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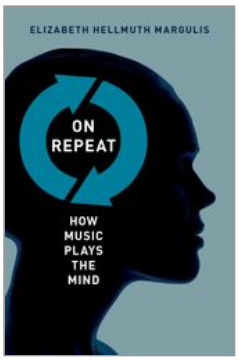

On Repeat: How Music Plays the Mind
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The Puzzle of Musical Repetition

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Abstract and Keywords

This chapter outlines the degree and kind of repetition present in both music and musical behaviors, contrasts it with the degree and kind of repetition present in related domains, and examines the way this repetition has been thought about (and not thought about) through history. Empirical findings on topics ranging from the speech-to-song illusion (where repeating a spoken utterance leads to the perception, on rehearing, that it's being sung) to repetition frequency in infant-directed speech (a frequency that peaks just when babies are learning to segment the speech stream) to semantic satiation (where repeating a spoken utterance causes it to devolve into nonsense) are marshaled to make a case for the central role of nuance, embodiment, memory, and the choreography of attention in repetition's musical functioning.

Keywords: Semantic satiation, Attention, Infant-directed speech, Repetition, Music, Embodiment

> Music can never have enough of saying over again what has already been said, not once or twice, but dozens of

> times; hardly does a section, which consists largely of repetition, come to an end, before the whole story is happily told all over again.
>
> —Zuckerkandl, 1956

Music's repetitiveness is at once entirely ordinary and entirely mysterious. The radio is full of songs whose choruses repeat again and again, and these repetitive songs often get downloaded and replayed over and over while a listener drives or runs or makes dinner. Musical repetitiveness is so common as to seem almost invisible. But when something draws your attention to it, this repetitiveness comes to seem quite strange. Try replacing the word "music" in the quotation at the start of this chapter with the word "Freddy." Freddy can never have enough of saying over again what he's already said dozens of times. Once he's finished telling one repetitive story, Freddy goes back to the start and tells the whole thing again.

Would you want to spend time with Freddy?

Yet this is precisely what our favorite music is like, and we go back again and again to rehear its stories. It's hard to understand why this fundamental puzzle has not been investigated with more fervor. The topic's general neglect is tied in with the history of music scholarship, and particularly with the history of the relationship between music and science. Music is a fundamentally human capacity, present in all known cultures, and important to intellectual, emotional, and social experience. Among domains of human communication, perhaps only language rises to a similar level of pervasiveness and occupies a similar position of centrality in everyday notions of what it means to be human. But until recently, cognitive science looked primarily to language as a window into the human **(p.2)** mind. It is only in the last thirty years or so, and especially in the last decade, that the comparative case of music has received substantial attention.

The reasons for this surprising delay are manifold. In Western culture, music is often viewed to be the exclusive purview of the specialist, and there is typically a clear distinction between performers, who produce the music, and listeners, who receive it. People competent in a language, on the other hand, both speak (produce the language) and understand (receive it). Production competence in language—the ability to speak—is

typically achieved without special training, whereas production competence in music—the ability to sing or perform on an instrument—often requires years of formal lessons. Most people acquire production competence in language, but only a subset acquires production competence in music. This imbalance has led people to conceptualize music as a secondary ability; yet the imbalance only arises if production (performance/speech) is taken as the comparative measure, and only if culturally specific notions of what constitutes expertise are brought to bear.

Only some people develop the level of proficiency with music that will allow them to perform at Carnegie Hall, but, similarly, only some people develop the level of proficiency with language that will allow them to win the Man Booker Prize. Yet reflexive cultural notions equate musical competence more with this rare variety of performance expertise than with ordinary abilities. In a study of music students in Britain, Pitts (2005) found that even highly proficient student instrumentalists were loathe to describe themselves as “musicians, ” preferring to reserve the term for more accomplished professionals. If people were this shy about language, they’d reserve the term “speaker” for professional orators. Although production competence is more widespread for language than for music, the difference is exaggerated by the two domains’ unequal criteria for competence. Moreover, were it not for cultural factors emphasizing the development of other skills, it is possible production competence in music would be more widespread. Children, for example, are almost universally capable not only of singing back tunes that have been sung to them, but also of vocally improvising simple new tunes. Receptive competence, on the other hand, is widespread for music and for language. Just as most people can understand, identify errors in, and answer questions about speech in their native language, most people can tap along to, identify errors in, and be moved (sometimes deeply moved) by music in the style with which they’re most familiar (whether classical, rock, or something else).

The idea that music is ineffable or resistant to articulation (see Jankélévitch, 1961/2003; Abbate, 2004; Gallope & Kane, 2012) is another cultural attitude that has contributed to the relative historical neglect of music by cognitive scientists. For one thing, music is ephemeral, sounding and then disappearing, and its meaning cannot be summarized or handily captured.

For another, it is subjective, **(p.3)** with experience and response changing from listener to listener. Language could be viewed as similarly ephemeral, resistant to summary, and subjective, but its capture, via writing, is more widely understood than musical notation. In many cases as well, people are able to provide a brief account of the gist of a passage of spoken text, but lack this capacity to summarize a passage of performed music. Although the interpretation of the typical spoken utterance certainly admits of subjectivity, basic aspects of comprehension can be tested with simple questions: “According to the passage, did Mary, in fact, catch the ball?” People are accustomed to reading books and talking about them, but much less accustomed to talking about the music they hear. It is common to participate in book groups where people sustain elaborate discussions about read material, but when groups leave a concert, the most nuanced comments often involve an enthusiastic “awesome!” or a skeptical shrug. As David Huron (2007) has noted, two audience members at a classical concert, one having a revelatory experience and one thinking about what to make for dinner, look exactly the same—mute, hands in lap, staring toward the stage. Since behavioral methodologies in cognitive science rely on eliciting and measuring responses to stimuli, language—where responses are more overt and easier to tally—has seemed more tractable.

Work in evolutionary psychology has sometimes suggested that while language is fundamental to human identity, and a clear product of natural selection, music represents a kind of “auditory cheesecake” (in Steven Pinker’s infamous 1997 assessment) that exploits pleasure circuitry that evolved for other purposes. The tendency to privilege language over music was especially dominant in early cognitive science, which emphasized “cognitive” skills—those related to logic and reasoning—over more holistic, emotion-related, and social abilities. A shift in these priorities has coincided with the publication, over the last ten years, of a number of theories that argue for natural selection as a direct determiner of the capacity for music (Cross, 1999, 2003, 2008, 2009, 2012; Miller, 2000; Mithen, 2006). Since this area involves much speculation and little opportunity for experimental verification, the theories in vogue at a particular moment can reveal much about cultural attitudes to the subject under inquiry.

In addition to these factors, which have been well documented elsewhere, I suspect that still another cultural reflex has contributed to the long reign of language as the form of communication at the center of cognitive science: the ubiquity of repetition in music, and the tendency to view repetition as regressive, childlike, and embarrassing. In a passionate plea within the pages of a late nineteenth-century edition of the *Proceedings of the Royal Music Association*, composer and writer Ferdinand Praeger (pointedly described by Wagner as "an unusually good-natured man, though one too excitable for his standard of culture") argues against the practice of part repetition in performance. Part repetition entails repeating individual parts within a musical form—the exposition or **(p.4)** the development and recapitulation in a sonata, for example—when performing for an audience. This practice has declined over time—recording technology now ensures many listeners arrive at performances already familiar with the piece—but it was still quite common in Praeger's day. His "excitable" take on the subject was presented to an assembly of musical thinkers and performers who had gathered for this debate:

> Would ever a poet think of repeating half of his poem; a dramatist a whole act; a novelist a whole chapter? Such a proposition would be at once rejected as childish. Why should it be otherwise with music?…Since any whole part-repetition in poetry would be rejected as childish, or as the emanation of a disordered brain, why should it be otherwise with music?
>
> (Praeger, 1882-1883)

"The emanation of a disordered brain"—for Praeger, repetitiveness links music with nonsense and even insanity; its abolition is critical if music is to be received as serious and important. But this enterprise, of course, is entirely quixotic; even if Praeger had succeeded in purging nineteenth-century music of the practice of part repetition, he would have been left with an art that persisted in repetitiveness along myriad other dimensions, at the level of the theme, and the section, and otherwise. Better to embrace the situation and ask, Why is it that we accept, even enjoy, degrees of repetition in music that would be repugnant in almost any other domain?

Other communicative spheres do not entirely lack repetition—consider conversations where one individual's contribution consists entirely of utterances of "uh-huh, " or stand-up comedy acts based on the repetition of a catchphrase (think

"We are two wild and crazy guys!" in Saturday Night Live sketches from the late '70s). But music is the canonical domain of repetition, and when we reinterpret another domain to emphasize its repetitiveness, we are, in fact, examining a quasi-musical aspect of that domain. Repetition in music is of two sorts: not only is there often a large amount of repetition within particular pieces, as Zuckerkandl observes, but we also tend voluntarily to reexpose ourselves to familiar pieces, again and again and again.

There's a stubborn repeatability to music at every turn that philosophers, ethnomusicologists, cultural historians, semioticians, theorists, and composers have banged their heads against for ages—in most cases, banged their heads against and then abandoned the pursuit. But it is only recently that cognitive scientists have begun to turn their attention to this phenomenon. It is the claim of this book that this particular brand of head-banging—cognitive science against musical repetition, in conjunction with a certain tenacious commitment to making repetition a center of inquiry rather than a peripheral issue—might be especially productive. **(p.5)**

Biologist W. Tecumseh Fitch calls repetition a "design feature" of music (2006); not only is music found in all known human cultures, but also musical *repetition*. Repetition is not an arbitrary characteristic that has arisen in a particular style of music; rather, it is a fundamental characteristic of what we experience as music. Particular styles (e.g., modernist and expressively avant-garde approaches) can seek expressly to avoid repetition. Consider aleatoric musics, for example, which incorporate chance into their composition. John Cage's *Imaginary Landscape No. 4,* a symphony for 12 radios, involves portable devices tuned to whatever stations are findable at the moment, resulting in a unique constellation of sounds that changes entirely on re-performance. But pieces in this tradition consciously set themselves against a standard practice and generally require the cultivation of special attitudes and ideas to appreciate. Both the prevalence and the extent of repetition in music around the world argue for a special biological role. Although a behavior's universality does not necessarily signify innateness (see the discussion in McDermott and Hauser, 2005), it does suggest that something interesting is afoot.

As a composer explicitly concerned with generating a sense of structure in music but resistant to traditional ways of doing so, Arnold Schoenberg admitted, “Intelligibility in music seems to be impossible without repetition” (1967). So prevalent is the practice of repetition, that notation possesses not one but many symbols for it. Peter Kivy (1993) surveys the different symbols that, one way or another, instruct performers to repeat, from the tremolo to simile marks to the repeat sign and da capo. The technique of repetition permeates musical practice to such a degree and in so many different ways that it is rarely considered as a single thing; the range of symbols used to notate it masks the fundamental connection among diverse types of repetition.

Not only is repetition a feature of the music of all known cultures, it is also rather irresistible. Making up a little melody and repeating it is fun. The applet Tone Matrix (http://tonematrix.audiotool.com/) exploited this fact so successfully that it became an Internet phenomenon. Users could click any of the squares in a 16x16 grid, randomly drawing their mouse across the board, or drawing pictures or writing their name, and end up creating something that sounded convincingly musical. The ease of producing likable results had to do with the isochronous metric grid represented by the x axis, and the pitch-forgiving pentatonic scale along the y-axis, but it also had essentially to do with the loop: the 16-beat segments repeat until the user clicks more squares or presses stop. Almost anything producible on the matrix sounds credibly musical after a few loops; this applet makes apparent the degree to which repetition can serve to musicalize. Making up tunes and repeating them when children are around might be hazardous to your ability to spend the afternoon doing anything else; children have a special passion for repetition that extends well beyond the musical. Conversely, making **(p. 6)** up tunes and repeating them around adults might be hazardous to your ability to retain friends; repeated tunes are likely to burrow in where they aren’t wanted in the form of earworms—those ditties that seem to get irrevocably stuck in your head (Bennett, 2002).

Repetition is an important component of music’s shareability, of its social and biological role in the creation of interpersonal cohesion. At many nursery schools, songs feature in the everyday routine—everybody sings, for example, a particular cleanup song at the appropriate transition time every day. Or

imagine a responsorial psalm in a church, the leader teaching the congregation a new responsorial, and them repeating it after each verse, en masse. Imagine a group of children playing *Ring Around the Rosie*, or adults singing *Auld Lang Syne* at midnight on New Year's Day. Repeatability is how songs become the property of a group or a community instead of an individual, how they come to belong to a tradition rather than to a moment.

While many theorists, most recently Gjerdingen (2007), have demonstrated that music is compiled of numerous stock patterns, riffs, and schemata, language also partakes of these structures to a certain extent. Tannen (2007) claims that much more speech than we normally acknowledge is comprised of formulaic expressions—memorized sequences of words, such as those you find in idioms and proverbs. These are often the first things adults immersing themselves in a new language learn—stock phrases such as "how are you?" Van Lancker-Sidtis and Rallon (2004) analyzed the instances of formulaic expressions in a screenplay and found them to make up a full 25 percent of the text. Pawley and Snyder (1983) found that formulaic expressions are processed more quickly than similar-length sequences generated creatively, and Conklin and Schmitt (2008) showed that they were also read more quickly.

Richman (2001) postulates precisely this kind of formulaic repetition as the shared origin of music and language. "In the beginning, speech and music making were one and the same: they were collective, real-time repetitions of formulaic sequences" (p. 300). He points to nonsense formulas, like eenymeenymineymo, as an example of this kind of communication—vocalizations whose component parts lack individual meaning, and which acquire meaning as a whole through their social function. Music psychology has been busy looking at the ways in which music might be similar to language, but Richman, Tannen, and others might be understood to be asking the inverse question, when is language processed musically? This question has been examined in terms of beat structure and intonation, but it might also be considered in terms of repetition structure: highly repetitive forms of language, such as chants and nursery rhymes, veer away from the typical syntactic and

semantic modes of understanding speech, and toward modes of comprehension that are more characteristically musical—emotive, social, and holistic. **(p.7)**

Repetition, Prediction, Participation

Music takes place in time, but repetition beguilingly makes it knowable in the way of something outside of time. It enables us to “look” at a passage as a whole, even while it’s progressing moment by moment. But this changed perspective brought by repetition doesn’t feel like holding a score and looking at a passage’s notation as it progresses. Rather, it feels like a different way of inhabiting a passage—a different kind of orientation. Work in my lab traced this shift in attention across repeated exposures (Margulis, 2012). Listeners heard short excerpts from commercially available recordings of classical music by composers ranging from Rameau to Strauss. The excerpt order was randomized, but blocked so that they heard all four repetitions of each individual excerpt successively. The participants’ task was simple: they pressed a button as soon as they detected something repeating within the excerpt. At the start of the experiment, each participant received training and practice on this task, and was explicitly shown, using examples, that the repeating entity could be short (a two-note gesture), or long (a sixteen-bar phrase). They were asked to respond as quickly and accurately as possible. After each excerpt, they also provided free text descriptions of each repetition they’d reported. These descriptions were collected as a means of disambiguating responses in cases where the click was interpretable as referring to more than one repetition.

The repeating units in each excerpt (defined as passages with the identical pitches and rhythms) were identified, timed, and tabulated. Listeners’ identifications of repeating units, made by pressing buttons while listening, were then tallied against these actual repeating units. Figure 1.1 shows exposures (from first to fourth) along the x-axis, and probability of correct response along the y-axis. The probability of correct response captures the likelihood that, given an actual repeating unit, the listener would identify it as a repetition. One excerpt, from a Rameau piece for keyboard, featured mostly very short repeating units, and another, from the Strauss opera *Der Rosenkavalier*, featured mostly long repeating units. (Length of repeating unit—LRU—refers to the length in seconds of the entity heard to be repeating). When participants’ success at repetition detection for each of these excerpts is tracked across exposures, it becomes apparent that with each

rehearing, they got better at identifying repetitions in the Strauss, but worse at identifying repetitions in the Rameau.

To determine whether this pattern was due to the different average length of the repeating units (short in the Rameau, long in the Strauss) in the two pieces, or whether it was attributable to one of the many other differences between these two works, data from all the pieces were collapsed together, regardless of composer. Task performance across exposures was tracked for short, medium, **(p.8)** and long repeating units, and the same pattern emerged (see Figure 1.2)—people were more likely to detect the repetition of a short unit on the first hearing, but more likely to detect the repetition of a long unit after multiple exposures. Perhaps something about the kinds of changes that tend to take place between repeated instances of a short or long pattern accounted for the results. To eliminate this explanation, we looked at cases where the repetition happens

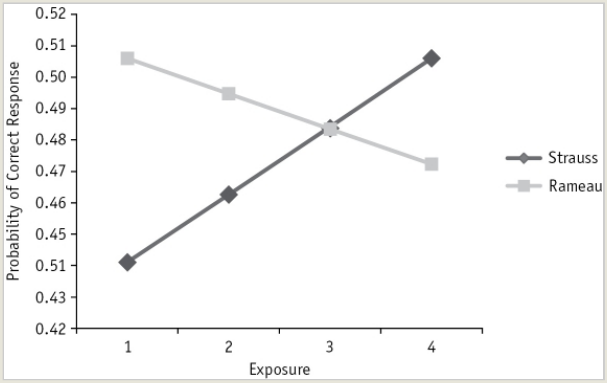

Figure 1.1 Probability of correct response by exposure for repetitions in the Strauss (the excerpt with the longest mean length of repeating unit) and Rameau (the excerpt with the shortest mean length of repeating unit). Reprinted with permission from Margulis, 2012.

(p.9) immediately, with no confounding intermediary material: cases where a passage is played, and then immediately played again. Since there were fewer cases in this category, occurrences were collapsed into two groups instead of three—short and long. Even in this case, the trend held, as shown in Figure 1.3. People detected more short repetitions when they were first encountering a piece, and detected more long repetitions after several exposures.

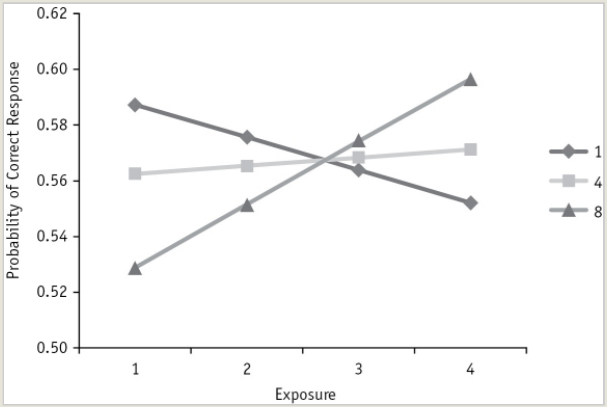

Figure 1.2 Probability of correct response by exposure for repetitions with repeating unit lengths of 1, 4, and 8 s. Reprinted with permission from Margulis, 2012.

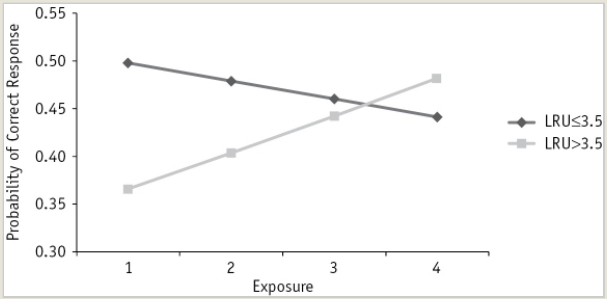

Figure 1.3 Probability of correct response by exposure for immediate repetitions when the repeating unit length was ≤ 3.5 s, and when it was ⟩ 3.5 s. Reprinted with permission from Margulis, 2012.

Together, these data suggest that repeated exposures trigger an attentional shift from more local to more global levels of musical organization. Repetition, thus, can be understood to affect a listener’s orientation toward the music; the horizon of involvement widens with additional exposures, so that the music doesn’t seem to be coming at the listener in small bits, but rather laying out broader spans for consideration.

Our experience of expectation, as Leonard Meyer (1956) has observed, is often a “felt” rather than a thought phenomenon. We hear the dominant leaning into the tonic—leading forward into it—and share this sense of directedness in time. To some extent always, but especially when the music is familiar—when it has been repeated—each moment seems not like a bead strung along a necklace, resting next to dozens of other beads, but more like a drink just when it starts to be poured—the cascade of liquid is so much a part of the gesture as to seem to be contained within it. Repetition makes it possible for us to experience a sense of expanded present characterized not by the explicit knowledge that *x* will occur at time point *y*, but rather by a heightened sense of orientation and involvement.

Music theory has examined temporal orientation through the lens of phenomenology, most famously in David Lewin’s 1986 paper *Music Theory, Phenomenology, and Modes of Perception*. But the experience of listening to music was understood much earlier to be illustrative of general principles of time **(p.10)** perception. Edmund Husserl, for instance, used the example of listening to a musical tone to illustrate that every event both leans into the future, conditioning expectations (however implicit) about what might come next, and trails from the past, carrying residue of the events and expectations that preceded it. Lewin constructs a formal model of musical events and their associated percepts, drawing special attention to the way that these percepts function recursively, calling on one another in increasingly complex ways as time progresses. He devises a symbology for discussing these percepts, specifying for each both the triggering event and the context being allowed to influence it. Thus, for example, in an analysis of Schubert’s *Morgengruss*, he lists a percept of mm. 12-13 considered within the most local context, mm. 12-13, and another percept of mm. 12-13 considered within the larger context of mm. 9-13, and yet another percept of mm. 12-13 considered within the context of mm. 12-13 plus the expected mm. 14. Using this terminology, repeated exposures to a piece might be understood to shift the dominant contextual influences to wider spans, subtly recasting the listening experience to a different set of perceptions of the same events.

There are clear biological rationales for experiencing pleasure when predictions are fulfilled, as David Huron explores in his 2006 book *Sweet Anticipation*. Such pleasure can be understood to reward successful prediction, and encourage more of it in the future. Familiar music can have a transportive quality, part of which may relate to the special way that surrounding events and sensations can seem to glom onto musical experiences, such that when we rehear familiar repertoire, vivid episodic memories arise. We all have examples of a commercial jingle or radio song summoning forth a forgotten moment from childhood, as suddenly and distinctly as if no time had passed at all. Indeed, Andrea Halpern has shown that auditory imagery possesses particular robustness (see Zatorre and Halpern, 2005, for a review). And Warker and Halpern (2005) have shown, using a musical stem completion task, that people have implicit memories for what notes will come next in melodies to which they were recently exposed, even when they lack the ability to explicitly produce (i.e., sing) these notes. Repetition, in other words, binds the notes in a piece of music closely together, such that hearing only a few of them is sufficient for the rest to mentally unfold, along with, sometimes, a set of associated autobiographical memories (see Janata, 2009).

Consider a common earworm. If I play you just the bit of The Muppets song that goes “Mahna-mahna, ” I wager that it is all but inevitable that you will subsequently have the auditory image that goes “Doo doo dee doo doo.” Yet if I show you a portion of a famous image, such as Rosie the Riveter, you may know what the missing part looks like, but it doesn’t occupy your imagination with vividness and irrevocability the way the missing music did. For one thing, you could probably imagine the missing part of the image, and then voluntarily put it aside, but you couldn’t imagine the rest of the music and put it aside; the music had to play to **(p.11)** a resting point in your head, however long that took. And worse, after it stopped, there’s a chance it might have started replaying. It is my intuition that one reason for this stickiness is our inability to conjure up one musical moment and leave it; if our brain flits over any part of the music, we are captured by it, and must play it forth to a point of rest. So we constantly have a sense of being gripped, even unwillingly, by the tune. And note that an earworm is usually a tune—something with a trajectory in time —not a timbre or a special harmony. In the very way we

remember music, there's some need for it to play itself out, again and again. Every time we recollect a musical performance, it's to a certain extent a replay. This link between memory and repetition pulls us into repeated music and invites us to inhabit it.

Turino (2008) goes so far as to distinguish two entirely different types of musical practice—presentational, where there is a clear distinction between the music-producing performers and the music-receiving audience, and participatory, where no such distinction exists, and everyone is expected to join in and contribute to making and enjoying the music. In Turino's construct, a classical concert is a canonical example of presentational music, and bluegrass jams or campfire songfests are canonical examples of participatory music. Turino identifies the kind and extent of repetition as a feature distinguishing participatory from presentational music, with "an emphasis on the heightened repetition of musical material—at the level of motives, phrases, sections, and the entire form—which is then repeated over and over again for a relatively long time" disproportionately concentrated in participatory musics (p. 38). Although repetition plainly invites participation in the way Turino describes, enabling newcomers to catch on and join in quickly, I'm not convinced that presentational music has so clearly shed this characteristic. "The use of stock forms, formulas, and a good deal of motivic repetition" (p. 40), although introduced to exemplify music that is essentially participatory, might just as easily be observed to describe much classical, presentational music as well (cf. Caplin, 1998; Gjerdingen, 2007). What I would like to propose is that the notions of participatory and presentational are imaginary poles, with substantial residue of the participatory clinging to much music that appears to be strictly presentational. When elements of the participatory, such as repetition, occur in presentational styles, they don't ordinarily trigger overt participation, but they do elicit a kind of imagined, virtual participation that can serve to powerfully involve an audience.

Repetition links disparate intellectual approaches to music as well. Ethnomusicologist Charles Keil (1987) articulates a reading of music that places itself in direct opposition to music-theoretical approaches:

> The syntactic or structural aspect of all music (Meyer 1956), but especially in thought-composed Western and other civilized musics, can create tensions, set up melodic/harmonic relationships that defer **(p.12)** resolutions and gratifications and thereby involve the listener in the music. But isn't this involvement more analytic, sequential, conscious, rather than "participatory"… ? Even in these civilized musical systems, syntax does not invite the listener to participate in the phenomena with the same powers that process and texture have. It is really only in relatively recent historical periods of Western music that syntax and a peculiarly rationalist approach to it (Weber et al. 1958) have managed to squeeze the mysteries of musical participation to the furthest corners of our awareness
>
> (Keil, 1987, 275).

Yet repetition plays an important role in both musical syntax and the kind of processes highlighted by Keil. This book will argue that investigations of musical syntax and investigations of musical processes examine different sides of the same musical experience, with repetition serving as a clear point of intersection between the two. Repetition can at once erect perceived syntactic structures and invite a kind of participatory, shared subjectivity. These twin functions underscore that part of music's distinct phenomenology consists of its merging of the objective and subjective stance. Auditory imagery can be stunningly vivid and robust (Halpern, 1988; Halpern & Zatorre, 1999; Kraemer, Macrae, Green & Kelley, 2005; King, 2006). Kraemer et al. (2005) found enhanced activity in the primary auditory cortex and in auditory association areas when silent gaps were inserted into familiar songs such as *Satisfaction* by the Rolling Stones, in comparison to when the same gaps were inserted into unfamiliar songs—a neuroimagistic trace of the way familiar songs can continue to play through listeners' minds even after the sound has been paused. We know what it's like to "think a phrase, " to be mentally gripped by imagined music. When we know what's coming in a musical excerpt, the listening becomes a motion, an enactment, it "moves" us. We are constantly in the future as we listen, such that we can seem to embody it—a topic to be explored in Eric Clarke's forthcoming book on music and subjectivity. My claim is that part of what makes us feel that we're a musical subject rather than a musical object is that we are endlessly listening ahead, such

that the sounds seem almost to execute our volition, after the fact. This sense of superexpressive voice (see Juslin, 2001) can be pleasurable in and of itself. It is the pleasure of expansion, of movement beyond limits, of increased power—all characteristic of strong experiences of music as chronicled by existing experimental work (Gabrielsson, 2011). Repetition, I would argue, encourages embodiment. And this embodiment contributes to musical pleasure.

Some modicum of empirical support for this notion comes from neuroimaging work by Petr Janata showing that when people listen to familiar music, **(p.13)** in comparison to when they listen to unfamiliar music, there is widespread activation "within structures that underlie sequencing and motor planning" (2009, p. 10). This is consistent with the notion that an embodied kind of forward listening characterizes the experience of rehearing music. Relatedly, I would argue, Pereira et al. (2011) showed that emotion-related limbic and paralimbic regions, as well as reward circuitry, were more active when listening to familiar rather than unfamiliar music —regardless of whether or not it was liked. This finding is consistent with the idea that familiarity makes it possible for us to experience a sense of inhabiting external sound, an experience which is itself pleasant, even if we dislike the music that triggers it. Research on subvocalization, the kind of silent, internal speech that can accompany reading or various kinds of thought, demonstrates that it sometimes consists of auditory imagery (a percept of internal sounds), and sometimes consists of kinesthetic imagery (a percept of internal mouth movements) (Smith, Wilson & Reisberg, 1995). Music is cross-modally linked with sensations and perceptions of motion (Todd, 1995; Zatorre, Chen & Penhune, 2007).

Nuance and the Aesthetic Mode of Attending

Allow me to erect a straw man for a moment, because this one plagues us even though we know he's flimsy: the notion that music is communicative, in the sense that it conveys information. Repetition is one of the things that show us that this cannot be music's primary function. Once you read Stephen Covey's *Seven Habits of Highly Effective People*, you don't need to keep revisiting the text. In fact, it may be that reading a five-page summary of the book would suffice. The book conveys information, and once the information has been transmitted, there's little residual value within the text, little impetus to reread or repeat the experience. But imagine hearing Beethoven's Fifth Symphony once, and being done. Or hearing a five-minute summary. Neither of these would suffice in the way that they might for the book. Part of this difference is an issue of grain—just as the image in Figure 1.6 seems to reward lots of staring and seeking and blob scrutinizing before a viewer recognizes the emergent image of a Dalmatian, but becomes arguably less interesting and more discardable once that's been identified, it depends on the *kind* of information we're seeking. Do we want simply to identify an object? Or are we approaching the illustration *aesthetically* (a mode of appreciation self-help books do not generally recognize or reward)? Part of the aesthetic orientation is a perceptual openness, a willingness to notice and believe in connections and meanings that may not be instantly apparent. If we trusted these blobs to convey ever-richer associations and patterns to us **(p.14)** the longer we looked, we might want to revisit this drawing ad infinitum. Knox (1994) observes that repetition in spoken discourse

> prompts the hearer to seek implicit meaning in utterances, by indicating that the speaker aims at a meaning different than that conveyed by uttering an expression only once. Thus, when ideas are complex or words are insufficient, speakers may repeat their utterances in order to engage their hearers in interpretive efforts to make more of what is said (p. 197).

Think of some cinematic lug telling his henchman: "Take him outside!" When the henchman answers, "OK, boss, " looking confused as to why fresh air would be an appropriate punishment for their captive, the lug might repeat "Take him *outside*!, " the repetition communicating that the utterance implies more punishment than its surface might indicate.

Music's function is obviously not to convey information, and its repetitive nature seems to be bound up with this other function—a function that might best be described as aesthetic. But there seems to be something more going on than this term can capture. We revisit favorite paintings, but not with the degree of obsession we revisit musical works (or there would be a painting iPod). Films we rewatch, but again not to the same degree, and not with mounting passion. Poetry is perhaps the best comparative case—it can take a comparable or even smaller amount of time to read a poem as to hear a piece, and poetry unfolds sequentially and dynamically in time (word after word after word), just like music (note after note after note). Poems are reread, and re-enjoyed, but lack both the internal repetition characteristic of music, and the capacity to generate earworms (you don't get stuck in the shower reciting "shall I compare thee to a summer's day?, " although if it were set to a pop tune you might). The rereading of poetry is also often the restudying of that poetry, with new "information" being extracted, and whereas the extraction of information *can* be a goal for musical rehearings, this was not the mechanism or goal at play when "Poker Face" was blasted everywhere during the summer of 2009.

Rereading (or rehearing, to take a closer example) familiar poetry is, I would argue, a less consuming experience than rehearing familiar music. Even if you love Robert Frost, you don't hear "Two roads diverged" and think "yes!" the way you might when you hear the opening notes of a favorite song. You could duck out of the poem fairly easily, whereas a snippet of familiar music triggers a cascade of "that song" that takes over and won't let you go. Interestingly, it's much harder to memorize a poem than a song. At first glance, this would seem to make repetition more desirable for poems than for music, where we are able to know "how it goes" much quicker. That the reverse is true suggests that the pleasure we derive **(p. 15)** from musical repetitions might stem less from increasing knowledge about the piece than from a growing sense of inhabiting the music: a transportive, even transcendent kind of experience. Indeed, recent theoretical work by Carolyn Abbate has questioned the centrality of "knowing" within musical experience (2004), emphasizing instead its momentary lived and sensed aspects. Similarly, my paper *When Program Notes Don't Help* (2010) presents some empirical support for the notion that people enjoy music more when they aren't given

explicit information about it. Participants in this study reported increased enjoyment of excerpts from Beethoven String Quartets when the excerpts were presented without any annotations, in comparison to the same excerpts when preceded by verbal descriptions of their dramatic or structural content. Having more explicit “knowledge” about the piece, in other words, not only didn’t help enjoyment, it reduced it. It seems that the increased pleasure repetition can afford stems not from enhanced knowledge, but rather from something more implicit, a changed sort of orientation toward the work.

Repetition and the Music-Language Divide

Repetition is both more prevalent in music than language, and better received. People might like repetition in music that they wouldn’t in language, but might also tend to disavow this affection, finding it somehow embarrassing. In a 2012 study, I asked participants without special musical training—everyday music listeners—to listen to excerpts from challenging contemporary art music (atonal pieces by Luciano Berio and Elliott Carter) and rate on a 7-point scale how much they’d enjoyed each excerpt, how interesting they’d found it, and how likely they thought the excerpt was to have been composed by a human artist rather than randomly generated by a computer (Margulis, 2013). Unbeknownst to the participants, mixed in with the original excerpts were adaptations of them. In these adaptations, segments of music had been extracted and reinserted to add repetitions of some material; repetitions that could occur immediately or after some other music had intervened (see Figure 1.4).

Listeners rated the immediate and delayed repetition versions as reliably more enjoyable, more interesting, and more likely to have been composed by a human artist rather than generated randomly by a computer. Even roomfuls of PhD-holding music theorists, when presented these examples at a meeting of the Society for Music Theory (Minneapolis, 2011)—an audience sympathetic to Berio and Carter if ever there were one—confessed to finding the repetitive versions more likable on first pass. This is a stunning finding, particularly as the original versions were crafted by internationally renowned composers and the (preferred) repeated versions were created by brute stimulus manipulation **(p.16)**

without regard to artistic quality. The simple introduction of repetition, independent of musical aims or principles, elevated people's enjoyment, interest, and judgments of artistry. This suggests that repetition is a powerful and often

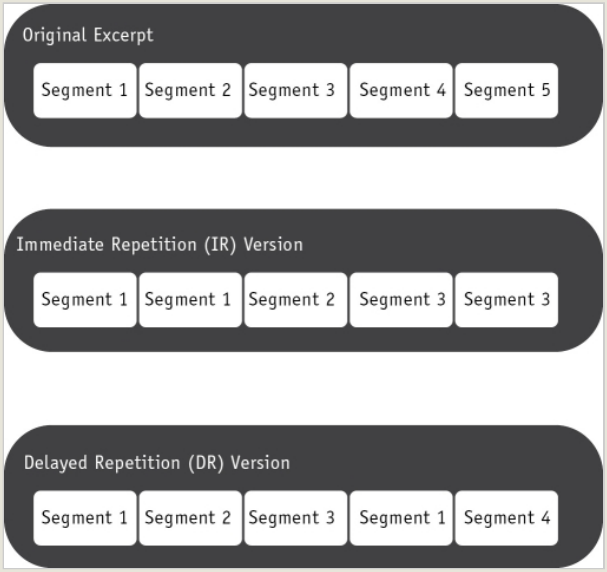

Figure 1.4 Graphic representations of the three types of stimuli used in Margulis (2013): original excerpts, excerpts with immediate repetitions inserted, and excerpts with delayed repetitions inserted.

underacknowledged aesthetic operative. And note particularly that introducing the same manipulations into spoken utterances (additional repetition, without regard to linguistic sense) would likely not trigger elevated ratings of enjoyment, interest, or the perceived likelihood of generation by a human speaker rather than a computer—quite the opposite, in fact. Repetition, thus, marks an important divider between the perception of music and language. Perhaps the most dramatic evidence for the special role of repetition in music comes from Diana Deutsch's speech-to-song illusion (hearable at http://deutsch.ucsd.edu/psychology/pages.php?i=212). In this well-known example (Deutsch, Lapidis, and Henthorn, 2008; Deutsch, Henthorn, and Lapidis, 2011), a sentence of ordinary speech is presented, followed by the excessive and temporally regular repetition of a single clause from the utterance. Finally, the original sentence is played again. For the majority of listeners (approximately 85 percent in most studies), a radical change in perception occurs: although the rest of the sentence sounds normal, the segment that had been repeated has shifted phenomenologically, such that it seems the speaker has suddenly burst **(p.17)**

into song. In the example featured above, what on first pass sounded like the words “sometimes behave so strangely” (and would continue to sound like such to any person encountering the sentence for the first time), comes to sound like the tune in Figure 1.5. Repetition, in other words, causes ordinary speech to be perceived as music.

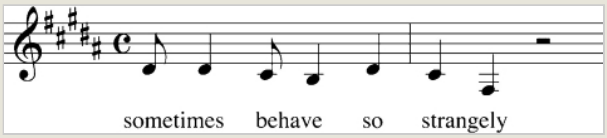

Figure 1.5 The musical sound of the repeated clause from the speech-to-song illusion. Originally published in Deutsch, D. “*Phantom Words and Other Curiosities,* ” Philomel Records, 2003, Copyright © Diana Deutsch. Reprinted with permission.

A similar phenomenon, first described by Severance and Washburn in 1907, is semantic satiation, where repeated viewings, utterances, or hearings of the same word cause it to seem to degenerate into nonsense. Not just any nonsense, but a nonsense in which the semantics vanish and are replaced by a sort of super-salience of the component parts—letters, phonemes, syllables. In the famous Dalmatian picture (see Figure 1.6), it’s as if the sense of the Dalmatian had disappeared (very difficult to do at will), and been replaced by a renewed sensitivity to the characteristics of the blobs. It’s interesting that repetition can cause language to dissolve into nonsense on the one hand or music on the other. This is not the first, nor the last time in this volume that the effect of repetition

(p.18) will be taken to suggest an affinity between these domains—an affinity, I should add, that I do not view as demeaning to music in the least.

Figure 1.6 The Dalmation illusion, designed by R. C. James.

Semantic satiation has sometimes been explained in terms of attention. Bored with repeated encounters with the same signified word, attention shifts to the only other available level—the constituent parts of the word—letters, phonemes, and so on; or, in the case of the speech-to-song illusion, from the sense of the words to the melody—the pitches—within it. What's remarkable in this example is that in shifting this way, we have the sensation that we're approaching the stimulus not in a slightly different manner, but rather as if it were a completely different stimulus altogether—as if speech had magically been transformed into music. Indeed, it could be argued that music is more about the nature of the blobs than about emergent Dalmatians. (There's a long literature devoted to this issue; see, for example, Raffman, 1993.) Nuanced objects are more compelling on repetition—it's not that we extract a Dalmatian and move on, but rather that there's always a richness just out of conscious grasp. There is a sense in which the thing is known, yet constantly rediscovered—never grasped—and this may result in a satisfying pull toward the present moment—perhaps a prerequisite for the loss of self chronicled by Gabrielsson (2011). The more a piece is repeated, the more we think we know it, and the greater the joy of discovery when we are surprised by the blobs. There's a point here where I believe that Paul Silvia's (2006) notion of interest as an emotion becomes relevant: I would submit that interest is an important

part of our emotional response to music, and that repetition facilitates the interest response. To my knowledge, the notion of interest as an affective response to music has not been deeply explored. Much has been made of emotional responses to music that entail sadness or happiness or some such feeling, yet often my own involvement with a piece, although deeply engaged, consists not of such feeling-states, but rather of a kind of committed and sustained interest. Repetition can encourage this interest to move away from explicit facts and ideas about a passage toward its actual sounding, making possible a vivid and immediate experience that is intrinsically pleasant.

The fact that repetition can engender such a dramatic perceptual shift from one acoustic domain, language, to another, music, suggests that it's playing an important role in distinguishing these two domains. In a diary entry from 1870, Wagner's wife Cosima quoted him to precisely this effect:

> Repetition! There is the absolute difference between music and poetry; a theme may be repeated because it is a person and not a discourse; on the contrary, in poetry, repetition is absurd, except when it is a refrain or when it has to produce a musical effect
>
> (quoted in Deliège, 2007, p. 11).

(p.19) In setting music and poetry alongside one another, Wagner appeals to an embodied sense of what music is, calling it a "person, " and contrasting it with the overtly conceptual content of a "discourse." Given the flurry of recent work comparing the cognition of language and music (see Patel's excellent *Music, Language, and the Brain*, 2008, for a summary), it's intriguing that the role of repetition has been largely neglected.

Communicative Functions

Although Lydia Goehr (2007) traces the emergence of the Western musical “work-concept” to roughly 200 years ago, ethnomusicologist Bruno Nettl (1983) finds reiterability to be a feature that is universally shared across music cultures. The advent of recording technology has strongly foregrounded this aspect of music, but people have been notating pieces for more than a thousand years, and sharing, transmitting, and replicating standard tunes for far longer than that. Moreover, this practice is not restricted to our species—whales, gibbons, and about half the 900 known species of bird sing. In fact, Suzuki, Buck, and Tyack (2006) report that repetition is a characteristic that leads researchers to characterize an animal vocalization as music: “The term *song* is used in animals, such as songbirds and whales, to describe an acoustic signal that involves a wide variety of sounds repeated in a specific sequence” (p. 1849).

Whale song involves repetition at multiple levels. Humpback whale songs are comprised of complex sequences of twelve or more units, discrete utterances separated by silence. They are constructed hierarchically (Payne & McVay, 1971), with repeated phrases coming together to form themes. In a single song session, the song will be repeated many times with surprising accuracy over a total duration of between seven and thirty minutes (Suzuki, Buck & Tyack, 2006, p. 1849).

These songs develop within particular populations and within particular regions; they gradually change with time and location. It has been suggested that repetition in whale songs functions as a mnemonic device, offering a strategy for coping with the cognitive demands of oral transmission and song evolution (Janik and Slater, 1997; Tyack and Sayigh, 1997; Guinee and Payne, 1988). Suzuki, Buck, and Tyack use information theory to show that entropy in whale songs decreases across the course of a season, as the whales settle in on canonical versions of each song. Moreover, they show that longer songs contain more redundancy. Li and Hombert (2002) report that these especially repetition-laden songs can last over thirty minutes.

> The repetition indicates a gradation of the intensity of the singer’s emotional state. The more the repetition, the

> greater the desire of the male to attract the female and the more it demonstrates the male's physical **(p.20)** fitness. Hence, repetition is not communicatively redundant. It has communicative significance
>
> (Li and Hombert, 2002, p. 197).

They note that songbirds repeat themselves with as much gusto as whales, sometimes for hours at a time, each repetition ratcheting up the intensity and advertising more strongly the motivation, strength, and health of the male bird. Searcy, Nowicki, and Peters (1999) report that researchers use the number of songs, as described by combinations of MUPs (minimal units of production), as the unit of analysis for variation in sparrows, and that song types are also meaningful units to the sparrows themselves.

Brown et al. (2004) point to the critical role of vocal learning and mimicry in the human song system. One way in which this manifests itself is in the quasi-musical amount of repetition in infant-directed speech. Informal observation suggests that several factors contribute to this tendency. First, at the stage during which the baby is not talking back, there's not much to push the conversation forward; a low-energy, default way to keep talking is simply to repeat what you just said. This is a pragmatic kind of motivation, which may influence compositional choices in music as well: if you're unsure about what to do next, the least-demanding solution may be simply to repeat the previous material. Second, repetition creates a soothing sort of rhythm—repetition at the sentence level, where I have often noticed it in interactions with babies, in particular creates a slow, calming periodicity. Similarly, repetition in music has been shown to facilitate the emergence of metric hierarchy (Lerdahl and Jackendoff, 1983); meter, in turn, facilitates entrainment, which has clear relevance for parent-infant interactions. Third, repetition aims to teach the infant how to speak an utterance and what it means. A parent will point to a ball and repeat "Ba-all. Ba-all. Ball." This hyper-repetitiveness, the parent hopes, not only shows the infant where the word boundaries lie, but also builds memory of its phonemic content and associations to its semantic referent. Musical repetition might also be profitably conceptualized as a way to teach people how to listen to the piece at hand—to guide them to the proper level of attention (see Margulis, 2012), and to underline the entities considered important. As Lidov (1979) frames it, "Since repetition can be perceived in an unfamiliar style, innovations which lack the support of an

established musical language can appeal to repetition to clarify their vocabulary and procedures" (p. 27). This link to musical process makes it instructive to examine repetition's didactic aims in infant-directed speech.

Parents use not only more word repetition, but also more prosodic repetition when they talk to newborns (Fernald and Simon, 1984). This verbal repetition seems to peak in speech directed to children between four and six months old, and declines to the level found in adult-directed speech by age two (Fernald & Morikawa, 1993). Unyk, Trehub, Trainor, and Schellenberg (1992) observe that **(p.21)** this repetition, in combination with other distinctive features of infant-direct speech, such as exaggerated prosodic contours, confer a musical quality on this type of speech. When speaking to infants between the ages of four and six months in the context of play, mothers on average repeat every fourth or fifth utterance (Stern et al., 1983). McRoberts, McDonough, and Lakusta (2009) point to the critical window between seven and nine months, when infants are starting to be able to segment familiar words and track probabilities in speech, as a hypothetical peak for a maximum interest in repetitive speech, since "repeated utterances can act as an important scaffold, providing an opportunity to perceptually explore the transient speech signal" (p. 169). Specifically, they may "provide infants with the opportunity to recover additional details from the transient speech signal that they may not be able to access from a single presentation" (p. 180-181). In presenting this hypothesis, McRoberts, McDonough, and Lakusta (2009) assert "repetition in IDS [infant-directed speech] and its role in language and cognitive development is a potentially important but understudied phenomenon" (p. 181). This observation is especially transferrable to music, where repetition plays an even larger role but is similarly understudied. In the study, which systematically varied the amount of verbal repetition in infant-directed speech, the researchers found that six-month olds, but not four-month olds, prefer repetitive speech—potential evidence of a shift around this age from attention to prosodic cues to attention to linguistic structure, since "infants' sensitivity to repeated patterns of speech appears at about the same time that other studies show infants are becoming sensitive to prosodic markers for phrase and clause structure in continuous speech" (p. 191). The authors note that sensitivity to repetition

was documented in Fernald and O'Neill (1993), which outlined cross-cultural similarities in peekaboo games, and observed that between the ages of five and seven months old, babies start anticipatory looking in advance of the reappearance of the mother's face.

> The high degree of exactly and partially repeated utterances in IDS during this same period suggests that repetition in speech might play a similar role by allowing infants to anticipate that identical or highly similar sound patterns will be repeated within a short time. This could provide the infant with the opportunity to deploy attentional and perceptual resources to access finer grained structure in the speech signal than would be available from a single presentation (p. 191).

This issue of grain seems particularly relevant to music, since so much expressive power lies in nuance. As musical phrases repeat, listeners gain access to more nuanced, communicative aspects of the sound. It would be interesting to vary the amount of repetition in "infant-directed song" (lullabies, nursery tunes), and **(p.22)** assess whether preferences for repetition in music followed the same trajectory, and to determine whether this preference developed at a similar age.

Repetition's Functions

Three primary roles have been identified for repetitive auditory stimuli, roles in: (1) learning and level-shifting, (2) segmentation, and (3) expectation. This section considers each in turn.

Auditory stimuli are temporally delineated—you can't stop and look at them for as long as you wish. Rather, they're presented and then gone, on their own schedule, and after that you must rely on memory to access them again. But remembering a passage is impractical while listening to music, as the music typically does not stop to allow this kind of rumination (although in my 2007 article *Moved by Nothing*, I discuss instances where composers seem to have inserted a pause expressly to make this possible). Musical repetitions, therefore, can be viewed as a kind of re-presenting, a kind of prosthetic memory, whereby past events are put once more before the ears. As Kivy describes it: "Musical repeats, then, perform an obvious and vital function in that they are the composer's way of allowing us, indeed compelling us to linger; to retrace our steps so that we can fix the fleeting sonic pattern; they allow us to grope so that we can grasp" (p. 356). This groping and grasping facilitates learning, in that details missed on the first hearing can be encoded on the next. Music processing might rely more on fine-grained surface representations than language. In the case of language, once the meaning is abstracted, the particular words and intonation used to convey that meaning can be discarded. When people are asked to recall a story, or even a sentence, they often paraphrase, preserving meaning but substituting new words and expressions. Psychologists have referred to this as a failure of "verbatim memory" (Sachs, 1967; Jarvella, 1971; Gernsbacher, 1985). For example, if asked to recall the sentence, "The grandmother, who lived in a dusty fourth-floor flat she no longer had the energy to vacuum, made her way carefully down the stairs, hand steady on the rail, heels clicking determinedly with each step, " participants might say, "A grandmother who lived in a messy fourth floor apartment walked down the stairs with care."

Verbatim memory improves for jokes and insults—statements of "high interactional content, " grounded in the context of direct social interaction (Keenan, MacWhinney & Mayhew, 1977). Murphy & Shapiro (1994) advance a pragmatic view of this processing difference: "listeners attend to the level of

analysis of text that is most relevant, important, or salient given their current goals;" in other words, the difference is a matter of attentional allocation (p. 87). Assuming this theory's viability for the moment, verbatim memory should be elevated in music as compared to language, because of the surface's importance. **(p.23)**

Raffman (1993) suggests that elements of musical nuance are by nature ineffable, and resistant to memory, such that the only way to reencounter them is to rehear them. If the music's emotional power lies in nuance, and nuance can't be vividly recalled, there would be a strong motivation to relisten. Huron (2006) summarizes another perspective, reliant on statistical learning, according to which repetitions always sound new because our schematic expectations have changed since the last hearing, by virtue of whatever we've heard in between. Because the music plays with these new expectations in new ways, it retains affective power. This case strikes me as relatively weaker. If our expectations are derived from the sum of listening experiences across a lifetime, it hardly seems possible that the amount of music encountered between radio replays of a particular song could be sufficient to significantly reorient predictions about it.

The studies on repetition and infant-directed speech also point to the role of repetition in segmentation; an interest in repetition starts to emerge simultaneously with the ability to segregate the speech stream. But as infants become more skilled at segmenting the speech stream, they also become less interested in repetition. This timeline suggests that repetition might be particularly critical at the point when segmentation still represents something of a challenge. Might repetition be more desirable in musical styles where segmentation is a challenge? Might listeners find themselves more favorably disposed to repetition in genres that are unfamiliar? For music in a novel style, repetition is often a listener's first way into what counts as a unit—what should be grouped together and treated as an entity. For example, undergraduates who have not yet developed a good sense of cadence, the standard formulae that mark the ends of phrases, often rely heavily on repetition to identify phrase lengths. Repetition can communicate which temporal span is carrying the piece's principal action—in other words, which temporal level might reward a listener's attention. In an experiment in which the scope of the repeating unit was systematically

varied, such that it was sometimes two notes, and sometimes twenty measures, my prediction would be that attention would orient toward a smaller level in the first example, and toward a larger level in the second. This orientation could be assessed by error detection, recognition memory for elements of various sizes, tapping rate, grouping characterizations, or another measure. Some evidence that repetitions guide temporal attending in this manner already exists. When a two-measure repeating unit is followed by one-measure, half-measure, and two-note units in succession, the cumulative effect is of acceleration. The sense of speeding up arises not from any surface change in pace, but rather from repetition having directed attention toward successively smaller units of time.

Starting with Nicolas Ruwet in the early 1970s and continuing through the work of Jean-Jacques Nattiez, semioticians have hypothesized that repetition might serve as a kind of perceptual primitive out of which listeners **(p.24)** could construct the sometimes elaborate structures common to traditional music-theoretic accounts. As Lidov (2004) observes, however, the hope of these theorists that high-level structural readings would prove buildable out of direct repetition analysis was not fulfilled. Tracking various kinds of repetition does not on its own produce the broader kinds of insights listeners regularly have in response to music. (Although Ockleford, 2005 does make a compelling case for the power of repetition to define diverse kinds of musical structures.) The more conservative claim made here, that repetition draws attention to particular elements within the musical fabric, should be understood as distinct from the broader claim advanced by early work in semiotics.

Work on infant-directed speech also implies that repetition plays a role in expectation. For example, infants can track regularities in the speech stream and actively predict that a verbatim repetition will occur every four to five seconds. For adult listeners, repetition’s function in the establishing, direction, fulfilling, and thwarting of expectations is more complex. Take, for example, the apparently simple question of what repetition might imply. Meyer proposes that repetition triggers an expectation for change, but Narmour explains that repetition triggers an expectation for more repetition. The fact that two such similar theorists (Narmour was Meyer’s student) diverge on this fundamental point is revealing. It’s simply too reductive to assert that repetition implies either continuation

or change. It depends on the type of expectation under consideration (see Margulis, 2007b, and Huron & Margulis, 2010), as well as on the context in which the repetition occurs, and the kind of thing being repeated (for example, a note or a section). Nevertheless, repetition clearly steers expectations in important ways deserving of further study. For example, what are the conditions that cause a listener to expect repetition at a particular point in a piece? How robust are veridical expectations for events within a repeated phrase in various circumstances? How can expressive choices by performers affect these expectations?

Several motivations prompt repetition to be considered as a singular phenomenon, rather than as a special case of more general similarity relations in music. The first is pragmatic: as Sisman (1993) observes, “Repetition is a topic of daunting size” (p. 4). Lidov (1979) notes that although the concept of variation is already laden with human perceptual tendencies, repetition is a more clear-cut case, closer to something directly measurable from the acoustic signal. This characteristic makes it more useful for examining the divergence between acoustic properties and human perceptions of them. The second motivation is grounded in empirical work. While studying semantic satiation induced by spoken recitations of a word, Pilotti et al. (1997) found that only repeated utterances spoken by a single voice triggered the effect. When the stimuli were merely similar (the same word uttered by different speakers), no satiation took place; when they were truly identical (the same word uttered by the same speaker), the result was **(p.25)** qualitatively different. Verbatim repetition triggered a special kind of response. Monaghan and Rowson (2008) sought to directly investigate whether repetition of identical stimuli is a special case for learning, or whether it is better conceived as one endpoint of a continuum of similarity. They measured learning success for tone sequences that included different types of patterns, including repetition. Patterns featuring repetition were learned differently and more successfully than other types. These results support “the claim, made in Endress et al. (2007), that identical repetition is a special case for learning.” Monaghan goes so far as to claim that repetition’s singular effect poses a problem for traditional accounts of statistical learning mechanisms. Repetition seems special, and its

prevalence in music makes it the perfect domain in which to explore what precisely this might mean and why precisely it might be.

This chapter offers a few preliminary observations. First, to remember a passage of music requires an uncommonly extended duration of time—the duration it took to play the passage in the first place. Remembering a passage entails mentally replaying it; thus, musical repetitions are quite like musical memories. This resemblance draws us in, and encourages a sort of embodiment of the sound—the music is doing objectively just what we imagined it to, subjectively—that is by its very nature pleasurable. Second, in music, ensuing (future) moments are much more present in the perception of the current moment than in other domains. But this stratified, expanded present can only emerge if the music is familiar—if the future course of the melody is known. Thus, the pleasurable “flow” state described by Csikszentmihalyi (1997) is likeliest to emerge in response to music that has been repeated. Third, essential components of musical expressivity depend on nuance, nonconceptual elements, and aspects resistant to description in words or even to representation in memory. Hearing the piece again is the only way for a listener to reencounter these aspects. Repetition allows for the re-experience of meaningful elements that could not be sufficiently represented in memory, and for the shifting of attention from one level to the other, such that multiple rewarding musical associations can be appreciated.

I want to suggest that repetition is a worthy subject for much more theoretical and empirical attention than it currently receives. I won’t say, like Ferdinand Praeger in 1882, that “if the slightest seed has been thrown out to help [this cause], I shall consider this to be one of the happiest days in my life, ” but I do think we have a lot to learn about diverse and important subjects by making repetition a focus of inquiry. The remainder of this book takes up this task in earnest.