Cognate Overview

Cognate is the project name for a simplified speech 'synthesizer' for use with Cochlear Implants in cases where the CI recipient is not getting functional speech recognition using existing speech to CI algorithms.

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Overview

Most current research is done to improve speech recognition for spoken English. However, for pre-lingually deafened patients who have a cochlear implant late in life, basically after childhood, the ability to hear speech is very limited. Cognate is a proposed alternate 'English' encoding systems that might be simpler to learn, that would translate written English, not spoken English. Late implant CI recipients do not distinguish speech sounds well, but it is not known if non-speech sounds can be differentiated, and if so, whether they can be used to create a functional language.

The research will use a structured 'audio' synthesizer that the CI patient would 'hear'.   The subjects will identify sounds (percepts) that are unique. The results of the CI feedback may help choose perceptual candidates as parts of speech. These would be analogous to letters or phonemes.

About cochlear Implants

The Cochlear implant normally uses an RF coil connected to a microprocessor-based signal processor which is built into a hearing aid like device. The signal processor converts sounds (speech) into appropriate CI encoded signals, then sends that information across an RF coil to an implanted receiver (not shown). The receiver decodes the signal and generates electrical stimuli that activate the auditory nerve fibers.

For the cognate research, the standard sound processor is replaced with an alternate research signal processing unit called a CCi-Mobile. The CCi-Mobile was developed at UT Dallas and is recognized by the FDA for "non-clinical" experimental investigational use with the approval of an Institutional Review Board (IRB). The CCi-Mobile uses the same encoding scheme and works in the same manner as a CI signal processor with the transducer and receiver. The CCi-Mobile configuration used will be one of

several standard configurations and is shown below.
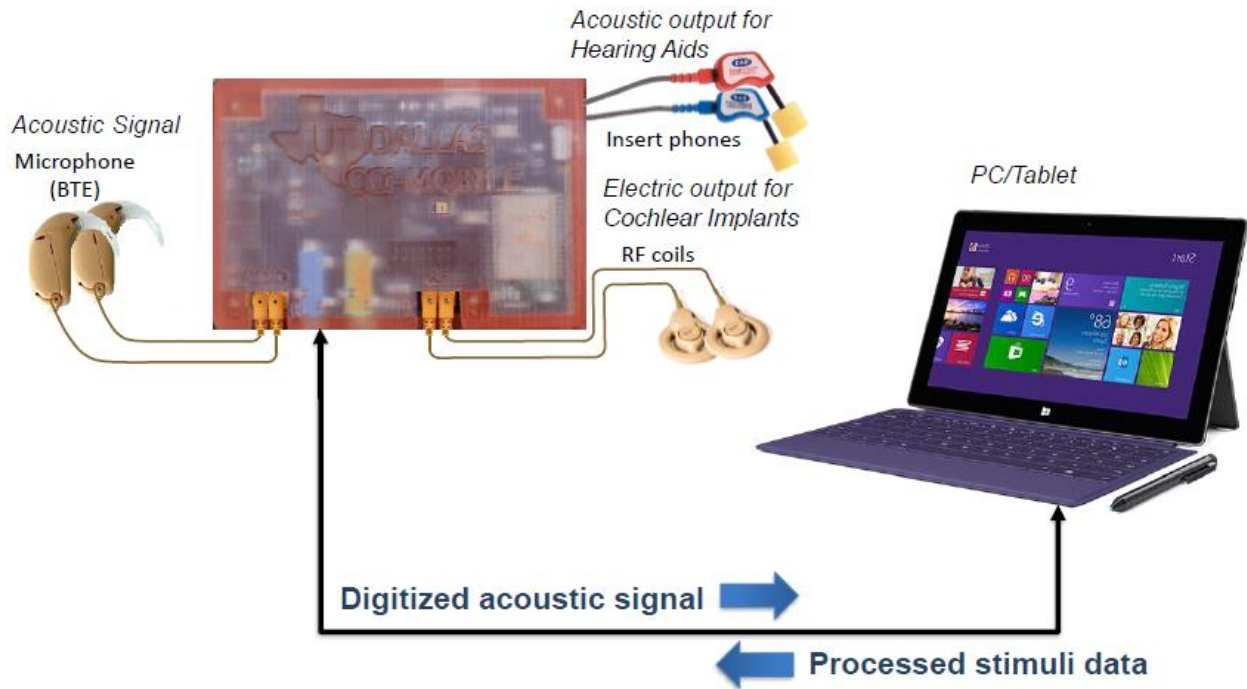
The CCi-Mobile has a computer interface that enables synthesized percepts (CI equivalent of a sound) to be converted to CI signals (electrical pulses) and delivered to the subject. The device was developed to allow researchers to try alternate algorithms that improve speech recognition.   For cognate, the input is a computerized synthesizer rather than a microphone, and the goal is to evaluate both speech-like and non-speech synthesized percepts.

The cognate synthesizer sends synthesized CI signals to the CCi-Mobile; simultaneously generates an acoustic 'equivalent' that the tester can hear, and outputs a visual display of the signal on the screen. The cognate synthesizer is software based, and has mouse input, keyboard input and midi control surface inputs. Any of these inputs can be used to control the synthesized output.

The midi interface has rotary knobs and buttons. Midi will be the primary input used by the subject. The search history and results will be recorded.

Midi control surface.

Purpose :

Phase one of the cognate test is to search for sets of distinguishable 'percepts' for potential use in a simplified phonemic system.

- A number of normal hearing subjects will try the system to evaluate work-flow , use-ability, and to establish baseline values for defining sound differences. Tranche 1.
- A number of subjects with CI implants that have good speech recognition will be tested to establish a baseline for patients in which speech recognition is known to be functional. The same metrics for workflow, use-ability, and sound differences will be measured. Tranche 2.
- At various times the program may be modified if defects are encountered or if preliminary data suggests additional options to evaluate.
- A number of subjects with CI implants that have sound perception but not speech recognition will be tested. Tranche 3.
- Subjects may be retested to establish baseline variability.

Subject Participation:

Subjects must have good visual acuity.

Will have no confounding or concomitant medical issues except for deafness.

Must be fluent reading and writing English.

Must be computer literate.

Must be able to understand and perform assigned tasks.

The implanted CI device type must be compatible with CCI-Mobile.

Notes :

- 'English' is used to mean spoken language. Studies will be in English but results may be applicable in other languages.
- 'Sound', 'hear' and other terms are used for both CI and normal speech and hearing although not always technically correct.
- Text from the web, a cell phone message, or tv closed captioning, or the output of a speech recognition system could be used as input to a 'cognate' speech synthesizer. This project is looking for opportunities and roadblocks related to this goal.