Music, analogy, and metaphor

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Within this volume, music has been connected with physical movement, other communicative media, various technologies, and other domains of human experience or endeavor. Such connections could be seen to implicate a cognitive capacity that contributes much to the distinctive character of human thought processes: analogy. At its core, analogy involves drawing correlations between elements and relationships from two different domains as part of a process of reasoning about the organization or features of one of the domains. Thus knowledge about physical gestures could be used to structure the understanding of a conjunct sequence of musical events, leading to the notion of a "musical gesture."

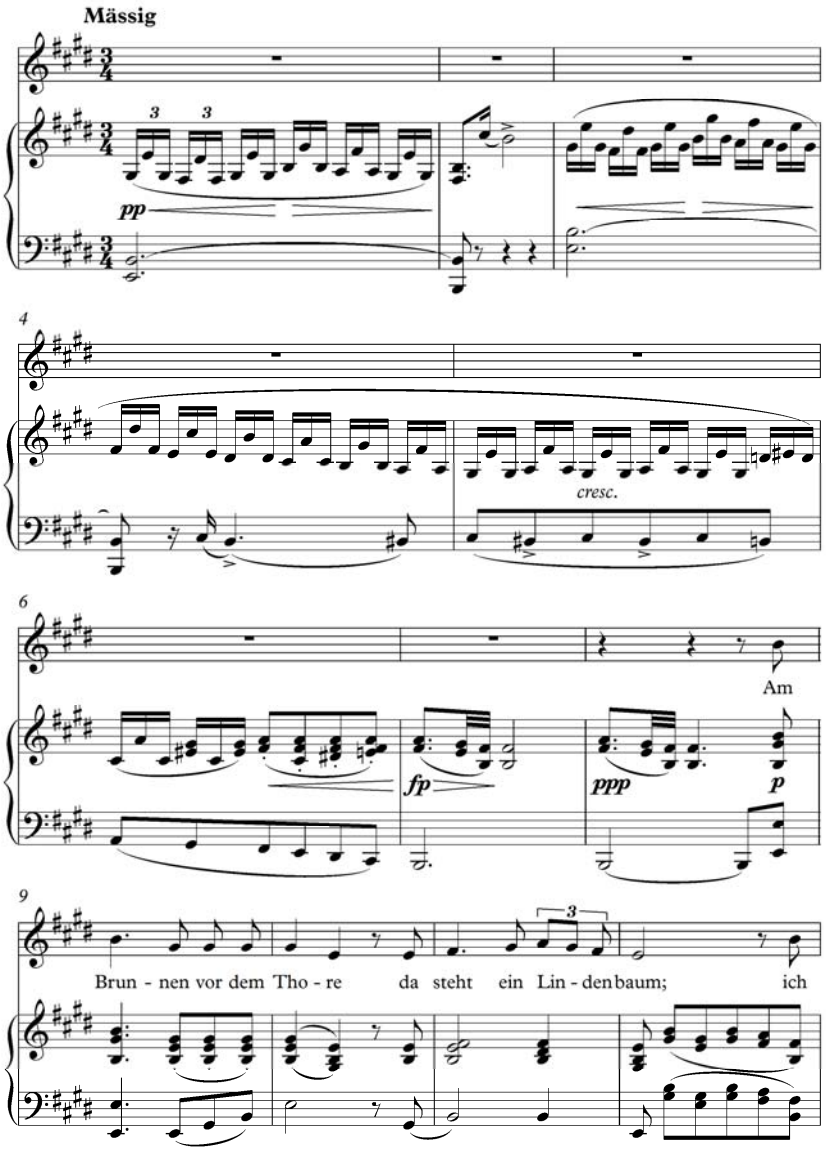
The first section that follows reviews recent research on analogy with the aim of assessing its role in musical understanding and its potential to provide a means of addressing a number of issues of long standing, including that of the relationship between language and music. The second section explores work on a cognitive process related to but in some measure distinct from analogy: metaphor. Beginning in the 1980s a number of researchers proposed that metaphor was a fundamental structure of human thought, and this proposal has influenced the work of scholars of music cognition. Both analogy and metaphor have affiliations with crossmodal correspondences exemplified by synaesthesia (and which, as recent research has demonstrated (Spence, 2011), are broadly demonstrated in human cognition), and in the concluding section I shall briefly turn my attention to how such crossmodal correspondences relate to analogy and metaphor.

Analogy

Analogy and Understanding

Analogy, as it has been studied by cognitive scientists over the past few decades, can be conceived of as a reasoning process based on an apprehended match in relational structure between two apparently different objects or phenomena. As an example, consider an analogy between a stalk of broccoli and a deciduous tree. There are similarities of shape (a central stalk supporting a rounded crown), structure (branches which build out from the central stalk), and life-form (both objects under consideration are plants), all of which might lead one to draw inferences between the two. For instance, since broccoli is grown from a seed one might expect that trees are also be grown from seeds. (Despite the obviousness of such an inference, it seems fair to say that most individuals' knowledge about growing things from seeds is based on their experience with garden plants rather than with trees.) And because the structure of a tree is relatively hardy (allowing it to flourish as a plant, and withstand the weather) one might expect that broccoli has adopted a similar shape for similar reasons. It bears mention that differences between correlated objects or phenomena are equally important for analogical reasoning: the fact that a stalk of broccoli is *not* a tree (it cannot be climbed by young children, it endures for only a single planting season) is itself productive for the process of analogy (Gentner & Markman, 1994). There is more to say about analogy as a cognitive process, but for the moment it will be sufficient to note that the emphasis here is on analogy as a species of reasoning that takes as its point of departure similarities and differences between two domains of knowledge.

To illustrate the role of analogy in musical thought and set the stage for a fuller discussion of analogical reasoning, let me offer a brief musical example. The introduction to Franz Schubert's "Der Lindenbaum" (shown in Example 1) opens with a rapidly oscillating pattern of sixths that circulate around E4 and that suddenly break off, in measure 2, with an arrival on the dominant, an arrival emphasized through a melodic leap into the upper register. This figure, which is expanded and modified over the next six measures, has suggested to a number of commentators the rustling of a linden tree's leaves (e.g., G. Johnson & Wigmore, 2014, vol 3: pp. 648–649). From the perspective I shall develop here, such suggestions are based on an analogy between the musical materials of Schubert's introduction and the sounds produced when the leaves of a mature deciduous tree are stirred by the wind.



Example 1: Franz Schubert, "Der Lindenbaum," (Song 5 from *Winterreise*, D. 911; Op. 89), measures 1–12. Text by Wilhelm Müller; translation: "By the well, before the gate, stands a linden tree."

As noted, analogical reasoning exploits similarities between the constituent elements of disparate domains. In the case of the introduction to "Der Lindenbaum," the rising and falling pitch of the right-hand's figuration is similar to the increase and decrease in sound volume that occurs as leaves are stirred by a breeze (a similarity strengthened by Schubert's dynamic markings); the sequences of triplet sixteenth-notes, bound together under a single phrasing slur, summon a sonic image of continuity quite similar to the sighing of boughs shaken by the wind; and the complexities of air flow (giving rise to gusts and eddies) create interacting layers of sound as various boughs are shaken, layers that can also be found in the push and pull between the left hand and right hand in measure 5 as Schubert builds tension in anticipation of the arrival on the dominant in measure 7.

While observations about similarities like these provide an anchor for the process of analogy, such observations by themselves cannot explain the sophisticated reasoning that follows. This reasoning builds on a two-part correlation: between the constituent elements of two different domains, and between relationships among the elements within each domain; the latter are called "second-order" relations by researchers on analogy (Gentner & Markman, 1997, p. 47). In the case of the analogy activated by the introduction to "Der Lindenbaum," the relevant second-order relations have to do with what might be broadly construed as agency: in the natural domain occupied by the tree, the agent is a powerful physical force (the wind) that animates innumerable objects (the leaves of the tree) to create a distinctive sound; in the musical domain of the song, the agent is the individual responsible for the sounds comprised by the introduction. Although this individual could simply (and quite logically) be identified with the composer, in performance the individual might also be understood to be the pianist or the singer (at whose behest the pianist plays).

A key feature of analogical reasoning illustrated by this example is the role of contextual goals in drawing analogical correspondences. There are, for instance, any number of similarities between the introduction to "Der Lindenbaum" and various extra-musical phenomena: Schubert's introduction could, for instance, represent the scurrying of a small animal or the rising emotions consequent to hearing a random snatch of a beloved companion's voice. The correlation of the musical sounds with the sonic image of a rustling linden fits, of course, with the title of the song and with the picture of rustic solitude sketched by the opening lines of Wilhelm Müller's poem. More broadly, however, this correlation fits with the notion that songs like "Der Lindenbaum" are expressive utterances: confronted with a sequence of musical sounds such as that represented by Example 1, it is quite natural to look for a reason behind the production of these sounds ("an evocation of the rustling of the leaves of a tree") and to attribute it to some individual (variously, the composer, pianist, or singer). The alignment of features and structure that typifies analogy is thus constrained by contextual goals that are distinct from the analogical process proper (Holyoak & Thagard, 1995, pp. 6–12). Were the context different, the music of Example 1 might well be heard to represent the hurried movements of a small animal or the surge of emotion consequent to a glimpse of one's beloved.

Making analogies is something that is virtually effortless for humans. Motivated by this fact, Douglas Hofstadter and Emmanuel Sander have argued that analogy, as the means by which concepts are assembled and connected to one another, is at the very core of human cognition (2013). At the very least, there is considerable overlap between judgments of similarity, making analogies, and processes of categorization, all of which contribute to the distinctiveness of human intelligence (Medin, Goldstone, & Gentner, 1993). Perhaps more striking is that the capacity for analogy is apparently unique to our species. Although other species are able to make some very sophisticated similarity judgments, current evidence indicates that no other species comes close to making or using analogies with the facility and speed of humans (Call & Tomasello, 2005; Gentner, 2003). And this capacity is available from a very early age: children as young as ten months are able

to solve problems by analogy (Chen, Sanchez, & Campbell, 1997), and by the age of three years analogical abilities are quite robust (Goswami, 2001; Gentner, 2003).

The ability to map systematic structural relationships between disparate domains bears witness to a capacity for abstract thought—for thinking about relations between relations—of enormous flexibility and wide application. Analogy has been recognized as a key factor in human creativity (Fauconnier & Turner, 2002, p. 14) and has been linked to the conceptual flights of fancy and processes of meaning construction created through metaphor and metonymy (Holyoak & Thagard, 1995, pp. 213–223). Given evidence of the capacity for analogy demonstrated by pre-linguistic children, it also seems apparent that being able to reason with analogy does not require the use of language, opening up the possibility of musical analogies that bypass language entirely.

Despite its importance to human thought there has at present been relatively little research on music and analogy (but see Kielian-Gilbert, 1990; Bar-Yosef, 2007; and Eitan & Granot, 2007). This is not to say, however, that analogical thought in the service of musical understanding is difficult to discover. As but one example, the music theorist David Lewin illustrated a rather abstract relationship between two transformational graphs with an analogy to the different ways a person might appear in a formal setting (for instance, discharging a solemn professional duty) and an informal setting (at a picnic in the park. where he or she is surrounded by friends and family). Just as we would understand that, despite appearances, the same person was involved in both of these activities, so we should understand that two apparently different transformational graphs manifest the same essential musical relationships (Lewin, 1987, p. 171). There are, additionally, intra-musical analogies associated with compositional practice. For instance, within the innumerable theme and variation sets produced by western European musicians during the late eighteenth century (which, incidentally, exemplify a practice common throughout the world's musics) each variation can be conceived of as an analog for the theme (as well as for other variations), a relationship fuelled by the similarities and differences between theme and variation as well as by variations in the expressive import of individual variations (such as those cast in a minor key). Analogical relationships such as these can also be seen in the many different guises thematic materials can take over the course of a musical composition or improvisation.

Analogical Reference and Musical Communication

In recent work I have used research on analogy as a basis for the notion of analogical reference (Zbikowski, 2012b, p. 127). This form of reference is effected through structural similarities between the symbolic token and the thing to which it refers (and is thus allied with what C.S. Peirce called an icon (1955, p. 104)), and can be used to explain how sequences of musical sound refer to other phenomena. In Schubert's "Der Lindenbaum," for instance, the music of measures 1–8 provides a sonic analog for the dynamic process associated with leaves rustling in the wind. It is important to note that, while the dynamic process that is analogized here is itself associated with sonic phenomena ("the rustling of the leaves of a tree"), the sounds produced by the piano do not have to faithfully reproduce those sounds. Indeed, there are a number of differences between the musical and natural sounds: the rustling of leaves has no definable pitch content; although there is certainly a temporal shape to the sound of leaves stirred by a breeze, that shape has none of the rhythmic specificity of Schubert's carefully constructed phrases; and while we might certainly attribute a kind of directedness to the boughs of a tree tossed by the wind—they are, after all, evidence of the movement of air from one place to another—rustling leaves by themselves offer none of the sense of anticipation created by Schubert's eight-measure introduction.

The notion of analogical reference offers one way to account for music's often-observed capacity to imitate natural sounds (which was the basis for the notion of musical mimesis used in the early modern period to explain how music could have meaning; see, for instance, Engel, 1998

[1780]). It also makes it possible to connect musical utterances with a range of dynamic processes that have proven to be important for human cultures, including the spontaneous gestures that accompany speech (Zbikowski, 2011), the patterned movements of dance (Zbikowski, 2012a), and the psychological and physical processes associated with the emotions (Zbikowski, 2010). Finally, and perhaps most importantly, it offers a way to distinguish between the resources humans employ for linguistic and musical communication. Language makes almost exclusive use of symbolic reference as a basis for communication (Deacon, 1997, pp. 69–101); music, by contrast, makes almost exclusive use of analogical reference (Zbikowski, in press).

Summary

There is now abundant evidence that analogical thought is a basic and characteristic feature of human intelligence. As such, it is not surprising that analogies would play a part in reasoning processes associated with musical practice, from the imitation of various natural sounds through sequences of musical events, to involved and highly analytical observations about musical organization, to drawing connections between a theme and its variations. Building upon such evidence, the notion of analogical reference (in contrast to symbolic reference) provides one way to capture the distinctiveness of musical utterances and to explain why every known human culture has developed the resources of both language and music.

Metaphor

Conceptual Metaphor Theory

Although there are any number of similarities between analogy and metaphor—enough that Dedre Gentner and her colleagues could give the ironical title "Metaphor is like analogy" (Gentner, Bowdle, Wolff, & Boronat, 2001) to a chapter on the relationship between the two —the exploration of metaphor from a cognitive perspective began only with George Lakoff and Mark Johnson's 1980 book *Metaphors we live by*. On the view developed by Lakoff and Johnson, metaphor was not simply a manifestation of literary creativity but was in fact an extremely common way of structuring thought. They pointed out that expressions like "I'm feeling *up*" or "My spirits *sank*" are concerned not with a literal orientation of an individual in space but are instead evidence of a consistent pattern of thought in which emotional states are correlated with orientation in space (Lakoff & Johnson, 1980, pp. 15–17). According to this pattern UP is correlated with an elevated emotional state ("happiness" or "joy") and DOWN is correlated with a depressed emotional state ("sadness" or "despair"). Patterns such as this, which Lakoff and Johnson called conceptual metaphors, provide the structure for manifold different linguistic expressions and also constrain the interpretation of these expressions: "My spirits *sank*" thus gives cues about a person's emotional state (including the person's physical appearance) but does not entail any belief in the actual buoyancy of inner emotional states.

This perspective on thought and language has ready applications to descriptions of musical organization. In my initial account of the music represented by Example 1, for instance, I observed that the pitches of the right-hand figuration of the introduction rise and fall; had I been interested in a somewhat richer account of the music, I might have noted that the sonorities of measure 7 possess a certain warmth. Of course, neither of these characterizations is true in a simple way: although we conventionally describe pitch relationships with reference to vertical space, the pitches are not literally rising and falling. Indeed, were one to observe the actual trajectory traced by the pianist's hand it would not be up and down, but rightwards and leftwards. And as for the warmth of the sonorities in measure 7, the temperature associated with these chords would not be significantly greater or lesser than the "icy shivers" commentators have found elsewhere in *Winterreise*. Both of

these characterizations—and, indeed, almost all non-technical accounts of music—can be seen to have their basis in conceptual metaphors, a point I shall explore in more detail below.

It should be noted that the characterizations I have just discussed also reflect correspondences between perceptual information drawn from different modes. Such correspondences connect with an important question raised by Lakoff and Johnson's research, which is the ultimate basis for the process of mapping knowledge between different domains. Even if we grant that we understand a target domain (such as pitch relationships) in terms of a source domain (such as orientation in vertical space), how is it that we understand the source domain in the first place? One explanation—considered in more detail in the concluding section—is that this understanding is based on crossmodal correspondences. For their part, metaphor theorists—and, in particular, Mark Johnson—took the position that conceptual metaphors had their basis in repeated patterns of bodily experience, patterns that Johnson called image schemata. As Johnson conceived it, an image schema was a dynamic cognitive construct that functioned somewhat like the abstract structure of an image and thereby connected together a vast range of different experiences that manifested this same recurring structure (Johnson, 1987, p. 2). Consider, for instance, the VERTICALITY schema, which captures the recurring structure manifested in experiences such as perceiving a tree, our felt sense of standing upright, the activity of climbing stairs, and watching the level of water rise in the bathtub. The VERTICALITY schema is the abstract structure of such experiences, images, and perceptions. Our concept of verticality is based on this schema, and this concept is in turn invoked by the various conceptual metaphors that use vertical space as a source domain through which to structure such target domains such as emotions, and musical pitch (Zbikowski, 2002, pp. 63–74).

For Johnson the image schema was a theoretical construct motivated both by the research on metaphor he did with Lakoff and by a philosophical perspective on knowledge that borrowed heavily from that developed by Immanuel Kant in his *Critique of Pure Reason* (Johnson 1987, pp. 144–166). Although empirical evidence supporting the notion of image schemata is still inconclusive, over the past three decades researchers from a broad range of disciplinary traditions have shown that human cognitive processes are shaped by bodily experiences such as those that informed Johnson's theoretical approach. This has led to a disciplinary perspective that has come to be called grounded cognition (Barsalou, 2008) which is, to a certain extent, complementary to research on crossmodal correspondences.

Recent Research on Music and Metaphor

Applications of conceptual metaphor theory to music have resulted in two different strands of research. The first strand was initiated almost immediately after Lakoff and Johnson set out their ideas about metaphor and has focused on the way the conceptual metaphors made explicit by language shape the understanding of music. The second strand is of more recent vintage, and has provided empirical studies—informed by metaphor theory—of the conceptualization of music.

Music, Language, and Metaphor. One of the earliest applications of conceptual metaphor theory to musical understanding is perhaps the most instructive. In his analysis of the musical thought of the Kaluli of Papua New Guinea, Steven Feld proposed that the metaphorical descriptions they used were a reflection of key aspects of their everyday experience. The Kaluli describe melodic intervals—whether in their own music or in the music of others—with the same terms they use to characterize features of waterfalls. For instance, in the language of the Kaluli *sa* means "waterfall," and a *mogan* is a still or lightly swirling waterpool; *sa-mogan* is the flow of a waterfall into a level waterpool beneath it. *Sa-mogan* is also used to describe a melodic line that descends to a repeated note, the contour of which replicates that of a waterfall flowing into a pool (Feld, 1981, pp. 30–31). The system of metaphorical relationships upon which such

characterizations draw offers a rich description of musical events, but one that also has its limitations: the Kaluli do not, for example, have specific names for ascending intervals, which nonetheless do occur in their music.

As did Feld's work, most of the research on music and metaphor in the decades that followed the publication of Lakoff and Johnson's study has focused on the conceptual metaphors that guide and constrain the understanding of music. One branch of this research has explored the role of metaphor in the theorization and practice of novel repertoires, including heavy metal, musical multimedia, the music of the Grateful Dead, the music of Neil Young, and music from Java and Azerbaijan. Another branch has focused on recognized but not clearly understood conceptual models within music theory, including those pertaining to musical invariance, modulation theory, and hierarchical structures in music. (A summary of the research on music and metaphor that draws on conceptual metaphor theory is provided in Zbikowski, 2008, pp. 510–12.) Although there has been some speculation on the image-schematic basis of conceptual metaphors often applied to music (Brower, 2000), most of the focus has been on evidence provided by descriptions of musical materials and practices.

Empirical Studies Bearing on Music and Metaphor. Empirical work that reflects the influence of conceptual metaphor theory is somewhat more limited and has developed only over the last ten years or so. One of the first published studies was by Zohar Eitan and Roni Granot, who investigated the visual and kinetic imagery summoned by sequences of musical sounds (2006). Eitan and Granot found that listeners drew on their knowledge of a variety of domains, including that related to objects moving through space, to characterize such sequences. One of the surprising findings was of asymmetries in such characterizations: as Eitan and Granot observed,

> Imagined musical space proves to be asymmetrical in diverse domains, as listeners who associate a musical stimulus with a particular kinetic quality often *do not* associate the inverse stimulus with the opposite kinetic quality. Thus . . . diminuendi descend, but crescendi do not ascend. Crescendi, however, speed up, while diminuendi (in faster tempi) do not slow down. Correspondingly, when pitch rises it moves faster (as well as further), but as it falls, it does not slow down or draw nearer. Pitch fall, however, moves strongly to the left, while pitch rise is only weakly related to motion rightward (2006, p. 238).

In brief, then, Eitan and Granot's results suggest that listeners mapped knowledge from a variety of domains to characterize musical events, and that while such mappings are consistent they do not reflect straightforward crossmodal correlations. Further research Eitan conducted with Renee Timmers (first presented in 2006 and published in 2010) confirmed these results. Participants in this study were able to use a range of contrasting terms (such as "crocodile"—which, among the Shona of Zimbabwe, corresponds with low pitch—and "those who follow crocodiles"—which corresponds with high pitch) to categorize pitch differences, a capacity which suggested that they were able to recruit knowledge from novel source domains to structure their understanding of musical relationships (2010; see also Dolscheid, Shayan, Majid, & Casasanto, 2013). Similar results were obtained by Mihail Antović in a study of the ways Serbian and Romani children characterized musical relationships; these descriptions proved to be overwhelmingly metaphorical and to draw on visual and spatial knowledge (2009).

A slightly different perspective on the role of conceptual metaphors in musical understanding was provided by experiments which included blind participants. Eitan, Granot, and Ornoy found that congenitally or early blind participants characterized basic pitch relationships in terms of visual metaphors similar to those used by sighted participants (2012). These results suggest that descriptions of musical relationships by blind participants reflect language-based semantic

associations rather than crossmodal perceptual information, something confirmed in a separate study by Antović, Bennett, and Turner (2013).

Summary: Music and Metaphor

To the extent that it involves the correlation of structural features proper to two different domains, metaphor is indeed like analogy. Research on these cognitive processes suggests, however, that where analogy is primarily concerned with using knowledge about one domain to reason about another, metaphor more typically involves using correlations between domains to construct meaning. In consequence, metaphors demonstrate a directionality that is not as prominent in analogies: while one might use an analogy between a dancer and an elephant as the basis for a variety of inferences, the metaphor "The elephant is a ballerina" (which uses knowledge about a lithe dancer to characterize a ponderous pachyderm) is quite different from the metaphor "The ballerina is an elephant." This directionality points to a substantive difference between analogy and metaphor: it *means* one thing to say that an elephant is a ballerina, and it *means* something different to say a ballerina is an elephant.

One issue raised by applications of conceptual metaphor theory to descriptions of musical organization is whether music can serve as a source domain for a metaphorical mapping. The issue is of marked significance for research on musical knowledge: if it is the case that music cannot be an originary source domain—that is, if metaphorical mappings are always *from* language *to* music, and never *from* music *to* language—it would suggest that human conceptual knowledge is first codified through the resources offered by language, and only subsequently used to structure the understanding of music. Musical concepts, to the extent such exist, would of necessity be derivative of linguistic concepts.

Conclusion: Analogy, Metaphor, and Crossmodal Correspondences

Work by a wide range of researchers has demonstrated that the ability to draw complex analogies is a basic and characteristic feature of human intelligence. Inasmuch as music is a product of human intelligence, it stands to reason that analogical thought would play a role in musical understanding. Such thought is not only demonstrated by writing about music—which, in many cases, is explicitly analogical—but also in musical imitations of natural sounds, in variation techniques, and in correspondences between music and other human activities (such as gesture and dance). Further, the role of analogy in musical understanding can be used as support for a notion of reference—analogical reference—uniquely exploited by music. There is also a body of research which suggests that a cognitive process closely allied with analogy—metaphor—is a fundamental structure of human thought. This research has led to thoughtful descriptions of the role conceptual metaphors play in musical understanding as well as empirical research that demonstrates humans' ability to use knowledge drawn from a variety of domains to structure their understanding of music.

A persistent question raised by research on descriptions of music that reflect conceptual metaphors is the extent to which such descriptions are influenced by correlations between perceptual modes. On the one hand, crossmodal descriptions by congenitally blind individuals would seem to argue against such influence. On the other hand, there is a substantial body of research suggesting that crossmodal characterizations of pitch relationships are independent from language (Casasanto, 2010, pp. 473–474; Walker, et al., 2010; Parkinson, Kohler, Sievers, & Wheatley, 2012; Eitan, Schupak, Gotler, & Marks, 2014; Palmer, Langlois, & Schloss, 2016). One way to approach this contradictory evidence is through distinctions between three classes of crossmodal correspondences: structural correspondences, statistical correspondences, and semantically mediated correspondences (Spence, 2011, pp. 988–989). Thus descriptions of musical pitch by congenitally blind individuals that make recourse to visual information can be taken as

evidence for semantically mediated correspondences; correlations of visual and sonic information by pre-verbal children, by contrast, reflect structural or statistical correspondences. This perspective can be expanded by taking into account the way analogical thought informs descriptions of musical relationships, especially where such descriptions reflect not only how modes are similar but also how they are different. Indeed, such an approach would conform with emerging research on predictive processing (Clark, 2016), through which top-down processes (such as analogy) shape bottom-up processes (such as those that drive structural and statistical cross-modal correspondences).

One can envision three research streams related to analogy and metaphor that might inform future work in music cognition. First, research could seek to expand our understanding of the role analogy plays in musical understanding, and the extent to which sequences of musical sound can be correlated with dynamic processes. Second, although there has been important work on music and metaphor, we have only begun to understand how conceptual metaphors inform musical understanding. Third, existing work on cross-modal correspondences could be placed in dialog with the perspectives on musical understanding provided by research on analogy and metaphor, the better to understand how processes of reasoning and meaning construction shape—and are shaped by—perceptual information.

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