Measuring pronunciation improvement in users of CAPT tool TipTopTalk!

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Abstract

We present a L2 pronunciation training serious game based on the minimal-pairs technique, incorporating sequences of exposure, discrimination and production, and using text-to-speech and speech recognition systems. We have measured the quality of users’ production during a period of time in order to assess improvement after using the application. Substantial improvement is found among users with poorer initial performance levels. The program’s gamification resources manage to engage a high percentage of users. A need is felt to include feedback for users in future versions with the purpose of increasing their performance and avoiding the performance drop detected after protracted use of the tool.

Index Terms: computer assisted pronunciation training, learning analytics, L2 pronunciation, minimal pairs

1. Introduction

There are many software tools that rely on speech technologies for providing users with L2 pronunciation training [1]. While such tools undoubtedly engage users in learning-oriented practice, there have been very few attempts to objectively assess the actual improvement attained by them [2][3]. In the present paper, we show the performance results of users of TipTopTalk! [4][5], a serious game designed for L2 pronunciation training and testing.

We will describe the software tool, the test campaign, the learning analytics technique we have implemented and, finally, the results. Discussion, conclusions and prospects for future development are included.

2. Program description

TipTopTalk! provides learning practice with minimal pairs (pairs of words identical except for one single phoneme). Training proceeds along cycles of exposure, discrimination and production stages [6]. With each exposure turn, the tool reproduces a pair iteratively to allow users to perceive a particular phonemic contrast. During the discrimination phase, users are aurally presented with one of the components of particular pairs, and they must identify which of two written words is being pronounced by the program. For exposure and discrimination exercises, the system asks the user to orally produce one of the words of particular pairs, and then the recorded word is analyzed by an automatic speech recognition system that assesses its accuracy.

The three activity types are articulated into a serious game that includes stimulating images and sounds, a scoreboard, a rank of best players, a timer, etc. At the beginning of each session users are required to select between two playing modalities: Training or Challenge. They can also choose to focus on exposure, discrimination or production routines, and select the phoneme or pair of phonemes they want to practice with. A third playing mode alternates the three activity types in order to test and rank the abilities of the player. Figure 1 shows different states of the program.

3. Assessment

We carried out a three-week test campaign after distributing the tool among students of computing engineering and English philology, and students of Chinese. Up to 100 users registered for practicing with TipTopTalk!, and 58% of them made extensive use of it with up to 6000 interactions during the first week. Some of the participants remained engaged for several weeks, registering more than 11000 interactions.

This campaign has generated a database with 88000 entries containing information about the use of the tool made by each user in relation to the different exercises. This set of records \( R \), can be interpreted as

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The analysis of results concerning the improvement functions $f_0$ and $f_r$ point to significant correlations between the user, the kind of pair that is being discriminated or the word produced, and the number of trials (ANOVA test) both in discrimination and production phases.

Figure 2 shows the evolution of functions $f_0$ and $f_r$ at $s$. We show their average values varying $u$ and $k$ with a size window of $w=6$. In order to interpret the dependence of $u$, we distinguish three categories of users depending on the values of $f$ in the initial window. We assume this value to be representative of the initial competence of each user before using the tool for the first time.

User’s performance shows improvement along time both in discrimination and pronunciation tasks. In the production mode, it is users with a poorer initial level who undergo the most significant progress. Users with a higher initial level (some of them are, in fact, native speakers) register an initial drop in performance which we think attributable to the playability variables introduced in order to make the game more challenging (for example, in discrimination exercises users must click on one or the other word within a pair depending not only on the word they hear, but also on the background color displayed).

A general drop in performance quality is detected with regard to pronunciation after some time. The average user progresses initially towards an optimal point after which the values of $f$ begin to fall. We believe this decrease in performance has to do with habituation and gradual loss of interest in the game.

![Figure 2: Evolution of the function of quality along time of use in discrimination (left-hand diagram) and production (right-hand diagram).](image)

5. Conclusions and future work

Experimental results show that the use of TipTopTalk! is conducive to an improvement in L2 pronunciation and phoneme discrimination among users with a low initial level. Despite the introduction of gamification elements, a habituation factor leads to a fall in interest and performance after protracted use. This suggests the convenience of introducing feedback mechanisms to assist and guide users especially when a performance drop is detected.

There is a high correlation between particular phoneme contrasts and performance results. We are currently working on the definition of a new version of the program that includes exercises adapted to difficulties concerning specific contrasts. This new version will allow us to analyze aspects of use in relation to exposure and discrimination when the same kind of pronunciation difficulties is encountered repeatedly.

6. References


