

Unroll

Game Development Methodology

Design Document

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1. Introduction

In this document, we discuss some aspects of the design process of our game idea, which we named Unroll. Throughout this process, we aim to follow a player-centered approach, as it has been proven more effective to make a successful game for all the stakeholders (but, of course, mainly for the players).

1.1. Main Characteristics

- **Genre:** Puzzle (3D)
- **Perspective:** Third person view
- **Platform:** PC (Windows)
- **No. of players:** 1

1.2. Plot

Our game takes place in a world where there are no round objects - only objects composed of straight edges such as cubes and pyramids. The main characters are a boy and his playing ball, which was a present from a family member who lives in a distant world. This ball will also be a character in the sense that it can talk and interact with the boy, although it cannot move by itself.

Being alone in a world with no curves, the ball always had the dream of finding another round object. However, this cannot be fulfilled without the help of someone else. So, the boy, who always had loved his unique ball, will decide to help her... and thus, together they depart on a journey to find roundness.

1.3. The game world

We can divide the characterization of the game world in physical and social aspects.

1.3.1. Social aspects

The boy and the playing ball mentioned before will be the characters the player will control during the game. The boy will be controlled directly by the player, but the ball cannot move on its own, and will need the boy's help to move.

1.3.2. Physical aspects

The game world is composed of several levels. Each level is a 3D region where the characters can move around. The environment will be mostly composed of cubes, prisms and other geometric shapes with no curves. Scattered throughout the levels, will be doors, keys, levers, buttons, moving platforms, and other objects. There will also be colored blocks, and the corresponding power-ups, which are one of the main unique aspects of our game (see 2.2. Entities).

2. Core experience

In this section, we define our game experience goals and some concepts we will include in the game to try to accomplish these goals.

2.1. Experience goals

These are the main goals we aim to achieve with Unroll:

- Getting the player addicted to the game (in a healthy way), by making him always curious about the next level and how to solve it;
- Making the player lose track of time while playing the game - immersion;
- Creating some frustration in the player while he tries to solve a puzzle;
- Making the player have a feeling of accomplishment after solving a hard puzzle, to balance the frustration.

2.2. Entities

Our game will include the following entities:

- The boy, which the player can control directly;
- The ball, which cannot move on its own, but can be pushed by the boy;
(**Note:** Both the boy and the ball will be affected by the game's physics, namely by gravity and inertia)
- Doors;
- Keys, to open doors;
- Moving platforms, that the characters can stand on. They can move horizontally or vertically (like elevators);
- Buttons and levers, to open doors or activate moving platforms
- Colored blocks, that can only be broken when the ball has the same color as them. Some blocks will be harder to break, requiring the boy to push the ball harder (see 2.3. Actions);
- Colored power-ups, which change the ball's current color.

By taking advantage of the capabilities of the boy and the ball, and creating original levels using the remaining entities, we will try to make interesting puzzles that convey a balance of frustration vs accomplishment. We will also try to make sure the player keeps interested in the story, by having story elements scattered throughout the game, like, for instance, messages in walls, conversations between the characters, among other things.

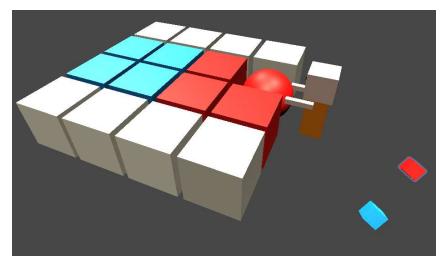


Fig. 1 - Sketch of Unroll's characters and blocks

2.3. Actions

In our game, the boy can perform the following actions:

- Move around and jump;
- Push/pull the ball or push it harder (we call this action “strong push”);
- Climb ladders;
- Press buttons or activate levers.

We think these actions can contribute to the immersion of the player, if well implemented. If that is the case, then the player might forget for a moment that he/she is controlling the boy’s actions, and act as if he/she was actually performing them.

3. The first “tweet”

We believe that the main concepts of this game can be summarized as follows:

“Lead a boy and his unique playing ball through a curveless world! Change color, break blocks, and solve puzzles in this 3D geometric quest!”

4. Competition

In order to be better informed about the current trends regarding 3D puzzle games, we researched which games could be possible competitors. Here, we present the ones we found with more similar features to our game idea.

4.1. Bunny's Ban

"Bunny's Ban is a colorful 3D Puzzle game, navigate the little rabbit and move the objects correctly to put them in the right place, light up all the crystals and solve all the puzzles."
(Steam, "About this game" section)



Fig. 2 - "Bunny's Ban" Steam game cover



Fig. 3 - "Bunny's Ban" gameplay

As can be read and seen above, this game has some features similar to ours, such as being a 3D puzzle game and featuring a main character (a rabbit) that can move around the game world and interact with objects. Some levels include **playing balls** that can be pushed by the rabbit. As the game progresses, the environment changes from a lake (Fig.3) to a cave and finally to a desert.

One of the main differences to Unroll is that Bunny's Ban has a **grid-based movement**. This implies that solutions to levels can be easily described by a finite sequence of actions. This can be both a strength and a weakness. On one hand, puzzles are more exact, which can be more appealing to pure logic/puzzle fans, but on the other hand there's less room for creativity and exploration, which can be a turn off for players that enjoy these aspects.

One aspect we consider negative in this game is that there are some details (like the roads in Fig. 3) that the player might think of as affordances, but are in fact merely decorative. There is no in-game difference between a road tile and a grass tile, and this might be confusing in a puzzle game. In our game, we think the contrary will happen - there will be much functionality and low detail (due to the unavailability of graphic artists), so this problem won't occur. But we fear that the reverse problem might occur - that the game might feel too empty.

We think this previous negative aspect in Bunny's Ban is somewhat compensated by the fact that the **levels' limits are well defined** by fences or tall walls. Although this does not fix the previous (roads vs grass) problem, at least it focuses the attention of the player into the limited region, making it more clear that the objects outside it are simply ornaments. We will try to convey the limits of our levels in a similar manner, by limiting the level world with walls (as in the "Holes" prototype in section 10.3), in case of indoors levels or with tall buildings and street objects, in case of indoors levels.

A final weakness we found in this game was that the **different environments bring no change in the gameplay**. There are no puzzle objects specific to each

4.2. Human: Fall Flat

"Human: Fall Flat is a hilarious, light-hearted physics platformer set in a world of floating dreamscapes. Each dream level provides a new environment to navigate, from mansions, castles and Aztec adventures to snowy mountains, eerie nightscapes and industrial locations. Multiple routes through each level, and perfectly playful puzzles ensure exploration and ingenuity are rewarded. (...)" (Steam, "About this game" section)



Fig. 4 - "Human: Fall Flat" Steam game cover



Fig. 5 - "Human: Fall Flat" gameplay

Some of the problems of this game are that some levels may be too big and exhausting to explore in one play session. Its ragdoll physics may not help in certain moments of the playthrough because they can be hard to control and have unexpected movements that may oppose our intentions. The existence of multiple solutions to a level may increase the difficulty of the player to find one of them, due to the multiplicity of available courses of action.

One of the strong points of this game is its diversity. The player can play tons of different levels, each with a different theme to explore and several ways to be beaten. This game also supports multiplayer, and has levels where players need to work together to overcome obstacles. The ragdoll physics create a lot of funny interactions and memorable moments for the players.

In our game, we won't have ragdoll physics. The levels will be a series of shorter isolated levels instead of one big puzzle to solve. We will also try to make a more direct and obvious solution and still have the option for other creative solutions. This way we can manage to reduce the search time for the less creative and explorers players.

5. Domain research

To get inspiration for our game idea, we also thought about other games, and tried to adapt some of their concepts. The game from which we took the most inspiration was “Mojo!” (2004, PS2/XBOX).

5.1. Mojo!

In “Mojo!”, the player controls a ball and, to clear a level, the player must clear all the colored blocks. To do this, the ball must have the same color as the blocks, and so, there are power-ups (shiny orbs) to change the ball’s color. **This concept of breaking blocks of the same color is the main feature we took inspiration from “Mojo!”.**



Fig. 6 - "Mojo!" game cover



Fig. 7 - "Mojo!" gameplay (world 2)



Fig. 8 - "Mojo!" gameplay (world 1)

Although this similarity could make “Mojo!” a possible competitor for our game, we don’t think that is the case, as this game is quite old, and is only playable in XBOX and PS2, whilst “Unroll” will be a PC game. Also, in our case the player controls the ball indirectly, through the boy’s actions, which is a key difference in gameplay. We will also have keys in our game, but it will be the boy picking them up instead of the ball.

5.2. Maze with ball puzzle



Fig. 9



Fig. 10

While doing some research for inspiration for new features and puzzles, we came across these mazes with balls that required balance and precision to complete it. This was an idea that we adapted for one of our prototypes, the “Mind control” one. Instead of having a clear view of the whole puzzle, we use a first person perspective so the player has to search the maze and have a feeling of being inside the maze and being confused and disoriented.

5.3. Elemental reactions



Fig. 11



Fig. 12



Fig. 13

For the “Elemental powers” prototype we searched for different kinds of reactions that each element has on other elements or objects associated with them. For example mixing water and lava to form land mass, freezing water to create ice paths or even burning leaves and herbs that might be obstructing something.

6. Player personas

Our intended audience are players that enjoy playing puzzle games. The game is aimed for every age range and will be a nice entry level game for new players of this genre while being an enjoyable and challenging game for the more experienced and intermediate players. Our focus will be mainly the players of the “Mastermind” category, however we also target to grab the attention of the “Achievers” and “Seekers”.

Name	Miguel Maria	Isabel Silva	Roberto Sá
Photo			
Gender	Male	Female	Male
Age	46	15	23
Background	Born in the island of Madeira, lives in Amadora, plays games since his 20's	Born in Coimbra where she still lives, started playing games 2 years ago.	Born in Lisboa, where he still lives, plays games since he was 5 years old
Profession	Bus driver	Student	University Student
Favourite games	Portal 2, Little Nightmares, Super Hot	Minecraft, Limbo, Inside	League of Legends, The Last Of Us, ESPER
Player Type	Mastermind-Achiever	Seeker-Mastermind	Mastermind-Socialiser
Interests	Football, chess, Rubik's cube	Music, Dance, Painting, Math	Cars, Gaming, Technology, Bitcoin
Context of Play	Plays when he arrives home after work	Plays in her spare time, sometimes alone other times with friends	Plays in his spare time, sometimes alone other times with friends
Goals	Plays to relax	Plays to be entertained and to socialize with friends	Plays to be entertained and to socialize with friends
Activities	Drives a bus, watches series	Studies, watches series and animes, practices swimming	Studies, watches car races, invests in the stock market

Knowledge	Knows a lot about strategy games	Knows how to dance and paint	Knows a lot about technology and games
Skills	Has a good focus and concentration, is patient	Is creative and persistent	Doesn't fear taking risks, good visual memory, is innovative
Limitations	Lacks hand coordination	Overthinks a lot	Sometimes can be impatient

7. Play scenarios

7.1. Ingame scenario

"Roberto/Isabel/Miguel begins the level. He/She notices the ball started with a plain white color. He/She starts looking around and sees he/she is in a large corridor. In the far end there is a large door blocked by some blue cubes. He/She starts moving his/her character (the boy), along with the ball by pushing it along the corridor.

As he/she approaches the end of the corridor, he/she notices there is a red power-up to the right of the blocked door. (...)"

Continuation of 7.1 (experienced player)	<p>"Being used to this kind of game, Roberto leads the ball to the power-up, as he guesses the power-up is there because it will be useful. He then leads the red ball to the left of the door, towards another corridor. At the end of it, he sees some red blocks, and charges recklessly towards them, breaking them and collecting a key (which was surrounded by those blocks) in the process. He realises the key must be the object needed to open the door he'd seen before.</p> <p>After that, he sees a ramp leading to a higher platform. He skillfully pushes the ball up the ramp, and reaches the platform. At the end of it, he sees a blue power-up, and charges towards it with the ball. Both the boy and the (now blue) ball fall from the edge of the platform onto the floor. He leads the ball back to the door and pushes the ball against the blue cubes blocking it.</p> <p>He finally opens the door and successfully completes the level."</p>
Continuation of 7.1 (beginner)	<p>"Isabel gets confused, as what she needed was a blue power-up. So, she goes left instead, continuing to another corridor, and at the end of it, she sees some red blocks, but doesn't understand their purpose and starts getting a little frustrated.</p> <p>So, she continues pushing the ball past the red blocks and behind them, she sees a ramp leading to a higher platform. She tries pushing the ball up the ramp but, at the first try, the ball falls off to the side of the ramp. At the second try, she succeeds, thus getting to the higher platform. She continues pushing the ball through the platform, trying hard to stay close to the wall to make sure the ball doesn't fall off again. At the end of it, she sees a blue power-up, and his mood starts lifting, as it is what she was looking for.</p> <p>She proceeds by pushing the ball towards the power-up, making it change to a blue color, and falling off the platform due to the inertia. She drops off the platform and continues solving the level."</p>
Continuation of 7.1 (intermediate)	<p>"Miguel, having some experience with this genre, leads the ball around the map to have a better understanding of the situation. Then he starts to develop a strategy. Having that done, he begins to follow his plan. He pushes the ball up the ramp but lets it fall off to the side of the middle</p>

ramp, due to his lack of hand coordination he has this problem several times during his attempts to push the ball up the ramp. After getting a little frustrated and annoyed he finally manages to get the ball up there and proceeds to pick up the power up.

Then, being afraid of what could happen to the ball if it fell off that height with the power-up, he decides to play safe and go all the way back with the ball. He continues to follow his plan, solving the level with ease despite the previous setbacks.”

7.2. Ingame failure scenario

“Miguel begins the level. He starts analyzing the level, moving around and looking everywhere, thinking of solutions to solve the puzzle. He starts testing his ideas, but starts getting frustrated because he isn’t making any progress. After some time of trial and erroring, Miguel closes the game and decides to give it another try later.”

7.3. Real life scenario

“Roberto grabs his laptop, while waiting for the shuttle to arrive at Taguspark. He doesn’t like to sit in the bus and wait without doing anything during the whole trip, so in order to entertain himself he has the idea of playing “Unroll”. He really enjoys playing puzzle games in his spare time to exercise his brain.”

7.4. Failure scenario

“Roberto is studying in a study room at Taguspark. As he ends his studying session, he decides to play some “Unroll”. He turns on the school desktop and tries to install the game. Unfortunately he is blocked by “DSI” because he cannot install unknown programs in the school’s computers.”

8. Core gameplay loops

Here we present a representation of the main game loop along with an example of a (high level) plan to break blocks of a certain color.

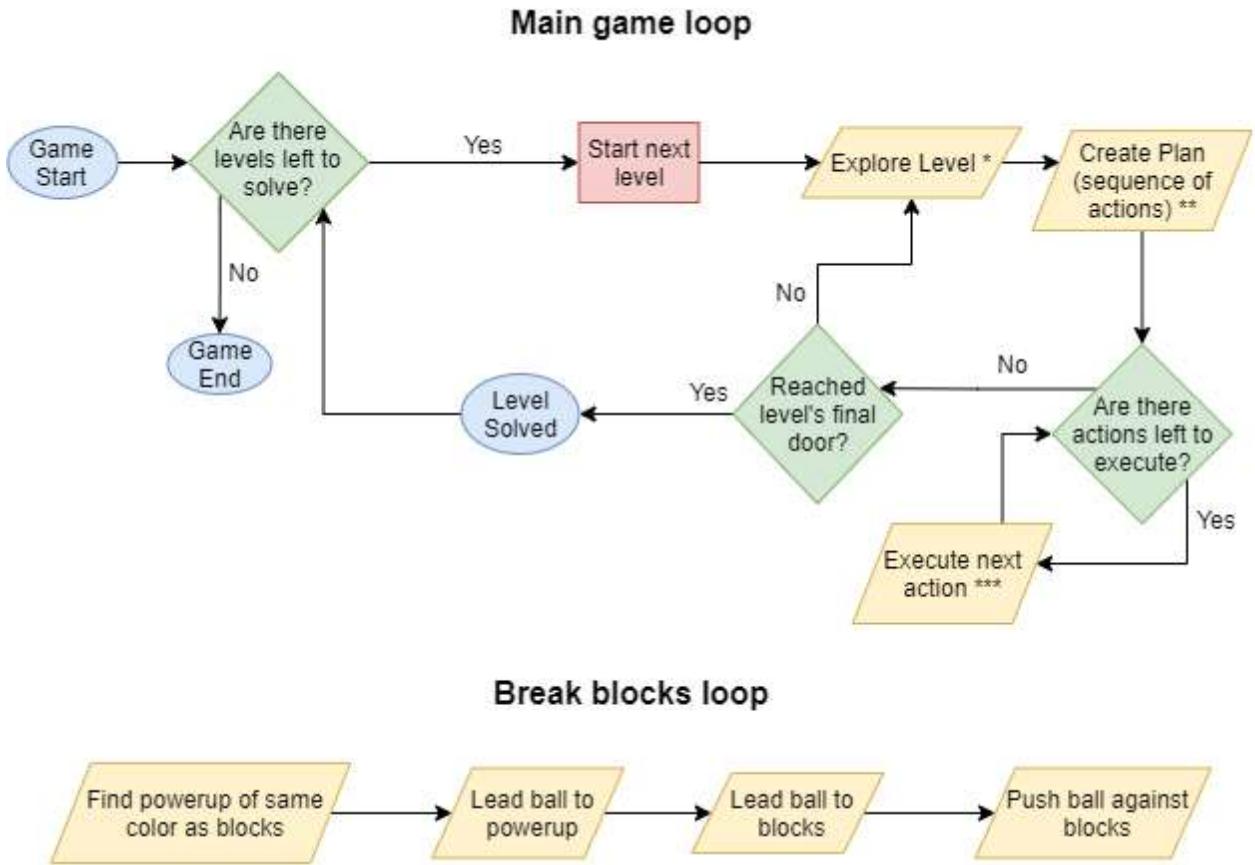


Fig. 14

* Exploration actions: Move player, push/pull ball, jump, climb ladder, strong push, press button, pull lever.

** We define a plan as a sequence of actions or other lower-level plans (sub-plans). In the example of the “break blocks” loop, which the user executes every time (s)he needs to break some blocks, “lead ball to power-up” is a sub-plan, which can be decomposed into a sequence of “Push Ball” and “Pull Ball” actions, depending on the specific case.

*** Planned actions: Move player, push/pull ball, jump, climb ladder, strong push, press button, pull lever.

Note that we include the actions “strong push”, “press button”, and “pull lever” in the “exploration actions” because the player can perform them in an exploratory sense, to see what effects they have in the game world. For instance, the player might in a first instance, pull a lever to see what it activates, and later as a part of a plan to advance in the level.

9. Focus group

Here, we provide a simple characterization of the current members of our focus group (names were changed for anonymity).

Name	Rodrigo	Nuno	Maria	Abilio	Aurélio
Age range	Young Adult (20s)	Adult (40s)	Teen (15s)	Young Adult (20s)	Young Adult (20s)
Gender	Male	Male	Female	Male	Male
Brainhex	Achiever-Conqueror	Mastermind-Achiever/Mastermind-Conqueror	Seeker-Achiever	Achiever-Socializer/Achiever-Mastermind	Seeker-Socializer/Seeker-Mastermind
Skills	Focused, good at reasoning	Focused, patient, good at reasoning	Creative and persistent	Doesn't fear taking risks, is patient and persistent	Good in problem solving and creative
Limitations	Impatient, gets bored easily	Not very fast reflexes	Overthinks a lot	Not very fast reflexes, gets angry easily	Distracted easily
Favourite games	The Sims	Hearthstone, Legends of Runeterra	Minecraft, Zelda:BOTW, Genshin Impact	Genshin Impact, CoD MW3, AC Brotherhood	Skyrim, Runescape, Minecraft
Occupation	Master's Student	Science Communicator	Student	College Student	Master's Student
Hobbies	Watching TV series, reading, playing chess	Playing video and board games, watching anime shows	Dancing, music and mathematics	Watching TV series and anime shows, play video	Gym, music and programming

				games, watch sports, reading	
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Due to covid, this focus group doesn't represent the ideal people that would play our game.

10. Prototypes

In this section we will show and explain the different prototypes each member developed. The main goal was to create an unique feature for each prototype and evaluate if it would have good feedback from the users.

10.1. Mind-control (João Galveias 90737)

In this level we included a mind-control machine that allows the player to **control the movement of the ball remotely**. This is useful because there is a power hidden in a maze that is only accessible by the ball, so the player has to control it remotely. With this new mechanic, the player has different options on how to pass the level, it can use the mind-control right in the beginning, in the middle of the level or just when it is necessary.

This prototype is a project done in Inkscape(vector graphics editor). Its purpose is to emulate a classic paper prototype. Each object has its individual layer in order to be controlled individually. For example when the ball destroys one block we just need to disable the visibility of the layer of that block. In the prototype there is a maze where only the ball can enter, however that 3d component can't be displayed here nor in a paper prototype. Nevertheless to emulate a first person view when the ball is in the maze there is a white area above it to hide where the power up is, so the player has to explore the maze to discover it. This can be done using the eraser tool that will draw the ball path on the maze erasing the white area. The ball also changes its color when picking up a new power up, this can be done simply by selecting the ball and using the eyedropper tool on the power up next to the ball.

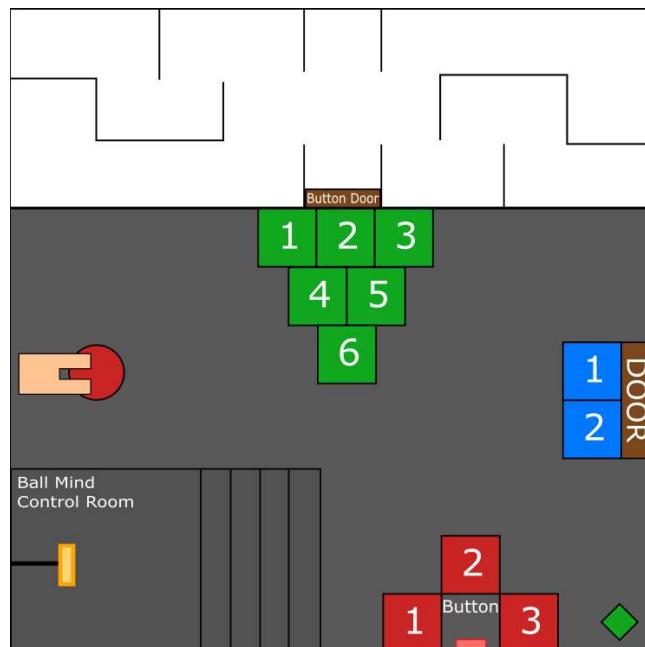


Fig. 15

Fig. 15 - Mind-control prototype

10.2. Elemental powers (Pedro Vilela 90762)

This prototype tests a new feature, where the ball, when it changes color due to a power-up, besides being able to destroy the blocks of the same color, gets a new ability based on an element. In this case, when the ball is blue, it gets water properties allowing it to cool down the lava and create a path to cross and, when the ball is white, it gets ice properties, being now able to freeze the water to cross the gap.

The prototype was made with paper, for the level map, legos, for the boy, the power-ups, the blocks, the path made by the ball and for the lever and the door, and plasticine for the ball. The player is meant to play this prototype by hand, by moving around the boy and the ball.

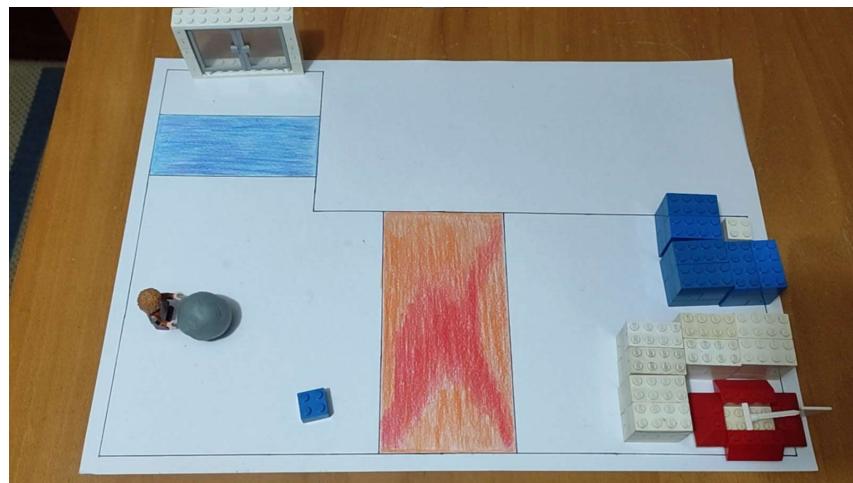


Fig. 16 - Elemental powers prototype

10.3. Power-ups hidden in holes (Filipe Sousa 90714)

This prototype features some of the previously described features, namely power-ups to change the ball's color, blocks of multiple colors, ramps (here represented as stairs), a key and a door.

However, the main purpose of this prototype was testing a possible new feature to use in the levels of Unroll, which is the existence of some **power-ups hidden in holes**. In order to progress the level, they need to change the ball to certain colors, and for some the corresponding power-up is hidden in a "tunnel-like" hole where the ball must be dropped by the player, and retrieved in the other end of the hole. We aimed to test if the players would try out to drop the ball in the holes, or, instead, be afraid that by doing that, they would get stuck, or lose the level. (Note: Gameplay scenario 7.1 is based on Fig. 17)



Fig. 18 - Holes prototype

This prototype was developed using Microsoft Office PowerPoint, and each slide of the slideshow contains a screenshot taken from a Minecraft custom world. It was made in a point-and-click fashion, so that the player can play it by itself (without a mediator). Although some programming (in Visual Basic for Applications) was required to store the current state of the game and change the ball's color and transparency, it was very simple to code compared to what we will face in the higher level digital prototypes.

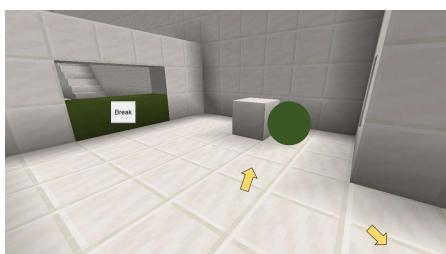


Fig. 19



Fig. 20

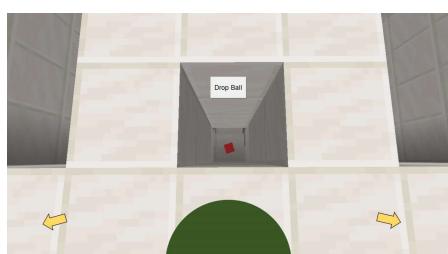


Fig. 21



Fig. 22

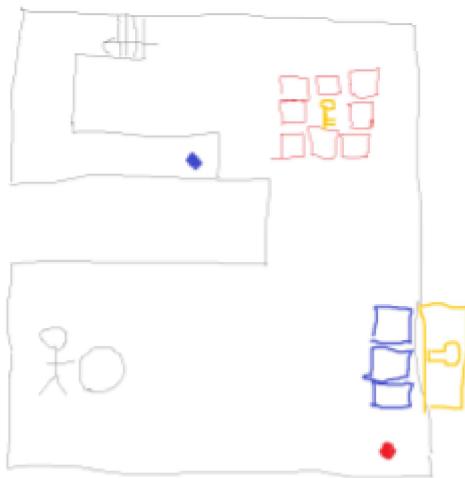


Fig. 17 - Sketch of example level

10.4. Prototypes demonstration

Mind-Control (João Galveias 90737):

https://drive.google.com/file/d/1ODqX6jq7SnKsRwLuQ_xGCsY85c4ls9S-/view?usp=sharing

Elemental powers (Pedro Vilela 90762):

<https://drive.google.com/file/d/1IQ3lt6yolvUHhgpgwooYZkOeMgNDoWrg/view?usp=sharing>

Power-ups hidden in holes (Filipe Sousa 90714):

https://drive.google.com/file/d/18e1UJ2wlh8hBcdH6vRoT_OfnQPCH1rEq/view?usp=sharing

11. Prototypes' user feedback report

We tested our prototypes both with people from our focus group, and with people outside it. Here we present the main feedback we received from the testing sessions.

11.1. Mind-control

11.1.1. Positive feedback

- Everything in the level has a purpose;
- At first, it's not obvious how to change the ball's color to blue, which encourages exploration;
- It was fun to search for the hidden power-up in the maze.

11.1.2. Negative feedback

- It was not clear how to activate the mind control room, and what exactly does it control (ball's color, movement, ...);
- Once the “button door” is open, it is not clear there is an entrance to the maze;
- A less experienced user thought that the button opened the final door, and that the power-up would switch to a different color after the ball used it.

11.1.3. Suggestions

- Blue power-up position being random in the maze (this was due to a problem that occurred in the prototype demonstration, which resulted in revealing the position of the blue power-up)
- Adding an info button next to the ball mind control room, that, when touched by the character, displayed an informative text about how the room worked.

11.1.4. Final remarks

In general, the players liked the prototype, although they thought it was not easy to visualize how the game would really look like, as the prototype was only 2-dimensional.

11.2. Elemental powers

11.2.1. Positive feedback

- The players found the feature an interesting concept to implement in a level.

11.2.2. Negative feedback

- It was not clear in the beginning that the blue ball could make a path through the lava.

11.2.3. Suggestions

- The path made by the ball, instead of being permanent, could disappear with time.

11.2.4. Final remarks

In general, the players liked the level and thought it was an interesting feature for a level.

11.3. Power-ups hidden in holes

11.3.1. Positive feedback

- The prototype allowed for a smooth interaction;
- All the players, although in some (few) cases reluctant, eventually tried dropping the ball in the holes;
- All the players eventually finished the level, and the slowest time was around 7 minutes;
- It allowed for a good visualization of how the game would look like.

11.3.2. Negative feedback

- Sometimes it was confusing the angle the player was facing after clicking in an arrow;
- The map was very uniform, and didn't have many points of reference in some corridors, resulting in some players getting lost;
- It was not clear that there was a character - a boy - pushing the ball (some players which had a shorter explanation of the game idea thought they were controlling the ball itself);
- The ball disappearing from the screen after being dropped was confusing;
- For one player, it was not clear at first what was meant by the label "Break".

11.3.3. Suggestions

- Showing the hands, or the full body of the boy in the prototype.

11.3.4. Final remarks

The players, in general, enjoyed playing through the prototyped level, although sometimes lost sense of direction, or got lost. It is interesting to remark that some players who played both this prototype and the Mind-Control one considered this one ("holes" prototype) "more interactive" and that it allowed a better visualization of how the final game would look like.

12. Tech Feasibility Report

In this section we explore the technological options available to use for our project.

12.1. Unreal Engine



Fig. 23

“Unreal Engine is a complete suite of development tools for anyone working with real-time technology. From design visualizations and cinematic experiences to high-quality games across PC, console, mobile, VR, and AR, Unreal Engine gives you everything you need to start, ship, grow, and stand out from the crowd.”

(Source: <https://www.unrealengine.com/en-US/features>)

This engine by Epic Games features high-quality graphics and real-time technology. It is free to use (for personal purposes) and there are plenty of learning materials available to learn how to use it.

However, our game will not require graphics with a quality as high as provided by Unreal Engine. Also, we would have to learn it, which, despite all the support available, would nevertheless decrease the time available to develop the project (which is low - about 2 months) without any particular advantage, when compared to using an engine we already know.

12.2. Unity Engine

This engine by Unity is one of the most popular engines available out there. It has a big community that helps beginners and even veterans with their doubts and difficulties.

The Unity Asset Store is also a great advantage of this engine. There, we can find a variety of different assets to be used in the engine, some free and others paid.

The main reason for choosing this engine is due to our previous experience with it, making it easier for us to start developing a new game. Regarding plugins and toolkits, Unity already comes with a default physics engine, known as PhysX, which will probably be enough to develop this game. The other reasons are both the advantages explained previously, such as having a great community available to help anyone and an asset store filled with useful resources.



Fig. 24

12.3. Final remarks

In conclusion, we think Unity Engine will be enough to support the features we want to implement, namely the 3D world and its physics (the movement of the boy and the ball, the gravity, the rolling and bouncing of the ball, among other things).

13. Workshop

Our workshop consisted of 2 activities: “Zen voting” and “Card Sorting”. We will proceed to explaining its goals, procedure and results.

13.1. Workshop goals

Our two workshop activities were made with different objectives.

The “Zen voting” activity had the main goal of receiving feedback from the focus group on which features to prioritize, or to implement at all. This is of utmost importance to us, because we have limited time, and so we cannot implement all features.

The “Card Sorting” activity, on the other hand, had the goal of better understanding the players’ mental models in order to upgrade our game’s conceptual model.

13.2. Workshop procedure

We did the workshop 3 times, two of them individually and the other one was with a group of 2 people. We started by explaining the general idea of our game to the people that we didn’t belong to the focus group.

The first activity was the card sorting. We proceeded by explaining how the activity worked and then each person sorted the cards as they wanted individually. Then we did the second activity which was zen voting. We did basically the same procedure where we explained the activity and then let them choose their options on their own.

On the final step of the workshop, we had a discussion with the group of 2 people, to compare results and have a better understanding of their choices.

13.3. Workshop results

13.3.1. Card sorting

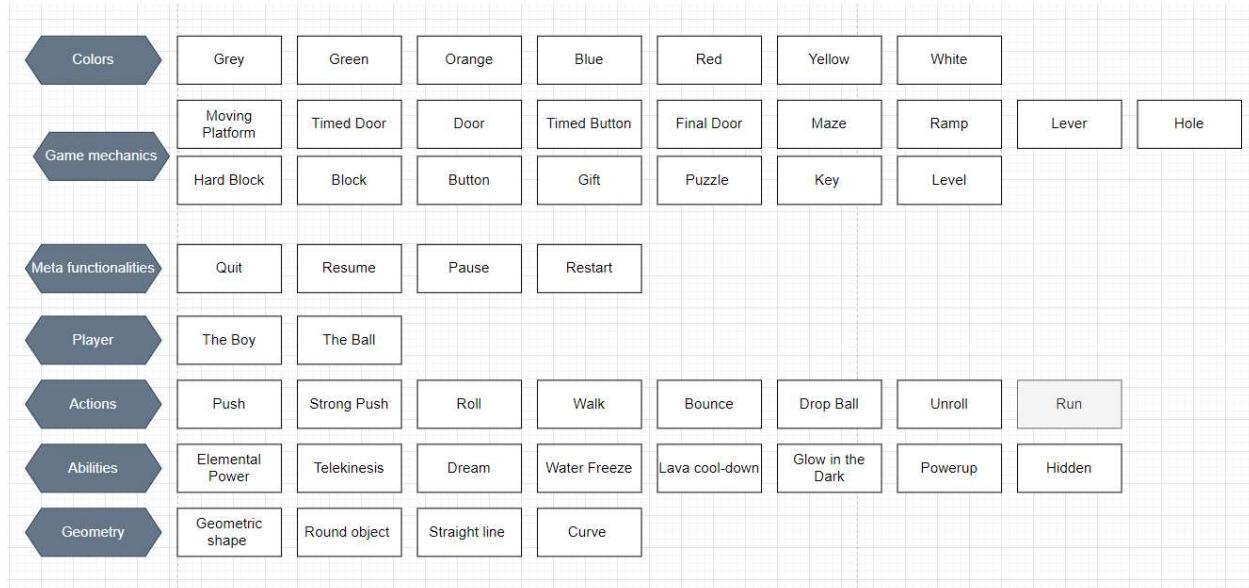


Fig. 25 - 1st card sorting

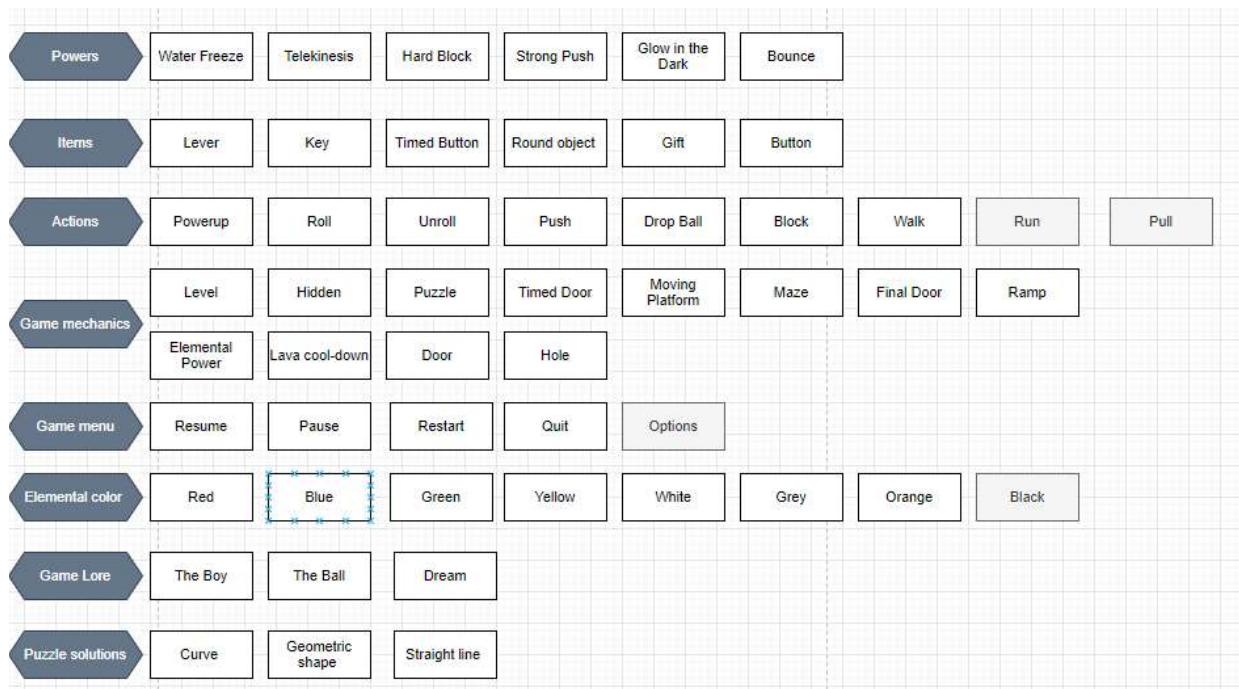


Fig. 26 - 2nd card sorting

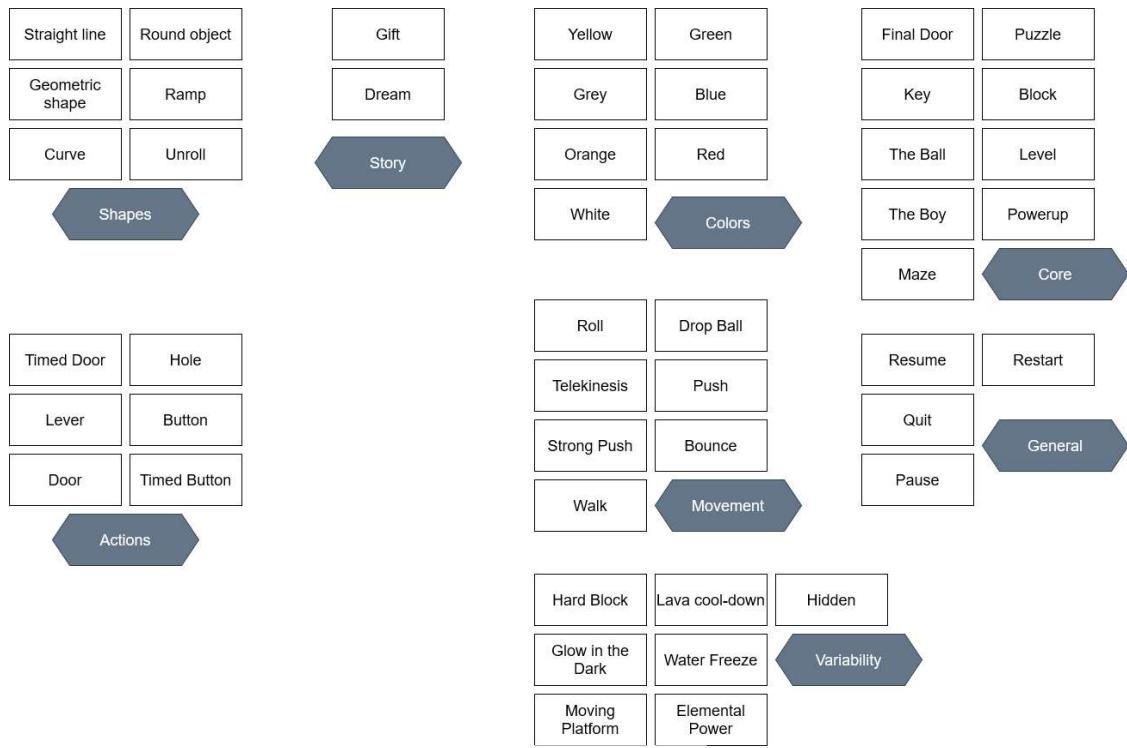


Fig. 27 - 3rd card sorting

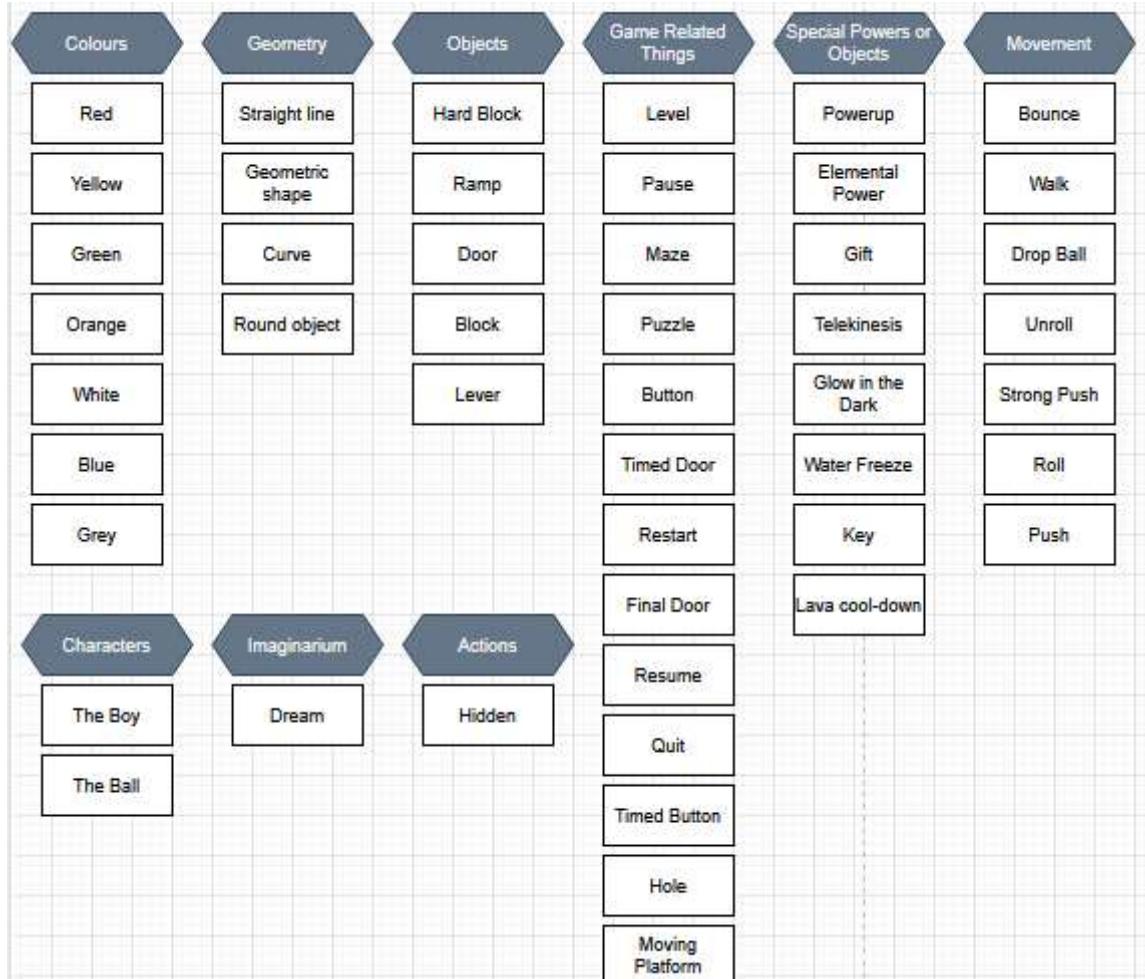


Fig. 28 - 4th card sorting

From these results, we conclude that some of the concepts we selected are ambiguous.

Some of the problems we encountered were the following:

- Multiple people thought “Unroll” was a ingame action;
- The word “Hidden” was interpreted as an action or power-up, when our idea was to refer to the power-ups hidden in holes;
- It was not clear which actions the characters can always perform, and which ones require a power-up to perform (for instance “Strong Push” can always be performed by the boy, but the participant in the 2nd card sorting classified it as a “Power”);
- In the 1st card sorting, the participant thought “Dream” was an ability;
- In the 3rd card sorting, the participant informed us that he didn’t know the names of the groups were important, which led to a confusing interpretation of the results on our end;
- In the 4rd card sorting, the “Lever” and the “Button” are in different groups and in our game they have almost the same function;
- In this last activity, the participant also created a group called “Game related things” for concepts he didn’t know where to put.

However, it seems to us that it is clear for most participants who are the main characters (the boy and the ball), lore elements (the ball’s dream, the straight lines and curved world) and most power-ups and actions.

13.3.2. Zen voting

In this activity, we presented the following options to the players:

- Telekinesis: Control the ball’s movement in specific situations;
- Control the ball’s shape: Change it to a cube, a disc, etc.;
- Power-ups in holes: Holes containing hidden power-ups. The player must drop the ball in the hole to use the power-up;
- Ice surface: When the characters walk over it, they can’t stop until they hit an obstacle
- Water elemental power: Cools down lava, creating a walkable stone path;
- Ice elemental power: Freezes water, creating a walkable ice path;
- Fire elemental power: Melts ice;
- Mazes: Labyrinths hiding power-ups, keys, buttons or levers.

Zen voting results

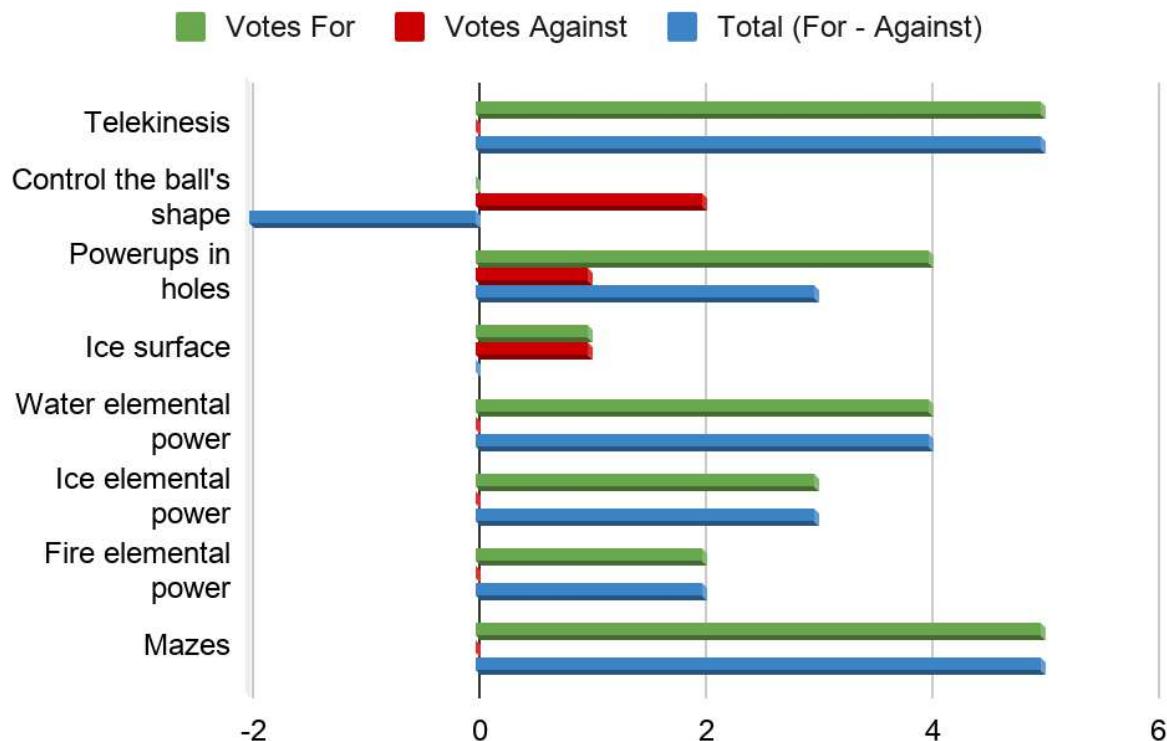


Fig. 29

From these results, we conclude that the most voted ideas were “Telekinesis” and “Mazes”. This is interesting because those two features can be used together, as we did in our “Mind Control” prototype. The water and ice elemental powers also had a good score, and those were the ones some players were able to test in the “Elemental Powers” prototype (the fire one had the least votes of the three, and was not tested in the prototype). The “Power-ups in Holes” feature, which also had a dedicated prototype, also had a good net result (3), although having had one negative vote.

The “Control the Ball’s Shape” feature had a negative result and the “Ice Surface” one had one positive and one negative vote. This might be because we didn’t use them in any prototype, or maybe they are just ideas that weren’t interesting for the players.

With these results, we will try to prioritize the implementation of the most voted ideas

14. Control scheme

To control the boy's movement we will use the "A,W,S,D" keys to go "Left, Forward, Backwards, Right" respectively; these controls will also be used when controlling the ball itself inside the mazes. The "E" key will be used to interact with objects, buttons and levers.

When the boy is moving with the ball, we are still unsure whether to have the ball movement independent from the boy's, so in order to apply a direction change to the ball, the boy has to position himself on the opposite side of the desired change and push the ball in that direction or just use the same controls as when the boy is moving alone but the "A, D" keys will be used to control the direction of the movement rotating the ball and the boy with the center of the rotation being the boy's body.

The player will be able to control the camera rotation with the mouse.

15. Presentation scheme

For our presentation we are thinking of a third-person "Over the shoulder" perspective, where the player can see the characters (the boy and the ball) and the environment around them. The camera will follow the characters and will be directed to where they are looking at.

Small text boxes will appear on screen when close to an interactable object, describing what kind of interaction is able to be performed. Picked up objects will be shown on the bottom left of the screen. When the ball is in a maze, the camera will change to an "Over the shoulder" perspective behind the ball. In the starting levels, contextual information will be displayed in certain situations to help. For instance, a message saying "Press WASD or the Arrow Keys to move" will appear if the player doesn't move during a certain period of time.

For the start screen, there will be some options the player can select, such as: "New Game", "Load Game", "Settings", "Exit Game". These options will be displayed in four boxes, one over the other, in the lower centre part of the screen, with the "New Game" option as the top option, then the "Load Game" option, then the "Settings" option and, at the bottom, the "Exit Game" option. Above these four boxes, will be the title of the game.



Fig. 30 - Interaction text

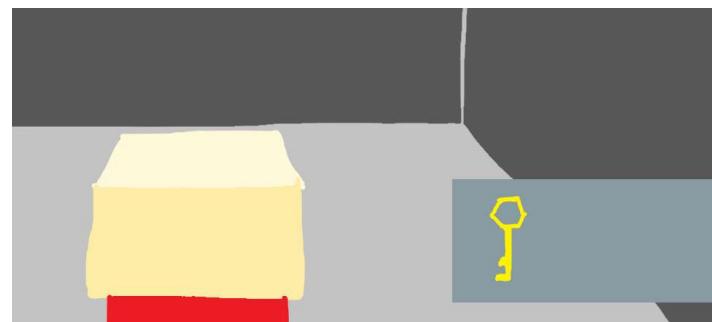


Fig. 31 - Key / pickable object display



Fig. 32 - Contextual information



Fig. 33 - Pause menu



Fig. 34 - Level completed



Fig. 35 - Initial screen

16. Tested options

One of the main goals of this prototype was to **test the controls** with the “W, A, S, D” keys for the movement of the boy and the ball when in the maze. After testing, we concluded that this is a good control scheme for the game.

The **camera movement** and the **field of view** were also an important part that was being tested, such as the camera turning sensibility (including when controlling the ball in the maze). Some players considered the current camera control a bit floaty, but for now we will stick with it.

We also wanted to test the ideal **range** for the boy to **grab the ball**. Many players complained about it being too small.

The **movement speed** of the **boy** with and without the ball was also an aspect that we wanted to test to make the right adjustments as well as the **ball speed** in the **maze**. We think the current setup is good, but we can change it in the future, given different feedback.

The **UI** also had some elements we wanted to test, such as the size of the tooltips with the controls for each interaction.

17. Focus group feedback

In general the players liked the **controls** of our prototype, mainly because we use the standard “W, A, S, D” keys for the movement (although moving with the arrow keys is also possible). However, some more experienced players noticed a minor issue with the **camera movement**, but they couldn’t quite describe it. We are trying to figure out what is really the cause for that initial discomfort. After some playing time they said it didn’t make much difference. Still, some players didn’t like the camera’s control scheme, and preferred that the camera rotated along with the character with the A, D or Left, Right keys. It was also pointed out that the boy’s head was too big, and blocked most of the ball out of view.

As for **controlling the ball** itself inside the maze, the players enjoyed the controls but felt like the camera should show a bit of the ball to give them the notion that they are playing as the ball and to know when they have picked up the power-up, while others found the first person perspective fun and a nice change. Another suggestion given by the players to solve this issue was to always have in the UI an icon displaying the ball’s current color.

Some players also pointed out that the **boy** was **moving too slow** when not holding the ball, while his current speed was adequate when holding the ball. They suggested a button to hold to increase the boy’s movement speed. Other players said that maybe the movement speed was OK, but the problem was that the **level’s area was too large** for the amount of objects present. The lack of the ability to **jump** was also pointed out by some players, although they concluded that it was not very important, but it still felt strange.

For the **UI** of the game some players said they could be **bigger**, that happened because they played in different resolutions from the one we are using to develop the game. We already know how to solve that issue by making the UI scale according to the screen resolution. There were some players who said the “grab ball” text was a bit misleading since the player doesn’t grab the ball. Also, for mind-control, in addition to the in-game explanation already present in the prototype, adding a tooltip to show when and how to activate the helmet would help the player to see its range, although some players considered the current plaque was enough.

The less experienced users such as “Isabel” were struggling to **grab the ball**, because when they tried to get close to it they ended up bumping the ball away. However, after some playing time, they had mastered that mechanic and weren’t struggling anymore, but we still decided to increase the range of the “grab ball” mechanic.

All players enjoyed the combination of “**shooting**” the ball on a ramp to hit and **activate a button**. They said they would like to have more areas in the game where they could aim and “shoot” the ball to hit buttons, go through holes or break inaccessible blocks.

For the **reset button** - the R key - most players thought that instantly resetting the game upon pressing the button was not a good choice as it would reset all the progress made in that level if the player happened to misclick it, which is probable to happen as the R key is close to the “W, A, S, D” keys used to move. These players recommended adding a confirm box asking the player if he/she would like to restart the level.

One player also suggested that the player could have a simple **health system** (lives/hearts), where on death he/she would lose one life (and be warped to a checkpoint), and 0 lives would imply game over.

Finally, it was also suggested adding a **menu with the controls**.

18. Player progression

The player progression we are planning is mainly based on **level progression**. In the initial levels, we will introduce simple concepts to teach the players how to handle each one, and combine them in the most difficult ones, to create interesting challenges.

We are also planning to include **achievements** (awarded when the player completes certain meta-goals), **collectibles** (found in hidden or difficult to access places in levels).

18.1. User journeys

In Unroll, we were able to identify 2 kinds of user journeys: the journey of the player observing the **unfolding of the story events** and the journey of the player **increasing his/her mastery** in the game.

The first one will occur mainly as the player progresses through the levels, and sees the **changes in the architecture and scenarios**. As we mentioned before, our game will not be much focused on the story, but we will try to convey it indirectly using visual elements. Nevertheless, we think an initial cutscene (and maybe some more in the most critical points in the story) would enhance our game's experience.

The second one will consist in the player improving his/her **knowledge of the various gameplay elements** as he/she plays through the levels. We will try to balance the difficulty in such a way that the player will **always feel prepared** to face the challenges imposed by the puzzles of increasing difficulty, while also trying to **avoid a dull gaming experience** and **keep the player engaged**. Also, the achievements and collectables we mentioned before will encourage players to repeat levels, increasing even more their expertise. We will further discuss the gameplay elements which will create this difficulty curve in the next section (18.2. Progression paths).

Our final prototype will focus more on implementing the second user journey we mentioned, because we think it is the most relevant in our game. For the story journey, we will most likely just create a simple text introduction to the plot.

18.2. Progression paths

The gameplay progression in Unroll will consist of the successive addition of different elements (in the first levels) and further developing or combining them (in the intermediate and advanced ones). We will first discuss level progression

18.2.1. Level progression

Our game is divided into multiple levels. In each level, the player must find and exit through a “final door” (as the level can have other doors). Players can only progress to the next level once they beat the current one. The game will **save its progress automatically** after the end of each level, and the player **can repeat previous levels**.

In the **easy levels**, we will begin by introducing one concept at a time, for example, a **new power-up color** and its **special effect**, a new **interactable element** (e.g. levers or buttons) and its effect in the environment or even a new **concept** (e.g. mazes, holes hiding power-ups). This does not mean that one level can only introduce one concept, but that each concept will be presented in a **linear** way (i.e. the player has a very limited number of

choices), and thus, the player will eventually learn to play the game by **trial and error**. This avoids the need for guided tutorials, which are sometimes disliked by more experienced players. But, as we said before, the player will still have contextual tooltips, at least in these first levels, to help him/her learn the controls and mechanics of the game.

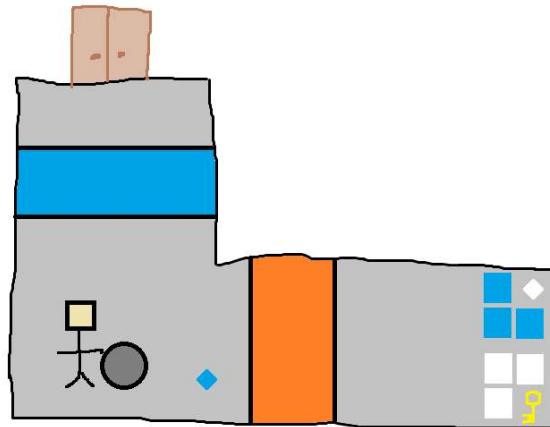


Fig. 36 - Example of simple level

In the **intermediate levels**, we will start increasing the difficulty curve, as we expect the player to be used to the controls and mechanics. Here, we will start to deepen each concept and to mix them together to create more difficult challenges. Examples of deepening a concept can be **more complex mazes** and levels requiring **more difficult aiming/balancing skills**. The merging of different concepts consists, for example, of levels having multiple power-up colors that need to be **collected in a certain order** due to the disposition of the colored blocks, and **power-ups hidden in mazes**. In this last example, if the player already knows what the entrance to a maze looks like, he/she will notice it much more easily, and thus, the challenge will be to realize that the maze is hiding a power-up, instead of trying to understand how it works (i.e., what is it and how to “activate” it).

In the **hard levels**, the player is most likely already accustomed to the gameplay concepts, and so we can increase the difficulty even further, and mix together a higher number of gameplay elements.

We think it would be a good balance to have 10 starting levels, 10 intermediate levels and 10 to 20 advanced levels. In the following experience matrix we summarize the evolution of some gameplay dimensions with the progression of the levels:

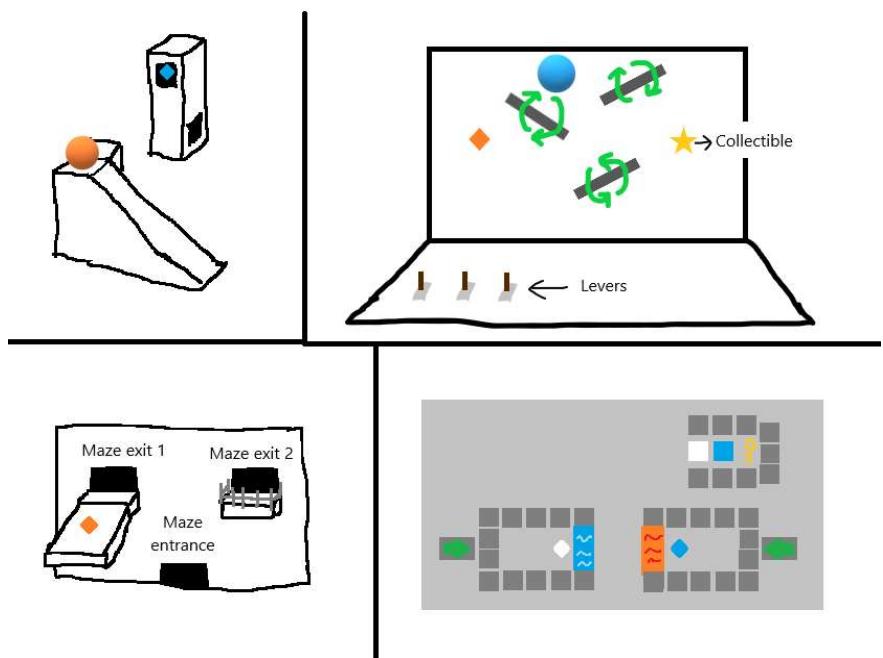


Fig. 37 - Ideas to include in intermediate and hard levels

Dimensions	Lv 1 - Lv 10	Lv 11 - Lv 20	Lv 21 - End
Difficulty	Easy	Intermediate	Hard
No. of different power-ups (colors)	1-2	1-4	1-6
Max. no. of different concepts present in a level	3	6	No limit
Average time to complete level	5 min	10 min	15 min
Feelings	Curiosity, Excitement	Determination	Involvement, Determination

18.2.2. Progression paths for each persona

In this section, we estimate what would be the average time

Dimensions	Miguel Maria	Isabel Silva	Roberto Sá
Average time/tries to complete easy levels	5 min / 3 tries	8 min / 6 tries	3 min / 1 try
Average time/tries to complete intermediate levels	10 min / 6 tries	15 min / 10 tries	6 min / 3 tries
Average time/tries to complete hard levels	15 min / 10 tries	30 min / 15 tries	10 min / 6 tries
% collectibles collected before completing all levels	85%	40%	10%

18.3. Collectibles

Collectibles are objects hidden on each level, where the player needs to do certain actions in order to pick them up. They will look like random geometric solids. These objects are optional to collect, but, if the player decides to find them, they will be stored in a special room where the player can look at them with more detail.

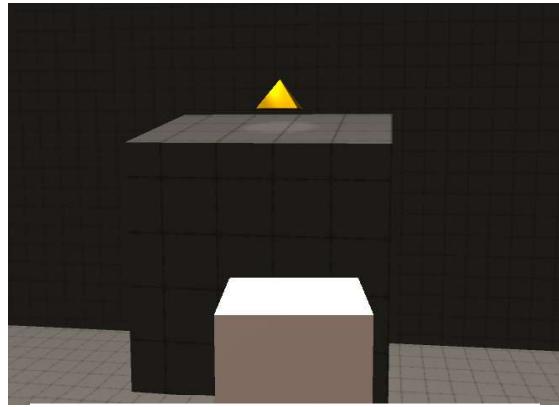


Fig. 38 - Collectible

18.4. Achievements

Achievements are certain **tasks** the player can **optionally complete** during the game. When an achievement is completed, a message appears on the screen informing the player of that feat. The player can also see the completed achievements in the menu. Some examples of achievements we are considering to include in Unroll are:

- ★ “Beat all of the easy/intermediate/hard levels”;
- ★ “Collect at least one powerup of each color during your journey”;
- ★ “Break at least one block of each color during your journey”;
- ★ “Walk a total of X meters during your journey”;
- ★ “Perform “hard push” Y times during your journey”;
- “Beat a certain level without dying”;
- “Beat a certain level in less than Z seconds”;
- “Beat a certain level without using a certain powerup”;
- “Get all collectibles”.

Note that the achievements marked with a star (★) are related with “linear” progression in the game (i.e., the player will eventually earn them if he/she completes all the levels, assuming the values for X and Y are not too high), while the ones marked with a dot (●) are skill related tasks.

In this way, even the players who do not want to perform all the optional tasks will feel rewarded for playing the game in their own way, while players with the “Achiever” Brainhex archetype will also feel pleased for having additional goals to pursue.

18.5. Experience time

Taking into account our estimations for the average time the players will take to complete each level, we predict the **average time to finish the game** will be around **7 hours**. However, many players will likely try to repeat the levels to get achievements or find collectibles they missed, so they will effectively take more time than that to finish the game, so this average only applies for players who do not repeat levels.

We also predict that each **play session** will last for about **1 hour**, which corresponds to a little more than playing through all the easy levels, 6 intermediate levels or 4 difficult levels. We hope our game is addicting enough to engage the players to play it for that time, but as this is a puzzle game, spending more time than that can cause the player to get fatigued.

19. Playtest plan

In this section, we will describe how we are planning to proceed during the playtesting session, to collect data from participants.

19.1. Context

Our playtest session will occur during the online event “**MOJO**”. The participants will be able to access our game by downloading it from our itch.io website.

The participants’ sampling will follow an approximately random selection, due to the dynamics of MOJO. For this reason, the participants will probably all be **first-impression testers**, as we have no way of selecting who will test our game. For the same reason, not all of them will belong to the target audience, and will therefore be **non-target-audience gamers**. Additionally, we think the testers will **not cover** all our defined **personas** nor the whole **target audience**.



Fig. 39 - “MOJO” event

19.2. Questions

We will be collecting data through game instrumentation. However, since it would be difficult to get players’ opinions, or answers to more subjective questions, for instance, questions about the players’ emotions, we will ask these kinds of questions in an online questionnaire.

So, we selected the following questions:

1. What percentage of collectibles did the player collect during the play session?
2. Are the gold collectibles harder to collect than the silver ones, and the silver collectibles harder to collect than the copper ones?
3. What percentage of achievements did the player unlock during the play session?
4. How long do players take on average to beat each particular level?
5. How long do players take on average to beat the full game?
6. How much time do players spend on average inside each particular maze?
7. Where do players get stuck more often?
8. How often do players die in each particular level? (In levels with water or lava)
9. How often do players fail to grab the ball?
10. What is the profile of players (age, gender, favourite game genres, degree of dedication to games) which find our game more enjoyable?
11. What is the profile of players (age, gender, favourite game genres, degree of dedication to games) which have a better performance in our game?
12. Is the difficulty curve inappropriate (too steep/not steep enough)?
13. Which of the game’s features are good as they are now, and which ones need improvement/rethinking?

In order to answer questions 1 to 9, we will use game instrumentation. For, questions 10 to 13 will use a questionnaire. We will discuss those data-gathering techniques next.

19.3. Data-gathering techniques

Due to this year's "MOJO" being online, we will not be able to interact directly with our testers. So, the data-gathering techniques we have available are more restricted. Nevertheless, as we mentioned before, we will perform **game instrumentation** and an **online questionnaire**. An ingame **random identifier** will be generated in order to link the game instrumentation with the online questionnaire.

19.3.1. Game instrumentation

For game instrumentation, we chose to use **Unity Analytics**, as it requires low effort to integrate it into our prototype, and allows for a wide range of types of information from play sessions.

We will collect the following data:

- A. Number of collectibles collected from each type (copper, silver, gold)
- B. Number of achievements unlocked
- C. Time the player takes to complete each level
- D. Heatmaps for the time player spends in each location of the map+
- E. Number of deaths per level (in levels with water or lava)
- F. Number of times player presses "E" (ignoring cases where the player is near a helmet or door)
- G. Number of times player successfully grabs the ball

"A" allows us to answer question **2**, as we will compare the number of collectibles of each type players collected, and see if the gold ones were the least collected and the copper ones the most collected.

The heatmaps ("D") will be analysed to determine the time spent in each region of the levels, answering questions **6** and **7**.

"F" and "G" together, allow us to compare the number of times players press the "E" key against the number of times they successfully grab the ball, in order to determine the fraction of "E" key presses which did not result in grabbing the ball, answering question

The remaining data will be used.

19.3.2. Questionnaire

In order to get the opinion of our players, and to answer more subjective questions, we will provide players with an optional questionnaire to answer after playing the game, in the itch.io webpage. Our questionnaire is composed by the following questions:

I. Player profile

- a. What is your age range?
 - Under 12 years old
 - 12-17 years old

- 18-24 years old
- 25-34 years old
- 35-44 years old
- 45-54 years old
- 55-64 years old
- 65 years or older

b. What is your gender?

- Female
- Male
- Other

c. What genre of video games do you play more often?

d. In a typical week how long would you say you spend playing video games?

- 0 hours
- 1-2 hours
- 3-5 hours
- 5-6 hours
- 6+ hours

II. Gameplay experience

a. Please state your opinion on the following statement: "I enjoyed playing Unroll."

1. Strongly disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

b. What is your opinion on the levels' difficulty progression?

c. Which features did you enjoy the most and why?

d. Which features did you dislike the most and why?

e. Do you have any suggestions you consider would improve the game?

Combining questions from section "I" of the questionnaire allows us to create a simple profile for each player.

Question 10 can be answered by combining the player profiles with the answers to "II.a".

Question 11 can be answered by combining the player profiles with some of the instrumentation data (for instance, "C": "Time to complete each level" and "E": "Number of deaths per level").

Question 12 can be answered using "II.b".

Question 13 can be answered using "II.c", "II.d" and "II.e".