

Testing speech perception today and tomorrow: serious computer games as perception tests

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We present a methodological comparison between a computerized version of a classical perception experiment for the detection and categorization of fine phonetic detail and newly designed serious computer game, and discuss general methodological consequences for experiments on auditory perception.

The classical experiment was a categorization test with acoustic stimuli, designed in a way to maximally resemble the game scenario (involving the category labels “human” and “alien”, just as in the game). The stimuli (German phrases and short sentences) were recorded by a native speaker of Standard High German and subsequently manipulated by altering the following phonetic characteristics: extended F0 range, the fricative spectrum and the second formant of the vowel segments. All manipulated items belonged to the “alien” category, whereas the original recordings were used as the “human” samples. The nature of the manipulation was not communicated to the participants (neither in the perception test nor in the game). After a short training phase where participants were helped with a visual label presented alongside the auditory stimulus, they had to categorize the stimuli in three blocks, with one manipulation at a time (similarly to the three levels in the game). Our new computer game was developed as a testing environment for the implicit perception and attention for phonetic detail [1,2]. The story involves an alien invasion on Earth, and the task is to save all humans and catch all aliens. The acoustic stimuli were uttered by the human agent in the game, who could, however, also be a disguised alien. Similarly to the perception test, there are visual labels present during the training phase, helping to distinguish aliens from humans. These visual aids fade after a certain amount of trials and the auditory stimuli become the only way of successfully identifying the two categories.

Our subjects were 24 German native speakers (age 20-31, 12 female) divided into 2 groups which differed in testing order (game first vs. perception test first). The two test sessions followed each other with a 3-7 days’ break. Analyzed were accuracy and reaction times, as well as individual post-hoc questionnaires on the evaluation of the two methods.

Results show, as expected, a considerable individual variation between subjects, and also a general motivation bias in favor of the game. Additionally, again rather non-surprisingly, players seem to have devoted more attention to semantic information than to phonetic detail in the game environment than in the perception test. This, however, calls to question the validity of perception test data (and foremost the magnitude of the observed effects) obtained by explicitly making the subjects aware of the need to pay attention to the phonetic detail present, since it might not at all be reflective of their natural attention to fine phonetic detail in everyday communication.

Serious games have been increasingly used in cognitive and psychological studies, and lately also in phonetic experiments. Based on our studies we argue that serious computer games excel classical experimental designs in several aspects. While classical designs can oftentimes be perceived as repetitive and abstract, emanating from - and at the same time fostering - the artificial laboratory situation, games can substantially increase the naturalness and validity of collected data. Categorization tests (and any other linguistic/phonetic tasks) can be implemented in a way not requiring explicit instructions or revealing experimental goals. Subjects in our game were not explicitly pointed towards the phonetic details in the stimuli and were nevertheless overall successful in their categorization. Games can therefore provide a good balance between spontaneous, natural data and a full experimental control.

[1] Duran, D., Lewandowski, N., & Schweitzer, A. (2016). A 3D computer game for testing perception of acoustic detail in speech. In *Proceedings of Meetings on Acoustics* (28:60004).

[2] Schweitzer, A., Lewandowski, N., & Duran, D. (2015). *Attention, Please! Expanding the GECO Database*. In *Proceedings of the 18th ICPhS*. Glasgow, UK.