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The origins of dance in infancy: Characterizing the development of dance during the first two years of life

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Dance is a universal human behavior, and a crucial component of human musicality. What drives and limits the earliest ages dance can appear? We aimed to characterize infants' earliest dance behavior, asking: When do infants begin to spontaneously dance to music, and how variable is this age of onset? What predicts whether an infant can dance: Is this simply a function of gross motor development? Does the nature of infants' dance change over the first two years, or remain stable? Parents of infants age 0-24 months (N=278) completed an online survey to characterize their infants' dance behavior. We asked parents to consider movements that were produced by the child, occurred more when music is playing, and "looked like dance, to them". We found that dance begins early in life, and at a wide range of ages across individuals: from 1 to 20 months (M = 9.5m). Once children can dance, they dance frequently, as a near-daily part of their behavioral repertoire. Motor development was not a major determinant of ability to dance: It did not account for more variance than age alone. Infants' dance changed dramatically with age: For example, infants increasingly used iconic gestures ($\chi^2(1)=45.4$, $p<0.001$), and danced more frequently ($F(1)=16.4$, $p<0.001$). These data provide an initial characterization of the developmental origins of dance, informing broad questions about the origins of human musicality and highlighting the prominent role of dance behavior in infancy.

KEYWORDS: *music cognition, development, infancy, movement, dance*

Subjective beat perception develops through adolescence and is related to phonology

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Rhythm and beat perception are critical for synchronized musical movement (e.g., walking, dancing) and may also influence some aspects of speech perception. It is assumed that listeners experience the beat as a quasi-isochronous pattern of prominent time points, inferred from regularly occurring events in the musical surface, and that they can sustain this percept even in the absence of events that reinforce it. However, few studies have attempted to disentangle the surface information from the internal beat percept, and no studies to our knowledge have done so with young listeners. In this experiment, we presented listeners aged 4-23 with a rich musical excerpt that induced one of two beat patterns, followed by a prolonged ambiguous phase during which they heard a rhythm that could match either of the two beat patterns. In a final probe phase, listeners indicated whether a drummer did or did not match the beat of the music. Younger children (age 4-7 years) did not perform above chance. Children aged 8-17 and adults accurately matched the probe with the induced beat, and children aged 12-17 performed with no statistically significant difference from adults. Since previous studies have suggested that rhythm ability is related to phonological awareness, we also administered

the Comprehensive Test of Phonological Processing (CTOPP). A hierarchical regression revealed that performance in our task was a significant predictor of phonology, accounting for 4.4% additional variance, above and beyond age (19% variance) and music/dance training (2.6% variance). Overall, these results suggest older (but not younger) children are capable of self-sustained and long-lasting beat perception, which is related to phonological language ability. However, self-sustained beat skills do not become adult-like until adolescence, suggesting that beat perception may have a more gradual developmental trajectory than has been previously assumed.

KEYWORDS: *beat, meter, rhythm*

Effects of Musicianship on Hypermetrical Interpretations of Rhythms

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Previous research reaches different conclusions on whether non-musicians or musicians are more likely to perceive the beat of a rhythm at a slower tempo. To investigate this, participants completed two tasks for thirty monotonic rhythms in either a *Fast* tempo (150 bpm, 400 ms inter-beat-interval) or *Slow* tempo condition (75 bpm, 800 ms inter-beat-interval). Their first task was to determine their preferred tempo of the rhythms; their second task was to tap along with what they felt was the beat of each rhythm. Participants did this both with and without an isochronous metrical context. Finally, participants' musical background was assessed using the Goldsmith's Musical Sophistication Index (GMSI). The ratio of the determined best tempo to the tapped tempo was calculated for each participant and rhythm. Of interest were ratios of 0.5 and 0.25, where participants tapped at half the tempo and a quarter the tempo of the beat unit, a phenomenon called hypermetrical interpretation. Overall, participants produced more hypermetrical interpretations in the *Fast* tempo condition and for rhythms presented with metrical context than without metrical context. Moreover, participants with higher GMSI scores produced more hypermetrical interpretations than participants with lower GMSI scores, but only in the *Fast* tempo condition.