Language-specificity and experience-dependence of phonetic adjustment to talkers

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Human listeners adapt to newly-encountered talkers with impressive rapidity. In the past 15 years, this process has been intensively examined using a paradigm in which listeners hear ambiguous sounds which can be disambiguated by invoking existing lexical knowledge [1]. In such studies, a form midway between /f/ and /s/, for example, will be learned as /f/ if heard in words like *giraffe*, as /s/ if heard in words like *horse*, but will remain ambiguous if heard in nonwords such as *liff* or *liss*. The learning generalizes to other words with the same phoneme, enabling adaptation to new talkers on first encounter, and is stable across position in exposure words. Crucial for the present work is that such learning has been attested in both European and non-European languages, and can be successfully applied in a second languages: L2 [2-9].

In one such study, successful L2 adaptation was accompanied, unexpectedly, by failure of the same listeners (regular users of both languages) to adapt in the native language: L1 [7]. The participants were long-term emigres (averaging 22 years in the L2 environment, but still using the L1 if only with family). This finding could reflect the participants' higher age than in other L2 studies, or some aspect of the emigre situation; or, interestingly, it could indicate that talker adaptation mechanisms in a language need regular practice for optimal operation, and talking with long-known family does not require adaptation, whereby no practice occurs.

We here test this latter explanation in another group of bilinguals who are younger and not emigres, but may potentially have a similarly asymmetric number of conversational partners in their two languages: heritage language users. Again, both L1 and L2 listening were tested in the same participants; these were 24 users of Mandarin and English, average age 22.2 years, with Mandarin as language of the family and English as language of the environment.

The English and Mandarin stimulus sets were balanced for phonological acceptability in each language, and both sets had successfully induced perceptual learning in other listeners. For each language, pre-tests established a maximally ambiguous percentual mix of /f/ and /s/, which was then substituted for either /f/ or /s/ in word-medial position in exposure-phase words such as *traffic* vs. *gossip*, or *bu4fa3* 'illegal' vs. *kuan1song1* 'loose'. All participants took part in both English and Mandarin test sessions, at least 14 days apart; language order was counter-balanced. In each session, participants first performed a lexical decision task as training phase, in which the ambiguous sound replaced either /f/ (inducing learning that this sound should be interpreted as /f/) or /s/ (learning it to be /s/). They then carried out a phonetic categorization task, in which they heard 5 tokens along a continuum from a near-endpoint /f/ to a near-endpoint /s/, each 30 times, in randomized order. Perceptual learning would be revealed by expansion of the trained /f/ or /s/ category. Each participant was trained on one sound per language; the trained category was the same across languages for half the group, different for the other half. At study outset, participants filled in an extensive language use questionnaire.

Figure 1 shows the results of the phonetic categorization experiment in each language. A significant perceptual learning effect can be seen with the English materials, $F(1, 22) = 4.47$, $p < .05$, but with the Mandarin stimuli, the same listeners showed only very small distancing of the category boundaries, and this was not statistically significant, $F(1, 22) = 2.46$, $p > .1$.

Analyses of the questionnaire data showed that 23 of the 24 bilinguals reported English as their dominant language, 91.7% reported talking always or mostly English with friends and acquaintances, and 86.3% reported talking English only or regularly at work. On the other hand, 83.3% reported talking Mandarin only or regularly with relatives. We conclude that our results support the hypothesis that the mechanisms enabling perceptual adaptation to talkers need a regular supply of novel conversational partners; they cannot be maintained in working order if the only available interlocutors are the ones you have been talking to your whole life.

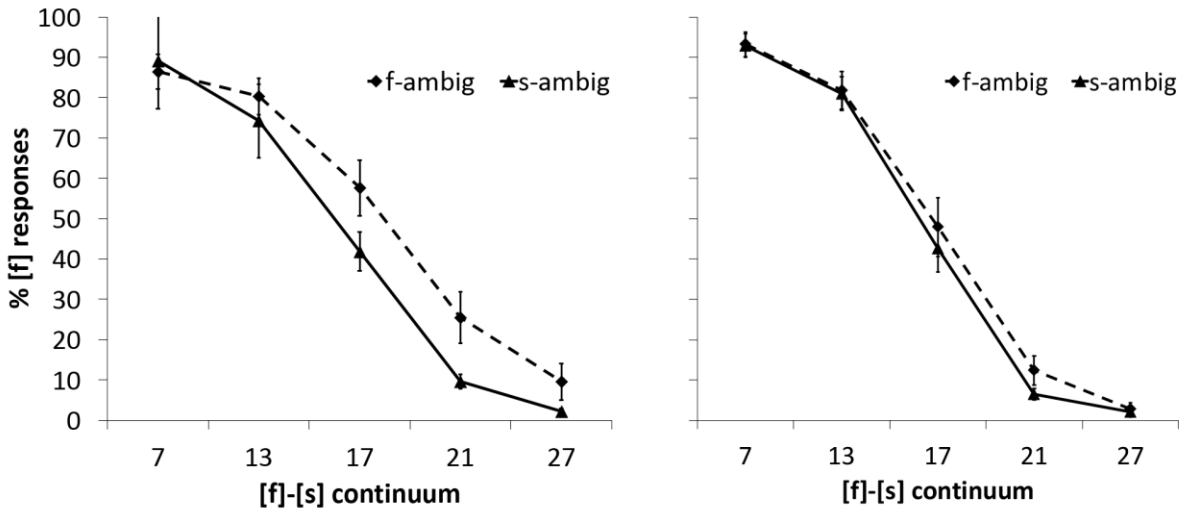

Figure 1. *Phonetic categorization results in English (left) vs Mandarin (right) by the same group of bilingual listeners as a function of training condition. The vertical axis shows % f judgements; the horizontal axis shows the tested 5 points along a 41-step continuum from [f] at the left to [s] at the right. In the English experiment, the training has caused the [f]-[s] category boundaries for the two groups, who heard the ambiguous token replacing [f] vs. [s] respectively, to shift significantly apart from one another; i.e., there has been category boundary readjustment. The difference in the Mandarin experiment is insignificant.*

Acknowlegement

This research was supported by the Australian Research Council (DP 140104389).

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