Differences in pitch discrimination for German and Catalan listeners: Do Catalan listeners judge the pitch of German vowels differently?

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It was found that different factors affect pitch perception and discrimination accuracy, i.e. musical education [Kishon-Rabin 2001, Schon et al. 2004, Rauscher and Hinton 2003], the temporal structure of the stimuli [Houtsma and Rossing 1986] and pitch memory [Gaab and Schlaug 2003]. But nearly no research has been done on possible cross-linguistic differences in pitch perception and discrimination.

To answer the question a speech perception experiment was conducted to examine (1) the possible existence of pitch discrimination differences in different language families and (2) the influence of vowel spectra on pitch discrimination. Listeners for this pitch perception experiment were (1) German listeners and (2) Catalan listeners (therefore examining Germanic and Romance languages). Listeners were pre-selected by their degree of musical eduction. The experiment was carried out as 2AFC (two-alternative forced choice) for three different German vowels. These vowels show the same vowel height, but differ in their tense/lax distinction (/i/ vs. /i/) and roundedness (/i/ vs. /y/). The pitch of each vowels was shifted from ±10Hz in 2.5Hz steps. Listeners had to judge if the first or the second vowel of the pair was higher in pitch. The stimuli were randomly paired.

The difference in spectral structure (roundedness) showed significant pitch differences in both language families. The tenseness differences were not significant in both language families. The pitch difference in roundedness can be explained by an influence of “sibilant pitch” on the pitch judgements. Sibilant pitch is the pitch impression of whispered vowels (which therefore have no harmonic pitch impression). Since it is impossible to control if the listener in a pitch discrimination experiment is judging the pitch based on F0 or a sibilant pitch impression a possible interaction can not be excluded. The sibilant pitch of /i/ was found to be 450Hz higher compared to /y/ [Traunmüller 1987] and could therefore induce an interaction of the pitch judgement.

Musical education significantly influenced sensitivity to pitch differences for German listeners, the values are in accordance to results found in literature. Surprisingly Catalan listeners show an insensitivity to even large F0 differences (10Hz correspond to about 2 semitones at the given F0) and judge the pitch differences in vowels mainly based on the categorical vowel identity. That means that a given vowel was always heard higher in pitch, even if the other vowel showed a +10Hz F0. More surprisingly, this insensitivity in pitch discrimination for Catalan listeners was not dependent on musical education: the correlation between F0 difference of the stimuli and pitch judgements was high for the German listeners but fairly low for both musically educated and musically not educated listeners.

It is not exactly clear what mechanisms cause the existing different pitch responses pattern for the two language families. The design of a new pitch discrimination experiment will be presented which will examine the underlying mechanisms and clarify the causes for the differences in pitch perception, i.e. testing the possible existence of different pitch perception mechanism for speech and musical complex tones.
References


