

AUDL 4007: Auditory Perception

Laboratory session on simulating speech-in-noise perception for users of cochlear implants (CIs)

Introduction

CI users have a great deal more difficulty in understanding speech-in-noise than normal listeners. In this laboratory session, you will be performing a speech-in-noise task both with targets that are normal speech signals, and with those that have been processed to simulate something like what a CI user would hear (using *noise-excited vocoding*).

Materials

You will use a computer-based program that implements an adaptive procedure in order to find the *signal-to-noise ratio* (SNR) that allows 50% performance on a closed set speech identification task. This level is known as the *Speech Reception Threshold* (SRT). Better performance is indicated by *lower* numbers, because lower numbers mean more noise and less speech can be tolerated for a certain level of performance.

On every trial, you will hear a sentence of the type 'Show the dog where the [colour] [digit] is' where 6 colours and 8 digits are possible (e.g., *Show the dog where the red 6 is*). You will then click on one of 48 response boxes. The SNR will be adjusted on the basis of your performance. Feedback will be given in the form of a smiley or sad face. In some conditions, the target signals will be ordinary speech. In others they will be noise-vocoded (12 channels spread over the frequency range 100 Hz – 10 kHz). The masking noise will also be of two types: 1) a steady-state noise which has the overall spectrum of speech; 2) the same steady-state noise modulated sinusoidally at 8 Hz with a depth of 100%.

Method

First, determine a random order of the 4 conditions and write them into the table overleaf. You will then run yourself in the first condition as a practice run, before running the 4 conditions in order.

The screenshot shows the 'SpecifyTestOrders' window with the following settings: Targets File: S1DogNo7.txt; Masker(s) File: noises\SpchNz15s.wav; Responses: Colour + digit; Feedback: Corrective; Face Graphics: Bears; Listener Code: Lxx; Start SNR: 20; Initial step: 10; Final step: 2; Max trials: 30; Final rev's: 6; rms: 0.05. Arrows point from the text on the right to the Targets File, Masker(s) File, and Listener Code fields.

When you start the program, you will see a GUI like the one at left. You will pick the targets with the drop-down menu at top left (either **S1DogNo7.txt**, which is normal speech, or **NV_S1DogNo7.txt**, which are the same sentences noise vocoded). You will also pick the masker from the drop-down menu just below that, either **noises\SpchNz15s.wav** (steady-state noise) or **noises\SpchNz15sAM8.wav** (amplitude-modulated noise). Also make sure to enter your initials for the Listener Code. Change no other value!

Run yourself through the 4 conditions. There is no point in trying to think too hard about the response when you are not sure. Go with your initial impulse.

Observations

Your results files can be found under 'Documents\AUDL4007Results'. There are two files generated for each test, both of them being .csv files which can be opened in Excel. One of them has the trial-by-trial record of the test (similar to the files you analysed from SHaPS, when you measured frequency selectivity and gap detection), and the other some summary values. You probably only need to look at the summary files (indicated by '_sum' in the name). The file names indicate which masker was used, and the time of the test, for example:

Lsr_GUI_SpchNz15sAM8_28-Feb-2012_14-03-45.csv

Don't use the result of your first (practice) run. The crucial outcome parameter is labelled *uRevs*, which is the mean level of the final reversals in the adaptive track (once the final step size has been reached).

target	masker	SRT

You will plot your results along with the rest of the class on the white board.

Things to think about

Make a sketch of what you think the amplitude-modulated waveform would look like. For a given masker, which type of target sentence led to better performance? For a given type of target, which noise masker led to better performance? Why might that be?