

# GSenses

## SMARTPHONE SERIOUS GAMES FOR SENSES EVALUATION

The GSenses project aims to develop a system capable of evaluating vision and audition through games played on a smartphone. By keeping track of these two senses, if a sudden change is noticed, actions can be taken to try to prevent further consequences.

### Motivation

Changes to vision and audition quality can be sudden, if these changes are detected early, they might be reversible or consequences might be avoided. Despite this fact, clinical visits are usually sparse. By being able to constantly monitor their own vision and audition senses, the users can notice sudden changes on their performance earlier and seek for medical help, perhaps avoiding worse problems.

## Solution

For the system to be truly effective it is important to provide the user with the ability and motivation to perform this tests frequently. As such, games were designed for each test, giving the user a more entertaining experience. Each game is purposely kept short and focuses on a specific characteristic of a sense. This allows the user to play the game frequently, without a huge time



Fig1. Distance Visual Acuity test.

commitment required, and to focus only on one sense if desired. Additionally, the system was designed to be as self-contained as possible, because all additional hardware would represent an extra cost, either economical or in complexity to the user, therefore potentially decreasing test frequency.

Following this guidelines six tests were developed, four of these are vision tests: Distance Visual Acuity, Reading Acuity, Contrast Sensitivity and Shape Discrimination, each targeting a different characteristic, and two are audition tests: Pure Tone Audiometry and Speech Discrimination. The vision

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#### Features

The purpose of the work developed is to allow self-evaluation vision and audition through gamebased tests played on a smartphone. As such four vision tests and two audition tests were developed and given a game-like setting.

#### Available Tests

- Distance Visual Acuity
- Reading Acuity
- Contrast Sensitivity
- Shape Discrimination
- Pure Tone Audiometry
- Speech Discrimination





Fig2. Distance Visual Acuity results comparison.

tests are applied to each eye separately and the audition tests require the use of a headphone set. All the tests are easy to perform and appropriate to be applied by the users themselves, without any help, in the comfort of their home.

### Results

Test procedures were conducted on ten volunteers, representing a sample of the target users. Prior to taking the test, the users were asked about known flaws of their vision or audition and this information was recorded. Then, the user performed each game available, as well as a distance visual acuity and reading acuity tests using traditional charts.

Figure 2 shows a comparison between visual acuity results obtained from the prototype-based and the chart-based test. In it, it is possible to see a good correlation between test results.

The combination of Pure Tone Audiometry and Speech Discrimination tests also presented encouraging results regarding audition problems detection. Volunteers which indicated hearing problems obtained worse results on both tests, as expected.

The reading acuity test presented inconclusive results indicating that some changes should be made in the test procedure. Contrast Sensitivity and Shape Discrimination could not be compared to the corresponding traditional test, and thus require further validation in order to obtain meaningful conclusions.

## Conclusion

GSenses is an easy to use system capable of evaluating both vision and audition. The six vision and audition tests are developed as appealing games dedicated to older people. The system is suitable to be used by the older person alone, requiring very few additional hardware (a headphone set). GSenses is a valuable tool for selfscreening of vision and audition faults while waiting for medical appointments.



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