5aSCb30. Perception of non-native consonant length in naïve English listeners

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English speakers are sensitive to phonetic length (Pickett & Decker, 1960) but do not maintain a phonemic length contrast (Hayes, 2002). This study examines English speakers' ability to discriminate and identify intervocalic consonant length in Finnish non-words. The consonants were manipulated for length and half of the participants were given brief written instruction regarding the Finnish length contrast. In an AX discrimination task, participants responded to increasing contrast ratio gradiently; however, the instructed group performed significantly better than the uninstructed group. Proficiency in any second language aids contrast detection in those receiving no instruction. In a forced-choice identification task, participants showed no evidence of boundary effects; however, the instructed group performed significantly more like native Finnish controls. Again, second language proficiency aids in consonant length detection. The present results indicate that information about and attention to a novel contrast, along with second language experience, aid processing in novice listeners. Given that learners can eventually maintain native-like contrasts, these factors may be influential in the initial formation of L2 phonological representations and support phonetic level of processing (Werker & Tees, 1984), intermediate to non-linguistic acoustic processing and phonemic processing, at which acoustic duration becomes a phonetically relevant cue.
INTRODUCTION

Languages like Finnish, Italian, and Japanese maintain a contrast for consonant length that can be difficult for English speakers to learn, as it is not a native phonemic contrast. Cross-linguistically, duration has been shown to be the primary cue to this distinction (Hankamer et al., 1989; Lahiri & Hankamer, 1988; Lehtonen, 1970; Ylinen et al., 2005). While segmental length does not constitute a phonemic distinction for English speakers, it does play a role in the production and perception of segments and words in English (Klatt, 1976; Lisker, 1957; Oller, 1973; Repp, 1978; Umada, 1977), particularly for the identification of prosodic boundaries (Pickett & Decker, 1960, Fougeron & Keating, 1997; Keating 2006; Byrd et al., 2006; Byrd & Choi, 2010) and voicing distinctions (Lisker, 1957). Despite this sensitivity English speakers do not maintain a phonemic contrast for length and learning the contrast can be difficult (Hayes, 2002).

The current study focuses on English speakers’ ability to discriminate and identify a non-native consonant length contrast. Given that this ability generally increases with exposure (Hayes, 2002; Heeren & Schouten, 2008; Kato, 2002; Takeuchi, 2010; Ylinen et al., 2005) and that learners can eventually acquire a contrast (MacKain, 1981), we investigate two questions: (1) What is the initial state for length perception in completely naïve listeners? (2) Can minimal instruction about consonant length contrast, and resulting attention to the cue, adjust perception in the direction of native-like ability? To investigate these questions, three groups of listeners performed a speeded AX discrimination task and a speeded forced-choice identification task on disyllabic Finnish non-words (e.g., /hupo/-/huppo/) produced by a native Finnish speaker and subsequently manipulated for intervocalic consonant length.

EXPERIMENT 1

Native English-speaking participants were randomly divided into two groups. The first group was informed they would hear words in an unknown L2 (No-Instruction), while the second group was informed they would hear words from Finnish which can distinguish words based solely on consonant length (Instruction). A third group of native Finnish speakers served as controls (Native). Participants from all three groups completed a speeded AX discrimination task in which the contrast between the word pairs ranged from 0% of average singleton/geminate contrast ratio (i.e., consonants of same duration) to 200% of average singleton/geminate contrast ratio (i.e., twice the normal contrast). The contrast ratios generated a 6-step continuum with steps of 50%. Participants listened to stimulus pairs and were instructed to respond by pressing one of two buttons on the computer keyboard, “S” for same and “D” for different.

Results

Logistic mixed-effects regression was used to model the responses (same vs. different) resulting in a significant interaction between contrast and condition. As can be seen in Figure 1a, native Finnish speakers respond well above chance beginning at the natural phonological contrast ratio (Contrast 3), as expected. English speakers in both groups do respond to increasing contrast between word pairs, but do so in a more gradient, phonetic fashion. The instructed English group does significantly better at detecting the contrast in a more native-like fashion than the group who are not given any information regarding the contrast. The two English-speaking groups obtain significantly different probabilities beginning at Contrast 5, which is beyond an average Finnish contrast ratio.

Additionally, if we subdivide the No-Instruction group by proficiency in a second language (L2) an effect approaching significance emerges which shows that participants who are proficient in an L2 have a perceptual advantage in hearing the contrast (Fig. 1b). This seems to indicate that for the most naïve listeners previous experience detecting non-native contrasts aids perception of varying phonetic input.

EXPERIMENT 2

Participants from the same three groups in Experiment 1 also completed a speeded forced-choice identification task in which the intervocalic consonant length of each stimulus item ranged from 75% of an average singleton to 200% of an average geminate. This generated a 10-step continuum with 25% steps. Participants listened to each stimulus and were instructed to respond by pressing one of two buttons on the computer keyboard, “S” for short and “L” for long. The order in which the participants completed each experimental task was counterbalanced.

Results

Logistic mixed-effects regression was used to model the responses (short vs. long) resulting in a significant interaction between length and condition. As can be seen in Figure 2a, native Finnish speakers respond well above chance beginning at the natural geminate length (Length 4), as expected. English speakers in both groups do not show evidence of a phonological boundary, responding again in a linear, phonetic fashion. The instructed group does significantly better at detecting the consonant length, at Length 8 (i.e., 150% of an average Finnish geminate) around which there is an anomalous dip for the No-Instruction group.

As in Experiment 1, proficiency in an L2 (or lack thereof) affects the detection of consonant length in English speakers (Fig. 2c). The results indicate that for those not proficient in another language, being told about Finnish gemination is quite beneficial and for those who are proficient in another language being told is still beneficial but less so. This indicates that, in the absence of previous experience detecting non-native phonetic cues, information about a particular feature becomes more influential.
DISCUSSION

The results indicate that naïve English listeners can and do detect gradation in consonant length and consonant length contrast ratios. However, as expected from previous findings (c.f. Hayes, 2002), they do not appear to show a phonological boundary effect. Interestingly, we find that their ability to detect length and contrast is significantly enhanced by the simple knowledge that consonant length is important in the foreign language. This provides evidence that, while native English speakers have no phonological category for consonant length, their initial perceptual boundary for it is still quite flexible and can be pushed to a range closer to the phonological boundary of native Finnish speakers. This finding is similar to that of Janson and Schulman (1983) who found that telling Stockholm dialect speakers that they were listening to English rather than Swedish words significantly improved their ability to discriminate between two vowels which were merged in their dialect. Information about and attention to meaningful features appear to play a role in a listener’s ability to identify non-native contrasts. The anomalous dip in the responses made by the No-Instruction group in Experiment 2 could be the result of these listeners noticing the increase in consonant length, but not knowing what to do with it, as this is not an important within-word feature in their native language. The results of the identification task provide evidence that, while native English speakers have no phonological category for consonant length, they can compare the percept to some reference point and their ability to do so can be enhanced which moves them closer to the performance of native Finnish speakers.

Previous experience with a second language appears to influence how English speakers begin to deal with fluctuating consonant lengths. In Experiment 1, we find that having proficiency in an L2 gives listeners (who are not told about the Finnish length distinction) an advantage in detecting the native phonological boundary. It may be that previous experience and practice in detecting other non-native contrasts provides listeners with some benefit of detecting different contrasts in another unknown language. In a sense, they are more aware of and tuned to fine phonetic detail. In Experiment 2, we see the same effect; listeners who are not told about Finnish length distinction, but are proficient in another language, are better at detecting consonant length. Thus, information about non-native contrast and previous second language experience are interacting.

The results of this study taken together provide a view of a novice language learner’s foray into learning the phonological categories of a second language and lend support for the phonetic level of processing proposed by Werker and Tees (1984). This level of processing is intermediate to non-linguistic acoustic processing and phonemic processing and it is at this level that the phonetic cue of duration begins to take on meaning for the listener. Werker and Tees (1984) illustrated this using a non-native place of articulation contrast, while here it has been demonstrated for the temporal cue of consonant duration. In their work, an attentional manipulation did not result in successful discrimination of the contrast, indicating the task, rather than attentional allocation, could explain their results. The
results reported here indicate that instruction and attention to the features involved in a particular non-native contrast can and does enhance perception, perhaps by allowing listeners to assign importance to the new cue. This in effect replicates the results of Hisagi and Strange (2011) who found that naïve English listeners could discriminate three types of Japanese temporally-cued contrasts well above chance when the three contrast types were presented in separate blocks with detailed instructions about what to listen for. Additionally, the present results indicate that even in the absence of overt information about a particular cue, previous experience with any foreign language helps novice listeners in processing novel contrasts. This is particularly interesting because it indicates that simply having practice in detecting the contrasts of any other language results in enhanced perceptual ability. It may be that previous practice in accessing and using the phonetic level of processing allows for easier subsequent access to it.

CONCLUSIONS

At the most novice level, the detection of cues to phonological distinctions in a second language may be facilitated by experience, attention, and information about the particular contrast. As phonetic learning has been shown to occur during L2 acquisition (Williams, 1979), the evidence here, taken with the idea of a phonetic level of processing, seems to provide a missing link between the fact that novice learners do not initially maintain a phonological contrast, but can eventually do so with either time in the target language country (MacKain et al., 1981) or auditory-perceptual training (Motohashi-Saigo & Hardison, 2009). In order to better understand how phonetic processing progresses toward phonemic processing, it would be interesting and necessary to compare these data with those of more advanced English-speaking learners of Finnish. Moreover, similar investigations of this type could also be done for other non-temporal contrastive features such as vowel quality or tone to better understand the role of phonetic processing and how it may be used by listeners as a means of forming representations of phonological contrasts in a second language.

REFERENCES


