Consonant confusability and its relation to phonological patterns

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Research questions

Big question: Which Cs are more similar to each other in Bengali?
1. Which Cs are more confusable in Bengali, across noise conditions?
2. Does confusability reflect other notions of similarity?
   a. Shared natural classes (PaA04)
   b. Fixed segment /-/use (K07)

How many features are shared between Cs

I examine preliminary data from a perception task to answer these Qs

Background: Consonant inventory

Fixed segment reduplication (FSR)

Substitution of one segment for a fixed segment (FS) in the reduplicant or RED (Y98, N903)

-doctor-schmctor, table-schmable

Bengali FSR (K07)

-FS is /i/, and meaning is ‘X, etc.’

—isun/ ‘iron’ → /isun ‘iron, etc.’

-‘beau/ ‘heavy’ → /beau ‘heavy, etc.’

-Except /i/-initial words, which use /i/ or /j/

-‘tual’ / ‘pulling’ → /tual ‘pulling, etc.’

-Interesting, /j/-like Cs have gradient behavior

-grain/ ‘stripes’ → /grain ‘stripes, etc.’

-33/40 (cont) errors involve identifying fricatives as stops/affricates, only 7/40 vice versa

Results: Errors in onset position

Clear condition (567, 85.7% accurate)

-Arguably the “ideal condition” for recognition

-56/81 errors were in [vol] and [asp]

-30/32 remaining errors reflect phonology:
  -20/20 [cont] errors reflect productive spirantization: 11 /p/t/ confusions, 9 /k/t’/ confusions

Noise condition (567, 67.5% accurate)

-Errors evenly spread across [vol], [cont], place

-Babble condition (567, 63.0% accurate)

-Resembles noise condition except:
  -MajPlace errors split between misidentifications as [cor] (23/50) and as [dor] (22/50)

Results: Errors in coda position

Clear condition (546, 59.7% accurate)

-Even in quiet, 143/220 errors were in [asp]; likely reflects [asp] neutralization in coda (ARA08)

Noise condition (546, 35.9% accurate)

-More errors reflect added percep of loud burst

-Babble condition (546, 31.1% accurate)

-Resembles noise condition except:
  -Huge increase in [vol] errors: 120

Results: Summary of errors

-Some errors reflect productive Bengali phonology: /p/ w/ spirantization, /s/ merger

-Rampant aspiration errors across conditions reveals neutralization in coda (Cba04)

-Less extreme case seen in Hindi (ABA08)

-Pink noise adds a percep of a louder (often higher-freq) burst

-MinPlace and MajPlace are resilient: few errors in clear condition

-cf. English, where manner and voicing are significantly more resilient than place (Cba04)

Methods

Comparison to Shared Natural Classes

Are Cs that share the most features also the most confusable?

-Highest SNC scores:
  -/d/a, /t/a, /d’/a, /t’/a (all .86-.87)
  -/s/a, /s’/a, /s’’/a, /s’’’/a (all .65-.67)

-Confusability in onsets:
  -Clear: /p/ /t/ (11), /d/ /t/ (8), /k/ /g/ (8)
  -Noise: /p/ /t/ (15), /d’/ /t’/ (14), /d/ /g/ (10)
  -Babble: /p’/ /t’/ (16), /t’/ (13)

-Confusability in codas:
  -Clear: /d/a /d’/ (18), /t’/ (15), /s’/a /s’’/a (14)
  -Noise: /d’a/ /d’/ (19), /t’/ (18)
  -Babble: /d’a/ /d’/ (20), /t’/ (15), /s’’/a /s’’’/a (14)

-No, only /t’/ had a high SNC similarity score AND confusation rate

Comparison to FSR avoidance

Are Cs that avoid /i/ the most in FSR also the most confusable with /i/?

-Highest % /i/-avoidance in FS REDs:
  -/i/ (79%), /i’/ (61%), /i’’/ (55%)

-Confusability with /i/ in onsets:
  -Clear: /d/ /t/ (8), /d’/ (3), /i’/ (2)
  -Noise: /d/ (15), /i’’/ (3), /i’/ (2)
  -Babble: /i’’/ (13), /d’/ (4), /i’’/ (2)

-Confusability with /i/ in codas:
  -Clear: /i’/ (20), /i’’/ (11)
  -Noise: /i’’/ (21), /d’/ (14), /i’’/ (12)
  -Babble: /i’’/ (18), /d’/ (15), /i’’/ (14)

-Yes, /t’/ had both the highest /i/-avoidance rates and some of the highest confusion rates with /i/

Conclusions

Which Cs are more confusable in Bengali, in noise and in quiet?

-Cs that alternate/merge
-Cs contrasting in [vol]
-Cs contrasting in [asp]
-Place, in noise and babble

Does confusability reflect other notions of similarity?

-Not clearly related to SNC
-Related to FSR patterns

Further questions

-Data from more listeners (in prog.)
-Statistical analysis (incl. correlations)
-Is confusability the cause for phono. patterns, or vice versa?
-Or is similarity a separate notion that phonology appeals to?

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