Blitzmerker: Learning Idioms with a Mobile Game

Laila Shoukry, Polona Caserman, Stefan Göbel, Ralf Steinmetz

TU Darmstadt
Rundeturmstrasse 10
64283 Darmstadt, Germany

`{firstname.lastname}@kom.tu-darmstadt.de`

Abstract. In this paper, we present a mobile learning game for helping children understand idiomatic expressions. This is particularly helpful for Autistic children as they have problems understanding abstract concepts which can hinder their natural interaction. The game is also suitable for children from a foreign background who often encounter such expressions in their everyday communication and also usually misinterpret them into their verbal meaning. The game has the option of learning either the English or the German Idioms and can be easily extended to include other languages. The game was created for Android phones and tablets and evaluated with 12 autistic children. Participants indicated that they enjoyed playing the game and that it helped them learn many idioms.

Keywords: game-based learning, serious games, child computer interaction

1 Introduction

Autism is the third most common cognitive disability with a prevalence rate of about 1 in 88 children worldwide and mainly affects social skills, communication skills and interests [1]. Children with Autism Spectrum Disorder (ASC) usually lack the knowledge of how to properly interact with their peers and thus lack the motivation to engage in social interaction [2]. One factor contributing to this problem is their inability to understand abstract concepts during conversations: In situations where people use metaphors and idioms, it gets more difficult for autistic individuals to respond [3]. Fortunately, studies have shown improvements in social skills of people with ASD in response to exposure and training [4]. However, failure in social interaction decreases motivation to get involved in such situations in the future increasing the social gap [5]. In addition, early intervention in childhood can be crucial, as the more children grow up, the more they become aware of their problem and thus the more their social anxiety can increase [6]. This can also hold true for non-native

speaking children who find difficulties in interaction with their peers during first-time exposure to foreign language idioms and thus may become introvert or show negative social behavior [7]. Using simulations and games to support training social skills in non-real world situations can provide encouraging environments for learning which have reduced risk and thus do not induce as much fear of failure [8,9]. Another advantage of such environments is that children with autism are usually inherently interested in computer games, partly because they are more predictable and consistent than real-life social interaction [10]. In general, serious games are considered to have positive effects on learner engagement and thus are used to indirectly benefit players while they are enjoying their playing experience [11]. For these reasons we have developed a game for helping children to learn idioms through conversation simulation in a personalizable, playful mobile environment. The game was evaluated with 12 autistic children and showed promising results.

2 Related Work

A conventional behavioral therapy method which has shown significant effectiveness for enhancing social skills of children with ASD is Applied Behavior Analysis (ABA) [12]. In intervention programs based on ABA principles, children practice social communication skills in different situations with these skills being broken down into small steps gradually increasing in difficulty and achievements being rewarded through positive reinforcement techniques. As these therapies are often too expensive because of the significant amount of time needed by a therapist to prepare appropriate materials, several applications have been developed based on ABA approaches to automate some intervention practices and thus make them more accessible for a wider audience [13]. TeachTown5 [14] is one example of a computer-assisted curriculum based on ABA principles for practicing social and cognitive skills which has shown to be effective for children with developmental disorders. In general, the use of multimedia to simulate real-life situations for children with autism to teach them social communication has shown positive effects in several studies [13]. Here, it was found that using motivating visual and auditory stimuli was a common element used for engaging players in these successful applications as many individuals with ASD are visual learners [13,15, 16]. Another success factor was found to be the ability of the software to adapt to progress and individualize interactions for different users [17,18]. As children with autism frequently suffer from sensory defensiveness, they may have an adverse reaction to ordinary sensory stimuli including sounds and images. This has to be considered when designing multimedia elements for autistic children and the best solution is to have different configuration options to make the applications suitable for use by different children [18,19]. Parents and caregivers can then configure them according to their child's individual needs. These design guidelines, among others, were considered in the development of our game Blitzmerker with the aim of providing a motivating learning experience for helping autistic children understand idioms used in everyday conversations.

3   Game Design

Blitzmerker is a learning game for children with ASD in which the player indulges in a virtual conversation with a character which constantly uses different German/English proverbs. Each phrase is followed by a quiz for the player to choose the correct meaning of the phrase and consequently choose a suitable response. If the player makes a mistake, s/he is presented with concrete cues and hints which lead to the correct answer. Different responses to the same question or phrase can be correct and thus allow for different paths in the game story. This feature increases the replayability of the game making it possible to repeat the game several times and learning new idioms. After finishing one iteration of the game, the player can compare his score to other players' scores and if a number of points is reached, a new level is unlocked. If not, the level can be repeated to improve the score. There is a total of three different levels. In the first level, the player is talking to a classmate and learns common idiomatic expressions which are used more often in daily conversations. In the second level, more complex proverbs are presented in conversations with an adult character. Finally, in the third level the character leading the conversation is a grandparent using more difficult, old proverbs which still occur in everyday life often enough to play a role in social interactions. At the time of writing this paper, only the first level has been implemented.

**Fig. 1. Examples of Quiz Screens in Blitzmerker**
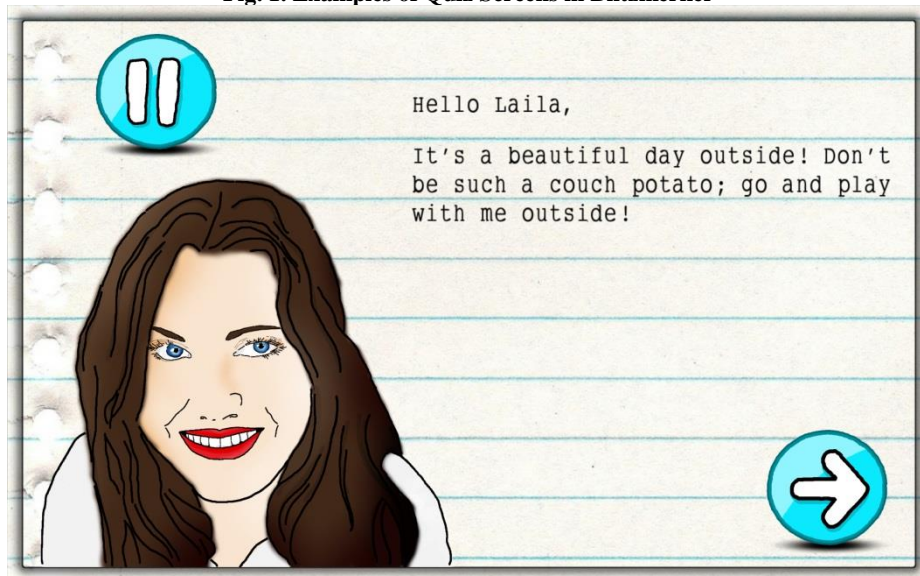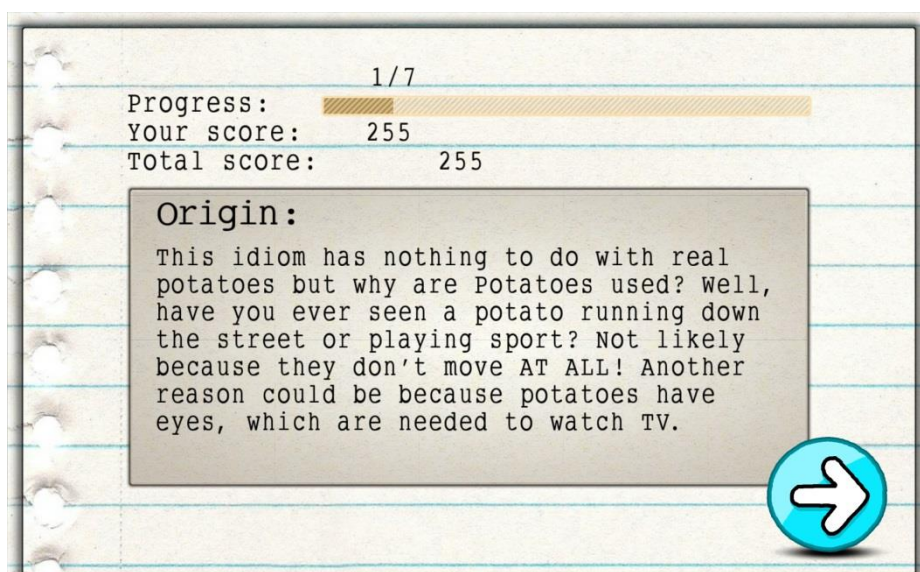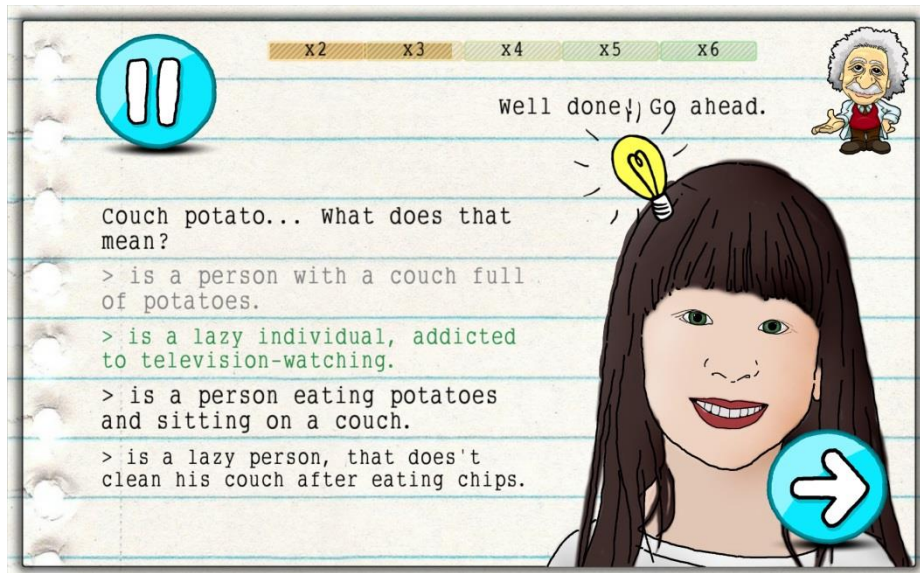
The scoring system is based on the Experience Points (XP) scoring system: This system uses weighing factors to make sure that if the player has reached a certain experience level, s/he cannot significantly deteriorate in later rounds even if s/he makes mistakes. Once a certain number of points is reached, the next level can be loaded. The progress is visualized to the player while playing to increase motivation. At any instance the game can be paused to change settings, turn off sound or quit.

The quizzes are loaded from xml files which makes it easy for non-programmers to change the content or the language and maybe even adapt to other learning scenarios.

4   Configuration and Personalization

As already mentioned, personalization is an important feature for addressing the target group of children with ASD due to its heterogeneity. It allows players to have an individual play experience tailored to their background and characteristics, especially if used by parents or caregivers who can judge the best settings suitable for the player. In Blitzmerker, the settings view can be used to change the language, the active user, the background image and music, the color of text and buttons. From interviews with parents, caregivers and therapists, it was found that many children with ASD have problems with certain sounds or sound levels and colors and this is why this feature was especially important. Personal pictures and music can be chosen from the device to personalize the experience. The player can choose between female and male characters and choose to turn off the reading aloud of the conversation. The camera can be used to take a photo of the player which is then also integrated in the game instead of the predefined characters. Some settings are meant only for the parents and can only be accessed using a password. For example, parents can set the maximum playing time per day. In addition, the log-in process includes a short questionnaire to be filled in by the player to determine his/her preferences. It consists of three questions which can be answered by yes or no. According to the answers it is decided where the player's score, the timer and/ or the bonus will get displayed during play. The player's selected options are then stored in an XML file to display the correct player preferences when reloading the game. Since this questionnaire is displayed only for newly registered players, there is afterwards the possibility to change these preferences in the settings menu.

Fig. 2. Some Personalization Options
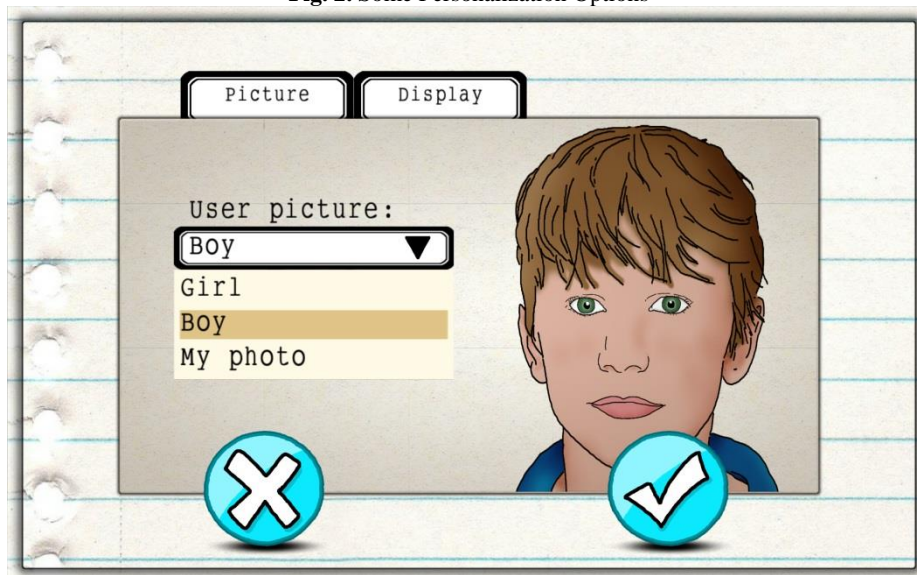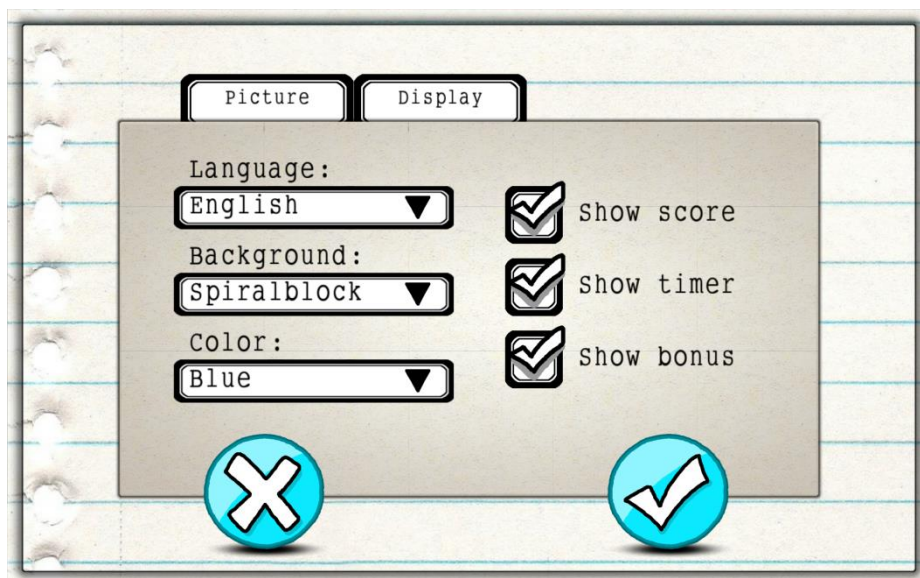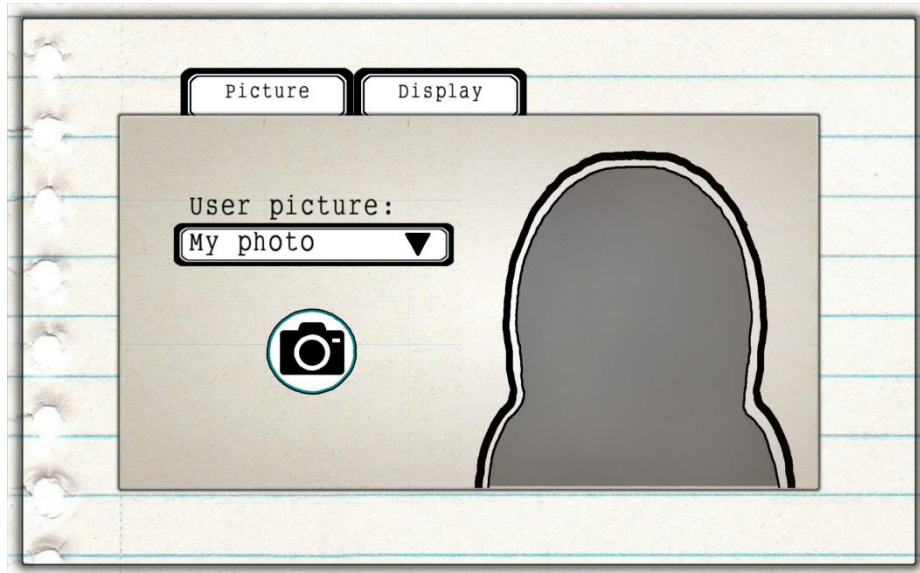
5 Logging

In this game different data is recorded about players' interactions to provide insights for both game design and player progress evaluation. The path which the player took from start to end is saved, all tapped points in all scenes are stored as XY-Coordinates, the time required for individual sections as well as the total time played

are recorded. In addition, attempts of the players to select the right answer and how long they needed for each answer are recorded as well as interruptions of game play by quitting. This data not only provide important information to improve the game but also provide progress reports for parents and caregivers to track the improvement of the child.

Fig. 3. Logging of Tapping Coordinates
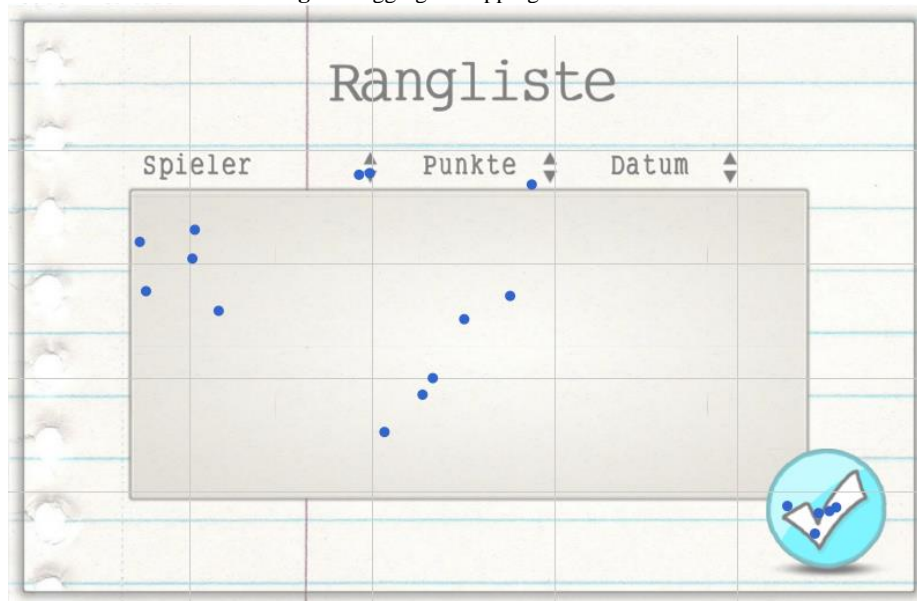
6 Evaluation

6.1 Evaluation with children

The game was evaluated by twelve male children with ASD aged from eight to sixteen divided into three sessions in two different locations in Germany. They came with their parents and two teachers. The children played the game using Android tablets and filled out evaluation forms before and after the sessions. Table 1 shows information about the participants and the number of times they played the game, with an average of 2.5 iterations. It was observed that children motivated each other, compared their achievements and discussed the stories they played. It was also observed that all children had experiences with mobile devices and therefore had no difficulty to interact with the devices. Only while typing their username, some children did not know how to close the touch keyboard.

Table 1. Participants in the Evaluation Study

Age	Name	Game Iterations
8	Dino	1
10	Anthony	2
10	Erik	2
12	Franz	3
12	Mop	2
12	Tobias	1
13	Tim	8
13	Lars	1
13	Leon	1
13	Pauli	5
15	Philipp	1
16	Johannes	3

From the data collected through questionnaires, differences in preferences and abilities of the children were found. Even though all children indicated that they spend at least one to two hours a week playing game, only one third of the children play educational games. Although more than half of the children stated to have medium or a lot of difficulties understanding proverbs, only a quarter of the children tried to memorize proverbs before. In the questionnaire which was filled out after playing the game, four of the children showed a strong interest in the game and wanted to continue playing it at home. Table 2 summarizes the ratings given by the children for different aspects in the game. Most of the children gave the game a high rating for the idea, audio, comprehensibility and ease of use. Content, Graphics and controls were rated good to very good. Fun was rated good and the overall game was rated good to very good.

**Table 2.** Ratings for Different Aspects of the Game

Criteria	Average Rating (1 is best, 3 is worst)
Idea	1.4
Content	1.5
Graphics	1.8
Fun	2.1
Control	1.5
Audio	1.3
Comprehensibility	1.3
User friendliness	1.4

As for the effectiveness of learning the idiomatic phrases, the following were the results obtained from the questionnaires: Almost all of the children stated that they already knew at least one of the proverbs except for one child who didn't know any.

Three participants (8, 13 and 15 years old) indicated that they learned one to two new idioms using the game (two of them had played the game once and one had played it eight times), one participant (13 years old) who played five iterations of the game indicated that he learned three to four idioms using the game and that the hints were helpful for him. Four kids (two 12 and one 16 years old) indicated that they have learned more than seven idioms using the game. The other four (one 9, one 12 and 2 13 years old) felt they didn't learn any new proverbs using the game. Three of these four children had played the game only once and could answer all questions correctly from the first time. The fourth kid has played it twice and showed improvement in correctness in the second time.

Fig. 4. Progress in Performance in Different Iterations of the same Quiz
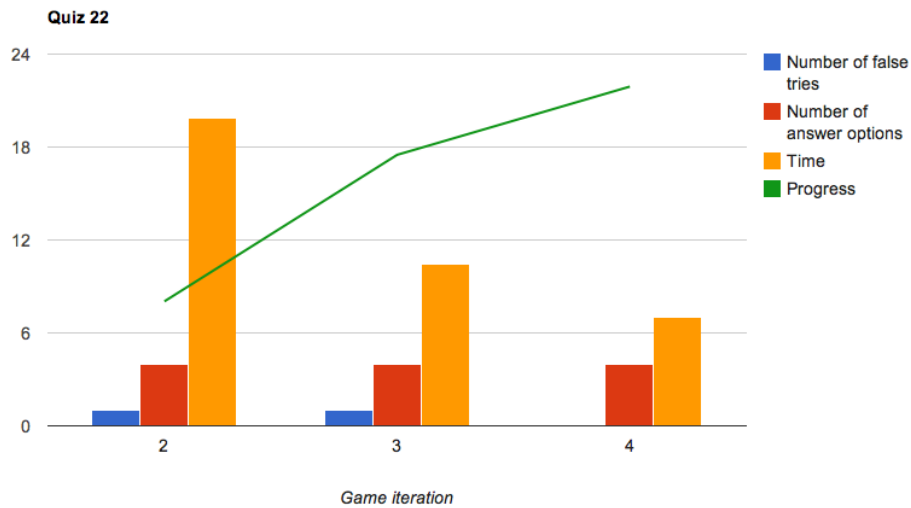

6.2   Evaluation by Experts

The game was also evaluated by two experts, both working as special education teachers in a priority school for children with autism in Germany and know all participants of the evaluation study, one of them also mother of an autistic child herself. They tried out the game, watched children play, filled out questionnaires and answered interview questions. They liked the fact that proverbs were explained in the game, that the order of answers was varied and that the game can be adapted to the player. They have criticized the monotonous praise and the lack of enough action in the game. They find the learning game appropriate for children with ASD as there are not many elements which can distract them from their tasks and hinder their interactions. They confirmed that autistic children are usually attracted to computer game and thus the game can teach them in an indirect way.

6.3   Logging Statistics

More evaluation results, especially concerning game settings, tapped points, story paths and learning progress could be extracted from the Logging data and visualized using Google Charts. The option of personalizing the game by taking a photo of one-self using the camera was very popular and used by all children. This is consistent with the observation in the evaluation studies were children were very happy while using this feature. One child has also changed the color of the buttons in the game and one child turned the audio off as he found the voice to be very disturbing. Nine of the children took a look at the leaderboard to compare their score. The tapping points showed that three children sorted the list by score, two sorted it by date and two by name (see Figure 3). Figure 5 shows that a lot of children tried interacting with the character by clicking on it. This might have distracted them from focusing on the questions and might also have frustrated them because the character didn't react to touch. For most children, a rising performance was observed from the logging statistics Figure 4 shows an example of a player's performance improvement in one of the quizzes in different iterations. Although in the 2nd and 3rd iteration the player made one mistrial, on the fourth time he answered correctly from the first time.

Fig. 5. Tap Logging shows Players tried to interact with the Character
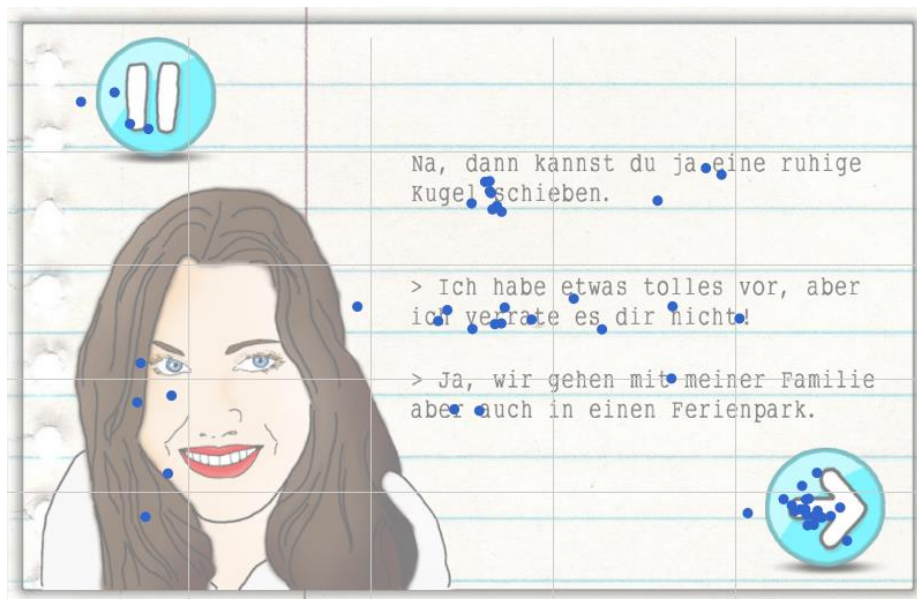
7　Conclusion

In this paper we have presented an Android learning game primarily targeting autistic children who have problems understanding proverbs by engaging them into conversations with virtual characters and explaining the real meaning behind these abstract phrases. The game was designed after interviewing autistic children as well as parents and teachers of children with ASD and evaluated with twelve autistic children, their parents and teachers. The game is available on Google Play for free download. The game evaluation shows promising results and suggests that games like this have the potential to help autistic children improve their social skills. More animations and interactions were desired to make the game more fun, but personalization features were found to be an important factor for engagement.

8　References

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