CHAPTER 25

MUSICAL DEVELOPMENT FROM THE EARLY YEARS ONWARDS

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Introduction

Music is ubiquitous in very young children's experiences (see Trehub, Chapter 24, this volume), but as children get older their experiences become more diverse. Defining the trajectories of musical development is thus complex; explaining them is still more challenging. This chapter provides a selective overview of existing evidence on children's responses to musical elements individually (pitch/harmony, rhythm/meter, and timbre) and in combination (structure, form, style, and emotion), and evaluates our understanding of musical development in culture and context, addressing theoretical challenges. The key focus throughout is on the processes of development, over short or long time spans.

Developing Musical Understanding

Pitch, Tonality, Melody, and Harmony

Pitch relationships have been the most studied in terms of children's musical understanding. Pitch includes tone chroma (individual notes), contour (high/low and patterns), and melodic and harmonic relationships between tones (tonality/tonal hierarchy) (see also Stainsby and Cross, Chapter 5, this volume). By 3 months, infants' brain responses to pitch as a musical parameter show adult-like tendencies (He, Hotson and Trainor, 2007). Infants are responsive to changes in absolute and relative pitch and show preferences for consonant combinations of notes and chords (Plantinga and Trainor, 2005; Saffran, 2003; Trehub, Chapter 24, this volume, but see Plantinga and Trehub, 2014). Labeling of pitches by note names is one way of detecting absolute pitch skills. This is more easily acquired or trained in early childhood than in subsequent years (Crozier, 1997; Takeuchi and Hulse, 1993). According to Crozier, music training that emphasizes relative pitch skills leads many children to “unlearn” absolute pitch processing skills in favor of the more important relative pitch processing (but see Trainor, 2005; Loui, Chapter 6, this volume). A second capacity relates to the psychophysical dimension of pitch height. Children aged 5 are able to detect the direction of a pitch change as upwards or downwards even when the differences are smaller than a semitone (Stalinski, Schellenberg and Trehub, 2008). However, young children are often unable to label pitch as “high” and “low” because of problems in analogical mapping between the musical and verbal concepts (Costa-Giomi and Descombes, 1996). This example illustrates how terminology for various features of music can be confusing for young children: the labels for the dimension of pitch height must be learned and take time to stabilize.

Children subsequently acquire implicit and explicit understanding of melody and harmony. Considering relationships between pitches, research has explored children’s developing sense of tonality. Krumhansl and Keil (1982) reported an increasing sophistication in differentiation between and among diatonic and non-diatonic notes from 6 to 11 years (cf. Lamont and Cross, 1994), but other studies find more stable representations across this age range (Cuddy and Badertscher, 1987), with children performing with less sophistication than musically trained adults. Training appears to accelerate the course of development (Lamont, 1998; Morrongiello and Roes, 1990). Melodic expectancy studies using both perception and singing tasks show that for children aged 5–11 the best next note in a melody is one close in pitch, whereas a pitch reversal only emerges as an appropriate note at 11 years (Schellenberg, Adachi, Purdy and McKinnon, 2002). Preschoolers can detect mistunings to conventional tonal melodies (Trehub, Cohen, Thorpe and Morrongiello, 1986), but often fail to notice transpositions and contour-preserving changes as “different” (Morrongiello, Roes and Donnelly, 1989), while out-of-harmony mistunings become detectable around the age of 7 (Trainor and Trehub, 1994). In priming tasks, both 6- and 11-year-olds make faster judgments about which vowel or instrument sound occurred on a target tone, and whether it is consonant or dissonant, when the target is a tonic and thus an expected chord (Schellenberg, Bigand, Poulin-Charronat, Garnier and Stevens, 2005).

To address the difficulties younger children have responding to experimental settings, researchers have developed innovative ways of studying musical understanding that avoid the use of sophisticated language or concepts. For instance, in a comparison task where children had to choose the best performance from two versions played by puppets, Corrigall and Trainor (2010) found that 4-year-olds do not rate out-of-key endings as any worse than in-key endings in melodic or chord sequences, while 5-year-olds rate all the out-of-key differences as worse. Both age groups find the task easier with complete melodies and accompaniments than with reduced chord sequences.

Electrophysiological methods have been used to study harmonic perception in even younger children. Jentschke, Friederici and Koelsch (2014) found similar brain responses to irregular harmonies in 2-year-old children, although not with the same consequent negative spike found in older children and adults. Corrigall and Trainor (2014) demonstrated 4-year-olds’ sensitivity to Western key and harmony structure by means of event-related potentials which involve pre-attentive processing (see also Koelsch et al., 2003). While these studies are useful in highlighting early sensitivity to harmonic features, they also indicate differences between young children’s responses to harmony and those from adults in terms of the implications of these irregularities (Corrigall and Trainor, 2014; Jentschke et al., 2014).

Converging evidence for the development of pitch understanding comes from musical production tasks. For example, Davidson (1985, 1994) showed a progression from general contour schemes in songs at 3 years of age to fixed pitch reference points with older children. Bamberger (1991) has also highlighted qualitatively different ways of understanding pitch in context. Six- to 11-year-olds without musical training organize melodies figurally into shapes, while highly trained 11- and 12-year-olds can use pitch formally in an abstract manner. Children's melodic improvisations show a similar developmental sequence: children aged 6–7 only use the first five diatonic tones, at 8–9 years prefer tones presented in the initial stimulus, and at 10–11 years created improvisations emphasizing the tonic triad; the oldest children were most likely to end with a tonic chord (Paananen, 2006a, 2006b).

In summary, very young children exhibit certain fundamental pitch processing capacities, including responsiveness to absolute and relative pitch, which become more refined and culturally specified with age. Between 4 and 7 years (depending on tasks), children exhibit an implicit understanding of Western tonality revealed by their brain responses, listening judgments, and song productions. A shift from context-dependence to context-independence in pitch relationships occurs between 6 and 11 years of age in explicit tasks (Lamont and Cross, 1994; Paananen, 2006a). Musical training accelerates the development of understanding of pitch and tonality, although often does not change it radically. Finally, there is very little research on development in these areas beyond the age of 11.

Tempo, Timing, Rhythm, and Meter

There has been less research on children's understanding of temporal aspects of music. Electrophysiological studies reveal that newborns are sensitive to the beat in simple metric sequences (Winkler, Háden, Ladinig, Sziller and Honing, 2009). This may go some way to explain why in listening tasks, little difference has been found with age or music training in detection of temporal irregularities (Drake, Jones and Baruch, 2000) or segmentation according to changes in tone duration or pause duration (Drake, 1993) between 4 and 12 years. Electroencephalography (EEG) methods reveal that 7-year-old children can extract regularities (the skill required to predict beats) at slower tempi (390 and 585 milliseconds) as well as adults, but not at faster tempo (780 milliseconds) (Cirelli et al., 2014). Five-year-old children judge puppets drumming in synchrony with the beat as "better" than those whose drumming is in incorrect tempo or phase, but only for simple meters (Einarson and Trainor, under review).

Looking at production tasks, earlier research suggested children's ability to synchronize using tapping tasks was not clearly present until the age of 4 (McAuley, Jones, Holub, Johnston and Miller, 2006). However, Soley and Hannon (2010) found that by the age of 4–8 months, infants have developed preferences for metrical structures that are familiar to their culture, and Kirschner and Tomasello (2009) found that 2.5-year-olds are able to synchronize when drumming with a social partner (as opposed to a drum machine or synthesized sound). Kirschner and Tomasello argue that the context of the study affects the results in terms of motivation, a point which could be applied to many developmental studies.

Children's invented notations of rhythms indicate differences in understanding in middle childhood, as they move from enactive action drawings to figural patterns and shapes (Bamberger, 1991). Only musically trained children can focus on absolute durations and inter-onset intervals. Children's compositions also show shifts from conventional metric patterns at age 5–8 to more speculative use of rhythm and meter at 9–11 years (Brophy, 2002; Paananen, 2006c; Swanwick and Tillman, 1986).

Certain fundamental features of temporal understanding are demonstrated relatively consistently across childhood, although others such as segmentation and the understanding (both perceptual and compositional) of more complex rhythmic ratios reveal gradual improvements with age and experience. Again, although some differences in understanding are found between children and adults, development in adolescence has largely been ignored.

Timbre

There is very little research on the development of timbre perception. One direct investigation of timbral sensitivity (Lowther, 2004) found rapid development between the ages of 3–8. Younger children make easy discriminations very accurately (e.g., comparing a triangle sound to a ratchet, or tuba to celeste), but are much less successful on more difficult comparisons (e.g., flute/clarinet). From children's qualitative responses, Lowther concluded that although accuracy increased with age, specific experiences with particular sounds are responsible for helping children make sense of timbral information.

Indirect information about timbre perception comes from research involving the priming paradigm (Schellenberg et al., 2005, experiment 2), which indicates that children aged 8–11 can discriminate between piano and trumpet sounds. Despite the lack of empirical evidence, timbre identification has often been used as an indicator of exceptional musical ability in children, being presumed to indicate a high level of auditory discrimination (Shuter-Dyson, 1999) and potential for learning (see Schellenberg, Chapter 26, this volume).

Combinations of Elements: Musical Structure and Form

Understanding musical structure depends on the ability to detect similarity and difference in the structural components of music. Plantinga and Trainor (2009) showed that 2-month-old infants discriminate familiar from unfamiliar melodies after limited exposure, so these skills are present in a rudimentary manner very early on (see also Ilari and Polka, 2006). Brand (2000) explored children's errors in learning to sing a new and unfamiliar song between the ages of 6 and 12. While older children learned the song more rapidly, all children irrespective of age or musical training made plausible errors in terms of song organization (e.g., more symmetrical phrases). Thus children attempt to organize the music they encounter into meaningful sections and familiar gestures, as in Davidson's "pot-pourri" songs (1985). Oura and Hatano (1988) found 9- to 10-year-olds with around 5 years of musical experience could reproduce a novel melody as rapidly and accurately as trained adults (and more so than inexperienced adults). Thus internalized organizing principles such as tonality or repetition are used to make sense of unfamiliar music.

Children's similarity judgments in terms of pitch and duration improve in accuracy between 5 and 11 years (Stevens and Gallagher, 2004), although higher accuracy is apparent for pitch than duration. When given the opportunity to organize musical stimuli along the dimensions of pitch, contour, tempo, rhythm, timbre, and loudness (Schwarzer, 1997), young children focus on melody-independent features such as loudness (5–6-year-olds), tempo, and timbre (6–7-year-olds), while adults use more melody-specific features like contour. Stalinski and Schellenberg (2010) found a shift from an emphasis on absolute pitch changes in early childhood to one on melodic variations in middle childhood when 5- to 12-year-olds were rating the similarity of melodic pairs. Children categorize short melodies analytically (using one musical element) rather than holistically (using combinations), and none of the younger children use pitch or contour relations. However, when real musical stimuli are used in a sorting task, surface features such as dynamics and contour as well as underlying features such as tonal structure are commonly employed by 10- to 11-year-olds (Koniari, Predazzer and Mélen, 2001).

In a study directly comparing melody/tonality and rhythm/meter, Paananen (2006a) showed that children's improvisations at age 6–7 either focus on surface (melodic/rhythmic figures) or on deep (tonal or metrical hierarchy) structures, passing through a substage of elementary coordination between the two at 8–9 years to a final substage of integration at ages 10–11. Children's invented notations also become more specific and detailed with age in relation to various musical dimensions (pitch, rhythm, and timbre), illustrating how symbolization is tied to musical understanding (Bamberger, 2006; Fung and Gromko, 2001).

This evidence is somewhat conflicting because of the variety of tasks employed. When making simple comparison judgments to artificial musical stimuli (e.g., Stevens and Gallagher, 2004), young children can focus on isolated musical elements (cf. Paananen, 2006a), prioritizing one or other features of the music at different stages (Stalinski and Schellenberg, 2010). However, with more complex stimuli or real music (e.g., Koniari et al., 2001), children are better able to combine musical elements. Although children aged 5–6 can recognize different musical elements and structures in complex tasks, older children are better able to process more complex underlying structures of music, and this is also sometimes dependent on formal training. It may take until adulthood to fully integrate different musical features in perception (Schwarzer, 1997), but again research has not explored this in adolescence.

Musical Structure and Emotion

Adults' perception of emotion relies primarily on the structural features of tempo and mode in Western tonal music (see Juslin, Chapter 13, this volume). With happy and sad musical excerpts from real music contrasting in tempo and mode, 3- to 4-year-olds are unable to distinguish them on any basis; 4- to 5-year-olds recognize emotions based on tempo changes, while 6- to 8-year-olds perform similarly to adults in recognizing emotional changes due to both tempo and mode (Dalla Bella, Peretz, Rousseau and Gosselin, 2001; Mote, 2011). Five- and 8-year-old children prefer music excerpts high in arousal whereas 11-year-olds and adults prefer those positive in valence, suggesting that different features of music are prioritized at different stages in development (Hunter, Schellenberg and Stalinski, 2011). With richer stimuli (using music and pictures), children aged 3–5 can recognize music that adults judged as happy, sad, angry, and fearful (Nawrot, 2003), although sometimes confuse fear and anger (Terwogt and van Grinsven, 1991). More research is required, along the lines of the recent study by Stachó (2006) indicating that children aged 3–6 are significantly less able to decode the emotional content of different musical performances.

Some work has also explored how children communicate emotions themselves in their own performances. Adachi and Trehub (1998) found 4- to 12-year-olds use the musical features of tempo, loudness, and pitch (increases in all of these to communicate happy versions of a melody). While Dalla Bella et al. (2001) noted that it was remarkable that 6-year-olds demonstrate full knowledge of the rules governing happy and sad emotions in music, and Morton and Trehub (2007) found 5-year-olds using the same acoustic cues as adults to identify positive or negative emotions in singers, it should be recalled that these are "basic" emotions and there is room for further sophisticated development.

Style Discrimination

Musical preferences have been demonstrated even before birth (see Parncutt, Chapter 23, this volume). Three-year-olds mainly prefer child-oriented music like nursery rhymes or television themes to adult-oriented music (Lamont, 2008), and also discriminate between different styles of classical and popular music (Marshall and Hargreaves, 2007). However, little research has directly explored developmental changes in children's understanding of style (cf. Hargreaves, North and Tarrant, 2006).

Children appear to experience phases of "open-earedness," such as in middle childhood, where they tolerate varied musical styles (Hargreaves, 1982), and "closed-earedness," such as in adolescence, where their preferences are far more constrained (LeBlanc, 1991). For example, Boal-Palheiros, Ilari and Monteiro (2006) found 9- to -11 year-olds like very unfamiliar and complex music (Boulez, Ligeti and Stockhausen) more than 12- to 14-year-olds. In adolescence, a narrow range of musical preference is an important part of self-identity (North, Hargreaves and O'Neill, 2000; Stålhammar, 2003). The "rebound of open-earedness" in early adulthood (LeBlanc, 1991, p. 37) is often also a phase where adults are seeking to acquire music, whether it be recordings or downloads (Greasley, Lamont and Sloboda, 2013). Music preferences may still convey messages about other individuals, although more subtle judgments can be made (Rentfrow and Gosling, 2006).

The rapidly changing nature of popular musical styles presents a substantial empirical challenge in this work (cf. Hargreaves et al., 2006). Furthermore, developmental effects are moderated by many other factors that influence preference (LeBlanc, 1982) including those relating to the music itself, to the listener, and to the context (Hargreaves et al., 2006) (see Greasley and Lamont, Chapter 17, this volume).

Production and Performance Skills

Generally speaking, gradual progressions are observed in various aspects of musical skill. There are individual differences in the ages at which children may show musical behaviors, which may differentiate those who succeed in performance careers from those who do not (Sloboda and Howe, 1991). However, it is generally assumed that skill develops in a fairly linear fashion in, for example, singing (Leighton and Lamont, 2006; Welch, 2006) or playing an instrument (McPherson and Davidson, 2006; see Part 6, this volume). There are few indications of qualitatively different elements in musical skill development, although the physical changes in production capacity and vocal development in adolescence represent one clear qualitative change that affects singing development (Welch, 1998).

Taking a more integrated approach, the process and product of children's compositions has been used to generate models of development (e.g., Barrett, 1996; Davies, 1992). There is evidence that early music production skills such as improvisation are shaped by gestures and body movements (Young and Rowe, 2012), and generally, children become more sophisticated and abstract in their musical compositions with age (Swanwick and Tillman, 1986). Although it has often been argued that creativity is not age dependent or phase related but rather dependent on context, general changes can be charted (Burnard, 2006). For example, early childhood is characterized by the importance of play, whereas middle childhood has wider social and educational influences, and adolescence prioritizes personal identity (see Lamont, Greasley and Sloboda, Chapter 43, this volume).

Theorizing Development

A critical issue concerns the *causes* of differences in musical understanding. Adopting an individual differences approach, one would expect differences as a function of age, gender, and prior musical experience (over short and long time spans). Most research focuses on age-related differences, although the effects of formal musical training have gained increased attention in recent years. As yet, however, there are no theoretical models of musical understanding which can explain the range of musical behaviors and understanding (cf. North and Hargreaves, 2008; Runfola and Swanwick, 2002).

Musical Development: One Thing or Many?

Many other aspects of development have clearly defined goals: for example, literacy development has an end point of being able to read. Musical development requires more careful definition since there are a number of different skills and capacities that can be included. Through experiencing music and interacting with it in generalized and effortless ways, children become socialized into the music and the musical traditions of their own culture. Sloboda (1985) drew a useful contrast between these processes of *enculturation* on the one hand and *training* on the other, which involves specialized, deliberate, and conscious activities (see also Hannon and Trainor, 2007). Formal training improves skills related to performing, composing, conducting, and other practical musical activities, and seems to have transfer effects to other domains (see Schellenberg, Chapter 26, this volume). Training also has consequences for listening skills in both adults (Gaser and Schlaug, 2003) and children (Shahin, Roberts and Trainor, 2004).

Despite the apparent appeal of the distinction between enculturation and training, many developmental music psychologists have adopted a fairly broad definition of musical competence (Deliège and Sloboda, 1996), which includes activities like singing, representations of music, perception, and composition (Hargreaves, 1996), and attempts to integrate the three areas of production, performance, and perception (Runfola and Swanwick, 2002). However, the inclusion of varied types of musical behavior within the same framework presents a major theoretical challenge. As illustrated above, differences in research findings can be ascribed to the particular task demands. For example, building a composition requires different skills and poses different challenges to listening to two notes and deciding if they are the same or different. Tasks requiring explicit knowledge also show slower rates of development than those requiring implicit knowledge (Schellenberg et al., 2005). Progress on the relative "rates" of development of different elements of music even within the field of musical understanding requires studies that explicitly include and compare these components in real musical settings. For example, Stevens and Gallagher (2004) showed that children can make better judgments based on pitch than duration, yet Schwarzer (1997) found that when more potential musical elements were added, children aged 5–6 chose neither of these dimensions. It is thus important that task demands do not constrain children's responses, giving children opportunities to demonstrate the full range of their understanding.

Should a theory of musical development be able to account for a wide range of musical behaviors, including perception and understanding alongside activities such as singing, playing instruments, and composing? In developmental psychology, "grand" theories of general development (Piaget, 1953; Vygotsky, 1978) have largely been abandoned in favor of more specific models of cognitive or social development (e.g., Bandura, 2001; Halford, 1993; Ryan and Deci, 2000; Siegler, 1996). In music, the generalizability of theories or models hinges on a balance between precision and explanatory power. Broader approaches to understanding musical development, like Hargreaves and Galton's (1992) model of artistic competence or Swanwick and Tillman's (1986) developmental spiral, can provide a useful description of similarities in stages of understanding (loosely tied to age) across different musical activities. However, these remain at a purely descriptive level. More constrained models of specific musical skills or understanding (e.g., Paananen, 2006a, 2006b; Stevens and Gallagher, 2004; Welch, 1996) seem to be more successful in explaining musical behavior and predicting development in a limited number of domains. An overarching theory of musical development is still out of reach, and it is unclear whether any such theory would be capable of accounting for all the phenomena subsumed under the umbrella of musical competence.

Where Is Musical Development Going, and How Does It Get There?

Considering the process of development itself, as illustrated above, there is very little research mapping cross-sectional patterns over large enough age spans or fine enough levels of detail to be able to explain the directions or the motors of change. Two main factors are responsible for this situation. First, there is disagreement about whether development proceeds linearly or in a stepwise fashion towards one or multiple end points (Bamberger, 2006; Hargreaves, 1996; Swanwick and Tillman, 1986). Second, most research is not designed to answer these questions. For example, the continuing strand of research exploring infants' responsiveness to pitch, rhythm, and emotion (see Trehub, Chapter 24, this volume) commonly compares findings with infants and adults to uncover the relative contributions of early learning, perceptual biases, or even innate features of responses to music, and musical experience gained in the years between infancy and adulthood. Few of these studies systematically examine the development and flourishing of these skills and capacities in childhood. Conversely, most researchers interested in childhood development have tended not to compare their findings with those gained from adults (with some notable exceptions), and often focus on particularly constrained age ranges in order to map more fine-grained developmental processes (with the age range 4–11 years being the most well studied). Although music training has become an increasing focus of interest (see Schellenberg, Chapter 26, this volume), greater attention is being afforded to the consequences of such training for nonmusical abilities than for musical ones.

Interactive studies following children over short time spans are highlighting microlevel changes in their musical understanding. For example, Koutsoupidou and Hargreaves's (2009) detailed study of 6-year-old children's progress across 6 months of improvisation activities provides an insight into the process of change. They found that the motor of change was children's engagement and re-engagement with the musical material, in this case stimulated by a research/teaching intervention (see also Bamberger, 1991). Applying this kind of approach to finer age- and experience-graded samples over longer time spans would help disentangle questions about the relative contributions of age and experience which are becoming recognized as being so critical in musical development.

Natural Development and Cultural Environments

The relative contribution of innately specified and culturally acquired aspects of musical development is another hotly debated issue (Hannon and Trainor, 2007). Recent evidence supports the notion of certain aspects of musical understanding being innately specified, such as sensitivity to the beat (Winkler et al., 2009) and neural specialization for musical pitch processing (Perani et al., 2010). Effects of early enculturation have also been documented in infancy, especially in relation to metrical structure (Hannon and Trehub, 2005; Soley and Hannon, 2010). The work that has explored the effects of learning opportunities and cultural environments on musical development tends to find that their impacts can be substantial (see Stalinski and Schellenberg, 2012). For example, in a study with 6-month-old infants, Gerry, Unrau, and Trainor (2012) found that 6 months of parent–infant engagement in active music classes begun at 6 months of age enabled infants to distinguish a tonal and a highly atonal version of an unfamiliar piece and to prefer the tonal version, while 6 months of passive music classes produced no such preference. This points to the very early influence of educational settings and opportunities on subsequent musical development. Later in development, 6-year-old children show enhanced development of the motor areas of the brain and the right primary auditory cortex, and enhanced melodic and rhythmic discrimination, after 15 months of music lessons (Hyde et al., 2009), and the effects of music training on cognitive development are now well documented (see Schellenberg, Chapter 26, this volume).

Given the fundamentally social nature of music in society, a more complex formulation of the learning process is required that accounts for the child as an active participant in culture (Vygotsky, 1978). Cultural contributions have played a small role even in models that attempt to account for experience (e.g., Swanwick and Tillman, 1986; see Runfola and Swanwick, 2002). Such goals may be achieved following suggestions to focus research on the "micro-structure of cognition" (Gruhn and Rauscher, 2002, p. 446). Studies such as those of Bamberger (1991) and Koutsoupidou and Hargreaves (2009) which explore how musical processes develop over shorter periods of time provide the starting point for this, but more research is needed.

Concluding Remarks: The Importance of Context

Research carried out to date on the development of musical understanding (pitch, tonality, rhythm, meter, form, structure, and style) and musical activities (singing, instrumental learning, composing, and improvising) reveals a complex pattern of findings. The principal debates in the field hinge around the types and breadth of development under consideration, and the influences of nature and culture, age, and experience.

Elsewhere (Lamont, 2002, in press) I have argued for the usefulness of contextually grounded theories such as Bronfenbrenner's (1979) ecological systems theory in understanding children's developing spheres of influence and their levels of engagement with music, ranging from the micro contexts of home and school up to the macro contexts of dominant beliefs in society. In similar vein, Burnard (2006) adopted a systems view in considering influences on children's developing creativity. She identified a "superculture" of children's musical creativity, incorporating the overlapping spheres of culture, society, and in- and out-of-school contexts to specify various micro cultures to be investigated. These approaches provide more formalized and more practical ways of identifying and exploring the significant contexts in children's and adolescents' lives that support and motivate many kinds of musical development.

A fuller consideration of context may also help address the empirical challenges of engagement and motivation for music. Not all children engage with music at school, with extracurricular music lessons, or with music from different cultures or subcultures (e.g., Lamont, Hargreaves, Marshall and Tarrant, 2003). It is possible that those that do, differ in many different social and psychological ways from those who do not (see Schellenberg, Chapter 26, this volume). This provides a different impetus for developmental research: in addition to systematic exploration of the effects of age and experience, it is vital to examine the effects of different situations and settings on various aspects of musical development. Flexible yet sensitive theories of musical development may offer solutions to these challenges, as well as informing us about the ways in which children develop in and through music and the diversity of musical goals to which they aspire.

In the first edition of this volume (Lamont, 2009), I highlighted the lack of coherent theories of musical development and made concrete suggestions for moving the field forward, taking account of systemic and individualistic influences alongside one another and conducting carefully designed research involving longitudinal components, multiple tasks, and suitable measures to tap children's musical understanding. In that light, it is encouraging to see innovative behavioral and brain-based measures that have shed light on developments in children's music perception abilities. This research has revealed, amongst other things, that subtle fine-grained differences in perceptual abilities can arise from one additional year of informal musical experience (e.g., Corrigall and Trainor, 2010). Future research into musical development must employ a range of measures research designs and samples to reveal these fine-grained differences. As exemplified by the recent work of Trainor and colleagues (Corrigall and Trainor, 2014; Einarson and Trainor, under review), increased reliance on implicit measures and measurements of brain activity alongside explicit judgments and ecologically valid tasks will yield further advances in our understanding of the development of music perception and production, as well as theories that can account for such musical development.

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