



Discover the value of augmented reality in tabletop games through novel game mechanics.

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1. Introduction

Eye of the Cyclops (Figure 1) is a concept for a new range of augmented reality tabletop games that introduces the technology as one of its core gameplay mechanics, rather than using it as a gimmick. By incorporating perspectives – like the first-, second- and third-person perspective – in addition to that of the players, AR offers many new possibilities for gameplay mechanics that benefit from both tangible as augmented elements in a face-to-face setting. This report will focus on the experimental design process of this boardgame, covering a series of exploratory prototyping phases, numerous game design concepts and both in- and external playtesting to reach the final design. The first half of the project was an exploration into the value that AR can offer players in their play experiences, while the second half focusses on incorporating the insights into the design of a complete and playable AR boardgame.

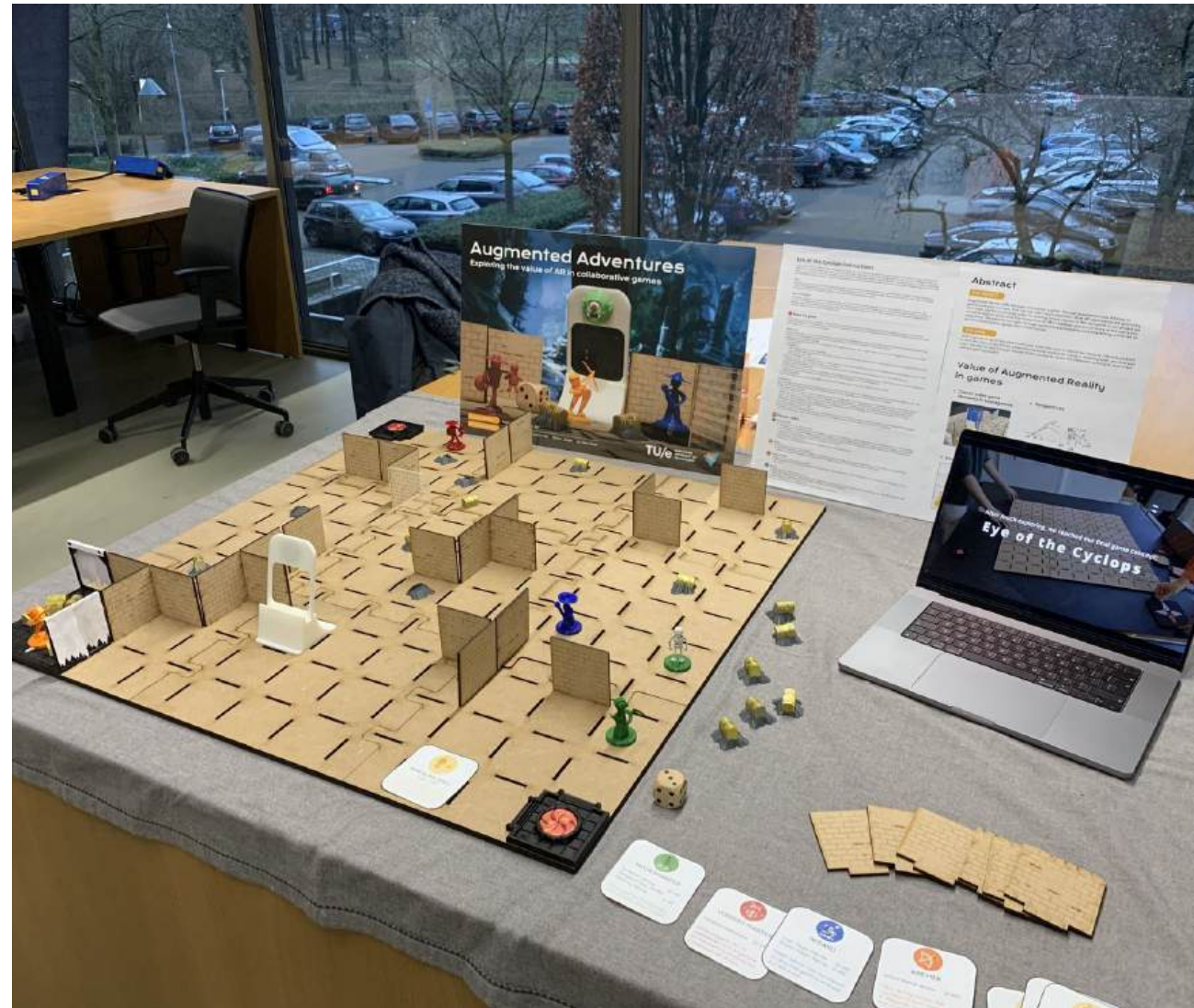


Figure 1: Eye of the Cyclops in Demo day

2.Related work

1.1 AR and (tabletop) games

The idea of exploring AR in the context of creating mixed reality games is one that has been previously addressed by Nilsen et al., in their research called “Motivations for Augmented Reality Gaming” [5]. To examine the possibilities that AR can have in games, they subdivide a player's gaming experience into four interactivity elements, namely: physical, social, mental and emotional. They use these to address where AR could possibly be introduced to enhance/support games that incorporate one or more of these elements. An example of a mental element that is mentioned is tabletop strategy games, where AR could be introduced as a medium to visualize events and/or enforce the game rules.

While it is generally accepted that the content of AR experiences consists of the presented reality and the virtual content generated by the AR device, Stapleton et al. introduce the player's imagination as a form of content as well [7]. Nilsen et al. propose – based on Stapleton et al.'s research – that the best way to design immersive interactive experiences is to include both real-world and virtual content, stimulating the player's imagination to fill in the gaps. This should lead to the player becoming fully immersed in the experience, expanding games beyond experiences that exclusively rely on virtual and imaginative content [5].

1.2 Collaboration using AR

Aside from supporting game rules and visualizations, AR also enables new forms of communication and collaboration between players. Through shared digital objects – using equipment like projectors, touch screens, specialized controllers, and cameras – AR can enable users to interact with each other remotely while performing tasks, while also creating opportunities to enhance face-to-face collaboration, and even introduce new forms of

communication [3][6]. A recent example of a product that presents the latter is Tilt5 [8]. Using specialized hardware, they enable players to play augmented reality games together both face-to-face, as well as remotely – using Tilt5 hardware or a standalone PC – and enhance the collaboration between players by giving them the ability to interact with virtual objects in a shared environment.

1.3 Prototyping and analyzing

The project consisted of two main parts: exploring the value of AR in tangible games and applying this knowledge to the design of a new AR (tabletop) game. The design approach revolved around phases of exploratory prototyping, after which the resulting prototypes were tested and reflected upon. The outcomes from each iteration would be used to develop the next one, up until the final design. This form of design process is comparable to Koth et al.'s approach to designing material representations of physical activity data [4]. In their research, they explored their design through three successive stages consisting of a multitude of prototypes that were tested and evaluated, incorporating the findings from each prior stage in their next iteration(s) of the design [4].

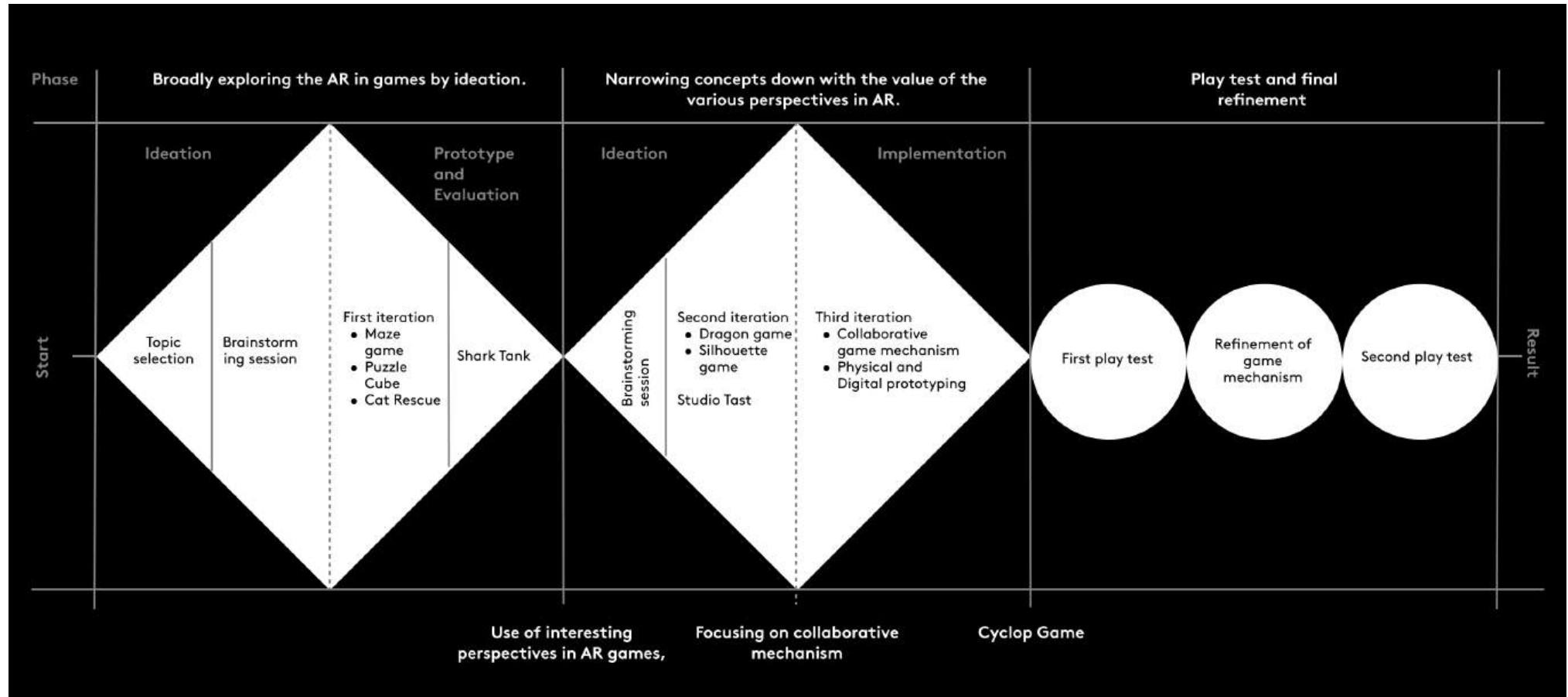


Figure 2: The Visualization of Design Process

3.Design process

The project started off with an initial ideation session where topics, subjects, and ideas were discussed that could potentially be the focus of the project. This session resulted in one topic that all members were interested in, which became the goal of the design project: Discover the value of augmented reality (AR) in tabletop games through novel game mechanics. As it shows in the Figure 2, the whole design process is documented and divided into 3 phases: (1) Broadly exploring the AR in games by ideation. (2) Narrowing concepts down with the value of the various perspectives in AR. (3) Play test and final refinement



In this section, we brainstormed 80 ideas and narrowed them down into three concepts, and following that we prototyped these ideas to examine and define how they bring value to AR. Finally, we demonstrated our ideas in the Shark Tank which was organized as a midterm feedback session by the Games and Play squad, and in turn concluded the specific value of AR games we found for further design iterations.

To begin with, we explored the possible value of AR in tabletop games and its applications through both paper/desktop research and another group brainstorming methods. Ideation sessions resulted in us defining 4 broad topics that we imagined to be most suited for developing an AR game around. These topics were:

- Role-based collaborative games
- Games for stimulating and maintaining new habits (impact on lifestyle)
- Playful learning and education
- Pushing the limits and exploring the possibilities of AR

We then held individual ideations in which we challenged each other to come up with 20 game ideas among those 4 topics, which contained a unique AR game mechanic. This resulted in us having 80 ideas (Figure 3) – which we compared in the following group session – of which we selected the best games by novelty and quality of ideas. By combining elements from the selection of ideas, some of the games were worked out in slightly more detail, which formed the basis for our first iterations of games. The first iterations consisted of Maze Game, Puzzle Cube, and Cat Rescue. They were prototyped in low or mid-fidelity to provide more complete interaction so that we can get a better grasp on the play features and find out how they can be further developed into a playable form.

3.1.2 First design iteration

First concept: Puzzle Cube

In this game, the player controls the rotation of a three-dimensional maze in the shape of a cube. Inside the maze is a ball that can roll around, the goal is to get this ball to a certain position in the cube. The puzzles could feature mechanics like portals, switches, and intelligent moving objects. The game is controlled by a physical cube that the player can grab and rotate (Figure 4). This cube has AR markers on each side, which allows a phone app to detect the position and rotation of the cube and augment the virtual puzzle cube on top of it. By rotating the tangible cube, the ball would move around in the cube, which makes controlling it very intuitive.

With this design, we explored the possibility to enhance video games by adding a tangible element, which added new intuitive interactions. However, a major downside of this game was that it did not feature any collaboration. From the prototype, we also concluded that the detection of the rotation works less well when the cube is rotated at a higher speed, therefore it is less suitable for games that require real-time input.



Figure 4: Puzzle Cube

Second concept: Maze Game

In this game, the players must navigate through a maze in AR. The phone is placed in a stand on the board as a pawn (Figure 5). The phone and the holder are the only physical parts of the game. The group goal is to reach the exit of the maze. However, each individual player has their own role and objective. For example, one player is the only one who can see traps and must collect treasure while another player is the only one that can see treasure but must sabotage the game by walking into a trap. Players can take turns to look at the screen for their role privately. We hypothesize that this game will create discussions about tactics, who is lying etcetera.

We fully realized a version of the game where you could navigate through the maze using AR and show role-specific views. This part of the interaction felt intuitive. However, the role feature clashed with the inherent problem that the phone screen could only be looked at from one direction, which forced players to move around the playing environment.



Figure 5: Maze game

Third concept: Cat Rescue

The goal of the game is to build a structure using a variety of blocks and shapes, creating a pathway for a cat to climb down from the high place where it is stuck at. Players would build the structure using physical objects while the cat and its surroundings are simulated using AR. Each level, players can only use a small selection of building blocks and must work together to build a stable path down with the given blocks.

The interesting aspect of this game is the bridge between the physical and digital world. However, it is questionable if this game is realizable and if it is meaningful collaboration.

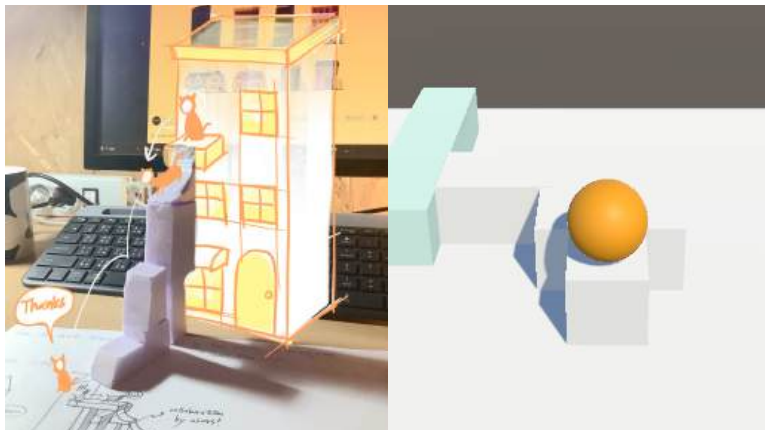


Figure 6: Cat Rescue



Figure 7: Shark Tank

3.1.3 Shark Tank feedback session

During the Shark Tank presentation, we pitched the potential of researching the value of AR in multiplayer games. To do that, we presented the Puzzle Cube and Maze Game to demonstrate how AR games can be valuable. According to the feedback, it was novel and interesting to use the phone as a pawn in the game rather than using it as a hand-held viewport.

Other feedback was that the user experience was not fully thought out yet. For example, in the Maze game it is difficult/impossible for every player to see the screen of the phone due to the phone's rotation and the small screen size. The hybrid teachers and later our coach advised us to work further with the mechanic of using the AR device as a piece on the board but trying to think of other games using this mechanic incorporating the previously mentioned limitations as a feature.

3.1.4 Conclusion of the first iteration

We decided not to continue with the Puzzle Cube because there was no multiplayer aspect. We also decided not to continue with the Cat Game because we could not see its feasibility. We wanted to continue with the Maze Game because it had the most potential because of its perspective. Although we wanted to work it out further, we also decided to do another exploration on using different perspectives in AR because the Maze Game is just one way to use interesting perspectives and we thought there were many more possible ways to implement those mechanics.

3.2 Narrowing concepts down with the value of the various perspectives in AR.

In this phase, we started a new brainstorming session in our design process by focusing on the use of interesting perspectives in AR games, and following that we narrowed the ideas down into 2 game concepts: Dragon game and Silhouette game, which were prototyped in low fidelity for evaluation. Afterwards, we presented our ideas to Studio Tast to gain insights from a third party and refocus our project. Lastly, we discussed the refinement of collaborative game mechanics and prototype the final idea in high fidelity.

3.1.2 Second Design iteration

Brainstorming session

To begin this new iteration, we started with a brainstorming session (Figure 8) on other ways to design AR games with different perspectives. Each group member first started by sketching an idea for five minutes, then another member would work further on the concept for five minutes, and so on until everyone worked on all concepts. This session motivated us to combine ideas from each group member, and finally two main ideas -the Dragon game and the Silhouette game were emerging.

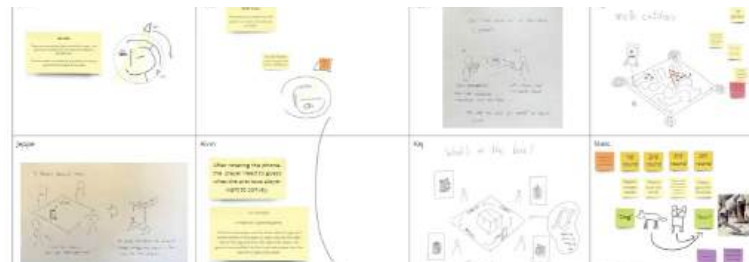


Figure 8: Brainstorming session

Perspectives

Now that we were looking into different ways to use perspectives in AR games, we wanted to formulate other perspectives and organize them with the perspectives that we already knew (Figure 9). In video game terminology, the terms first person and third person are used to classify game perspectives.

The pawn perspective from the Maze Game is the same as first person because the player looks through the eyes of a piece and controls it. It is their piece, and they have a direct connection to it. Third person is like first person with the difference of seeing your piece that you control instead of looking through its eyes. This allows you to see more than the piece but reduces your connection to it. For us, the fourth person is one step further than the third person. We defined it as still seeing the piece but being detached from it and not explicitly following it. This also means that there could be multiple pieces. This perspective is most similar to tabletop games. Finally, the second-person perspective is not defined in video game terminology which leaves it open to our interpretation. In literature, the second person is 'you' or 'they'. This means that this is not the player's piece and they cannot control it but the player can still see from the piece's perspective. The reasoning is flawed to some extent, but we found that it allows us to discuss AR games more easily.

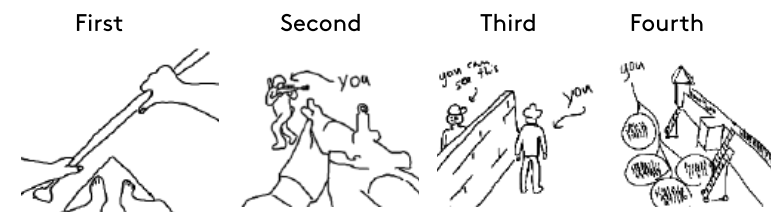


Figure 9: Visualization of perspectives



Figure 10: The low-fidelity prototype of the Dragon Game during an internal playtest.

Fourth concept: Dragon game

The Dragon Game concept follows directly from the finding in the previous part. The players can see through the dragon's eyes. In this case the 'you' is the dragon. In this concept, each player's goal was to collect as many treasures as possible from the dragon's cave. Numerous chests are scattered around, and the board is filled with walls that block both players and chests from the dragon's sight. Looking through the dragon's eyes would reveal if chests contained an actual treasure or a trap. The game ended when one player had a certain number of treasures. All players have their own pawn they control, but the phone represents a dragon that acts as a (non-playable) enemy that also moves around the board, creating a second-person perspective experience. During each player's turn, the dragon would rotate so that the player was able to see the phone screen and have the option to peek through the eyes of the dragon.

This game was internally tested with two play sessions using a low-fidelity prototype consisting of a paper sheet with a grid and additionally stylized walls, pawns, and a dragon-shaped phone holder constructed using LEGO bricks. The use of AR was acted out during the sessions, but a phone's outside camera was used to simulate the perspective of the dragon.

The playtests showed that, while the overall game and introduction of a second-person perspective was engaging, the restrictive angles at which the phone screen could be seen by players worked against the benefits that the revealing mechanic should have. In a competitive nature, this concept simply did not work well.

Fifth concept: Silhouette game

In this game, the players try to guess silhouettes of object(s) displayed on their phone. The silhouettes can be captured by positioning the phone around a marker in AR. In this free looking mode (Figure X, left), the players cannot see anything except a cube with a question mark. Once the player is happy with the positioning, they can 'capture' the position which will reveal a static silhouette of the object (Figure X, right). Each player can subsequently try this with a different position. Players can often not guess the object(s) from a single position and therefore we hypothesized that they are encouraged to communicate.

Testing the game ourselves, we found that the silhouette game was fun to play but only moderately stimulated communication. Communicating shape features is difficult and game success is majorly based on luck. After changing the scene from one difficult object to multiple easier objects, the game was a little more balanced.

A team member showed this game to a person that works at a municipality that is making an empathy and inclusion game. This person saw the potential for this kind of AR game as being a 'minigame' in a larger inclusion game. For example, you could make a similar AR game that would emulate what it feels like to have a serious vision impairment. The graphical capabilities of AR might help create empathy through immersion. Although we did not choose this direction for our project, it is an interesting design opportunity.

3.3.3 Studio Tast

We presented the Dragon Game idea to the experts at Studio Tast using a low-fidelity LEGO prototype. Overall, they thought the use of perspective was novel and interesting, but some improvements could be made. The main suggestion was to change the players' competitive relationship to a collaborative one.

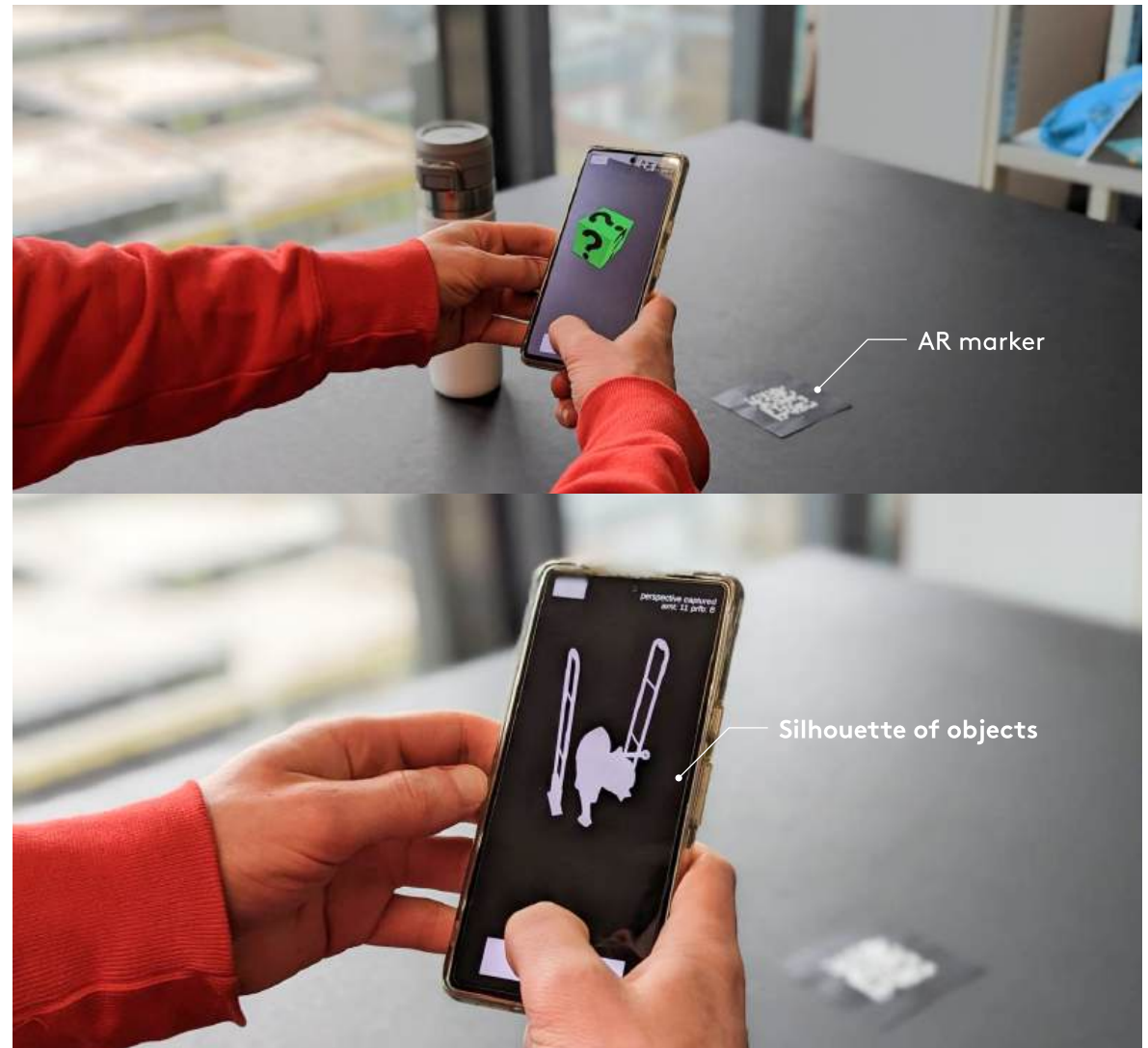


Figure 11: Picture of the prototype for Silhouette game. The bottom picture shows what a silhouette could look like.

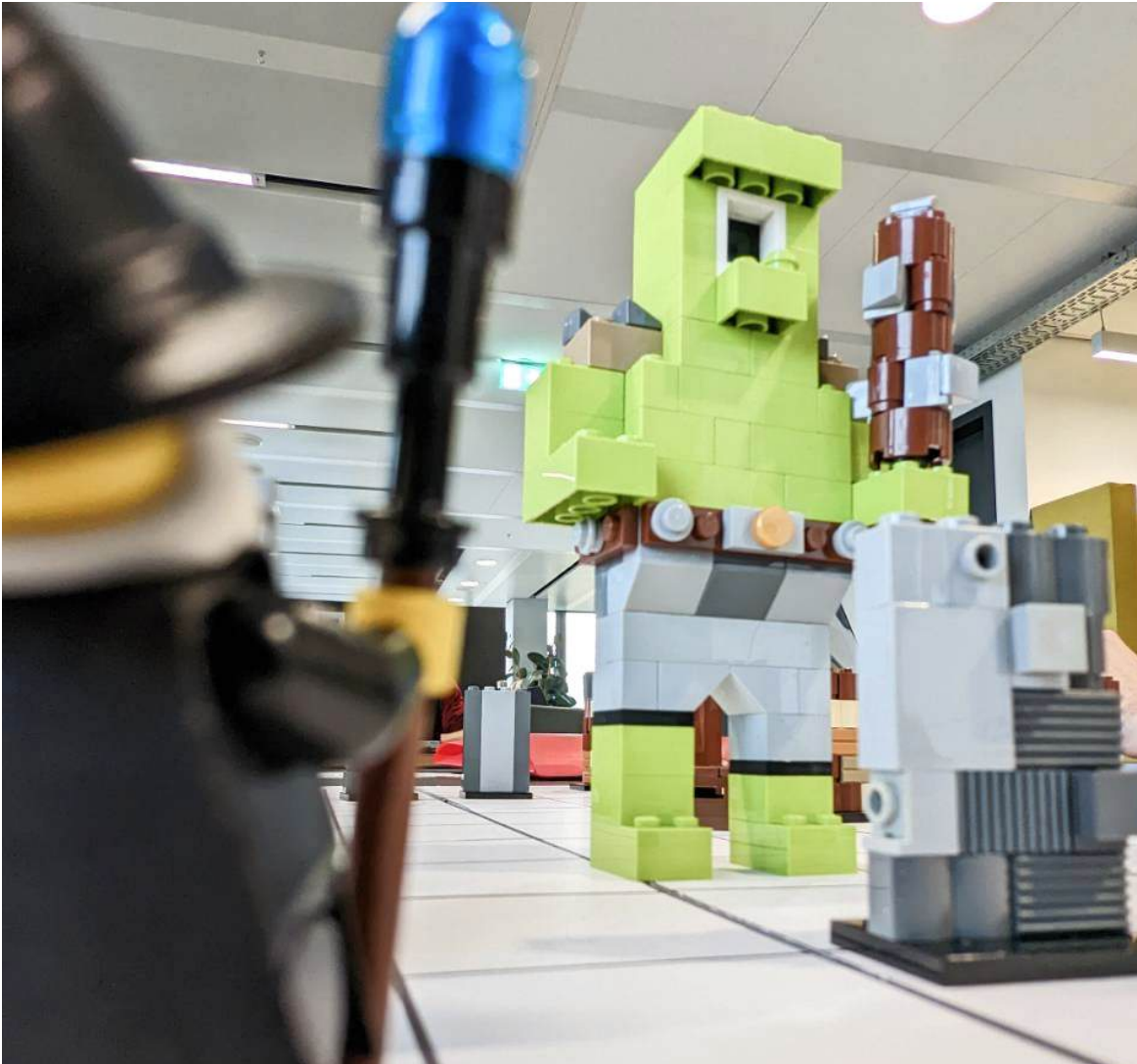


Figure 12: A close-up on the low-fidelity prototype board for Eye of the Cyclops.

They stated that the collaborative relationship could solve the problem that not everyone can see the phone screen at the same time, through communication with other players.

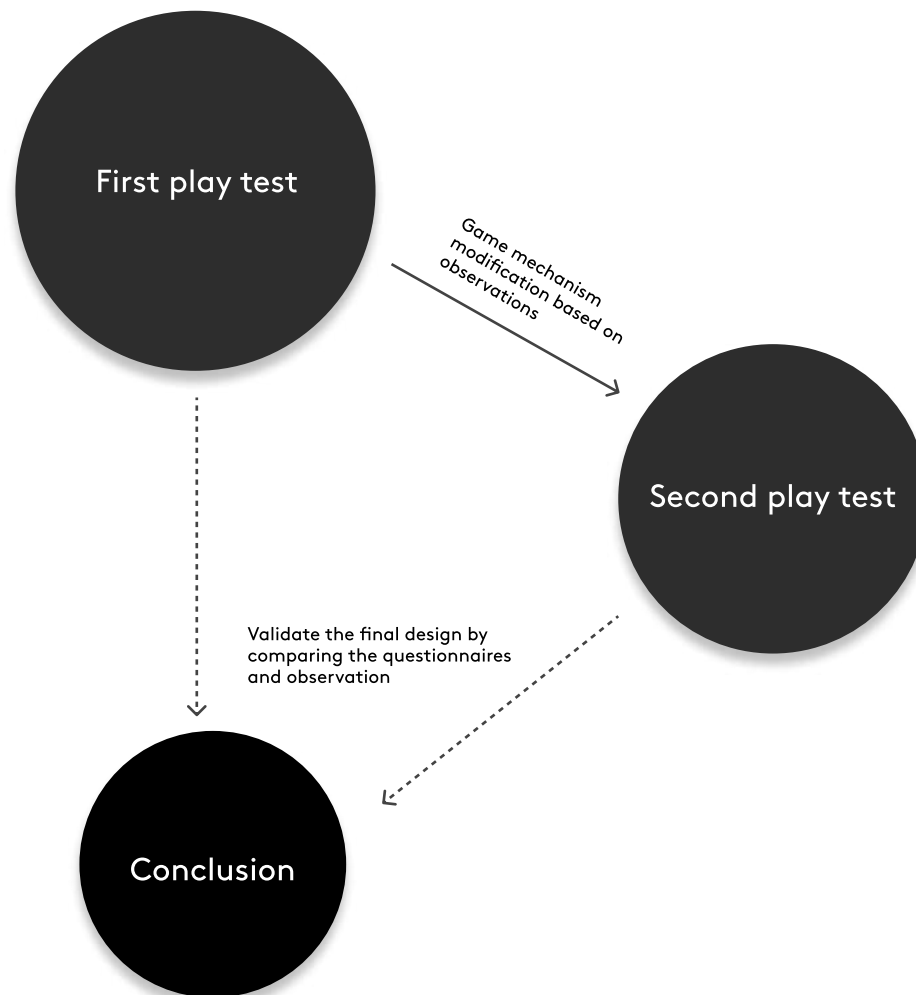
After the feedback session from Studio Tast, we decided not to continue with the Silhouette game because it did not encourage communication as expected and proved difficult to balance between skill and luck. On the other hand, the Dragon game showed potential with its unique approach of using the phone as a piece on the board rather than using it just as a viewport.

Sixth concept: Eye of the Cyclops

In order to turn the Dragon Game concept into a collaborative game, we individually brainstormed possible new rulesets and thought of settings and stories of where the game could take place. We ended up with four different rulesets, from which we combined parts into a new game concept which we called Eye of the Cyclops.

In this game, up to four players have to work together to find buried treasure in some ancient ruins that are guarded by a cyclops. The cyclops is represented by the phone in the holder. Only the cyclops knows where the treasure is, but the players can cast spells to look through the eye of the cyclops—the camera—to see where the treasure is hidden in AR. Each player has a different role with a different ability that can be used to help each other. The goal of the game is to retrieve a certain amount of treasure, but the players lose if they collectively get caught by the cyclops three times.

The low-fidelity prototype from the Dragon Game was adapted to fit this game. After an internal play test, we concluded that the game was enjoyable and had enough potential for further testing and becoming our final concept.



3.4 Playtesting and final refinement

Two user tests were conducted with the Eye of the Cyclops concept prototype, both tests had four participants. The participants were recruited through contact with other students in the department. In the tests, the participants were asked to play the game for at least one hour, after this they were asked to fill in a questionnaire about their experience. Most questions were based on the Player Experience Inventory scale [1]. As there were no questions about social presence in PXI, the social presence module from the Game Experience Questionnaire was added. [2] During the gameplay, observations were made about decisions the players took and thoughts the players expressed.

3.4.1 First user test

After the first user test, the rules of the game were adapted to improve the experience based on the results, which means that the second group played with altered rules from the first group. The results from the second test also led to further modifications to the rules of the game. Since the AR application was not finished yet, the movement of the cyclops was instead enacted by one of our team members who would roll dice to determine the direction and distance it would move on the board if it did not see a player it could chase after. Since we also did not use a camera on the board to determine what the cyclops can see yet, eleven specific tiles in a cone shape in front of the cyclops were chosen as being 'in vision', players and treasure could be detected only on these tiles.

From the observations during the first test, it became clear that the game had some overly complicated rules. At this time there was a rule that the amount of action points a player has would be limited by the amount of treasure they are carrying, but we noticed that this did not occur often and thus did not influence the game a lot. Furthermore, the cyclops had a mechanic of attacking players in an area of six tiles in front of it, but not all tiles had the same chance to attack successfully. For the second test, the action point limit was removed and all tiles in the attack range had the same chance to hit the player. There were also some problems

with the player roles we created. We concluded that the roles in a cooperative game should allow the player to help other players as well; two of the roles mainly benefited the individual player and did not contribute much to the team effort. These roles were therefore removed, and new ones were created. The game also took a long time to complete, we tried to address this by decreasing the amount of treasure needed to win the game. To balance this out, we made the cyclops a little 'smarter' as described in the next paragraph.

3.4.2 Second user test

For the second user test, the way of simulating the cyclops' movement was changed. In the first test, it often ran into walls which results in an unreasonable amount of die rolls. Now, the die was rolled to determine the distance and a random tile on the board was generated using software. A team member would emulate a pathfinding algorithm. This way was closer to how we envisioned the final game, where the application would handle the cyclops' movement entirely. This sped up the game significantly, but it still took a long time. This led to the decision to shrink the board down from 12x12 tiles to 11x11 tiles for the final game. The participants still found the attack mechanism too complicated so it was changed that the Cyclops can only attack when directly placed on the player since this happened already for most of the attacks.

3.4.3 Conclusion in overall user test

From the questionnaire, it became apparent that the game concept was received well since the participants rated it highly in all categories, especially the 'enjoyment', 'curiosity', and 'clarity of goals' categories were given high scores. This meant that the participants liked playing the game and felt eager to find out how the game continued. The participants also gave good scores for the social experience, stating that the experience made them feel socially involved and being connected to others. By comparing the two test groups with each other we concluded that the changes we

made between testing improved the gameplay. The second test group rated the experience significantly higher than the first group in the categories 'meaning', 'mastery', and 'ease of control'. This meant that the game was perceived as more meaningful, made participants feel capable, and made it easy to know how to perform actions in the game.

For both playtests, participants were not in a hurry to quit the game and we had to cut the games short since the players wanted to keep playing. Overall, the game was perceived as enjoyable, and the participants liked the concept. The results helped us greatly in improving the game to improve the experience further.

4. Final design

4.1 Rules of the game

The players play as a group of adventurers who must work together to find treasure in some ancient ruins guarded by a cyclops, but the treasure is buried underground. Only the cyclops knows where the treasure is, but you can cast spells to reveal the treasure from the cyclops' perspective.

The game is turn-based, and to win the players must find six treasures and bring them safely back to the starting area. The players have three collective lives, a life is removed if a player gets caught by the cyclops. When no lives are left, the players lose the game. A player starts their turn by rolling the die. The number they roll determines how many action points they can spend during that turn. These actions can be either moving their pawn, picking up treasure, casting the vision spell to reveal treasure through the AR camera, or performing a role-specific action.

There are four different player roles with different abilities. These are: the Necromancer who can summon a decoy; the archer who can distract the cyclops with a burning arrow; the Voodoo Master who can move other players; and the Wizard who can place a magic barrier on the board. After each player's turn, the cyclops moves on the board. If it sees a player, it will chase it. A full overview of the rules can be found in Appendix A.

4.2 AR application development

First, we tried to make the application work completely with AR. This means that the location of the Cyclops is only determined by the AR calculations. After discovering that the accuracy of AR was inconsistent when placed close to the surface of the board, we decided to use AR only partially. The Cyclops was locked to the grid, and you could only manually move the Cyclops around the virtual board using a grid and by selecting a wind direction

(Figure 13, GRID and FACING DIRECTION). This ensured that other features like revealing treasure worked consistently. However, it was possible to enter a free-moving mode (Figure 13, FREE MOVING) to demonstrate the AR functionality and later go back to the original grid position.

It was also a goal to implement pathfinding since we found that letting the cyclops navigate to a random location on the grid during the playtesting was a relatively balanced behavior. There are multiple relatively easy-to-implement pathfinding algorithms like A* available. However, the major challenge was to visualize the steps the cyclops needs to take on the screen. The first idea was to highlight the tiles in the world. However, if the AR did not work, this would also fail to give the user proper instructions.

A feature to reveal the treasures was implemented (Figure 13, REVEAL TREASURE). Currently, the application shows all treasures, even the treasures far away and behind walls. Since it is often not clear where a faraway treasure exactly is, it would be wise to set a max distance to show them. In addition, treasures that are behind walls from the cyclops' perspective should not be shown.

Finally, some graphics were added to demonstrate the potential immersion. The treasure is shown with a cross and a treasure chest that slowly rotates (Figure 13, REVEAL TREASURE). The screen constantly shows the hands and club of the cyclops, these show an attack animation when the attack button is pressed (Figure 13, ATTACK). Every time the attack button is pressed, a life is taken. Finally, the portals are visually enhanced by adding particle effects.

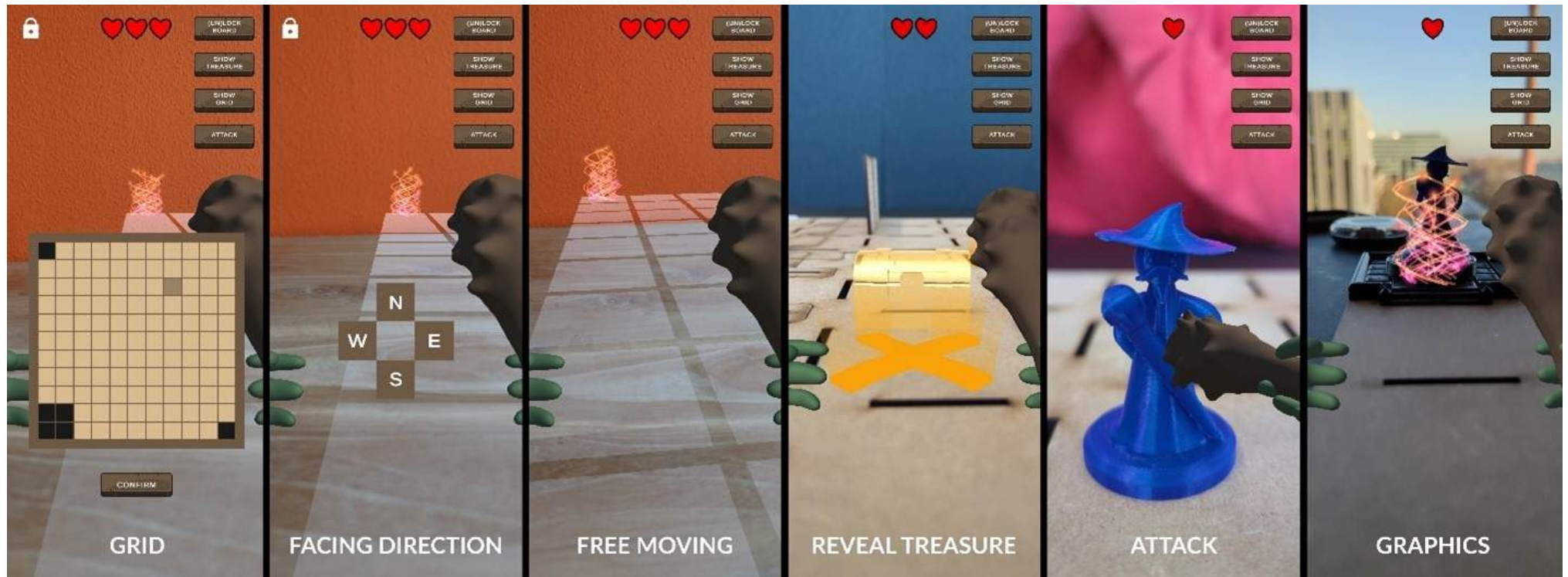


Figure 13: Screenshots of the different functions in the phone application.

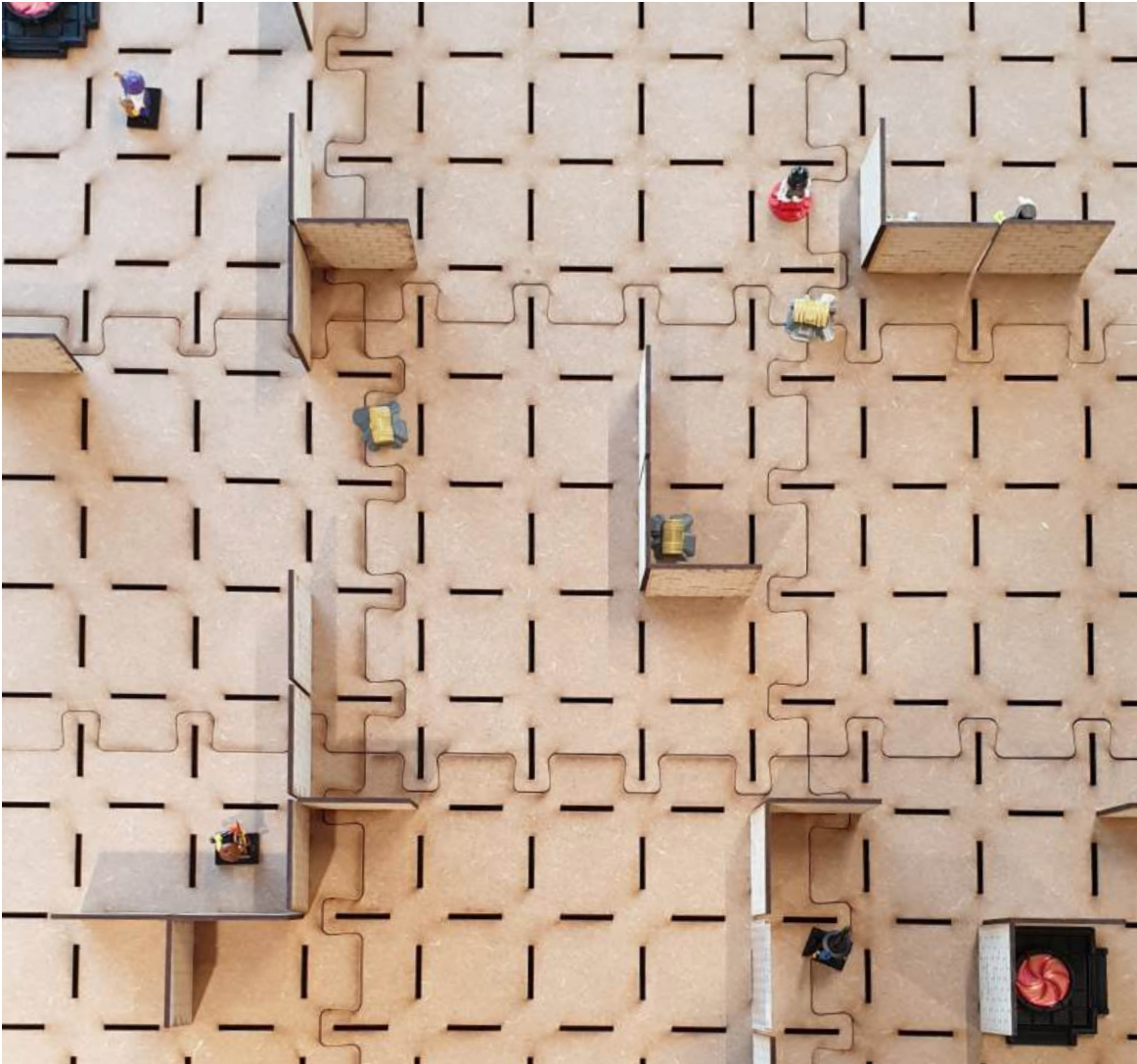


Figure 14: A top view of the board for the final prototype.

4.3 The playing board

For the final demonstrator the tiles of the board were increased in size, which comfortably fit a phone (with stand) or up to four game pieces at the same time. The board (Figure 14) itself was redesigned to be modular – consisting of 9 pieces – to make the board both manufacturable and portable, due to its increased size totaling almost a meter in length and width. For the walls, slots were cut out of the board on all possible wall positions, which also act as the grid. Both the board and walls were laser cut from MDF, while the walls were also laser engraved with brick wall patterns to fit the narrative of the game and add visual detail to them.

In addition to the walls, stylized 3D models were created for the portals and starting area as well. These were designed to be plugged into the board like the walls, and were all 3D printed. The starting area was given a compass shape on the board, which serves as a guide for recalibrating the cyclops manually.

The choice for using wood rather than cardboard was mostly because we strived for function and rigidity rather than feasibility as a marketable product. Ultimately the playing board and walls should be made of high-quality printed cardboard, like most boardgames, with plastic injection parts to secure the walls onto the board. This would make the physical components of the game more feasible for mass manufacturing, and more portable overall.

5. Discussion

1.1 Compared to existing formats

This project demonstrates different ways in which tabletop games with AR elements offer unique value that both tabletop and video games cannot provide on their own. Compared to video games, AR tabletop games offer tangibility and social aspect of physical board games.

Compared to tabletop games, AR tabletop games firstly offer elements from video games that enrich the playing experience. For example, graphics can be used to create juicy gameplay and increase immersion. Because of the nature of AR, these graphics can interface and blend with the actual environment. Another example is smart behavior of computer agents in the game. They might find their own path on the board, detect objects with their camera, reveal hidden rewards by scanning AR markers and roll different dice with skewed chances based on the state of the game. Finally, the presence of a digital interface affords the creation of easy to access community content like maps, visuals, rulesets, and AI behavior.

1.2 Perspectives

AR can be used to create interesting perspectives in board games. AR is mostly used as a top view (fourth person view) that is relatively far away from the AR main object/scenario. We found that it is interesting to use AR as a first- or second-person view by placing the AR device on the board like a pawn. A first-person view means that you look through the eyes of the player that you are playing. A second person view means that you can look through the eyes of another party in the game that is not you (in case of our game, this is the enemy). These perspectives allow to hold off and reveal information in a natural way. These perspectives might also add immersion. In case of second person perspective, this makes you feel like an intelligent being is on the board.

While developing the game, we struggled to choose between different ways to detect players and reveal treasure. The first option is to follow a grid-based system, where everything is measures and displayed based on tiles. The other option is a more natural approach that utilizes the camera more (what you see is what you get). For example, the cyclops will chase players if the camera detects as certain amount of them. We found that a natural leaning approach is more suitable for these kinds of games because it is closer to the player's experience of the game and will cause less inconsistencies between the perception of the players and the digital calculation.

1.3 AR software sophistication

The potential of AR might still be too limited to fully develop a game like Eye of the Cyclops. Unity AR on both Android and iOS is still inadequate for these kinds of games. The most important issue is that AR environment awareness deteriorates when placed closer to the main surface of game. This is essential for the first- and second-person perspective games that we propose. A custom solution, developed by a team of experts might be able to achieve the desired features.

1.4 Hardware requirements

This game requires players to have a relatively new phone. Having no technology might be seen as a core value of tabletop games to some people. This requirement shrinks the size of the market to only people with smartphones. However, it does not necessarily exclude others from playing the game because only one phone is needed in a party. Even if someone has a phone, it requires certain technical specifications. Firstly, the game takes 1.5 hours and running AR drains the phone battery quickly. In addition, older phones might not be able to run AR well or not at all, depending on the operating system and hardware.

6.Future Work

In the current concept, the cyclops chooses a random spot to walk towards, but with more advanced AI, it could be 'smarter'. For instance, the cyclops could then remember spots where it has already checked for players and might think actively about where players could be hiding. Right now, the players have to look at the screen to see if any pawns are visible, but ideally, the phone could recognize player pawns by itself. This could be done using color blob detection.

The game concept could also be explored further with added game mechanics. A suggestion from our coach was to make different sections on the board have different influences on the players and cyclops. Lastly, we only developed one game concept fully, but there are a lot more possibilities with the core mechanic of using the phone as a pawn on the board. Many different games could be made that can all be played with the same phone holder, which can be an interesting business model.

7.Conclusion

In this project, we discovered and demonstrate how to make valuable AR games. We explored our topic through exploratory prototyping and playtesting, which resulted in many different game concepts that use AR in a novel way. We explored the use of perspectives in games which led to our final board game design: Eye of the Cyclops. Through testing this game, we can conclude that we used augmented reality in a novel way which resulted in an enjoyable game. We worked out one concept, but the possibilities for games using our new mechanic seem endless.

8.References

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Appendix A

Eye of the Cyclops instructions

Augmented Reality (AR) has been around for a while. The user experience value it brings to games and play is a topic that has not seen much attention. Most AR applications are gimmicky, and often use the technology solely for placing virtual objects in the real world. In our project we aimed to explore what value the integration of AR in tabletop games can bring to the user's play experience. We explored our topic through exploratory prototyping and playtesting, which led to our final board game design: Eye of the Cyclops.

Story

You play as a group of adventurers who are eager to find treasure in some ancient ruins guarded by a cyclops, but the treasure is buried under ground. Only the cyclops can see the treasure, you can cast spells to get a perspective from its view. Will you be able to use and outwit the cyclops to gather and leave with all the treasure safely?

Goal of the game

Eye of the Cyclops is a collaborative game where all players have to work together to find treasure and not get caught by the cyclops. The players win if they manage to find six treasures and bring them safely back to the starting area, there are a total of 16 treasures spread out hidden on the board. The players have three collective lives, a life is removed if a player gets caught by the cyclops. When no lives are left, the players lose.

How to play

At the start of the game, all players choose a role and place their pawn on the starting area. The cyclops is placed in the corner diagonally opposite of the starting area. Decide who goes first, the game continues in a clockwise direction after the first turn. After each player turn, a cyclops turn is played.

Player turn

A player starts their turn by rolling the die. The number they roll determines how many action points they can spend during that turn, players are not obligated to spend all action points. Action points can be spent for numerous actions:

Moving (1 Action Point per tile)

- Players can move their pawn to an adjacent tile: eighter up, down, left or right. Pawns may not move diagonally and cannot walk through walls.
- Exceptions:
 - a. The starting area counts as one tile
 - b. Two teleport tiles are placed on the board, if a pawn is moved on one of these tiles it should be placed on an adjacent tile next to the other teleport tile.

Pick up treasure (1 action point)

- Players can pick up a revealed treasure if their pawn is on the same tile as that treasure. The player places the treasure chest in front of them but they leave the pile of rocks on the board. Players can bring back treasure to the starting area to stash it and place it there if their pawn is on the starting area.

Vision spell (2 action points)

- Press the 'show treasure' button on the phone, the cyclops will reveal if there is treasure on any tiles it can see. If treasure is revealed, place a treasure chest with pile of rocks on those tiles. These treasures can now be picked up.

Character ability

- All roles have a special character ability, the amount of action points these cost varies for each ability.

Cyclops turn

After a player has finished their turn, the cyclops play their turn. The cyclops will move based on whether it can see a player or not. The player who has the best view of the phone screen will look if it can spot any pawns in the vision of the camera.

The cyclops sees a pawn

- The die is rolled, the rolled number is how many tiles the cyclops will move. The cyclops will choose the shortest route to the closest player that it can see. The cyclops is always rotated towards the direction it is going. If the cyclops lands on the same space as a pawn, the 'attack' button needs to be pressed and a life is removed. The player pawn is moved back to the starting area, if this player was carrying treasure, this is placed on the tile where the player was standing. The cyclops will end their turn if it has trampled a player, even if it still had tiles left to move.
- Exception: decoy, see player roles.

The cyclops does not see any pawns

- The die is rolled, the rolled number is how many tiles the cyclops will move. A random tile on the board is generated and the cyclops will choose the shortest path towards that spot. The cyclops is always rotated towards the direction it is going.

Player roles



Necromancer

- Summon decoy (2 action points)

The decoy pawn can be placed on the board in a range with a maximum of four tiles away from the Necromancer. If the cyclops sees the decoy, it will also target it as if it were a player pawn and target the decoy first in case it sees player pawn as well. If the cyclops lands on the decoy, no lives are lost and the decoy is removed from the board and given back to the Necromancer. This action can also be played if the decoy is already on the board.

- Recall decoy (1 action point)

The decoy is removed from the board and given back to the Necromancer.



Archer

- Shoot flame arrow (2 action points)

The flame arrow will attract the cyclops. In the next cyclops turn, the cyclops will target the archer directly as if it spotted the archer. This happens regardless of if the archer is actually in view or not, or if other pawns are in view.



Voodoo Master

- Possess teammate (2 action points)

Move any other player pawns a maximum of three tiles on the board. This action can only be done once a turn. The decoy cannot be moved.



Wizard

- Cast magic barrier (2 action points)

Place the magic barrier on any gridline. The magic barrier will act as a wall and the cyclops cannot see through the magic barrier. This action can also be played if the magic barrier is already on the board.

- Recall magic barrier (1 action point)

The magic barrier is from the board and given back to the Wizard.

Appendix B

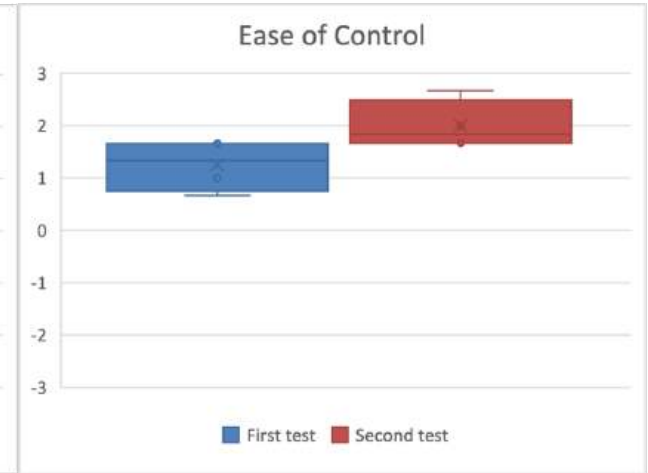
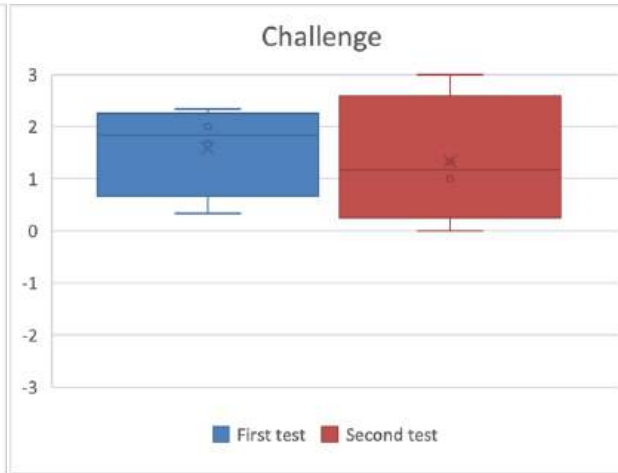
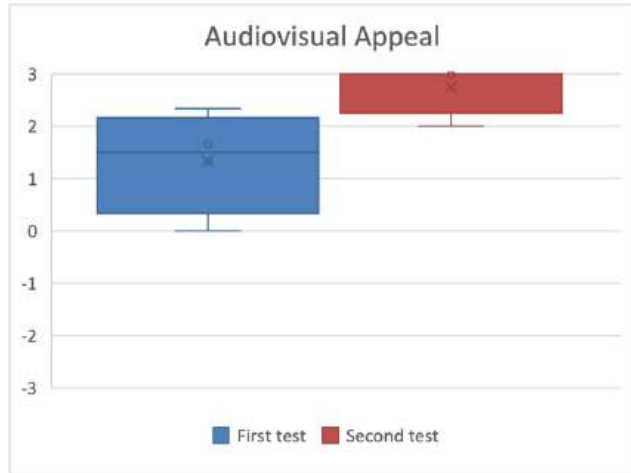
Constructs	Items	<i>Strongly disagree</i>	<i>Disagree</i>	<i>Slightly disagree</i>	<i>Neither disagree, neither agree</i>	<i>Slightly agree</i>	<i>Agree</i>	<i>Strongly agree</i>
		-3	-2	-1	0	1	2	3
Meaning	Playing the game was meaningful to me.							
	The game felt relevant to me.							
	Playing this game was valuable to me.							
Curiosity	I wanted to explore how the game evolved.							
	I wanted to find out how the game progressed.							
	I felt eager to discover how the game continued.							
Mastery	I felt I was good at playing this game.							
	I felt capable while playing the game.							
	I felt a sense of mastery playing this game.							
Autonomy	I felt free to play the game in my own way.							
	I felt like I had choices regarding how I wanted to play this game.							
	I felt a sense of freedom about how I wanted to play this game.							
Immersion	I was no longer aware of my surroundings while I was playing.							
	I was immersed in the game.							
	I was fully focused on the game.							
Progress Feedback	The game informed me of my progress in the game.							
	I could easily assess how I was performing in the game.							
	The game gave clear feedback on my progress towards the goals.							
Audiovisual Appeal	I enjoyed the way the game was styled.							
	I liked the look and feel of the game.							
	I appreciated the aesthetics of the game.							
Challenge	The game was not too easy and not too hard to play.							
	The game was challenging but not too challenging.							
	The challenges in the game were at the right level of difficulty for me.							

Ease of Control	It was easy to know how to perform actions in the game.							
	The actions to control the game were clear to me.							
	I thought the game was easy to control.							
Clarity of Goals	I grasped the overall goal of the game.							
	The goals of the game were clear to me.							
	I understood the objectives of the game.							
Enjoyment	I liked playing the game							
	The game was entertaining							
	I had a good time playing this game							

Constructs	Items	<i>Strongly disagree</i>	<i>Disagree</i>	<i>Slightly disagree</i>	<i>Neither disagree, neither agree</i>	<i>Slightly agree</i>	<i>Agree</i>	<i>Strongly agree</i>
		-3	-2	-1	0	1	2	3
Social experience	Gives me the feeling that I'm not on my own							
	Gives me a sense of social support							
	Makes me feel like I am socially involved							
	Gives me a feeling of being connected to others							
	Feels like a social experience							
	Gives me a sense of having someone to Share my endeavours with							
	Influences me through its social aspects							
	Gives me a sense of being noticed for what I have achieved							
	Gives me the feeling that I'm not on my own							
	Gives me a sense of social support							

Appendix C





■ -3 ■ -2 ■ -1 ■ 0 ■ 1 ■ 2 ■ 3

Gives me the feeling that I'm not on my own

Gives me a sense of social support

Makes me feel like I am socially involved

Gives me a feeling of being connected to others

Feels like a social experience

Gives me a sense of having someone to Share my
endeavours with

Influences me through its social aspects

Gives me a sense of being noticed for what I have
achieved

Gives me the feeling that I'm not on my own

Gives me a sense of social support

