Artefact Development Report -Spellslingers-

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Introduction

Since the release of Pokémon GO, games involving walking and fitness have largely shifted to relying on the geolocation of the player as opposed to the number of steps taken.

Benefits to this approach include accessibility for wheelchair users who may have struggled to play the game due to how progress is measured. Encouraging players to gather around the same location may also create opportunities for players to connect with one another using local trade features.

Despite the benefits, the location-based approach also has several drawbacks which are rarely addressed. In-game resources are often tied to real-world locations with high population density, which can exclude players living in rural areas. However, players have discovered workarounds such as location spoofing tools or driving to play the game in resource-dense areas. The problem that arises from this is that the most engaging games do not necessarily encourage fitness, while the applications most focused on fitness are not necessarily engaging.

This project aims to research and develop a fitness game which incorporates pedometer-based walking mechanics with modern game design sensibilities to increase the average daily step count of its users without reliance on geolocation, boosting both fitness and the potential number of users due to the increase in accessibility.



https://youtu.be/BDsJK6xjXn4

Aims, Objectives and Deliverables

Aims

This project aims to research and develop a fitness game which incorporates pedometer-based walking mechanics with modern game design sensibilities to increase the average daily step count of its users without reliance on geolocation, boosting both fitness and the potential number of users due to the increase in accessibility.

Objectives

- Investigate the design and technical challenges of creating a pedometer-based game in the modern gaming landscape.
- Create an application that encourages a healthier amount of walking by users.
- Build assets for mobile game development
- Research existing modern and older fitness-based games

Deliverables

- A playable game made in Unity, using pedometer technology to create a game which is engaging while also encouraging the player to take more steps in a day to boost fitness.
- Slide deck outlining the development process and research conducted to reach the final product.
- A design document to demonstrate the logic behind the mechanics and explain the overall balance of systems.
- A portfolio quality video showcasing the final product as well as the development of the artefact.
- Art assets created for the visuals of the game artefact in the form of low-resolution pixelart.

Research Methodologies

Practice-Based Research – Making the functional game

This involves building a game in Unity which uses a pedometer as the primary input for gameplay as the foundation for a functional mobile game in Android. Assets will need to be created including C# scripts, sprite art and audio files.

Playtesting – User feedback on game play and bugs

A small-scale qualitative survey will be produced to ask participants questions about various metrics which can be used to verify the effectiveness of changes to the solution. The participants must all have access to an Android device as the solution will be made in Unity for Android.

Literature – Technical docs, online forums, health science/fitness resources

Online resources are to be used to find estimates for both the healthiest number of steps for the average person to aim for in a day and player psychology to keep the player engaged to encourage longer walks.

Obscure problems are bound to appear in any niche technical research. As such, official documentation and online tech forums discussing workarounds will see use or reference throughout the practice-based research.

Contextual – Other games, technologies etc.

Pedometer games have existed and were relatively common in the past. Popular devices in days gone by such as the Pokéwalker are likely the closest analogue to the practice-based research being conducted.

Other pedometer devices have also gained traction in recent years, particularly smart watches such as 'Fitbit' and fitness applications on mobile devices. These can be seen as successors to pedometer-based games, which therefore makes them worth studying.

Geolocation-based games widely appear to be responsible for the lack of pedometer games since they tend to incorporate the mechanic as a supplementary support to geolocation tracking for the purpose of gameplay.

The resulting research documents can be found separately.

Fitness Games.pdf

Balancing for Healthy Step Goals.odt

Player Retention.docx

Documentation of Production

The first step of production was to decide on the theming and direction. In the end, a magical wasteland was chosen as the setting to represent how the game can be played anywhere, no matter how barren the landscape. The player character is a wizard who traverses the wasteland collecting spirits.

Pedometer System

The main technical challenge of this project was the pedometer mechanic.

Step counting is measured through several steps:

- Accelerometer is the device moving?
- Oscillating is the accelerometer measuring up and down movements?
- **Sustained** is the movement sustained? (Prevents steps counted from user waving their phone around)

Unity has its own input to handle step counting, however this has some flaws for the use case of the project:

- **Slow** The sustained movement requirement causes a delay of approximately 10 steps before updating.
- **Foreground only** The step counter input will often fail to count steps when the app is closed. Android will automatically kill the app frequently for consuming battery life in the background.
- **Does not log step time** This artefact could benefit from being able to track when steps are counted for gameplay to encourage movement throughout the day. This is not possible in the background with the Unity system.

To keep an accurate step counter while the game is not running, a plugin would have to be created in Java – this would be able to communicate with the Android device and pass the step count data over to Unity. Several attempts were made to create this plugin, however this proved unsuccessful due to the lack of documentation on the subject. Google Fit API would normally be the standard API used to communicate to Unity, however this was recently deprecated for Health Connect which has reportedly been buggy. After the artefact began development, RepForge released a plugin called "StepCounter Pro" which solves some issues. Compared to the Unity input system:

• Works in foreground and background – As long as the device is turned on, steps will be tracked.

- Logs step times Comes with a built-in query to take the number of steps from up to a week prior. This makes it simple to reward encounters if days are missed.
- **Extremely slow** Steps update at inconsistent intervals in real time but stay correct over a slightly longer period.

Implementing the plugin as the only system caused issues as the updates were not frequent enough to be responsive during gameplay.

Combining both systems created a functional system which could track steps as long as the device is turned on while still updating consistently in the foreground. However, it still felt unresponsive in-game as the walking animation would only start after around 10 steps each time the player stopped moving. To solve this, the animation was instead tied to the accelerometer, which is much more responsive.

The final solution uses a mix of three systems:

- **Unity Input System** Counts steps faster than StepCounter Pro while the app is open.
- **Repforge Plugin** Counts steps reliably and accurately in the background, used to count when steps were counted and can track steps taken on missed days for up to a week.
- **Custom motion detection** Updates the walking visuals more responsively based on player motion. Not used for step counting.

Spirit Mechanics

To gain spirits, the player must first earn encounters. Each day, encounters are saved as

Compared to a pedometer, a game solution has the advantage of being able to set many tasks and anchor points for goals to encourage the player to walk more. The player needs to constantly have short-term goals to work towards to keep encouraging more walking, so quests were added to the spirits to unlock their spells.



Testing on mobile took time to build and accrue steps, so a settings menu was added with debug options to add steps on desktop. This made the iteration process much faster.

Early user feedback noted that the low number of spirits caused a lack of content for the collectathon element of the game, noting that even simple palette swaps may help to alleviate some of the repetition. To create a more flexible system with less upkeep associated when new spirits are introduced, a gradient-based system was created inspired by Beastieball. Each collectible creature has a set of gradients for each colour they have. Each instance of that creature then holds a set of variables which represent a point along each gradient to determine their final colours. With four gradients each with 100 possible values, this would give 100,000,000 possible variations. This approach works effectively with flat shaded drawings such as the small spirit sprites.

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Due to a lack of experience with the Unity shader system, research had to be conducted to find how to make the colour swap shader. A tutorial on this subject was already made by "Game Development Envato Tuts+", which was adapted to fit the needs of the project.

https://gamedevelopment.tutsplus.com/how-to-use-a-shader-to-dynamically-swap-asprites-colors--cms-25129t





Saving System

A saving system needed to be made. This had the most bugs and technical issues of any feature by far. At various points, players would suddenly find their spirits were replaced with blank squares. Looking at the save data files, the spirit data was usually completely missing with no indication as to why.



The final solution uses a JSONUtility saving system adapted from a tutorial on the official Unity YouTube channel to accommodate for the different variables being saved out for this project. (<u>https://www.youtube.com/watch?v=uD7y4T4PVk0</u>).

Various fixes were attempted along the way throughout early weeks, primarily removing the directly saved "SpiritBase" scriptable object, instead saving out an integer from an index which corresponds to a list of each SpiritBase.

What happened was the save system was not saving the spirit data, but rather an address in device memory, as the spirits are instantiated while the game is running. This means that when the user restarted their device or downloaded an update, spirit save data would frequently be lost. However, the other elements of save data such as the total number of steps were on a different system and therefore were not lost.

In the final solution, a spirit save data class was created which holds a set of simple variables was made. Saving a list of this class and loading each variable back in when the app restarts solved the issue.

User Feedback Changes

User feedback frequently noted the lack of content and the lack of personality from the individual spirits. The emotional attachment between the player and the spirits is relevant, as the stronger the attachment the player has, the more likely they are to continue playing the game and continue walking. Spirits now float up and down slightly in the quest menu and the first spirit in the party wander around the main screen. When interacted with, the spirit will respond with an emote for a few seconds to emulate petting it. This can be expanded upon later as well with the likes of personalities or rewards for interacting with a spirit consistently over a period of time.



A number of bugs were also uncovered via player testing. Different mobile devices have different aspect ratios, as the 9:16 portrait standard has not been followed for a number of years now. Approximately a dozen different devices were tested to ensure buttons were anchoring correctly and that the UI was fully visible on all types of devices. Issues with Unity canvas management were discovered early thanks to the testing, so the rest of the project was set up in a way that allows all other UI to scale correctly with the screen size based on the original 180x320 screen resolution.

Polish weeks

Parallax

The background scrolling issue was resolved by creating a custom shader. To do this, the project had to be upgraded to the Universal Render Pipeline. The shader is based on a tutorial by Mark Edwards made for the "Arcade Games Development" module, however it was heavily modified as it was not designed to stop moving. Some custom code and shader variables had to be added with logic gates in the shader graph itself to achieve the desired effect.

https://staffsuniversity.sharepoint.com/sites/TheVault/_layouts/15/stream.aspx?id= %2Fsites%2FTheVault%2FLearning%20Materials%2F23_24%2FLevel%205%2FGDE V50006%20-

%20Arcade%20Games%20Development%2FVideo%20Tutorials%2F2D%20Parallax %20BG%20Shader%2Emp4&referrer=StreamWebApp%2EWeb&referrerScenario=A ddressBarCopied%2Eview%2E0fcabfbc-4ca6-42e8-874d-93762fd08897

Changed spirit sprites

Some users noted that the sprites and available gradients varied in quality, so some touch-ups and redesigns were implemented.



Spirit wanders

Users often gave feedback on how the static overworld spirit icon was somewhat confusing as it didn't do anything other than show the current active spirit. At the same time, spirits were hard to project onto due to a lack of personality. To address both of these issues, the main spirit now wanders around the screen and follows the player character while walking.

New magicule icon

The original icon was 16x16 pixels, but the final game required something significantly larger – scaling this sprite up created an issue known as "mixels" where different assets appear to have different pixel sizes. A new sprite resolved this issue. It also gets bigger and bounces on gaining a magicule for extra juice.

New Spirits

New spirits were added to keep up with the rate players were consuming the game content. 12 spirits were created in total, all with at least some gradient variations to keep the more frequent players with something to look for.

Spells added, changed descriptions – standardised spell descriptions and added spells for golems. Created more variety in spell lists to allow for greater customisability when building a team.

Encounter images

Players noted that the encounters were interesting to read but could use more visual elements since the system was simply a black screen. Adding some banner drawings to the top left the players satisfied.



Volume settings

These were surprisingly difficult to save out. With the existing audio system setup, only the first audio channel would actually load correctly. It was saving, but the function needed to be split up to save each slider value as intended.

Wizard damage shader

To add visual feedback to taking damage in combat, a white flash shader was created using the Unity URP shader system.



(Available in high quality video here: https://youtu.be/dyBorlxdTsA)

Final Artefact



https://youtu.be/BDsJK6xjXn4





Evaluative Review

Ultimately the project has met all of its deliverables, however a few optional features (such as online interaction and accessibility features) were not implemented as of the submission time due to a mix of time constraints and user feedback causing alterations to the schedule.

According to playtesting survey results, on a scale of 1 to 5 the average player willingness to continue playing was 4.5/5. The player retention techniques such as the daily rewards with diminishing returns, the spirits and the associated collectibles have all combined in a way which they synergise well together.

Some systems such as the encounters system do work perfectly well, while others could use changes to become more interesting. Visuals were added to encounters, but more features could be added such as a dialog choice to affect the reward outcome. For example, an option could be to spend magicules to gain a spirit or to instead gain magicules which scares away the spirit. A system like this would give the player more agency and keep the player engaged for longer as the spirits would be sparser, extending playtime to collect everything.

The battle system could be improved upon. While the battle system does function and can encourage running. I found that in the end the running-based magic system has flaws which make the game less accessible to play.

While the core game has step goals for as much as 20,000 steps a day, the battle system works over smaller quantities of steps. This means that shaking the phone repeatedly is more consistent compared to the standard gameplay loop. Other players may be able to walk and struggle running, or have shorter legs to run more steps faster than those with taller builds.

A more traditional turn-based system could work effectively for this system while allowing more players to compete at a fairer, safer level.

In comparison to the Pokéwalker, this artefact has more content and is arguably easier to use in modern times due to its modern UI design for mobile phones, which most users are much more likely to be familiar with.

The artefact is to be considered a vertical slice in terms of content such as spirits and spells. This is an area which could easily be improved upon in future, as most modern fitness games tend to survive for years by focusing on adding more content for their existing game mechanics, with some shakeups over longer periods of time to keep players interested.

Overall, I am satisfied with the final result and I look forward to continuing this project with added features and additional content, as well as an overhaul to the battle system.

Future Plans

Online features such as battling between other players and some form of co-operative play are a primary feature to implement. One of the main benefits of this artefact compared to geolocation-based games is the ability to play anywhere in the world. For players in more isolated areas, being able to play with other people would be a great benefit – the added social element will also keep players more likely to stay in the game and create a greater sense of community around the game as a whole.

Day end / daily report – some games such as Pikmin Bloom, Animal Crossing Pocket Camp and the Pokéwalker have features where the player can get an overview of their physical activity over a certain period of time. The StepCounter Pro plugin has this functionality built-in, so it would theoretically be relatively simple to implement a feature where the player can see the number of steps they walked and other statistics such as spirits unlocked, magicules gained and enemy wizards defeated. Combining these together could allow for the creation of a fitness chart showing the player how consistent they are at getting exercise.

More spell unlock conditions would be nice to incorporate more variety into the gameplay. Running for the battle system may have been difficult to add, but having a mechanic where the player needs to take a certain number of steps within a short period of time could be an interesting piece of variety which would encourage a faster walk or more walking than normal on a particular day.