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# Misusing mobile phones to break the ice: the tabletop game Maze Maestro

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## ABSTRACT

Performance of newly-formed project teams is often limited, or at least delayed, when team members refrain from sharing their ideas due to unfamiliarity with their peers. A variety of ice-breaking methods can help overcome this cold start, but mostly they need to be deployed and moderated by experienced facilitators. This setup is rarely an option for most undergrad project courses at university level, typically carried out in small teams. In order to help breaking the ice in this context, we developed Maze Maestro, a collaborative tabletop game in which the board is made up by attaching the displays of the team members' mobile phones to form a large maze. Each member controls a character in the maze, and the whole team has the common goal of leaving the maze together; however, this is only possible with timely communication and much cooperation. While playing, team members are encouraged to confer possible plans and share their ideas, which is the fertile ground for breaking the ice. Play testing has shown that Maze Maestro was perceived as a fun and original collaborative game. So far, results of a preliminary user study are optimistic about the ability of Maze Maestro to break the ice within newly-formed teams, without requiring any facilitator.

## CCS CONCEPTS

• Applied computing → Interactive learning environments.

## KEYWORDS

Serious games, Mobile games, Tabletop games, Ice Breaking, Cooperation

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## 1 INTRODUCTION

Forming a team of highly skilled individuals does not guarantee good performance. Rather, members of the team need to familiarize and be able to work together for achieving the team goals [12]. Comfort among team members has also shown to improve their results, while a dominant person in the team usually causes it to perform worse [20]. Literature also suggests that familiarity within teams actually helps in improving the team's performance [22]. Thus, for newly-formed teams, fostering comfort and familiarity between team members can decisively improve their performance.

Moreover, each team member has a different personality which, in one way or another, influences the effectiveness of the team both at individual-level and team-level [13]. For team members to take risks in aspects that affect the whole team or project, there needs to be a shared belief that no member faces negative consequences for expressing their vision or ideas. This notion is known as psychological safety [7], and whenever it is present, team members will feel they can share any opinions and ideas without worrying about a backlash from the other members.

To address such aspects, traditional ice-breaking activities, such as individual introductions and games have been proposed to “break the ice” among team members. In particular, ice-breaking games can play an important catalyst role in promoting team cooperation and ideation. Sometimes, ice-breaking activities may ask people to directly interact with each other in an unconventional way, e.g. to join a collaborative game which they might find uncomfortable or highly embarrassing to play. However, having an embarrassing or bad experience can potentially drive some team members away from further participation in the team.

Potentially, many free and fun digital mobile games, very easy to learn and casual to play, could be used as ice-breaking tools. Very often, however, mobile games end up entertaining only individuals while pulling them away from each other, rather than stimulating a team to communicate, collaborate and share in their entertainment. Alternatively, tabletop games typically provide an immersive and convenient context for an ice-breaking activity, with their sense of togetherness, collective focus on a common board, facilitated face-to-face communication and shared goals/resources. However, the need for specific material (e.g. board, tokens, cards, etc.), the complexity of the rules and the possible need for an experienced facilitator may hinder their deployment.

In this paper we describe the mobile tabletop game Maze Maestro, an ice-breaking game for small teams of college students (4-6 members), which brings together the best of these two worlds: the power and accessibility of mobile entertainment with the advantages of a collaborative tabletop game. For this, the game knowingly misuses mobile phones in at least two ways: (i) it “forces” team members to

leave them to the game itself (thus eliminating a “source of escape”), and then (ii) it uses their displays to physically make up the game board.

## 2 RELATED WORK

Many ice-breaking methods have been proposed to help team members become acquainted with each other, initiate conversations or relieve inhibitions within the team [3]. In this way, they open up the way to build trust and promote openness among team members [8]. Ice-breaking activities have been proposed in many different forms including card games, social games and video games [4]. In recent years, more research has been done on the successful use of such games for ice-breaking purposes [1, 5, 6]. The reader is referred to the above references for in-depth discussion and conclusions; here, we just summarize the most relevant features they identify for ice-breaking games, as follows:

- **Simplicity:** the game should not take much effort to learn nor to play, so that everyone feels comfortable.
- **Non-threatening:** players should not feel pressure, like the possibility of embarrassment or guilt.
- **Relevance:** the game should feel like it is not a waste of time and it has a purpose.
- **Energizing:** players should really enjoy playing the game.

After playing, members should feel they are a respected part of the team, and that they have unique skills to make the experience better for others. Eventually, this helps everyone get more comfortable and motivated to work together. For achieving this, a variety of game mechanics have tried to explore and/or combine communication, silly acting, different roles and collaboration aspects.

### 2.1 Ice-breaking Games

Ice-breaking games that do not require a facilitator have been proposed for several contexts and environments, both on digital and physical formats.

Overcooked [19] is an entertaining multiplayer cooking game for up to four players which promotes ice breaking. The players have to prepare, cook and serve up a variety of orders in a virtual kitchen. The changing kitchen layout forces the players to cooperate, communicate and continuously adapt in order to fulfill the orders. The players need to display teamwork and modify their strategy as the game progresses. However, poor performance from one of the players can let down the whole team, which can lead to a negative impact on psychological safety. It is therefore important to explicitly minimize this risk when designing ice-breaking games.

Let’s Team! [10] is a serious game which is used for development of teamwork competency and assessment. The game requires real-life interaction and in-game cooperation. The aim of the game is to collect resources and build a civilization within a virtual world. To achieve this, players organize meetings, share work and reflect about their real-life interactions through the game. This is useful for putting team members in perspective of decisions that might affect individual members or the team as a whole. The game is a valuable tool for expert coaches, but due to its complexity, it is unpractical for breaking the ice in a short time and for smaller teams.

Keep Talking and Nobody Explodes [11] is a collaborative game which requires very intensive in-game communication. The goal in the game is to defuse a bomb before time runs out, by using the instructions found in the Bomb Defusal Manual. One player takes the role of the “Bomb Defuser”; all other players take the role of “Experts” who must use the Bomb Defusal Manual to guide the Defuser through the challenging task of defusing a bomb. The challenge is that the experts cannot see the bomb and the defuser cannot see the defusal manual. In order to find the right steps to defuse the bomb on time, they both need to intensively communicate with each other. The bomb and defusal manual are designed in such a way that players are subtly forced to communicate about resources, assistance and objects. This game also teaches that immersion of a team in a (virtual) stressful situation needs to be carefully crafted, so that members keep collaborating despite misunderstandings, without loosing the sense of reality.

Grapplenauts [1] is a recent mobile ice-breaking game that focuses on psychological safety and openness. The game aims to generate a beneficial atmosphere for ideation without requiring any facilitator. In Grapplenauts, each couple of team members has to jointly steer a spaceship to collect valuables. On their quest, team members discover the advantages of collaboration among spaceships, including to save each other from space obstacles; eventually, all spaceships come together to defeat a final boss. The game promotes communication and collaboration, and was shown to give freshly-formed teams a head start.

### 2.2 Tabletop Games

Tabletop or board games have been played for thousands of years, contributing to fun, relaxation, and education. The success of old-fashioned board games is partly due to the social context they associate with: most board games are made for multiple players and are played in social events, where people spend time together in a group-cohesive manner. The social element is very rich in board games, as players mostly sit around a table facing each other and focused on a common ongoing situation, which strongly promotes communication, interaction, collaboration and/or competition. Combining advantages of computing technology with the social impact of tabletop games has been identified as a major improvement in social gaming experience [14].

Labyrinth [17] is a competitive multiplayer maze board game with a modular maze. Each player has a token, which they move in the maze. The players can rearrange the maze to their advantage by moving a row in the maze. Treasure cards are dealt between the players at the beginning. The goal of the game is for each player to collect treasures in the maze and return to the starting position. The competitive nature of the game comes into play when a player, who has collected all the treasures, heads for the starting position. All the others players try to prevent the leading player from returning to the starting position. The leading player also tries to predict other player’s move in order to make their proceeding more difficult or try to trap them in dead ends. While the game is competitive by nature and therefore unfit to get the players feel comfortable and safe with each other, Maze Maestro shares from Labyrinth the idea of dynamic and modular maze level, but replaces its competitive mechanics by a collaborative one, that fits its ice-breaking purpose.

Mario Party [18] is a popular video game that uses a virtual board, and can be played by up to 4 players. The goal of the game for each player is to collect as many "stars" and "coins" as possible. In every turn, each player rolls a dice and progresses on the virtual board, which usually has branching paths. At the end of each turn all the players have to play a mini-game. Players can earn coins by performing well in the mini-games. Some of the mini-games need all players to cooperate in order to earn coins. The simple setup of Mario Party facilitates that every player grasps the different game mechanics and quickly joins the fun. The theme of the game is also lighthearted and generally focused on fun, which makes it enjoyable for many different types of players.

To overcome the need of specific materials for board games, such as tokens and cards, one can make use of mobile devices. The tabletop game Maze Maestro uses the team members' mobile phones as playing board, while taking care of the turn-based playing rules, mechanics and visuals. In this way, Maze Maestro combines the best of digital devices with the facilitated communication and immersive experiences of cooperative board games, to help break the ice in newly-formed teams of college students.

In contrast to many ice-breaking games, both digital and physical, and even without facilitator, Maze Maestro fosters a balanced communication among the players, aiming at promoting a safe and well-distributed ideation process in a newly-formed team. Moreover, its (mis)use of mobile phones as table board introduces a novel experience that can be flexibly and gradually adopted by the team members.

### 3 GAME DESIGN

Maze Maestro is a collaborative tabletop game in which players have to interact, controlling their own character in turns, to achieve the common goal of leaving a maze together. One of its unique features is that the game board is made up by attaching the displays of the players' mobile phones on a central table; each phone display depicts a small part of a larger maze.

The game features a turn-based movement system for multiple reasons. First, real-time movement is impractical for multiple players on a small game board. Players might focus on their own character and interfere with each other, possibly reducing interaction and collaboration, and consequently, hindering the ice-breaking purpose of the game. In addition, turn-based movement enables players to talk and cooperate when it is not their turn. Moreover, small breaks between turns provide players with time to think about their next move and to confer possible plans and share ideas among them.

#### 3.1 Game Setup

At the start of the game, players lay down their mobile phones in a layout of their choice: the more phones available, the larger the potential variety and complexity of the maze layout. With this feature, team members are "subtly" kept from distracting uses of their mobile phones in the team. In addition, decision on a layout encourages team members to start talking from the beginning of the game.

In order to attach any two adjacent phones, a player just makes a doorway between them by selecting a tile on the edge of two

different phone screens. During this action, the edge is highlighted to indicate the various tiles available for the attach operation. This makes the process easier to understand and follow for the players.

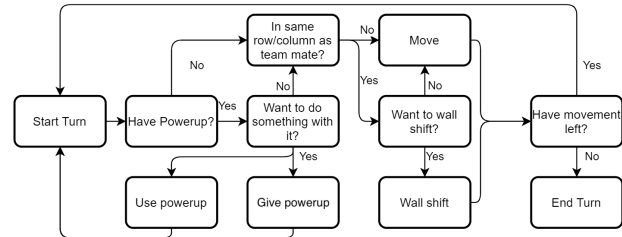


Figure 1: Player options during each turn.

#### 3.2 Game Mechanics

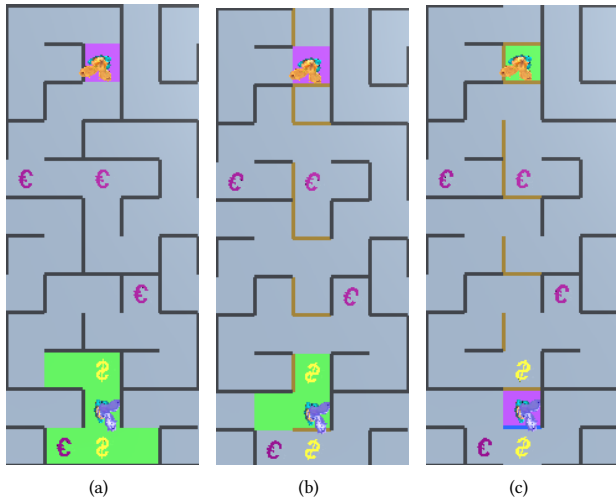
In addition to the basic game movements, several game elements give players certain abilities. Such mechanics encourage players to cooperate and agree on a strategy; see Figure 1.

**Teleporter/Doorway.** When players step on a *teleporter* (the red cells in every corner of the maze), they appear instantly on the location of another randomly-selected teleporter of the same phone. Teleporters cannot be used to cross over between phones. In contrast, when a player steps on a *doorway* (the blue cells), they are instantly transported to the doorway's counterpart: each doorway has one and only one counterpart and it enables players to cross over between phones. Contrary to teleporters, two connected doorways are never on the same phone.

**Wall Shift.** In the initial maze, the path all the way to the end is typically long and contrived to follow. To smooth that away, players have the ability to *shift walls* for a whole row (or column), but subject to one constraint: there must be another player in the same row (or column) you are trying to shift. In this way, a discussion is triggered on how to improve the team's moving strategy, aiming at a common easier path. Figure 2 illustrates the movement.

**Power-ups.** Maze Maestro features power-ups to help players traverse the maze quicker. However, if a player gets stuck in the maze and needs a power-up, another team mate who has a power-up can give it. By giving power-ups, players show their willingness to cooperate with the team for the common goal, and help establish a positive relation with the team mate who receives the power-up. This helps making team members more comfortable with each other. Currently, the game offers two power-ups:

- **Wall Phase:** Gives players the ability to walk through walls during their turn. This power-up is displayed as a purple euro sign. When a player picks it up, a purple circle appears around the character.
- **Agility:** Gives players the ability to move twice as far during their turn. This power-up is displayed as a yellow dollar sign. When a player picks it up, a yellow circle appears around the character.



**Figure 2: A player uses all available movements (in green) to shift walls: (a) at the start of the turn, a team mate in the same column is highlighted (in purple); (b) after clicking on it, the walls in the column move up by one cell; (c) a second step is spent in the same way, to further shift the same walls.**

*Fog of war.* The fog of war is a black layer that covers yet unexplored regions of the maze. This feature reduces the amount of information players can gather on the maze. This encourages all players to discuss the next possible moves, while preventing dominant players from dictating what others should do next, as the full maze needs to be gradually explored.

## 4 IMPLEMENTATION

We implemented the game in Unity [21], a cross-platform game engine that can create the game for both Android and iOS, the two most frequently used operating systems for mobile phones. Moreover, Unity supports debugging on a multi-monitor setup or on multiple phones at once.

The networking stack for the connection between phones is built upon the Photon Networking Unity library [16]. The only requirement is that all phones have an internet connection, which allows players to use WiFi or a data plan. In contrast, the default Unity networking tool requires clients to be on the same network. Additionally, Photon easily makes use of a lobby/room matchmaking system with a central server that matches clients, all other communication thereafter is delegated to the selected host.

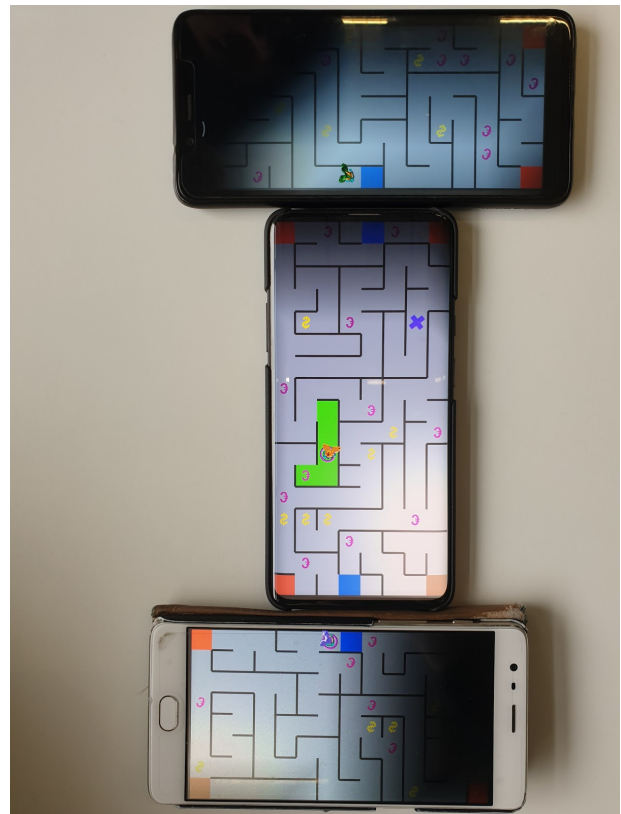
### 4.1 Multiple Mobile Phone Displays

Maze Maestro is inspired on classic tabletop board games. However, the board is built using mobile phone displays as “modules” of the game board; see Figure 3.

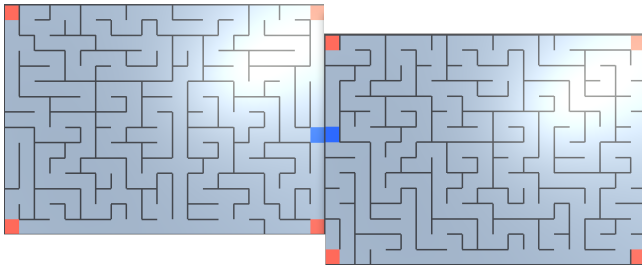
The idea of relating multiple displays as parts of a bigger viewport has previously been explored on different libraries. Swip.js [9] is a JavaScript library used for attaching multiple mobile phone displays to form a single and larger display. It allows placing two or more displays next to each other, and connecting them with a

pinch gesture (sliding two fingers towards each other). This allows for persistent, bidirectional and real-time connections where both devices can communicate. In addition, Swip.js works in the browser, which makes it platform independent. Pinch [15] is another example of this type of interface. Similarly to Swip.js, it allows attaching multiple mobile phone displays. The difference is that it uses WiFi or Bluetooth. When a mobile device using Pinch starts, it automatically seeks for other devices in the same network. When devices are connected to each other, doing a pinch gesture is enough to attach two displays together. This interface is used on one of their applications named *Traveling Crickets*, in which a cricket jumps forward when tapping behind it. The cricket is restricted by the edges of the screen, but when multiple displays are connected the cricket can jump “off-screen” onto another display.

In *Maze Maestro*, each phone’s display shows a small portion of the maze; but once attached to each other, they together represent the total maze extent. In contrast with Swip.js and Pinch, instead of a pinch, players use a tap gesture along the edges of the two displays to be connected. Moreover, each phone is set to have tiles of 0.8 centimeters, which has proven to be big enough for a phone to contain enough tiles and to avoid players mis-tapping a tile. Whenever a character moves to another display, communication between the two phones occurs, by which the character is removed



**Figure 3: A complete maze, built up from three different mobile phones.**



**Figure 4: Two individually generated mazes attached to each other: teleporters are shown in red, doorways in blue.**

from its current phone and added to the other. This is indicated in the game by using a spinning animation.

## 4.2 Level Generation

We used a Hunt-and-Kill algorithm [2] for generating the maze. This algorithm is based on multiple random walks. First, a random cell of a grid is chosen and the algorithm randomly “walks” to create a maze’s path until there are no possible moves. Then, it chooses another non-visited cell that is adjacent to those that were already visited and performs a random walk again. The procedure is repeated until the grid is covered with visited cells.

The maze is populated with power-ups and characters at random positions. Teleporters are placed in the corners of the maze; doorways can be placed along the border columns or rows of the maze, as shown in Figure 4.

## 5 EVALUATION

To evaluate Maze Maestro, several play-test sessions were performed. We assessed whether the game fulfills the ice-breaking goal, as well as its intuitiveness and entertainment factor. These play-test sessions were performed with students as volunteers.

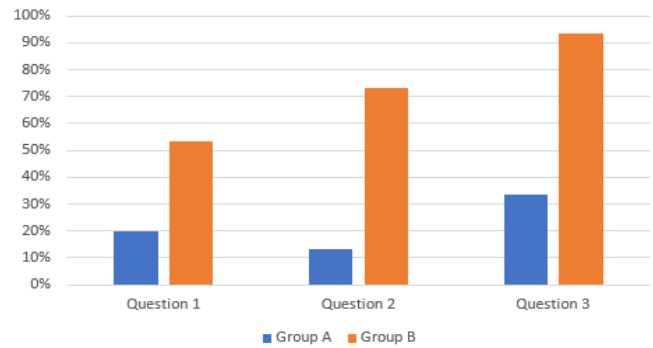
### 5.1 Breaking the Ice

The most important evaluation consists of assessing the extent to which Maze Maestro helps break the ice in newly-formed teams, so that members feel more comfortable sharing ideas among them.

*Play test set-up.* In this evaluation, 30 players were split up in two equal groups, A and B. These groups were then split into smaller teams of 5 members, each containing at least one player with a self-proclaimed shy personality and one with a self-proclaimed dominant personality compared to the other players. Players of A teams were asked to get to know each other within five minutes. They were then given a small questionnaire. In contrast, players of B teams were asked to briefly introduce themselves and start playing the game, after which they filled in the same questionnaire as A teams.

This questionnaire focused on the relation towards other players, as follows:

- (1) What are the names of your other team members?
- (2) Would you feel comfortable sharing your ideas with this team if you were to work together on a project?



**Figure 5: Results of the first questionnaire. The horizontal axis corresponds to the questions given to teams in group A (blue) and group B (orange). The vertical axis is the percentage of answers labeled as correct for question 1 and the percentage of players who answered ‘yes’ for question 2 and 3.**

- (3) Do you feel comfortable asking your team for help if you need it?

This questionnaire aims at assessing how well players get to know each other and whether they feel comfortable in their team. The first question is assessed as correct (or incorrect) whenever players remembered the name of each member from their group (or not). Questions 2 and 3 are assessed as yes/no questions, with ‘yes’ labeled as a correct answer.

After playing the game, B teams received an additional questionnaire about their play experience, consisting of the following questions:

- (1) Did you give a power-up during the game?
- (2) If you answered yes to the last question, do you think the receiver of the power-up was grateful?
- (3) Did you receive a power-up during the game?
- (4) If you answered yes to the last question, how did you feel after receiving the power-up?
- (5) Did you ever go out of your way to shift a wall for another player?
- (6) If you answered yes to the last question, do you think the other player appreciated the help he received?
- (7) Did you ever feel like you had no choice on what move to make because another player was telling you what to do?
- (8) Would you recommend other students to play this game with their project teams to quickly break the ice?

These questions were chosen to evaluate if players made use of the cooperative mechanics of the game. Questions 7 and 8 capture how well the game deals with dominant players and whether they feel the ice-breaking dynamics of the game. Questions 1, 3, 5, 7 and 8 are all yes/no questions and questions 2, 4 and 6 are open questions.

*Results.* Figure 5 shows the results of the first questionnaire, depicted as the percentage of correct answers for each question.

The results in Figure 5 indicate a significant difference between A and B teams. This difference supports the conclusion that playing

the game has a positive effect on how well players get to know each other. Questions 2 and 3 captured how comfortable the players felt to share ideas with their teammates or to ask them for help, which resulted on B teams feeling considerably more comfortable than A teams.

The second questionnaire confirmed the results of the first one, with 80% of the players giving one or more power-ups to another player and 73% receiving one or more power-ups. During these actions, players expressed that they felt thankful, happy and connected. There was just one player who mentioned to be indifferent when receiving a power-up. The results regarding wall shifts were similar: players generally appreciated the help of other players, although these occurred less often (about 40% of the players helped another player with a wall shift). Moreover, players indicate they did not feel pressure from dominant players attempting to dictate their moves. Finally, 87% of the players would recommend the game to other students to quickly break the ice. These results indicate that Maze Maestro seems quite successful in fulfilling its ice-breaking purpose, although deeper psychological safety assessment will be needed to determine all the positive effects of the game.

## 5.2 Intuitiveness

A successful game needs to be intuitive. Players should not struggle with controlling the game or its features. Therefore, we tested players in relation to the intuitiveness of the game mechanics.

*Play test set-up.* In this evaluation, we assessed the intuitiveness of Maze Maestro. Players were split into two groups: group A and B. Players in group A were familiar with multiplayer games and players in group B were not.

Players were asked to set-up the game with multiple phones without explicit instruction given to them (Task 1). Then, players were asked to move their character to specific points in the maze (Task 2). And lastly, players were asked to use power-ups in their intended ways (Task 3): a Wall Phase power-up to walk through a wall and Agility power-up to move more than two tiles in one turn. Every task was assessed by the amount of time and the amount of clicks needed by the players to fulfill the tasks.

*Results.* The results of the play-test are shown in Table 1. The largest difference between groups was found in the task of setting up the game. Group B had some major issues in setting up the game, which is shown in the average number of taps and the fact that it took more than triple the time of group A. This shows that setting up the game might not be intuitive enough for players that are unfamiliar with the concept of creating and joining a multiplayer game lobby.

Task 2 mainly tested the intuitiveness of player movement. Every player managed to get to the assigned points in a minimal number of moves, which was set to four in this test. The time it took to finish the task differed just slightly between groups.

The last task was about the intuitiveness of power-ups. This task took longer than the other tasks due to players figuring out how to use power-ups properly. Group A performed considerably better regarding the time they spent, which is probably due to their familiarity with games. Both groups took a similar amount of taps and were not far from the minimum of 8 moves. This indicates that the power-ups seem easy to use, but take some time to learn.

Group	Task 1		Task 2		Task 3	
	#Taps	Time	#Taps	Time	#Taps	Time
A	10.3	22.41	4	6.38	10.3	48.56
B	21.5	71.73	4	7.32	11.1	61.78

**Table 1: Performance of groups A and B in the intuitiveness play-test: Task 1 tested the set-up of the game with multiple phones; Task 2 tested moving characters to a specific point in the maze; Task 3 tested the use of power-ups (times in seconds).**

## 5.3 Entertainment Factor

The entertainment factor is crucial in any game. If a player does not enjoy the game, this will likely influence the experience of other players as well, which in turn can negatively affect the ice-breaking purpose of the game.

*Play test set-up.* In this evaluation, we focused on the entertainment factor of the game. Players were asked to play the full game, after which a small questionnaire was requested in which we assessed their overall experience, with the following questions:

- (1) If you could rate the amount of fun you had while playing the game between 1 and 10, what would you give the game?
- (2) Would you play this game again?
- (3) What did you like most about the game?
- (4) What did you like least about the game?

*Results.* The game was perceived as fairly entertaining, receiving an average score of 7.3 out of 10. About 67% of the players answered that they would play the game again. Which indicates that players found the game entertaining. In general, the most appreciated features were the abilities (i) to create a maze layout by attaching mobile phone displays and (ii) to share power-ups. The least liked were the (slow) process to set-up the game and the repetitiveness due to a limited variety of possible actions players can take.

## 6 CONCLUSION

We presented Maze Maestro, a collaborative tabletop game designed with the goal of breaking the ice in newly-formed teams of college students, without requiring any facilitator. Maze Maestro creatively combines the power and accessibility of mobile entertainment with the advantages of a collaborative board game. Among other salient features, its game board is made up by attaching the displays of the team members' mobile phones to form a large maze, which in turn, can be collaboratively modified by the players as they find their way to the exit. Our results of a preliminary player study are optimistic about the ability of Maze Maestro to help break the ice within freshly-formed teams. From a variety of play-test sessions, we also concluded that players found the game enjoyable and easy to use, even though some features were considered hard to learn at first. Also, players found the concept of attaching mobile phones to build up the board of the game a very attractive, powerful and fun idea. We are planning a large-scale player test of Maze Maestro for the start of the upcoming Fall semester. For this event, the fully polished game (including a coherent style and final content) will be made publicly available. The data collected will be used in a

meta-critic evaluation of each game feature and its influence on ice-breaking and ideation.

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