

## How attention to speech pitch is guided by its linguistic function

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This paper compares listeners' attention to segmental information with attention to pitch variation with three different levels of linguistic contribution (none, postlexical information such as sentence mode, and lexical information). Previous research has shown that pitch information is attended to less than segmental information, even for listeners of a tone language (Cutler & Chen, 1997; Ye & Connine, 1999). More importantly, a number of studies have reported similar results for listeners of a tonal and a non-tonal language in a number of tasks: Repp & Lin (1990) showed that both listener groups were equally slowed down by task-irrelevant pitch variation when classifying segmentals. Cutler and Chen (1997) showed that both listener groups were equally good or bad at discriminating monosyllabic stimuli differing in segmentals or tone. These results suggest that attention to speech pitch is driven by low-level acoustic processing and not by linguistic function. However, since these studies used monosyllabic stimuli, listeners from an intonation language may have interpreted these pitch movements as signaling postlexical or paralinguistic information (e.g., surprise, boredom), see 'Nine ways of saying yes' in Crystal (1995). Therefore, it is still unknown to what extent linguistic function guides attention.

In this paper we therefore investigated (a) whether Dutch listeners attend to pitch information at all if it does not signal a communicative function, (b) whether they are even more attentive to pitch movements that are linguistically meaningful (i.e., postlexical information such as declarative vs. echo question) and (c) whether such an increased attention to linguistically relevant pitch movements is comparable to a tone-language speakers' attention to lexical pitch movements.

Sixteen native Dutch and sixteen Mandarin Chinese listeners performed a speeded ABX categorization task on disyllabic trochaic nonwords. The first syllable was produced with a pitch fall (signaling Tone 4 for Chinese listeners and a declarative for Dutch listeners). This was compared to either a pitch rise on the first syllable (signaling Tone 2 for Chinese listeners but had no linguistic function for Dutch listeners) or a pitch rise on the second syllable (signaling Tone 2 for Chinese listeners but an echo-question for Dutch listeners). There were two conditions, match trials (i.e., token X matched either token A or B in both segmentals *and* suprasegmentals) and ambiguous trials (i.e., token X matched token A in segmentals but token B in suprasegmentals). Results showed that Dutch listeners overwhelmingly classified along the segmental dimension, irrespective of trial type (96% of the cases,  $p > 0.2$ ). However, they attended more to postlexical information (pitch rise on the second syllable signaling an echo question) than to non-linguistic information (pitch rise on the first, unstressed syllable) - as shown by an increase in reaction times in ambiguous trials relative to match trials ( $p < 0.05$ , see Figure 1). Strikingly, in terms of reaction times, this attention to postlexical pitch information was comparable to Chinese listeners' attention to potential *lexical* pitch information ( $p > 0.2$ , see Figure 2). However, Chinese listeners classified ambiguous stimuli along the suprasegmental dimension in 40% of the cases (compared to 99.1% in match trials,  $p < 0.005$ ), when the pitch rise and fall were both realized on the first syllable. This indicates a stronger role of lexical pitch information for Chinese listeners compared to postlexical pitch information for Dutch listeners.

To conclude, identical pitch movements draw varying amounts of attention, depending on their linguistic function in the language. The combined results of our forced choice and response latency measures point to a step-wise increase in attention

to speech pitch, from non-linguistic (which goes unnoticed despite its peculiarity) to postlexical to lexical.

## References

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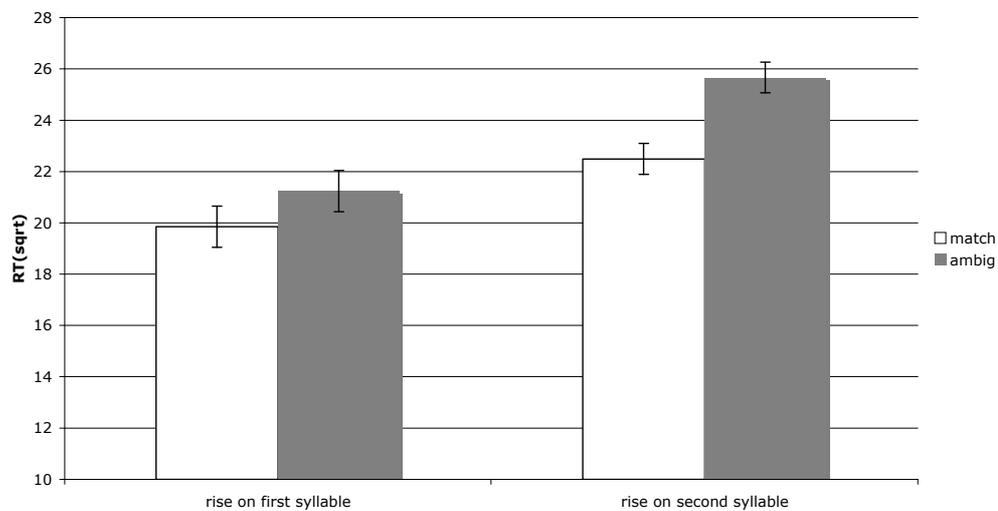


Figure 1. Reaction times (square-root transformed) for Dutch listeners in the non-linguistic pitch condition (left bars) and in the postlexical pitch condition (right bars). Whiskers represent standard errors.

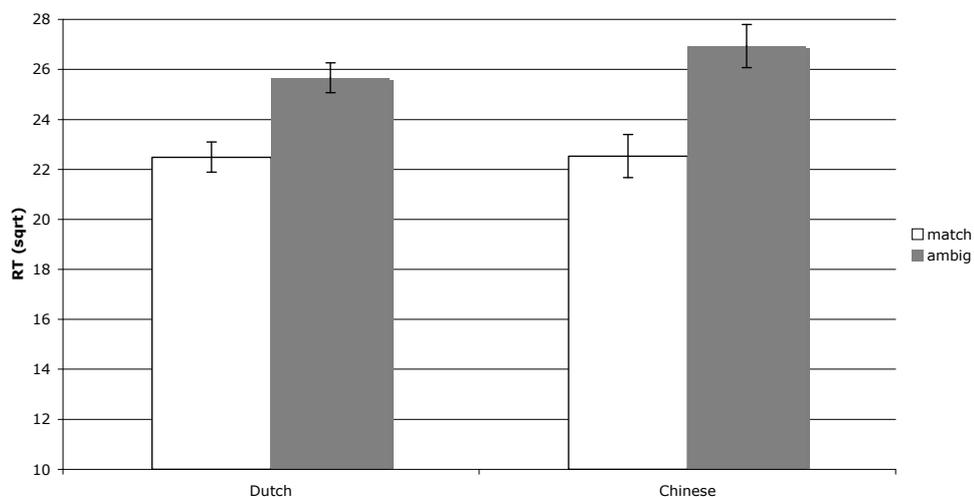


Figure 2. Reaction times (square-root) to postlexical pitch information (right bars, Dutch listeners) and to lexical pitch information (right bars, Chinese listeners).