Little Fitness Dragon: A Gamified Activity Tracker

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Abstract. We propose the design of an activity game and virtual pet for smart-watches that combines casual game design principles, lessons from fitness trackers, and location-based features. Players take care of a newly hatched dragon that grows and changes depending on their activities, reflecting their general fitness in a playful and encouraging manner. Where most virtual companions are aimed at children, we designed this game with young adults in mind. An early PC prototype was tested by ten members of this target group to gauge interest and inform design iterations. The general design of the game and the virtual dragon were mentioned as strong points, while the emulation on the PC was considered not intuitive. Upcoming prototypes will be tested on smart-watches, with the ultimate goal of exploring the impact of connecting a virtual pet to the physical location of a player on engagement and activity levels.

Keywords: Applied gaming · Games for wearables · Activity tracking · Virtual pet

1 Introduction

In recent years wearable fitness trackers and smart-watches have become more widely used and increasingly sophisticated. No longer are users limited to simple step counters; with devices like the Pebble and Apple Watch we now see smart-phone functionality integrated with fashionable technology that fits unobtrusively on our wrists.

Our goal is to explore the novel interaction possibilities that smart-watches provide and how they may be used to improve people's lives. In that light we have begun development on *Little Fitness Dragon*, and activity game for mobile phones and smart-watches. By building on existing research and incorporating lessons from the casual game industry, we aim to develop an engaging wellness tracker that encourages its players to be active on a regular basis by combining a virtual pet with location-based game mechanics. The novelty of this game lies in grounding a virtual character in a player's physical surroundings, as well as utilizing modern wearables which so far remain underused, both for gaming purposes and in research relating to activity trackers.

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This paper describes the preliminary design and conception of a PC prototype for the game. The prototype was tested with a small selection of participants, some of whom had game design experience. This was done purposefully to better inform the design of the game before moving forward with its development. We conclude this paper with our plans for future work and follow-up studies.

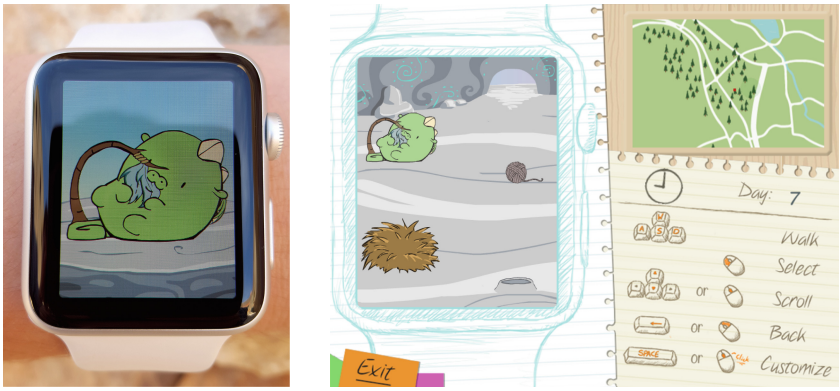
2 Related Work

Over the last decade researchers have studied both the successes and the limitations of wearable fitness devices. One documented project is *Fish'n'Steps* [7], which used a wearable pedometer and linked a user's daily step count to the growth and happiness of a virtual fish. The digital fish tank was displayed in a common area of the test participants' office space, and users were required to check in on a daily basis to log their activity. Out of 19 participants, several increased their daily step count over the testing period of six weeks. Another relevant example is UbiFit [3]. It aimed to encourage users to monitor their own activity and to implement varied activities into their lives on a daily basis. It did this through a glanceable display background on the user's mobile phone showing a garden, which would change depending on the level of activity and the variety of activities the user participated in that week. Users of the glanceable display were able to maintain their activity levels over a period of several months (which included holiday weeks), while that of test participants not using the display dropped significantly. While these projects showed positive results, commercial activity trackers often end up being abandoned by their users. Barriers to continued use are that the devices do not record all physical activity, are inaccurate, do not provide a social functionality, or that the devices themselves are ugly or impractical [5].

The *Tamagotchi* showed many years ago that users can grow attached to a digital creature or pet. Research has begun to explore this further, for instance with testing the use of virtual pets to influence changes in behavior. A study with 39 adolescents determined that those with a virtual pet providing positive and negative feedback on their breakfast habits were twice as likely to eat breakfast than those in the control group [1]. With the continued development of mobile devices, location-based games and apps have also become more common. *Gaea* [2] uses mobile phones and a public display in a location-based multiplayer mobile game that encourages the public to recycle. Another interesting case of using location-based game features for encouraging behavior can be seen in the overnight commercial success of *Pokemon Go*, which has players walking long distances in their quest to 'catch them all' [8].

3 The Design

Little Fitness Dragon (LFD) is a game for both smartphones and smart-watches. While it works as a self-standing application on mobile phones, it can use more accurate sensors when used in combination with a smart-watch (i.e. the heart



(a) Photograph of mock-up implementation.

(b) Screenshot of the prototype application.

Fig. 1. Target platform mock-up (left) and prototype screenshot (right)

rate monitor and step counter). It makes use of the GPS sensor in the mobile device to create a casual gaming experience that combines aspects of virtual pets, location based gaming, and activity tracking.

Its goal is to stimulate regular activity and it is aimed at young adults with a sedentary lifestyle who wish to increase their daily activity level. While much of the existing research, especially that related to virtual pets to stimulate lifestyle changes [1,6], has been focused on children, we argue that the use of virtual characters and 'cute' graphics can be just as effective in adults, as is illustrated by the wide appeal and success of casual games like *Peggle* and *Farmville*.

In LFD, players are tasked with taking care of a newborn dragon, which is always visible when the game is open (see Fig. 1a). The fully animated dragon keeps track of a player's activity (e.g. calories burned and step count), and will grow and change depending on the player's activity level. A player who moves the minimum recommended daily amount will have a calmer, more relaxed dragon, while a player who exercises a lot will have a more energetic dragon. A similar approach was used in Fish'n'Steps and showed that users were pleased to see their progress reflected in the growth of their virtual fish. The study discovered that negative feedback for underperformance could lead to feelings of guilt and reluctance to return to the application. By having the dragon's behavior change with the user's activity level we provide an abstract way for users to reflect on their performance without negative connotations. The dragon will always be excited to see its owner and encourage them to engage, lowering the barrier to return to the game when it has not been used in a while.

During walks the player may come across 'resource locations', where he or she can find ingredients to use in the game. These locations are generated by the game, following certain constraints (e.g. keeping a minimum distance between locations). They can vary in type (and therefore resources that may be found

there), and are discovered by coming in close physical proximity of their GPS coordinates. One aspect of the game is a compass screen on which players can see both visited and unvisited resource locations in their surroundings. Whenever the player comes across a resource location, they will be prompted by their dragon for an interaction or mini-game. Mini-games are optional and not necessary to complete for those who simply wish to collect the resource. For these players they will have a simple interaction with the dragon, after which it will return to them with a resource its managed to hunt, depleting the location for that day. Locations can be revisited on a daily basis to collect more resources and enable players to replay the corresponding mini-game.

Resources can be used to cook and craft items for the dragon, e.g. toys and different nests. Each dragon has different preferences for food and items. Additionally, feeding the dragon different types of food allows players to gradually change its appearance, e.g. color, scales, horns, wings. The default view of the game shows the dragon's den, where the player can feed their dragon and place toys and other items for it to play with. Tapping the dragon shows a zoomed in view of what it is currently doing, e.g. eating, sleeping, or playing, as well as the progress towards the daily activity goals. Here the player can also interact with their dragon to which it will respond with different animations.

By developing for current day smart-watches we can overcome some of the barriers encountered in previous studies [5], such as inaccurate tracking or the need for additional tracking devices. Furthermore, the availability of a high-resolution display allows us to provide players with appealing graphics and positive reinforcement. During the development of this project we follow theory-based design principles for apps that track daily activity levels [4], for instance by making use of 'abstract' and 'reflective' data in showing the player's performance through changes in the dragon rather than numbers and statistics. We expect that basing the design of LFD on these principles will make it an encouraging activity companion, while the addition of location-based play creates a real-world connection to an otherwise virtual creature.

4 Player Experience

To test the viability of the design we created an initial prototype for PC systems using *GameMaker Studio* (see Fig. 1b). While this prototype could not be used to test the effectiveness of the game as an activity tracker (as it lacks the mobility necessary to collect meaningful data on the subject), we consider this as the first step in the development process. With this basic prototype we created a functional discussion point with other designers and were able to gauge initial user response to the game concept.

Care was taken to simulate the controls and mechanics of the intended design as intuitively as possible in a PC application, while giving a clear idea of the intended game play and aesthetics. A tutorial explained the game, while daily exercise was emulated by adding an avatar on a map screen that was controlled with the keyboard. A total of ten people played the game with ages ranging

between 21 and 32, all with relatively high gaming literacy or a background in game development. Feedback was collected in open discussions with the testers, first allowing them to freely voice their initial impressions of the game and then asking more specific follow-up questions. With two of the testers, both working in game development, a more in-depth interview took place to ask about suggestions for the next stage of development.

All ten testers responded positively to the prototype, with the only negative comments referring to the PC controls not being intuitive. The combination of activity tracking with casual game play was mentioned as an interesting idea that testers could see themselves using in their lives. Testers specifically enjoyed the style and quality of the aesthetics, as well as the design of the dragon. Several concerns also came to light during the discussions. The user interface, in the prototype presented in 800 by 600 pixels resolution on a computer display, showed to potentially become too cluttered on a smaller display, especially that of a smartwatch. It also became clear that the initial plan of using resources for both cooking and crafting, and the large amount of available resources planned resulted in an overly complicated system. The compass also needed to be redesigned, as players were observed to not understand the representation of themselves and the resource locations.

It is possible that the high levels of gaming literacy of our participants influenced the receptiveness to the proposed game concept. This was a conscious decision, however, as at this stage it was deemed important to discuss potential issues in the game's design. We argue that game literate participants are better equipped to provide in-depth comments. They furthermore tend to be more critical, as they tend to spend a lot of time interacting with games and technology. Overall, we feel the prototype served its function as a discussion point for desired features and showed a positive interest in further development of the game.

5 Future Work

The next step is the creation of a second prototype for the target platform that has the basic functionality needed to test the game as an activity tracking tool. Based on the comments received during the initial test we will be making several changes to the design as well. One such change is that while we at first intended the game to be completely self-standing on smart-watches, it has become clear that the extra screen space offered by mobile phones will be needed to include all the features we envision. Core features will work independently from the phone on the smart-watch side, while some non-essential features will be available on the phone side and data is synced between the two. Additionally we will be streamlining the design of the resources and crafting mechanics, and focus on increasing interaction with and feedback from the dragon. We will also implement a reward mechanic that can take stationary activities (e.g. gym activities) into consideration for users who do not have a watch with a heart rate monitor.

The main limitation of the prototype is that it could not be used to test the validity of the design as a wearable activity tracker. We argue, however,

that there is merit in testing games and applications before considering them for further study. Although we could not yet test the validity of the game as an activity tracker, we were able to gauge the interest in the design from our target audience. More importantly, it allowed us to identify issues and make design changes that would have been more costly at a later stage of the projects, or could have hampered our research further down the line. We argue that the use of early prototypes like these can improve the quality of both future research and the applications produced for it.

Our next study will focus on testing the efficacy of this second prototype. We will continue to involve users over the course of the development, although as we move forward we will also be including those less used to playing games. Later on we also see potential of using the game to explore the potential impact of connecting the physical environment to the virtual domain in regards to player engagement and activity levels, specifically compared to virtual companions that do not react to the player's physical environment.

References

1. Byrne, S., Gay, G., Pollack, J., Gonzales, A., Retelny, D., Lee, T., Wansink, B.: Caring for mobile phone-based virtual pets can influence youth eating behaviors. J. Child. Media **6**(1), 83–99 (2012)
2. Centieiro, P., Romão, T., Dias, A.E.: A location-based multiplayer mobile game to encourage pro-environmental behaviours. In: Proceedings of the 8th International Conference on Advances in Computer Entertainment Technology, p. 31. ACM (2011)
3. Consolvo, S., Klasnja, P., McDonald, D.W., Avrahami, D., Froehlich, J., LeGrand, L., Libby, R., Mosher, K., Landay, J.A.: Flowers or a robot army? encouraging awareness & activity with personal, mobile displays. In: Proceedings of the 10th International Conference on Ubiquitous Computing, pp. 54–63. ACM (2008)
4. Consolvo, S., McDonald, D.W., Landay, J.A.: Theory-driven design strategies for technologies that support behavior change in everyday life. In: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, pp. 405–414. ACM (2009)
5. Harrison, D., Marshall, P., Bianchi-Berthouze, N., Bird, J.: Activity tracking: barriers, workarounds and customisation. In: Proceedings of the 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing, pp. 617–621. ACM (2015)
6. Hswen, Y., Murti, V., Vormawor, A.A., Bhattacharjee, R., Naslund, J.A.: Virtual avatars, gaming, and social media: designing a mobile health app to help children choose healthier food options. J. Mob. Technol. Med. **2**(2), 8 (2013)
7. Lin, J.J., Mamykina, L., Lindtner, S., Delajoux, G., Strub, H.B.: Fish'n'Steps: encouraging physical activity with an interactive computer game. In: Dourish, P., Friday, A. (eds.) UbiComp 2006. LNCS, vol. 4206, pp. 261–278. Springer, Heidelberg (2006)
8. Novak, M.: Sore legs become pandemic as Pokemon Go players accidentally get exercise. http://gizmodo.com/sore-legs-become-pandemic-as-pokemon-go-players-acciden-1783402931. Accessed 20 July 2016