Do not puzzle the puzzle player:

when communicability issues influence playability

Mayara J. Oliveira, Luana Müller, Angelina C. A. Ziesemer, Luciana S. Espindola, Milene S. Silveira
School of Technology
PUCRS
Porto Alegre, Brasil
e-mail: {mayara.jesus, luana.muller, angelinabueno, luciana.espindola}@acad.pucrs.br, milene.silveira@pucrs.br

Caroline Q. Santos
Departamento de Computação
UFVJM
Diamantina, Brasil
e-mail: caroline.queiroz@ufvjm.edu.br

Abstract— **Puzzle games are a popular category of games whose goal is to challenge players by offering them hard problems to be solved. Nowadays, it is possible to find several games from this category available to computers, mobile devices, and on the Internet. However, sometimes, to increase its difficulty, game designers might puzzle the player, by offering challenges which they find difficult to understand regarding what needs to be done in order to evolve. On the other hand, we underline the concept of communicability, which refers to the users' capability to understand the interface design as it was conceived by the designers. In this context, our question is: May communicability failures impact game playability and the users' first-hour experience? To answer it we present a qualitative research in which we conducted a user observation using the Communicability Evaluation Method. Our findings show that the unavailability of help resources in games can affect the game communicability, and we lead a discussion regarding the importance of this kind of resource, not only to help gamers understand how the game works and how to interact with it, but also to support them to evolve and to engage in the game.**

Help resources; games; communicability; playability; user observation; first-hour experience

I. INTRODUCTION

According to the Oxford Living Dictionary[1], a puzzle is "a game, toy, or problem designed to test ingenuity or knowledge". The verb to puzzle means "to cause (someone) to feel confused because they cannot understand something" and "think hard about something because one cannot understand it". Nowadays, it is easy to find games categorized as puzzle games, available on smartphones and the internet, making it easy for players to have access to an extensive catalog of options. Similar to the definitions presented previously, these games aim at providing problems to be solved by its players. However, sometimes the same tests of knowledge which categorize these games may impact negatively on their "first-hour experience".

Cheung, Zimmermann and Nagappan [1] reported that the first time a player plays a game is critical to define if this player will engage on it or if he will abandon the game. According to them, during the initial play session (named as first-hour experience) is when the players familiarize themselves with the game and reconcile their expectations with this initial experience.

But, what happens when the puzzle game puzzles the player to the point of negatively impacting his first-hour experience, leading him to give up? In order to explore this issue, we present an analysis of 100 Doors, a puzzle game whose players' goal is to open elevator doors by solving a series of logical challenges. During a preliminary analysis of this game, we observed that some challenges can cause frustration in the player culminating in the abandonment of the game; the fact that the game does not present any help, guidelines or tutorial to support the player to understand different phases, and only presents poor tips in few levels, contributes to frustration.

Considering this fact, we decided to evaluate 100 Doors' communicability. Communicability [10] refers to the users' capability to understand the interface design as it was conceived by the designers. This concept assumes the hypothesis that, if a user can understand the designer's decisions about an interface, they are more likely to make a better use of the system. In the case of a game, we believe that the (mis)understanding of the designer's rationale may impact the player's first-hour experience.

The communicability concept is proposed by Semiotic Engineering [3], a semiotics theory applied to Human-Computer Interaction, mainly based on Peirce's [9] and Eco's [4] theories. This theory also offers methods (interface inspection and user observation) to help researchers assess the communicability of a system interface. Considering our focus on the players' experience, we chose the Communicability Evaluation Method (CEM) [8], an observation method, to help us identify the presence of communicability problems and their impact in game playability. We used CEM with 12 participants interacting with 100 Doors game, identifying hundreds of communicability breakdowns and discussing their impact in the game playability.

The next sections present the methodology of this research, providing details regarding 100 Doors game, the observation method (CEM) used, and the research design, followed by the results we found. Next, we present a discussion regarding our results and related work, and our final considerations. Finally, we present our acknowledgments and the list of references used in this research.

II. METHODOLOGY

Our goal with this descriptive research [7] is to answer the question: May communicability failures impact game playability and the users' first-hour experience? To answer this question, we performed individual user observations

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[1] https://en.oxforddictionaries.com/definition/puzzle

with 12 participants, and analyzed their interaction with 100 Doors game by using the CEM.

A. 100 Doors Game

100 Doors [13] is a digital game in which the player is presented with an elevator door he is supposed to open to get to the next level. To open each door, the player is challenged to solve a puzzle, whose difficulty is gradually increased level by level.

In a prior analysis, we observed that learning how to pass one level does not necessarily help passing the next one. Taking Figure 1 as an example, level 1 (Figure 1a) presents a simple elevator door, where the player needs to press the button to open the door and unlock the next level. However, level 2 (Figure 1b) introduces new elements, not necessarily understandable by the context, which, in this case, is the possibility to use the accelerometer resource that identifies if the cellphone is upside down. This change motivates us to analyze this game.
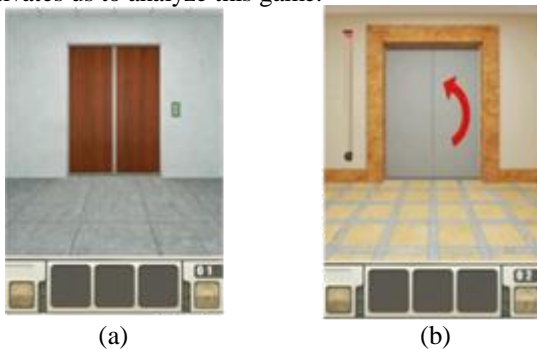

(a)   (b)

Figure 1. 100 Doors – first and second levels [13]

We highlight that our interest goes beyond puzzle challenges themselves. We are interested in the breakdowns that could affect the players' engagement (and the first-hour experience).

B. Communicability evaluation

To perform the game analysis, we used the Communicability Evaluation Method (CEM). This method is based on the observation of a small group of users interacting with an application (6 to 10 users), leading to a qualitative analysis approach to describe results [8]. According to de Souza and Leitão [8], "CEM focuses on a particular class of observable phenomena in user-system interaction, namely, that referring to communicative breakdowns, which narrows the scope of analysis even further".

Communication breakdowns happen while the user is interacting with the application and needs to deviate from his goal in order to understand the interaction itself. The main step in the CEM is tagging these deviations with communicability utterances. To do so, the evaluator needs to watch a playback of users' interactions, look for behavioral patterns, and categorize these patterns with the tags presented in TABLE I [3].

TABLE I. CEM'S COMMUNICABILITY UTTERANCES

Tag	Description
What's this?	It happens when user hopes to see some tip or any other signal regarding the meaning of a component from the interface.
Why doesn't it?	It happens when user does not understand or does not accept the fact that their actions did not produce the expected results.
Help!	It happens when user cannot perform their tasks by exploring the interface.
Where is it?	It happens when user knows the action they want to do, however, they don't find it immediately on interface.
What now?	It happens when user doesn't know what to do and they search for what should be the next steps.
What happened?	It happens when user repeats an action because they are not able to identify its results.
Oops!	It happens when user performs an unwanted action and, immediately realizing it, they undo the action.
Where am I?	It happens when user is interpreting or using the interface components in the wrong context of the application.
I can't do it this way.	It happens when user leaves an interaction path because they believe their actions don't help them to achieve their goals.
Looks fine to me.	It happens when user is convinced that they achieved their goals, however, it didn't happen.
I give up.	It happens when user explicitly admits their inability to reach their goal.
Thanks, but no, thanks.	It happens when user knows the designer's preferred solution, but explicitly chooses for another form of interaction.
I can do otherwise.	It happens when user cannot accomplish the task the way the designer has idealized, and decides to follow another path, usually longer or more complicated.

C. Research Design

This research is divided into two main steps (Figure 2). The first consists on the CEM conduction, during which we:

- presented the research goals to participants and requested them to sign an Informed Consent Form, authorizing the use of collected data;
- applied a questionnaire to collect information regarding the participants' profile;
- performed the user observation (video recorded for further analysis), in which all participants needed to interact with the game for 10 minutes;
- applied a post-test questionnaire to collect their feedback regarding the game.

During the user observation, whenever asked for some help, the evaluator could give the following tip: "you can use all the resources of the phone".

After the observation, we proceeded with the analysis, the second step of this research, in which we:

- tagged the user-system communication by analyzing the recorded videos in order to identify and categorize communication breakdowns;
- interpreted the collected data, identifying the main interaction problems.
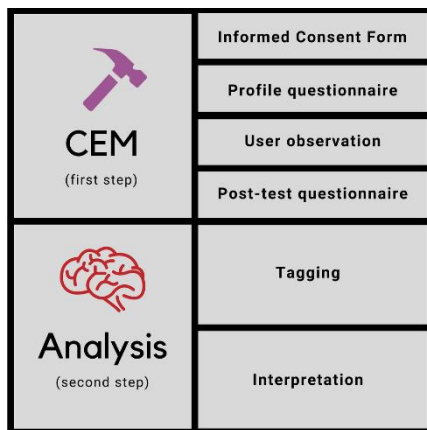
Figure 2. Research design

III. RESULTS

To perform this observation we recruited 12 participants, selected by convenience. The sample was composed by 8 men and 4 women, aged between 24 and 46 years old, all of them with higher education related to Informatics and students of a postgraduate program in Computer Science (only Participant 3 was an undergraduate). Their profiles are presented in TABLE II.

TABLE II. USER OBSERVATION PARTICIPANTS' PROFILE

Participant	Gender	Age	Educational Level
1	M	27	Graduate
2	F	40	Graduate
3	M	27	Undergraduate
4	M	24	Graduate
5	F	24	Graduate
6	M	26	Graduate
7	M	28	Graduate
8	M	46	Graduate
9	F	37	Graduate
10	M	24	Graduate
11	M	24	Graduate
12	F	31	Graduate

The change between levels may lead to a paradigm breakdown, which means that all that was learned before does not necessarily help for the solution of the puzzles in the current or next levels, as it had been observed prior to the observation. Thus, we chose to analyze in detail the participants' interactions with the levels 1 and 2 of 100 Doors, which, in our understanding, already present enough challenges to analyze.

Regarding level 1, we identified only two communication breakdowns (see TABLE IV). The more frequent one was "Why doesn't it", related to the players' first contact with the elements of the game, when they used trial and error approach in order to identify their interaction options in the game. This communication breakdown means that the participants did not understand or did not accept the fact that their actions did not produce the results they were expecting. The other communication breakdown was "What happened?", probably caused by the lack of information regarding the system status after each interaction, leading players to repeat their actions due to lack of feedback.

Regarding the actions themselves, we observed that clicking on the elevator door in order to open it was done by most participants in Level 1. Even though this action did not work as expected, some participants repeated it ("Why doesn't it?"), due to lack of feedback to this action. When detecting the existence of a call button next to the door, the participants pressed it, unlocking the next phase.

In level 2, the pressing-the-button strategy to open the door did not work. A completely different strategy to pass this phase was required. TABLE V presents an overview regarding the communication breakdowns occurred during level 2, and it is possible to observe an increase of breakdowns as well as the time spent on this level.

During this level, the most occurring communication breakdown was "What now?". This means that, in these cases, the participants did not know what to do and tried to find out what should be the next step.

Regarding this game level, one of the participants described how he felt while playing: "*At this time, I feel like I have finished all possibilities and the game loses the fun. It is as if the proposed challenge was too big to my skills to solve it, and that discourages me*"[2] (Participant 4).

The second most occurring breakdown on level 2 was "Oops!", which means that the participants made a mistake, however, they immediately realize it and undo the action. This breakdown was mainly due to mistakes such as accidentally returning to 100 Doors' main menu and closing the game. The breakdown "Why doesn't it?" was the third most observed. An example regarding how this breakdown happened during this level is that, many times, the participants tried to perform a movement with their fingers following the arrow located over the door. Regarding this, Participant 1 mentioned that "*In my point of view, the arrow tells me to follow the arrow's route*"; however, after trying it, he realized this was not the correct action. Participant 2 even though the game was passing through some technical problem: "*Isn't it stuck? Are you sure?*".

We also noticed the occurrence of the communication breakdowns "Where am I?" and "Help!". This first one means that the player tried to execute actions or that he was looking for elements in the wrong place; while the second one means that the player was unable to perform his task by only exploring the interface. The "Help!" breakdown usually has as symptom the opening of the help system, performed by the user. In the case of the game we explored, at that time, a help system was not in place, so we interpreted the help asked to evaluators as this communicability utterance. Some participants asked for tips, while others wanted to know if there was a help menu. Participant 5 mentioned the desire to avoid the level: "*It is hard, it is hard. I am almost skipping the level! Can I skip a door?*". By skipping, the participant means the possibility to avoid playing a game level and moving forward to the next one. Another example is the following sentence from Participant 10: "*I don't know, I don't have any idea about what I have to do right now. Everything that I would do in a game, I have already done, and apparently the game does not respond to any command*". Whenever help was necessary, the evaluators would only provide the tip "you can use all the resources of the phone".

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[2]All participants' sentences presented on this paper were translated from the original language into English

We observed that the main difficulty presented by the players was to identify they could use all cellphone resources (in this case, to turn the device upside down) as a valid way of interaction (see Figure 3). Most of them only tried different types of interactu after receiving the tip. Consequently, we see how the lack of minimum help or initial instructions may impact players' motivation to play the game.
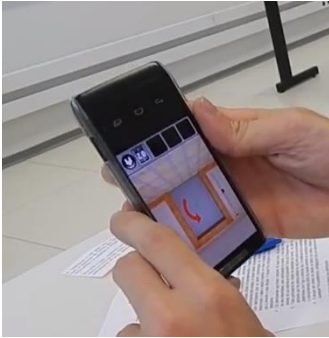

Figure 3. Interaction with the game's second level

It is possible to notice a huge difference between the communication breakdowns identified in the levels 1 and 2. From the analysis of videos recorded during the observation, considering all game levels (TABLE III) participants had played during 10 minutes, we tagged 237 communication breakdowns, presented in TABLE VI.

TABLE III. LEVELS COMPLETED BY EACH PARTICIPANT

Participant	Number of completed levels
1	10
2	7
3	3
4	9
5	9
6	9
7	9
8	4
9	9
10	5
11	10
12	8

Among the three most recurrent breakdowns, the one that happened the most was "What now?". While playing the game's level 2, it was possible to observe that in several moments participants wandered through the game and did not know what should be done or how to perform some actions. Sentences such as "*I will start trying my options through trial and error, because the game is beginning to get boring*" (Participant 6), and "*My wish is to make random movements on the screen, to try to discover how it opens*" (Participant 4) show us situations in which the participants were not sure about what their next steps should be. The breakdown "Why doesn't it?" happened frequently since the game did not provide any feedback regarding some of the wrong steps made by the participants. Because of that, participants tended to repeat their wrong steps, believing that they were doing the right action and the game was presenting some problem: "*There is an arrow suggesting that I have to do a movement, and it did not work!*" (Participant 3) and "*It did not open! It did not open! I'm getting nervous!*" (Participant 12). Finally, regarding the

breakdown "Oops!", it was mainly observed while participants tried to solve the level by trial and error, and, many times, they executed an unwanted action, which they immediately noticed and went back.

After the user observation, participants answered a post-test questionnaire in which they provided their opinions and feedback about the use of the game. We also asked them about their opinion regarding the help support provided by 100 Doors, in which three of them reported they believed the game must not provide help resources since this is its premise. Participants 6, for example, mentioned: "*thinking of the purpose of the game, I think it should not offer help, because it is in the essence of the game to find out forms of interaction*".

The remaining participants believed the game should offer some help resources, especially during the initial levels, in order to introduce the gamer to its functionalities: "*I believe there should be an introduction stating that all resources from the smartphone will be used. After starting level 1, it is part of the challenge not to receive any help*" (Participant 1); "*Not to affect the challenge of the game, presenting a simple text when the game starts would be interesting, pointing out the game's main goal and suggesting the gamer to explore several kinds of interaction.*" (Participant 4); and "*[it is interesting to offer some help resource] by providing an initial help about the used artifacts and types of movement*" (Participant 12). Some participants also mentioned that the game should offer tips in all levels, however, they suggested that these tips should be available only "*after some time trying*" (Participant 2) or after "*some incorrect actions*" (Participant 7), and these tips should "*direct the gamer to look at something that might be going unnoticed*" (Participant 5).

Participants highlighted some positive factors regarding the game, such as: "*[it is nice] to exercise reasoning to show that, sooner or later, you will find a problem that you may be unable to solve*" (Participant 1); "*it motivates and challenges us*" (Participant 7); "*it challenges you to think in a new way to open each door*" (Participant 5); and "*the game forces us to think*" (Participant 9). Regarding the negative factors they mentioned, we highlight: "*the lack of a game introduction, such as a 'how to play'*" (Participant 1); "*the feeling of helplessness while trying to discover how to open each door and the amount of time used to discover how to open a door*" (Participant 2); and, ironically, "*despite my belief that the game should not have help resources, the negative factor is that the game does not have a help system*" (Participant 9). Finally, regarding whether they would remain engaged in the game, only 2 out of 12 participants mentioned they would not continue playing the game anymore.

IV.   DISCUSSION

Communicability evaluation methods applied to games had been used before to analyze aspects related to audio and accessibility [14][15]. Andrade and Gomide [16] also used them (in their case, the CEM method) to identify semiotic characteristics presented by mobile strategy games that help increase sales on mobile app stores. During their evaluation, they found that several communicative breakdowns could be avoided by using dynamic and metalinguistics signs.

TABLE IV. TOTAL OF COMMUNICATION BREAKDOWNS PRESENTED DURING GAME'S LEVEL 1

Tag	Participant												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
Why doesn't it?	1	2									1	1	5
What happened?					1	1							2
Total	1	2	0	0	1	1	0	0	0	0	1	1	7
Level duration	3s	10s	4s	3s	10s	12s	3s	4s	4s	4s	6s	13s	

TABLE V. TOTAL OF COMMUNICATION BREAKDOWNS PRESENTED DURING GAME'S LEVEL 2

Tag	Participant												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
What now?	1	5	7	1	1	3	3	9	5	5	1	10	51
Oops!	2		2	1	1		1	6	4	1	1	8	27
Where am I?												1	1
Why doesn't it?	2	5	1		1					1	1	1	12
Help!					1			1			1	1	4
Total	5	10	10	2	4	3	4	16	9	7	4	21	95
Level duration	91s	228s	293s	176s	185s	92s	49s	506s	113s	210s	202s	382s	

TABLE VI. TOTAL OF COMMUNICATION BREAKDOWNS PRESENTED DURING THE STUDY

Tag	Participant												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
What now?	6	13	14	4	7	6	9	12	19	17	5	21	133
What's this?		2				1	2				1		6
Oops!	4		1	1			1	6	4	1	2	8	28
Where am I?												1	1
Why doesn't it?	11	10	2	6	5		4	4	1	2	2	2	49
What happened?					1	8	1	1	2	1		1	15
Help!					1			1			2	1	5
Total	21	25	17	11	14	15	17	24	26	21	12	34	237

Regarding these signs, they are defined as "anything that stands for something else, to somebody, in some respect or capacity" [9]. Semiotic Engineering classifies the signs presented by computational systems in three levels: static, dynamic, and metalinguistic. The static signs may be represented by buttons or any other kind of sign perceived when the user looks at the system interface and their meaning can be interpreted apart from temporal or causal relations. The dynamic signs are those that emerge from the interaction with the interface, and differently from the static ones, are related to temporal and causal events. The dynamic and static signs are related to each other, once the static signs are those which stimulate the user interaction with the interface, while the dynamic sign is the one which confirms the interaction performed by the user through the static signs. An example of this relation is the dialog window that appears when a user selects an option, such as saving or opening a file. Finally, the metalinguistic signs are those which explicitly inform, illustrate or explain the meaning of static and dynamic signs, being presented usually in the form of help or messages (error, warnings, tips) [3][8].

According to [16], through metalinguistic signs presented in games, the designer can explicit help players by communicating to them the meanings codified in the game and how they can be used. Conforming to the view of Semiotic Engineering regarding providing help, Silveira et al. [12] showed that online help system is an essential part of an application. The authors pointed out that it is "through help that the designer can directly communicate with the application users, revealing the reasons underlying his/her design and how users may make better use of it". Our analysis confirms this point, highlighting the importance of knowing how "to move on" in order not to lose the users during the game.

There is little research addressing the subject of help resources in digital games. According to Iacovides et. al [5], players learn how to play by resorting to different strategies, such as learning by error, using the same approach repeatedly to accomplish a goal, stop and think, and also accepting suggestions from help resources. Oliveira et. al [2] and Santos et. al [11] found that players would like to receive help support, but this should fit the game type and must not take away the challenges they are supposed to face. According to the authors, puzzle game players prefer to receive help through graphical tips, that is, highlighted elements presented by the game, in this case, metalinguistic dynamic signs that will appear according to interactions made with the game by players, with the goal of explaining something to them. In the 100 Doors' second level, the arrow presented to users could be considered as an example of a metalinguistic static sign, presented to support players understanding regarding the interaction they should do. However, this sign fails in deliver this message to players, whom had problems to solve the puzzle. During the post-test questionnaire, most participants reported that the game should provide some kind of help in order to introduce players to possible ways of interaction. Also, during the observation, participants said sentences regarding their need for help, such as: "*I don't know, at first, I would need some help or whatever, read some tips before*" (Participant 9); "*At this moment, I would go to the internet to see how to solve this second door*" (Participant 11); "*Is there a help system here?*" (Participant 12).

We also highlight that their need for help was mostly related to their difficulty to realize that turning the phone upside down was a way of interaction. After we provided the tip "you can use all the resources of the phone", then players started trying new ways of interaction. Participants tried to use multi-finger touch, to shake the device, to press volume buttons, to turn the device in several different ways, and to use voice commands, telling the game to "*Open the doors*". Even so, we observed that these attempts were randomly made. Even with our tip, it was not clear which resource could help them. After solving the second level challenge, Participant 5 reported that "*I was never going to

do it, I did it just by trial" and Participant 10 mentioned that "*something happened, which was not intuitive at all*".

Even those participants who mentioned during the post-test questionnaire that 100 Doors game should not offer help (Participants 6, 8, and 9) presented frustration facing difficulty to solve the second level challenge in some moments during observation. They reported: "*I'm going to start with trial and error, because here things are getting boring already*" (Participant 6); "*The worst thing is that we feel a bit diminished, right?*" (Participant 8); and "*I have no idea about what I have to do here*" (Participant 9). The same frustration is presented by other participants, such as Participant 2, who reported the game "*is annoying me*", Participant 5, who said "*Guys, I cannot do it!*", and finally Participant 12, who affirmed "*I am getting nervous!*" and after that, "*I can't, it's too difficult, I want to give up*".

Due to these facts, we are able to answer our question: May communicability failures impact game playability and the users' first-hour experience?

In the case of 100 Doors game, we observe a relation among the number of breakdowns and players' frustration not being able to evolve in the game. Only in phase 2 we have identified 95 communicative breakdowns and also several sentences reported by participants that clearly present their frustration. Most of these problems are related to the poor help presented by the game, which does not present enough information regarding how to interact with it.

And, finally, even though only 2 out of 12 have reported that they would not keep playing the game during the post-test questionnaire, evidence about their first-hour experience shows us that their first contact with the game was not fun at all, since they needed to solve more than the puzzle itself.

V. FINAL CONSIDERATIONS

Puzzle games have as their goal "to test ingenuity or knowledge" by causing "(someone) to feel confused because they cannot understand something" [3] . In this particular category of games, offering help to players can reduce the challenge and, consequently, the fun of playing them. Kieras [6] mentioned that the existence of a "Solve Problem" button in a game would act as a "killjoy", due to the fact that players want the challenge and without it the fun element might disappear. However, the same lack of help that would increase the fun, could also support players' first-hour experience, helping them to comprehend and learn about how to interact with the game interface.

In this work we presented a qualitative research regarding the impact caused by communicability failures in puzzle games and how they affect game playability. To perform this analysis, we used CEM, a method offered by the Semiotic Engineering Theory [3], through which we were able to identify the occurrence of several communication breakdowns, especially during the initial levels, when the player is learning about how to interact with the game interface, during his first-hour experience.

In relation to our research question "May communicability failures impact game playability and the users' first-hour experience?", we stand that the communication breakdowns we have identified suggest that

their first-hour experience was affected by the frustrations of not being able to evolve in the game, and also highlight the importance of providing help resources in 100 Doors game, as well as in other games in general.

Regarding 100 Doors game, we suspect its game designers intended the game to present an average level of difficulty, focused on players with prior knowledge about mobile device functionalities and puzzle games. Perhaps the designers believed that players could comprehend the game's functionalities and would agree with the idea of not having help throughout the levels, which would make the challenge more interesting. However, many participants were not able to understand the concept of some levels and chose to ask for external help or other options that could help them solve that level and progress faster in the game. Thus, it was found that the designers' idea of not providing help resources in the game did not fit the participants' needs, for our results show they needed initial help in order to comprehend the game's thematic and style. The problem seemed to be caused by the designers' expectation regarding the players' previous knowledge. Based on this analysis, we believe that designers should reflect on the needs identified in this study and remember that, even if their idea is to challenge players, they "have only one chance to make a first impression", and in the case of a game, such first impression is crucial to keep players' engagement.

Our main contributions are the evidence that lack of help resources may affect playability, and examples of communication breakdowns that shall occur in this context. These results could be used to highlight the need of a careful help design in this kind of software, as well as in any software in general. Moreover, in the case of games, the importance of helping players in their first experience with a game is crucial.

This work presented an initial step in order to comprehend the impacts of communicative failures in games, and, as limitations, we report the analysis of a single game, which may provide evidences, but not a definitive answer to our question. As our next steps we intend to continue investigating this field, analyzing distinct kinds of games and related help resources, besides talking with game designers in order to understand their vision about the availability of help resources in games and their effect on playability.

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