

Rhythmic Techniques Used to Elicit Surprise

Daniel LaCombe

University of Delaware

Introduction:

The role of rhythm in the perception of music is extremely important in that it is the basis upon which all music is created. Without rhythm, humans would have no sense of patterns, and music would simply sound like nonintegrated noises of nonsense. So how do humans perceive rhythm? According to Brower, the answer is simply memory. Humans' ability to remember different elements of music over time allow them to perceive rhythm in terms of patterns. People's ability to store information is not all the same. "Psychologists account for these differences by describing memory as consisting of sensory, short-term, and long-term stores" (Brower, 1993). As a result, humans are able to remember some parts of a musical sequence for only short periods of time. Extended exposure, however, can allow a person to encode the information into long term memory, which provides greater access and more accurate perceptions. Depending on what level the stimuli are encoded results in what is called the psychological present. "Under these circumstances, short-term retention can be related to the notion of the psychological present" (Brower, 1993). This is the sort of circumstance an individual would be in if they were listening to a piece of music for the first time. When in this position, individuals use their retention of short-term memory in the psychological present as a basis of recognition. Recognition involves the perception of recurrent patterns in rhythm or melodies. People's ability to recognize the patterns forms a hierarchy of rhythm.

The hierarchy of rhythm can be explained as follows. "First, for convenience the rhythmic hierarchy may be divided into three regions- foreground, middle-ground, and

background. The boundary between foreground and middle-ground corresponds to the shift from echoic to short-term memory, and the boundary between middle-ground and background corresponds to the shift from short to long-term memory" (Brower, 1993). The more one listens to a particular stimulus, such as a song, the more dimensions of rhythm one is able to perceive. "As memory traces are strengthened, our ability to perceive the organization of the events in the present and to anticipate those of the future is enhanced, thereby expanding the range of foreground and middle-ground perception" (Brower, 1993). The foreground of the rhythm is considered to be the most basic, and is described to be the basic "pulse". "Once one cross the boundary between foreground and middle-ground, cognitive processing plays an increasingly important role in perception" (Brower, 1993). This implies that in order to perceive higher levels of the rhythm hierarchy, one must actively engage in the listening to understanding the music.

Another important distinction in the perception of music is the difference between meter and grouping. "Meter plays an important role in this process, for it provides a simple, recursive means of organizing our rhythmic perceptions" (Brower, 1993). This is the most basic level of rhythm, and is dependent upon the time signature of the musical piece. For example, a music composition with a time signature of 4/4 will have four beats in a measure, as well as four measures in a meter. "At the same time, the listener instinctively infers a regular pattern of strong and weak beats to which he relates the actual musical sounds" (Lerdahl & Jackendoff, 1983). This statement refers to the grouping effect human cognition has on perception. Instead of perceiving individual notes, people tend to group and categorize different elements of a musical sequence to better understand it fully and in a more efficient manner.

The human mind has a strong inclination to organize things in a systematical and efficient manner. The gestalt theories propose that humans organize these things in groups that must conform to a certain format. "...Many gestalt psychologists claim that human internal forces tend toward the "production of a perception which has 'good form', 'good gestalt' or 'pragnanz'. What this seems to mean is that there is always a tendency to see an object as being simple, regular, symmetrical, continuous, closed and the like" [3]. Perhaps the sense of order suggested by patterns in a given composition brings a certain satisfaction to the listener, while a temporary disruption of those patterns promotes a sense of drama" (Wilson, 1989). This implies that those composers that wish to convey satisfaction do so by using recurrent rhythms that do not change. But many composers play with different rhythmic techniques to create temporary disruptions that result in a sense of drama and disarray. Many composers do just this because it is known that "Listeners prefer a moderate degree of incongruity between expected and actual events" (Thompson, 2009). Therefore, composers must find a successful medium between congruent and incongruent aspects of music writing.

An important consideration when discussing expectation is the effect of enculturation. If a person grows up surrounded in a world of music that shares similar time signatures and styles, then this will greatly effect what he/she expects to hear in other music. "In turn, the greater familiarity listeners have with a style, the more easily they can perceive patterns in a given piece in that style, and the sooner they can begin to become involved in the act of predicting. Such involvement does not imply exact prediction of an upcoming event; rather, it implies that persons use past experiences to make sense out of new situations. Conversely, unfamiliarity with a given style causes a

lack of expectations, and consequently leads to a less meaningful experience...on the other hand, too much fulfillment of such predicting leads to habituation, the mechanism in the reticular system of the brain that keeps the brain from being bothered by continuous, unimportant signals [11]. This can lead to the mind's focusing on other things, or to boredom-even to drowsiness. Interestingly, too many contrasting or novel ideas can lead to a similar result-frustration and sleep [12]. Thus, the composer must find the successful middle ground: encouraging the listener's expectations and predictions through the repetition of patterns, and then manipulating those materials so that the expectations are either fulfilled or not fulfilled" (Wilson, 1989). As a result, composers should not use completely conventional ideas because these ideas have already been presented and might result in disinterest. Instead, a composer should incorporate new ideas on top of conventional ideas so that it seems novel in some ways, while familiar in others. A good example for a composition that finds a successful middle ground would be a composition in which recurrent rhythms are present but that in some measures unexpected changes occur. This allows the listener to get a sense of the rhythm to some degree, but also allows room for the element of surprise.

Something that is perceived in all forms of music and which is increased by unexpected events is that of tension and relaxation (resolution). "The interplay between expectations and the sounded events is hypothesized to play a central role in creating musical tension and relaxation" (Krumhansl, 2002). As an expectation is about to be fulfilled, tension increases in anticipation of an expected event. When that even is experienced and the expectation is fulfilled, a sense of relaxation or resolution is perceived. "Meyer proposed that expectations play the central psychological role in

musical emotions. Some points in the music engender strong expectations for continuation, creating a sense of tension and instability. Other points in the music fulfill expectations, and units are perceived as closed off and completed. Musical meaning and emotion depend on how the actual events in the music play against this background of expectations" (Krumhans, 2002). As a result, different emotional responses can result based on whether the music matches perceived expectations.

When this expectation is not fulfilled, further tension is experienced and a further longing for understanding the unexpected results. "When events conflict with our expectations, the lack of congruity between expected and actual events causes an arousal response from the autonomic (sympathetic) nervous system (ANS)" (Thompson, 2009). The ANS is congruent to the idea of the P600 activation. "The P600 is a positive component of the event-related brain potential (ERP) elicited by words that are difficult to integrate structurally into meaningful sentences" (Patel, Gibson, *et al.*, 1998). These examples display the neuropsychological effects of such unexpected events an individual may encounter.

Margulis suggests that there are "...five basic ways in which musical expectations can vary: their origin, their nature, their time course, their object, and their consequence" (Margluis, 2007). In relation to this study, the origin of musical expectation is that of rhythm and people's use of memory to create those recurrent expectations. The nature of rhythmic expectations is usually unconscious and automatic, but can also be conscious and aware. In the case of rhythmic dissonance, expectation is at first unconscious until an unexpected event results in surprise. After this, conscious effort and cognitions are involved in reconstructing an expectation that coincides with the unusual rhythm. The

third aspect of musical expectation is time course. With relation to rhythm, short time course expectations are much clearer than longer-term expectations. In other words, a listener develops strong expectancies to what should be played in a short period of time. On the other hand, listeners have weak expectancies on what is to happen later in a musical piece. The object of expectation is a particular event that embodies the expectation. What is interesting about the object of expectation is that it is perceived at the same time every time for all people. "People seem to have the same type of aesthetic response at exactly the same place in the music each time they hear it" (Madsen, Brittin, et al., 1993). This matches the idea of surprise in terms of rhythmic dissonance. When an unusual time signature is played, tension is created as time goes on. When the signature resolves on the same down beat, an aesthetic response is elicited, which can be described in terms of resolution. Furthermore, if the resolution is unexpected (not at time when thought to occur), a higher aesthetic response results. The object of expectation for rhythm is the reoccurrence of a meter at the end of a previous meter. This can be considered a transition from one part of a musical sequence to another. The final aspect of musical expectation, consequence, can vary depending on if the expectation is fulfilled or not. If the expectation is fulfilled, the consequence is satisfaction. If the expectation is not fulfilled, then the result is drama and disarray. So what kind of rhythmical techniques are used to create this sense of rhythmic dissonance and surprise?

Annotated Bibliography:

Arom, S. (1989). Time structure in the music of central Africa: periodicity, meter, rhythm and polyrhythmics. *Art and the New Biology: Biological Forms and Patterns*, 22(1), Retrieved from <http://www.jstor.org/stable/1575146>

“Rhythm in Central African music is based on a strictly periodic structure. The period is internally organized on two levels: by the pulse and by the minimal operational values. Rhythm consists in the imposition of cyclic figures-with or without variations-on an underlying period. Rhythmic figures can be defined by a set of five features: mark, durations, morphology, metricity and structure. The dominant rhythmic feature in Central Africa is a contrametric relationship to the pulse, which creates an antagonism between the rhythmical events and their temporal framework. Polyrhythmic music results from the interaction of two or more superposed rhythmic figures, which may vary in dimensions but have periods standing in simple ratios, and its dominant feature is the interweaving of accents, tone colors and/or attacks of the simultaneously performed figures. This gives rise to a conflict between rhythm and rhythm, which is coupled with the antagonism between rhythm and meter characterizing each individual figure. Many of the phenomena described in this paper are current over a much wider area of sub-Saharan Africa.”

Arom studies the forms of musical construction in different areas of the world. His affiliation to this research is very applicable because it relates to the idea of enculturation and that different areas of the world have different structures in their music. He has extensive knowledge of the basic music terminologies as well as much more in

depth knowledge of music. In his study, he broke down the different levels of rhythmical hierarchy to understand the complex rhythmical structures used in Africa. He discovered wide use of polyrhythms as well as call and response systems. The general findings of his study found that African music is basically a periodic structure. He found two main elements of the periodic structure: pulse, and divisions within the pulse that give it different qualities. In terms of relevance to this paper, it was quite significant. Although this source was not cited nearly as much as other references, it did provide some very helpful definitions that helped make my point clearer. It was also very relevant in that there was a parallel in terms of polyrhythm use in both African cultures as well as progressive metal bands such as Meshuggah.

Margulis, E. (2007). Surprise and listening ahead: analytic engagements with musical tendencies. *Music Theory Spectrum*, 29(2), Retrieved from <http://caliber.ucpress.net/doi/abs/10.1525/mts.2007.29.2.197>

“Roughly fifty years ago, Leonard Meyer made the intuitively appealing proposal that music engages the listener by generating expectations that can be fulfilled or avoided for aesthetic effect. Yet in the intellectual climate then prevalent, the mind was conceptualized as a black box. Given the changes in intellectual milieu over the past half century, including significant ventures into the mental black box not only in cognitive science but also in music theory, now seems a particularly suitable time for picking up some of the strands of Meyer’s visionary theory of tendency and suggestion in music. This paper aims to extend some of the hints he offers on the mental phenomenon of expectation and to develop them into explicit tools amenable to use in analysis. This

endeavor starts with a general categorization of the experiential correlates of musical tendency into types of listening ahead and types of surprise.”

Margulis studies the relationships between music and cognition. As a result, she is very qualified for this study since this was the main goal of this paper. She was one of the first to propose that music activates the listener by creating expectations that can be fulfilled or not. Her findings suggested that human cognition plays an active role in music perception in that they generate expectations and also react depending on whether the expectation was fulfilled or not. She also noted differences between active and passive listening that was not referenced in this paper. The act of listening ahead can have stronger effects on one’s cognitive processes and perception of the music. This research was very relevant to my research because it discussed one of the main elements of music, which is the relation between cognition (the expectations that they create) and the music (whether the expectation is fulfilled or not). As a result, it was one of my favorite research articles that I read, and was also very relevant to my topic.

Wilson, D. (1989). The Role of patterning in music. *Leonardo*, 22(1), Retrieved from <http://www.jstor.org/stable/1575147>

“Patterning plays a major role in the construction of music and, apparently, in the communication of ideas. In this article, I first discuss the possible reasons for the evolution of patterning in music. Then I examine patterning in Western European 'art' music, American jazz and non-Western musics. Finally, I suggest physiological links between patterning in a composition and emotive response in a comprehending listener.”

Wilson studies the different aspects of music in general. In this particular study, she explored the role of patterning in music. As a result of her extended knowledge of music, she is very qualified and can be used as a reference in this study. In addition to her discussion of the role of patterning in music, she also went into some detail about the physiological and emotional responses that result from different patterns. To do this, she used methods that recorded brain waves to discover connections between the music and psychological responses. She concluded from her study that there was a distinct link between the physical attributes of sound and human physiological correlates. By this she means that our brain is constructed in such a way that there are balances between human cognitions and the emotions that is felt from music. As a result of her discussion of the connections between cognitions and emotive responses from humans, I found her study to be somewhat relevant in my research. Although I was not directly interested in the emotions that resulted from rhythmical dissonant techniques, I thought it was important to note some more common emotional responses that could be related to ones that would be felt if listening to rhythmically dissonant music.

Krumhansl, C. (2002). Music: a link between cognition and emotion. *Current Directions in Psychological Science*, 11(2), Retrieved from <http://www.jstor.org/stable/20182764>

“Cognition and emotion are closely linked in music. The interplay between expectations and the sounded events is hypothesized to play a central role in creating musical tension and relaxation. The research summarized here is part of an ongoing program investigating how this dynamic aspect of musical emotion relates to the

cognition of musical structure. Musical emotions change over time in intensity and quality, and these emotional changes covary with changes in psychophysiological measures. Perceptual studies support music theoretic descriptions of musical structures that underlie listeners' expectations. Cross-cultural comparisons suggest that certain psychological principles of expectation are quite general, but that musical cultures emphasize these differentially. A schema of temporal organization that relates episodes of tension and relaxation to musical form and expressive aspects of musical performance is described. Finally, some results suggest that the expression of emotion in music shares properties with the expression of emotion in speech and dance.”

Krumhansl is a psychologist who also studied music to find a link between cognitions and emotions. In his study, she touched upon many different relations between cognitions, music and emotions. He spoke of tension, expectations and physiological responses. He also tried to make connections between the role of motion and dancing in music and the emotions that is felt from it. His methods mostly included self-reporting based on emotion-quality judgments. He concluded from his study that there were significantly strong relations between the brain substrates for music, emotions, and cognitions. Thus, I thought his research was very applicable to my research in that it helped my discussion of the connections between music and our cognitions.

Brower, C. (1993). Memory and the perception of rhythm. *Music Theory Spectrum*, 15(1), Retrieved from <http://www.jstor.org/stable/745907>

Brower also works with the connections between cognition and one's perceptions of music. In this particular study, he discussed the role of memory in the perception of rhythm. Brower broke down the individual levels of rhythmical hierarchy and discussed the role of memory in one's perception of each different level. Brower used self-report methods to distinguish differences in things, such as the feeling of the music and what is actually heard. He also used evidence from children that have metrical irregularities in their perceptions. His findings suggested strong relations between human memory and rhythm perception. I found this study to be very relevant in terms of how human's perceive music. It offered background that gave insight to what is available to a listener at certain periods of time in listening to music.

Madsen, C., Brittin, R., & Capperella-Sheldon, D. (1993). An Empirical method for measuring the aesthetic experience to music. *Journal of Research in Music Education*, 41(1), Retrieved from <http://www.jstor.org/stable/3345480>

“This study was designed to investigate empirically the "aesthetic experience" as individually defined by each subject. Subjects (N - 30) were faculty members and advanced graduate students at a large university school of music. Each subject listened to a 20-minute excerpt from Act I of Puccini's *La Boheme* and simultaneously manipulated the dial of a Continuous Response Digital Interface (CRDI) to indicate perceived aesthetic level. The CRDI dial represented a negative/positive continuum along a 256-degree arc. Data collected were charted graphically to indicate levels of aesthetic response across time. Subjects completed a questionnaire designed to estimate frequency,

duration, location, and magnitude of perceived aesthetic experiences and also indicated whether dial manipulation roughly corresponded to these experiences. Results indicated that there were different responses throughout the excerpt by all subjects. Heightened aesthetic responses were evident during certain parts of the excerpt. "Peak experiences" were relatively short (15 seconds or less in duration), proceeded by a period of concentrated focus of attention, and generally followed by an "afterglow" ranging from 15 seconds to several minutes. All subjects reported having at least one aesthetic experience and also reported that movement of the CRDI dial roughly approximated this experience. "Aesthetic responses" for subjects seemed to cluster at many of the same places in the music with one collective "peak" experience that was represented by the highest and lowest dial movements."

These authors studied the methods that could be used to measure aesthetic experiences to music. All of them are involved in music education research, and therefore are qualified to be referenced in my research paper. In their study, they used listening tasks with college students to determine the aesthetic experience of music at different sections of music. The method they used was that of self-report. Subjects were told to manipulate a dial of Continuous Response Digital Interface so that they could indicate the aesthetic response to the music at different points in a musical sequence. The results of their study showed different aesthetic responses by individuals throughout the duration of the musical sequences. Regardless, certain areas of musical sequences displayed strong aesthetic responses across the board. This shows that there are certain elements in musical structure that elicit aesthetic responses from all people at the same point in time. It also shows that there is some subjective element to the type of aesthetic experience that

results from the certain point in the musical sequence. I found this study to be somewhat relevant in terms of some reference to emotional responses to certain types of music, but for the majority was not completely applicable to my research. The most relevant piece of information is that the aesthetic experience occurs for all people at the same time.

Pieslak, J. (2007). Re-casting metal: rhythm and meter in the music of Meshuggah. *Music Theory Spectrum*, 29(2), Retrieved from <http://caliber.ucpress.net/doi/abs/10.1525/mts.2007.29.2.219>

“The music of the Swedish metal band, Meshuggah, reveals a distinct rhythmic and metric structure based on large-scale odd time signatures, mixed meter, and metric superimposition. Their 2004 EP “I,” however, pushes the boundaries of surface-level meter through the absence of small-scale recurring units of pitch and rhythm. This article uses models for rhythmic analysis developed by Harald Krebs, Fred Lerdahl and Ray Jackendoff, William Rothstein, and Maury Yeston in pursuing an architectonic examination of hierarchical layers in this music. Additionally, I introduce the important relationship that exists between fans and structural analysis based on a socio-cultural profile of the subgenre”.

Pieslak is very knowledgeable in terms of musical vernacular as well as non-conventional music. In his study, he did not research responses from participants, but instead explored the construct of different musical compositions from the band Meshuggah. In terms of his musical exploration, he used rhythmical analysis so that he could interpret the transcriptions of some of the musical sequences. His findings suggested that the metal band Meshuggah used rhythmical techniques such as odd time

signatures, mixed meter, and metric superimposition. This was by far the most relevant study as well as my favorite. He explored the different techniques that are used to create rhythmic dissonance, which is exactly what I set out to understand in my research.

Thompson, W. F. (2009). *Music, thought and feeling: Understanding the psychology of music*. New York: Oxford University Press.

Thompson studied the connections between music, cognitions, and the emotions that result. In his study, he explored the different views of these connections. Examples would be differences in cognitivist's and emotivist's views on the result of music perception. Most of the studies involved self-report about the emotions that were felt or perceived during different changes in music. In the studies, he concluded that there are some universal links between music and emotions. I thought this was relevant in that I could connect the emotions felt from different techniques in music to that of the rhythmical dissonance used in the compositions of Meshuggah.

Patel, A., Gibson, E., Ratner, J., Besson, M., & Holcomb, P. (1998). Processing syntactic relations in language and music: an event-related potential study. *Journal of Cognitive Neuroscience*, 10(6), pp. 717-733

“In order to test the language-specificity of a known neural correlate of syntactic processing [the P600 event-related brain potential (ERP) component], this study directly compared ERP's elicited by syntactic incongruities in language and music. Using principles of phrase structure for language and principles of harmony and key-relatedness

for music, sequences were constructed in which an element was either congruous, moderately incongruous, or highly incongruous with the preceding structural context. A within-subjects design using 15 musically educated adults revealed that linguistic and musical structural incongruities elicited positivities that were statistically indistinguishable in a specified latency range. In contrast, a music-specific ERP component was observed that showed antero-temporal right-hemisphere lateralization. The results argue against the language-specificity of the P600 and suggest that language and music can be studied in parallel to address questions of neural specificity in cognitive processing”.

Patel and the rest of these researchers are credible in that they all are involved in cognitive neuroscience, and therefore were very qualified to be used in my research. In their study, they explored the relations between language and music. They used neuroimaging techniques to get data on the different physiological responses from syntactic incongruities in music and in language. The results of their study showed that both types of syntactic incongruities elicited a P600 ERP response. This suggested that there was a close relation between the syntactic structures of music and language. Furthermore, it supported the localization of incongruent responses in the brain for both music and language. Although I was not researching the connection between language in music, I wanted to note the neuropsychological effect of syntactic incongruities in music. Therefore, I thought it would be relevant to note that those who listen to rhythmically dissonant music like Meshuggah’s for the first time, the P600 response should be elicited. I also noted that after extended exposure to this unconventional style of music, the P600 response should be to a lesser degree if not absent all together.

Lerdahl, F., & Jackendo_, R. (1983). A generative theory of tonal music. Cambridge. MA: The MIT Press.

These two researchers explored the structure of rhythm. I thought they were very credible because they were part of the MIT press, and also displayed thorough understanding of music and its elements. Once again, this article was not a research based article, but was instead attempting to explore deeper into the structural makeup of rhythm. In this article, they talk about the rhythmic hierarchy that forms as a result of human perceptions, as well as makes distinctions between different elements of music. I thought that this article was relevant in terms of background information that could be used to explain the different elements of rhythm.

Conclusion:

The band Meshuggah will be used to illustrate my idea of rhythmic dissonance in musical composition. "The music of the Swedish metal band, Meshuggah, reveals a distinct rhythmic and metric structure based on large-scale odd time signatures, mixed meter, and metric superimposition" (Pieslak, 2007). These types of techniques result in perceived tension and resolution, and can also elicit certain emotional responses due to unexpected events.

To create expectations in a musical composition and then have an unexpected event requires some breaking of boundaries. In terms of melodies, delayed resolution can be used when a high-tension note is extended into a resolution measure. For rhythmically dissonant and surprising music, certain metrical techniques must be used to change the structure of the music. Meshuggah uses rhythmic techniques such as "...metric superimposition, or overlay, [which] characterizes many Meshuggah songs and is articulated typically through the instrumental texture, where the guitars, bass, and pedal bass drum are based on a large-scale odd time signature and mixed meter while the cymbals (or some other instrument of the drum set, usually a hi-hat) maintain a steady quarter-note pulse that expresses a symmetrical hypermetric structure" (Pieslak, 2007). In this example, it is evident that the drum hi-hat is used to maintain a steady sense of rhythm and an expectation of future events. The hit-hat rhythm can be considered the foreground of the rhythmical hierarchy. Then the guitars, bass, and double bass are all used to create a sense of syncopation and ambiguity until the notes match up again on a

shared downbeat. These instruments create the middle ground and background part of the rhythmical hierarchy. To fully perceive the effect of these instruments, higher cognitions and active listening must be involved as well as extended exposure to the stimuli.

A commonly used technique that produces rhythmic dissonance is the use of polyrhythms. "Polyrhythmic music results from the interaction of two or more superposed rhythmic figures, which may vary in dimensions but have periods standing in simple ratios, and its dominant feature is the interweaving of accents, tone colors and/or attacks of the simultaneously performed figures. This gives rise to a conflict between rhythm and rhythm, which is coupled with the antagonism between rhythm and meter characterizing each individual figure" (Arom, 1989).

"These features are based on two simultaneous, but independent, rhythmic layers and thus could be interpreted as polyrhythmic or "metrically dissonant" (after Krebs) with two "interpretative layers whose cardinalities are different and are not multiples/factors of each other" (Krebs 1999, 31). However, such principles tend to have symmetrical or repeated patterns within both rhythmic layers that come together or align on a mutual downbeat within the context of a single meter, or a beat within a rhythmic grouping" (Pieslak, 2007). One of the easiest examples is the time signature of 3/4. This is a fairly basic polyrhythm in that it contains low integers so that the syncopation does not have a long and confusing duration. Meshuggah also plays very intricate polyrhythms that do have long durations. One example is as follows: "...the measure of 25/16 would have to be repeated sixteen times in order for the downbeats to ultimately fall in the same place..." (Pieslak, 2007). This is a clear example of a musical composition that would have extreme ambiguity for an extended period of time before resolving at a common

down beat.

This band also uses a technique that I have termed “chopping”. It can involve polyrhythms, but its defining element is the fact that it does not fully complete the expected measures, or extends the measure more than expected. An example of starting a measure early can be displayed in the song “Bleed”, where they play 3 full groupings of a riff, but come in a note before expected on the fourth grouping. This elicits a surprise and grabs the attention of the listener. This would be categorized as an odd-time signature technique, using something like a 31/32 time signature that is ambiguous only over long time distances. An example of an extension of a particular grouping can be found in the song “Ozben”. In this particular example, an extra note is added to the end of every second measure. This technique is more specifically referred to as metrical superimposition. This gives the music a sense of delayed resolution and as if it is slowing down as one listens to it. As a result of the laws of music, since four extra notes are added in the body of the riff, four beats are taken off the final measure of the four groupings of music so that it matches up. It matches up well due to the fact that the third triplet of the last measure in the sequence becomes the first triplet in the beginning of the sequence. As a result of all of these very small changes in structure, there is increased perceived ambiguity that urges the brain to understand what was unexpected. Also note that they had to take off four notes off the end that were added in the main body to abide to the rules of musical structure. If they did not do this, it would not be perceived as whole.

Relating back to the idea that the level of exposure to a certain type of music changing one’s perception, that in time, listening to this type of music, one would come to expect what was once unexpected. I can speak from personal experience in that when I

first listened to this music, it was completely unexpected. Due to my extended exposure to this style of music, I have come to expect those changes from conventional music. This effect demonstrates the plasticity of our musical perception and also suggests that what is “normal” in music is simply what one has been cultured to hearing.

If a neuroimaging study was conducted upon this type of music, I hypothesize that something interesting would result. I think in the beginning, when first listening to these types of techniques, P600 and ANS responses would result from the perceived rhythmical dissonance. After extended exposure, I believe that these responses will be to a much lesser degree, if not absent all together. I believe this would be a result of new expectations being formed that allow the listener to accurately predict the music after extended exposure.