. If the system has a gambling element to it (i.e randomized rewards for real money),

it is wise to familiarize oneself with the local gambling laws (Pillsbury Winthrop Shaw Pittman, 2018).

## 2.7 Common Criticism

While gamification related success stories are not too hard to find, there are skeptics whose opinions differ from the mainstream. It is easy to see gamification as just one of the fads of this particular decade, which inevitably dies down in time. "It is just hype, it will pass" is a common statement against gamification, while some argue that the real hype has not even started yet. Whatever the case may be, gamification is not a miracle solution you can slap on anything and get results straight away (Rimon, 2017). Successful gamification requires innovation and risk taking. Showering the users with points and badges without any further thought will not lead to any grand results, and constant competition will most likely cause stress among the userbase (if the system has been designed to be competitive). Lee Wilson argued back in 2011 that gamification is just a passing fad (Wilson, 2011), which seems to have been proven wrong as time has passed. He pointed out that gamified solutions only work on a certain subset of people, and for others they may feel like a chore. Like with so many other apps, there is a risk that people are entertained by a gamified system a week or two and then forget it. This pattern is more than common in the mobile game market. One of the factors for this is the lack of context meaning that repurposing mechanics randomly from video games while dropping the context behind may leave some people confused, since they have no experience with virtual reward systems. Wilson argues that reward systems cannot hold up just by their own merit, and user negligence follows. Reward systems are amplified when tied to a beautifully crafted world or an enticing story narrative and are not sustainable by themselves.

Kai Riemer has similar worries about gamification and shares them on his blog (Riemer, 2014). He points out, like Wilson, that gamification is likely a short-term solution to a long-term problem. He argues that the userbase's interest towards the system dwindles after they've earned a few badges and claimed their place on the leaderboard which most likely stagnates after a while. Another problem related to the leaderboards is competitiveness, which easily tires out majority of people who don't play games to be competitive. Arguably both problems can be avoided by designing the leaderboards to change weekly or monthly and emphasizing cooperation over competition. A game like



football can be competitive, but the cooperation between the team members is still a huge part of the game.

While Rimon argued that gamification is not a universal miracle solution, Riemer says that gamification is inherently trying to fix a problem that it possibly cannot fix no matter what. The problems with employee motivation lie deeper, and gamification is merely a band-aid. Employee disengagement can be a result from them failing to see the bigger picture of their actions, but the reasons may be elsewhere. Monotonous and repetitive work which offers no challenges or little variety is unquestionably a motivation zapper, but unlike the former problem, this can be fixed with gamification. Unfortunately, companies usually try quick band-aid type solutions instead of tackling deeper problems, and sometimes the solution to a problem in the company may not be gamification at all. Successful implementations of gamification by other companies and the hype it creates may cloud the judgment ability of the people in charge. This may lead to a false conclusion that anything and everything can be fixed by gamifying the problem area, when in truth the solution may be something completely different.

## 3 DESIGNING AND IMPLEMENTING A GAMIFIED SYSTEM

As stated before, gamification utilizes certain aspects of human psychology to achieve better results in the targeted field. Individual people are remarkably varied when it comes to what encourages them to do activities, and traits like age, culture, and gender only make matters worse for gamification designers. As stated in the Common Criticism (chapter 2.7), there is no miracle solution which applies to all users who interact with the gamified system.

### 3.1 Implementing Usable Data to Game Mechanics

We have talked about what motivates people and how different mechanics can be added to a system to make it more game-like. To make any use with this knowledge we need data.

Not that long ago an extensive gathering of what is called 'user activity data' was strictly limited to video games. Video games are by default an environment where everything the user does can be recorded and analyzed. The current trend of digitalizing everything possible has opened this opportunity to our everyday lives. As we live our lives and use services and products, we create huge amounts of data about our preferences, habits, and actions. Visiting a store generates data about our shopping habits, and driving somewhere in a car generates traffic data. The amount of data generated grows exponentially when we use digital applications like online shopping or social media platforms. Companies like Netflix, Amazon, and Facebook track user interactions online to use the resulting big data, a term used to describe huge data sets, to further improve their services. (Paharia, 2014)

In the case of the Target's cashier system (introduced in chapter 2.4) the data that gets collected is the cashier's time that it took to scan a product. The register then analyzes the elapsed time and provides the cashier with instant feedback: fast enough or too slow. This way the daily boring routine of scanning items becomes a game where the cashier competes against himself or other co-workers depending how the acceptable time frames are set. The instant feedback tells the cashiers how they are performing,

and if the performance has been sub-par, the cashier will know about it and has time to fix it before unexpectedly getting fired one day. The cash register is able to show the average speed of previous transactions and therefore offers the cashier a sense of accomplishment. (Rimon, 2015)

It is also important that a gamification design identifies correctly what the goal of the gamification should be in order to gather and process right kind of user data. There is a risk of emphasizing wrong behaviors that accidentally prioritize quantity over quality. A gamification consultant Andrzej Marczewski uses Twitter as an example, where at first it looks obvious that the desired quality for an awareness campaign is the number of tweets or retweets a participant makes. In actuality, the desired quality is the number of people who were reached via said tweets. In Marczewski's model the user gets points when he tweets or retweets about the campaign product. In the old model the participants were rewarded points for tweeting and retweeting with no upper limit for point accumulation, but this kind of reward system encouraged spamming. The number of points the participants could get in a day were eventually capped, and further plans were laid to factor in the follower counts of the participants to improve the overall quality of the campaign. (Marczewski, 2015)

In conclusion, the easiest place to implement gamification is in a situation where the nature of the underlying task is repetitive and easily recordable. It is easier in cases where the user already has a device at hand which he uses for his job and which can be programmed to record, analyze, and provide instant feedback based on the user's activities. The older the gamified system is the less data it likely gathers, while with modern apps there is no limit to what can kind of data can be collected.

### 3.2 Expanding the Core Drives

A developer can fail in designing a good video game. There is a ton of aspects that can go wrong and different video game genres have different priorities for avoiding design flaws. A failure may be caused by an external factor like oversaturated market for that particular genre or lazy marketing. Gamification is a rather different story, since it lacks many of the parts that make or break a video game. There are usually no characters, story, or graphics involved in gamification development, and that gives greater emphasis for the psychological aspects of gamification. This brings us back to Yu-Kai Chou's Core Drives.

### 3.2.1 Common Design Failures

Gamification has a myriad of different fields, situations, and tasks it can be applied to, but in the end it all comes back to the Core Drives and how they are utilized. Why is one service more enticing than another? Facebook is the world's biggest social media website while Google+ never took off, but why? Stian Sandsgaard provides examples of different games and service platforms, and explains how the Core Drives are utilized. In this case it is better to go through why certain gamification attempts failed and what they lacked. Facebook, as ubiquitous as it is, lacks meaning. While users enjoy using Facebook, all the hours it consumes are seen as a waste. The user does not feel like he is special or that he has changed or contributed to something important. Facebook's competitor Google+ lacks the development aspect, which makes the service feel inadequate for the user. There is no progress to be made, no struggle, and no sense of accomplishment, so users feel demotivated. In Google+'s case this proved to be particularly deadly, since the lack of this Core Drive also prevented the further usage of creativity and social influence. Facebook's other rival LinkedIn lacks creativity due to the site's nature involving employment. Users feel restricted about sharing most of their personal life since they are afraid it affects negatively on their chance to land a new job. Therefore they feel that their creativity is limited. (Sandsgaard, 2018)

### 3.2.2 White Hat Drives and Black Hat Drives

The Core Drives can be divided into two categories, which are White Hat Core Drives (accomplishment, meaning, empowerment) and Black Hat Core Drives (scarcity, avoidance, unpredictability). Ownership and Social Influence remain in the so called grey zone being part of neither. In short, White Hat Core Drives empower users while Black Hat Core Drives urge users to action. A good gamified system has both of these to balance each other out. Making the user feel empowered is useless if other urgent tasks keep the user occupied, and the lack of empowerment with constant sense of urgency makes the tasks feel boring. The user has to have a free reign to do what he wants but not without a sense of urgency or threat. Sandsgaard uses Minecraft as an example, where the player can build whatever he wants (empowerment), but the monsters will start coming once the night arrives (urgency) (Sandsgaard, 2018). If these two hats are not balanced correctly, it reflects negatively on the user. Constantly rush-

ing the player is tiring, especially when the rewards are uninteresting and the game lacks creative options to reach the daily goals. A good example of a game of this kind is Farmville. (Chou, 2015c)

### 3.2.3 Intrinsic Versus Extrinsic Motivation

Humans can derive motivation from many sources. We may strive for money, power, status, acceptance, excellence, and so on. Whatever the motivator may be, it can be classified as either an intrinsic or extrinsic motivator. Motivation is intrinsic when one wants to do an activity for the activity's sake with no external incentives. These motivations come from within us and are caused by our feelings, values or goals. We perform an activity because we want to be better at it or because finishing it makes us feel accomplished. Hobbies are usually driven by internal motivations of those who have them. Extrinsic motivation on the other hand is something that motivates us with incentives which come from outside our personal space. Most common example of this is salary, but extrinsic motivation can be in the form of other material goods. It is not bound to strictly material incentives either. School grades are another example of a material extrinsic motivator and praise would work as a non-material one. (Schinnerer, 2016)

The eight Core Drives can also be split to intrinsic ones (accomplishment, ownership and scarcity) and extrinsic ones (empowerment, social influence and unpredictability), or as Chou puts it, 'left brain (extrinsic) and right brain (intrinsic)' Core Drives. Meaning and avoidance are the ones that remain in the grey zone this time. It is worth mentioning that this is more of a case between 'emotional brain and logical brain', and not strictly between the actual locations of said brain halves. The left brain drives are connected to an outside incentive, be it a goal, an item, or something else worth obtaining. The right brain drives get completed because the task itself is rewarding. There is no solid consensus between researchers which motivations are strictly intrinsic and which are extrinsic. For example, Chou categorizes strive for mastery as an extrinsic drive, while the author Daniel Pink argues such motivation to be intrinsic. Chou bases this on the fact that the person who seeks to master something has a goal, which can be considered an external motivator (Chou, 2015d).

Considering White Hat Drives and Black Hat Drives, successful gamification can benefit from both intrinsic and extrinsic motivation types. When the motivation to perform a

task is intrinsic, it means the task itself is pleasant to do and as long as the task does not change radically, it remains so. When any task is inherently pleasant, it can be further enhanced with external motivators like achievements or levels. Even simple websites like Twitter have parts from all Core Drives, both intrinsic and extrinsic, but it is arguable that they are not there thanks to some grand gamification plan by the company, but merely because they are methods that have been proven to work over time. Twitter followers, responses, and the excitement of finding interesting content are aspects that provide intrinsic motivation to use the service, while likes, retweets, and follower count can be considered as extrinsic motivators. Single things are not always limited to a single Core Drive, and in this case 'followers' can fall under more than one Core Drive.

### 3.3 User Participation

A part of gamification development is figuring out what is the best way for the target users to interact with the gamified system. Sometimes the developer has very little say in the matter, but in the wake of more powerful smartphones and faster mobile internet, it is good to map out the adoption rates of these technologies.

#### 3.3.1 Smart Devices

How the users interact with the gamified system happens usually in the same way how the users interact with the host system. In most of the previously mentioned cases (in chapter 3.2.1) the main product is a website. It logically follows that the user requires a device which has an internet access to access the service. In these kinds of cases the gamified part is digital by default. The userbase needs an end device to access the service and therefore we don't have to ponder if they have an end device on hand or not to access the gamified elements. Of course some mechanics, like physical rewards, have to be deliberately moved outside the digital environment, but the majority of the basic gamified elements are still accessed through a smart device screen or a computer.

Smartphone applications, or apps, have become more and more frequent nowadays. Most large stores, brands, and companies have their own apps as extensions to their services. According to Pew Research Center, 73% of adult Americans owned a desk-

top or a laptop in 2015 and 68% owned a smartphone (up from 35% in 2011) (Anderson, 2015a).

In developing countries the ownership rate goes down drastically. In Africa there is either no data available in most countries, or the ownership percentages were under 30%. South-Africa has the highest smartphone ownership with 37% of adults owning one. In Eastern Europe Poland's percentage is 41% and Ukraine's 27%. China has a smartphone ownership rate of 58% and India stands at 17%. In some developing countries the smartphone adoption rates have skyrocketed in recent years. In two years (2013-2015) the percentage of smartphone users in Turkey went up by 42 points. In Chile and Brazil the number was 26. It is worth noting that men are more likely to have a smartphone in developing countries than women. (Poushter, 2016)

In USA young people tend to have smartphones more often than older people. The age group 18-29 has 86% smartphone ownership rate, while for people over 65 the percentage was 30%. People who are highly educated have a high income and live in urban areas are more likely to have smartphones, but in most cases the user penetration rate is over 50%. In addition to smartphones, tablet ownership has also gone up from 4% in 2010 to 45% in 2015. Same pattern applies as with smartphones: a typical tablet owner is young, educated, and has high income. (Anderson, 2015b)

When researching the possible end-devices which can be used in gamification, it is good to map out the public access to so called pocket devices. For example, would it be wise to establish a store which uses only credit card payments if nobody in that country has bank accounts? Based on the data, a more smart-device oriented gamification is not a bad idea in western countries, but in other places a more old-fashioned implementations would probably work better.

### 3.3.2 Mobile Internet Access

It is one thing to have a smart device in one's pocket as he goes through his daily routines, but to implement achievements, leaderboards and user levels successfully would in most cases require an internet connection. Accessing, manipulating, storing, and utilizing worthwhile data for the benefit of both the customers and the administrator an internet based solution with its own databases and servers would be an efficient solution.

According to StatCounter, the worldwide use of mobile internet exceeded traditional desktop based internet usage in 2016, even if desktops still hold the top spot in UK, USA, Australia, and Ireland. In these countries the difference was highest in USA with 16 percentage points (58% against 42%). The worldwide mobile internet usage rate is 51%. The CEO of StatCounter states that developers should make sure their websites are mobile friendly. If the same trend continues in the future, this will no doubt apply to gamified products as well. (StatCounter, 2016)

Internet World Stats estimates the number of people using the internet to be 4.15 billion at the end of 2017. If we go along the 2016 percentage of mobile internet users (51%), this would mean that in 2018 there is at least 2.11 billion people regularly using internet on their mobile devices. In developed countries the percentage of internet users is even higher, and in Europe 85% of the people use internet regularly. Going by the UK statistic of 44% mobile internet users, Europe would have around 309 million active mobile internet users. (Internet World Stats, 2017)

With such high percentages of mobile internet users, it does not seem like artificially restricting the end-devices used in gamification is a good idea. While traditional models of gamification, like bonus cards, still evidently work well, it is up to the developer to decide whether he wants to have internet functionality in the gamified system. Statistics point to the fact that there is no critical shortage of potential customers for smartphone based gamification. In many cases utilizing the internet is preferable, since the developer gets access to variety of functions like cloud services or databases. The potential amount of user activity data increases since smartphone features like location services can be fully utilized. On the downside such an internet heavy system would be more expensive to implement and to maintain.

### 3.4 Workplace Conditions Affecting End-Devices

Mobile apps and websites which are used through a mobile internet connection exist to serve a specific customer base. More and more large corporations have their own apps, websites, and programs to maintain services which anyone can use at their leisure. Customers tend to go wherever they please whenever they please and they are not tied down by regulations, rules, or guidelines restricting them from using services or devices. It is not rare to see an individual using his phone in a shop, on the street, in cafes, restaurants, buses, schools and so on. There are some exceptions like movie



theaters, but usually people don't let time and place interfere with their internet surfing. If a system that requires smart devices and internet connection is to be gamified, arguably the biggest potential audience consists of regular individual customers with access to said conveniences. As we have established before, having a smart device or a computer with internet access has become a norm during this decade.

Some problems may arise from the lack of viable end-devices or the lack of internet access when gamifying customers. Some popular 'regular customer' systems avoid this problem by not utilizing modern handheld technology at all, while some accept the risks involved. In the case where employees are the gamification target, the problems may be more persistent. Personal end devices can be forbidden in some professions involving hygiene or dangerous situations, and some work sites may be cut off from internet altogether.

#### 3.4.1 Restrictive Work Equipment

When it comes to gamifying employees, there exist completely different problems regarding end-devices. In most occupations people are hired to do a single task for money, which places certain requirements for their behavior in the workplace during working hours. It is hard for a cashier to check his phone during busy day shifts. Some employee groups are ill-fit for gamification due to the varying or busy nature of their jobs. Other jobs may lack necessary equipment to collect meaningful data, which is necessary for most gamification solutions. A good example would be a construction site employee, who may have to work on various locations throughout the year, usually has his hands full of practical tasks, and works in dusty or dirty environments ill suited for smartphone usage. Factors like these will no doubt affect negatively on the user engagement of any digitalized gamified system. Jobs which require high hygiene from the employee can also be restrictive. People handling or packing food products have to be careful about their smart device usage (at least in Finland). For example, a person who packs fruits and vegetables cannot use his phone during a shift due to hygienic reasons. This is due to smartphone screens having a huge concentration of bacteria on them. If a packer used his smartphone he would have to immediately wash his hands and get a new clean pair of work gloves. Regulations like these will likely lower the motivation or prevent completely the chance to check or update data on one's phone.

Even in an office an employee that is constantly seen browsing his phone during work hours may eventually face the ire of the upper management.

### 3.4.2 The Lack of Mobile Internet

We often take easy and fast access to internet as granted, but there exists some work environments where internet access is regulated, slow, or does not exist. If gamification is planned to be implemented in these kinds of workplaces, thought should be given to how the system is accessed and with what sort of device if at all. If any or all components of the system work in cloud, with no internet the need for an end-device can also become rather nonexistent. Internet limited areas may include ships, underground worksites, high security facilities, or otherwise distant places.

On board international cruise ships internet access may be limited or slow. The antennae aboard the ships are usually small and cannot provide reliable internet access to everyone needing it. In ports the signal may get blocked by tall buildings or natural formations (such as fjords in Norway). Some cruise ships offer wi-fi, but they may get congested during certain parts of the day or are expensive to use. If there are tourists from foreign countries, they may even have additional costs added to their regular mobile internet fees. Other factors limit the connectivity further, like sharp turns the ship makes, or parts of the ship themselves (funnel, mast, or hull). Ships not involved in tourism like research ships, cargo ships, or military ships don't fare much better. These kinds of ships have no incentive to offer high speed internet connection to a paying customer base, but they do recognize the importance of internet access for their employees (Intertanko, 2011). While a cargo ship may technically have internet access, it can be heavily regulated and monitored to prevent leaking of confidential information, broadband hogging, or preventing viruses. Individuals who have been assigned to elongated shipping duties often describe the on-board internet connection as "only good for checking email" in various forums. Sometimes the ships may take routes where there is no satellite coverage at all. This includes routes that are far north or far south, but it is not unheard of receiving signal in Svalbard or Antarctica. (Lyons, 2017)

Keeping all this in mind, gamifying a ship's crew or a having a gamified service platform for its tourists may face some annoying hurdles. Some problems apply to other transportation related work environments. Depending how fast we can connect to a service and use it generally tends to affect out motivation to use the service at all. The pa-

tience of an average human is rather limited, so guaranteeing the customers a staple internet connection is important. If the gamified system requires large amounts of data to be transferred, it may be wiser to keep possible gamified systems non-digital or think up alternative solutions. If the internet access is possible only occasionally (like when the ship arrives to a port), it may instigate "out of sight, out of mind" mentality among the users.

Other barriers to easy internet access may arise in more common workplaces. For example an odd-job man on a metro station construction yard 30 meters underground (or on any other similar installation) may have hard time getting working internet access. The construction site is dirty, damp, dark, and the ground blocks wireless internet signals quite efficiently. In sites like this an internet connected application is only accessible during the coffee break if even then. Other distant workplaces where internet connection can get bad may include forest maintaining, logging, and replanting sites for example. Same goes for people in active military duty in lightly urbanized areas. If a person is employed by the army, personal electronics that can capture and send audio and photo material may have restrictions on their usage during work time especially if they might cause safety hazards. These kinds of situations would include classified briefings or explosives preparation (Gerecht, 2011). In places with large concentration of people in otherwise secluded locations (like some military garrisons in Finland) the internet base stations may get clogged during evening hours.

## 4 EPOS DEMO

### 4.1 The Problem and the Proposed Solution

This part of the thesis focuses on a program which demonstrates how a gamified EPOS system would function. The abbreviation 'EPOS' comes from Electronic Point of Sale which refers to any computerized system which lets customers to pay for goods or services (Duval, 2012). The premise is that a cashier's work performance is largely tied to his speed when scanning customers' purchases. A cashier's job in any convenience store fits well to the theme of gamification. It is usually simple, repetitive, and boring, but easily quantifiable. While a more experienced cashier may have swift hands and good grasp on where the barcodes are in any given product, gamifying the situation can bring positive results especially for new employees. After they have learned how to use the EPOS machine (a cash register in this case), one of the hurdles in the way to better productivity is presumably with the scanning speed. Long days in front of a cash register may become dreary after some time. Making the process feel more like a game should improve the motivation of the cashiers and speed up the scanning process.

### 4.2 Overview

The company that has commissioned this thesis is not a video game or gamification company. The idea for the theme came as sort of a by-product from a gamification course organized by Turku University of Applied Sciences in fall of 2017. The course was attended by the commissioner company CGI Advanced Analytics Solutions (previously BigDataPump). The CEO of CGI Advanced Analytics Solutions, Martti Reilander, came up with the idea to research gamified EPOS systems around that time. The forte of this company is gathering and analyzing big data, and due to this fact there are no gamification related projects going on at the company at this moment. The other problem has to do with the fact that the author of this thesis is focused on studying programming, so designing a gamified system that has no digital elements would have been counterproductive.

Keeping all this in mind, it was figured out that the best way to develop a system that fits well with the theme of this thesis and that best utilizes the author's skills as a programmer is to design and program a simple EPOS cash register with integrated gamified features.

### 4.3 General Description

The main point of this EPOS demo is to demonstrate how gamification would work with a modern cash register. While it cannot function as an actual cash register, it can showcase how such a machine would work in practice to prove the point and feasibility of gamified EPOS systems. If this kind of system was to be developed and tested in a real life scenario, it would need the backing of a large store chain, but that is not the case here. For a student thesis there would have to have been an ongoing project underway in order to examine such a system in action, but instead the approach to this subject is very theoretical in this thesis. There is no indication that this kind of gamification project has ever been tried in Finland, and the documentation for other attempts at gamified EPOS systems is almost nonexistent. The only noteworthy mention belongs to the Target's "cashier game", which has been covered already in this thesis (Rimon, 2015).

Actual gamified EPOS machines would be used by cashiers in any store which has conveyor belt operated checkout points. Most people have a basic conception of how a cash register works seeing one operated almost daily. Implementing a gamified solution on top of that and explaining or showing how it works is easily understood even by people who are not so tech-savvy. Additionally, programming an EPOS demo from the ground up is a task that provides enough challenge for a programmer without the need for a whole team of UI designers, artists, and sound designers. Since CGI Advanced Analytics Solutions owns no cash registers or other EPOS systems, Unity 2017.3.x game engine will be used for this task with coding done in C# programming language. The demo is therefore usable in most windows-based machines and Android-based peripherals.

#### 4.4 Gamified Elements

The gamified elements of this EPOS demo are similar to what Target uses (Rimon, 2015). The system measures the scanning time between items as they come along from the conveyor belt. Scanning items becomes a game where the cashier competes against a preset par time. This time can be randomly picked or it can be based on the average of each individual employee or the average of all employees. The scan will get marked as green if it was under the par and red if it was over the par. Other colors could be implemented too, like yellow for 'just quick enough' and orange for 'just a bit too slow'. Concluded transactions have a 'quick scan percentage' to indicate how many scans were under the desired time limit. The quicker the scanning, the more efficient the checkout procedure becomes which in turn improves the customer experience and makes the store more profitable and the employees feel accomplished. If the employee refuses to participate in gamification, these functions can be turned off.

The element that measures the success of this particular system is the scanning speed of the employee and the 'quick scan percent' he has accumulated. Averages can then be calculated from this data and we can calculate numbers like 'average scanning time per product' or 'average quick scans per day'. This data is available to the cashier and employer in a separate platform, preferably an extranet of the employer company. In the context of this thesis such extranet will not be simulated in its full capacity, but the EPOS demo can show individual cashier data on demand. Based on this data the cashier can strive for self improvement, since he now has a concrete statistics about his own work performance. Therefore he can more easily justify to himself that he should put in effort to improve himself. Meanwhile, the employer gets a solid set of data which indicates the productivity of each cashier. This makes it easier to pinpoint problem cases and provide them extra care and guidance that wouldn't necessarily happen in normal circumstances.

Another feature this demo has is badges (or alternatively called achievements, the idea is the same). Each cashier has a set of lifetime and daily badges to pursue (daily badges reset on midnight). Daily badges which get randomized every day can offer cashiers a sense of unpredictability and excitement, but coming up with a varied selection of badges based on just the scan times is challenging. Ideally these badges should be related to the quick scan percentages of the cashier since it is the biggest aspect that he can influence in himself by trying harder. There is a possibility for the employer

to give out material rewards to cashiers who achieve said badges one day after another, but that is something this demo cannot unfortunately mimic. Achieving things, even if they only exist in virtual space, gives most people a rush of joy. In some cases they may even indicate status and prowess. Another option is to add badges that correlate for thresholds of sold item costs that get accumulated, or selling an amount of different product categories (“sell 50 dairy products” for example), but these kinds of badges are not as effective since the cashier cannot directly affect which items the customers are purchasing. Nevertheless, they can function as information tidbits that the cashiers may find interesting to know.

Additionally, a leaderboard is a possible extension if enough employees participate in the gamification. One model would be to make stores compete against each other for best average scan times, and once the week is over the leaderboard resets. This way the system resembles more of a team game, and more anxious employees who don't care much for competition have fewer reasons to opt out.

From the Core Drives' perspective, the demo utilizes mainly Accomplishment and Empowerment Core Drives. Both are White Hat Core Drives, but Accomplishment is extrinsic motivator while Empowerment is intrinsic. This provides a nice balance to the Core Drives even with the absence of a Black Hat drive, but, to be fair, how much urgency should a cash register provide? In this kind of work environment it is not the best gamification practice to make the employee feel hurried.

A system like this can potentially be crammed full of all sorts of gamified features, but it is important that the underlying system remains balanced and optimal in its functions and presentation. It is best not to use the eight Core Drives as a checklist and cram features into an environment they don't fit in. The cashiers should not be constantly preoccupied with gamified content which distracts them from the actual job. The system that uses these functions is just a cash register after all. It is good to keep in mind that we are dealing with a limited system on a limited hardware setup where new features cannot be added on a whim (nor is there any need for them to be added) like could be done with a commercial website for example.

Lastly, the method of feedback should be addressed. Currently whenever a cashier achieves something he gets a quick message which is comparable to a toast message on smartphones. Alternative messaging methods are possible, and instead of a written message a small achievement icon could be used. Optimally the achievement notifica-

tion should not steal the cashier's attention for too long, but the progress he makes should still be visually quantified. The successful scans in a transaction are viewable for the cashier if the transaction happens to be visible in the Transaction History window (Figure1, window 1). Logging out will clear this window.

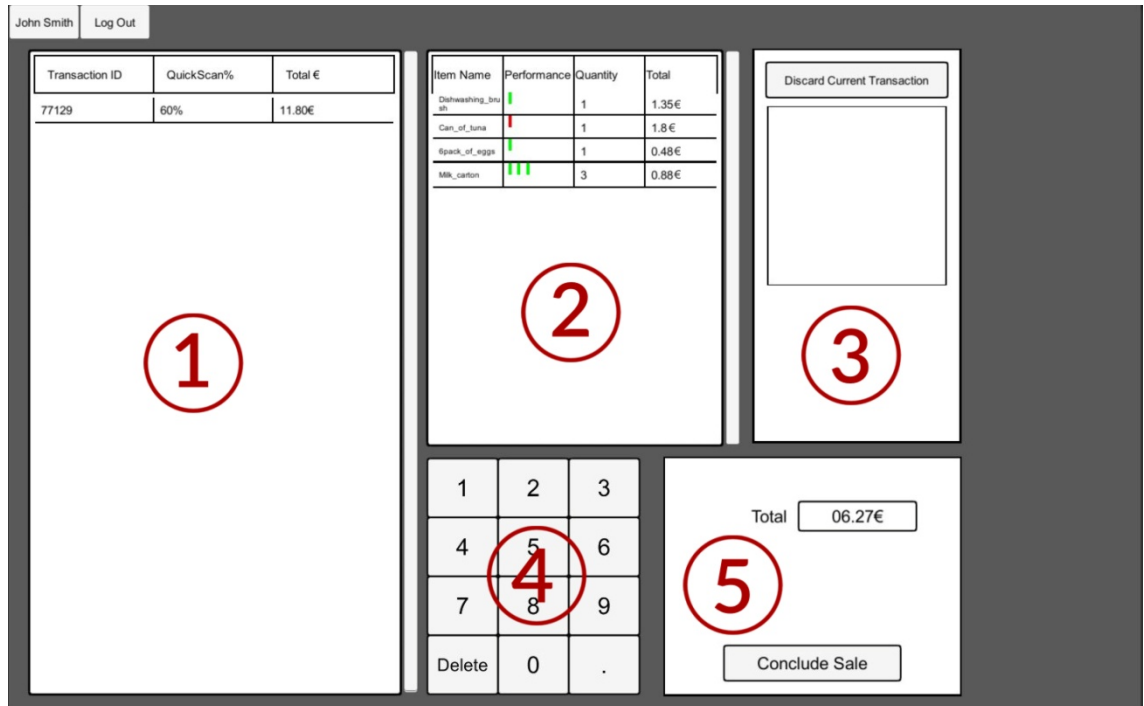


Figure 1: User interface

#### 4.5 Structure

This program is rather simple so the user does not have awfully lot of interactions to begin with. Scanning items is the main interaction the user is expected to take and that is the gauge the instant feedback is based on. The UI itself is simplistic, and some functions which are present in typical EPOS systems are missing since they are not necessary for the demo. All user and item data is saved as either CSV-files or binary-files.

##### 4.5.1 Data Storing

Each user account has a name, id, list of transactions, and badges of both daily and lifetime variant. Every concluded transaction produces a receipt with its own item list,



date, and transaction id. The user data is saved in binary files made by Unity's BinaryDecoder-class. StreamWriter and -Reader are also used for this purpose. Saving and reading long item lists in binary files is faster than doing so with CSV-files, especially since the CSV files get long quickly with scanning data. Item data which is fetched with each scan is still saved in CSV files, since the item list this demo uses will not be inconveniently long. Furthermore these CSV-lists can be opened in Excel or similar programs for easy insertion and deletion of items. Each item has its own id, name, type, cost, and weight. The program still has a class that performs CSV writing and parsing, but the employee-files that are created this way are meant only for backup.

#### 4.5.2 User Interface and Interactions

Most of the program works through Manager-class, which has most of the crucial functions the demo needs to perform. It performs the employee log in and log out, item scans, concluding transactions, updating UI elements, and saving data. The user can use a webcam to scan real life barcodes which then get converted into integers. The program automatically detects the default webcam connected to the computer. Alternatively the user can scan a random item by pressing 'S' which causes a random item from the item list to be scanned. However, this is not ideal for potential demoing purposes, and the use of the webcam is encouraged.

The main user interface is split into smaller windows (Figure1) some of which hold data, buttons, or both. Window 1 lists recent transactions including the total cost and the percent of scans which were under the preset threshold. Window 2 holds individual item data of the items which are scanned as part of the ongoing transaction. Next to the name of the item are the colored bars that indicate whether the item was scanned quickly enough. Green indicates a scan time below the threshold and red means that the scan took too long to perform. Window 3 was designed as a utility space for extra actions, but in the current version it is mainly used to hold the button to erase the current transaction. The square under it shows the webcam image if one is connected to the computer. This makes scanning products easier since actual scanners with laser pointers are not being used. Window 4 is the number pad. By pressing any number the system adds that many items to the current transaction of most recently scanned item variety. If the last scanned product is a can of tuna, then pressing the number would add that many cans of tuna to the transaction. Delete cancels the last scanned item

regardless whether it was added by actually scanning it or via the number pad. Window 5 shows the total cost of the current transaction and lets the cashier conclude it when needed. In the context of this demo it is assumed that the customer always pays by card and it happens instantly. A new transaction is created the moment the cashier scans something again which causes the clock to start ticking. If the user needs to log out the button for that is in the upper left corner.

The program has a separate screen which shows the user information about the current employee. This includes lifetime and daily quick scan percentages, badges, average scan times and other information which the demo user may find useful. If this was an actual EPOS system, it is best if the data was not accessible for the cashier through the EPOS machine. A permanent access to his personal scanning data by the employee through his cash register is not required for him to perform his job (aside from the badges). The main focus point is the instant feedback the EPOS system provides. In this particular case it may be optimal to make any employee data available only on the company's extranet for example. This way it can be assured that the employee will not get preoccupied with anything outside his actual job and any sort of achievement or statistics checking can be left for coffee breaks or outside work time altogether.

#### 4.5.3 Webcam Functions

The webcam functionality was created by a GitHub user Kefniark, and the scripts are free to use open source code (kefniark, 2018). The results varied on how quickly the webcam notices the barcode. When tested with a Logitech C170 webcam, the results were poor even in bright lamplight and only the biggest barcodes were correctly scanned such as ones in 1.5 liter soft drink bottles with barcode being in white background. Smaller barcodes were either ignored or resulted in a faulty integer output. A webcam mounted on an old Fujitsu Siemens laptop from 2012 worked surprisingly much better with even smaller barcodes on items like deodorant bottles and toothpaste tubes. When reading barcodes directly from a computer screen the results were much better with both webcams. It has to be mentioned that a laptop webcam is much harder to point at a computer screen, and it naturally cannot be pointed towards the screen of the same laptop. A standalone webcam works best for the purpose. To make the program interact with the barcodes they have to be added to the item data CSV-file as

integers. After that they can be used instead of the S-key granted that the surrounding environment is well lit preferably with natural sunlight.

#### 4.6 Proof of Concept and Minimum Viable Product

As stated before, the company that commissioned this thesis has no EPOS systems and therefore this demo works mainly to show how EPOS systems could potentially be gamified. It is an estimation of how a gamified EPOS system would look like and how it would work, but it cannot be tested in actual store environment without cooperation and further development from companies involved in convenience store business. This demo could be characterized as something close to a proof of concept (PoC) or minimum viable product (MVP). It is meant to work as a comparison to regular EPOS systems that lack the gamified features, and upgrading it to an MVP would require the contribution of an actual store chain to access the information about the development platform, databases, cloud services, and so on. Unlike the demo, an actual MVP product could be tested in a real store environment.

Unlike in other fields, a PoC in software development is meant to demonstrate that the actual product can be built and with what kind of technology (Technopedia a). The main goal may not be to deliver anything concrete when it comes to software, and the final product can be merely a report that addresses technical problems and satisfies the requirements that have been set for the project. A good proof of concept helps the company save money and it can give leverage over stakeholders. MVP in this case would be a program that actually works and can technically be sold to early adopters. It needs to have enough value for people to use it, it needs to demonstrate future benefit, and it can provide feedback for future development (Technopedia b). The demo is an actual program, so in that sense it has exceeded the minimum requirement for a PoC regarding programming, but the demo itself cannot be commercialized as it is only meant to demonstrate a feature. The demo cannot replace an actual EPOS machine just like that, and therefore trying to sell copies of it is unviable.

#### 4.7 The Opinion of an Expert

To acquire more information and feedback about possible merits and downfalls of this kind of gamified EPOS system, a local market manager from Turku was interviewed.

Tanja Salminen with over 30 years of market experience shared her thoughts about the project.

The most important point which came up in the interview was that speed is not always the best factor to measure the efficiency of a cashier and solely focusing on speed may hamper accuracy: "There are customers who want to see each product scanned to see the cost, and they don't necessarily even start packing but instead wait until all the products are at the trough (the end bit of the conveyor belt). In the case the customer has made large purchases the trough may get full fast which forces the cashier to slow down or wait. --Sometimes the customers could think how to better place the purchases onto the conveyor belt. Some of them like to pile the products up and it interferes with the belt moving sensors. It takes time for the cashier to dismantle the pile and items like shopping bags may be at the very bottom. --Another problem is that the EAN-codes can be faulty. Sometimes they are too smudged, sometimes too shiny, and sometimes they are in a weird place and may require straightening. Some batches may be alright and others unreadable." From this statement we can conclude that there are external factors which affect the cashier's ability to work fast. If the EPOS machine refuses to read the barcode or if the scanning procedure becomes sluggish due to the actions of the customer we cannot hold the cashier responsible for it. Some customers start packing their purchases faster than others and some are naturally faster at it. A young person will probably perform this act faster than a pensioner. Another problem comes from the cashier's other duties which he has to undertake during his shift at the cash register as seen in the next paragraph.

"In some cases we have to ask the customer for identification for tobacco, alcohol, or gambling, and the procedure has been set to be very strict. The customer has to be greeted before starting and the ID must be checked by hand (not just glanced over quickly). The cashier cannot just ask them while he is scanning the products. Their work nowadays is monitoring in large parts, and the cashiers need to have their eyes everywhere. It may seem easy to just swipe the products along the belt but the cashier needs to keep an eye out on the slot machines, someone may ask about tobacco or so, or the EPOS machine may not give the item data at all which halts the whole procedure. If the screen is not properly attended, possible errors may accumulate." This statement furthermore indicates that the main trait a good cashier should have is accuracy instead of speed. Blindly focusing on scanning reduces the attention the cashier

can pay to the rest of his surrounding which proves to be detrimental to his other duties as a cashier.

Up to this point a lot has been said about the duties of a cashier, but it is important to go through possible motivational problems too: "Many of our employees are clearly just 'passing by' and have no intention of staying in the industry. One of the biggest problems we have is to make the work so desirable that people would actively seek out to work here. Some take up the job for the duration of studying, but we do have some permanent employees here and they definitely don't come to work with 'I'll just do this thing and go home' attitude. --There are lots of things that employees have to find out themselves. We have a myriad of things we inform and get informed about, but the flood of emails is sometimes unimaginable---. But there are matters that require initiative and activity from the employees themselves. Some open up easily about their problems and some can be noticed through their behavior. In the latter case it is best to go ask them if everything's alright. We have a system where employees can submit feedback about their feelings and problems, but even so we have to notice and intervene in possible motivational problems with the employees." It is interesting to notice that not all motivation problems that an employee may have are caused by the monotonous nature of the job, and some may very well come from outside the job. While older and more experienced employees may get little benefit from a gamified EPOS, newer and younger employees who are accustomed to video games may find the system more beneficial. Same kind of conclusions have been reached at Target, where older employees were more skeptical about the system but younger people found the 'scanning game' more interesting (Rimon, 2015).

"I will not endorse that speed is the most important aspect because there are lots of situations where the cashier has to, and should, slow down. Customers may not experience that the cashier is concentrating to them and only them in the situation if the items get scanned with unnecessary speed. Today customers are seeking an experience in a way, and we have to exceed the customers' expectations, and it may be dependent on how different customers act on the spot."

If a gamified EPOS system succeeds in motivating the employee to scan products faster (in cases where there are minimal external factors), there are still issues with other duties the cashier has. If cashiers' performance was dependent of the scanning speed only, there would be no problems with the achievement and feedback system that is currently present in the demo. While faster average scanning speed would lead

eventually to better productivity, it is not worth sacrificing quality over quantity, or not in the case of this particular store at least. Instead of just speed, the EPOS should react and give feedback based on other interactions as well if possible. The store that was featured in this interview was rather small in size with only two checkout points. Larger stores can have as much as twenty or thirty, and the preferable traits and job description may change between store chains and countries. A speed-based gamification may not work so well in smaller Finnish stores, but we cannot be sure with large American stores for example.

#### 4.8 Proposed Changes for the Demo

After hearing what an expert had to say about the demo and gamification regarding EPOS systems, there are some alternative ways this problem can be approached.

The major hurdle that has to be addressed is the favoring of speed over other qualities of a cashier. Unfortunately the cash register cannot quantify interactions with the customers, following the monitors, or keeping track of whether the trough is full. Instead the system could take into account possible distractions regarding the scanning process. Instead of giving instant feedback for every item based on strict time threshold, the whole transaction could be evaluated as a whole. For example, the overall performance score could be calculated by dividing the total time of the transaction by the number of items in that transaction (disregarding items added by the number pad). With this method one or two bad spikes in the scanning times will get diluted to the overall performance score. Adding a pause button for the scanning timer is one solution, but it must be considered thoroughly whether this kind of feature could be misused. Same problem comes with a hypothetical 'disregard latest scan time' button because we cannot guarantee any cashier not to use it even in situations where the slow scan time is his own fault. Different solutions could bring different results depending whether the store is large or small. The location of the store matters too, since different people from different nations have different priorities for their shopping experience. The 'cashier etiquette' also varies from country to country, and purely speed based gamification may work better in some places.

Some items that are large, bulky, or otherwise abnormally shaped usually take more time to scan. This problem can be alleviated by giving each item its own par time for scanning. Granted this would be a huge undertaking, and the par times would have to

be based on scanning data that has been accumulated over months from different employees. This would ensure that the scan time threshold (that has been set to three seconds right now in the demo) will not be arbitrary. This way any 'quick scans' are always below the average of the store employees.

There is another problem regarding feedback, which should be digitalized if it is not already. Instead of an EPOS machine, this should be done in the extranet where the employees could give feedback about general working conditions and feelings about their everyday work. This could contribute towards the achievement system somehow, but the concept would need a lot of fine tuning to work properly. A system like this would bring a little bit of social aspects into the mix, but in the final product it would not have any significant role.

#### 4.9 Development- and Testing Plan Proposal

In a normal case the program associated with the thesis would be tested in real life environment. Gamification is a concept that is very close to psychology and behavior, so developing and studying the effects of gamified products would have to last for months, maybe even years before the researcher has conclusive data that has meaningful value. In addition, the initiative for developing and testing a functional gamified EPOS system would have to come from a big store chain. This would require the commissioner company to be in the industry or to have close ties to it, but for a student's thesis these requirements cannot be met. Since actual testing cannot be conducted due to these reasons, a theoretical testing situation will be devised instead on how a company would approach developing and testing a gamified EPOS system. For the sake of this section we'll assume that the gamified elements of the hypothetical EPOS system are similar to the demo. This plan would be financed and carried out by a store chain that has necessary capital and motivation to implement gamification into their EPOS devices.

For this testing plan we are using a testing framework by Philipp Herzig, Michael Ameling, Bernhard Wolf, and Alexander Schill (Herzig;et.al., 2015). The framework consists of several work stages: business modeling, requirements, design, provisioning, implementation, testing, deployment, and monitoring. Additionally, there are specific groups each project member is allocated to: end-users, domain experts, business experts, gamification experts, and IT experts. End-users are store cashiers in this case

who have no actual say in the development process, but who in time provide feedback for the other groups. Domain experts are people who have a long history with working in stores and know the profession inside out. Business experts manage the goals, money and deadlines, but also keep the shareholders informed. IT experts know the existing system, how it functions, and how to upgrade it, but they also need to manage the tools required for the project and inform the other groups of software or hardware restrictions. Lastly, the gamification experts have a good grasp on human psychology and, in addition to knowing how to make a game system as compelling as possible, have preferably several successful gamification projects under their belt.

Once a store chain has decided to implement gamification into their EPOS system and gathered the required team members, the project moves to the business modeling stage. During this stage the domain experts tell the other groups which processes of the EPOS system should be gamified and what are the main objectives of the project. The domain experts know what the typical end user is like and what possible environmental variables exist. In the end of the business modeling stage all the other groups (excluding end-users) know them too.

After the business modeling, the project team starts to map out the requirements for the project. This involves all the groups except IT experts. During this stage the end users (cashiers) are analyzed to get more information about their engagement, motivations, and participation when it comes to their daily work. This data is usually gathered through interviews or questionnaires and in the end the project team should have a clear picture of what motivates the end users. This data should also indicate possible pros and cons regarding the gamification process. Once this is over, the groups must agree on the metrics of how the success of the system will be measured and what sort of quantifiable outcome is preferred.

The design stage is the next one and it is also one of the first iterative stages, meaning that the project team will come back to this stage multiple times after testing and getting feedback about the gamified system. The stage consists of mainly coming up with the overall gamification design by the gamification experts, which is then presented to the domain and business experts. If the stakeholders approve the concept, the stage moves on to playtesting which is conducted either with a low-fidelity prototype or a proof-of-concept software if the IT experts manage to build one in a reasonable amount of time. The playtesting is done with a group of end-users who can then share their



experiences of the trial. The cycle of design and playtesting continues until the shareholders settle on “a precise definition of the intended gamification concept”.

Once the concept is ready and the design document has been written, the IT experts start planning their solutions in the provisioning stage. Based on the concept, the IT experts choose what kind of tools and utilities they will use to make the concept reality. They are usually restricted by the existing infrastructure, which in this case is the EPOS system the company uses, and by the gamification concept itself. The IT experts have to usually consult the other groups in order to reach optimal provisioning.

After all the necessary equipment, software and hardware have been acquired, the actual work of implementing the gamification begins. Once again, this is mainly done by the IT experts. During this stage all the gamified elements are integrated to the existing system. In the EPOS case this means upgrading the OS to provide feedback to the employee based on the scanning speed and achieved badges. Additionally, the employee statistics that reside in the company’s database have to be updated to support the storing of scanning data and badges. Lastly, the company’s extranet needs to be able to show the gathered data to both employees and the employers. The desired output of this stage is a working testable prototype.

The prototype, which was produced in the previous stage, can now be tested in the testing stage. The testing makes sure the prototype is functional and bug free. Business-, domain-, and gamification experts participate in this stage along with the end users to provide additional feedback on the product to determine whether the prototype meets the expectations of the team. If all the tests are passed successfully, the product can be deployed.

After the deployment has been done successfully, the project team receives constant stream of data from the end-users on how the product works. This data can be compared to the expectations the team had before and use it to determine whether the implementation is successful. Based on the generated data and user feedback the team can go back to the design stage and reinvent some aspects of the product and improve others. Ideally, the scanning speed of the cashiers using the system should show signs of improvement over time. Whether or not this is the case, qualitative information can be collected from the end-users to determine how to improve the system in the next iteration.

## 5 CONCLUSION

This thesis examined the factors and situations that have impact on the availability of devices used for gamification. Publically available data, research, articles, and examples were used to support claims made in the thesis. As a practical project a gamified EPOS demo was developed by the author of the thesis, and a market manager gave her thought about the project.

For a game development student the greatest benefit from this subject was undoubtedly the eight Core Drives. Since modern gamification sprung off from video games, the same tricks which make gamification so addictive can be used in video games too. Knowing the Core Drives and how they are categorized into Black Hat drives, White Hat drives, Intrinsic Drives, and Extrinsic Drives gives a game developer deeper understanding why some games succeed where others fail.

There are myriad of ways gamification can manifest in, but it is usually the underlying host system that has the most weight on how the gamification development proceeds and what kind of end-devices get involved. In addition to the host system, the physical environment where the system is placed must be accounted for by the developer. It is the responsibility of the developer to know the target audience and available resources and use them in a way that brings the best possible outcome.

EPOS-related gamified systems are few and far between, and more of them need to be developed and tested by large companies to gather conclusive data whether they are worth the effort. In the case of the EPOS demo, the premise regarding the scanning speed was partly faulty, and other responsibilities of the cashier must be taken into account in the gamification process. Different cashier conducts and priorities in different countries and store chains bring about a bunch of variables for the developer to keep in mind. As it is with gamification in general, there is no miracle solution which works automatically in all stores.

## REFERENCES

- Allen, Kathryn. 2016.** The National Law Review. *Location Data Gathering Under Europe's New Privacy Laws.* [Online] 8 2016. <https://www.natlawreview.com/article/location-data-gathering-under-europe-s-new-privacy-laws>.
- Anderson, Monica. 2015a.** Technology Device Ownership: 2015. *pewinternet.org*. [Online] Pew Research Center, 10 2015a. <http://www.pewinternet.org/2015/10/29/technology-device-ownership-2015/>.
- . **2015b.** The Demographics of Device Ownership. *pewinternet.org*. [Online] Pew Research Center, 10 2015b. <http://www.pewinternet.org/2015/10/29/the-demographics-of-device-ownership/>.
- Augustin, Kai. 2016.** *Are We Playing Yet? A Review of Gamified Enterprise Systems.* s.l. : Pacific Asia Conference on Information Systems, 2016.
- Bunchball.** What Is Gamification? *Bunchball.com*. [Online] Bunchball. <https://www.bunchball.com/gamification>.
- Chou, Yu-Kai. 2015b.** Gamification, Manipulation, and Ethics. *Yu-kai Chou: Gamification & Behavioral Design*. [Online] 5 2015b. <http://yukaichou.com/gamification-study/gamification-manipulation-ethics/>.
- . **2015d.** Left Brain (Extrinsic) vs Right Brain (Intrinsic) Core Drives in Gamification. *Yu-kai Chou: Gamification & Behavioral Design*. [Online] 2015d. <http://yukaichou.com/gamification-study/left-brain-extrinsic-brain-intrinsic-core-drives-gamification/>.
- . **2015a.** Octalysis - Complete Gamification Framework. *Yu-kai Chou: Gamification & Behavioral Design*. [Online] 2015a. <http://yukaichou.com/gamification-examples/octalysis-complete-gamification-framework/>.
- . **2015c.** White Hat vs Black Hat Gamification in the Octalysis Framework. *Yu-kai Chou: Gamification & Behavioral Design*. [Online] 2015c. <http://yukaichou.com/gamification-study/white-hat-black-hat-gamification-octalysis-framework/>.

**Deterding, Sebastian;ym. 2011.** *From game design elements to gamefulness: defining "gamification"*. s.l. : ACM Digital Library, 2011.

**Duval, James. 2012.** What Are EPOS Systems, And How Do They Work? *Business 2 Community*. [Online] 10 2012. <https://www.business2community.com/sales-management/what-are-epos-systems-and-how-do-they-work-0319907>.

**Gerecht, Mark. 2011.** Can Army commands restrict on-duty cell phone use? *AskTop.net*. [Online] 2 2011. <http://asktop.net/q-and-a/can-army-commands-restrict-on-duty-cell-phone-use/?all=1>.

**Google. 2018.** Google Trends - gamification. *Google Trends*. [Online] Google Inc., 2018. <https://trends.google.com/trends/explore?date=all&q=gamification>.

**Hatala, Greg. 2013.** Made in Jersey: S&H Green Stamps - in the sixties, Americans were stuck on them. *nj.com*. [Online] 4 2013. [http://www.nj.com/business/index.ssf/2013/11/made\\_in\\_jersey\\_sh\\_green\\_stamps.html](http://www.nj.com/business/index.ssf/2013/11/made_in_jersey_sh_green_stamps.html).

**Hein, Rich. 2013.** How to Use Gamification to Engage Employees. *cio.com*. [Online] 6 2013. <https://www.cio.com/article/2453330/careers-staffing/how-to-use-gamification-to-engage-employees.html>.

**Herzig, Philipp;ym. 2015.** Gamification in Education and Business. *ResearchGate*. [Online] 1 2015. [https://www.researchgate.net/publication/278681698\\_Gamification\\_in\\_Education\\_and\\_Business](https://www.researchgate.net/publication/278681698_Gamification_in_Education_and_Business).

**Hunicke, Robin, LeBlanc, Marc and Zubeck, Robert. 2004.** MDA: A Formal Approach to Game Design and Game Research. *cs.northwestern.edu*. [Online] 2004. <https://www.cs.northwestern.edu/~hunicke/MDA.pdf>.

**Internet World Stats. 2017.** Internet Usage Statistics. *Internet World Stats*. [Online] 12 2017. <https://www.internetworldstats.com/stats.htm>.

**Intertanko. 2011.** Crew Internet Access on board Ship – a Best Practice Guide. *intertanko.com*. [Online] 8 2011. [https://www.intertanko.com/Global/admin\\_WeeklyNews/Copy%20of%20Crew%20Internet%20Access%20on%20board%20Ship%20-%20a%20Best%20Practice%20Guide%20PK.pdf](https://www.intertanko.com/Global/admin_WeeklyNews/Copy%20of%20Crew%20Internet%20Access%20on%20board%20Ship%20-%20a%20Best%20Practice%20Guide%20PK.pdf).

**kefniark. 2018.** Github. *Simple Unity Barcode Scanner*. [Online] 2 2018. <https://github.com/kefniark/UnityBarcodeScanner>.

**Kim, Tae Wan. 2015.** *Gamification Ethics: Exploitation and Manipulation*. Seoul : Gamifying Research Workshop Papers, 2015.

**Krogue, Ken. 2012.** 5 Gamification Rules From The Grandfather Of Gamification. *Forbes*. [Online] 7 2012. <https://www.forbes.com/sites/kenkrogue/2012/09/18/5-gamification-rules-from-the-grandfather-of-gamification/#330845c339f2>.

**Lyons, Ben. 2017.** Internet at Sea: 7 Things You Need to Know. *cruisecritic.com*. [Online] 9 2017. <https://www.cruisecritic.com/articles.cfm?ID=1419>.

**Marczewski, Andrzej. 2015.** Rewarding quality over quantity in gamification. *Gamified.uk*. [Online] 3 2015. <https://www.gamified.uk/2015/03/16/rewarding-quality-over-quantity-in-gamification/>.

**P&S Market Research. 2016.** Gamification Market by Application (Marketing, Sales, Product Development, Human Resource), by Deployment Type (On-Premises, Cloud-Based), by Solution (Enterprise Driven, Consumer Driven), By End-User (Enterprise, Entertainment, Media, Consumer Goods, Ret. *P&S Market Research*. [Online] P&S Market Research, 3 2016. <https://www.psmarketresearch.com/market-analysis/gamification-market>.

**Paharia, Rajat. 2014.** How Gamification and Big Data are Driving Business Today . *salesforce.com*. [Online] 1 2014. <https://www.salesforce.com/blog/2014/01/gamification-big-data-gp.html>.

**Pelling, Nick. 2011.** The (short) prehistory of “gamification”. *Wordpress*. [Online] 8 2011. <https://nanodome.wordpress.com/2011/08/09/the-short-prehistory-of-gamification/>.

**Pillsbury Winthrop Shaw Pittman. 2018.** Overview of Legal Issues. *Pillsbury*. [Online] 2018. <https://www.pillsburylaw.com/images/content/4/5/v2/4525/VirtualCurrency.pdf>.

**Poushter, Jacob. 2016.** Smartphone Ownership and Internet Usage Continues to Climb in Emerging Economies. *pewglobal.org*. [Online] Pew Research Center, 2 2016. <http://www.pewglobal.org/2016/02/22/smartphone-ownership-and-internet-usage-continues-to-climb-in-emerging-economies/>.

**Research and Markets. 2016.** Gamification Market by Solution (Consumer driven and Enterprise driven), Applications (Sales and Marketing), Deployment Type (On-Premises and Cloud), User Type (Large Enterprise, SMBs), Industry and Region - Global Forecast to 2020. *Research and Markets*. [Online] 2 2016. <https://www.researchandmarkets.com/research/3v779v/gamification>.

**Riemer, Kai. 2014.** Why work gamification is a bad idea. *Wordpress*. [Online] 5 2014. <https://byresearch.wordpress.com/2014/05/18/why-work-gamification-is-a-bad-idea/>.

**Rimon, Gal. 2017.** Is Gamification Important in 2017? *business.com*. [Online] 2 2017. <https://www.business.com/articles/gal-rimon-is-gamification-important/>.

—. 2015. Posture.io & the Target cashier game: feedback is essential to gamification. *GameEffective*. [Online] 5 2015. <https://www.gameeffective.com/feedback-is-essential-to-gamification/>.

**Sandsgaard, Stian. 2018.** Toptal. *Good Design Motivates Humans*. [Online] 2018. <https://www.toptal.com/designers/ui/gamification-design>.

**Schinnerer, John. 2016.** The Power of Positive Internal Motivation. *PsychCentral*. [Online] 2016. <https://psychcentral.com/lib/the-power-of-positive-internal-motivation/>.

**Schrage, Niklas. 2014.** Gamification And Governmentality. [kirjan tekijä] Mathias Fuchs;ym. *Rethinking Gamification*. s.l. : Meson Press, 2014.

**StatCounter. 2016.** Mobile and tablet internet usage exceeds desktop for first time worldwide. *statcounter.com*. [Online] StatCounter - Global Stats, 11 2016. <http://gs.statcounter.com/press/mobile-and-tablet-internet-usage-exceeds-desktop-for-first-time-worldwide>.

**Statista. 2017b.** Video Game Industry - Statistics & Facts. *Statista - The Statistics Portal*. [Online] Statista, 2017b. <https://www.statista.com/topics/868/video-games/>.

**Takahashi, Dean. 2010.** Website builder DevHub gets users hooked by “gamifying” its service. *Venturebeat.com*. [Online] 8 2010. <https://venturebeat.com/2010/08/25/devhub-scores-engagement-increase-by-gamifying-its-web-site-creation-tools/>.

**Technopedia a.** Proof of Concept (POC). *Technopedia*. [Online] <https://www.techopedia.com/definition/4066/proof-of-concept-poc>.

**Technopedia** b. Minimum Viable Product (MVP). *Technopedia*. [Online]  
<https://www.techopedia.com/definition/27809/minimum-viable-product-mvp>.

**Wilson, Lee. 2011.** Gamification Is A Stupid Fad. *educationbusinessblog.com*. [Online]  
9 2011.  
[https://www.educationbusinessblog.com/2011/09/gamification\\_is\\_a\\_stupid\\_fad.html](https://www.educationbusinessblog.com/2011/09/gamification_is_a_stupid_fad.html).

