

The Artful Mind

*Cognitive Science and the Riddle
of Human Creativity*

EDITED BY MARK TURNER

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Contents

Contributors, ix

Prologue, xv

PART I Art and Evolution

1. Art and Cognitive Evolution, 3

Merlin Donald

2. The Aesthetic Faculty, 21

Terrence Deacon

PART II Art and Emotion

3. A Cognitive Account of Aesthetics, 57

Francis Steen

4. Composition and Emotion, 73

David Freedberg

PART III Art and the Way We Think

5. The Art of Compression, 93

Mark Turner

6. The Cognitive Tango, 115
Lawrence M. Zbikowski
7. Dynamics of Completion, 133
Shirley Brice Heath

PART IV Art, Meaning, and Form

8. The Neuroscience of Form in Art, 153
George Lakoff
9. Form and Meaning in Art, 171
Per Aage Brandt
10. Slippages of Meaning and Form, 189
Stephen Murray

PART V Art and Sacred Belief

11. Making Relics Work, 211
Robert A. Scott
12. Architectural Space as Metaphor in the Greek Sanctuary, 225
Gloria Ferrari

PART VI Art and Ambiguity

13. The Neurology of Ambiguity, 243
Semir Zeki
14. Mastering Ambiguity, 271
Marc De Mey

Epilogue, 305

Index, 307

6

The Cognitive Tango

Lawrence M. Zbikowski

This chapter explores how three basic cognitive capacities—categorization, cross-domain mapping, and the use of conceptual models—operate at the specific level of understanding music. This exploration reveals the intimate dance that takes place between music, mind, and brain.

Midway through the first act of Sigmund Romberg's 1928 operetta *The New Moon*, Philippe, a servant on the Louisiana estate of Monsieur Beaunoir, pauses to reflect on the fickleness of women. After a brief, freely sung introduction to the topic, he breaks into a tango, singing:

Softly, as in a morning sunrise
The light of love comes stealing
Into a new born day.
Flaming with all the glow of sunrise
A burning kiss is sealing
The vow that all betray.

The song, as it continues, offers a rich set of images, as much through the music as the text, and it is almost instantly memorable. Indeed, Romberg, together with his librettists Oscar Hammerstein, Frank Mandel, and Laurence Schwab, must have realized this, for they gave the song an extended reprise in the second act of the musical. Never mind the incongruity of a twentieth-century ballroom

dance in the midst of an eighteenth-century southern plantation, replete with bloodthirsty pirates—there was a larger story to tell, and “Softly, as in a Morning Sunrise” was an essential part of that telling.

The effect of songs like “Softly, as in a Morning Sunrise” is immediate and profound. Which, considering the perspective developed in this collection, leads to this question: How is it that we humans can make sense of music—a complex, multidimensional sequence of patterned sound—on our first encounter with it? And, more than just make sense of such sequences, how can we have them invade our very being, leading to changes in our affective disposition and reorientations of our bodily programs (causing us to tap our toes, imagine physical gestures in response to the music, or get up and dance)?

There are a number of ways to answer this question. One approach that developed out of the pioneering work of Hermann von Helmholtz in the nineteenth century started with physiology and led ultimately to psychology (Green and Butler 2002). This has generated an impressive range of empirical research over the past hundred years, and we now know a great deal about how humans process sound. However, not all sound is music, and an account of how humans process sound is not the same thing as an account of how they understand music. Indeed, I would argue that musical understanding involves cognitive processes that occupy the *conceptual* level, which I take to be a level of cognitive activity at least potentially accessible to conscious thought. To explore this level, I want to take a slightly different approach to the question of musical understanding by showing how three general cognitive capacities crucial to our conceptual lives are specified for the understanding of music. These capacities are categorization, cross-domain mapping, and the use of conceptual models. All appear to be basic to having and, more important, using concepts. Taking “Softly, as in a Morning Sunrise” as my example, I shall describe the part each plays in our conceptualization of music. What is revealed is an intimate dance between music, mind, and brain, a cognitive tango every bit as enthralling as those that play out on the Broadway stage or the ballroom floor.

Categorization

Our ability to categorize things is a cognitive process so basic and so pervasive that it can easily escape our notice. Were you to lift your eyes from this book and survey your surroundings, you might well see chairs, lamps, tables, and other books; were you outside, you might see trees, birds, clouds, cars, and

bicycles. If you considered the other things that populate your day, you might think of friends and family members, facial expressions and gestures, actions and activities. Your recognition of these things reflects the categories through which we structure our thought: to recognize a book is to identify it as a member of the category *book*; to recognize a tree is to identify it as a member of the category *tree*. Categorization occurs in all sensory modalities and throughout the range of mental activities: we categorize smells and sounds, thoughts and emotions, skin sensations and physical movement (Barsalou 1992, chap. 2).

Given that categorization is so central to our understanding of the world, what part does it play in our understanding of music? The answer to this question is a bit complicated, but we can simplify it somewhat if we restrict ourselves to two things important for musical understanding: the comprehension of a series of temporally successive events, and the ability to draw connections between such events on the basis of shared features. Let us take the second of these first, using the melody of the opening phrase of “Softly, as in a Morning Sunrise” to illustrate; the score for the entire song is given in example 6.1. (The song is cast in a highly typical 32-measure, AABA form: two nearly identical and successive phrases of eight measures each [measures 1–8 and 9–16]; a contrasting eight-measure section, known as the bridge [measures 17–24]; and a concluding reprise of the first phrase [measures 25–32].) The first phrase comprises three clearly audible falling gestures: a drop from F₅ to C₅ in measure 1, from F₅ to A_b₄ in measure 3, and from C₅ to F₄ in measure 5.¹ These gestures mark off measures 1–2, 3–4, and 5–7 as separate units within the larger phrase (even though none of the units seems complete unto itself). Musical analysis would characterize these units as all built from the same motive, but we don’t have to rely on technical language to understand the connection between them—we can simply group them together in the category *brief musical chunks that begin with a falling gesture*. And once we do this we have an initial, if rather limited, understanding of the opening phrase of the song.

Associating the beginning of musical understanding with brief musical chunks like those evident in the opening of “Softly, as in a Morning Sunrise” has two advantages. First, such chunks have long been recognized by music theorists and composers as important for musical organization (the “motives” mentioned above; for discussion see Zbikowski 2002, chap. 1). Second, in their scope and function such chunks are remarkably similar to what researchers on categorization call basic-level categories.

The hallmark of the basic level is that it occupies a maximally useful level in the middle of a hierarchical taxonomy. The category *furniture* would occupy a rather abstract and widely inclusive level near the top of the hierarchy; the

Molto andante ed espressivo

Soft - ly as in a morn - ing sun - rise, The light of love comes

steal - ing in - to a new born day. Oh!

Flam - ing with all the glow of sun - rise A burn - ing kiss is

seal - ing The vow that all be - tray For the pas - sions that

EXAMPLE 6.1. Score for "Softly, as in a Morning Sunrise," from *The New Moon*, by Sigmund Romberg, Oscar Hammerstein, Frank Mandel, and Laurence Schwab; © 1928 Harms, Inc.

category *the Chippendale chair I inherited from my grandmother* would occupy an extremely concrete and very restricted level near the bottom. Although we could use either of these terms to categorize the thing that's in the dining room, our usual preference would be simply to call it a "chair." This description picks the object out from its surroundings (distinguishing it from the table and the sideboard, for instance) but doesn't overload us with details. *Chair* is a typical basic-level category.

There are a number of empirical operations that converge at the basic level. The basic level is the highest level whose members have similar and recognizable shapes; it is also the most abstract level for which a single mental image can be formed for the category. The basic level is also the highest level

17 *mf* *Poco animato*
thrill, love, And lift you high to heav - en, Are the pas - sions that

mf più espress.

21 *poco rit.* *f* *ff molto allarg. e marcassimo*
kill, love And let you fall to hell. So ends the sto - ry!

poco rit. *f* *ff molto allarg. e marcassimo*

25 *mf a tempo*
Soft - ly as in an eve - ning sun - set The light that gave you

29 *f* *sf* *ff*
glo - ry Will take it all a way!

EXAMPLE 6.2.

at which a person uses similar motor actions for interacting with category members. Finally, the basic level is *psychologically basic*: it is the level at which subjects are fastest at identifying category members, the level with the most commonly used labels for category members, the first level named and understood by children, the first level to enter the lexicon of a language, and the level with the shortest primary lexemes (Rosch et al. 1976; Rosch 1977; Tversky and Hemenway 1984).

The similarities between basic-level categories and the basic musical chunks that make up the first phrase of "Softly, as in a Morning Sunrise" are striking. Attending to these chunks, we are occupied not with individual notes or with four- or eight-measure phrases, but with a level somewhere in between. Their

cognitive salience thus mirrors that of the basic level: in both cases, the focus is on a manageable whole rather than on the smallest parts. Such musical chunks have a distinctive “shape” or contour that allows us to distinguish them from other chunks; similarly, the basic level is the highest taxonomic level at which category members have similarly perceived overall shapes and the highest level at which a single mental image can reflect the entire category.

Treating the musical chunks of measures 1–2, 3–4, and 5–7 as basic-level categories offers a way to explain the salience of these chunks, as well as the basis for drawing connections between them, a capacity important for musical understanding. There remains the issue of how we relate these chunks to one another as they unfold in time—that is, how we comprehend a series of temporally successive events. To address this issue, let us take a closer look at the musical materials that make up the first phrase.

If we compare measures 1–2 with measures 3–4, and measures 5–7 with each of these, it becomes evident that the figures that make up these measures actually have little in common other than the falling gesture. Each involves different pitches and describes a different melodic interval: a descending perfect fourth in measure 1 (F₅ to C₅), a descending major sixth in measure 3 (F₅ to A_b₄), and a descending perfect fifth in measure 5 (C₅ to F₄). Measures 1–2 and measures 3–4 both conclude with an oscillating figure (between B_b₄ and C₅ in measure 2, and between G₄ and A_b₄ in measure 4), but measures 5–7 do not, ending instead with a highly typical cadential gesture that guides the melody to its conclusion on F₄ in measure 7. Given these differences, should these various musical chunks really be in the same category? Here the answer is provided by a different line of research into processes of categorization, which has shown that, contrary to our usual impressions, membership in the categories we use in daily life is not an all-or-nothing affair (Barsalou 1987). Instead, membership is graded through a dynamic process in which the attributes of potential category members are compared with the attributes most typically found within the category.

As an example of such a graded structure, consider the category *bird*. Experimental rankings show that subjects view robins and sparrows as the best examples of birds, with owls and eagles lower down in the rankings, and ostriches, emus, and penguins among the worst examples. All are considered members of the category *bird*, but some better represent the category than others. Category structure is consequently graded according to typicality: category members range from the most typical to the least typical, with the former securely inside the bounds of the category (robins and sparrows) and the latter in danger of being excluded from the category (emus and penguins) (Rosch 1973; Rosch 1975).

Typicality effects can also be seen among our three musical chunks, which, with their repetitions across the AABA form of the song, expand to a category with nine members. Four features of the members of this category stand out:

- All members begin with a descending gesture
- For most members, the descending gesture begins on F5
- Most members conclude with an oscillating figure
- Most members are two measures long

The most typical member of this category, then, will begin with a descending gesture that starts on F5 and leads to an oscillating figure, and will be two measures long. Members that have the features first seen in measures 5–7, which begin with a descending gesture but which lack the other features, can still be included in the category but will be less typical of the category as a whole.

From this perspective, membership in the category *brief musical chunks that begin with a falling gesture*, at least to the extent that this category is manifested in the first phrase of “Softly, as in a Morning Sunrise,” is something that becomes apparent only over time. The phrase begins with one chunk (mm. 1–2), the basic features of which are confirmed by the following chunk (mm. 3–4). There then follows a divergent member (mm. 5–7), which shares some but not all features with the preceding chunks. In the process of comprehending these successive musical events, two things emerge: first, certain musical features (such as gestures) will be confirmed, while others (such as the specificities of pitch) will not; second, some members better fit the category than others. The miniature drama played out in the first phrase, in which a category is first established (in the opening four measures of the phrase) and then destabilized (in the second four), is immediately reenacted in measures 9–16. Subsequent to the bridge, it unfolds once more (in mm. 25–32, with a slightly different conclusion) and brings the song to a close.

The perceptual salience of the musical chunks of measures 1–2, 3–4, and 5–7 explains why our understanding of “Softly, as in a Morning Sunrise” would start there (mirroring the salience of basic-level categories). Our capacity to organize these chunks into a category with graded membership explains why they do not need to be identical to one another and provides a basis for making sense of relationships between them as they unfold in time. The way members of this graded category are deployed in the course of the song, with the most typical members preceding the least typical, also suggests an elementary syntax for music, a topic discussed in greater detail in Zbikowski (2002, chap. 1).

What I have sketched here provides but a glimpse into how processes of categorization shape our conceptualization of music. Indeed, there is much more that could be said just about “Softly, as in a Morning Sunrise.”² What should be apparent nonetheless is that part of the explanation for both the immediacy and the complexity of music can be found in cognitive capacities shared by all humans. Music, as an expressive medium that involves sequences of patterned sound, places some unique demands on these capacities. It also provides some unique opportunities for exploiting them, something to which extended compositions by Ludwig van Beethoven, Richard Wagner, and any number of other composers bear witness.

In my own work I have used the perspective provided by research on categorization to explain relationships among different forms of the same musical motive, to identify aspects of musical syntax and semantics, and to give an account of musical ontology (in particular, why “the same” musical work can change over time) (Zbikowski 2002). There are currently empirical studies under way to test the limits of this perspective with respect to musical themes and musical rhythm, but, given the flexibility and broad application of categorization as a cognitive process, it would seem that exploring musical categorization is an open-ended prospect. It also promises to give rise to some surprising insights into how we understand music, and how this understanding relates to other domains of knowledge.

Cross-Domain Mapping

I initially characterized the distinctive musical figures that mark the opening phrase of “Softly, as in a Morning Sunrise” as “clearly audible falling gestures.” But where in fact is the trajectory through space that constitutes falling? True enough, the C₅ that follows the initial F₅ is placed lower on the printed page, but the actual vertical orientation of the page is of no significance: the score could be flat on the table and the C₅ would still be “below” the F₅. Were we to play the two notes on the piano, the C₅ would be to the left of, but not really below, F₅; played on the cello, the C₅ would in fact be *above* F₅.

These discrepancies between our characterization of musical pitch and orientations in physical space, minor though they might be, are evidence for the essentially metaphorical nature of our descriptions of musical events. Indeed, our accounts of virtually all aspects of music—from relationships between pitch and rhythmic events to characterizations of musical form to descriptions of musical structure—rely on metaphorical mappings from other

domains onto the domain of music. This fact serves as further evidence that metaphor is fundamental to human thought, as George Lakoff, Mark Johnson, and others have argued for more than twenty years (Lakoff and Johnson 1980; Lakoff 1993; Lakoff and Johnson 1999; Lakoff and Núñez 2000). During the 1990s, the conception of the process of metaphorical mapping was generalized and came to be regarded as one of mapping between two different domains. The various linguistic expressions for characterizing musical pitch in terms of “high” or “low” are thus guided by the conceptual metaphor *pitch relationships are relationships in vertical space*. This conceptual metaphor correlates the domain of physical space with the domain of music, and allows us to map spatial orientations such as *up-down* onto the pitch continuum.

According to current theory, conceptual metaphors have their ultimate grounding in image schemata. In brief, an image schema is a dynamic cognitive construct that functions somewhat like the abstract structure of an image and thereby connects a vast range of different experiences that manifest this same recurring structure (Johnson 1987). The basis for the *pitch relationships are relationships in vertical space* conceptual metaphor is the verticality schema, which might be summarized by a diagram of the sort given in figure 6.1. We grasp this structure repeatedly in thousands of perceptions and activities that we experience every day. Typical of these are the experiences of perceiving a tree, our felt sense of standing upright, and the activity of climbing stairs. 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 to structure things like relationships between musical pitches. Our characterization of musical pitch in terms of “high” and “low” is thus a manifestation of embodied knowledge—indeed, it is this knowledge that truly gives meaning to the characterization.

Mappings between music and other domains are the basis for much of the meaning construction prompted by music. And under some circumstances, the mappings can get quite a bit more complicated than the fairly simple

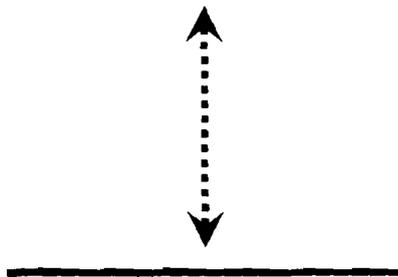


FIGURE 6.1. Diagram of verticality schema.

mapping that occurs with “high” and “low.” In the bridge of “Softly, as in a Morning Sunrise,” for instance, when Philippe sings, “For the passions that thrill, love, / And lift you high to heaven,” the melody ascends nearly an octave, from the F₄ held over from measure 15 to the E_b5 of measures 17 through 19. The compositional technique in evidence here—representing some aspect of the text through music—is conventionally called text painting: when the words of the song evoke an *ascent* to heaven, the melody *ascends* into a higher register, the music thus painting the image summoned by the text. But while this interpretation makes sense for the first line of the bridge, it doesn’t make any sense for the second line. When Philippe completes his thought with “Are the passions that kill, love, / And let you fall to hell,” the melody, far from portraying an infernal descent, repeats the pattern of measures 16 through 19 a whole step *higher*. Here the music argues against the text painting of the preceding measures. Even more strange, the song does not seem fragmented here: the bridge as a whole both provides an effective contrast to the first two phrases of the song and brings the story told in those phrases to culmination.

To explain how the bridge accomplishes this, we need to make recourse to work on conceptual blending.³ Conceptual blending extends cross-domain mapping to include correlations between a number of integrated domains, and has provided a systematic way to explain how new meaning is created through interdomain and intradomain mapping. For instance, the correlation between the domain of physical space and the domain of music created by the conceptual metaphor *pitch relationships are relationships in vertical space* makes it possible to blend concepts from the two domains to create a unique imaginary domain in which pitches describe all manner of fantastic journeys through two- and three-dimensional space. A similar process is set up by Romberg’s song. As shown in the conceptual integration network diagrammed in figure 6.2, one of the input spaces for the conceptual blend is set up by the text for the song. Key elements in this space are the inevitable fickleness of women (an inevitability less apparent in the lyrics for the song proper but quite evident in the conclusion of Philippe’s introduction to the song: “Fickle was she, faithful never . . . So it will be forever, forever”) and the tragedy of thwarted love (as one falls from heaven to hell). The other input space is set up by the music, a tango in which the bridge section (that is, measures 17–24), through two ascending passages in sequence, creates a climactic arrival on the dominant of F minor in measure 23. Elements from these spaces are then projected into the blended space, creating a true dance of seduction and summoning the intensity of a failed love affair.⁴ As shown in figure 6.2, guiding the blend is a generic space structured around the paired notions of the inevitability of fate and the narrative structure of

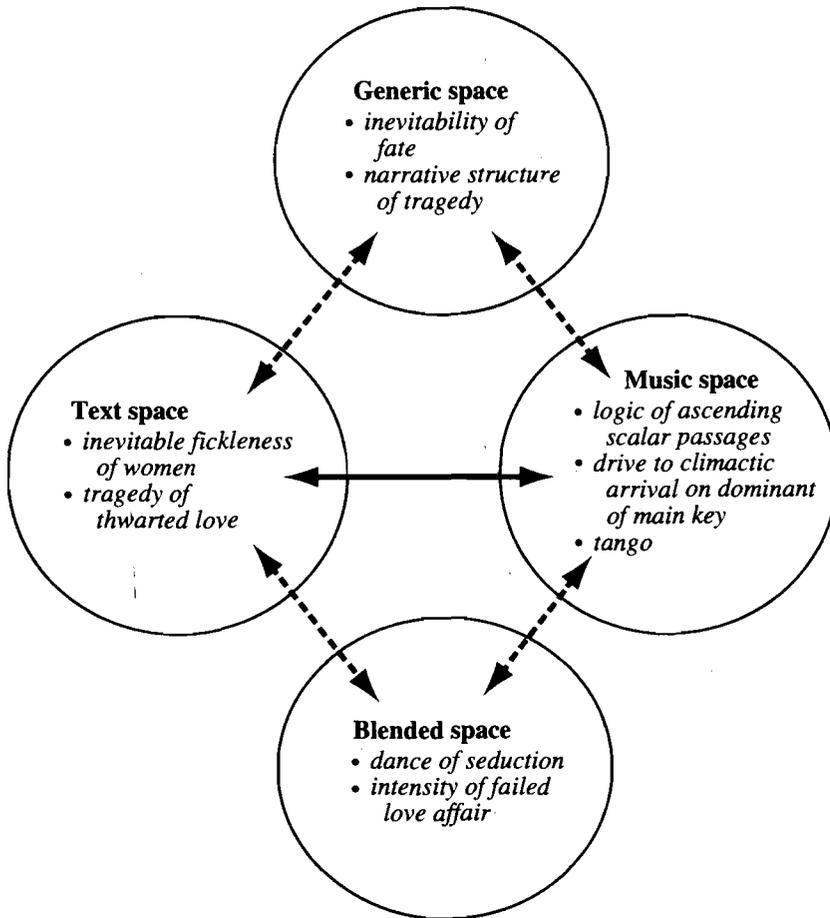


FIGURE 6.2. Conceptual integration network for the bridge of "Softly, as in a Morning Sunrise."

tragedy, both of which inform the structure of the input spaces.⁵ The result is more than a somewhat simplistic representation of one or two words from the text through a stylized musical gesture—that is, having the music go "up" to depict "lift" and "heaven." By exploiting humans' capacity to blend concepts from different domains in order to create new meaning, "Softly, as in a Morning Sunrise" creates a rich domain for the imagination within which we can hear portrayed the anguish of confounded and lost love.

For at least two hundred and fifty years there has been an active discourse about whether music, as a nonlinguistic mode of expression, can mean anything. Thanks to work on cross-domain mapping, we now have a much richer and more flexible sense of how humans create meaning. Humans create meaning by using what they know about a familiar domain to structure a less familiar domain, and by blending concepts from two correlated domains together in a new domain. As I have shown, this has direct application to the process of constructing meaning in and around music.

There is now a body of work that demonstrates the part cross-domain mapping plays both in basic characterizations of musical relationships and in extended theories of music (Saslaw 1996; Zbikowski 1997; Zbikowski 1998; Cox 1999; Brower 2000). Work on conceptual blending and music proceeds apace, and has been applied to the analysis of nineteenth-century songs (Zbikowski 2002), film music (Sayrs 2003), and the basic problem of musical meaning (Cook 2001). Building on the work of cognitive linguists, an exploration of cross-domain mapping and its relationships to embodied knowledge should also make possible a much more thoroughgoing account of musical meaning, and thus a fuller explanation of the transformative effect musical compositions can have on listeners.

Conceptual Models

When I noted that the tango was a part of the mental space set up by the music for “Softly, as in a Morning Sunrise,” I had in mind something more than the dry, dictionary definition of a tango: “a ballroom dance of Latin-American origin in $\frac{2}{4}$ time with a basic pattern of step-step-step-step-close and characterized by long pauses and stylized body positions.” A tango is this, but it is also something more: the word summons a rich network of associations, a network that includes not only the close physical proximity of the dancers but also the aroma of sexuality and seduction, redolent of a bygone era, that swirls around the dance. This network is a manifestation of our conceptual model for the tango. Conceptual models are relatively basic cognitive structures that act as guides for reasoning and inference; each model consists of concepts in specified relationships, and pertains to a specific domain of knowledge. If, once this structure is active, we are given a bit of appropriate situational context, we have available many likely inferences concerning what might happen next in a given situation.⁶ Once we know that a song is a tango and that it is sung by a solo singer, we can easily infer that it will be about seduction (if of a somewhat archaic sort), and that the lovers (like the dancers of a tango) are oblivious to all else.

In truth, the tango is even a bit more than this. Coming out of the slums and back streets of Buenos Aires in the late nineteenth century, it was only gradually absorbed by high society. During the early twentieth century it emigrated, first taking up residence in Paris and then in New York. In these metropolitan settings, it became even more of a dance of license than it was in South America, an opportunity for the spending classes to experiment with an exotic and foreign excess (Collier et al. 1995; Savigliano 1995). Romberg’s use of the tango in *The New Moon*, at a time when the dance was still somewhat

current, taps into this richer vein of knowledge, intending as it does to evoke a kind of dangerous sexuality equal to the subplots of insurrection and piracy that his librettists called on to energize an otherwise flaccid and predictable story line.

What is important for my argument is not whether we understand “Softly, as in a Morning Sunrise” as we might have in 1928, but that our conceptual models reflect knowledge that is basic to culture. One sort of knowledge was active in the culture of which *The New Moon* was originally a part; another sort of knowledge shapes the cultural perspective from which we view the tango (or, more to the point, *The New Moon*) some eighty years later. Put another way, culture consists of shared knowledge: as Naomi Quinn and Dorothy Holland put it, culture is “not a people’s customs and artifacts and oral traditions, but what they must know in order to act as they do, make the things they make, and interpret their experience in the distinctive way they do” (Quinn and Holland 1987, 4). A tango in the early twenty-first century is not the same as it was in the early twentieth century because the conceptual models basic to culture have changed.

It is very common for conceptual models to be nested, one within another. Thus the conceptual model for the tangos that occur within *The New Moon* operates within the model of the Broadway musical. We know that such musicals often take as their premise the most unlikely of circumstances, and that their purpose is entertainment rather than edification. Thus the appearance of a resolutely twentieth-century dance within a musical play set in eighteenth-century Louisiana is not cause for alarm, but simply represents one of the licenses permitted the authors of such shows. When we hear the tango in this context we do not infer that the scene has suddenly shifted to modern times, only that the (presumably) timeless topic of sexual intrigue is now afoot.

Conceptual models, as one of the basic structures through which we organize our understanding of the world, inform most of our conscious thought processes. With respect to categorization, our conceptual models for how musical materials are most typically organized will inform what we regard as the basic musical figure of the first phrase of “Softly, as in a Morning Sunrise.” Although the descending gesture of measures 1, 3, and 5 certainly has salience, our knowledge about how tunes of this sort are structured may lead us to expand the first two figures to include the oscillations of measures 2 and 4. Similarly, what counts as a typical member of a musical category is often informed by the function of category members within a broader context. For instance, while measures 1 and 3 begin with the same pitch (F5), and thus seem to set out a clear perspective for what is typical of the category of musical

figures around which the first phrase is organized, measures 1 and 5 involve the same pitch classes (F and C).⁷ The importance of these pitch classes to the key of F minor, along with the placement of both measure 1 and measure 5 at the head of a four-measure subphrase, might cause us to regard *them* as most typical of the category, were these factors to inform the conceptual model relative to which the categorization was made.

With respect to cross-domain mapping, the characterization of musical pitches as “high” or “low” so common among Western musicians is by no means necessary, but reflects a conceptual model that includes not only the conceptual metaphor *pitch relationships are relationships in vertical space* but also an entire network of linguistic expressions and notational conventions based on this metaphor. In contrast, musicians in Bali and Java describe pitches not as “high” and “low” but as “small” and “large.”⁸ Behind these descriptions is a conceptual model focused on the norms of acoustic production: small things typically vibrate more rapidly than large things. This acoustic fact is represented throughout the numerous parts of the gamelan, the collection of instruments central to the musical practice of Bali and Java.

Conceptual models, then, are not only crucial for explaining the larger context for our judgments about how musical events relate to one another; they also help to capture the uniquely cultural aspect of music. They are important to fuller accounts of the parts that categorization and cross-domain mapping play in musical understanding, and I have also used them to explain the differences and similarities between audiences’ and performers’ construals of works of popular music (Zbikowski 2002, 2004). Although we still have much to learn about the structure and use of such models, they will prove essential to our fuller explanation of how we understand music.

Conclusion

Discovering how humans make sense of complex and multidimensional sequences of patterned sound does not promise to be simple. This is so not only because human cognition is so staggeringly complex, but also because understanding music is not simply a matter of processing auditory signals—it involves a number of higher-order processes that humans use in a variety of ways to structure their understanding of the world. These processes include, but are not limited to, categorization, cross-domain mapping, and the use of conceptual models. It is important to emphasize that these processes are *embodied*, in two senses: first, they are part of the way the mind and brain

connect to and structure interactions with the outside world; second, they arise from more basic cognitive processes that operate on a preconceptual level. The cognitive tango that mind and brain dance with music is a complicated one, and the partners intertwine—music adapted to the capacities of mind and brain, mind and brain stretched and reconfigured by music—much as dancers in Buenos Aires and elsewhere have done for over a century. Some of the steps in the dance, as well as some of the stylized gestures, are now becoming more apparent, even as many remain obscure. But the dance has much to teach us, not only about how music relates to mind and brain, but also about how mind and brain make music itself possible.

NOTES

1. The pitch designation I use is that of the American Society of Acousticians: middle C is C₄; the B below middle C is B₃; the octave above middle C is C₅.

2. Left out of my discussion of “Softly, as in a Morning Sunrise” is consideration of the contrasting phrase that occurs in mm. 17–24, the arpeggio traced by the three descending figures of the first phrase (encompassing F₅, C₅, A_{b4}, and F₄), the octave transit the melody makes from the F₅ of m. 1 to the F₄ of m. 7, and the harmony. One could also note the higher-order musical category formed by the A sections (a category interrupted by the B section of mm. 17–24).

3. Most of the work that has been done on conceptual blending focuses on blends set up by language. However, there is a strong argument that the process is not specific to language; see Fauconnier and Turner 2002.

4. The tango has long been associated with lovemaking in general and acts of seduction in particular. What is interesting about “Softly, as in a Morning Sunrise” is the sense of denial created when the ascending lines of the bridge are exposed as shams: these expansive gestures lead not to an escape from the jagged descents of mm. 1–15 but back to the very premise of those descents (the F₅ of m. 25, equivalent to the F₅s of mm. 1 and 9). This same sense of denial is lacking in the instrumental tango that introduces the song “Fair Maria” later in act 1 of *The New Moon*.

5. Note that the generic space of figure 6.2 is itself a richly blended space. Describing its structure would require a number of conceptual integration networks; for discussion, see Fauconnier and Turner 2002.

6. The conceptual model, as I construe it, is similar to knowledge structures proposed by a number of other researchers in cognitive science, such as the idealized cognitive model (Lakoff 1987), cognitive domain (Langacker 1987), frame (Minsky 1975), and mental model (Johnson-Laird 1983). From the larger perspective that I develop in recent work (Zbikowski 2002), musical concepts are a result of processes of categorization, and relationships between musical concepts are a derivative of the process of cross-domain mapping. Conceptual models are consequently the first level of organization for concepts. Although I characterize conceptual models as “relatively basic” and “fairly small,” this is only within the context of higher cognitive processes

(which is where I prefer to focus). Were we to consider the whole of cognition, it would be apparent that conceptual models are hardly basic and are of a compass that is far from small. For further discussion, see Zbikowski 2002, chaps. 3 and 4.

7. Pitch class is simply a more general way to characterize pitches. Whereas F5 designates a single *pitch*, F (as a pitch class) designates a *class* of pitches that includes F5, F4, F3, and so on.

8. Benjamin Brinner, personal communication, July 8, 1997. See also Zanten 1986, 85.

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