Elicitation and analysis of a robust word misperception corpus in Spanish

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Motivation

Speech misperceptions consistent across listeners can give valuable insights into human speech perception and can be used to refine and evaluate computational models of speech perception. Contrasting with previous work [1, 2, 3, 4] which focused on anecdotal reports of individual 'slips of the ear', we propose the laboratory elicitation of 3000+ robust Spanish word misperceptions in noise. We conduct a phonetic analysis on the confusions presented, as well as introduce a novel categorisation scheme based on the amount of information recruited from the masker present in the confused word.

Methods

Speech materials

3962 high frequency, 1-3 syllable Spanish words recorded by two male and two female talkers.

Maskers

SSN: Speech-shaped noise
BMN1: Speech modulated noise
BMN3: 3-talker babble mod. noise
BAB4: 4-talker babble
BAB8: 8-talker babble

SNR ranges were set for each of the above maskers based on [5] as well as pilot tests, and range from 1 to -4 dB for informational and -3 to -13 dB for energetic maskers.

Procedure

Adaptive techniques which prune tokens that are unlikely to lead to consistent confusions yielded a 2.6-fold increase in interesting confusion discovery rate over earlier non-adaptive techniques [5, 6].

Listeners

173 young adults (monolingual in Spanish or bilingual in Spanish/Basque) screened up to 20 blocks of 100 tokens each. A maximum of 15 listeners heard the same token.

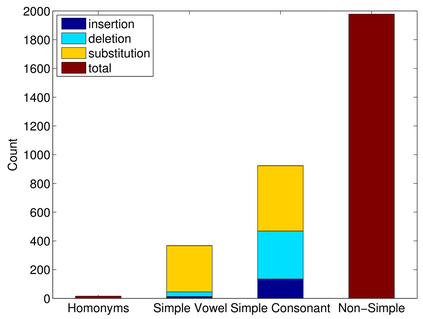
See [7] for more details on elicitation and analysis of the corpus in its initial state.

Outcome

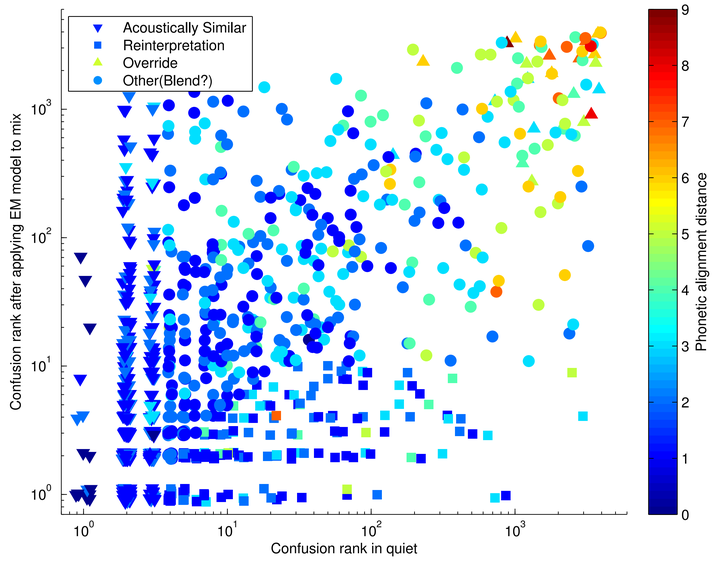
- **308 157** responses to **53 039** different tokens were collected.
- **3270** 'interesting' confusions with minimum listener agreement of 6 of 15.
- Interesting token discovery rate: **9.6** per listener hour.

Segmental errors

- The taxonomy is an extension of [1].

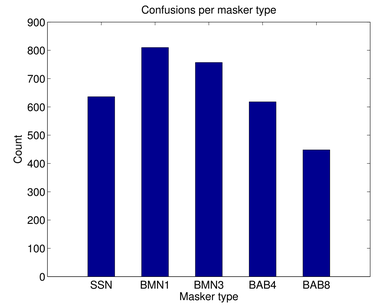


Automatic classification of confusions



- Confusions ranked in quiet (rq) and after applying EM model (rEM) [8]
- 3-state 10 mixture triphone HMMs with cochleagram representations
- Acoustically similar: $rq <= 3$
- Reinterpretation: $rEM <= 10$ & $rEM <= rq/2$
- Override: confused word can be found in babble

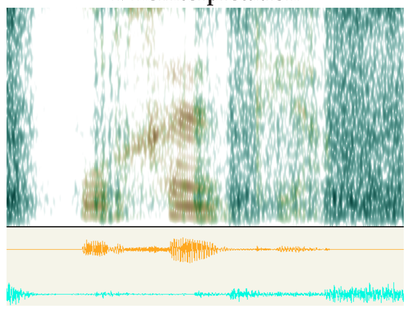
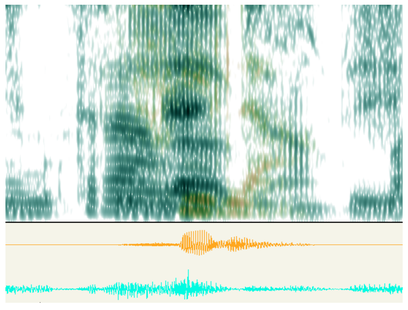
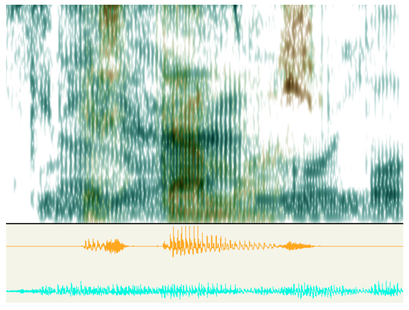
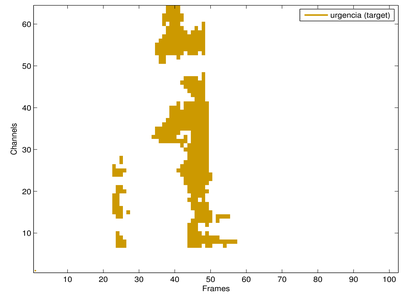
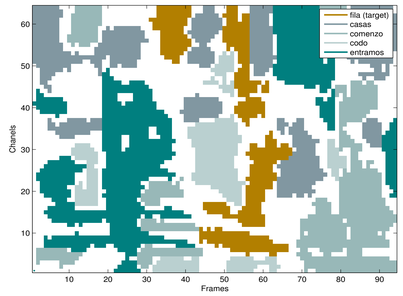
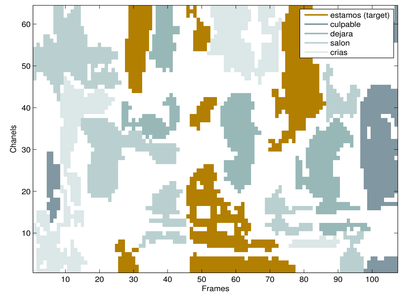
Confusions Vs. Masker



Discussion

- Microscopic perception models such as the missing data recognizer [8] and the glimpse decoder [9] can be helpful in identifying the origin of confusions.
- In turn, robust speech misperceptions help refine computational speech perception models.
- Follow-up listening tests will determine which properties of the target and masker combination lead to the misperception.
- The corpus will be released to the community as an open resource.

Speech-noise interactions: how much of masker appears in confusion?

Category	I. Reinterpretation	II. Override	III. Blend
			
			
Confusion	/urxenθia/ ↦ /muxer/ (11)	/fila/ ↦ /entramos/ (14)	/estamos/ ↦/kristal/(10)
Masker	BMN1 @ -9.6 dB	BAB4 @ -2.9 dB	BAB4 @ -0.2 dB
Other responses	s, empujar, empuje, mujre	entrar	cristales (2), quien esta, crital, estamos
Info from masker	minimal	total	partial

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