

# The BioVisualSpeech speech therapy games platform

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## ABSTRACT

Here we propose a platform for speech and language therapy that includes speech therapy games for children, and that allows the speech and language pathologist to customize the games' settings according to the child's speech difficulties. This allows a better adaptation of the games to each child's needs. The platform can be used during face-to-face and online speech therapy session. In addition, it can also be used at home for intensive training. The platform provides post-training information about the child's speech performance during the games' trials. This feature is quite relevant when the platform is used for home intensive training, as it allows the speech and language pathologist understand the child's performance and be able to make better choices when planning future therapy sessions and future home training plans. The platform was accessed by four speech and language pathologists. The validation confirmed that the platform is suitable for home intensive training and provides relevant settings to adjust the games to the needs of different children.

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## 1 INTRODUCTION

Speech and language therapy is very important to treat children with speech sound disorders (SSDs). Usually, children that attend speech therapy, have a single therapy session per week. Nonetheless, repeating the speech exercises often is key to the progress of the child, and in most cases, children need to continue training outside the sessions, in order to surpass their speech difficulties faster. Intensive therapy has been proven to lead to faster improvements than those obtained by a single weekly session [1–3]. In particular, when the intensive training is done at home, it can increase the overall exercise practicing time substantially and contribute to reaching speech improvements faster.

Due to the interest of children in computer games, well designed serious games that include therapy exercises can be very beneficial. Moreover, this can be one of the best ways to motivate children on practicing speech exercises outside of therapy sessions. An

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Figure 1: Insert new patient window

important aspect of such games is the possibility of parameterizing the games to meet the needs of each child. Another important aspect that should be considered when the games are used for home intensive training is to provide feedback to the speech and language pathologist (SLP) about the child's performance, so that the SLP can adapt the training settings for future game trials.

Here we propose a speech therapy platform that includes several therapy games. These games integrate speech therapy exercises that are usually done during the speech therapy sessions. One of the main novelties of this platform is the possibility of personalizing the games according to parameters of interest to speech and language therapy. More specifically, the platform allows to personalize the games to meet each child's needs with parameters related to the child's SSD. Another main contribution of this platform is providing post-training information to the SLP about the child's speech performance on the games according to those parameters.

The platform can be used during face-to-face speech therapy sessions. It can also be used during online therapy sessions, which may take place when face-to-face sessions are not possible, such as what happened in many countries during the Covid-19 pandemic. In addition, since the games include automatic speech recognition systems or automatic voice analysis, the platform can be used for intensive training at home, where the child can play independently without the SLP or parent supervision.

## 2 THE PLATFORM

The proposed platform includes two applications: an application for the child and another for the SLP. The SLP can use the platform with more than one patient as the SLP's application manages information about all inserted patients. Figure 1 shows the window for inserting a new patient. The SLP's application allows the SLP to choose the games that his/her patients can play. It also allows the SLP to set several parameters to personalize the training of each of his/her patients. That information is sent to the child's application, which gives the child access to the games chosen by the SLP.



Figure 2: Parameterization window

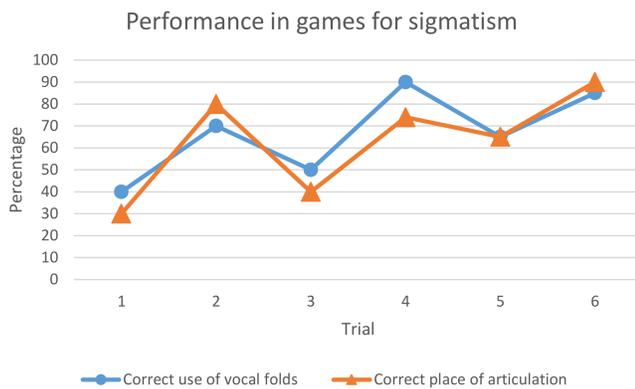


Figure 3: Post-training information about child's performance in games for sigmatism.

The games in the platform are grouped into categories that depend on the SSD addressed by the games. The platform's current version has four categories: games for sigmatism (SSD that consists of problems with the production of sibilant consonants), games for dysphonia (which is a voice disorder), games for practicing the fricative consonants, and games to practice phonological awareness (for children who are starting learning how to read).

The SLPs can start by choosing the game category that is the most appropriate for the child (figure 2). Since different children have different degrees of SSD, different interests, and different difficulties, the games that each child should use to practice the speech exercises are different. Thus, the SLP can access all the games in the chosen category and select which ones will be active for that child.

Some games have specific parameters that should be set by the SLP. These parameters are related to the speech or voice qualities to be improved by the games. For example, it is possible to choose the sibilant consonants the child should practice in the settings for the category games for sigmatism (figure 2), and it is possible to choose the length of minimum phonation time, and the intensity of phonation in the category games for voice disorders.

Among other parameters, there are also parameters related to the difficulty level of the exercises. Some of the games can adapt the difficulty level automatically to prevent children from getting frustrated by playing when they fail the speech exercises often. In these cases, the difficulty level should decrease. Another concern is

to avoid that children who do the speech exercises with ease lose interest in the games. In these cases, the difficulty level should increase to keep the child interested in playing.

In order to help the SLP understand the child's speech performance during the exercises integrated in the games, some of these games provide post-training data and graphics with relevant information. This feature is of particular interest when the child's application is used for intensive training at home, as it provides a way for the SLP to be aware of the child's speech evolution and difficulties during home practicing. For now, only two games for sigmatism have this functionality, but it can be extended to other games. The post-training information consists of: the percentage of the game trials won by the child; the percentage of correct sibilant productions; and a graph for each sibilant consonant with information about the vocal folds use and point of articulation used to produce the sibilant phonemes (figure 3).

### 3 VALIDATION

Since this work was developed during the Covid-19 pandemic and lockdown, we were not able to validate it with a user test with children. Nonetheless, we managed to validate the platform with a questionnaire to four SLPs. The four SLPs shared the opinion that the platform can be helpful to adapt training with serious games to each child's needs. The SLPs also agreed that post-training information can be very helpful and useful, since SLPs can take into account, not only the performance of the children during the speech therapy sessions but also during other game trials performed at home. This positive feedback from SLPs indicates that the platform has potential to fulfill its objective: (1) help SLPs in their work, (2) adjust the training of their patients taking into account their performance and speech difficulties, (3) provide a tool that enables intensive training at home and also (4) motivates children on training the speech exercises at home frequently.

### 4 CONCLUSION

Here, we propose a platform for speech and language therapy that includes several therapy games that can be used to practice speech therapy exercises. The platform allows the SLP to choose the games that are adequate for each of his/her patients, and allows the SLP to parameterize the games in order to meet the needs of each child. In addition, the platform provides post-training information that helps the SLP on following the speech improvements and difficulties of each child during home intensive training.

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