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# Our Varying Histories and Future Potential: Models and Maps in Science, the Humanities, and in Music Theory

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# Our Varying Histories and Future Potential: Models and Maps in Science, the Humanities, and in Music Theory

## **Abstract**

Part 1 briefly recounts the influence of social unrest and the explosion of knowledge in both psychology and the humanities circa 1970-1990. As the sciences rely on explicit top-down theories connected to bottom-up maps and models, and whereas the humanities build on bottom-up differences within malleable top-down “theories” (approaches, themes, theses, programs, methods, etc.), the changes in the sciences during this period contrasted sharply with the changes in the humanities. Part 2 discusses in detail how these two social transformations affected the histories of music theory and cognitive music theory. The former fractiously withdrew from its parent organization (AMS), whereas the latter was welcomed into SMPC. Inasmuch as both music theory and cognitive music theory rely on maps and models, Part 3 examines the metatheoretical importance of these terms for music cognition, music theory, and cognitive music theory. Part 4 speculates about the future—how music cognition, cognitive music theory, and music theory contribute to the structure of musical knowledge. The intellectual potential of this unique triadic collaboration is discussed: psychology provides a commanding empirical framework of the human mind, while music theory and cognitive music theory logically model moment-to-moment temporal emotions and the auditory intellections at the core of musical art.

## **Keywords**

history, humanities, sciences, theory, epistemology

## **Disciplines**

Music | Music Theory

## OUR VARYING HISTORIES AND FUTURE POTENTIAL: MODELS AND MAPS IN SCIENCE, THE HUMANITIES, AND IN MUSIC THEORY

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**PART 1 BRIEFLY RECOUNTS THE INFLUENCE OF SOCIAL UNREST** and the explosion of knowledge in both psychology and the humanities circa 1970-1990. As the sciences rely on explicit top-down theories connected to bottom-up maps and models, and whereas the humanities build on bottom-up differences within malleable top-down “theories” (approaches, themes, theses, programs, methods, etc.), the changes in the sciences during this period contrasted sharply with the changes in the humanities. Part 2 discusses in detail how these two social transformations affected the histories of music theory and cognitive music theory. The former fractiously withdrew from its parent organization (AMS), whereas the latter was welcomed into SMPC. Inasmuch as both music theory and cognitive music theory rely on maps and models, Part 3 examines the metatheoretical importance of these terms for music cognition, music theory, and cognitive music theory. Part 4 speculates about the future—how music cognition, cognitive music theory, and music theory contribute to the structure of musical knowledge. The intellectual potential of this unique triadic collaboration is discussed: psychology provides a commanding empirical framework of the human mind, while music theory and cognitive music theory logically model moment-to-moment temporal emotions and the auditory intellections at the core of musical art.

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### Part 1

#### *Introduction*

**O**n the occasion of Tirovolas and Levitin’s research survey of *Music Perception* from 1983 to 2010 (this issue), it seems appropriate to recount the historical, cultural, and philosophical contexts that shaped

the rise of music cognition and cognitive music theory in the United States. I begin shortly after the Vietnam War. Following the social divisiveness of the war (when many, including the present author, were in graduate school), radical changes occurred in almost every corner of modern life (e.g., the women’s movement, civil rights, jurisprudence, post-colonialism, etc.).

A competing transformation in the 1970s was the growth of new knowledge and the establishment of new fields, which expanded the size of university faculties. During this development, college and university faculties became more professionalized. For those wanting to teach at the college level, doctorate degrees were the new reality, and to earn tenure, publication at many universities and colleges became mandatory. All this created pressure for more venues of publication. The emergence of music cognition (and its flagship journal *Music Perception*) was an outcome of all this (to which I shall return).

Recent Ph.D.’s may regard my selected time frame as ancient history (occurring well before they were born). But both young and old should not forget the power that music exhibited during that turmoil, for it became a favored medium of rebellion and protest (e.g., “We Shall Overcome” during the civil rights movement and Bob Dylan’s “Blowin’ in the Wind” during political protests). Throughout this period, music showed its power by uniting people who had similar moral, political, and economic values and who were against the war, against current authority, and in favor of radically rebuilding the worldwide social structure. More so than any of the other arts, music created a sense of solidarity. It achieved this partly because mass culture via the simultaneous emergence of wide-reaching modes of electronic communication (AM/FM radio, satellite television, video tapes, LPs, multi-track recordings, etc.) efficiently delivered music for like-minded consumerists, regardless of geographical location.

The burgeoning multiplicity of types of listeners represented every economic, racial, gendered, and cultural level of society, including, of course, those who favored the war. Society saw a rapid rise of counter-cultural diversity in the proliferation of pop, folk, jazz, rock,

gospel, country-western, and ethnic music, something that is still with us today. Yet there remained, of course, a commitment to the institutionalized traditions of symphony, chamber music, opera, ballet, and the Broadway musical.

In higher education a consequence of targeted-listener demography was that both psychology and academic departments of music began to acknowledge music as a cultural, social, economic, and emotional force to be reckoned with. In other words, a social and academic revolution also took place regarding the way music was conceptually valorized. All music—whether “low” or “high”—was now worthy of collegiate study along with the European classical music of the past.

With the war draft and the burst of new ideas, the number of undergraduate and graduate students wanting higher degrees increased. And a new kind of student, unschooled in classical musical traditions and interested mostly in the music of his or her social demographic, began to arrive on campus. Thus, shifts in the musical curriculum became inevitable. As diversity was now valued, the study of popular culture, cultural history, ethnography, and music anthropology came to populate the course lists of universities and colleges across the country. At the forefront of this change stood postmodernism, offering new methods for conceptualizing culture, identifying new subjects and areas for music research, and generally transforming how music was to be understood. From the new wave of students, those who qualified for the doctorate entered the professoriate and permanently changed the face of music study.

### *Postmodernism*

After the war, the wave of radical anti-authoritarianism in the humanities morphed into what emerged in the 1960s in the vernacular juxtapositions of postmodernist art. The critique of the modern versus the postmodern was carried forward by the rise of literary theory in the 1970s and then applied to epistemology by a prolific group of French philosophers in the late 1980s (Derrida, Lyotard, Foucault, Deleuze, Baudrillard, and others).

Today, in some quarters scholars would say that we have now moved past postmodernism to an anti-postmodernism environment. Indeed, in the mid to late 1990s humanistic scholarship began to shift closer to the social sciences—to cultural history, cultural anthropology, political theory, and the like. Other humanists during this period retrenched to the writing of traditional history, but with an increased sensitivity toward the multiplicity of voices within a given culture and a correlated

reluctance to think in terms of theoretical generalizations.

Because the postmodern movement had an important impact on the interpretation of knowledge not only in the humanities but also in the sciences (to be explained), we must discuss it briefly and sketch out a few of its attributes inasmuch as, even after a fairly short reign (roughly one generation), the residue of this ideology lingers on, permeating many current beliefs and practices in both fields. In what follows below, I will list some of the core beliefs and propositions.

Postmodernism’s modus operandi was reflexive and hermeneutic. It attempted to construct and deconstruct written narratives (discourses, dialectics) about reality rather than to settle for the reality derived from empirical research. In its most conservative, purest form, it embraced interpretation while suppressing the analysis of facts, and favored personal understanding while holding general explanation suspect—this because reductionism marginalized difference, an important issue to postmodernists.

Psychologists would regard the term *postmodernism* as a “fuzzy” category of general-knowledge (GK) (Medin & Barsalou, 1987) with multiple, sometimes contradictory, strands. Defining the term is thus out of the question. As an ideology without boundaries, postmodernism therefore does not proscribe how postmodernists go about their research programs. Some scholars adopted postmodernism in a pragmatic, fluid, and nuanced way. Others have been less flexible, even dogmatic and doctrinaire, claiming, for example, that “all, or nearly all, aspects of human psychology are completely socially determined” (see Duignan’s overview, 2011). In other words, to this latter group, behavioral science was just one narrative among many in the “game of language” (see Patton’s overview, 2001).

Although these statements may seem absurd to the readers of this journal, the postmodernist’s philosophy was respect and tolerance—for the irreducible, for signifying, non-dialectical differentiation, for local variation, and for heterogeneously incommensurate values (the literature on postmodernism is immense; for general overviews, the reader may consult Duignan, 2011; McGowan, 2005; Patton, 2001; for uses of the word in musicology, see Williams, 2000, and the numerous essays in Lochhead & Auner, 2002). Validity of experience per se could thus be trusted (though without “foundational” status), provided postmodernist scholars demonstrated self-awareness in their research by confessing their “situatedness” (and thus potential bias) with respect to a chosen text, dialectic, narrative, or what have you. Hence, unlike the sciences, postmodernist writings are full of

biographical asides and personal introspection. Such egoism is perhaps not surprising, given the movement's focus on difference.

The postmodernist emphasis on deconstructing written discourse confronted not just the semantic self-reference of written language but also the multivariate contexts of signifying images, icons, and other non-verbal imaginative phenomena (e.g., music and dance). They insisted that in language, word meanings functioned as parts of other word meanings in an infinitely reflexive regression (or in a bracketed arbitrariness). No words were concrete; all required interpretation. But within a given historical moment this enabled research to furnish a more or less accurate knowledge, one that was pragmatically useful if only of limited truth. (For today's humanists, the test for knowledge production is how well any approach, theme, thesis, program, method, etc., accurately and interpretively elucidates a chosen social discourse. This is notably different from the sciences where theories attempt mathematically or logically to model or map natural phenomena.)

Postmodernists were suspicious of any kind of centrism, essentialism, elitism, or high-level metatheory that suppressed nonconformist thought. Ironically, in its heyday postmodernism itself became the kind of grand metanarrative that it disparaged. That is, for all its protestations against past ideologies, postmodernism became just one more ideology among many, and in many cases was just as domineering and conservative as, say, the eighteenth-century Enlightenment or German Idealism (Kant, Hegel) that it vilified.

In any event, like all humanists, postmodernists elevated the notion of qualification to the nth degree. Intellectually, the movement institutionalized a kind of existential skepticism toward any kind of ideology (but too rarely skeptical of its own ideology). Its adherents claimed that all knowledge (including that gleaned from scientific techniques) was relative and historicized because human agents always construct knowledge in compliance with current social practices and beliefs, which change over time. (Relative though knowledge may be, it cannot be gainsaid that both civilization and biological survivability strongly argue that human beings have for a very long time known quite a lot about the world, though not the elitist knowledge derived from scholarly pursuits.)

The interpretive vocabulary of postmodernism was replete with adjectives such as ideological, perspectival, situated, immanent, privileged, problematized, provisional, phenomenological, subjective, approximate, contextualized, intertextualized, imbricated, mutable, speculative, qualifiable, and contingent. Postmodernist

scholarly discourse placed a high value on heterogeneous and multiply textured interpretations along with a keen interest in the power relations that bolstered a given cultural ideology.

Many postmodernists were wary of interpretations that relied on scientific vocabularies—words such as axioms, constants, unity, generalities, equivalence, cyclicity, veridicality, laws, rules, universals, reductionism, causation, prediction, probability, objectivity, independent reality, certainty (binding implication), verified and falsified evidence, logical formalism, determinism, closed systems, foundational or holistic knowledge, truth, quantifiability, normative behavior, and the like. Instead, postmodernist “perspectivism” insisted that knowledge was necessarily a social construct (Kuhn, 1962) and that scientific reality was never totally objective (Gieryn, 1999). (But again, to find out what science is about, physical and biological facts, however conceived, have to be part of the cultural discourse within the languages of mathematics and symbolic logic.)

In sum, postmodernism was the academic discipline that made the case for idiostructuring—for difference and oneness (undefined by comparison to contextual similarity), for personal and group individuality, and for the value of sheer uniqueness. This is its legacy, although like all ideologies it overreached (particularly in its anti-science posturing).

#### *The Decline of Humanistic Positivism*

During the 70s and 80s, postmodernists largely brushed aside older disciplines in musicology, such as archival and manuscript research, primary source studies, and any kind of data collecting for its own sake inasmuch as isolated facts were suspect. According to them, the methodology of such philological practices was driven by a “positivist” mentality (a charge leveled by Kerman, 1985).

Over several generations, however, these so-called positivists had rediscovered and deciphered early music and then transcribed it into modern and reliable scholarly and performing editions. In so doing, they had bequeathed a lasting legacy not just to the field but to the art of early music. But by concentrating on the verification and falsification of source facts, postmodernists denigrated positivistic methodologies because they were, so it was said, theoretically impoverished, overlooking the relativistic and cultural nature of humanistic knowledge. As we have seen, texts engendered multiple interpretations, and notated scores were no different.

According to postmodernist sensibility, the “closed” research of positivism rarely came to grips with the

culturally “open,” social meaning of the music. The charge was that the methods of scholarly positivism would never be capable of dealing with the true nature of musicological subject matter because text and authenticity were contradictory concepts.

Postmodernists also regarded stand-alone score analysis as just another form of positivism, which called for new kinds of historical and cultural approaches to music theory. But those committed to theory and analysis were unconvinced of postmodernist doctrine, and most held their ground. This decision had, as we shall see, a significant outcome in music theory and analysis.

#### *Literary Theory and Postmodern Musicology*

Eschewing the disciplines and methodologies established by music positivism, the “new musicology” had to find new rules of scholarly behavior and, in general, looked to literary criticism and cultural theory for its models. If positivists and postmodernists shared any common ground, it was that both believed in musical styles as languages and scores as texts. So literary theory appeared to be an appropriate model for what was called the “new musicology.”

*Theory* in the humanities means any kind of more or less fixed and hypothetically identifiable top-down approach to a text or a score, where the target of the literary or musical analysis is mapped onto the phenomenon in accordance with the chosen approach. The difference between the sciences and the humanities is obviously that in the latter there are no replicated experimental tests of the various hypothetical approaches. This is because the subject matter of arts and letters is unique, and so humanists respect the bottom-up, idiostructural quality of written phenomena (whether text or score) even if the internal analytical mapping violates the external top-down approach (i.e., transgresses the boundary of the selected “theory”).

Hence, in the humanities, “anomalous” analytical uniqueness is frequently valued more than the general integrity and consistency of the approach because individuality is regarded as essential to the meaning of the humanistic phenomenon being analyzed. Humanistic theory is thus not paradigmatic because analytical mappings are always shifting the top-down grounds preselected to generate the analysis (sometimes the grounds are ignored altogether in favor of the originality of the work or of the intellectual promise of an atypical mapping). In other words, the analysis need not be isomorphic to the chosen approach (to the “theory”). Free-wheeling analyses without explicit theoretical commitments are thus not unusual in the humanities (e.g., in essays and journalistic pieces).

The positivistic literary criticism of the 1930s and 40s was on the wane in the 1950s, and by the 1960s literary theory was in the ascendant. From 1960 onward one witnessed endless turnovers in literary theory—from critical theory and literary history to semiotics, narratology, Marxism (commodification), structuralism, reactive deconstruction, psychoanalytical approaches (Freudian, Lacanian), myth criticism, phenomenology, existentialism, hermeneutics, reader-response theory (which had a psychological component), feminist criticism, black aesthetics, neo-Marxism, and leftist politics (Leitch, 1988).

Cycling through all the various approaches was remarkable (many monists adopted one approach for their entire career). As said, these approaches are, from a scientific point of view, not theories but mappings or models without explicit goals of theoretical unity. This is not to say there is no attempt at theoretical codification—narratology, which comes from structuralism, is a very well developed literary theory (see Prince’s 1967/2003 dictionary), as is semiotics (musical semiotics has clear mappings and an analytical symbology to go with them; see, e.g., Nattiez, 1990). Because the literary terrain is so varied and complex, one frequently must use many maps to arrive at a critical explanation of a given text, whether a poem or a score, inasmuch as textual meaning always remains culturally and historically contingent.

The important point is that throughout the 1970s, 80s, and 90s these “theories,” themes, motifs, programs of research, approaches, mappings, models, and what have you were imported and freely appliquéd onto the postmodern studies of music history and culture.

To respond to these new ways of thinking, a rush of new publications occurred in the arts and letters (e.g., *New Literary History*, 1970; *Critical Inquiry*, 1977), and this was no less true in musicology (e.g., *Journal of Musicology*, 1981). As elsewhere, various fields in music were carved up into subfields with specialized interests (e.g., *19th Century Music*, 1977; *Computer Music Journal*, 1977; *Black Music Research Journal*, 1980; *American Music*, 1983).

As time wore on, the structuralism that typified earlier literary and music criticism thus yielded to the post-structuralism of certain postmodernists. Many new subjects found a place in the curriculum, and conflicts between “old” and “new” ways culminated in what came to be called the “cultural wars” (positivism vs. postmodernism). These disagreements paralleled the “linguistics wars” (the polarization between transformational grammars and transformational semantics; see Harris, 1993) and the “science wars” (postmodernist tenets vs. the nature of science; see Gieryn, 1999). All three conflicts dominated the humanities, the social sciences, and the

sciences even into the late 1990s. Although tempers have cooled, the scars are still present. The question is, was all the polemic necessary?

### *Science and Psychology*

If postmodernism foregrounded human difference *per se*, then human science in the form of psychology takes precisely the opposite tack, by seeking out the commonality and cross-cultural universals between individually different social groups—between novices and sophisticates, savants and normals, and so forth.

In science, change is motivated by a belief in incremental progress abetted by the unending analysis of experimental data. Top-down theories are strongly integrated with their bottom-up models and mappings, and these require the latter to stay within the confines laid down by the theory. The lingering anti-authoritarianism in the humanities and the strong desire to reject the received wisdom (which seemed unwise to many) was thus not nearly so pronounced in the sciences, which as an intellectual domain, has traditionally been less impacted by social change than the humanities or the social sciences. This is because normal science relies on “paradigms,” where change results from accumulated anomalies that eventually topple or suddenly dethrone a current theory (Kuhn, 1962), relegating a once accepted practice to the status of an historical artifact. Such shifts perhaps depend less on social revolutions, which are motivated by metaphysical beliefs, than on confronting an accumulation of unsupported data. So postmodernism had a limited effect on the “hard” sciences (physics, chemistry, mathematics).

However, it invaded the “soft” social sciences (cultural anthropology, sociology, political science, and economics) and social psychology. This is because the bottom-up mappings and models used in the soft social sciences are less tied to their theoretical structures, which is to say, in the soft social sciences a lot of modeling and mapping takes place without obedience to explicitly or implicitly fixed theories. So what happened in the “soft” social sciences roughly paralleled what went on in the humanities; hence, postmodernism—following the social upheaval after the Vietnam War—played a greater role in these disciplines. In contrast, the “hard” social sciences more closely resembled the “hard” sciences and so remained somewhat immune from postmodernism (space does not permit examples from the social sciences).

Also less affected were “hard” psychological research areas (psychophysics, perception, cognition, memory, development, attention, etc.) since these experimental fields are data driven and paradigmatic in their approach. Thus in general the methodological rigor of the “hard”

sciences was influenced more by the growth of new knowledge and new technologies than by the social unrest.

As said, in the 60s and 70s scientific knowledge was expanding at an exponential pace, and, as new subfields emerged, there was a large increase in the number of research articles being written (as in the humanities). Consequently, traditional journals, whose editors were conservative and committed to the past, were overwhelmed, and scholarly societies felt strong pressure to provide more venues for publication. This was partially solved by subdividing journals into topics (e.g., in 1970 *Physical Review* was broken into nuclear physics, particles and fields, general physics, and solid states; *Journal of Experimental Psychology* [1916] was split into animal behavior [1976], general [1976], human learning and memory [1976], human perception and performance [1976], learning, memory, and cognition [1982], and applied [1996]). Of course, many new journals were founded as well (e.g., *Quarterly Journal of Experimental Psychology*, 1981; *Cognitive Neuropsychology*, 1984; *Theory and Psychology*, 1991). Other solutions for increasing the “bandwidth” were to publish more issues per year and to opt for a two-column, larger page with smaller type.

New publications also appeared in the hard sciences, where novel kinds of interdisciplinary research (e.g., genetics) required new interdisciplinary publications (e.g., *Molecular Biology and Evolution*, 1983; *Methods in Organic Synthesis*, 1984). Parallel developments in psychology saw the advent of information processing (and later informatics), artificial intelligence, personal computers, the high-tech fields of cognitive science, and eventually cognitive neuroscience.

### *Music Cognition*

As in the humanities, there was some irritation by music psychologists that psychology as a whole had prioritized the studies of language and vision and largely ignored the topic of music (which to some extent is still the case today). It was into this milieu that Diana Deutsch launched the interdisciplinary journal *Music Perception* in 1982. But as we saw, the establishment of a new journal was not unusual at the time. *Psychomusicology*, whose founders included scholars from both music and psychology departments, appeared in 1981, one year before *Music Perception*, and the British journal *Psychology of Music*, which had a strong bent toward educational psychology, had existed since 1973. The point is, a critical mass of psychologists collectively yearned to push music cognition into prominence.

The argument behind this thrust was that that study of music opens a window onto psychological processing like no other art form. Music is primarily a temporal art, with inherently mathematical properties of time and space (intervallic and durational ratios; pitch height, registral direction, return of pitch frequencies; meters on many levels, etc.). Yet perceptual experiences swirl constantly, like the blades of a windmill (see Figure 1). Theories of music cognition bring this windmill into focus, providing a shuttered lens that models the whole gamut of the temporal human experience, from psychophysical stimuli to mapping our deepest emotions. Such musical snapshots of this experiential temporal swirl have the potential to fan outward, informing every aspect of psychological processing. This is the importance—and the challenge—of our field.

It was clear from the beginning that *Music Perception* was to be an international journal, and Deutsch worked hard to include European and Asian scientists (in the East the chief participants have been the Japanese, the Koreans, and the Australians). But the unusual philosophy of *Music Perception* was its commitment to *interdisciplinary research*. The very earliest issues made this clear, where articles by music theorists (Benjamin, Brown, Bruner, Butler, Erickson, Narmour, Lerdahl, Lewin, Thomson, Walsh, and others) and linguists (Chen, Jackendoff, Keiler, Steedman, and others) appeared alongside those by psychologists. In addition, Deutsch's acceptance of interdisciplinarity encouraged psychologists and music theorists to collaborate, and over the years many such co-authored

articles have appeared (e.g., by Butler and Ward, Eitan and Timmers, Krumhansl and Lerdahl, Narmour and Rosner, Meyer and Rosner, Parncutt and Bregman, Repp and London and Keller, and others). Music theorists also began to publish their own experiments in the journal. *Music Perception* was thus always meant to be a mixture of theoretical and empirical approaches to the study of music (I will discuss the importance of music theory to the interdiscipline later).

The use of the word “perception” in the title of the journal made the point that, even though cognition was then the dominant approach, the areas of perception, psychophysics, and acoustics were not to be left behind. In other words, Deutsch was something of a maverick with respect to the cognitive revolution (*Cognition* was first published in 1972). Yet from the beginning the articles in the journal cast a wide net—from biology to bells to art to medicine and beyond, even as cognition swept over the field of psychology from the 1960s onward—following the rejection of positivist Skinnerian behaviorism and the codification and incorporation of Gestalt principles into the mainstream.

When Deutsch stepped down as editor in 1995, the high quality of the journal continued unabated under the leadership of Jamshed Bharucha (1995–98), Robert Gjerdingen (1998–2002), and Lola Cuddy (2002 to the present). Particularly noteworthy in the past fifteen years or so has been the broadening of subject matter to include research in the perception of musical time, musical emotion, and musical performance along with, perhaps, an increase in use of patterned and contextualized musical stimuli which are thought to be more “ecologically valid” (see Figure 2 in Tirovolas & Levitin, 2011). And in 2005 under Cuddy's supervision, the journal underwent a complete makeover in format with double columns and more issues per year to accommodate the growing rate of submissions. In the world of science publications *Music Perception* has thus achieved more visibility than ever before.

The prophetic music books on psychology in the 1950s, 60s, and 70s—for example, those of Meyer (1956; for a recent scholarly appreciation of Meyer, see the entire first issue of *Musica Humana*, 2009), Francès (1958/1988), Fraisse (1956), Roederer, (1973), Plomp (1976), Davies (1978), Critchley & Henson (1977), and Pierce (1983)—begged for a collection of expert essays summarizing the latest research, which Deutsch's (1982) path-breaking volume more than met (a second, new volume with fresh articles followed in 1999; a third is in preparation).

After 1982, a cascade of edited volumes of scholarly essays flooded the market (see Table 1). Numerous textbooks augmented these scholarly essays at the undergraduate level (e.g., Butler, 1992; Dowling and Harwood,

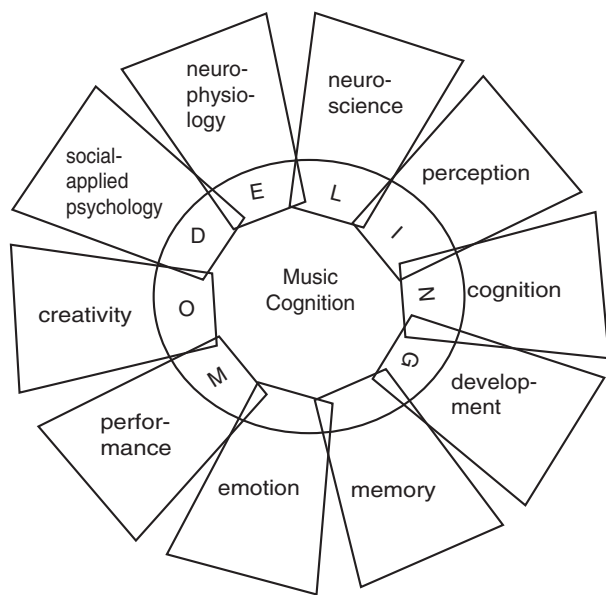


FIGURE 1. The shuttered lens behind the windmill (see text).



TABLE 1. Chronological Listing of Edited Essay Volumes Published During the Rapid Rise of Music Cognition as an Independent Discipline.

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Deutsch, (1982)
Bruhn, Oeter, & Roelsing (1985)
Howell, Cross, & West (1985)
Gabrielsson (1987)
Sloboda (1988)
McAdams & Deliège (1989)
Howell, West, & Cross (1991)
Jones & Holleran (1992)
McAdams & Bigand (1993)
Aiello (1994)

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1986; Hargreaves, 1986; Sloboda, 1985, and others). During the same period, a number of music-theoretic books specifically directed toward music psychology shaped the field (e.g., Gjerdingen, 1988; Lerdahl & Jackendoff, 1983; Narmour, 1990, 1992; Parncutt, 1989). Solo books by scientists were also a regular and important occurrence (e.g., Krumhansl, 1990; Serafine, 1988; Sundberg, 1987). Diana Deutsch formed SMPC in 1990, and the first meeting was held in 1992 (at the second ICMPC). By then music psychology had clearly become an independent research area and had achieved status as an interdisciplinary subject throughout the academic world.

Much more could be said about the many scholars who contributed to its rise, but I need not recount that history because it has been dealt with elsewhere (see Cohen, 2009; Cross, 1998; Gjerdingen, 2002; Hallam, Cross, & Thaut, 2009; Huron, 1999, and many others).

By the mid-1980s music theorists had gained access to the voluminous amount of empirical work being done in music psychology. Musicians could now efficiently examine the discipline's methodologies and experimental designs along with glimpsing into the specialized bibliographies of psychophysics, perception, cognition, development, attention, and memory. Music theorists also became aware of comparative psychology in areas such as language, vision, and animal behavior. And not a moment too soon: for looming just around the corner was the juggernaut of cognitive neuroscience, which would eventually take a strong interest in music.

## Part 2

### *Music Theory as an Independent Discipline*

Although tonal systems (learned pitch hierarchies) have dominated pitched music for thousands of years (and continue to typify what most people listen to), twentieth-

century audiences had to confront many new systems of composing that suspended, avoided, weakened, or suppressed tonality altogether. There were many reasons for this revolution, rejection, whatever one wishes to call it. In twentieth-century music (whose early innovators were Debussy, Schoenberg, Bartók, and Stravinsky), it appears that these composers were rebelling against the tonal authoritarianism of high romanticism, whose musical ideas seemed to be depleted. In a political sense, we might historically interpret the compositional desire to overthrow the past—to reject tonal knowledge as stylistically “played out”—as a musical protest against the capitalist societies that produced the carnage of the late nineteenth century, which culminated into World Wars 1 and 2. As we saw earlier, wars cause cultural changes in the arts because to some extent the arts model the culture to which they belong.

However, the more direct reason for the rejection of romantic tonality, up to the tonal minimalism of the 1960s, was to free composers from the stylistic constraints that tonality imposed and from the entrenched musical traditions that seemed to ignore the momentous changes taking place in twentieth-century society; namely, the onslaught of modernism, the hegemony of scientific reasoning, and the growing wonders (and musical possibilities) of technological innovation.

Following nineteenth-century egoism—that it was genius and originality that guaranteed historical greatness—composers of the early twentieth century, who boldly accepted the new social status quo of modernist society—thus sought to formulate new musical identities. If great scientists possessed the innovative creativity to discover new and unanticipated natural laws, why couldn't both modern and post-modern composers invent new systems of music? Given the number of great tonal composers from the past—whose works were preserved and had dominated concert programming for 150 years—the problem for contemporary composers was crafting an individualized musical voice, finding new audiences for that voice, and becoming a new great—one who invents original and compelling music. Thus, like literature and the visual arts, “serious” music radically cycled through styles decade by decade (see Morgan, 1992) since every composer wanted to be recognized and remembered as an innovator.

Traditional tonal theory and analysis were at a complete loss to cope adequately with the blitz of new modernist styles in the twentieth century, such as non-serial atonality, twelve-tone atonality, integral serialism, experimentalism, indeterminacy, pluralism, minimalism, electronic music, computer music, and so forth.

Accordingly, beginning with the early revolutionary works of Debussy, Ives, Scriabin, Stravinsky, and Schoenberg, and continuing through the Futurism of the 1910s (Russolo), the neoclassicism of the 20s (Poulenc et al.), the experimentalism of the 30s and 40s (Cowell, Cage), the integral serialism of the 50s (Babbitt and many others), and the minimalism of the 60s (Reich and many others), new theories had to be constructed and formulated to unravel these never before imagined musical “languages.” And such theories had to be created whole cloth because these newly asserted, highly original styles seemed largely without precedent. That is, unlike past changes in tonal styles, these new languages did not gradually evolve, and so exhibited musical content that was either very high in information or else heard just as noise. Although much of the new music was directed toward connoisseurs, increasing numbers of new styles were imposed on ordinary listeners who found modern and postmodern music either very demanding, confusing, or altogether unintelligible.

Consequently, composers played a very important part in constructing the theories of this new music. Given that music theory had always been shaped by composers, it was not surprising that many modern composers were likewise involved in formulating music theory (e.g., Schoenberg, Hindemith, Stravinsky, Krenek, Sessions, Babbitt, Rochberg, Perle, Stockhausen, Boulez, and many others). Thus composers were directly responsible for much of the new thinking in music theory.

They even had their own journal, *Perspectives of New Music* (established at Princeton University in 1962), which complemented the *Journal of Music Theory* (established at Yale University in 1957). The significance of these publications in shaping the future of music theory as an independent discipline cannot be overestimated (the scholarly problem for this Princeton-Yale axis at the beginning was that the field was so small “insider” peer review was common). Together, the two journals defined the subjects, methods, techniques, and assertiveness of the field, a tone that probably derived from the myth of the misunderstood, alienated composer of romantic lore, which easily transferred to music theory: like positivistic musicologists, music theorists felt isolated and disdained by the American Musicological Society (AMS).

With so much at stake, the theorists who took up the cause had to sort out the pitch collections, the synthetic scales, the non-tertian chords, the new kinds of textures, the complexes of additive and subtractive rhythms, the asymmetric meters, and the impact of all these on new types of formal arrangements, which seemed to be non-organic and lacking the aesthetic tonal arches that listeners were accustomed to.

By the early 70s, music theory had constructed an array of new analytical techniques to determine the structures of these unprecedented works. Because these theories depended largely on internally consistent logics, they and the descriptive graphic analyses that they generated were different from anything previously seen in the history of music theory.

Both traditional and “new” musicologists found these innovative descriptive theories and their graphic analyses hard to fathom, and, moreover, too many of the analyses seemed overly technical and thus uninformed by historical and cultural knowledge (earlier tonal theories of music relied on roman-numeral analysis and key labeling, which can be learned by first-year undergraduates). As appreciations, these analyses, many of which were intellectually interesting and analytically enlightening, attempted to validate the new styles through theory alone, with scant attention paid to the part history or culture played in such a judgment.

Because the new theory had, it seemed, few precedents and marshaled new kinds of analytical methodologies and novel symbologies (e.g., derived from ideological commitments to Schenkerian theory, set theory, mathematical groups, arrays, combinatorics, and many other kinds of formalistic descriptions), the editors of traditional musicological journals were generally reluctant to publish the research articles using these techniques. Given the pressure to publish in academe, music theorists found this frustrating. A correlated irritation was the perception that at national conferences of AMS they felt they were receiving less than their fair share of the allocated program slots for discussions of recent theory and innovative analysis.

If the music historians were troubled by the new theory, the new theorists felt that both the old and new musicology devoted too much time to taxonomies of style, manuscript attributions, social functions, cultural meanings, and social histories with only rudimentary and unsophisticated attention to the “music itself,” to its structures, forms, materials, composition, and so forth. (Furthermore, the “new” musicology had been woefully negligent in studying the compositional content of “serious” twentieth-century music.)

In short, those interested in analysis and theory and who were fascinated by contemporary composition were simply “disinterested in the kinds of activities AMS fostered” (Forte, 2003, paragraph 5). Consequently, music theorists begin to plan seceding from their parent organization inasmuch as the “very idea of an autonomous ‘field’ of music theory was anathema to many in the AMS” (Forte, paragraph 4). (It should be noted that Leonard Meyer, who began his career as a composer, was

against the split from the beginning because he thought that theory and analysis would be severely compromised in the absence of also studying the appropriate historical contexts.)

In 1977, alienated theorists founded the Society of Music Theory (SMT), and in 1979 launched the society's journal, *Music Theory Spectrum* (to complement the *Journal of Music Theory*, 1957, and the German journal *Musiktheorie*, 1979). The British journal *Music Analysis* followed in 1982, and France's *Analyse Musicale* in 1985 (*Music Theory Online* appeared in 1993). As in music psychology, for the first time a plethora of articles about twentieth-century music qua music saw print, and even the analysis of tonal music received a more thorough and rigorous treatment than ever before. Like music cognition, music theory seemed to be a discipline whose time had come. (For the chronology of SMT's founding, see Browne, 1979.)

But after the split, the bad feelings between AMS and SMT did not dissipate. Postmodern "liberals" took a dim view of "positivist" music theory which, as a stand-alone discipline, seemed to churn out pluralistic analytical "readings" and "feature" descriptions of music scores for their own sake. Aside from their technical complexity, such stand-alone analytical articles represented a textual, logical exegesis of complex musical works. "Ideas" (Schoenberg, 1950/2010), "imaginary concepts" (Goehr, 2007), or "fictions" (Guck, 1994) were also explored, which implied the need for imaginative prose interpretations and elaborate analytic graphs to accompany the elitist musical experiences of the professional analyst.

The postmodernist charge was that such analyses, however logical, lacked sufficient context (history, culture, society, aesthetics, and cognition) without promise of connecting to a "larger picture," and relied too much on the authority of the printed score, where the music text was "freeze-framed." In effect, the score was reduced to an objective, reified, autonomous thing (Butterfield, 2002) with a determinable, closed structure. (Since the mid-1990s, many theorists have taken great pains to deal with these criticisms, and SMT is more open to criticism and much richer in diverse approaches than it was in the 80s and 90s.)

But at SMT's inception, music theorists (and the composers that backed the stand-alone analytical enterprise) were very protective of their turf. They insisted not only on their right to independence from AMS but also asserted the logical value of "analysis itself" in producing isolated analytical "readings" of works with little attention to communicative properties or meanings outside the analysis itself. Nevertheless, the attacks continued from the historians (e.g., Kerman, 1980, 1985; Treitler,

1982) with replies in like kind from the theorists (see, e.g., Agawu, 1997, 2004). Music theorists felt under siege at the time (Schmalfeldt, 1998), and SMT hunkered down to preserve and defend itself against all postmodernists, determined to show AMS members that sophisticated analysis was necessary and that it would survive, flourish, and in time validate itself (for more bibliography and examples of theory's defense, readers should consult the first six essays in volume 3 of the 1997 *Journal of Musicology*).

#### *Music Theory versus Cognitive Music Theory*

I relate this chronology because during the "circling of the wagons" in the 1980s, an important moment was missed. Many theorists interested in music cognition, empirical evidence, scientific method, formalized linguistics, and so forth were also searching for publication outlets. But SMT, with its strong representation of composers, overlooked music psychology and did not encourage an interest in it. In the very first issue of *Music Theory Spectrum* the editor (Simms, 1979) welcomes "historical studies, contributions to pedagogy and reflections upon the discipline itself, analyses of a wide variety, refinements or innovation in analytic methods, and more speculative statements about musical logic, meaning, and effect." But there is no hint of music cognition here. Even twenty years later, aware that music theory is regarded as "insular, elitist, and inbred," a former president of SMT (McCreless, 1998) makes a case for reaching out to the "sister societies" (College Music Society, Society for Ethnomusicology, and AMS), but again, no mention of connecting to SMPC.

As we have seen, unlike the situation in music theory, the study of music cognition involved *opening up the field*—studying listeners instead of the introspective analytical judgments of an academic elite. And cognitive music theorists were not so much interested in the score (the "text") as in the perceptual processes and emotional experiences of ordinary listeners. The questions were, what exactly does music communicate, and how does it do so in terms of cognitive processing?

Implicit in music psychology was the skepticism toward logical theories that were incapable of empirical testing. To cognitive music theorists, many analyses of the new theory had a rationalistic quality. In the year SMT was founded, I wrote that theorists "should attempt to formalize an implication-realization model within the context of certain psychological theories that bear directly on the problems of perception and structure" (Narmour, 1977, p. 212). Much later, others (Wiggins,

Müllensiefen, & Pearce, 2010) echoed this sentiment, saying that unless music theory is “explicitly informed by music cognition studies,” it will remain “a figment of the imagination,” a “kind of folk psychology” (p. 231; see also Cross, 1988). Of course, “where one draws the line between, say, fictional objects and set-theoretical structures may well depend on one’s metaphysical convictions” (Frigg & Harman, 2009, section 2).

Those in music cognition, who moved beyond the encircled perimeter of SMT, became outsiders overnight. Cognitive music theorists, however, felt little need to challenge either the postmodernist status quo of AMS or the positivistic status quo of music theory. With the open policy of *Music Perception*, and all the burgeoning publications preceding and following the establishment of the journal, they were welcomed into music cognition, which by this time was in full bloom (the Society for Music Perception and Cognition was established shortly thereafter).

Now there are national organizations dedicated to music cognition in six countries—Korea, Japan, Australia, Europe, Argentina, Canada, and the U.S. (the SMPC website lists 49 labs dedicated to auditory perception and music cognition). ESCOM was formed in 1990, and its journal, *Musicae Scientiae*, came out in 1997. Today, in distinguished institutions in both the United States and Canada, there are faculty in music departments whose research lies mostly in music cognition. And, somewhat ironically, as of this writing, one of the largest study groups in SMT consists of theorists interested in music cognition. In sum, music cognition is here to stay.

Table 2 summarizes the discussion thus far. Let me now, however, contrast a number of the differences between “outsider” cognitive approaches to music theory and the practices “inside” current music theory. We recall that *Music Perception* was to be an interdisciplinary journal (also emphasized by Mari Riess Jones in her 2004

presidential address to SMPC); so it is important to list what the general disciplinary differences between cognitive music theory and music theory are.

Of course, no one is in complete agreement about what music theory is (see the variety of essays in Broman & Engebretsen, 2007). But it is clear that since its founding, traditional music theory has remained focused on composers, composing, on specific compositions (criticism), and on the styles and materials of music. Major concerns in this respect are a work’s “motivation,” its unique style of composition (parametric interactions, concatenation of techniques, etc.), and its multi-leveled structuring. But as discussed, a given analysis in traditional music theory is primarily *introspective* and *phenomenological* and interposes the analytical “reading” between the listener and the hearing of the score. The goal of such analysis is thus to mediate, explain, and elucidate the score for those who wish to purvey its meaning through the theorist’s personal experience, understanding, description, and evaluation.

These personal interpretations are to reveal the analyst’s “deeper sense” of the text in order to enhance others’ appreciation of the work (Temperley, 1999). Such analytical practice is obviously conservative. A perfect example is Schenker’s view that only through his theory can people hear and understand the long-range coherence of the great German works of tonal art (see Snarrenberg, 1997; Cook, 1990, regards Schenker’s view as just metaphoric). Modeled again after textual analysis in literature, such logical exegeses are typical of the composer/score approach.

Historically, pedagogy and “appreciations” have, of course, always been a central concern of music theory. In schools of music, analytical coursework has always attempted to explain how sophisticated music is written, how it is structured, and by extension how one can learn the grammatical rules to write convincing musical

TABLE 2. Four Related Fields, Comparing What Each Doubts (= Rejects) and Trusts (= Embraces).

Fields:	Music Cognition	Cognitive Music Theory	Music Theory	Musicology
doubts	mechanistic, “positivistic” Watsonian-Skinnerian behaviorism	rationalistic music theory without a convincing psychological foundation	postmodernism’s anti-positivist critique of music theory; extent of psychology’s relevance	“positivistic” musicology; “positivistic” music theory, “positivistic” experiments
trusts	the cognitive revolution, music theory, linguistics, all subjects of psychology	music cognition, experimental methodology, perception and emotion of ordinary listeners	stand-alone music-theory, concentration on logical analysis, elitist score “readings,” and their relevance to theory pedagogy	postpositivism, post-modernism, post-structuralism, social & intellectual history, cultural studies, cultural anthropology

“forgeries” of a given style. Such “exegetical” analyses dominate theory textbooks at both the undergraduate and graduate levels.

However, music theory was never just about improving theory pedagogy but rather about revealing the creativity of past masters to give musicians the analytical tools to study great works, to provide music criticism with a library of “close readings,” to explain a musical work’s unity (or at least its consistency), and to furnish culture with aesthetic rationales to valorize musical artworks. Even style studies by themselves were ultimately designed to function as prisms for elucidating individual artworks and illuminating the composer’s unique accomplishments.

In contrast, cognitive theorists are fascinated with how experienced and inexperienced listeners *prospectively* perceive and comprehend music’s emotional affects and intellectual stimulations. In addition, they take a strong interest in explanations of common behavior and natural learning rather than in the individualized, *denaturalized*, exegetical analyses of music. Indeed, cognitive theorists claim that much of what current analysis accepts is not cognitively feasible, despite the degree of logic. That is, it goes against inborn processing systems that cannot be switched off.

To explain: cognitive impingements exercise a tremendous constraint on remembering long-term relationships, and much of what current analysis produces is

problematic in terms of the limitations of both attention and working memory. Moreover, many analyses violate what is known about the psychological principles of grouping (chief among these are the far-fetched mappings of linear patterns in tonal music and the bracketing (or encircling) of non-parametrically equivalent sets in the analysis of contemporary music). In short, the less cognitive, the more rationalistic, and the more personal analyses are, the more dependent their value is on the metaphysical beliefs of like-minded analysts.

Tables 3–4 summarize some basic and generalized differences between music theory and cognitive music theory. Table 5 shows some of the focal differences and similarities, Table 6 the different attitudes toward listening, and Table 7 some differences in outcomes. Although the dualistic descriptions in these tables are “essential half-truths” (after O’Brien, 1998), they are useful in sharpening our views about the different though inter-related connections between the two fields.

Given that the music theorist’s retrospective study of composition, the score, and the value of expert academic “readings” has historically and pedagogically been of obvious value, we might ask, how does music cognition deal with the topic of analytical criticism and the legacy of a great composer? How does it, in vouching for the experiences of ordinary listeners, account for the extraordinary listening of great composers? The answer is

TABLE 3. Some Basic Differences Between the Two Fields.

Music Theory (as a humanistic discipline)	Music Cognition (as a scientific discipline)
subject matter: how music is composed, structured, and functions as an art form	subject matter: how music exemplifies basic psychological processing
the score as a complex historical text containing multiple interpretations, some of which are purely imaginative	the score as a partial but variable formalization, a recipe, or a set of instructions
focus is on composers and composing	focus is on perception, cognition, and experimental design
ideas with experimental possibilities are of little or no concern	emphasis on hypotheses that can be experimentally tested

TABLE 4. Some Generalized Differences Between the Two Fields.

Music Theory (as a humanistic discipline)	Music Cognition (as a scientific discipline)
main preoccupation: analysis of score	main preoccupation: analysis of data
analysis: largely retrospective (retrodictive) and relativistic	analysis: largely prospective (predictive) and reductionist
memory and attention are an afterthought	memory and attention are always considered
deep structural knowledge of the musical repertory	shallow structural knowledge of the musical repertory
modus operandi: logical, rationalistic, theory driven, introspective, personal connoisseurship	modus operandi: empirical, data driven; hypotheses must be replicable by others
metaphysical grounding: belief	metaphysical grounding: behavior
chief mode of explanation: word	chief mode of explanation: number

TABLE 5. Focal Differences and Similarities.

<b>Music Theory</b> (as a humanistic discipline)	<b>Music Cognition</b> (as a scientific discipline)
high-level structure of central concern	manifest structure of main concern
details valorized as individualized properties of artworks and essential to the phenomenological experience of the analyst	experience modeled but with individualized details classified as outliers or anomalies; generalizing the aesthetic experience
generally more interested in aesthetics, ideas, imagination, “fictions,” myths, and narrativity than in psychological emotions	more interested in arousal, emotion, affect, feeling, mood, than in aesthetic philosophizing of any sort

TABLE 6. Attitudes Toward Listening.

<b>Music Theory</b> (as a humanistic discipline)	<b>Music Cognition</b> (as a scientific discipline)
listening assumption: professional or expert attention by a sophisticated academic elite	listening assumption: variable attention expected from a subject sample of ordinary listeners
humanistic stance: existential, personal “reading”; autobiographical stance; egoism analytically maximized	scientific stance: social, population response (contagion); sense of self minimized so as not to influence data
musical development of listening not an issue (analysis by and for a academic elite)	development a major issue (experts vs. novices; trained vs. untrained; old vs. young)

TABLE 7. Different Outcomes.

<b>Music Theory</b> (as a humanistic discipline)	<b>Music Cognition</b> (as a scientific discipline)
explanations: formal, phenomenological, heuristic, etc.; relying on technical, insider vocabularies	explanations: perceptual, cognitive, developmental, etc.; relying on technical, scientific vocabularies
interpretations: semantic, symbolic, representative, reductive	interpretations: statistical, mathematical, graphic, numerically weighted
written work organized by approaches, theses, topics, and themes	written work organized by testable hypotheses and data analysis
published work: a humanistic form of literature, criticism, or essay; based largely on semantic and logical reasoning	published work: a scientific form of literature; based largely on empirical argument and numerical data

that a significant proportion of any composer’s musical processing is the same as that of the ordinary listener. To compose is simultaneously to listen and to perform in one’s head. When a motive, passage, or phrase is sketched, the composer constantly critiques the compositional decisions by reentering the creative domain of the performer and the cognitive constructions of the listener.

Among their many motivations for writing music, great composers are first and foremost great listeners who gradually acquire deep psychological insights into producing human emotions and affects. They also capture the auditory human intellect with impressive sonic precision. This is what cognitive music theorists study, and it is a propitious way to take up the issues of analysis and criticism as regards the perceptual—rather than the compositional—experience.

### Part 3

#### *Theories, Maps, and Models: Analogical Thinking*

Humanists and scientists employ four different strategies to map or model the world, depending on the circumstances that confront them: (1) through belief (e.g., a cultural ideology), (2) through logic (as in mathematics or other rigorously systematic thinking), (3) through empirical evidence (as in duplicated, controlled experiences), or most commonly (4) through a varied invocation of all three modes simultaneously. Because humans are social creatures, all theories are in some nontrivial sense culturally conditioned. We cannot avoid having our beliefs creep into the creation of our knowledge (Poovey, 1998). This is why we have such trouble objectively evaluating

and choosing between alternative theories with more or less equal weight: inherent cultural relativity cannot be objectively falsified (Kuhn, 1962; Polanyi & Prosch, 1975). This means that facts are not pure; they are neither value-free nor theory-free, and social processes are always implicated in their discovery (or their theoretical invention).

The relationship between experienced fact and empirical observation is mediated by discursive interpretation, and such interpretation, if it rises to the level of explanation, is itself mediated by theoretical construction. Theory-building feeds off empiricism, and empirical analysis derives equal value from theory. The tension between theory and empirical data constitutes the epistemological problem of knowledge. Sometimes this can be resolved by tweaking the logic of the theory or sometimes by gathering more (or different) empirical data. But a perfect solution is never possible.

*Theory* is a used and abused word with a thousand meanings, from the hazy mappings in the arts and humanities (theses, themes, approaches, programs, positivistic methods) to various kinds of partially representational models that provide a psychological perspective on reality (Giere, 1999) to the precise theories employed in the physical and mathematical sciences (very clear axioms, definitions, hierarchical propositions, etc.). Although many types of theory construction exist, the organization of most formalized work is logically similar in its structure and involves a common set of distinctions.

As an example, consider the metatheoretical path chosen to formulate the implication-realization model (Narmour, 1990, 1992). I began by: (1) listing my intuitive, contemplative, and introspective speculations about melody; (2) devising postulates, grounds, axioms, and hypotheses for the theory; (3) making clear definitions of abstract (theoretical) and concrete terms, properties, and attributes (those to which people will normally assent); (4) writing a set of hierarchical statements (major and minor premises) in order to formulate (5) how the theory's construction can be systematically operational in terms of a symbological system and (6) how the theory is to be empirically evaluated in terms of principles, logical consistency, coherence, and parsimony. Of course, no matter how careful the initial protocol, such organization says nothing about the ultimate quality of the theory—(7) its ecological accuracy and scope and (8) its implicative consequences as regards revealing new knowledge and formulating new questions.

Thus, we have the classical attributes of theory-construction: conjecture, observation, terms and sentences, symbological goals, and allowance for empirical testing. Only one thing is missing: analogy.

In that connection, now consider the importance of modeling and mapping to theory-making (see Figure 2). Models and maps are highly defined research programs representing the theories to which they are attached (Frigg & Hartmann, 2009). Such theories can be logically or empirically driven (or both). Without models, theories lack the specificity to become operational with respect to their targeted research goals. In an important sense a model or a map interprets—which is to say explains and fills in—the correlated theory's formalized properties in terms of the phenomenological content that the theory is designed to explain. But the content of a model or a map is rarely identical or completely isomorphic to the abstract properties of the theory that comprises it. Yet it is not entirely independent either. Rather, the modeled or mapped content complements the theory.

Models and maps are thus less complete and more tentative than theories. This is why I call the theory the “implication-realization model”: its target of study is mostly melody, although I have claimed (Narmour 1990,

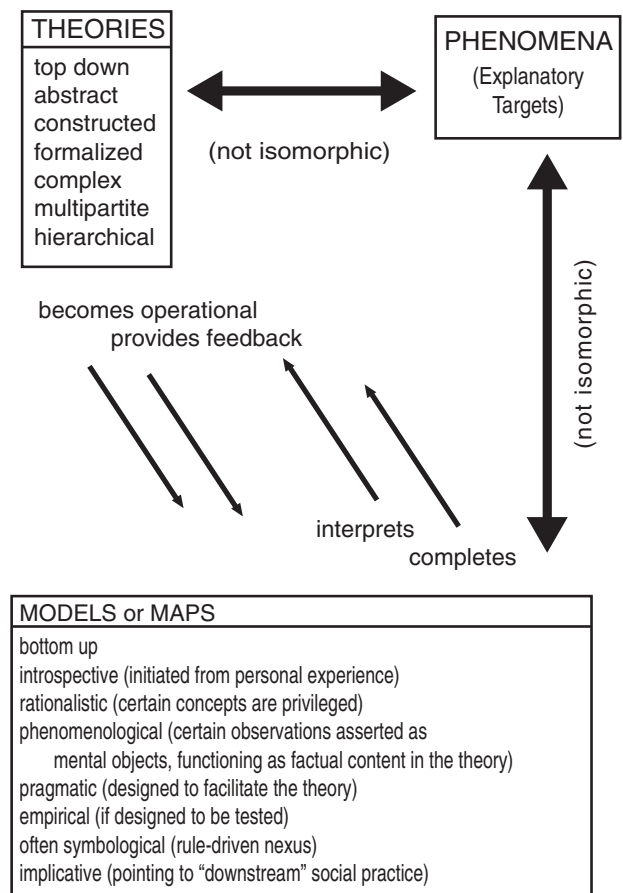


FIGURE 2. A hypothesized tripartite conceptualization of research phenomena vis-à-vis the properties of theories and models or maps.

1996) that the theory has the potential to deal with all musical parameters in any style. But that remains to be modeled (or mapped).

If theories are *top-down*, post-facto constructions formalizing the applications of their associated models and maps, then the latter constitute ongoing, incomplete, *bottom-up* analogues (Frigg & Hartmann, 2009)—research programs engaging the manifest, objective content that defines the ecological subject matter. In some sense, then, models and maps are always more connected to reality than theories are. Yet models and maps alone—without explicit connection to a theory—remain impoverished and incapable of moving to stage 8 (above). As we have seen, in both literary and musicological criticism, mappings can be employed with no attached theory whatever. But such mappings rarely coalesce into an operational theory by themselves (i.e., theoretical guidelines are always necessary). Likewise, theories without models or maps lose their ability to generate new knowledge and to pose new questions, no matter how rigorously logical or beautifully constructed.

Music theories descriptive of a stylistic domain often involve logical sentences that have positivistic-like predicates reflecting the style—the “language” to which they apply—but associated models and maps need not be linguistic in nature; that is, they may be *neither semantic nor syntactic* and yet adequately analogize or represent the targeted phenomena of the research (Frigg & Hartman, 2009).

The best theories are connected to maps and models via refined analytical symbologies (e.g., the importance of mathematics in the sciences). Indeed, analytical symbologies form an epistemological nexus between theories and models by concretizing the analytical space that exists between the theory and its models (or its mappings). In the absence of symbolic analytical systems to bind them together, both theories and their models connect less strongly. Intellectual domains that use models and maps but lack integrated analytical symbologies thus tend to produce more tenuous research conclusions. Through concrete analytical symbols governed by clearly formulated rules, the power of a top-down theory is liberated, and through concrete analytical symbols, bottom-up models and maps fill in the gaps of the theory with precise analogical content.

The analytical symbols of the implication-realization model are syntactic because they attach directly to the score (whose relationships, we presume, exhibit cognitively perceptible sequences). This means that the symbols are minimally reductive because, no matter how accurate the notation, a highly detailed score itself is already an idealized reduction of what the composer envisioned. (To be sure, the model is designed to generate higher reductive levels as well, but these lack the reality of the manifest

surface of the music.) It is clear, then, that theories, maps, models, and analytical symbologies are not all of a type. Together they form complex intellectual creations that in some sense recapitulate epistemological history.

By themselves, models and maps are part Aristotelian (or Lockean) in that one initiates their construction by trying to think from the ground up (item 1 earlier) by introspecting one’s own perceived experiences. They are part rationalistic in that they involve believing and privileging certain concepts (2 and 3). They are part phenomenological in that certain observations are asserted as mental objects and thus function as the factual content of the theory (4). Their properties are logically empirical when the theory is designed to be tested (5). They are pragmatic (6) in that items 1–5 are purposely designed to be complementary and to allow theory, model, map, and symbology to work analogically, hand in hand. And finally, their ultimate value results from “downstream” social practice (7), causing those to whom the theory is addressed to conceive of the targeted phenomena in new ways and to attend to relationships never before observed (8). In short, models and maps make the purpose of a constructed theory clear via its expressed ontology (nature), epistemology (conceptual basis), and formalized rule-driven methodology governing the use of its analytical symbology.

Obviously, most of the ways society bandies about the word *theory* falls far short of items 1–6 (the best scientific and mathematical theories being exceptions). However, there is an important addendum: no ideal, perfect theory exists because theories have complex, multiple parts, not all of which the analogous models or mappings express. This is because initial introspective protocols of any theory may turn out to be badly mistaken; the original choice of grounds may be based on misleading metaphors or myths; early definitions may be false, inaccurate, or incomplete or else require either additional or fewer distinctions (having been overspecified), and so forth. As the inevitable contingencies emerge, it becomes clear that certain theories are more useful than others, but only to the extent that they carry with them the seeds of their own improvement—generating anomalies and untenable facts that have to be taken into account in order to improve the theory (the unavoidable conclusion derived from the data as tested by the theory).

Relationships between theory and data are symbiotic. Experimental work is the feedback system. Many empirical scientists, it would seem, rarely think about theory. But theory frames all data collecting, looms behind all data analysis, and ultimately determines the worth of all data interpretation. Statistics, after all, is based on theorems and theoretical laws regarding numbers. Those who use statistics without knowing those theorems and laws do so at their



peril (e.g., multiple regressions can be misleading if the data lack homoscedasticity; see Rosner & Narmour, 1992).

Nevertheless, theory is biasing — a pair of blinkers that can prevent one from seeing contradictions. To change the metaphor, a theory must be worn like a set of clothes (not taken by faith as a system of belief). A selected theory may be appropriate for certain circumstances but not for others. Interpretively modeled empirical data tell theorists what concepts in the closet are suitable for analytical wear and which should be left on the hanger.

Yet empirical evidence without theory is also biasing. What counts in explaining any natural phenomenon emerges from a point-by-point conversation (or narrative) between theory, model, and analytical symbology, and this must involve not just the data that support the theory but also the anomalies that fly in the face of the analogues and thus contradict the theory, the model, the analytical symbology, or all of them together.

#### *Music Theory, Cognitive Music Theory, and Cognition*

No reasoning is ever completely abstract because experience invades every thought. Likewise, not every experience is entirely relativistic. In the construction of theories, maps, models, and analytical systems, what matters depends on the degree of holistic coherence among the abstract, the empirical, and the relativistic. It follows that music theory as a logical humanistic discipline and music cognition as a scientific empirical discipline are complementary. Each in its own way has weaknesses that can only be ameliorated by the strengths of the other. Table 8 summarizes this. The comparison shows how each discipline augments the other.

To repeat, this is not to say that music theory and cognitive music theory are not independent. There will always be areas of interest in music cognition that hold no interest for music theory, and vice versa (Krumhansl, 1995). Working together need not compromise the authority of either field.

If the humanities strive to understand the differences between putative sameness or similarity, and if the sciences attempt to explain the commonalities between putative behavioral differences, then who deals with the chasm between these two diametrically opposed worlds? One answer is cognitive music theory, an interdisciplinary that, at least potentially, can initiate and sustain dialogues between the two disciplines. Yet because both music theory and cognitive music theory are young fields, many practitioners do not seem to recognize their special calling in the scheme of knowledge production.

As we see, then, the epistemological distance between humanistic mappings and scientific theories, and thus between music theory and cognitive psychology, is great (Clarke, 1989; Cross, 1988). Likewise, the explanatory space between musicology, ethnomusicology, music anthropology, and moment to moment musical emotions is vast, and larger than ever. And this is where cognitive music theory steps to the fore. It can bridge the gap in all areas because cognitive music theorists straddle the two fields, one foot in psychology and the other in music theory.

From one (modeled) perspective, cognitive music theory functions as a delivery system through which normal music theory gets uploaded to psychology in an empirically testable package (as in the I-R model) or as a set of hypotheses needing to be tested (as in the rules of Lerdahl & Jackendoff's 1983 model or in Gjerdingen's 2007 schema theory of *galant* music). In its download mode, cognitive music theorists can identify what is psychologically relevant, useful, and critical toward constructing, correcting, or refining a music theory. In addition, they can identify and channel psychological facts that are most relevant to music analysis and thereby ground music-theoretic observations in perceptual and cognitive reality.

Many perceptual studies have shown how grouping principles determine everything from motivic salience to voice streaming (compound melody), and if those principles are violated, ordinary listeners will simply not hear the connections (Bregman, 1990). If, for example,

TABLE 8. The Need for Interdisciplines.

<b>Music Theory</b> (as a humanistic discipline)	<b>Music Cognition</b> (as a scientific discipline)
flaw 1: intuitive, theory-based concepts and definitions may lack cognitive grounding, ignoring the perceptual reality of subject matter	flaw 1: knowledge structures and acquired data may be too abstract, irrelevant, or trivial to be of cognitive musical importance
flaw 2: analysis can be too subjective with problems of private, egoist content and unexplained multiplicity (too many events and tokens to be temporally perceived in a single object)	flaw 2: selected data can be rationalistically objective with inadequate representation (events too few), ignoring the possibility of other minds and lacking in ecological validity
result: too many disconnected articles; too many specialized theories; insufficient attempts to formulate unified theories; output is cognitively implausible	result: too many disconnected experiments; too many hypotheses; too many theories; too little generalizing about cognitive unity

linear patterns lack cognitive reality and are forcibly mapped onto analytical reductions, they will be misleading regarding unity or coherence (as an example, see Morgan's 1992 linear analysis of Webern's fifth bagatelle, op. 9, which ignores known grouping principles). Grouping principles and the processing mechanisms of attention are inborn and cannot willy-nilly be switched off unless one adopts a kind of inattentive deafness to the music. Such *denaturalized listening* occurs when idiosyncratic, exegetical, expert, elitist analyses disregard what is known about the perceptual and cognitive principles that govern music. That said, the importance of music cognition to music analysis does not deny music theory's autonomy as a scholarly field inasmuch as generalized psychological explanations lie very distant from the multidimensional cultural, sociological, political, aesthetic, and historical concerns of score-centered music study (as illustrated later in Figure 3).

To take another example, consider the relationship between structure and memory. Most music analyses are structuralist-oriented and move hierarchically from manifest levels to higher-level reductions, or vice versa (most often generated from a top-down grammar of some sort). Such structural reductions tend to be correlated with formal junctures, cadences, and keys—the assumption being that these “structural points” are what sophisticated music listeners store in long-term memory to enable the recognition, the rehearsing, or the processing of other works with similar stylistic sequences.

However, there is convincing evidence to show that listeners also remember emotional peaks and emotional endings (see Rozin, Rozin, & Goldberg, 2004). What this means in terms of memory is that any theory that deals with only the structural aspects of a work provides only half an analysis, ignoring altogether the remembered *affective structuring*. In order to capture both the remembered structure and the remembered affect of a musical work, analysts need to construct a simultaneously running analysis of both, showing how syntactical structure and affective structure complement, reinforce, and deform each other.

#### Part 4

##### *The Potential of Cognition and Music Theory in Understanding the Arts*

In the Old Schools quadrangle of the Bodleian Library at Oxford University, the upper stones on each side bear inscriptions of the medieval quadrivium (namely, mathematics [or arithmetic], astronomy, geometry, and music) and the trivium (grammar, logic [*dialectica* or debate], and rhetoric). These stones tell us that in the

early 1600s music was still regarded as part of mathematical science as defined by the Pythagoreans (proportion, measurement, interval, ratio, degree of consonance, and structure of the universe, i.e., the musical harmony of the spheres). Of course, we do not think of music this way now (the textualists would say that music is a form of rhetoric). Nonetheless, it is inspiring to think that music study once occupied a lofty scientific position, as opposed to today where music is regarded solely as an art. But as I will explain, music study *should* occupy an exalted position in the humanities and in psychology.

In modern universities there is a *new trivium* in place: the humanities, the social sciences, and the sciences (see Figure 3). Encircling this is the *postmodern quadrivium*, where religion (belief systems, faith systems, ideologies) and philosophy (metaphysical interpretation) arch over the humanities on one side, and where mathematics and psychology envelop the physical sciences on the other (recall that the sciences are cultural constructs and thus partly psychological). By philosophy I mean the discipline that arbitrates metaphysical interpretations, disputes, and explanations in and between all fields. Mathematics in Figure 3 includes not only the ordinary definitions of the subject but also formalized logical systems of all kinds that map more or less perfectly onto experience.

The disposition of religion needs more explanation. By it I do not mean just organized religion as practiced by its believers, but religion as a system of propositional, metaphysical, structured, and operational beliefs apart from its social, political, anthropological, and economic manifestations. There is no question that all research concepts, whether scientific or humanistic, entail a complex system of structured propositions. In this broad sense, we may even regard ideologies as a kind of secular religion (agnosticism, mysticism, and myth also characterize belief systems).

Because human knowledge will always remain incomplete, we will never rid ourselves of metaphysics, religions, faith systems, beliefs, and ideologies, and because of that, we must scrutinize practices concerning such propositions for whatever biases they marshal against the acquisition of logical and empirical knowledge (hence their position in the outer ring of Figure 3 as serious subjects of study). Belief systems arise on every level because all natural and social phenomena are *inherently* resistant to a complete and detailed *logical* or *empirical* mapping or modeling. Because knowledge is a social construct, as postmodernism has taught us, empirical work is thus always associated with belief(s) and propositional system(s). The use of the words *mapping* or *modeling* reminds us of the limitations of logical and empirical theories vis-à-vis whatever proportion of propositional belief that such metaphors entail.

Psychology lies at an outer ring of the new quadrivium because all written knowledge, whether scientific or humanistic, is a product of the human mind. Lying below are the rest of the humanities, the sciences, and the social sciences, the latter of which are partially humanistic (e.g., case studies, political history) and partially scientific (demography, economics). Below this ring we find the professional schools. Diagrams such as this, of course, are simply another example of constructive thinking that enables us to understand what is, after all, one of the most complex social entities ever conceived—the modern research university.

The general organization of Figure 3 is thus not definitive or deterministic but rather suggestive and imaginative. The nested circles, which are purely organizational

and not closed, are meant to be read across different angles of radii and evaluated in terms of nested circumferences. That is, any one subject can radiate throughout the diagram but can also travel around any given circle (e.g., language). These circles thus do not contain their subject matter because, as we all know, the modern university is a vast heterarchy, where interdisciplinary cross-cutting and networking are the norm.

The figure's visual rhetoric is purposely meant to pay homage to those iconographical medieval drawings of circles within circles, which tied human activities to the cosmological scheme of things, except here, of course, my cartography attempts to emphasize the radiating correlations throughout all human knowledge-seeking.

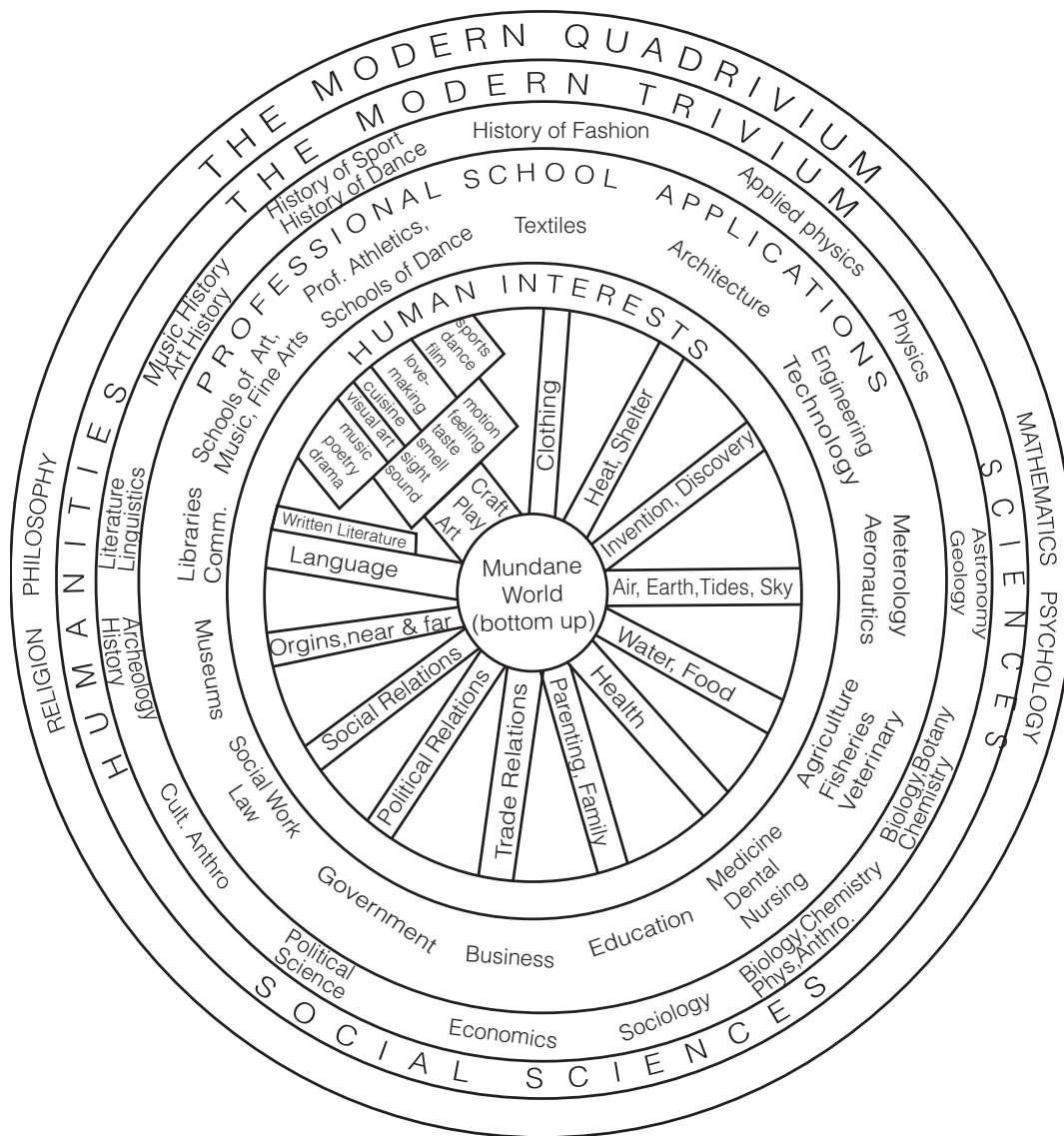


FIGURE 3. A hypothesized, nested, circular arrangement of intellectual domains of study at research universities (see text for interpretation).

At the center of the wheel are “human interests,” the usual elements without which human life is not conceivable (shelter, food, water, clothing, craft, play, art). In any civilized society these human concerns radiate outward and evolve into areas of study, education, and research. Figure 3 shows these as spokes, which articulate areas of study as we move from the mundane center toward the outer rings.

The geometrically progressive spoke, which expands outward, is where craft, play, and art (at the edge of the core) recruit each of our sensorial systems, developing and channeling them into the various aesthetic productions (and ultimately into games and sports). All these become academic areas in the modern university. As a form of adult play, observe that the performing arts meld into one ongoing progression from dance to ice-skating to gymnastics to competitive sports (at many institutions, athletics is also studied as a business). Notice also that language per se is a dominant activity (having its own spoke; note that writing sits astride, as most of the world’s people are illiterate).

In the intellectual scheme of Figure 3 music might seem to be a minor activity (note its small size relative to language). However, as we have seen, music and the arts lie at the very core of what it means to be human inasmuch as they model our life experiences and make us more emotionally fit (Dissanayake, 1988) to live meaningfully. Indeed, all the arts are not peripheral but core activities radiating outward to the upper circles. Note that music history sits not at the core, where music theory resides, but higher up, in ring three above the applied schools (hence the huge space between musicology and the study of musical emotions at the core).

As we see, in this projection, psychology and mathematics operate at a magisterial level, informing all human thought. Along with religion and philosophy, they co-reign over the academic enterprise. Yet neither the outer ring nor the core dominates the circle. Rather, the areas in-between—all those subjects encompassed by the modern trivium—bind the core to the quadrivium, as gravity binds the universe.

The academic world is psychology’s oyster because it spans from neurobiology to sociology and has, since its beginning, purveyed the sciences, the social sciences, the humanities, and the arts in all their manifestations. There is no part of Figure 3 that psychology has not studied, influenced, informed, and interpreted. After all, everything humans do is, in some profound sense, psychological, and that includes all the core intellectual and artistic activities that engage us. Such envelopment could hardly be otherwise because the scholarly and research worlds that we create are psychological human constructs. Psychology thus impinges on every aspect of human life and on all human knowledge-seeking (how could it be otherwise?).

Although still a young field, psychology is thus *not* just another science. Its purview over all human activities (and thus all academic disciplines) is pervasive, and consequently it belongs at the outer ring, along with mathematics, religion (of which it was once a part), and philosophy (of which it was also once a part).

In contrast, music is essentially a moment to moment core experience. To the engaged listener it is processed on the manifest level—the level of emotion, affect, arousal, mood, feeling, sentiment, and unanticipated intellectual insights into the temporal domain. Music theory deals with these moments by attempting to understand music’s materials, functions, structures, and stylistic and artistic musical instantiations.

But as a core experience (near the basic elements necessary to life), there is a large gap between music theory and the psychology of emotion—a gap, however, as we have seen, that can be effectively bridged by cognitive music theory.

Figure 4 illustrates this. The point here is that in connecting music theory to psychology via cognitive music theory, psychology releases music theory’s potential by grounding it as an intellectual discipline and by directing music upward to the postmodern quadrivium (the outer circle). As recompense, music theory repays the favor by affording psychology genuine, ecological musical content with which to experiment. Both psychology and music theory are dependent on cognitive music theory in order to draw a complete map of, or to model, the musical experience. Hence music cognition shows how psychology can imaginatively and advantageously unite with music theory, and vice versa.

Because of the numerical nature of music (scales, intervals, ratios, meter, etc.) and because music already has an elaborate and sophisticated symbology, music theory and cognitive music theory can model how the other arts and letters might connect to cognition. What is needed are more cognitive theorists of literature, cognitive theorists of the fine arts, cognitive theorists of film, and cognitive theorists of dance. In the long run the whole research enterprise of the humanities cannot be divorced from psychology. The humanities need grounding in cognition no less than music theory. Furthermore, the need is mutual: psychology needs enrichment from the experiences that model moment by moment human emotions at the core.

As psychology continues to mature, to consolidate its research programs, and to unify its theories, and as neuroscience reveals more and more about how our brains work, both sciences will come to rely more on learning what the content of music, literature, and the arts is, without which psychological laws and brain research will remain general in nature, lacking the real-world of

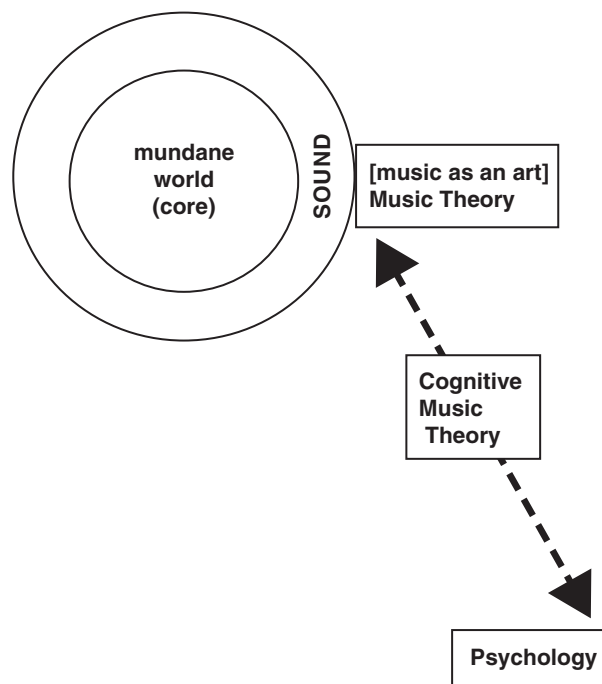


FIGURE 4. The gap between the mundane world with its musical core (as studied in music theory) and the elevated and remote level of psychology (as mediated by cognitive music theory).

human emotion and concrete human intellect. As stated earlier, this does not mean that the humanities or the arts will become reduced to what is known only in psychology or neuroscience.

What I am arguing here is a permanent link between the artistic core and the outer ring without the subjugation of one to the other. In other words, I am saying that music as an academic subject *must reclaim* its former lofty status held from Pythagorean times to the high Renaissance by reconnecting to the science of psychology. Music theory and cognitive music theory have the potential to bridge the ontological span that separates them from musicology, ethnomusicology, and music anthropology.

What are called for are new programs for interdisciplinary Ph.D.'s and more appointments of interdisciplinary faculty. Theory in the arts and letters is too sophisticated for psychologists to dabble in, just as the field of psychology is too complex for faculty in arts and letters to play at. *Music Perception*, *Musicae Scientiae*, SMPC, and ESCOM have blazed the way in this regard and can serve as a model for the future of interdisciplinary education, provided cognitive music theorists continue to contribute to this journal *as theorists* (rather than just as experimentalists) and provided they remain essential to the public discourse of cognitive psychology.

Current work in cognitive music psychology has taught us much about the specialized psychological processes that are unique to music and also about the generalized processes that music recruits and utilizes from other cognitive domains (such as language). What we should not overlook, however, is the unique potential of collaborative scientific work in music to uncover previously unknown foundational principles in psychology. That music psychology has the potential to lead music theory and cognitive music theory to new insights is indisputable. This can best be realized if music cognition, music theory, and cognitive music theory work together toward creating unified theories.

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