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0.1. Main Ideas

- What are some of the ways that speech is studied in phonetics
 - Some general uses of speech information in forensics
- Give an overview of how speech information could be used in cases of identity, crime investigation, and law.

1. Earwitness identification

- When a perpetrator is heard, but not seen, how do we identify them?
 - History of earwitness testimony
 - Guidelines for fair use
 - Evidence about its effectiveness

1.1. Charles Lindbergh's Famous case

- Charles Lindbergh had a young son who was kidnapped from his home in 1932.
- Ransom money was demanded. He heard a voice
 - On the phone
 - Also in the cemetery where the ransom was delivered
- Charles Lindbergh went to the meeting place with a doctor, and dropped off the money, and picked up his son.
- The child was found, dead, and he was murdered **before** the ransom was paid
- An individual, Bruno Hauptmann, a German immigrant, was arrested for the crime.
 - The voice that Charles heard was accented: English with an accent.
 - Bruno was captured 2.5 years after the kidnapping.
 - He was asked by police to say what Lindbergh had heard in the cemetery
 - “Here doctor, over here.”
 - Charles Lindbergh was disguised as another officer in the room at the time.
 - He testified that the man had the same voice.
 - The suspect was convicted and executed for this crime.

1.2. Guidelines for Fair Use

- Nolan (2003)

- It's an extensive list (29 separate points) for best practices.
- They need foils who match in age, pitch range, presence of a speech disorder, sex, regional accent/ethnicity, etc.
- Use 'mock' witnesses to ensure that suspect's voice does not sound more threatening.
- Interestingly, even when you do earwitness identification properly, there is little evidence to show that it is effective, especially over a long period of time.
 - After 3 weeks, the percentage of correct identification is only 51%. After 5 months, this drops to 13%.
 - Earwitness identification is not enough to convict someone of a crime.

2. Expert speaker identification

We have a recording of a speaker, and we bring in an expert in phonetics, or speech, to make some deductions about the nature of the speaker. We want to identify a speaker from a sample of speech.

- **U** sample: Unknown voice from a piece of evidence (video, wiretap, voicemail, etc.)
- **K** sample: known voice of a suspect, who is possibly in custody already.
- This task is to evaluate whether $\mathbf{U} = \mathbf{K}$, and perhaps also offer a degree of matching.

2.1. Methods of Speaker Identification

- **Impressionistic**
 - Detailed transcription/comparisons (analytical)
 - How similar on a scale (holistic)
- **Instrumental:** Human-compared spectrograms, pitch-tracks, other acoustic measures (e.g. f1, f2)
- **Automatic:** artificial intelligence techniques used to identify voices.

2.1.1. Impressionistic Approaches

- Sample questionnaires for a forensic phonetician would ask about vowels, prosody, nasality, non-fluencies, etc.
 - creakiness, breathiness, etc.

2.1.2. Instrumental Approaches

- Unlike the impressionistic approach, the instrumental approach takes actual measurements of the voice.
- Can look at fundamental frequency in similar recordings
- We can also look at characteristics of how people pronounce vowels
 - F1, F2, etc.
 - We can compare this data between the perpetrator and the suspect for more evidence.

2.1.3. Automatic Approaches

- How did the FBI use automatic speaker recognition to identify whether or not Osama Bin Laden is the same person in each recording?

3. Speaker profiling and utterance analysis