The Magic Stone: a video game to improve communication skills of people with intellectual disabilities

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Abstract

"The Magic Stone"[1] is a video game whose main aim is to help people with Down syndrome to improve communication skills that have been affected due to their disability, especially those related with prosody. The interface of the video game includes a number of elements to motivate the users to practice and train their pronunciation. The usability tests of the system have reported high degrees of satisfaction of users and trainers. Perception tests have permitted to confirm that players improve the use of prosody with the use.

Index Terms: computer assisted pronunciation training, Down syndrome altered speech

1. Introduction

Children and adolescents with Down syndrome (DS) are digital natives that use the information and communications technologies (ICT) with relative ease. They enjoy interacting with computers and mobile devices, browsing the web and playing with video games, just like any other people [1]. In addition, there are some studies that show the efficiency of ICT and video games in the cognitive rehabilitation and teaching of people with intellectual disability [2]

2. System Description

The video game has the structure of a graphic adventure game, including conversations with characters, getting and using items and navigating through scenarios. Players go through different scenarios where they have to do some actions, like doing an activity or using an item. Same of the activities imply the correct interpretation of sound messages or the correct production of utterances. In order to progress on the graphic adventure, the activities must be performed correctly.

Figure 1 shows the system architecture. Two users interact with the system: the player and the trainer. The player is normally a person with language deficits, specifically in prosodic comprehension and production. The trainer is typically a helper (teacher, speech therapist, family) that assists the player during
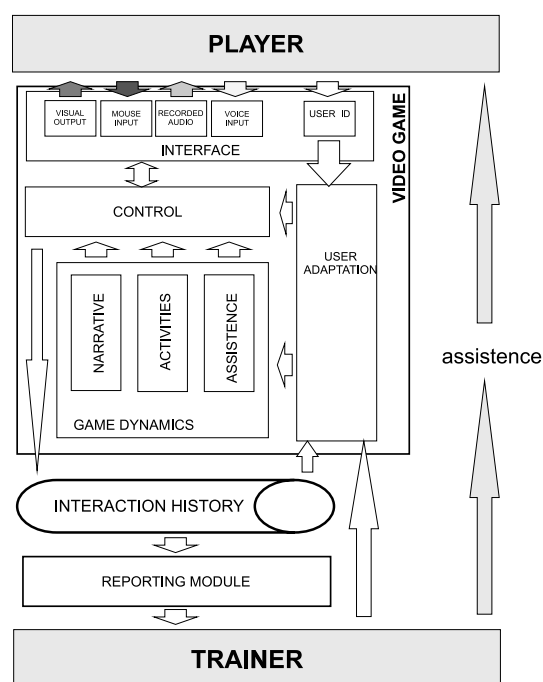
Figure 1: System architecture.

game sessions. When trainer and player are working together on a game activity, the trainer will help the player in the correct use of voice and also to configure the system. The trainer evaluates the player's recordings in production and prosodic activities, making the player repeat the exercise when the result is not correct. The role of the trainer is essential to maximize the educational potential of the game.

The application has a multimodal interface, as much for input as for output. Input is performed using voice and mouse. On voice training exercises, players will have to use their voice. Output is performed using visual and sound channels. The sound output channel is used for the voice over that narrates the story, to play character voices and to play the voice of the virtual assistant.

A virtual assistant is used to guide the player during the game. This assistant is a parrot, as shown in Figure 2. This assistant tells players to which scenario they must go or which object they must find or use. It also reminds players of the current goal.

Figure 2: Main game screen, in which the player's avatar (the girl) and the virtual assistant (the parrot) are visible.

The development of the scenarios, items and characters has a uniform design, close to cartoons, but without making them too childish. Bright colors are used in accordance with the scenarios represented in the game. A simple text font is used, with a larger size than usual to make it easier to read.

The instructions of the activities are formulated in a way easy to understand for the users. We use simple sentences and high frequency words, so they can understand all the words used. An expert on developmental and language disorders and on intellectual disability revised the sentences to guarantee that they are in accordance with the cognitive level of people with intellectual disabilities.

The scenarios, characters and items that the players find in the game are representations of real world elements. The objective of this is that players can identify daily situations and be able to transfer the game lessons to real world situations.

Each activity offers the users feedback according to the results obtained. However, due to the difficulties presented by the target users, it is important not to cause frustration that can produce an abandonment of the game. For this reason, errors are dealt with in a positive way.

3. Activities

Three activity types are defined to practice speech, communication and prosodic skills:

- **Comprehension activities** that are focused on lexical-semantic comprehension and on improving of prosodic perception in specific contexts, like making a question or asking something politely.

- **Production activities** that are focused on oral production, so the players are encouraged by the game to train their speech, keeping in mind prosodic aspects like intonation, expression of emotions or syllabic emphasis.

- **Visual activities** focused on improving specific aspect of prosody, with the corresponding visual response to the user voice input and other activities designed to add variety to the game and to reduce the monotony feeling while the player is playing.

The activities are included in the general context of the game and players need to do them in order to progress in the game. All the activities have been planned according to the principles of learning that have proven most effective for teaching and presenting information to people with intellectual disabilities [3, 4].

Figure 3: Prosodic activity. The user has to reproduce the intonation contour and to make the breaks at the traffic lights.

4. Implications

During the game session, information about user interaction is stored, as well as the audio recordings of the production activities. This information can be used by the speech therapist to analyze the evolution of the user in successive game sessions, to analyze the user interaction with the game or to study the prosodic difficulties of this population.

A set of usability tests have been performed showing that the degree of satisfaction of players and trainers is high. The game elements engage the users motivating them to use the software. It has been analyzed in perception tests and confirmed by the teachers that the oral productions of the players improve with the use.

The video game is being used for collecting a speech corpus with the voice of people with intellectual disabilities [5]. A population without any intellectual disability has also been recorded in order to have control version of the corpus to be used for identifying the anomalous productions of the target population.

5. References

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