

A voice therapy serious game with difficulty level adaptation

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ABSTRACT

Here we propose a serious game for the the sustained vowel exercise (SVE) with automatic player-adjustable difficulty. The SVE is an exercise commonly used by speech and language pathologists (SLPs) to treat children with voice disorders. To create more adequate levels for each child needs, the game adapts automatically to the child's performance, which can contribute more effectively to keep the child motivated during the speech therapy sessions.

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1 INTRODUCTION

Speech therapy is very important to treat children with speech sound disorders (SSDs). Repeating the exercises often is key to the progress of the child. However this can lead the children to loose interest in doing the exercises since it can turn into a tedious task. Due to the interest of children on computer games, well designed serious games that include the therapy exercises may help SLPs on keeping children motivated on doing these exercises.

Voice disorders are a particular case of SSDs, that can damage vocal cords, leading to nodules and cysts, hoarseness and, in extreme cases, aphonia. The SVE is an exercise that can be used to treat voice disorders. In this exercise the child must say a vowel for as long as possible, which is called the maximum phonation time, with as few variations in the intensity level as possible.

Here we propose a serious game for the SVE, specially designed to motivate children on doing this exercise. Since children with different ages and different disorders perform the exercise differently and progress at different rates, a key aspect of our game is the automatic adaptation of the difficulty level according to the child's performance. This will help to motivate children and prevent them from becoming frustrated with their performance when they fail.

2 THE GAME

The proposed game includes colorful scenarios with appealing main characters (fig. 1 shows one of the scenarios). At the beginning, the character is located in the left region of the screen, and the goal is



Figure 1: Low (top) to high difficulty levels (bottom).

to make the character move until it reaches the target on the right side (the starfish in fig. 1). The main character is controlled by the child's voice, which moves towards the target while the child is performing the SVE correctly.

The game uses a player-adaptable algorithm to choose the difficulty level of the game automatically before each new trial. Changing the difficulty level translates into changing the expected maximum phonation time (MPT_e), which is reflected in the screen as a variation of the distance between the main character and the target (fig.1). While we are working on algorithms that measure the evolution of the performance during a longer period, the game's current version takes into account the child's performance in the current trial to choose an appropriate difficulty level for the next trial. For this, it compares MPT_e with the maximum phonation time achieved by the child (MPT_c) while producing the sound with the correct intensity level. If MPT_c does not reach MPT_e (in which case the main character does not reach the target), the algorithm reduces the game difficulty, reducing MPT_e . On the other hand, if MPT_c is equal to (or greater than) MPT_e , the algorithm increases the game's difficulty by increasing MPT_e . The initial distance between the character and the target varies in accordance to MPT_e .

3 VALIDATION

The game was validated with a survey to nine SLPs, who share the opinion that the game can motivate the children and teach them to perform the SVE correctly. They also found the automatic adaptation of the difficulty levels very helpful, since in this way the game evolution is appropriate for each child's needs. This positive feedback indicates that the game has potential to fulfill its objective: motivate the children to practice the SVE as often as required.

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