Music in the Social and Behavioral Sciences: An Encyclopedia

Development

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Music is a defining component of human experience that relies on a range of complex perceptual and cognitive abilities. Despite the fact that music has universal social and communicative functions, there are diverse musical systems throughout the world, and listeners from different cultures possess tacit knowledge of the musical “rules” that govern their specific musical system. Humans are not born with this culture-specific knowledge, but rather they begin life with basic musical preferences and abilities that are rapidly modified through experience and interaction with a structured musical environment. Examining the development of pitch and rhythm processing capacities as they become increasingly adult-like can provide a better understanding of the nature of human musicality.

Pitch

Without ever taking a music lesson, a typical adult listener can usually remember and accurately reproduce a repertoire of melodies, detect wrong notes, use context to form expectations about which pitches are most likely to occur, and respond meaningfully to emotion conveyed in a musical passage. Knowing the rules that govern musical pitch structure in one's culture may play a critical role in forging social bonds between members of a group, whether those ties are between lovers, friends, or caregivers and their young children.

Early abilities. A listener's earliest exposure to pitch information occurs in utero. During the third trimester of pregnancy, a fetus can hear its mother's voice, the voices of others, music, and other environmental sounds. Even though sound is attenuated in the high-frequency range (500+ hertz, or Hz) by the mother's abdomen, the prosodic contour of language and music is heard and discriminated by fetuses in the third trimester. Newborns prefer listening to the sounds they heard in utero, such as their native language or familiar melodies. In the months after birth, infants can detect changes in pitch as small as a third of a semitone, even though their detection and discrimination thresholds are elevated relative to adults until childhood.

Very early in life, infants are sensitive to musical and linguistic pitch contour, the pattern of rising and falling pitch in a sequence. Young infants prefer infant-directed (ID) to adult-directed (AD) speech and song, in large part because of the exaggerated melodic contours and music-like features of ID speech. Young infants respond in emotionally appropriate ways to ID speech contours (i.e., rising and bell-shaped contours attract and maintain attention, while falling contours soothe), and they respond differentially to different types of ID song, such as the low-pitched, slow-tempo lullabies versus higher-pitched, faster play songs. The ability to categorize melodies based on contour emerges by 5 to 8 months. For example, in a conditioned head-turn paradigm where infants are reinforced for turning their heads when they hear a novel stimulus, infants make head turns in response to a novel-contour melody but they ignore (or treat as same) transpositions or same-contour variations of the standard melody. Thus, melodic contour appears to be a defining feature of pitch for the youngest, least experienced listeners.

Infants are also sensitive to the consonance and dissonance of tone combinations. As early as a few days after birth, infants exhibit listening preferences for consonant over dissonant stimuli (such as two-tone intervals or musical passages). Likewise, 6-month-olds exhibit superior detection in the context of consonant than dissonant pitch patterns.

These early biases are somewhat surprising given that definitions of consonance and dissonance are not universal but vary across cultures and/or historical periods. One possibility is that the auditory system of young infants is sensitive to low-level fluctuations in amplitude, or “beating,” and infants find this aversive. However, recent work suggests that adults' subjective ratings of pleasantness are uncorrelated with beating. Instead, pleasantness ratings are correlated with harmonicity (the extent to which the acoustic spectrum of a sound conforms to a single harmonic series), and harmonicity ratings correlate with experience (i.e., years of music training). This implies that a preference for consonance may increase over the course of development with experience.

Experience. As young listeners become more familiar with musical structures in their own environment, they begin to perceive pitch patterns through a culture-specific lens. For example, Western adult listeners are very likely to notice when a wrong note is out of key, but they are more likely to “miss” a wrong note that conforms to the key or implied harmony. This is presumably because experienced listeners use implicit knowledge of musical key and harmony to generate expectations, and in-key violations conform to adults' expectations more than do out-of-key or out-of-harmony violations. At 8 months, infants are equally good at detecting in-key or out-of-key changes, and it is not until childhood (age 8) that children begin to show the adult-like pattern. This suggests that knowledge of Western musical key and harmony develops gradually over the course of childhood. This claim is corroborated by evidence that reaction times and brain responses of adults and children (older than 5) are faster and larger for harmonically expected chords than for harmonically unexpected chords.

Experienced listeners can recognize a familiar melody regardless of the pitch level at which it is performed, an ability that depends on sensitivity to relative pitch structure. Even though young infants are sensitive to melodic contour (described above), a reliance on relative pitch may emerge gradually over the course of development. Evidence supporting this possibility comes from studies showing that absolute pitch (the ability to name a specific note in isolation) is more common in individuals who began music lessons prior to 6 years of age. Similarly, when listeners compare melodic variations of a standard, younger children's similarity ratings are more strongly influenced by the variation's absolute pitch level than by its relative pitch pattern (i.e., specific sequence of intervals), whereas older children's and adults' ratings are more influenced by relative pitch than by absolute pitch level. Thus, even though listeners are sensitive to both absolute and relative information, part of Western musical enculturation may involve more heavily weighing relative over absolute pitch information.

Constraints. While young listeners must acquire knowledge of the rules that govern music in their culture, so too must music conform to the processing limitations of young listeners in order for musical traditions to continue from generation to generation. The presumption is that universal human auditory capacities will shape the musical structures that can or cannot be learned. Despite cultural variation, most musical traditions obey certain constraints such as the presence of pitch stability and the consistent division of the octave into five to seven hierarchically organized, discrete pitches. Musical scales are typically comprised of unequal spacing instead of equally spaced intervals, which lead to more distinct interval categories and thus reduced cognitive load. Consistent with this hypothesis, even 6-month-olds are more sensitive to violations of an unfamiliar scale that has unequal rather than equal scale steps. Another potentially universal constraint on pitch structure may arise from auditory stream segregation, where large and sudden pitch changes in a sequence can give rise to the perception of distinct streams or sound sources. Auditory stream segregation has been observed in young infants, and it may account for the preponderance of small steps in melodies throughout the world, particularly those performed for infants and children.

Rhythm and Meter

Rhythmic behaviors such as dancing, marching, clapping, and chanting are universally observed at significant social and cultural events around the world (such as concerts, sporting events, and military functions), suggesting that such behaviors are critical to human musicality. Knowledge of rhythm and meter enables experienced listeners to recognize, remember, and reproduce familiar tunes and rhythms (such as “shave and a haircut”); to form dynamic expectations about when future events should occur and when a pause or a breath is appropriate (through sensitivity to temporal grouping or phrase structure); and to move in synchrony with music and with others (through sensitivity to meter).

Early abilities. Rhythmic information is available in utero, and it is the prosodic rhythm of speech that newborns recognize when they exhibit preferences for their native language. As young as 2 months of age, infants can discriminate simple sequences on the basis of rhythmic pattern or sequence of durations (i.e., long-short-long versus long-long-short), and they can discriminate a rhythm from a perfectly isochronous sequence (the same interval repeating like a metronome). Young infants can tell when an isochronous sequence speeds up or slows down. By 7 to 9 months, infants can categorize stimuli on the basis of rhythmic pattern—they make head turns in response to sequences that alter the rhythmic pattern, but they do not respond when sequences preserve the rhythm but have altered tempo or pitch level. Infants also prefer listening to a musical passage containing extra pauses between phrases over a passage containing extra pauses within (i.e., interrupting) a phrase. Thus, a rudimentary sensitivity to grouping and rhythm is apparent early in life.

Perhaps most surprising is the mounting evidence that the very youngest listeners may perceive aspects of meter well before they are capable of dancing or moving in synchrony with music. For example, 7-month-olds appear to categorize rhythms on the basis of implied meter. After hearing multiple rhythms that conform to the same meter (such as duple or triple), they only increase interest in (dishabituate to) a new rhythm that violates the established meter. At this age, infants are also sensitive to the correspondence between movement and rhythm. If parents bounce their infants to an ambiguous rhythm (bouncing every two or three beats), infants subsequently prefer a version of that rhythm that matches the bouncing. Recently, sleeping newborns were shown to exhibit larger brain responses when a downbeat was omitted from a drum sequence than when an upbeat was omitted, suggesting that at least a crude sensitivity to beat is present at birth.

Despite the early sensitivity to rhythm and beat, the ability to synchronize precisely with the beat develops quite gradually. Infants are much more likely to spontaneously move rhythmically to music than to speech, and the tempo of their movements tends to follow the tempo of music. However, these early rhythmic movements are not phase-locked to the beat. In fact, it is not until approximately 4 years that the beginnings of precise synchronization to music have been observed. Some evidence suggests that social functions of synchronized movement to music may begin to emerge at this age. Preschoolers will exhibit increased pro-social helping behavior after moving in synchrony with their peers and adults than after doing another equally physical but nonsynchronized, nonmusical activity (although recent evidence suggests this association with pro-social behaviors is not cross-culturally universal).

Experience. Despite the ubiquity of dancing to music, important differences exist in the ways that cultures organize time and synchronize with music. While most Western music contains isochronous meters (such as 4/4, with even beats at all levels of the metrical hierarchy), many cultures (for example, throughout the Balkans, South Asia, and Africa) have nonisochronous meter with a primary beat that alternates between short and long intervals standing in a 3:2 ratio. Western adults have difficulty detecting metrical disruptions (such as an extra note) in a nonisochronous folk melody, but they readily detect the same size disruptions in an isochronous melody. By contrast, adults from Bulgaria, Macedonia, Turkey, and India are equally sensitive to rhythmic changes in either type of meter, suggesting that prolonged exposure to exclusively isochronous meters might lead to the difficulties experienced by Western listeners. Six-month-old Western infants are equally good at discriminating isochronous and nonisochronous melodies, an ability that declines only in Western infants for nonisochronous meters by 12 months of age. Exposure to nonisochronous meters—even for only a few minutes a day—can allow young listeners (1–6 years) to maintain discrimination of nonisochronous rhythms. However, by late childhood and adulthood, such incidental exposure is insufficient for learning, suggesting that metrical knowledge becomes increasingly robust with age and experience. Thus, while the foundations of metrical perception might exist early in life, metrical interpretation may become increasingly limited to the most frequently used meters of a specific musical tradition.

Constraints. Just as listeners probably cannot learn any type of scale, basic perceptual or cognitive constraints may limit the structures that cultures adopt and reproduce. For instance, at 6 months, before culture-specific biases are evident, Turkish infants prefer simple meters. At this age infants also have difficulty detecting subtle changes to an unconventional or highly complex meter (with ratios of 7:4) that does not exist in any culture. Thus, some degree of rhythmic regularity may be necessary.

Conclusion

These emerging musical listening skills represent a complex and dynamic interaction between both innate auditory processing constraints and exposure to the music of one's own culture. Despite recent advances in research on the development of music cognition and perception, many questions remain about why and how adult-like musical knowledge emerges. For example, although it has been shown that young infants are sensitive to musically meaningful structures such as melodic contour and beat, it is not clear whether this sensitivity emerges independent of experience or benefits from prenatal or very early experience with sound. Likewise, although adult-like perception of culture-specific tonal and metrical structure has been observed by 8 to 12 years of age, the specific developmental trajectory of emerging musical abilities has not been described in detail; nor is it clear how domain-general cognitive changes during childhood might contribute to these emerging listening skills. It is possible that, just as children gradually acquire increasingly nuanced expertise about the syntax of their native language, so too do they acquire increasingly nuanced knowledge of the tonal and metrical structures of their culture.

An important question for future research is how individuals—as childhood advances into adolescence—integrate their culture-specific musical knowledge into their emerging social identities and use it to forge bonds with others. For example, college students often share information about musical preferences (i.e., favorite types of music or favorite bands) when getting to know their peers, presumably because this information conveys important social and cultural information. Much research is still needed to fully understand the rich and nuanced ways that music interacts with and contributes to the lives of young listeners.

- absolute pitch
- infants
- music
- sensitivity groups
- sensitivity
- native language
- id

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See Also:

- Cognition and Learning, Childhood
- Consonance and Dissonance
- Enculturation
- Human Behavior, Music as
- Lullabies
- Melody Processing
- Meter
- Pitch, Absolute
- Pitch, Relative
- Pitch Perception
- Plasticity
- Rhythm
- Training

Further Readings
Burnham, D. and K. Mattock. "Auditory Development." Wiley-Blackwell Handbook of Infant Development, J. G. Bremner and T. D. Wachs, eds. Hoboken, NJ: Wiley-Blackwell, 2010.
Masataka, N. "Music, Evolution, and Language." Developmental Science, v.10/1 (2007). http://dx.doi.org/10.1111/j.1467-7687.2007.00561.x
McDermott, J. H. and A. J. Oxenham. "Music Perception, Pitch, and the Auditory System." Current Opinion in Neurobiology, v.18 (2008). http://dx.doi.org/10.1016/j.conb.2008.09.005
Patel, A. D. Music, Language, and the Brain. New York: Oxford University Press, 2010.
Stalinski, S. M. and E. G. Schellenberg. "Music Cognition: A Developmental Perspective." Topics in Cognitive Science, v.4 (2012). http://dx.doi.org/10.1111/j.1756-8765.2012.01217.x
Trainor, L. J. and E. E. Hannon. "Musical Development." In The Psychology of Music, 3rd ed

., D. Deutsch, ed. San Diego, CA: Academic Press, 2013.