

## Assessing young children's musical enculturation: A novel method for testing sensitivity to key membership, harmony, and musical metre

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### ABSTRACT

#### Background

Western adults with no formal music training have implicit knowledge of the tonal and metrical structure of music within their culture (Hannon & Trehub, 2005; Tillmann, Bharucha, & Bigand, 2000; Trainor & Trehub, 1992), but little research has explored the developmental trajectory of these abilities. Here we test Western preschool children's knowledge of Western key membership and harmony. We also test their ability to perceive simple metrical structures typical of Western music and to complex meters common in some foreign, but not Western, musical systems (London, 1995).

#### Aims

To examine 4- and 5-year-old children's enculturation to both tonal and metrical structure, using a novel, video-based testing paradigm.

#### Method

In the tonal structure task, on each trial 4- and 5-year-old children watched two videos, each of a puppet playing a melody or chord sequence, and gave a prize to the puppet that played the better song. One puppet played a standard sequence that ended according to rules of Western harmony, whereas the other played a deviant version that was either entirely atonal, or that ended on an out-of-key note or chord, or on an unexpected harmony within the key.

In the metrical task, we developed a beat synchronization test for children based on the Beat Alignment Task created by Iverson and Patel (2008). The beat synchronization task uses the same computer puppet game as the tonal task. Children judged which of two puppets was a better drummer, when one puppet drummed in synchrony with the beat of a musical excerpt and one puppet was either out of phase or out of tempo with the beat. Excerpts had either simple or complex metric structures.

#### Results

In the tonal structure task, 5-year-olds selected the standard version significantly more often than predicted by chance when the deviant was entirely atonal for both melodies,  $t(23) = 2.60, p = .02$ , and chords,  $t(23) = 3.82, p < .01$ , and when the deviant ended in an unexpected key for both

melodies,  $t(23) = 3.56, p < .01$ , and chords,  $t(23) = 3.21, p < .01$ , but not when it violated the expected harmony but remained within the key for melodies,  $t(23) = 1.57, p = .13$ , or for chords,  $t(23) = .85, p = .41$ . Four-year-olds performed at chance in all conditions (all  $ps > .05$ ).

In the metrical task, five-year-old children selected the puppet whose drumming was correctly aligned with the beat of the music significantly more often than predicted by chance when the excerpts were in simple metre,  $t(23) = 4.60, p < 0.01$ . However, performance was not significantly different from chance when excerpts had complex metric structure  $t(23) = 0.35, p = 0.73$ . These observations were true in both the phase error condition and the tempo error condition. Testing of 4-year-old children is currently underway.

#### Conclusions

These results suggest that enculturation to tonal structure in Western music increases between four and five years of age, and that harmonic sensitivity develops later than knowledge of key membership. The results of the metric task suggest that 5-year-old children are sensitive to both tempo and phase information when assessing a musical beat, but only in culturally typical timing structures. In both cases, this novel testing paradigm has proven to be an age-appropriate and engaging method of obtaining musical judgments from young children. It also has the potential to assess other aspects of musical sensitivity which have thus far proven challenging to measure with this age group.

#### Keywords

development, enculturation, harmony perception, metric processing, rhythm

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