UNIVERSITY OF GOTHENBURG

Gamification
Engaging the Future

I.BACHELOR OF SCIENCE THESIS [DEPARTMENT OF COMPUTER SCINCE AND ENGENEERING]

A. *BJÖRN ERIKSSON*

B. *MICHAL MUSIALIK*

C. *JUSTIN WAGNER*

University of Gothenburg
Chalmers University of Technology
Department of Computer Science and Engineering
Göteborg, Sweden, June 2012

UNIVERSITY OF GOTHENBURG

Gamification
Engaging the Future

BJÖRN ERIKSSON
MICHAL MUSIALIK
JUSTIN WAGNER

Examiner: Helena Holmström Olsson

University of Gothenburg
Chalmers University of Technology
Department of Computer Science and Engineering
SE-412 96 Göteborg
Sweden
Telephone + 46 (0)31-772 1000

Department of Computer Science and Engineering
Göteborg, Sweden June 2012

University of Gothenburg
Chalmers University of Technology
Department of Computer Science and Engineering
Göteborg, Sweden, June 2012

UNIVERSITY OF GOTHENBURG

Gamification

Engaging the Future

Author: Björn Eriksson
Department of Computer Science and Engineering
University of Gothenburg
Gothenburg, Sweden
aldhissla87@gmail.com

Author: Michal Musialik
Department of Computer Science and Engineering
University of Gothenburg
Gothenburg, Sweden
michal.musialik79@gmail.com

Author: Justin Wagner
Department of Computer Science and Engineering
University of Gothenburg
Gothenburg, Sweden
justin.m.wagner@gmail.com

Abstract— **The concept of game principles for motivation and engagement outside the game arena has become a hot topic in recent years. The challenge is to keep humans motivated and engaged in everyday activities; using game principles on non-game artifacts has already been proven useful. A number of areas will be explored to show how gamification increases engagement in each, e.g. education, user behavior, health, and productivity (corporation application). This research provides an historical precedent and correlation between community, games, and non-games that migrates to embodiment through various computing paradigms which builds a framework for gamification.**

Keywords: Community, Computing Paradigms, Embodiment, Engagement, Gamification.

II. INTRODUCTION

In the information age, the average attention span has shortened making the need for engaging solutions essential to newly developed software. The question is not just one of engagement in software, but in life and reality in general. Engagement is closely connected to positive psychology and the search for happiness [57]. Therefore, the problem explored in this research is how to ensure that everyday life becomes more engaging through digital means.

The problem is framed by viewing it through a number of filters which will build into a viable framework. The broad themes of gamification and embodiment will be unified, expanded, and considered in order to create these filters. To guide this research, we view this problem as exploring the potential for using gamification and community support in developing more engaging applications. Specifically, we do so by focusing on:

- Defining game principles upon which gamification are applied.
- Defining examples of 'use of community'.
- Defining embodiment and how it is extended with emerging paradigms.

Thematic analysis will provide the basis for connection, exploration, understanding, and interpretation of the data sets. As we intended to tie together several large themes, this seemed particularly suited to our needs [17]. Primary sources are gathered from Chalmers Technical College library, Google Scholar, and IEEE Xplore, an online database with a large collection of engineering literature. We intend to strengthen the maturity of gamification theory by connecting it to a wider conversation, namely embodiment.

In section 2, the framework will be developed and thoroughly structured. Section 3 outlines the method and data collection while section 4 applies the data to societal themes for improvement. The final section will discuss the interpretations of the data in light of the framework ending with conclusions and suggestions for future work.

III. THEORETICAL FRAMEWORK

The framework will start in section 2.1 by elaborating on the game principles from which gamification is defined. Section 2.2 will follow bringing out community attributes and the three axes which make up the game versus non-game discussions. Embodiment is touched upon and extended by the emerging paradigms in section 2.3. Finally, the aforementioned parts will be unified in section 2.4

A. Applying Gamification

The topic of why [cf. 26, 47, 51] and how to gamify [cf. 20, 33, 86] artifacts has already been thoroughly covered in literature [cf. 49, 57, 86]. Rather, we will explore gamification in an analysis of the interrelations that the concepts of game, non-game, and community have in common. Gamification connects to concepts like skill mastery, embodiment, and various computing paradigms where game design principles have been applied.

First of all, we will discuss the differences between game mechanics and game design principles. Game design principles are the design concepts behind the implementation of any game mechanics. Game mechanics, then, is the implementation of the engaging principles to structure the

University of Gothenburg
Chalmers University of Technology
Department of Computer Science and Engineering
Göteborg, Sweden, June 2012

program giving the user a clear picture of what can and cannot be done in the application. Hence, it refers to concepts like points, badges, achievements, highscores, and cooperation structures [cf. 2, 21, 75], but also physics engines, hit points, and object interactivity. The term 'game principles' will be used to simplify the discussion as there are many game mechanics which may implement any one principle.

Bartle did a study in which he discovered the primary archetypes that gamers fall into. When comparing the types of game principles used to gamify most non-game artifacts, the conclusion is that the majority of principles designed for gamification are for achievers, but misses out on the other user characteristics in Bartle's model (Diagram 2-1) [4].

Diagram 2-1 Bartle archetypes players [4]

Achievers have the user characteristics that traditionally have been related to engagement. Similar achievement-oriented goals are frequently visible outside the software domain. The loyalty programs that preceded the gamification concept, e.g. 'buy 3, get 1 for free' model, and the frequent flyer mile programs apply only to achievers [86]. Hence, the concept of rewarding based achievements is well-established outside game and software development. By addressing the principles, new ways of engaging the other player types can be achieved reaching a broader audience [43].

Game principles focus on the abstract themes which games seek to address. McGonigal [57] points out four major categories that intrinsic rewards falls under. These categories are what humans seek during play and are part of positive psychology. The findings from her studies are 'satisfying work', 'the experience, or at least the hope, of being successful', 'social connection', and 'meaning'. These are the categories that are fulfilled by engaging with the world around us. These are the most powerful factors for creating engagement and satisfying life aside from our basic needs for food, safety, shelter, and sex [cf. 6, 18, 56]. Interestingly, all four categories tie back to engagement for different purposes, e.g. relationships, self-improvement, causes, and projects that are larger than ourselves. Thus, the principles of how to satisfy these needs are important. McGonigal suggests that making things into a game will engage the users, but what need to be considered are the user characteristics in Bartle's model (Diagram 2-1). Extrinsic rewards are a faster way to achieve engagement, but are not sustainable in the long term compared to the intrinsic. This is why McGonigal advocates designing to cultivate intrinsic reward.

To assess the possibility to reach intrinsic rewards through games, the idea of what is a game must first be addressed. The four aspects that characterize a game, as presented by McGonigal [57] and Deterding, et al. [20], are a goal [2, 75], rules [12, 50, 75], a feedback system [36, 50, 85], and voluntary participation [11, 14, 19]. After applying the four characteristics of a game on non-game artifacts, McGonigal identifies that the initial four categories pointed out in diagram 2-2, can be adapted and broken down into 14 'fixes' for use on non-game artifacts.

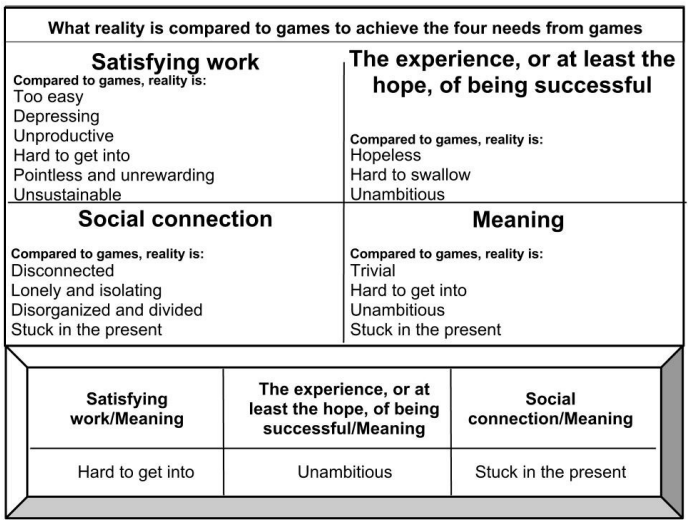

Diagram 2-2 illustrates McGonigal's 14 'fixes' [57]

Diagram 2-2 shows the four categories, 'Satisfying work', 'the experience, or at least the hope, of being successful', 'social connection', and 'Meaning' and how they are distributed amongst the reality problems. Each point under the various needs addresses how reality is 'broken' and can be fixed by a design principle. McGonigal describes the 'fixes' as the difference between games and reality, e.g. "compared to games, reality is hard to get into" [57, p.124] which applies to both 'satisfying work' and 'meaning' of the four categories.

In 'satisfying work', McGonigal [57] argues that we can see the direct impact of our daily efforts. Games have voluntary obstacles with which the player can better use their personal strengths, but the real world can be 'too easy' in that tasks are neither challenging enough nor personalized for our strengths. Since games are voluntary, the player focuses the energy on something he is good at and enjoys. In real life, it is not always possible due to time constraints and could be construed as 'depressing'. Games give us clear missions allowing knowledge of what is expected from us. In the real world, vague goals with different solutions are common. When goals are vague, we can see ourselves as 'unproductive'. Work consists mostly of extrinsic rewards

e.g. money or promotion, the lack of intrinsic rewards can make it 'hard to get into'. As game principles focus extrinsic rewards on creating intrinsic motivation, we will become engaged and participate fully in what we are doing. In contrast, work can be seen as 'pointless and unrewarding' or 'unsustainable'. Games with their explicit reward systems can make them an infinitely renewable resource of motivation.

In 'the experience, or at least the hope, of being successful', McGonigal [57] discusses how we want to feel powerful in our lives and show to others what we are good at. We also like the belief in success through striving for something and to feel that we are getting better in what we are doing. While trying something new, the chances of feeling 'hopeless' can easily appear, but games eliminate the fear of failure. As it is always possible to start over and learn from our mistakes, the chances for success and learning will improve. In life, we are often not open to advice and trying out happier habits. It can even be 'hard to swallow' good advice from someone. In games, when an experienced user gives advice to someone, it is more likely that the person will listen as the veteran has proven to be a "successful character" in the game. In reality, overwhelming projects leads us to feel 'unambitious'. Games help us to break down normally terrifying goals where we can cooperate together and tackle what seems to be impossible in the real world.

Humans are social creatures in general. We like to spend time with the people we care about and engage with other people by building bonds to increase happiness. 'Social connection' is the third element. It is easy to feel 'disconnected' in life when you are sitting at home in your apartment alone, but games can build stronger social bonds that lead to more active social networks. The more time spent interacting with people with the same interests the more likely it is to generate positive emotions known as "prosocial emotions". Hence, the reasoning that reality can be seen as 'lonely and isolating' compared to games falls under the same argument where we can build powerful communities from scratch. It can be hard to see how reality is seen as 'disorganized and divided', but games improve the chances of putting more effort together as a group. A "perfect group", with complementing skill-sets, gives us group collaboration superpowers. Games help us investigate virtual worlds where we can imagine and build new societies together. In reality, these chances are not that easy because it can be expensive, time consuming and we are 'stuck in the present' [57].

McGonigal [57] states that we crave 'meaning' as the fourth and last element that generates happiness other than the basic needs. This is because humans want to be part of something bigger than ourselves. The feeling of fear and curiosity of what is beyond our knowledge, but more important, we want to be part of and contribute to will last forever in our minds. Games give us a meaning of belonging to a greater good through our actions. Compared to this, reality, where you do not gain any experience points, badges, or special items, can be seen as 'trivial'. The terms 'hard to get into', unambitious', and 'stuck in present' are already defined in the previous paragraphs, but are repeated in the diagram 2-2 to show that they are part of more than one element.

McGonigal [57] provides a well-developed model for how gamification may be approached for non-game environments. Other articles give examples where using game principles can be applied to non-game artifacts [cf. 15, 20, 36]. These core elements of Bartle [4] and McGonigal provide a distinction for what we consider game principles used for gamification.

In section 2.2, the underlying concepts behind game principles are expanded and illustrated. It is not by chance that these can be applied on non-game artifacts. Rather, the fact is that they already share the same phenomenological stance with principles that are part of what is considered effective design outside the gaming domain.

B. *Community, game and non-game*

The framework of this paper will be broken down in several ways. In previous sections, we know that extant research argues for the possibility of applying and adapting game principles to non-game artifacts. We also know that engagement is a keyword towards the achievement aspect of users both inside and outside the gaming domain. We will further extend the connection between game principles and the underlying concept they promote by extending the unit of analysis from the sole user to a community of users. One of the growing trends in both gaming [74] and non-gaming [48, 79] is to further strengthen engagement by providing and promoting community-related benefits to users. The concept of community is not only restricted to online communities, but is aimed towards shared user experience regardless of the actual use being shared or not.

The first distinction is three pillars: community, games, and non-games. Each of these pillars is themselves broken down into portions to present a clearer overall picture. Diagram 2-3 will be considered in a top down manner starting with community. Community relates to gamification in three important ways [43].

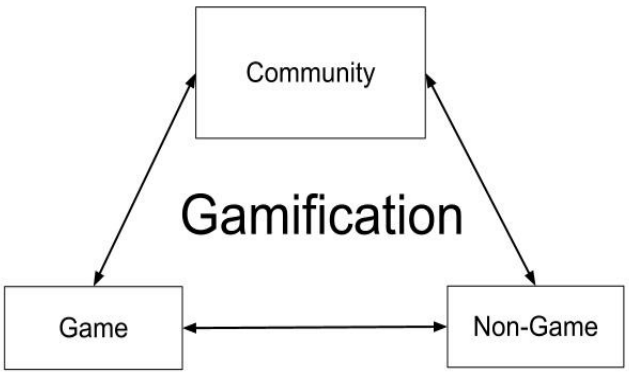

Diagram 2-3 The three pillars of Gamification

First, the nature of a community has certain constants that form the basis for evaluation. Communities are a collection of individuals gathered around a common purpose. Both games and non-games share this attribute. Individuals grow, or evolve themselves and promote growth of the community in which they belong.

The second relation centers around maturity. The maturity of the community is directly linked to the growth of its members. The link here is between the development of individuals and the overall development of the community. Hence, the concept of skill mastery must be explored. The members can master skills in either a community or a game. Both engage members in different ways, but enhance the maturity of the community. It is important that the user feel engaged and motivated while striving to climb the mountain toward skill mastery [25, 43, 44]. Individuals should possess or develop certain skills to be able to grow as a member in the community. Kim [44] argues that this principle of community growth is designed in games at every level of engagement from 'beginners', to 'intermediate', and to 'expert'. Dreyfus [25] in the 80's discussed the concept of skill mastery advancing through various stages. In his work, he discusses the skill steps where one advances from 'novice', 'problem solver', 'intermediate', 'expert', and finally, 'master'. The right amount of engagement is needed to keep interest and involvement throughout this process. In comparison, as a gamer progress through a game, it reveals more of the system and increases its challenge complexity. This skill development can be compared to the stages of community maturity. As the community grows and expands, members of varying degrees of skill and expertise are added or developed. As a young community slowly evolves, it gets larger and more complex until it reaches full maturity [43]; this process mirrors skill progression. Furthermore, in a Massive Multiplayer Online (MMO) setting, the release of new content and rule adjustment causes a continual upheaval to the maturity model forcing the group dynamic to revert to previous stages [80]. This is necessary to ensure a game lives rather than runs its course and becomes boring [57].

The third key attribute for the concept of community has to do with the social connections [43]. A large part of the nature of a community is to enable communication and relationships between members. Individuals can be either the users as well as the members of the product organization, such as community moderators, public relations representatives, or developers etc. There are both significant differences and similarities between online and offline communities. Online communities do not suffer from location limitations as offline communities do. Forums and web based channels are commonly used in the same way in both cases. Both have some form of ranking system where the purpose is to increase posters level. One particularly successful online community is StackOverflow [16] where the combination of communication concepts and purpose together with game principles add additional meaning. This helps create more engagement in the forum. As feedback from the users is given to developers, they can develop fixes, extensions, and tweaks that enhance the experience of gameplay. When this feedback loop is effective, an application becomes largely self-sustaining extending its lifespan [25, 33, 83].

All of this ties back to the concept of engagement, an example of this is the Elder Scrolls series, especially Morrowind. People still play this game even though it was made in 2002. This is because a community has created great mods, information, and 'wikis' around it [28]. Oddly, it is a completely single player game. Thus, the community aspect of the game lives outside the actual gameplay and is only communicative. This shows that the lifespan of this game has been thoroughly extended by the love and care of its community. Since the goal is to improve engagement, the lifespan of the user extends the lifespan of the community and by extension of the software [33, 43, 83].

Having talked about the role of community, game principles, and how gamification is related to both, we now shift to illustrate the game and non-game discussion as displayed in Diagram 2-3. There are three axes which need to be addressed to evaluate the effectiveness and possibilities of gamification to improve behaviors. Briefly, these axes concern themselves with action, aim, and acceptance.

The first axis, action, is the distinction between the real tangible world and the virtual world. This applies to the gamification discussion in that using game principles or gamified applications is many times virtual, but affects the real [57, 86]. Primarily, we focus on where the action takes place. Does the action take place in the real world, or is it limited to the virtual? Regardless of where it happens, does it also affect the real?

The second axis is one of focus, or aim. Does the application focus on accomplishing some task or behavior, or is its purpose to be entertaining with the other benefits being incidental? Both Games and Gamified applications can be applied to any theme, e.g. Education, Health, User Behavior, Productivity, and others, with the intent to improve the process. However, games lean more to the entertainment side with the benefit of improving the theme whereas gamified applications lean toward improvement with the benefit of being fun. This may seem like a trivial distinction, but it is an important one.The importance of the distinction is found when we highlight places which might be inappropriate for a true game to become a gamified application. By gamifying non-game artifacts, the chances of intrinsic rewards that make the users more engaged will increase [57].

The third axis concerns itself with work versus play [57]. For the purposes of this research, we are looking at it as traditional applications versus gamified applications, but the core issue is how we perceive a tool as being used for work or play. A game is generally viewed as being for entertainment purposes. Therefore, the acceptance of game principles in areas where work is traditionally serious becomes a tricky matter.

C. Theoretical Foundation

The concepts surrounding gamification, elaborated in previous sections, together with the three pillars, game, non-game, and community, form a foundation which can be built upon the notions of embodiment. Just as Dourish [23] connected the developments of social and tangible computing to embodiment, a similar connection can be made to gamification. This connection has its root in engagement.

In the following sections a detailed description of embodiment is provided; to which we then add five developing computing paradigms: virtual reality, augmented reality, tangible computing, experiential computing, and ubiquitous computing. These paradigms are a selection that support embodied interaction and subsequently provide support toward gamification.

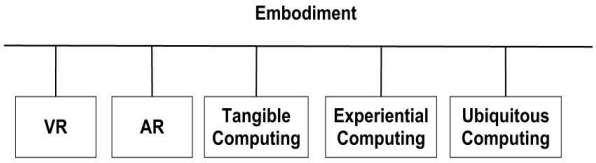

Diagram 2-4 shows the content of this section by exploring embodiment and later the ties of new computing paradigms to it.

1) Embodiment

Dourish [23] argues that embodiment, abstractly, is a property of objects that exist as a part of the world and establishes the transformation from the domain of ideas to the everyday experiences. This does not mean physical embodiment, but the most recognizable artifacts, e.g. desks, trees, and roads, are the most common aspects of that type of embodiment in our lives. However, embodiment permeates throughout our daily existence. Thus, it can be illuminated together with game principles to further strengthen the point that it is extended by the various computing paradigms.

Dourish [23] presents a discussion on how embodiment can be used as a foundation for designing artifacts that support 'embodied interaction'. Through this interaction, between computers and humans, a meaning is created in both the physical and social world that forms a substance to the interaction. Embodied interaction is not static, nor objective in this sense as rooted in the concept of interaction is a spark of participative status. This aspect of embodiment draws a comparison with gamification as the two view engagement and active participation as central components to promote. By giving rise to new opportunities for meaning and interaction, gamification is another tool in embodied interaction that creates engagement for non-game applications.

This subjective view of embodiment rejects the positivist themes that run central to computer development for a more phenomenological view. Dourish [23] relies on Edmund Husserl and later Martin Heidegger who already in the early 19th century showed that this phenomena is based on human experience and not science or math. This is not new to Human Computer Interaction (HCI) where theory of cognition was one of the elements of computational analysis presented in 1986 by Winograd and Flores. Dourish further elaborates through Heidegger that common actions in our world have already been classified in basis of meaning and purpose. Consider how the phenomena which birthed the ideas of computing have, like geometry, become divorced from the context which gave rise to it. Embodiment provides the validity for the essential need for computing devices, but now we design them for their own sake forgetting why they were developed in the first place, as a means to extend our computing needs without a hassle. Dourish draws a few conclusions from the phenomenological approach about interaction, “that interaction is physically and socially embodied; that ontology arises out of activity; and that meaning subsists in embodied action.” [23, p.12]

Norman [64] approaches the concepts of designing intelligent appliances and of computing from the same human centric mindset. This lends credence to the shift away from the traditional paradigms found in computing today. Gamification takes this same human driven design as the principles developed by study of their users and psychology as briefly touched on above with Bartle [4].

2) Computing Paradigms

The boundary between the virtual and the real has given rise to several new computing paradigms. While they are not completely new, it is only recently that technology has reached the level where they can conveniently become parts of everyday life for consumers. These computing paradigms provide new ways to interact and engage with activities - some of which only possible through these technologies, e.g. avatars in virtual reality [76, 82], computer mouse in embodied interaction [23], and flight simulators in augmented reality [58]. While further paradigms could be added, we exemplify this shift in computing with ubiquitous computing [38], tangible computing [24], augmented reality [73], virtual reality [11], and experiential computing [84]. The purpose of this section is not to separate these paradigms, but rather to illustrate that they, in fact, all share a relation with embodiment and embodied interaction.

One of the more prominent drivers for the shift away from the traditional business computing paradigm, where the triad of keyboard-mouse-screen still dominate, lies in what Dourish [23] points out, i.e. that computers have never been our natural first line of interaction. Simple things like pen and paper, or common tools exemplify embodied interaction that exists in our daily lives [24]. The pervasive nature of computing devices in modern life brings forth a world where computation and interaction can leave the traditional desk model. “Digital natives” interact with these devices the same way as “digital immigrants” do with the pen and paper [84].

In the case of ubiquitous computing, the nature is to capitalize on our experience with these simple items that ties back to embodied interaction. Primarily, by connecting different devices which have been specialized for certain tasks, but allow for interoperability with several devices, computing can become enmeshed in human interaction of

shared situations and unexamined technological skills [37]. Ishii and Ullmer stresses that the dispatch of computation should be "transparent" or "invisible", as discussed by Mark Weiser [38].

Tangible computing focuses on the method of interaction between humans and computing devices. Users directly interact with computing systems while in reality manipulating objects instead of the traditional input/output methods [38]. The tangible computing's work is trying to benefit from our physical skills and knowledge of real world objects. Tangible computing tries to make computations as clear to us as objects in the real world in order to make computations more natural in the everyday world and improve our experiences with the physical [23].

Another paradigm that relates to both of the previous is augmented reality (AR) which concerns itself with how to merge computational media and reality [38]. The connection to tangible computing is easily seen as Ishii and Ullmer [38] has already suggested this link between these two. AR is about improving reality through the virtual, in other words, adding fictional objects to real life [73].

Virtual reality (VR) has been central in the game world with the rise of the MMO games, e.g. EverQuest [43]. Yoo discussed "an imagined view of computing ...[where] scholars focus on users interacting primarily with computers as an end in itself." [84, p.6] In the virtual world, e.g. Second Life and World of Warcraft, the user can be visible with a totally different shape or identity compared to reality. Avatars have been explored outside the realm of games by several researchers [cf. 76, 82, 84], for example, the usage of graphical avatars in meetings. The shift from use of VR for entertainment to work or community issues shows how this paradigm is expanding the ways of interacting and engaging.

All of the previous paradigms have been recently incorporated into a larger, more extensive blanket paradigm called experiential computing. Yoo [84] pioneered experiential computing where devices sense event-related information adjusting to the context in which the information is explored and interacted with. He defines this as "[e]xperiential computing involves digitally mediated embodied experiences in everyday activities through everyday artifacts that have embedded computing capabilities. Experiential computing is enabled by the mediation of four dimensions of human experiences (time, space, actors, and artifacts) through digital technology." [emphasis added, 84, p.1] He points out how the traditional computing paradigms focus on use of computing devices with organizations, especially work environments. However, this is no longer the case as computing is no longer bound to the work arena, but extends into every aspect of daily life. A classic example of this is the stationary bicycle connected to the internet through broadband where a user's physical activity gains many layers of meaning through this technology.

Each of the paradigms connects to embodiment extending our abilities to compute through a plethora of ways. When combined with digital reward systems, i.e. gamification, the result is new forms of engagement being ubiquitously spread through our daily experiences. This leads to manipulation of information that we could not do before and give us options to new opportunities.

D. *The Gamification framework*

The Gamification framework can be thought of as a building. It relies on embodiment as a foundation upon which the three pillars, i.e. game, non-game, and community, stand. The five paradigms form the extending arches which enclose, but not encapsulate, the opportunities found by the framework. Gamification can be thought of as the electrical systems extending throughout every part bringing life, i.e. engagement, to the building.

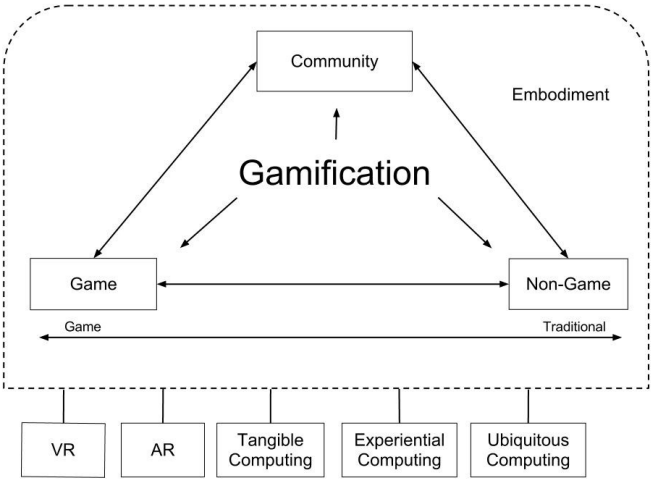

Diagram 2-5 The Gamification framework

As pointed out in section 2.2, gamification principles mirror and enhance many aspects of any software, or indeed, any activity. The nature of community ties back closely to the purpose around which it is built and achieves maturity through the actions of its members. There is also good evidence to support that community extends the lifespan of an application.

The three different axes that make up the game and non-game discussion provide filters through which proper analysis concerning the implications of gamification can happen. By looking at the issue through them, we can evaluate where the action takes place; what the aim is; and how can it be made acceptable.

Finally, grafting gamification to the notion of embodiment gives a wider, deeper context from which to interpret and affect the outcome of that analysis in the future. The computing paradigms provide newer platforms with which to construct applications, processes, and interactions for embodiment and, by extension, gamification.

IV. METHOD

The method used for this paper was an interpretive theoretically-driven thematic analysis [8]. The intent was to

collate patterns and themes to further develop theory surrounding gamification and embodiment. Both themes are large and have a flurry of literature surrounding them which led to new enlightenments throughout the phases of writing. As Braun and Clarke stated while relying on Ryan and Bernard, "themes are abstract (and often fuzzy) constructs the investigators identify [sic] before, during, and after analysis" [8, p.86].

Thematic analysis is quite broad in terms of methodology as many variants on it exist allowing the researcher to tailor it to their needs. This flexibility is more strength than weakness as the method can be more readily applied to a wide variety of topics and disciplines. We utilized Braun and Clarke [8] as a template for how to conduct an accurate thematic analysis as they semi-formalized the principles and phases needed to carry it out.

A. Phase 1: familiarising yourself with your data

During the initial phase, and in the discussions leading up to the research topic being chosen, a number of themes were suggested. The interest of the researchers is within software engineering, but particularly we were caught by the expression "gamification". It was recommended to us that perhaps we should take a look at embodiment. The literature on embodiment lead to a number of sub-themes emerging for exploration. The idea for computing paradigms was there, but as yet unrealized. The number of articles reviewed was by no means exhaustive, but truly was expansive. Notes were taken for early coding and articles were reviewed for possible relevance [8]. As this was early, not much was discarded unless it clearly did not fit. We were reading immersively as Braun and Clarke define it: "Immersion usually involves 'repeated reading' of the data, and reading the data in an active way - searching for meanings, patterns and so on. It is ideal to read through the entire data set at least once before you begin your coding, as your ideas, identification of possible patterns will be shaped as you read through." [8, p.87]

B. Phase 2: generating initial codes

As there has never been a consensus on how to define gamification, we began to see a number of themes within the topic which were close to one another, but differing in a few aspects. Coding of the data set began in earnest as we could identify patterns based on the definitions that aligned the articles [8]. Our initial research question and the intended direction shifted with new information and deeper understanding. The scope began broadening as more themes and patterns emerged until it became apparent that re-scoping was necessary. In following Braun and Clarke's advice, we "a) code[d] for as many potential themes/patterns as possible (time permitting) – you never know what might be interesting later; b) code[d] extracts of data inclusively – i.e., keep[ing] a little of the surrounding data if relevant, a common criticism of coding is that the context is lost (Bryman, 2001); and c) remember that you can code individual extracts of data in as many different 'themes' as they fit into - so an extract may be uncoded, coded once, or coded many times, as relevant." [8, p.89]

C. Phase 3: searching for themes

We began to develop diagrams based on the themes and an interpretation of the data extracts [8]. These served to further refine the overarching ties between the relevant data which had been extracted up to this point. The data set was continually refined as some points needed new references to strengthen them while others were discarded from both the set and the corpus as too weak or vague for the transformation of scope. Different viewpoints on the themes were visualized in more diagrams aiding this process.

D. Phase 4: reviewing themes

The foundation for the theoretical framework began to take shape as the dual themes of gamification and embodiment were divided into sub-themes which in turn were broken into sections. Gamification became the three pillars of Community, Games, and Non-Games. Embodiment was extended by the computing paradigms. After reviewing the data, the primary themes solidified and examples were organized along an area of application level as a way to explore the framework [8].

E. Phase 5: defining and naming themes

When the thematic map of the data was sufficient, we continued work with additional data mining of coherent literature that would further bolster our points. The essences of the themes were now firmly established and the structure consolidated. Refinement still happened as, "analysis is not a linear process where you simply move from one phase to the next. Instead, it is more recursive process, where you move back and forth as needed, throughout the phases." [8, p. 86]

F. Phase 6: producing the report

The final phase consists solely with the writing, editing, and questioning that the themes have been properly woven to answer the research question [8].The construction of the theoretical framework through an iterative process provided a guideline to move forward closer to finalization where additional 'blanks' and weaknesses are corrected. The shortcomings and challenges that occurred through the entire paper will be discussed in the following section.

LIMITATIONS

There are several limitations that are identified in this paper. First of all, the method has several potential shortcomings as an analyzing tool that has been reflected by Braun and Clarke [8]. The one identified as a difficulty for our paper is the border between themes that can appear misleading or at least questionable and had to be strengthened with additional examples.

A further limitation presents itself in embodiment and the paradigms. Each theory is vast with broad implications, but was only briefly explained due to scope. This was a design

decision which we would like to see elaborated in future work.

Additionally, the themes discussed in following section are education, user behavior, health, and productivity (corporation application). Both the themes of health and education were chosen as they are universal needs of the individual. Likewise, user behavior, defined as learning a skill, is commonly useful across a myriad of disciplines. The final theme, productivity, is aimed at the corporate world, but can be applied to individuals as well. This was chosen to show how a community can be affected organizationally and individually.

Other themes were discarded for precisely the same reason. An example of this is military which has already applied game principles [2]. They are a select group which not everyone has familiarity with. Thus, points there might not be as strong.

A final difficulty is the breakdown of the game definition. Many times researchers will call something a game when it is a gamified process. Indeed, the definition of what constitutes a game is dissolving and debated. We defined how we view a game in section 2.1 with the four attributes as a way to resolve this.

V. Review of Cases examples for Gamification

There are four themes and a collection of findings that have a major impact in everyday life. The themes will be divided along three axes of comparison described in section 2.2 of the theoretical framework. These comparisons will be underscored by the computing paradigms discussed in section 2.3.

A. *Themes*

The first theme is education on account of its strong influence over the development of individual. Education is generalized and applicable to everyone regardless of individual constraints. This makes it an ideal and valid candidate to be discussed. An example of this is Khan Academy [42] where anyone with an internet connection and understanding of English can participate in the educational progress at their own pace.

Another universal theme is the idea of health. Good health can be argued to have the greatest impact on quality of life [56]. Whether an individual is battling weight, disease, age, injury, or diet, the struggle to maintain healthy habits is great. WII Fit is an example of a videogame that will help the player to be more engaged during exercise [53, 60].

User behavior is the third defined theme which applies to the development of a skill. Human improvement in various skills affects individual self-worth [56]. An experiment made by Chiang and Chen [13] suggests that Xbox Kinect that combines video games with physical activities is a viable tool to improve visual performance skills, especially for institutionalized older citizens in wheelchairs. This has also been proven successful for elderly people by Gerling and Masuch [29].

Productivity is the final specified theme in this paper that mainly helps within companies and organizations. In Global Software Development (GSD), we find an example of a productivity game called Local Agile Game-based Process (LAGPRO). Team performance is evaluated through a local score table after every interaction process where team members will be ranked according to a performance index [70]. Beside these themes, it is important to point out that gamification extends to other places which are out of the scope for this paper.

B. *Theme Examples*

Table 4-2 shows a breakdown along the game versus gamification axis while being contrasted against the work versus play axis. All of them fall into the discussion on the digital versus the real axis.

Table 4-1 Examples of non-games, gamified non-games and games

Themes	Non-game	Gamified non-game	Game
Education	SELFA [10], JollyMate [40].	Khan Academy [42].	Quest for Learning [49, 57], Docugames [34], SimulES-W [59].
Health	SapoFitness [77], CalorieCounter [30, 77], CardioTrainer [31, 77], MOPET [77], MyFitnessPall [32, 77], StepUp [41, 77].	NIKE+ [62], Time to Eat [67, 77], Health Month [86], Salubrious Nation [22],	WII Fit [29], Move Fitness [26],
User behavior	Scratch [65], MCAR [7].	EcoGuide [36], EcoScore [36], Chevrolet Volt's [36], MEECO [81], Chore Wars [15].	MS Flight Simulator [58], SuperBetter [57], Mouse mayhem [13], Follow the arrow [13], Matchmaker [13], ComCity [61], PanMaster [35], Power House [69], World without Oil [9, 57].
Productivity	Waterfall model [79], Extreme Programming [79], Agile processes [79], Redmine [68].	Windows Language Quality Game [78], LAGPRO [70], Badgeville [3], Second Life [46], Communicate Hope [78].	Second Life [46], TaskVille [63].

The tables (table 4-2 to table 4-6) in the following subsections reflect the work versus play axis of each theme. The examples show how game principles can be found in more serious everyday activities.

1) Education games

Table 4-2 Education games

Education	
Play	***Work***
Easy to access: Requires only an internet connection to access it.	**Easy to access:** All students have to go to school for a certain amount of years.
Teachable agents.	**Teachers.**
Badges: The user earns badges for special achievements. That can be shared and compete against friends to motivate the studies.	**Gold stars:** Students who have done well can earn golden stars and compete who earned the most [5].
Immediate feedback on work problems.	**Feedback from teachers or supervisor:** But not always immediate.
Increased difficulty: As the user progress in the game the harder it gets.	**Increased difficulty:** After each year the student pass in school, the harder it gets.
Skill tree: Structured for mastery, not mere competence.	**Grades:** Show the students' competence or validity in the different subjects.
Online community: Meeting place for the users to collaborate and share ideas for different problems.	**School:** Meeting place for the students to communicate with each other and teachers.

Already in 1981, Malone [55] argues that meaningful, multiple, clear goals, and leveling, should be included in educational programs. In the fall 2009, Quest to Learn [57], a public charter school in New York where with help of secret missions, boss levels, points, teachable agents, and other techniques, entangles middle school students with educational activities. Gamification motivates students to engage in curriculum activities by removing informal and formal barriers showing that education can be a fun learning experience [49]. Klopfer, et al. [46] propose application of various commercial games into different areas of education. In light of new ways of thinking, gaming consoles, e.g. Nintendo DS, PS3, XBOX, can be used by students to improve education in the various subjects.

In the same vein, there are a number of games that have been created, e.g. Total War, which are a series of war games set at different periods of history. Learning there is incidental, you learn more about the cultures, history, and geography of the time and also about war and tactics. Contrast that to the Khan Academy [42], an online website that allows you to view video lectures on math, science, history, and all the topics that are easily quantifiable. As you learn, you earn points and badges which help motivate you to try more.

Kimer, et al. [45] introduce an AR game, Game of Words, which uses tiles with letters on them. By combining them in right order and constructing a word, a visual and additionally "hearing" confirmation is produced. This technology can be further extended with help in training persons with dyslexia. There is a solution for this in the form of JollyMate [40], a non-gamified software for children. By moving from rigid teaching methods to one that introduces another level of reward through gamification, users' motivation of progressing will greatly increase.

2) Health games

Table 4-3 Health game

Health	
Play	***Work***
Easy to access: Applications can be bought or downloaded for free with a smartphone or video game.	**Easy to access:** Exercising to achieve better health can easily be done by talking a walk or running.
Virtual personal trainers: Small avatars that are encourage and give feedback to the player .	**Personal trainer:** A personal trainer or coach that gives feedback and motivates a group of people or an individual.
Badges: The user earns badges for special achievements. That can be shared and compete against friends to motivate exercise and a healthier lifestyle.	**Medals:** Athletes that are competing in different events, e.g. championships or the Olympics, earn medals for the top three participants.
Highscore: A list with the player's score is provided in games to compete against friends.	**Scoreboards:** In competitions the different times or scores achieved by the participants are displayed on a scoreboard.
Online community: Meeting place for the users to share their achievements and encourage the other members.	**Footpath/Gym:** A place where people can meet and exercise together to become more motivated and show to others that they are exercising.

Several researchers cited by Chiang and Chen [13] suggest that appropriate training, physical exercise, and sports are commonly used to promote health to maintain brain and body functionality that will decrease by ageing. WII Fit, Kinect, and PlayStation Move that are using motion controllers are useful for encouraging physical activity [53]. As mentioned in section 4.1, weight, health, age, and injury are other issues to be considered, Silva, et al. stated:

"Obesity is a serious public health concern in the current society, mainly, in developed countries." [77. p.1] In today's healthcare, a great problem is the prices and the lack of availability for patients who need frequent health monitoring [52, 77]. There are many different attempts to deal with these problems, both gamified and non-gamified applications e.g. NIKE+ [62], SapoFitness [77], and Health Month [86].

Nike+ is an example of how the community itself is a part of the mechanics. The program is designed to allow both competitiveness and collaboration, for example, high score and group running goals. This shows how gamified applications are attempting to redress the previous imbalance where Bartle's [4] archetypes are concerned.

3) User Behavior games

Table 4-4 User behavior games

User Behavior	
Play	***Work***
Feedback: A feedback system that provides the user with feedback.	**Feedback:** Feedback through driver's lessons.
Task management: A rewarding ticketing system that are fun to use.	**Task management:** Non-rewarding ticketing system that are mandatory by the management.
Highscore: Scoreboard where users can measure how much energy that are saved [69].	**Electricity bill:** Shows the individual how much energy that has been used.

Eco-driving is a skill that has seen recent design toward gamification through various displays ranging from simple feedback to more inventive visual feedback. Ford's EcoGuide dashboard rewards eco-driving, another idea is to add Eco-Score where different drivers can compete against each other or compare it between different trips. The main point running through every display is to help people improve their driving skills to reduce emissions and fuel expenditure. The future of eco-driving has a dual goal of, rewarding the eco-driving by excellency and the community aspect being environmentally concerned [36].

Chore Wars [15] is another example of a user behavior game that can be compared to a management tool. Instead of groups, the users create their own party where the different tasks made are called "adventures". The central focus is on the player's avatar which gains experience points for every task completed.

4) Productivity games

Table 4-5 Productivity games

Productivity	
Play	***Work***
Badges: The user gets rewarded with achievement points or badges for certain tasks.	**Personal gifts [71]:** Employees get rewarded for their work in form of gifts instead of money for extraordinary work.
Local score table: Team performance is evaluated and ranked through a performance index [70].	**Leaderboard:** Companies sometimes provide a leaderboard to show how well the employees have been working each week.
Feedback: Feeling of being useful through a game that improves the software [78].	**Feedback:** Meeting with a manager or supervisor who provides the employee with feedback.

To understand how the gamification affects us in our professional life, we will introduce the theme of productivity. These games are related closely to crowd-sourcing or human computation efforts [78]. In the 90's, a Σigma [27] game was introduced as an alternative managing tool for handling complex organizations. Its goal was to improve interaction during talks and to gather data for a posteriori analysis by project managers occurring after the project.

Badgeville [3] is a behavior platform that enables businesses to measure and influence user behavior with social rewards using game principles, e.g. levels, missions, and tracks. The users will be rewarded for tasks that are beneficial for the companies using this platform. Real customer results provided from their website are: 300% increase in User-Generated Content, 500% increase in Social Sharing, and 100% increase in Time on Site. It is also using reputation building gamification to increase "quality contributions" by establishing a user reputation hierarchy. The results of this area were: 300% increase in Comments and 150% increase in Content "Likes".

Microsoft's productivity game, Communicate Hope [78], improves their engineering processes. Participants are motivated with this particular game to complete beta feedback tasks and in this way earn achievement points. In the case of Communicate Hope, where participation was voluntary, 67% of ad-hoc feedback was sent by game users versus 3% participants in betas that have not used game principles. As the overall result, 97% of the participants would like to be included into another similar beta testing program where these numbers were between 50%-70% before.

These three productivity examples show that gamifying work processes combine fun which comes from games with "hard" established developing methods. This successful synthesis shows adding fun can improve productivity.

C. Analysis

The themes emerged as examples of gamification applications that are broadly discussed and developed. The lack of consensus for what constitutes a game and what is gamified leaves that line still blurry. Perhaps it is better to view it along a more analog line of reasoning with degrees of each moving in both directions. Diagram 4-1, seen below, shows the distinction between a game and a gamified artifact on both a theoretical and application level.

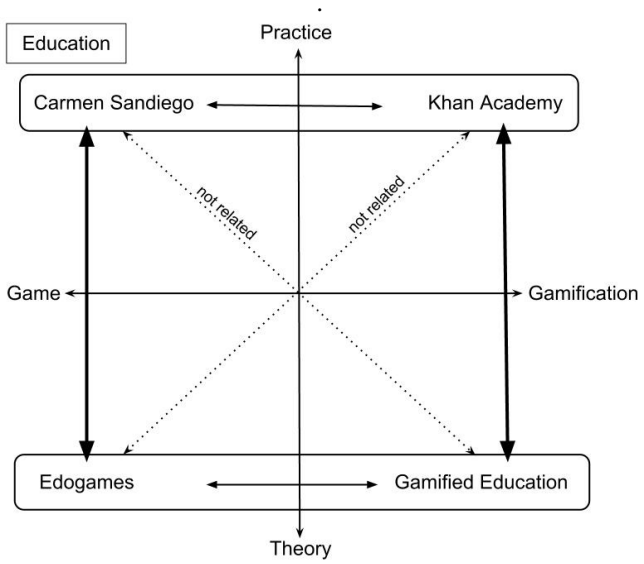

Diagram 4-1 Distinctions between Game and Gamification: Theory vs. Practice.

The diagram is best viewed in quadrants with the lower two displaying that there is a difference surrounding game development and gamified development for education. The upper two quadrants give examples of both theories put into practice. While both theories and their examples are attempts to increase engagement through digital means in education, they attack the problem from different angles.

In 1975, Csikszentmihalyi wrote "Games are obvious flow activities, and play is the flow experience par excellence. Yet playing a game does not guarantee that one is experiencing flow" [18, p.36]. This emotion allows us to end in an unaware state where the chain of actions is built on top each other. This state can be tied back to positive psychology. In relation to flow, the implication is one of intrinsic and extrinsic rewards. McGonigal [57] takes a visionary optimist view as her principals are focused on creating intrinsic motivation using game principles to enhance that process. She even acknowledges that one should not add extrinsic motivators to something that you do intrinsically as psychology has shown this can overshadow intrinsic motivators. A danger in gamification is making intrinsic reward extrinsic.

Bartle [5] argues that gamification can be seen as bribery as players receive worthless rewards for something that they have to do. By cultivating intrinsic rewards extrinsically, the goal of a well-designed gamified application provides rewards that have lasting value. Putting games and gamification next to each other to compare, we discover the following: what games offer is fun as an extrinsic reward for actions that we have already deemed enjoyable, but in gamification this emotion occurs when player receives a reward that is worth receiving.

Subsequently, engagement is re-appearing here as a central aspect of this study. We will now spend the discussion session talking about the other two axes. Keeping valuable rewards in mind, we turn to the discussions of how serious work can be improved by gamification and how it already uses game principles.

VI. Discussion

The themes brought up in section 4 will now be interpreted in light of the framework of section 2. One of the suggested theoretical implications brought out by these axes is better engagement. Section 5.1 takes up the challenge of our perception that game principles have no place in the real work world. This is followed by section 5.2 discussing how the real and the virtual are combining providing new ways to engage through gamification. Diagram 5-1 shows how both work vs. play and virtual vs. real are addressing engagement through gamification.

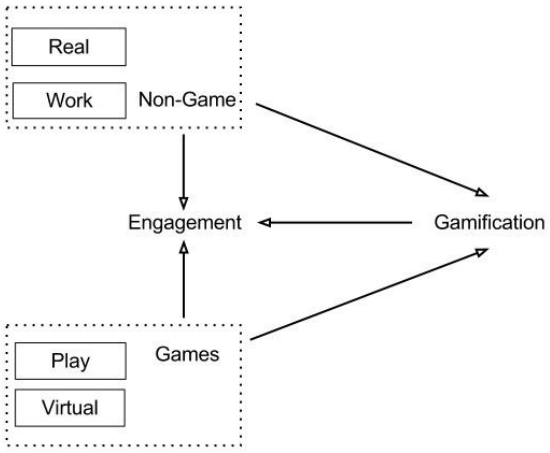

Diagram 5-1 Engagement - Aim and Acceptance

Both 'real' and 'work' are associated to 'non-game' at the top while 'virtual' and 'play' are joined to 'game' on the bottom. The goal of engagement is firmly situated in the middle as both sides desire it. Gamification provides a means to combine the two sides of the divide toward that goal. Through the new opportunities offered by the computing paradigms, the task of introducing gamified principles to the workplace becomes easier and more innovative.

A. Work versus Play

Turning first to work versus play, we find that while the terminology differs game principles are found in other fields.

To illustrate the metaphor presented in diagram 5-1 surrounding engagement, a selection of examples is provided. Work versus play has been understood as opposites, but this gaping divide is made to seem larger than it is by a semantic illusion of terms. The connection to engagement here is more potent than what name we use to define the principles put into practice.

1) Military

It is common to associate 'badges' with online game platforms, e.g. PlayStation Network, Xbox Live, and Steam where the players earn badges for achieving certain goals or milestones in the games. This concept has already been used for a long time in history outside the gaming world. Already in ancient Rome, military heroes were honored with medals, a tradition still held in militaries across the world today. In modern times, an example of this is when soldiers get the Purple Heart for being wounded in combat. Similarly, the Boy Scouts of America are using badges to promote specific skill-sets which are valuable in different fields, e.g. basketry or nuclear science [2].

2) Corporate

It is becoming widespread that companies seek to identify or develop new skills needed by the business to improve the competence, multi-skill, and flexibility within the company. Companies have started to reward employees on skill based or "competence-related" pay awards. However, the training required getting the experience or competence is voluntary and can be seen as a reward for achievements during work [71].

Nevertheless, companies have started to use something called "perks" instead of money to reward special contributions [71]. Perks are a form of gift and a way for the company to say "thank you" which can include small gifts, or even a company car, that could be seen as a badge for achieving voluntary tasks that are outside of the employees' area. The chances of increased engagement at the workplace will be enhanced when considering that "[a] good extrinsic motivation is a good map to intrinsic motivation." [86, p.29]

3) Academics

Researchers can be rewarded by different awards for their published work. The Electron Devices Society (EDS) award the best papers published in IEEE Transactions on Electron Devices (T-ED) and Electron Device Letters (EDL) with the prestigious Paul Rappaport and the George Smith awards to reward proper citation philosophy in EDS [39]. As mentioned earlier awards can be seen as badges which imply how the gamification terminology is found even in the academic science field.

4) Education as a system

All around the world, students have an exam or standardized test that they must pass to reach the next grade in school [57]. As the knowledge increases, the possibilities of passing that exam will increase. In the same way, games have the character reach a new level after gaining enough experience points. If a student does well in the exam, the better the grade will motivate the student. The worthiness of the student can be shown as some kind of ranking, e.g. class ranking based on grade point averages [1] or as a high score list or ladder list in games.

Every subsection discusses ways to mark progress and motivate the people involved. They are all attempts to engage the members of a community. The connection here shows the work vs. play discussion in another light. It is easier to accept gamification methods when you realize that they are, in principle, already found in the serious workplace.

B. Virtual vs. Real

When we accept that game principles are already found in work, we can begin to explore new forms and principles that can likewise be applied. As not only the work world, but other aspects of our daily life are merging two separate realms, the virtual and the real. Facebook, email, internet, and phones permeate every part of the social and work world. Constant connection makes possible for us to gamify the virtual world in order to affect the real one.

Chore Wars [15] can be used as a gamified management tool for both organizational and individual purposes. It can be compared to a simplified version of the tool Redmine [68]. for beginners, a complex tool like Redmine can be hard, annoying and frustrating. Thus, a basic tool like Chore Wars where the users create their own avatars alters the experience in a fun way. As the user accomplishes new tasks in the real world, the avatar will become stronger in the virtual. Each task completed by the user will be rewarded by experience points and gold. Task completion is enhanced by adding an element of fun to increase engagement instead of only logging a task. Numerous studies show that students, executives, and athletes are more successful if they feel like they can change things with their own actions and are in control over their fate [57]. This implies that Chore Wars can be a useful tool to gain experience and become familiar with the different professional management tools. Similarly, Santorum [72] argues for a "goal-based approach" will make it easier to learn and familiarize oneself with new skills in the virtual world. The simulation tool developed by Santorum is a prototype based on role playing games and quality management tools that takes part in the virtual world, Second Life [54].

In Second Life, the users create their own '3D avatars' that reflect themselves where they can interact with each other during work. A common misclassification of virtual worlds is to identify them as video games; it has a real game engine but it is truly a virtual world without pre-defined goals [46]. Virtual reality becomes a new media for humans to project their personalities in the virtual world in which characteristics of personality are transferred to a virtual simulation of us [54]. This transference can be viewed as becoming embodied in the virtual world. The user can "escape" from reality into a world as a completely different person, for example, a disabled person in a wheelchair can walk and run again [84]. Second Life can be seen as the poster child for gamification in reverse from the ordinary way. Compared to other gamified software, the action takes

place in the virtual world instead of the real. The reason we can see it as gamified software is that the users work collaboratively to build societies, buildings, and whatever the user aims to build within the world. It is possible to see it as a graphical extension of our online communities. This lends itself to the explorer, socializer and achiever player types found in Bartle [4]. Achievements are not identified by badges, tags, nor completed quests. Rather, they are found in buildings, e.g. bars, clubs, hotels, or an entire island. There is other education or business based ways of using Second Life as well. It has been tested as a virtual meeting space for real world distributed teams [72, 76] and has even been used to support the training for paramedics in Stanford medical school [51].This is principally utilizing the virtual world to affect reality. Hence, we see this tie back to gamification.

VII. Conclusion

The feeling of fun is one of the strongest drives that we possess. A successful insertion of this emotion together with game principles will help us in our everyday activities. As presented in diagram 5-1, engagement is the central aspect that ties these concepts together. All three axes are boundaries used to discuss how engagement through gamification is possible. From McGonigal's [57] intrinsic needs found in gaming, we see engagement connected to positive psychology and flow [18].

Engagement creates a more lucrative boost in our process in many areas. Whether it is a quest for better education, better health habits, a more productive process, or mastering a skill, gamification gives us one platform to explore these possibilities. Applying game principles to our everyday life can be an effective motivator for us.

Most of the examples given use one or more of the computing paradigms showing embodiment in action. As we interact in games and gamified processes to improve behaviors, we are extending a part of ourselves through technology. This allows us to grow, create new meaning, and new forms of interaction.

Finally, as shown in section 5.1, the work versus play axis is addressed showing the historical precedence of the gamification concepts that are already used in many fields today. Through this connection, we hope to grow the acceptance of gamification in the public domain and make it more mature.

Future Work

What we propose as future work is a quantified research where it is appropriate to apply gamification. Additionally, search for a deeper correlation between embodiment, meaning, and context with gamification. As mentioned in section 3.1, there are other themes outside of scope in this paper that needs to be explored, e.g. energy, science, or the military. Exploring the other themes can aid in seeing where the boundaries shall be drawn. The concept of 'flow' in relation to positive psychology and gamification should also be expanded for maturity of gamification theory.

Acknowledgment

We would like to thank our mentor, Carl Magnus Olsson at Chalmers|University of Gothenburg for his inspiration and sharing his knowledge in background behind the background. As well our colleagues for the contribution through discussions and support.

References

[1] D. Ai-halabi. "Dynamic Grading System for Universities," in 2010 Third International Conference on Advanced Computer Theory and Engineering (ICACTE), 2010, pp. 539-543.

[2] J. Antin and E. Churchill. "Badges in Social Media: A Social Psychological Perspective," in CHI 2011 Workshop Gamification: Using Game Design Elements in Non-Game Contexts, 2011, pp. 10-13.

[3] Badgeville. "The Behavior Platform." [Online]. Available at: http://www.badgeville.com/.
[Accessed 18 May 2012].

[4] R.A. Bartle. Designing virtual worlds. Berkeley, CA: New Riders, 2003.

[5] R. Bartle. "Gamification and its shortcomings." [Online]. Available at: http://www.youtube.com/watch?v=UEBAh6CnLVg.
[Accessed 15 May 2012].

[6] T. Ben-Shahar. Happier: Learn the Secrets to Daily Joy and Lasting Fulfillment, New York: McGraw-Hill, 2007.

[7] P. Boulanger. "Application of augmented reality to industrial tele-training," in First Canadian Conference on Computer and Robot Vision, 2004, pp. 320-328.

[8] V. Braun and v. Clarke. "Using thematic analysis in psychology," in Qualitative Research in Psychology, vol. 3. pp. 77-101, 2006.

[9] R. S. Brewer, G. E. Lee, Y. Xu, C. Desiato, M. Katchuck, and P. M. Johnson, "Lights Off . Game On . The Kukui Cup : A Dorm Energy Competition," in CHI 2011 Workshop Gamification: Using Game Design Elements in Non-Game Contexts, 2011, pp. 7-10.

[10] J. J. Castro-Schez, E. Castillo, J. Hortolano, and A. Rodriguez. "Designing and Using Software Tools for Educational Purposes : FLAT , a Case Study," vol. 52, pp. 66-74, 2009.

[11] L. Cheng, S. Shami, C. Dugan, M. Muller, J. DiMicco, J. Patterson, S. Rohall, A. Sempere, and W. Geyer. "Finding Moments of Play at Work," in CHI 2011 Workshop Gamification: Using Game Design Elements in Non-Game Contexts, 2011, pp. 18-21.

[12] G. Cheung. "Consciousness in Gameplay," in CHI 2011 Workshop Gamification: Using Game Design Elements in Non-Game Contexts, 2011, pp. 22-25.

[13] I.-tsun Chiang and S.-ti Chen. "Using Xbox 360 Kinect Games on Enhancing Visual Performance Skills on Institutionalized Older Adults with Wheelchairs," in 2012 Fourth IEEE International Conference on Digital Game and Intelligent Toy Enhanced Learning (DIGITEL), 2012, pp. 263-267

[14] S. P. Choe, H. Jang, and J. Song. "Roleplaying gamification to encourage social interactions at parties," in CHI 2011 Workshop Gamification: Using Game Design Elements in Non-Game Contexts, 2011, pp. 26-29.

[15] Chore Wars. "Chore Wars." [Online]. Available at: http://www.chorewars.com.
[Accessed 21 March 2012].

[16] Coding Horror. "The Gamification." [Online] Available at: http://www.codinghorror.com/blog/2011/10/the-gamification.html. [Accessed 20 May 2012].

[17] J. W. Creswell. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. 2nd. Edition, London: Sage Publications, 2002.

[18] M. Csikszentmihalyi. Beyond Boredom and Anxiety: Experiencing Flow in Work and Play, 25th Anniversary Edition. New York: Jossey-Bass, 2000.

[19] S. Deterding. "Situated motivational affordances of game elements: A conceptual model," in CHI 2011 Workshop Gamification: Using Game Design Elements in Non-Game Contexts, 2011, pp. 34-37.

[20] S. Deterding, D. Dixon, R. Khaled, L. E. Nacke. "Gamification: Toward a Definition," in CHI 2011 Workshop Gamification: Using Game Design Elements in Non-Game Contexts, 2011, pp. 6-9.

[21] S. Deterding, M. Sicart, L. Nacke, K. O'Hara, and D. Dixon. "Gamification: Using Game Design Elements in Non-Gaming Contexts," in CHI 2011 Workshop Gamification: Using Game Design Elements in Non-Game Contexts, 2011, pp. 2-5.

[22] N. Diakopoulos. "Design Challenges in Playable Data," in CHI 2011 Workshop Gamification: Using Game Design Elements in Non-Game Contexts, 2011, pp. 38-40.

[23] P. Dourish. "Embodied Interaction : Exploring the Foundations of a New Approach to HCI." pp. 1-16, 1999.

[24] P. Dourish. "What we talk about when we talk about context." Personal and Ubiquitous Computing, vol. 8, pp. 19-30, 2004.

[25] S. E. Dreyfus and H. L. Dreyfus. "A Five-Stage Model of the Mental Activities Involved in Directed Skill Acquisition." [Online]. Available:http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA084551&Location=U2&doc=GetTRDoc.pdf.

[Accessed: May 2012].

[26] M. S. El-Nasr, L. Andres, T. Lavender, N. Funk, N. Jahangiri, and M. Sun. "IgnitePlay: Encouraging and sustaining healthy living through social games," in 2011 IEEE International Games Innovation Conference (IGIC), 2011, pp. 23-25.

[27] I. Exman and D. Rauch, "The Σigma Game for Management," in CompEuro '90. IEEE International Conference on Computer Systems and Software Engineering, 1990, pp. 236-240.

[28] forums.uesp.net. "Morrowind." [Online]. Available at: http://forums.uesp.net/viewforum.php?f=5&sid=642f51709d34c087a7562259f0d97352.

[Accessed 09 May 2012].

[29] K. Gerling, and M. Masuch. "Exploring the Potential of Gamification Among Frail Elderly Persons," in CHI 2011 Workshop Gamification: Using Game Design Elements in Non-Game Contexts, 2011, pp. 45-48.

[30] Google Android Market. "CalorieCounter." [Online]. Available: https://market.android.com/details?id=com.fatsecret.android.

[Accessed: April 2012].

[31] Google Android Market. "CardioTrainer." [Online]. Available: https://market.android.com/details?id=com.wsl.CardioTrainer.

[Accessed: April 2012].

[32] Google Android Market. "MyFitnessPal." [Online]. Available: https://market.android.com/details?id=com.myfitnesspal.android.

[Accessed: April 2012].

[33] A. Grabowski and R. Kosiński. "Life span in online communities." Physical Review E, vol. 82, pp. 1-5, 2010.

[34] L. Grace. "Gamifying archives, a study of docugames as a preservation medium," in 2011 16th International Conference on Computer Games (CGAMES), 2011, pp. 172-176.

[35] J. Gu, N. Li, and H. B.-L. Duh. "A remote mobile collaborative AR system for learning in physics," in 2011 IEEE Virtual Reality Conference, 2011, pp. 257-258.

[36] O. Inbar, N. Tractinsky, O. Tsimhoni, and T. Seder. "Driving the Scoreboard: Motivating Eco-Driving Through In-Car Gaming," in CHI 2011 Workshop Gamification: Using Game Design Elements in Non-Game Contexts, 2011, pp. 60-63.

[37] H. Ishii. "TeamWorkStation: Towards a Seamless Shared Workspace," in ACM Conference on Computer-Supported Cooperative Work (CSCW'90), 1990, pp. 13-26.

[38] H. Ishii and B. Ullmer. "Tangible Bits : Towards Seamless Interfaces between People , Bits and Atoms," in Conference on Human Factors in Computing Systems (CHI '97), 1997, pp. 234-241.

[39] R. P. Jindal. "Proper Referencing of Prior Art." IEEE Electron Device Letters, vol. 52, 2005, pp. 282-282.

[40] J. Khakhar and S. Madhvanath. "JollyMate: Assistive Technology for Young Children with Dyslexia," in 2010 12th International Conference on Frontiers in Handwriting Recognition, 2010, pp. 576-580.

[41] A. Khalil and S. Glal, "StepUp: A Step Counter Mobile Application to Promote Healthy Lifestyle," in International Conference on the Current Trends in Information Technology (CTIT), 2009, pp. 1-5.

[42] Khan Academy. "Khan Academy." [Online]. Available:

http://www.khanacademy.org/.

[Accessed: April 2012].

[43] A. J. Kim. Community Building on the Web: Secret Strategies for Successful Online Communities, Boston: Addison-Wesley Longman Publishing Co., 2000.

[44] A. J. Kim. "Smart Gamification: Seven Core Concepts for Creating Compelling Experiences." [Online]. Available at: http://www.youtube.com/watch?v=F4YP-hGZTuA&feature=related. [Accessed 20 March 2012].

[45] C. Kimer, E. R. Zorzal, and T. G. Kirner. "Case Studies on the Development of Games Using Augmented Reality," in 2006 IEEE International Conference on Systems, Man and Cybernetics, 2006, pp. 1636-1641.

[46] E. Klopfer, S. Osterweil, K. Salen, J. Groff, and D. Roy. "moving learning games forward." 2009.

[47] K. Kuikkaniemi, J. Holopainen, and K. Huotari. "Play Society Research Project," in CHI 2011 Workshop Gamification: Using Game Design Elements in Non-Game Contexts, 2011, pp. 68-71.

[48] F. L. Law, Z. M. Kasirun, and C. K. Gan. "Gamification towards sustainable mobile application," in 2011 Malaysian Conference in Software Engineering, 2011, pp. 349-353.

[49] J. J. Lee, T. College, D. Ph, E. Hammer, and M. Interdisciplinary. "Gamification in Education : What , How , Why Bother ? What : Definitions and Uses," vol. 15, pp. 1-5, 2011.

[50] M. Laschke and M. Hassenzahl. "Mayor or a patron? The difference between owning badges and telling stories," in CHI 2011 Workshop Gamification: Using Game Design Elements in Non-Game Contexts, 2011, pp. 72-75.

[51] F. Liarokapis, L. Macan, G. Malone, G. Rebolledo-Mendez, and S. D. Freitas. "A Pervasive Augmented Reality Serious Game," in 2009 Conference in Games and Virtual Worlds for Serious Applications, 2009, pp. 148-155.

[52] I. M. Lopes, B. M. Silva, J.J.P.C. Rodrigues, J. Lloret, and M. L. Proença Jr. "A mobile health monitoring solution for weight control," in 2011 IEEE International Conference on Wireless Communications and Signal Processing (WCSP), 2011, pp. 1-5.

[53] F. Lu and J. Welton. "Towards Combating Youth Obesity with a Mobile Fitness Application," in 2012 IEEE Seventh International Conference on Wireless, Mobile and Ubiquitous Technology in Education, 2012, pp. 226-228.

[54] A.D. Lucia, R. Francese, I. Passero, and G. Tortora. "SLMeeting: supporting collaborative work in Second Life." Proc. AVI 2008, ACM Press, 2008, pp. 301-304.

[55] T. W. Malone. “Toward a theory of intrinsically motivating instruction.” Cognitive Science, vol. 5, 333-369, 1981.

[56] H. Maslow. “A theory of human motivation.” Psychological Review, vol. 50, pp. 370-396, 1943.

[57] J. McGonigal. Reality Is Broken. New York: The Penguin Press, 2011.

[58] J. B. Mendes, G. H. Caponetto, G. P. Lopes, and A. C. B. Ramos. “Low cost helicopter training simulator a case study from the brazilian Military Police,” in 2010 IEEE International Conference on Virtual Environments, Human-Computer Interfaces and Measurement Systems, pp. 18-22, Sep. 2010.

[59] E. S. Monsalve, V. M. B. Werneck, and J. C. S. D. P. Leite. “Teaching software engineering with SimulES-W,” in 2011 24th IEEE-CS Conference on Software Engineering Education and Training (CSEE&T), 2011, pp. 31-40.

[60] F. Müller, F. Peer, S. Agamanolis, and J. Sheridan. “Gamification and Exertion,” in CHI 2011 Workshop Gamification: Using Game Design Elements in Non-Game Contexts, 2011, pp. 80-83.

[61] A. Navarro, J. V. Pradilla, U. Icesi, and P. Madriñan. “Work in Progress - Serious 3D Game for Mobile Networks Planning,” in Frontiers in Education Conference (FIE), 2010 pp. 1-2.

[62] Nike+. “Nike+.” [Online]. Available at: http://nikeplus.nike.com/plus/.
[Accessed 23 March 2012].

[63] S. Nikkila, S. Linn, H. Sundaram, and A. Kelliher. “Playing in Taskville: Designing a Social Game for the Workplace,” in CHI 2011 Workshop Gamification: Using Game Design Elements in Non-Game Contexts, 2011, pp. 88-91.

[64] D. A. Norman. The Invisible Computer: Why Good Products Can Fail, the Personal Computer is So Complex, and Information Appliances Are the Solution. Cambridge, Mass.: MIT Press, 1998.

[65] K. A. Peppler and Y. B. Kafai. “What Videogame Making Can Teach Us About Literacy and Learning : Alternative Pathways into Participatory Culture,” in 2007 Authors & Digital Games Research Association (DiGRA), 2007, pp. 369-376.

[66] C. Peterson, and S. Martin. Character Strengths and Virtues: A Handbook and Classification, Oxford University Press: New York, 2004.

[67] J. P. Pollak, G. Gay, S. Byrne, E. Wagner, D. Retelny, and L. Humphreys. “It’s Time to Eat! - Using Mobile Games to Promote Healthy Eating.” IEEE Pervasive Computing, vol. 9, pp. 21-27, 2010.

[68] Redmine. “Overview - Redmine.” [Online]. Available at:http://www.redmine.org/.
[Accessed 12 May 2012].

[69] B. Reeves, J. J. Cummings, and D. Anderson. “Leveraging the engagement of games to change energy behavior,” in CHI 2011 Workshop Gamification: Using Game Design Elements in Non-Game Contexts, 2011, pp. 92-97.

[70] M. B. Ribeiro, R. M. Czekster, and T. Webber. “Improving Productivity of Local Software Development Teams in a Global Software Development Environment ∗,” in IEEE international conference on Global Software Engineering(ICGSE’06), 2006, pp. 253-254.

[71] S. Rothwell. “Current trends i n reward systems.” Engineering Management Journal, vol. 4, pp. 252-256, 1994.

[72] M. Santorum. “A Serious Game based Method for Business Process Management,” in 2011 Fifth International Conference on Research Challenges in Information Science (RCIS), 2011, pp. 1-12.

[73] N. A. M. E. Sayed and H. H. Zayed. “ARSC : Augmented Reality Student Card An Augmented Reality Soultion for the Education field.” Computers & Education, vol. 56, pp. 113-120, 2011.

[74] J. Science. “The Case Analysis of Serious Game in Community Vocational Education,” in 2011 International Conference on Computer Science and Network Technology, 2011, pp. 1863-1866.

[75] M. Sicart. “Defining Game Mechanics. the international journal of computer game research.” [Online]. Available: http://gamestudies.org/0802/articles/sicart
[Accessed: May 2012].

[76] N. S. Shami, L.-te Cheng, S. Rohall, A. Sempere, and J. Patterson. “Enhancing Distributed Corporate Meetings with ‘Lightweight’ Avatars,” in CHI 2010: Work-in-Progress, 2010, pp. 3829-3834.

[77] B. M. Silva, I. M. Lopes, J. J. P. C. Rodrigues, and P. Ray. “SapoFitness: A mobile health application for dietary evaluation,” in 2011 IEEE 13th International Conference on e-Health Networking, Applications and Services, 2011, pp. 375-380.

[78] R. Smith. “The Future of Work is Play : Global Shifts Suggest Rise in Productivity Games,” in 2011 IEEE International Games Innovation Conference (IGIC), 2011, pp. 40-43.

[79] I. Sommerville. “Software Engineering.” 8th Edition. Harlow:Addison Wesley, 2010.

[80] B. W. Tuckman. “Developmental sequence in small groups”, in Psychological Bulletin, vol. 63, pp. 384-399, 1999.

[81] D. Vara, E. Macías, S. Gracia, A. Torrents, and S. Lee. “MEECO : GAMIFYING ECOLOGY THROUGH A SOCIAL NETWORKING PLATFORM.” M.A. thesis, Universitat Ramon Llull, La Salle, 2011.

[82] H.V. Welbergen, A. Nijholt, D. Reidsma, J. and Zwiers. “Presenting in Virtual Worlds: An Architecture for a 3D Anthropomorphic Presenter.” Intelligent Systems, IEEE, vol. 21, pp. 47-53, 2006.

[83] J. Yang, X. Wei, M. S. Ackerman, and L. A. Adamic. “Activity Lifespan : An Analysis of User Survival Patterns in Online Knowledge Sharing Communities,” in Fourth International AAAI Conference on Weblogs and Social Media, 2010.

[84] Y. Yoo. “Computing in Everyday Life: A Call for Research on Experiental Computing.” Yoo/Computing in Everyday Life, vol. 34, 2010, pp. 213-231.

[85] A. Yusoff, R. Crowder, L. Gilbert, and G. Wills. “A Conceptual Framework for Serious Games,” in 2009 Ninth IEEE International Conference on Advanced Learning Technologies, 2009, pp. 21-23.

[86] G. Zichermann and C. Cunningham. Gamification by Design. Canada: O’Reilly Media, 2011.