The Effect of Gamification in Sport Applications

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***Abstract*—The effect of gamification in sport applications on the people's sporting habits and performance. Due to the counting number of sensors built into everyday used devices, such as smartphones and wearable technologies opened the possibility to a broader user group to track and analyze their own performance with sport tracking applications in a gamified system, to keep the users motivated. The aim of the research to measure the effect of the different game design elements, based on the responses of 21 statements. The results show that it is the least influencing factor while choosing the application. On the other hand, progression related game elements showed the most positive impact on the workout regularity and intensity.**

Keywords—gamification, sport application, effectiveness

I. INTRODUCTION

Due to the rise of the infocommunication technologies, mobile tools and sensors became strong part of the everyday life (Clarke, 2017). The data gathered from these innovative sensors are used in several areas and became accessible to the public as well. CogInfoCom views any kind of hardware or software component that collects and stores information and allows users to interact with this information as an infocommunication system (Baranyi & Csapó, 2012). Previous studies showed, that such systems could be well adapted into the area of health and sports. From the hardware perspective, based on doppler measurements, the fitness activity can be recognized (Fu, Florian, Arjan, & Vaithyalingam Gangatharan, 2018). From the software perspective, changing the elderly people's exercise habits (Katajapuu et al., 2017), to create a system to store electronic health records (HER) in the cloud (Adamko, Garai, & Pentek, 2017), to encourage patients to report their medical conditions (Toth & Tovolgyi, 2017) and even to help people with non-standard cognitive characteristics (Izso, 2016).
In this article the sport tracking systems will be examined as infocommunication system, focusing on smartphones and accessories are a key subject for amateur and professional athletes. Such devices are widely used during workouts (Janssen, Scheerder, Thibaut, Brombacher, & Vos, 2017), because various sensors are assembled into these devices (e.g. GPS, gyroscope). Body area networks can encompass a large variety of different kinds of interactions between the physical sensors they use and the human biological and cognitive system (Baranyi & Csapó, 2012). These sensors provide data to the application used on the smartphone. These applications share common elements, such as GPS tracking, community, feedbacks and rewards.
This study aims to provide answer on the preferences of consumers choice, how satisfied are they with those and the impact of gamification on the athletes.

II. GAMIFICATION

Fast-growing research area that uses User eXperience (UX) design and evaluation methods to build interaction technology that increases user motivation and engagement across areas of health, business, and education with an increasing focus on personalized experiences (Tondello & Nacke, 2018). Deterding (2011) defined gamification as the use of game design elements in non-game contexts. Gamification is different from games, simulations and free play. The differences will be highlighted based on the Caillois concept (2001). On the vertical axis play (*paida*) means the free form of play, not necessary connected to goals, and game (*ludus*) structured and rule based, goal oriented. In this axis, gamification is closer to ludus, thus using gamification always carries a goal. On the horizontal axes the gamification does not mean a whole game, it only uses elements from games that supports the purpose.

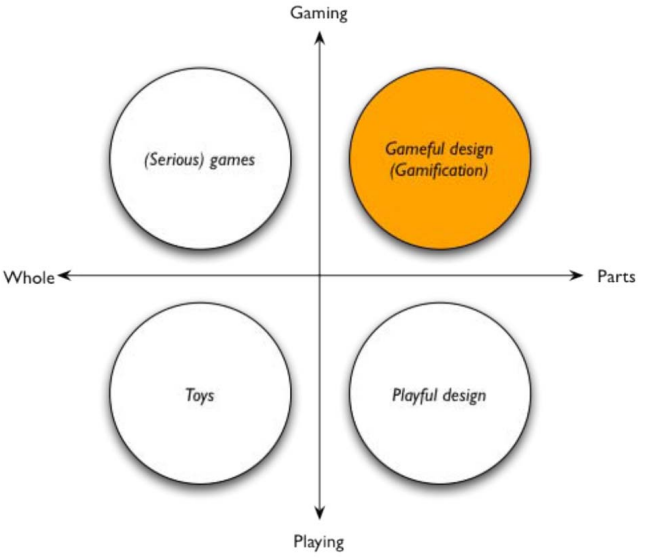

Figure 1 - Gamification between game and play, whole and parts
Reference: (Deterding et al., 2011)

The most basic game elements are points, badges and leaderboards (PBL), that helps the users to track their progress, compare themselves with others and collect achievement symbols for excellence (Mekler, Brühlmann, Tuch, & Opwis, 2015).
Yu-Kai Chou's Octalysis framework (Chou, 2015) is the most accepted gamification tool to create a gamified environment or analyze one. The game elements are grouped based on which of the 8 Core Drives do they aim to motivate in the user. Furthermore, the Core Drives are arranged in an order to differentiate those game elements that effects the extrinsic motivation and those which activates the intrinsic motivation. In addition, the top part of the framework considered positive motivations, while the bottom Core Drives are considered to be more negative (Chou, 2015).

III. Theoretical background

Gamification elements in the sport applications are key features to change user's behavior (Ha, Kang, & Kim, 2017). Generally, the applications are feedback and reward based (e.g. Strava, Nike+ Run, Runkeeper, Endomondo). However, there are some applications that has a bit different approach. Zombies Run where the runner can see on the screen where the zombies are, to know which direction to run, so the athlete won't be catch by the zombies. Another example, Spotify, the music streaming application has a feature, that it choses music within a given genre, that matches to the user's running pace. Based on the idea of music, the application Rock My Run provides selected tracks to match with the heartrate and steps of the athlete.
Based on the Hook Model (Liu & Li, 2016), sport application provides triggers, in the form of notifications in connection with planned workout, someone gain upon the user or that a friend just competed a workout, congratulate him/her. These are present to make the user open the application and follow through a certain action. The main goal for each application is to make the user to track sport related activities and build connections with other athletes.
During the sport activity instant feedback and progression tracking are the most commonly used game elements. The applications generally have a simplified user interface while the athlete tracks the workout, to provide the user with the most important data and trends (e.g. speed, distance, location). If the user created a route to follow during the workout, progress bar is shown. In Strava, there is an option to switch on the live segment feature, which enables the athlete to see the stats just as if all the other competitors were there. Almost like a video game.
As it was sad earlier, the after-workout feedbacks and reward mechanisms are the strongest in these applications. From experience points, to Nike's Fuel Score, to trophies and different kind of measurements are in use to provide an accurate feedback of the training. These elements help to understand and highlight the key points of the workout, e.g. fastest lap, personal record, longest workout. Also supports to show the user their progression overtime.
Some applications reward users by giving badges if they complete a challenge. Challenges can work as a trigger to the users by adding a time limit and a goal to complete. Sometimes these challenges relate to real world events, such as Tour the France or Mt. Everest, e.g. climb the height of the Mt. Everest with a bicycle or by running to collect the badge. These events can provide a narrative to a workout, thus makes it more interesting. The collected rewards, badges are generally shown in trophy cases and displayed publicly.
To track progress there are training calendars used in all the applications and the possibility to set a goal as well. Therefore, the application always provides feedback on how much the athlete completed of the goal and how much training needs to be done.
To sum up, activity tracking systems are trying to gamify the workout experiences, however, it is mainly datafication, where the user can monitor activities (Loh, Sheng, & Ifenthaler, 2015). However it is not all negative, because "Once we datafy things, we can transform their purpose and turn the information into new forms of value"(Kenneth, Cukier, & Mayer-schoenberger, 2013).

IV. The research

The aim of the research was to identify which game mechanics in connection with app action are the ones, that trigger the user's reaction. The setup was the following: an online questionnaire was shared on social media pages and groups to reach the target audience.
The target audience was all the people who use their smartphones to track their workout regularly. Based on age restrictions, it was based on the applications regulations, thus anyone could participate whom was over 13 years old. The next criteria was to use a smartphone during a workout. Nor the type of the phone, nor the type of the used sport application was important. Apart from having previous experience with any sport application, other regulation was not in use. This resulted, that anyone whom used a sport application on their smartphone to track their workout could be suitable to fill out the survey.
The target audience was reached by posting the questionnaire in groups and pages that showed relevance. These were found by searching for keywords that are connected to: sports, e.g. running, biking, workout.
The questionnaire was built up from six parts; (I.) sport specific questions, (II.) regularity of doing sports, (III.) overall workout patterns, (IV.) applications used during workouts, (V.) statements and lastly (VI.) demographic questions.
From the first section (I.) the aim was to see what kind of sport they practice and if they are / were professional athlete. The importance was to have the possibility to be able to separate the professionals and the other participants. The professionals are more experienced, and they tend to review and understand data from their workout in more depth. During the analysis, this will be examined from the results.
The second part (II.) measured the regularity of doing sports based on three parameters. The (1) first one was the average duration per exercise. The (2) second aspect was the average number of workouts per week. The (3) third question aimed to categorize the intensity of the activity. Based on these three criteria, an overall score was calculated, between 0 and 126.

In the third sector (III.) the question was about to gather data on which sport on what regularity does the participant does. It was essential information to know, to have the possibility of connecting the rest of the data with each sport.
Furthermore, the next block (IV.) contained 12 questions on the applications that are used during a workout and the reason behind choice of those ones. It is important to understand why the user chose that certain application among the several other ones. Here the list of applications was gathered based on the top downloaded numbers in the Apple Store and the Google Play Store. Also, there was an option to add the name of the application that they use, however it was missing from the list. Moreover, in this part the overall usefulness, the overall satisfaction and their level of recommendation was asked. This set of questions purpose was to show an overall evaluation of the applications listed in the research.
The next part (V.) was aimed to measure the characteristics of the gamification elements in the sport applications. This was carried out with 21 statements in connection of different scenarios in the sport tracking systems. The respondent had to evaluate the statement on a four level Likert-scale, from strongly disagree to the strongly agree. The novelty of the research that the statements were assembled based on the Octalysis framework (Chou, 2015). The 21 scenarios contained game elements from all the 8 Core Drives. Thus, the different scenarios that a user generally meets in sport tracking applications, can be connected to concrete game elements and grouped based on the Core Drives of the Octalysis.
The last part (VI.) consisted of demographic questions, age, highest degree of school has completed.

V. The Results

The results are based on 306 responses average age of 29 (*standard deviation: 10,55, median: 25, range: 43*). The data shows, the cycling, running and fitness were the sports that were the most actively done. Biking was the highest among everyday usage, running and fitness was 1st and 2nd among the number of people done it several times a week. This means that people use their bikes daily, thus not only for clearly recreational and sport related, but as for commuting.

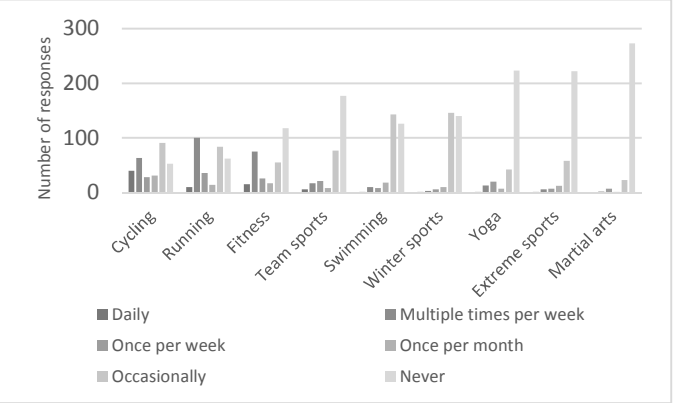

Figure 2 - Regularities in sports

From the list of sport application available, based on the three factors introduced in section IV. (*usefulness, impression, recommendation*), the highest received score was for Polar, Garmin, Strava.
Both Polar and Garmin sell professional sports related products, e.g. watches, thus their programs are the highest rated, might be because their interest to provide the best tool. The relation between professionals and non-professionals were around 50% (Average Dev.: 8%) for all the applications, only exception was showed at the results of the Garmin users, where around 24% was professional user. This might be because of the thought that, if someone, who is not a professional athlete uses professional tools, they might do better.
Another possible tool to compare the different sport tracking systems is the Net Promoter Score (NPS). NPS is derived from a single question that may be included as part of a larger customer survey. The single question asks the customer to use a scale of 0 to 10 to rate their willingness and intention to

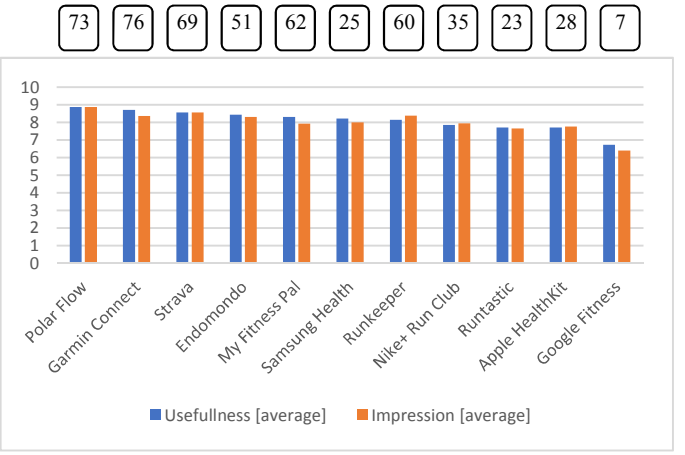

Figure 3 - Questionnaire responses on applications and NPS

recommend the company to another person. Ratings of 9 and 10 are used to characterize so-called 'promoters,' ratings of 0 through 6 characterize 'detractors,' and ratings of 7 and 8 characterize 'passives.'(Jeske, Callanan, & Guo, 2011). The NPS score varies between -100 and 100. The top 3 scores are in alignment with the other two factors measured. The reasons behind the bigger differences between the results of Google Fitness, Apple Health Kit and Samsung Health could be because these applications are pre-installed on the devices. To understand the NPS more research need to be done.
In the 4th section of the questions aimed to understand the importance of each feature for the choice. Based on the results the most important ones were the free features, The visual and detail of the workout summary and The stability of the application. Interestingly, when the question was about the rewards after each workout, seemed the least important in the choice. However, the user only meets with the gamified elements, after the first use of the sport tracking system. Another result that requires attention is the 10th place, the question about the impact of the friends using the application.

If a friend uses a certain app, that would not make be an important feature for the athlete to take into consideration.

Table 1- The ranking of the features influencing the users
1=most influential, 10=least influential

	More influence	Less influence	
1	Free features	Information during workout	7
2	visual and detail of the workout summary	Compatibility	8
3	Stability of the application	User Interface – Design	9
4	Ease of use	Friend's use the app	10
5	Accuracy	Educational features	11
6	Customization	Workout Rewards	12

In the next paragraphs the results from the sport tracking systems Octalysis focused analysis and the statements will be introduced.
The overall results indicate that among the game elements tested in the study, instant feedback, progress bars, earned lunch and appointment dynamics has effect on the participants. Instant feedback in sports is one of the most basic game element, that are used, since during the workout information is provided about the current state and after finishing the workout to show the captured data. Progress bars are beneficial mostly during the workouts, when in the progress is displayed (duration and distance) visually. Thus, the athlete receives information on, how much effort is needed to finish the workout. Earned lunch means, that the user knows the straightforward actions by which the player can obtain a reward. A good example would be to complete a challenge, where the user needs to reach a given meter of elevation (e.g.: the height of Mt. Everest) or to complete a distance. Game element appointment dynamics utilize a reoccurring schedule where users have to take the Desired Action (in this case a workout) to effectively reach the Win-State (e.g. a race, new record). This game element was the most positively stated in the study.

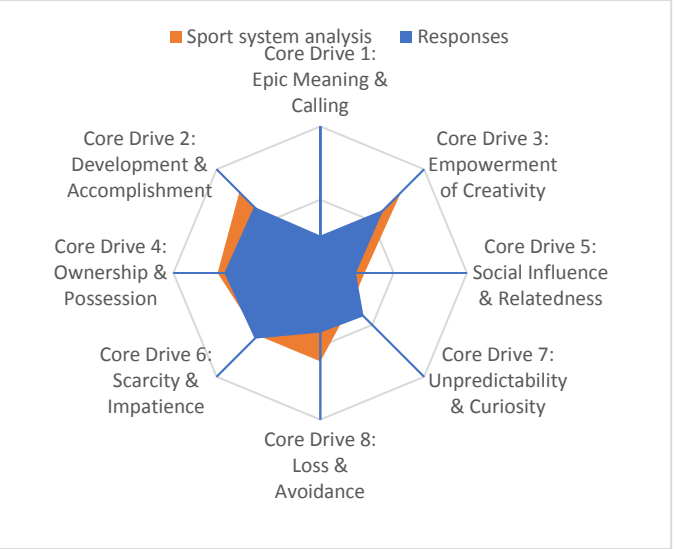

Figure 4 - Sport systems game elements and participants responses

On the other side, the least typical statements follow. The social elements are considered as one of the key features of the sport applications. However, the results from the study shows that game elements in relation to the Social Influence and Relatedness (Core Drive 5) are the least motivating mechanics. This result is in parallel of the answers for the preferences to choose a sport tracking application (See Table 1).
From the results, it can be seen, that users are using the application mostly to monitor their workouts to complete the weekly planned routine (Statement: *"I like to see that I completed all the workouts I have planned"*), or to see progression, (Statement: *"I am only satisfied with a workout, if I broke any of my personal records"*) received also high points. Moreover, to see the completion of the weekly workout plan is also a statement that the majority agrees with. This shows, that the sport application users are mainly focusing on the data analysis and to track their progression.

The comparison was done based on the responses to the statements and the game elements implemented in the sport tracking systems with the Octalysis framework (See Figure 4). The sport systems (orange in Figure 4) shows the overall scores of each Core Drives based on the game elements implemented. The further from the center, the more game element is used in connection of that Core Drive.
On the other hand, the responses (marked blue in Figure 4) are displayed contrary. The marks closer to the center are the ones that has stronger effect on the athletes.
In this way, the impact of the Core Drives and the game elements can be compared. This figure shows that the game elements effects does not fulfill the effect on the athletes.

VI. Conlcusions

Gamification is an interdisciplinary area, that is between HCI, game studies (Xu, 2012), that makes it difficult to analyze the user's behavior from all the aspects. During the use of a sport application several properties influence the athlete's attitude. The results of the research shows, the choice of the sport tracking application is based on objective values, rather subjective ones. The users are looking for a stable and easy to use application that provides useful free features. Also, the reward mechanism at this point are not taken into consideration. This shows that gamification is not implemented, as an extrinsic motivation to make people to download the application. In contrast, it is used to help athletes to from a habit and make the progression easily understandable.
The net promoter score can add a broad information about the user's perception of the application's usefulness. However, to understand more about the reason why the users gave certain NPS, another more detailed questionnaire or a focus group could be done. This the user's preferences on why one application received a higher score than the other could be determined.
The findings of the study show, that the game elements applied in sport tracking systems are focusing on datafication. The

athletes are motivated by mainly extrinsic rewards, badges, leaderboards and intensity scores.

This type of reward mechanism combination boosts motivation during the discovery and onboarding phases, however, lacks the game design elements to keep the user in the sport tracking application on the long run. On the athletes, whom has a strong intrinsic motivation to progress in a sport, the previously mentioned reward system has a low impact, thus for them these game elements are negligible. Thus, the analyzed sport applications lack the possibility to motivate the user on the long term.

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