

Perception-induced sound change and the identification of plosives in the coda: a cross-linguistic study

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Ohala (1989, 1993a,b) claimed that the source of sound change may lie in misperceptions which can be replicated in the laboratory in language-neutral conditions. Chaoshan Min Chinese has been reported to merge /at/ with /ak/ before a more general sound change merged /t/ with /k/ in the coda. Native speakers of Chaoshan, which has unreleased /p k ʔ/ in coda position, of Zhangquan Min Chinese, which has unreleased /p t k ʔ/ in its coda, and Dutch, which has released /p t k/ in its coda, participated in a forced-choice coda stop identification task. The mixed-effects analyses showed that the preceding vowel ([i u a]) and Place of Articulation of the coda ([p t k ʔ]) affect participants' identification of unreleased final stops. First, there were higher confusion scores for [at] → [ak] than for [ak] → [at] in all three languages (Table 1). The negative coefficients indicate the higher confusion rates of [at] with [ak] than of [ak] with [at].

Table 1: Frequencies and percentages of misperception in the pairs [at] → [ak] and [ak] → [at], and their coefficient represents the asymmetry of [ak]→[at] in the three languages.

| Misperceptions | Chaoshan | Zhangquan | Dutch |
|----------------|------------------------------|-----------------|-----------------|
| [at] → [ak] | 962/1133 (81.7%) | 418/826 (50.6%) | 102/294 (34.7%) |
| [ak] → [at] | 121/1039 (11.6%) | 204/691 (29.5%) | 44/234 (18.8%) |
| Asymmetry | -3.754** (.127) ¹ | -916** (.110) | -899** (.214) |

Second, [at] is more confusable with [ak] than with either [ap] or [aʔ] (Table 2), as again shown by the negative coefficients, which have [k] as the reference. The negative coefficients indicate the lower numbers of misidentifications of [at] as either [ap] or [aʔ] (Table 3).

Table 2: Frequencies and percentages of misidentified codas for [at] in the three languages.

| Misperceptions coda [t] | Chaoshan | Zhangquan | Dutch |
|-------------------------|-------------|-------------|-------------|
| [k] | 962 (54.4%) | 418 (45.2%) | 102 (53.1%) |
| [p] | 442 (25.0%) | 299 (32.4%) | 68 (35.4%) |
| [ʔ] | 363 (20.5%) | 207 (22.4%) | 22 (11,5%) |
| | | | |

Table 3: Regression coefficients of misperceiving [at] as [ak] in relation to misperceiving [at] as [ap] or [aʔ] in the three languages.

¹ Standard errors are given in parentheses.

| [at] | Chaoshan | | Zhangquan | | Dutch | |
|-----------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|--------------------|
| perceived coda | [p] | [ʔ] | [p] | [ʔ] | [p] | [ʔ] |
| Misidentification compared to [k] | -.335** (.076) | -.703** (.085) | -.778** (.057) | -.975** (.062) | -.405** (.157) | -1.534** (.235) |

Finally, there was a negative effect of [a] compared to [i u] on the identification of the coronal and velar articulation places of the coda. Tables 4 and 5 both single out [at] as being more frequently misidentified as [ak] than [it] and [ut] are as [ik] and [uk], respectively.

Table 4: Frequencies and percentages of misperceptions of coda [t] as [k] after three vowels in the three languages.

| Misperceptions of [t] as [k] | Chaoshan | Zhangquan | Dutch |
|------------------------------|-------------------|-----------------|-----------------|
| [a] | 962/1133 (84.9%) | 418/826 (50.6%) | 102/294 (34.7%) |
| [i] | 303/658 (46.0%) | 165/719 (22.9%) | 37/185 (20.0%) |
| [u] | 1013/1302 (22.2%) | 235/842 (27.9%) | 16/349 (4.6%) |

Table 5: Regression coefficients of misidentifications of [t] as [k] after [a i u] in the three languages, with [a] as the reference.

| [t] → [k] | Chaoshan | | Zhangquan | | Dutch | |
|-----------------------------------|--------------------|--------------------|--------------------|-------------------|-------------------|--------------------|
| Vowel | [i] | [u] | [i] | [u] | [i] | [u] |
| Misidentification compared to [a] | -1.822** (.113) | -2.982** (.106) | -1.235** (.113) | -.973** (.104) | -.754** (.221) | -2.403** (.284) |

In conclusion, this cross-linguistic study yielded strong evidence that [t] is the least stably perceived segment whose identification is moreover negatively affected by preceding [a], with a confusion bias to [k]. This supports a perceptual account of the historically documented sound change in Chaoshan, lending credibility to Ohala's scenario of perceptually motivated sound changes. We recognize that such changes do not represent the only or even the most common type of sound change.

References

- Ohala, J. J. (1989). Sound change is drawn from a pool of synchronic variation. In L. E. Breivik & E. H. Jahr (Eds.), *Language change: contributions to the study of its causes* [Series: Trends in Linguistics, Studies and Monographs No. 43] (pp. 173-198). Berlin: Mouton de Gruyter.
- Ohala, J. J. (1993a). Sound change as nature's speech perception experiment. *Speech Communication*, 13, 155-161.
- Ohala, J. J. (1993b). The phonetics of sound change. *Historical linguistics: Problems and perspectives*, 237-278.