BitRun: Gamification of Health Data from Fitbit® Activity Trackers

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Abstract. This paper presents a mobile game, BitRun that is designed to interact with Fitbit® data in the generation of the game terrain of an endless runner mobile app. By authorizing the game to interact with their Fitbit® data, a user experiences unique and personalized gameplay based on their daily activity. The aim is to use real-game mechanics to encourage users to stay engaged with their activity trackers and subsequently create positive behavior change by rewarding the user in the game for an increase their activity.

Keywords: Wearables · Gamification · Activity trackers · Fitbit® · Quantified self · Games · mHealth

1 Introduction

Within the last decade, activity tracker and wearable technologies have experienced a transformation from humble pedometers to devices that can calculate calorie burn, track sleep, record heart rate, log GPS, classify exercise types, determine elevation, etc. These devices have gone from bulky clip-on, plastic gadgets to sleek bands that are as much a fashion statement as a tracking device. The growth of activity tracker bands has increased by 67.2% from Q1 2015 to Q1 2016 [1]. The market has diversified due to the introduction of smart watches that both track activity and function as watch that connects to a mobile device. The proliferation of activity trackers has resulted in over 20% of American adults using some form of wearable technology [2].

This significant adoption of the devices provides an opportunity to harness and utilize the data to encourage healthy behaviors. Unfortunately, 32% of users stop wearing the devices within six months, and 50% after one year [3]. Our user experience suggests that the drop-off is more pronounced and is often within the first three months. This dramatically reduces the potential for the devices to be used to create initial and sustained positive behavior change or as a means of tracking surrogate markers for health. If activity trackers are to be utilized to change behavior or to track long-term health indicators, a means of keeping users engaged is required. At the same time, it would be beneficial to address the issue that activity tracker users are normally healthy and interested in their health [4] and not people who live a sedentary life and therefore could benefit the most. If trackers are used to change unhealthy behaviors, then a means to encourage and onboard users who are not already interested in the technology is

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necessary. A methodology to attract users to activity trackers, keep them engaged and encourage positive behavior change is required to be able to produce a long-term impact on health. This paper presents gamification as a means to address the aforementioned issues.

2 Gamification

The term 'gamification', first used in 2008, is defined as the use of game design elements in non-gaming contexts [5]. For example, point systems, competition, rewards, game mechanics, leaderboards, applying rules of play, etc. From business sales leaderboards and home chore chart through to collecting friends on Twitter, game elements have long been used in daily life to encourage productivity, behavior change and make life fun. The ubiquitous mobile app market provides the perfect opportunity to use mobile devices for gamification and thus can be attributed to its adoption as a common household term and rise in gamification within the digital space.

The aim of the project was to create an app that both encourages long-term engagement with a wearable activity tracker and also promotes healthy behavior change regarding a user's activity. In the US, 55.7% of the 2016 population is considered to be a mobile gamer and this is set to reach 63.7% in 2020 [6]. Due to the popularity of mobile games and the psychological persuasive nature of video games [7] a game-first approach was taken to creating a mobile app that utilizes Fitbit®[1] [8] activity tracker data. The idea was to create a more meaningful experience for the end-user based on their activity data, potentially increasing long-term engagement, and providing a sustained platform for which positive behavior change can be achieved. Video games have in the past been noted for their impact on behavior change in a negative manner [9], however, in recent years there have been a lot of talk about their use in psychology and positive behavior change [10, 11] although there have been very little studies to test clinical effectiveness in terms of improving physical activity [12].

Well-established mobile game styles were considered as potential options to gamify wearable data. The final decision was to proceed with an "endless-runner" style game for two reasons: a runner game has parallels with the real-world idea of movement which we are encouraging and more importantly the game mechanics of this game style lends itself to being associated with activity tracker data for the purposes of gamification. The result was to produce the mobile game, BitRun that is a game-first approach to engaging users with their activity data.

[1] Fitbit is a registered trademark and service mark of Fitbit, Inc. BitRun is designed for use with the Fitbit platform. This product is not put out by Fitbit, and Fitbit does not service or warrant the functionality of this product.

3 BitRun: Mobile Game Using Fitbit® Data

BitRun is a mobile game available on iOS AppStore [13] and Google Play store [14] for use with Fitbit® devices to populate the game terrain a user plays. It is a runner-game, where the user plays as a ship/object on track with four lanes. A user moves left or right by tapping on the relevant sides of the mobile screen. The user must avoid the obstacles (wooden crates, boulders and road-blocks) and collect the golden rings for extra points. This gameplay is shown in Fig. 1.

Fig. 1. BitRun gameplay

The game terrain has a pre-determined length and a user completes the game when the ship crosses the finish line. The game can be played with or without Fitbit® data. If the game is played without syncing to a Fitbit® device, the maximum possible score is 25,000 and there is the maximum number of obstacles for the user to avoid and very few rings to collect. The idea of making the game playable without interacting with Fitbit® data is to remove any barriers to onboarding a player, giving the game psychology a chance to have an effect and the competitive nature of the player to take over. When a player authorizes BitRun to interact with their Fitbit® data, a new daily terrain is generated based on the previous day's activity. The maximum achievable score will depend on the user's level of activity for the previous day. We use the previous day's worth of data, as we need a full day of data to generate the game track.

3.1 Beyond Gamification: Associating Activity Data to Terrain Generation

The game utilizes the following data in the generation of terrain: total number of active minutes and number of sedate minutes. Sedate minutes translate to obstacles: less sedate means less obstacles. The idea is to reward being active by making it easier to complete

the game. Active minutes are linked to rings: the more active minutes the player has, the more rings the game will generate, with the saturation point of rings being reached at 100 active minutes. BitRun rewards activity with rings, which are then linked to additional points and thus higher score if collected. Figure 2 shows the game terrain generation screen linking active and sedate minutes to the obstacles and rings. The user also receives a bonus point for each step taken on the previous day. An additional bonus 1,000 points is also awarded to a user for simply authorizing the app to interact with their Fitbit® data. This decision was taken to encourage people to connect in the first place. Therefore, the player starts the game 1,000 points more than the number of steps they walked the previous day. As a result, taking 24,001 steps in one day will be sufficient to beat the high score of any user who has not connected their wearable device.

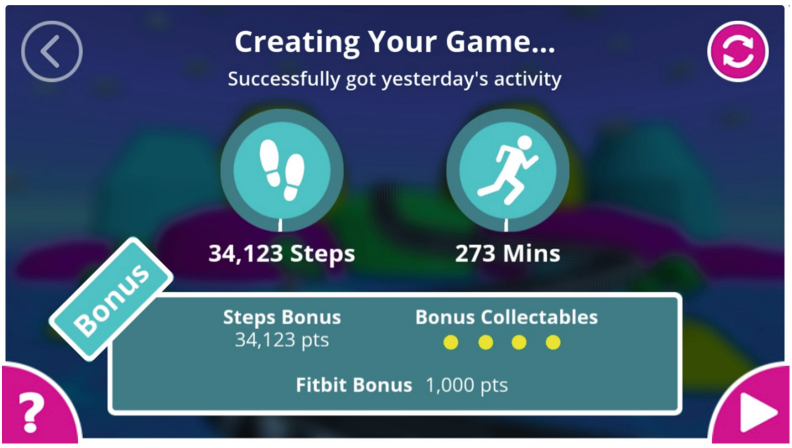

Fig. 2. Terrain, collectables and bonus point generation from Fitbit® data

3.2 Using the Traditional Leaderboard

Leaderboards feature in both video games and gamification systems. A leaderboard can activate the social, identity, challenge and feedback elements of an engaging gamification experience. Leaderboards are a key element of BitRun and there is both an in-game leaderboard, shown in Fig. 3 and a web-version of the leaderboard [15] for sharing on social media. Leaderboards create prestige and thus form a large part in motivation and engagement. The in-game leaderboard contains global all-time rankings and monthly rankings. Within a few months of release, it was evident that the leaderboard was no longer an engagement tool and became a source of demotivation for many casual users. Qualitative surveys were conducted and user dissatisfaction around the leaderboard was noted as the main reason for disengaging with the app. A small number of users with extraordinarily high number of steps had effectively set a very high entrance level to the leaderboard. This level of activity, in excess of 50,000 daily steps, is not achievable or even realistic for most users. People wanted to compete with others just like them or at least have a chance of appearing on the

Fig. 3. BitRun in-game leaderboard

leaderboard. These are the users we need to engage, not necessarily the current leaders who are scoring in excess of 100,000 by walking over 75,000 steps in one day (approximately 37.5 miles). As a result, monthly leaderboards were introduced. This effectively resets the points every month and gives people a chance to get on the leaderboard and compete monthly. Notably, people are playing early in the month to maximize the opportunity to be number 1 even if it is for a day or two.

4 Conclusions and Future Work

With this project we created a mobile game to engage users with their activity data. The strategy was to publish the game in the Google Play and iOS app stores as a means to receive general public feedback on the concept of engagement. So far, the response has been positive and the feedback on the actual gameplay is that it looks, feels and responds like a game opposed to a gamified experience, which was our desired outcome. Our initial results indicated that leaderboards are a large portion of motivation and that a global overall leaderboard was not enough. Users become quickly disheartened trying to beat a score that was achieved by a user who walked more than 50,000 steps in a day. Therefore, we added a monthly leaderboard, which is effectively transient and resets each month. Our internal statistics indicate that people like to play the app throughout the month especially if they have had a particularly active day. Therefore, we will be introducing more granular leaderboards of weekly and daily to encourage this concept of retention with our next release.

The longer-term plan is to allow users with different types of wearables compete against each other rather than stay within the ecosystem of one type of wearable. People with a Microsoft band will be able to complete with Garmin users and people who use their phones as an activity tracker can also get involved with the game. This greatly reduces the barrier to entry for users to gamify their activity data with BitRun. Finally, BitRun was created as part of a much larger mHealth product of AppAttic's,

known as MediMerge [16], which is used to collect health and wellness data from wearables, IoT, apps, and games for clinical review. We are already trialing MediMerge with other wearables and apps as a means of healthcare intervention for respiratory conditions. The mHealth strategy for BitRun is to run a pilot clinical trial with the game being given as an intervention for a specific cohort that would benefit from being more active. The study will focus on assessing whether BitRun does encourage positive behavior change to activity and whether this is sustained over a period of time, using MediMerge as the aggregator of the clinical data for review.

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