Infants are immersed in sound even before they are born. Their auditory system is well developed and fully functional during the last trimester of gestation allowing them to come into the world with remarkable sound perception abilities. Young infants can differentiate music on the basis of melodic, rhythmic, and timbral characteristics with a high degree of accuracy (e.g., Trehub, 2001). They discriminate melodies of different contours (Trehub, Bull, & Thorpe, 1984), rhythmic sequences of different meters (Bergeson & Trehub, 2006), and music played by different instruments (Costa-Giomi, in press). They discriminate melodies that differ in a single note (Trehub, Thorpe, & Morongiello, 1985) and sounds that differ in a single partial (Trehub, Endman, & Thorpe, 1990). It is clear that they are sensitive and perceptive listeners capable of detecting subtle changes in auditory information.

Perceiving Similarities in Music

Although we know a lot about infants’ abilities to perceive differences in the music they hear, we do not know much about their abilities to perceive similarities. Can infants perceive that the contour of a tune remains unchanged when played by a trumpet or a violin or sung by their mom or dad? Do they perceive that a melody is the same whether played louder or softer or at a faster or slower tempo? In other words, can infants perceive invariant properties in stimuli that are similar but not the same?

Identifying similarities in stimuli that are not the same is essential for the understanding of the world around us and for the efficient processing of the enormous amount of information we encounter every day (Cohen, 2003). Perceiving similarities allows us to group what we see and hear into categories. For example, we effortlessly identify an unfamiliar animal as a dog because we see that it has the typical attributes shared by most dogs. Similarly, we
know that the tune that young Jimmy is trying to play on the recorder is “Hot Cross Buns,” because despite the many mistakes and stops of his erratic performance, we recognize the essential melodic elements of the familiar tune. We can do this thanks to our recollection of previously formed categories related to animals and melodies. Although we know that adults are very skillful at categorizing visual and auditory concepts (e.g., Berger & Donnadieu, 2008), the categorization of music in infancy has remained largely unexplored.

Categorizing by Melody and Timbre

The study of categorization of melody and timbre is critical for our understanding of children’s perception and organization of music. Knowing whether young children can recognize a melody played by different instruments or identify an instrument playing different melodies may affect the way we develop certain activities in our early childhood classes. In such classes, we often present infants with multiple timbral variations of the same tune such as recordings and live performances of a song. We assume that infants indeed perceive them as variations of the same song rather than completely different songs. Similarly, in early childhood classes we often associate certain instruments or combinations of instruments with specific movements or activities. Typical examples are movement activities based on Prokofiev’s Peter and the Wolf, or directives such as “when we hear the guitar, it is time to sit down.” These activities assume that young children can recognize the instruments playing different melodies. But do they?

The results of a series of experiments with 7-, 11-, and 13-month-olds show that although infants can discriminate instruments and melodies and categorize timbre from a young age, they do not seem to categorize melody until they are 13-months old (Costa-Giomi, 2012). Infants in the two youngest groups perceived changes in instrumentation as indications that the melodies themselves had changed. Only after the first year of life, did infants show awareness that the melody was the same regardless of whether it was played by a piano or an oboe. On the other hand, even infants in the youngest age group recognized an instrument playing different melodies, suggesting that the categorization of timbre occurs earlier than the categorization of melody. Whereas melodic changes did not affect infants' recognition of the instrument, changes in instrumentation affected infants’ recognition of the melody.

In summary, these findings combined indicate that timbre is a very salient characteristic of music for infants and that, from a young age, children naturally organize musical information on the basis of timbre. In fact, timbre may be so salient during the first year of life that it may be too difficult for infants not to pay attention to it. In other words, infants’ attention to timbre may prevent them from processing melodic information in the sophisticated and flexible manner required for the categorization of melody. After all, to recognize that different instrumental renditions of a tune share the same melody, they must somehow disregard the timbral differences between them and focus on the melodic similarities. Needless to say, this is a complex cognitive task.

Focusing on Timbre

That infants are attentive to the timbre of the music they hear is not a novel finding (e.g., Trainor & Tsang, 2004). Extensive research has shown infants’ sensitivity to this acoustic property as reflected, for example, in their preferences for specific instruments and voices. Six- to nine-month-olds prefer their mother’s voice over that of another female (Standley,
1990) but 11-month-olds attend longer to the singing voice of an unfamiliar singer over that of their own mothers (Costa-Giomi, 2011). On the other hand, 8-month-olds show a preference for a single timbre rendition of a musical piece over its multitimbre version (Ilari & Polka, 2006). By the age of 6 months, infants discriminate between tones identical in frequency, amplitude, and duration but that differ in timbre (Trehub, Endman, & Thorpe, 1990) or in sound decay (Tsang & Trainor, 2002) and show the ability to remember timbral information for days (Trainor & Tsang, 2004). Trainor and Tsang found that infants had difficulty in recognizing a familiar melody when played by a different instrument, further emphasizing the salience of timbre in infants’ processing of musical information. Overall, it is clear that infants are attentive to changes in timbre in music and that such changes affect their perception of melodies.

Timbre is a salient feature also in speech according to language research conducted with infants. Houston and Jusczyk (2000) found that infants aged 10.5 months could recognize words spoken by talkers of different gender whereas infants aged 7.5 months could not. The younger infants could recognize the words only if spoken by talkers of the same gender. In other words, when the timbres of the spoken words were different, the younger infants perceive the words as being different while the older ones were able to perceive them as being the same. These results show developmental changes in the categorization of words with older infants being able to use a broader category than do the younger ones. The studies on music categorization showed similar results in the sense that younger infants could not recognize a melody when played by different instruments whereas the older infants were able to do so (Costa-Giomi, in press).

In summary, the results of music and speech research indicate that infants’ perception of auditory information, such as melodies and words, becomes more flexible as they grow. A simple change in the instrumentation of a melody or the voice of a speaker affects 7-month-olds’ ability to recognize the tune being played or the words being said. But by the second year of life, infants seem to have developed broader categories for melodies and words so that such changes no longer prevent them from recognizing the critical information embedded in the music and speech they hear. This more flexible perception allows them to learn words and melodies and, ultimately, to use music and language as effective forms of communication.

Concluding Thoughts

As educators, we must be aware that there are drastic differences in how younger and older children perceive and organize sounds. Knowing about such critical developmental changes would allow us to provide an environment conducive to music understanding and learning throughout early childhood as well as to set realistic expectations regarding the perceptual and cognitive prowess of infants. We cannot assume that young infants recognize melodies that present changes in timbre. In fact, even changes in tempo seem to reduce their success at identifying melodies (Trainor & Tsang, 2004). So, during the first year of life, when we organize activities based on multiple renditions of a melody, we may consider directing infants’ attention to the tempo and timbre of the tune rather than the melody itself. This focus lends itself very well to movement activities as movements can easily reflect the beat and the overall sound of the music. With older infants and children, on the other hand, we may consider focusing their attention to the melody itself when presenting them with multiple instrumental variations of a song, as it is during the second year of life that children become more successful at identifying tunes of different timbre.
Perceiving similarities in musical stimuli that are not the same is so critical for the understanding of music that teachers should be encouraged to provide opportunities for the development of categorization in their young students. Activities that facilitate and improve children’s perception of differences in specific musical elements are important components of early childhood classes, but activities that elicit the perception of similarities in the music they hear are equally valuable experiences.

Notes

1. Nine experiments were completed to study the discrimination of melody and timbre, categorization of melody, and categorization of timbre of 7-, 11-, and 13-month-old infants. Approximately 10 girls and 10 boys participated in each of the experiments. A novelty habituation procedure was used because of its simplicity and effectiveness in establishing discrimination and categorization. This procedure, which has been used in hundreds of categorization studies (e.g., Cohen, 2003), is based on the principle that infants attend longer to novel than to familiar stimuli. Infants are familiarized with single or multiple exemplars of a category and then presented with familiar and unfamiliar exemplars of a category as well as with members and nonmembers of the category. Longer attention to the unfamiliar exemplar or the nonmember exemplar indicates discrimination and categorization respectively. For detail information about the methodology, please see Cohen, 2003 or Costa-Giomi, 2012.

2. Teachers may support toddlers’ identification of melodies played in different timbres by organizing simple movement activities. Find (or record yourself playing) different instrumental or vocal renditions of a single song such as “Twinkle, Twinkle Little Star” or “Here We Go ‘Round the Mulberry Bush.” Record them onto a CD or digital file consecutively. Among the multiple timbral renditions of the song, also record a different tune once in a while. You may record the entire songs or just sections of the tunes. During the class, model the activity for the children after providing simple instructions. For example: “We need to sleep when we hear ‘Twinkle Twinkle.’ But we must get up quickly if we hear another song!” or “Listen to the song. If it is ‘The Mulberry Bush,’ walk around the bush [a chair would do]. But if it is another song, stand still just like a statue!” Play the CD or file that you had prepared and perform the activity with the children.

About the Author: Dr. Eugenia Costa-Giomi is professor of Music and Human Learning and Affiliated Professor in Developmental Psychology at the University of Texas-Austin.

References


