Gamification: State of the Art Definition and Utilization

Fabian Groh
Ulm University
Institute of Media Informatics
Email: fabian.groh@uni-ulm.de

Abstract—This paper analyzes a definition of gamification as "the use of game design elements in non-game contexts". In this context, gamification can be set in relation to and differentiated from exisiting research. Due to the fact that this definition allows various game design elements, these are related to the self-determination theory. Consequently, there is a discussion about what gamified applications are able to offer and what problems they indicate.

I. INTRODUCTION

Current developments show the success of gamified applications, like the location-based service Foursquare[1] or the protein folding game foldit[2], where gamers solve the crystal structure of a retroviral protease which is involved in reproduction of HIV [1]. Analyzing these examples, a phenomenon can be observed: user activity and retention are improved by combining game design elements with non-game context. This phenomenon is called "gamification" in most cases.

While this term was first introduced in the early 2000s, it did not get huge attention until different industry players as well as conferences put it on the map for a wider audience in the second half of 2010. Thereupon, plenty gamified applications were developed across different domains such as productivity, finance, health, education, sustainability as well as news and entertainment media. Of course this also caught the attention of digital marketeers and interaction designers to improve their products. For example several vendors offer gamification as a software service layer of rewards and reputation systems like levels and badges. As we can see, the commercial aspect of gamification has a wider audience and it mainly differs between two concepts. The first point is the increase of acceptance and ubiquity of games in everyday life [2, 3, 4] and the second is to improve non-game products by increasing the motivation of users to engage with them on the same level of unique intensity and duration which is known from game design elements [5, 6]. Additionally, this also offers new possibilities and data sources for human-computer interaction.

Although, the phenomena of gamification is recently gaining the scientific attention [7, 8] [9], only few works

[1]https://foursquare.com/
[2]http://fold.it

provide a definition of gamification. Therefore, we firstly have a deeper look into the work of Deterding at. al. [10, 11]. They survey and situate current uses of gamification within existing research and explain as well as take apart their definition of gamification as "the use of game design elements in non-game contexts". Thereafter, we analyze the criteria which should be fulfilled by an gamified application. The last part then discusses the chances as well as the threads of gamification.

II. DEFINITION

This part mainly follows the work of Deterding et. al. [11, 10], who define gamification as "the use of game design elements in non-game contexts". If gamification has to be identified as an academic term, it is necessary to demarcate this phenomenon from previous research as well as embed it into existing fields. Therefore and in order to better understand gamification, we first need to clearly define the related terms of this definition.

A. Game

First, we have to distinguish between game and play. Whereas the word "play" is used for games as well as for toys, there is a difference. Therefore, we follow Caillois' concept, which describes paidia and ludus as two poles of play activities [12]. While paidia (playing) describes free-form, expressive, improvisational behaviors and meanings, ludus (gaming), on the other side, characterizes rule-based playing with determined goals.

In matter of gamification we are talking about the design elements of gaming (i.e. ludus) since critiques from the academic as well as the industrial point of view have indicated the focus of gamification is almost exclusively on ludus with just a little space for paidia [13]. Consequently, the term "gamfulness" is taken over from McGonigal [7]. She has introduced "gamefulness" as a counterpart for "playfulness". While, "gamefulness" describes the experiential and behavioral qualities of gaming (ludus), "playfulness" describes the same for playing (paidia). Hence, in the HCI context gamification is distinguished from playfulness, playful interaction and playful design [14, 15]. Nevertheless, in practice gamified applications can also encourage playful behaviors and mindsets.

Additionally, gamification should not be limited to digital technologies. Whereas the majority of gamified applications is digital, this constraint is not required.

B. Element

In contrast to "serious games", which are full-fledged games for non-entertainment purpose, gamified applications just use elements of games. On "Serious games" the main goals are solving problem to train, investigate or advertise the users [14]. Examples are "America's Army"[3] for the purpose of train and advertise recruits, and "Microsoft Flight Simulator"[4] which was created as a simulator for civil aviation. However, this distinction may be very personal, social and subjective and depends on your perceptions and enactments. Hence, it is not clear if a group of people 'play' or 'use' an application like for example Foursquare. In their work, Deterding et. al. also found increasing acknowledgment that a definition of game must go beyond properties of the game artifact to include situated and socially constructed meanings to handle applications like Foursquare where the aspects of 'play' and 'use' are mingled [11]. Therefore, we have to (a) look for technical as well as social elements of games and (b) technical elements should be more as affording gameful interpretations and enactments rather than being gameful.

The next step is to clarify what is the set of 'game elements'. For example, take some of the "Ten Ingredients of Great Games" by Reves and Red [8] like avatars, time constraints, feedback, ranks or levels. Whereas if one of these elements are common in one type of game, it could be very unlikely to be found in another kind of game, e.g. avatars and levels are usual in adventure games but there are rare in real-time strategy games. However, non of such elements would automatically identify an application to be gamified. Additionally, all of them can already be found outside of games. In matter of define gamification there are two opposite poles to limit the set of game elements. On the one hand any element found in any game (liberal), and on the other hand elements that are unique to games (constrained). However, this would be either boundless or empty. Thus, Deterding et. al. suggest to limit gamification to the description of elements that are characteristic to games, but this is a heuristic and there is still much room to discuss [11].

C. Design

As already mentioned, elements of games can be found outside games. If we are looking more into the technical aspects, there is for example a long tradition in HCI to use game controllers and other hardware for non-game purposes, e.g. XBMX[5] a media center for the video game console xbox, as well as using graphic engines and three dimensional environments for simulations. Hence, the term of game *design*

[3]http://www.americasarmy.com/

[4]http://www.microsoft.com/games/flightsimulatorx/

[5]http://xbmc.org

Table I
LEVELS OF GAME DESIGN ELEMENTS.

Level	Description	Example
Game interface design patterns	Common, successful interaction design components and design solutions for a known problem in a context, including prototypical implementations	Badge, leaderboard, level
Game design patterns and mechanics	Commonly reoccurring parts of the design of a game that concern gameplay	Time constraint, limited resources, turns
Game design principles and heuristics	Evaluative guidelines to approach a design problem or analyze a given design solution	Enduring play, clear goals, variety of game styles
Game models	Conceptual models of the components of games or game experience	challenge, fantasy, curiosity; game design atoms;
Game design methods	Game design-specific practices and processes	Playtesting, playcentric design, value conscious game design

is used instead of game-based technologies or practices.

Deterding et. al. have analyzed the description of game design elements from previous researches and out of that they defined their own five levels of abstraction, which are shown in Table I from concrete to abstract [11]. They suggest to include all these levels in the definition of gamification.

D. Non-game contexts

Game design elements are normally created for the purpose of entertainment. However, for the case of gamification these elements are now used to enhance other applications, similar to serious games [11].

Nonetheless, Deterding et. al. suggest to not limit the definition of non-game context any further for any specific usage, intentions, contexts, or media, because (a) there is no clear advantage of such a restriction and (b) serious games have also developed themselves into all kind of contexts, although there was a specific purpose (e.g. learning) at the beginning. Thus, Sawyer's taxonomy of serious games [16], which provides training games, newsgames, or health games as potential subcategories can also be adopted for potential subcategories of gamification: training gamification, news gamification, health gamification, and other application areas.

Furthermore, this definition for gamification also excludes the presumed gamification of games [17] with a meta-game platform like an achievement system [18], because this would simply be an extension of a game and consequently a part of the game design and not gamification.

E. Situating "Gamification"

The definition of gamification from Deterding et. al. can be summarized the following way. Gamification is:

- the use of (in contrast to extension)
- game (in contrast to play or playfulness)
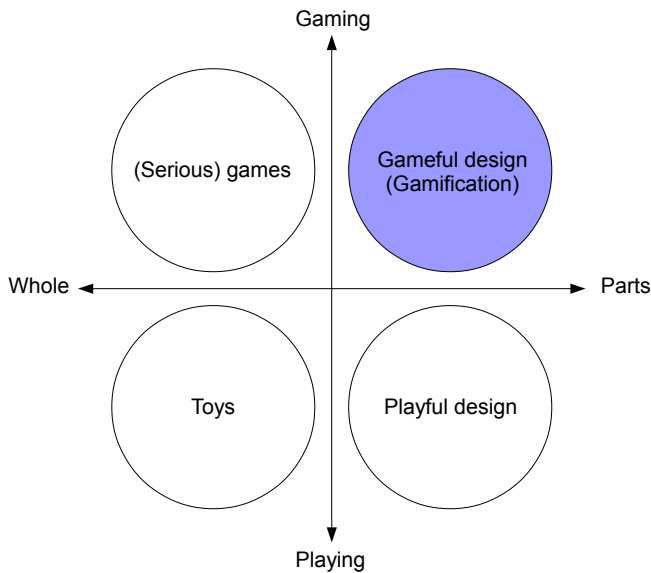- design (in contrast to game-based technology)

Figure 1. Separating the term of gamification from serious games on the parts/whole axis as well as from playful design along the gaming/playing axis [10].

- elements (in contrast to full-fledged games)
- in non-game context (regardless of specific usage intentions, contexts, or media of implementation)

As shown in Figure 1, the definition from Deterding et. al. separates gamification from serious games and the design of playful interaction on the two dimension of playing/gaming and parts/whole. While, the parts/whole-axis separates games and respectively serious games from gamification, the playing/gaming-axis differentiates between gamification (gameful design) and playful design as well as toys if both axes are used.

If a broader scheme is used to place gamification, it can be found in the socio-cultural trend of ludification. This is illustrated in the Figure 2.

There is one alternative academic approach for defining gamification from Huotari and Hamari [19]. They use a service-marketing point of view to define it as a "service packing where a core service is enhanced by a rules-based service system that provides feedback and interaction mechanism to the user with an aim to facilitate and support the users' overall value creation". Deterding at. al. indicate that, if the definition from Huotari and Hamari would be taken, even an touchpad for ordering snacks in a cinema would be a gamified application. Therefore, their own definition would improve this weakness.

III. PRINCIPLES FOR GAMIFYING APPLICATIONS

This chapter is inspired by two presentations from the "GoogleTechTalks" program[6]. The first presentation "The Pleasure Revolution: Why Games Will Lead the Way" is presented by Jesse Schell [20] and the second one
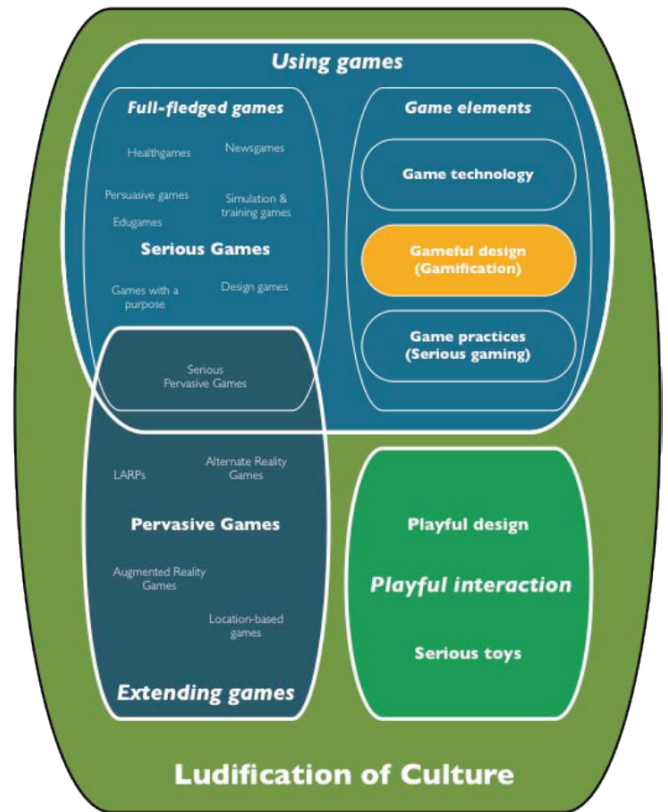
[6]research.google.com

Figure 2. Placing the term gamification into the broader schema of ludification to get the relations. Graphic from Deterding [10].

"Meaningful Play: Getting Gamification Right" by Sebastian Deterding [21]. These speeches present some principles for the elements of game design for a good gamified application. Unfortunately, there is no published print version about the presentations until now due to the novelty of the field.

First of all, Schell and Deterding both criticize the state of the art of gamification, as a blueprint for putting point, badges, and leaderboards on everything. However, pleasure is not additive and rewards can backfire. This is shown by Alfie Kohn in his book "Punished by rewards" [22]. One of the studies demonstrates that children will draw more pictures, but in lesser quality, if they are paid for drawing pictures. However, the more important fact is that the children did not like drawing pictures as much as before, after they are stopped being paid. This effect is know as "Overjustification" and verified by Lepper et. al., where intrinsic motivation is shifted towards the extrinsic incentives [23].

Therefore, Schell and Deterding introduce three important principles, which are adopted from the "self-determination theory" from Deci and Ryan [24]. This theory describes three innate needs for intrinsic motivation:

- **Relatedness**: The universal need to interact and be connected with others.
- **Competence**: The universal need to be effective and master a problem in a given environment.
- **Autonomy**: The universal need to control one's own life.

The connection between the "self-determination theory" and games is shown in "Glued to Games" by Rigby and Ryan [25], where they also demonstrate that games are doing well in satisfy this needs.

Thus the next three paragraphs explain these points in detail.

A. Relatedness

After its huge success, more and more foursquare users are leaving the service, because they have realized that there is no real benefit beyond the rewards. Comparing this to a site like "stackoverflow"[7], a question and answer platform mainly for the purpose of programming. Even after removing all points and badges from the platform, there would still be meaningful content. For that reason, it is important to catch the user's *personal goals*, or more general, customizable goals, which are connected to any interest or passion of the user that he already has in his everyday life. For example, the mini game foldit, mentioned in the introduction, primarily engages a lot of people with a scientific background.

This directly leads to the next point. In order for status and reputation (levels, badges, leaderboards) to work, it is important to connect the user to a *meaningful community* with the same interests. An achievement is made to show it your friends with the same interests. If there is nobody whom you can show it to, your achievement will be nothing special. A common method of video games to reach more relatedness is a *meaningful story*. In most cases this means that the player has to save mankind from something. This approach can also be used in real-life applications by wrapping a story around the activity, which is further supported with suitable visuals. However, in the context of relatedness it is important to *beware of social context meaning*. While something is clear on different platforms or within a certain group, it can be confusing for people outside this area.

The principle of relatedness can be summarized as:

- Connect to personal goals
- Connect to a meaningful community of interest
- Create a meaningful story
- Beware of social context meanings

B. Competence

The need of effectively solving a problem depends on problem itself. Therefore, Schell introduce an idea of a button, where somebody who needs to clean dishes could simply push the button and all the work would be done. A great number of people would like to have such a tool. However, if this button would also exist to win a game by simply pushing it once, this game would probably have not much success. The "Progress Wars"[8] from Jakob Skjerning is such a game, where the only task is to click a button, which

[7]http://stackoverflow.com
[8]progresswars.com

Figure 3. Progresswars: A parody of game design, where you get rewards and levels by simply clicking one button.

is not really engaging (Figure 3). Thus, the set of tasks can be divided into the categories of "Have to do" and "Want to do". Where the category of "Have to do" includes things like duty, work, slavery, and even efficiency, whereas the "Want to do" involve fun, play, freedom, and especially pleasure. While the first category should be as simple as possible, the second category should not.

Furthermore, the game designer Raph Koster said: "Fun from games arises out of mastery. It arises out of comprehension. It is the act of solving puzzles that makes games fun. With games, learning is the drug." [26]. This means that the fun in video games is to develop an ability to master the next step in the game. While, solving mathematical equations in the context of games is fun for a lot of people, they would simultaneously disagree to denote the same task as fun in the context of school, where most of the tasks seem to be boring and repeating. Additionally, in the context of games, people often even do not notice or realize that they are doing math. Thus, it is important to confront the user with *interesting challenges*. This can be reached by combining well-defined goals and rules.

Moreover, it is crucial to present these goals in a *clear and visual* way as well as *structure* them well. That means the goals are taken apart into smaller chunks in such a way that there are always small and doable tasks. The *scaffolding* for those challenges should increase the difficulty for reaching the next level. Additionally, it should match the "Flow theory" from Csikszentmihalyi [27] illustrated in Figure 4. This theory describes a mental state of full focus and immersion in one activity.

Therefore, is is also desirable to *vary* the difficulty inside the flow region, where people are neither underchallenged nor overchallenged. Even failures are desired, because it improves the experience of mastering the challenge thereafter. Of course, it should also vary the challenge itself to prevent doing the same thing all over.

There is one more thing games are really good at: give *juicy feedback*, something often lacking from real-life. The term "juicy" means that the feedback is "fresh" and encouraging as well as, in contrast to real-life, a gamer has the possibility to get feedback at any given state of the game.

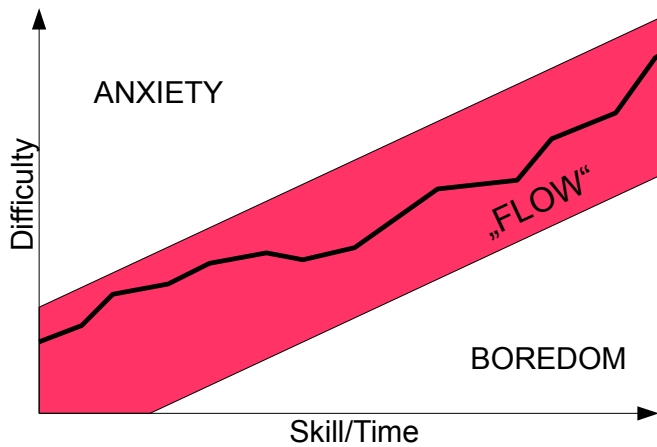Although, there is a danger in the part of competence by

Figure 4. The Flow theory: As long as the difficulty of the challenge is within the flow, poeple are neither overchallenged nor underchallenged [21].

Figure 5. Choose personal goals for your own contract of this month. "DO's" are visualized in greed, while red is the color for "DON'Ts".

Figure 6. The chosen goals can further be customized to match personal interest as well as influence the level of difficulty.

emerging *unintended behaviors* trying to avoid the challenge. One example is "Mayor Maker" for Foursquare, a tool which automatically checks in and out of places the user is just driving by.

Therefore, gamified applications have to address the user's competence need by offer tasks in a challenging and interesting way, while handing "juicy" feedback.

Recap this paragraph:
- Provide interesting challenges
- Provide clear, visual, varying, and well structured goals
- Provide jucy feedback
- Beware of unintended behaviors

C. Autonomy

Most games are a *voluntary activity* and the choice to play is intrinsic. Following the "overjustification" effect [23], it can be dangerous if extrinsic rewards, like cash incentives, are used, especially in contexts of work. Therefore, if there is a "if..then" reward, people will tend to realize that they are *losing their autonomy* and being controlled, which is in general a really de-motivating experience. Furthermore, *devaluating the activity* is another point to beware of when using extrinsic rewards. For example, if there is a sweepstake from a service and the condition to take part is to re-tweet it, the signal is that the service is not good enough. For that reason, the people would not autonomously re-tweet it to their friends.
However, there are methods to deal with that. Like customer services shows that *shared goals, but individual pursuit* works quite well. As well as using informational feedback rather than controlling feedback and using unexpected rewards.

Wrapping it up:
- Play is voluntary
- Beware of losing autonomy

- Beware of devaluating activity

D. An example of a gamified application

Now let's have a look at healthmonth.com as one specific example. It is a pervasive health application which tries to help people live healthier.

1) Relatedness:

a) Personal goals: After the registration, the first task is to choose *personal* goals from a list of "DO's"(green) and "DON'Ts" (red). These goals can further be *customized* to range from easy to difficult and match the user's interest, see Figure 5 and Figure 6.

b) Connect to a meaningful community of interest: The gamer is connected to people who are also interested in enhance their health and the set of teammates is further determined on the difficulty of the chosen goals. Therefore, you always play with or against people on an almost equal level of interest. This placement can be seen in Figure 7.

So far, you have chosen 5 rules.

Difficulty Level   DO's vs DON'Ts   Extreme, Moderate, & Kaizen

Medium

Based on the difficulty of the rules you've chosen, you will be placed in the **Orange Game** with 286 other people so far, a bracket meant for those looking for small, incremental, changes to their health habits.

Figure 7. There is always a feedback about your current state as well as at this point you see where you would be placed depending on the currently chosen personal goals.

I, fabi, accept the following rules for the month of December...

1. No alcohol
2. No caffeine
3. Cook dinner 1 day a week
4. Drink at least 1 glass of water a week
5. Eat raw fruit at least 1 day a week

I have chosen these rules in the hopes that I might slowly begin to live a healthier life, and enjoy the process.

If I succeed at following these rules for a full month without running out of life points (I will start with 10 and lose 1 every time I break a rule), I understand that my name will be added to the **Wall of Awesomeness**. But if I run out of life points, I also accept that my name will be added to the **Wall of Almost-But-Not-Quite Awesome**.

In addition, I (optionally) pledge to the following self-created rewards and punishments...

If I end the month with at least 1 life point, I will...   If I end the month with less than 1 life point, I will...

Examples: take a trip to San Francisco, adopt a puppy, eat an ice cream cone.   Examples: donate $10 to a charity, try again next month, eat a whole head of lettuce.

Signed,

Figure 8. This shows a contract with the chosen goals. The gamer has to sign this contract to start the game.

Additionally, it is also possible to heal your teammates to help them if they missed a goal. This improves the importance of playing together, because it is not possible to heal oneself.

c) The meaningful story and the social context meaning: There is no fictional story, just the real-life and the shared monthly recap of the behaviors. While, healthiness is a desirable goal within the society, a player has to consider that his information can be watched by others. Therefore, it is possible to use the service anonymously.

2) Competence:

a) Provide interesting challenges: As the goals are determined by the users themselves, it is up to them to come up with interesting challenges. In Figure 8 you can see a contract, which is set up and has to be signed by the user to start the game. There are also free spaces to define own rewards or punishment. Nevertheless, the difficulty also depends on previous habits.

b) Provide clear, visual, varying, and well structured goals: As it can be seen in Figure 9 the goals are clear and visual as well as there are some additional incentives like team points and extra points. However, the variation as well as the structure is mostly in the hands of the user by defining the goals for each month. It could help to put some more incentives to increase the difficulty as well as points gained over time.
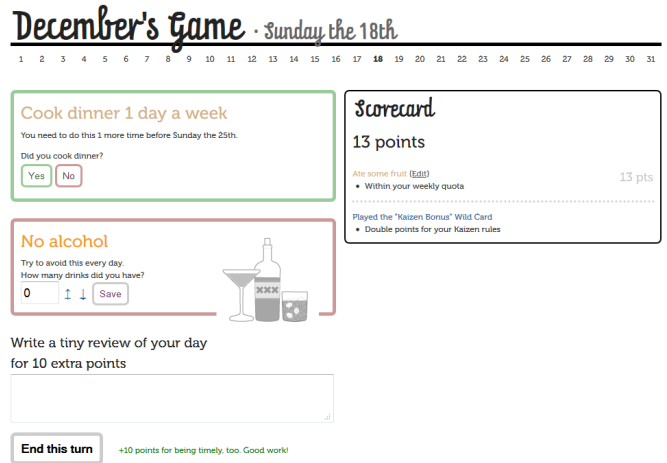

December's Game · Sunday the 18th

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 **18** 19 20 21 22 23 24 25 26 27 28 29 30 31

Cook dinner 1 day a week
You need to do this 1 more time before Sunday the 25th.
Did you cook dinner?
[Yes] [No]

No alcohol
Try to avoid this every day.
How many drinks did you have?
[0] ↑ ↓ [Save]

Scorecard
13 points
Ate some fruit (Edit)   13 pts
• Within your weekly quota
Played the "Kaizen Bonus" Wild Card
• Double points for your Kaizen rules

Write a tiny review of your day
for 10 extra points

[End this turn]   +10 points for being timely, too. Good work!

Figure 9. When you play healthmonth, you have to do daily turns, where you describe the progress of your goals.

c) Provide jucy feedback: You will get feedback all over the place, like it is visualized in Figure 7. Even though the feedback is discreet, it is enough and visualized well.

d) Beware of unintended behaviors: This is one of the most difficult parts to handle in the context of healthmonth.com, because there is no guaranty that a player is faithful in his tasks. Therefore, the whole concept is built on self-assurance as well as the trust within the community. Furthermore, there is no real benefit from cheating themselves.

3) Autonomy:

a) Play is voluntary: All of healthmonth.com is firstly intrinsic. Otherwise it would not have a real attraction.

b) Beware of losing autonomy or devaluating activity: However, there is a superior socio-economic principle which could be denoted as extrinsic. Therefore, there is the danger that people start to realize that. However, the result would be simply to stop playing the game.

IV. THE FUTURE OF GAMIFICATION

The chapter is a discussion about the future of gamification between hope, thread and hype.

One of the best-known proponents is Jane McGonigal. She is a game designer, researcher and author, specializing in pervasive computing and alternate reality games. One of the main aspects from her book "Reality Is Broken: Why Games Make us Better and How they Can Change the World" [7] is that for solving the world's problems it is important that people play more games and not less. One of the games which substantiate her argumentation is "World without Oil"[9]. Where, the gamers have to image that they are living on earth without oil and find out how they can survive. The players created podcasts on how they are living and helped each other on developing strategies for that. The second game is "Superstruct"[10] in which over 8000 people

[9]worldwithoutoil.org
[10]superstructgame.net

have tried to find superstructs to save mankind. The players have to develop ideas to hold superthreats like ravenous, power struggle or outlaw planet. However, there were no particular guidelines how such superstruct should be formed. Both games have the principle of "Play it - before you live it".

Of course, there are threats in the topic of gamification. One of this threats is the "Vision of the Gamepocalype" introduced by Jesse Schell [2]. In his vision there is a possible future, in which you play a game in every second of your life. For example: if you brush your teeth you will get +10 points, if you look at advertisement: +20 points, if you are eating the right cereals: +30 points and so on. This also goes along with Gabe Zichermann, he said: "games are the only force in the known universe that can get people to take actions against their self-interest, in a predictable way, without using force" [28]. Additionally, there is a huge privacy problem. Because all over, these gamified applications acquire a lot of personal data and in the way of achievements, presented in the internet, this data is also permanent.

V. CONCLUSION

A huge discussion about gamification started in late 2010. For that reason, this overview about the current state of gamification is just able to present a small part of the whole discussion. Nevertheless, the definition introduced by Deterding et. al. is able to isolate the phenomenon of gamification from previously introduced areas of research as well as set it in relation to it [10]. While, their definition seems fitting, it will be probably just the start and it has to be further enhanced.

Since, the definition just says, that there are game design elements which should be used in non-game contexts. There is still much room how these game design elements should behave and look like. Therefore, the second part mainly discussed important game design elements and associated them to the "self determination theory", used as the base of a good gamified application. Whereas, there are maybe some applications which have success outside this spectrum, most of the current successful gamified applications can be substituted to fulfill these three points: competence, relatedness and autonomy.

McGonigal is one of the first researchers who examined the question what games can offer for the society in particular. Although, serious as well as pervasive games have a long tradition in game design, this has opened a new perspective. The crowdsourcing potential is currently used in a lot of gamified applications like DNA matching games foldit or phylo.

Finally, following the point about losing autonomy made before, the exaggerated vision from Schell and Zichermann is unlikely to happen. However, there are of course threats of privacy and "over gamification". Nonetheless, Schell makes a point that the hype about gamification is based on the fact that society itself changed into a more pleasure based society. Thus, gamification has its rights in the current discussions. However, for a good academic summary the hype has to cool down before and proper scientific studies about the benefits as well as the side-effects of gamification are needed.

REFERENCES

[1] F. Khatib, F. DiMaio, F. C. Group, F. V. C. Group, S. Cooper, M. Kazmierczyk, M. Gilski, S. Krzywda, H. Zabranska, I. Pichova, J. Thompson, Z. Popovic, M. Jaskolski, and D. Baker, "Crystal structure of a monomeric retroviral protease solved by protein folding game players," *nature structural & molecular biology, advance online publication*, 2011.

[2] J. Schell. Visions of the gamepocalypse. [Online]. Available: http://bit.ly/bT62k3

[3] D. Helgason, *2010 Trends*, Blog, Unity Technology Blogs Std. [Online]. Available: http://goo.gl/AZ4vm

[4] T. Chatfield, *Fun Inc.: Why Gaming Will Dominate the Twenty-First Century*. Pegasus Books, 2011. [Online]. Available: http://books.google.de/books?id=aYq7Fp79kzYC

[5] G. Zichermann and C. Cunningham, *Gamification by Design: Implementing Game Mechanics in Web and Mobile Apps*, ser. O'Reilly Series. O'Reilly Media, 2011. [Online]. Available: http://books.google.de/books?id=Hw9X1miVMMwC

[6] D. Flatla, C. Gutwin, L. Nacke, S. Bateman, and R. Mandryk, "Calibration games: Making calibration tasks enjoyable by adding motivating game elements," in *UIST '11: Proceedings of the 24th annual ACM symposium on User interface software and technology*, Santa Barbara, California, USA, 2011, pp. 403–412.

[7] J. McGonigal, *Reality is broken: why games make us better and how they can change the world*. Penguin Press, 2011. [Online]. Available: http://books.google.de/books?id=yiOtN_kDJZgC

[8] B. Reeves and J. Read, *Total engagement: using games and virtual worlds to change the way people work and businesses compete*, ser. Harvard Business School Press. Harvard Business Press, 2009. [Online]. Available: http://books.google.de/books?id=hbFSia7bdUoC

[9] S. Deterding, K. O'Hara, M. Sicart, D. Dixon, and L. Nacke, "Using game design elements in non-gaming contexts," *CHI 2011*, 2011.

[10] S. Deterding, D. Dixon, R. Khaled, and L. Nacke, "Gamification: Toward a definition," *CHI 2011 gamification workshop*, 2011.

[11] ——, "From game design elements to gamefulness: Defining ªgamification," *Mindtrek 2011*, 2011.

[12] R. Caillois and M. Barash, *Man, play, and games*. University of Illinois Press, 2001. [Online]. Available: http://books.google.de/books?id=bDjOPsjzfC4C

[13] K. Alfrink, *New Games For New Cities*, Presentation, FutureEverything Std., May 2011.

[14] C. Abt, *Serious Games*. University Press of America, 1987. [Online]. Available: http://books.google.de/books?id=axUs9HA-hF8C

[15] I. Bogost, "Persuasive games: Exploitationware," *Gamasutra*, p. 4, May 2011. [Online]. Available: http://goo.gl/88969

[16] B. Sawyer and P. Smith, *Serious Games Taxonomy*, Presentation, GDC 2008 Std., February. [Online]. Available: http://goo.gl/xc1ZX

[17] J. Hamari and V. Eranti, "Framework for designing and evaluating game achievements," in *Think Design Play: The fifth international conference of the Digital Research Association (DIGRA)*, C. Marinka, K. Helen, and W. Annika, Eds. Hilversum, the Netherlands: DiGRA/Utrecht School of the Arts, September 2011, p. 20.

[18] M. Montola, T. Nummenmaa, A. Lucero, M. Boberg, and H. Korhonen, "Applying game achievement systems to enhance user experience in a photo sharing service," in *Proceedings of the 13th International MindTrek Conference: Everyday Life in the Ubiquitous Era*, ser. MindTrek '09. New York, NY, USA: ACM, 2009, pp. 94–97.

[19] K. Huotari and J. Hamari, "ïgamificationî from the perspective of service marketing," *CHI 2011*, 2011.

[20] J. Schell, *The Pleasure Revolution: Why Games Will Lead the Way*, Presentation, GoogleTechTalks Std., November 2011. [Online]. Available: http://youtu.be/4PkUgCiHuH8

[21] S. Deterding, *Meaningful Play*, Presentation, Google Tech Talk Std., January 2011. [Online]. Available: http://youtu.be/7ZGCPap7GkY

[22] A. Kohn, *Punished by rewards: the trouble with gold stars, incentive plans, A's, praise, and other bribes*. Houghton Mifflin Co., 1999. [Online]. Available: http://books.google.de/books?id=-fFsZWg-JfAC

[23] M. Lepper, D. Greene, and R. Nisbett, "Undermining children's intrinsic interest with extrinsic reward: A test of the" overjustification" hypothesis." *Journal of Personality and Social Psychology*, vol. 28, no. 1, p. 129, 1973.

[24] E. Deci and R. Ryan, *Intrinsic motivation and self-determination in human behavior*, ser. Perspectives in social psychology. Plenum, 1985. [Online]. Available: http://books.google.de/books?id=p96Wmn-ER4QC

[25] S. Rigby and R. Ryan, *Glued to games: how video games draw us in and hold us spellbound*, ser. New directions in media. Praeger, 2011. [Online]. Available: http://books.google.de/books?id=H3MipRj4Id0C

[26] R. Koster, *A theory of fun for game design*, ser. Paraglyph Series. Paraglyph Press, 2005. [Online]. Available: http://books.google.de/books?id=GQpQAAAAMAAJ

[27] M. Csìkszentmih·lyi, *Flow: The Psychology of Optimal Experience*, ser. P. S. Series. HarperCollins, 2008. [Online]. Available: http://books.google.de/books?id=epmhVuaaoK0C

[28] G. Zichermann, *Fun is the Future: Mastering Gamification*, Presentation, Google Std., October 2010.