

# Developing a Protocol for Acoustic Analysis of Disordered Speech

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## Purpose

- To develop a protocol for analyzing the **intelligibility** of **disordered speech** by evaluating the clarity of consonants produced within a list of words that include all 24 consonants in Standard American English in most of their **contextual positions** (word positions, proximity to vowels and other consonants, in stressed/unstressed syllables).

p, b, t, d, k, g, f, v, θ, ð, s, z, ʃ, ʒ, h, tʃ, dʒ, m, n, ŋ, w, j, l, r

## Rationale

- A research protocol is needed for the purpose of requesting **Institutional Review Board** (IRB) permission to collect and analyze data from human research subjects.
- Methodology at every step, including the equipment used, is important for the experiment to be **reproducible**.
- Need a formal protocol to design an effective study whose results are useful to the clinical field of **speech-language pathology**.
  - Speech-language pathologists (SLPs) assess and treat motor speech disorders that lead to difficult to understand speech.
    - This can be an outcome of brain injury, strokes, neurological diseases (such as Parkinson's or Multiple Sclerosis), toxicity, and is also a side-effect of many medications.
  - In order to provide therapy, we must first assess the disorder so we can determine if treatment is needed and have a **baseline**.

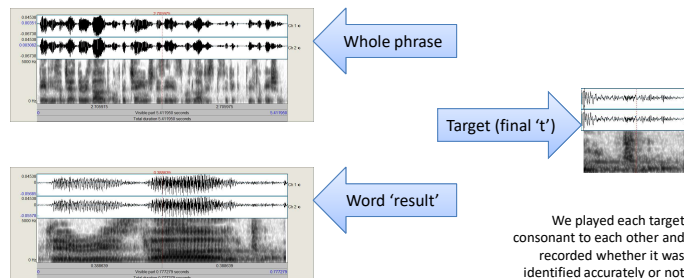
## Methodology

- Goal: To evaluate the clarity of consonants produced in words within phrases.
- The problem is that after recognizing the word, a listener can identify most consonants accurately even if they are not produced clearly.
  - E.g., 'administration' – we want to judge the accuracy of the production of the **d** in that word, but a listener can understand the word even if the **d** is missing or distorted, so can recognize it as a **d**. *Need to remove the word context.*
- Segmenting** a word using acoustic analysis software (PRAAT) we can extract mini files of each consonant that can be played individually to **naïve listeners** attempting to identify the sound without the context of the word to rely on.
- Each research assistant (RA) recorded and segmented two phrases that included a total of 20 target consonants.
  - Example phrase (with 11 targets):

*Did he suggest the result of the changed disease was largely specific to this location?*

suggest	suggest	result	result	result	changed	disease	largely	specific	specific	location
sag dʒest	sag dʒest	rɪ zʌlt	rɪ zʌlt	rɪ zʌlt	tʃeɪndʒd	dɪ zɪz	ˈlɑːdʒli	speɪˈsɪfɪk	speɪˈsɪfɪk	lɒʊˈkeɪʃən

- Analyzed 120 target consonants produced by **typical** (not disordered) speakers.



## Results

- Developed & practiced the procedures (protocol)
- Each consonant (extracted from a word in a phrase) was played to a naïve listener, and accuracy of identifying the correct consonant was determined.
  - The percent itself isn't relevant for the current aim (although the fact that it wasn't 100% was expected and is useful information).
- The exact steps (methodology) were documented and feasibility of replicating with a much larger data produced by **clinical populations** was determined (it is!).
- Some considerations we discovered along the way included needing training on extracting the target sounds, standardizing tracking them in notes, and presenting them randomly to a listener not already familiar with the specific phrases. The protocol was adjusted to reflect these.

## Impact

- We expect to be able to use the results of this project to (1) submit a protocol for IRB approval of the full research project analyzing disordered speech; and (2) to have the methodology in place to proceed with analyzing the clinical data.

### Benefit to us (students): Bridging research and practice

- Exposure to research in our field (research design, research purpose and impact, preparing to work with human subjects)
- Get to use skills we developed in our undergrad training (acoustic analysis, working with disordered speech)