Music and language invite comparisons at many levels. These range from the sensory analysis of the acoustic signal, through the formation of well-structured units, to cognitive representations of large-scale organization. This article focuses on large-scale organization. In particular, it considers comparisons between music and discourse structure. In the experiment, two pieces of music were presented, a movement from a Mozart string quintet and a movement from a Beethoven string quartet. Listeners made real-time judgments of the degree of openness, memorability, and emotion. These data were analyzed to see how well the judgments could be accounted for by the musical topics identified in these pieces by Agawu (1991). The central question is whether these topics have psychological reality that influences the cognitive representation of these pieces. The experiment addresses this by determining whether the psychological judgments correspond to the proposed parsing of the music into the different topics.

Address correspondence to Carol L. Krumhansl, Department of Psychology, Uris Hall, Cornell University, Ithaca, NY 14853. (e-mail: clk4@cornell.edu)
Earlier research using similar methods (Krumhansl, 1996, 1997) has focused on segmentation in music, considering possible parallels with prosodic units in speech. According to Chafe (1994), prosodic units are defined by both physical and perceptual properties, such as pitch, loudness, timing, voice quality, and pauses. A unit begins with what Chafe calls a starting point or point of departure. New information is then introduced, given emphasis by pitch contour, duration, and loudness. Units typically end with a drop in pitch, a decrease in tempo, and a pause. Chafe encourages comparisons with music: “Once one has become accustomed to observing intonation units, ... it becomes impossible not to hear analogous segments in music. Their presence there may be no accident. The convergence of language and music in this respect may very well show a human need to process information in relatively brief units in active consciousness, to combine such units within larger centers of interest, and every so often to shift from one cluster of semi-active information to another” (p. 186).

In a study that examined whether this description of intonation units has parallels in music, Krumhansl (1996) used the first movement from Mozart’s Piano Sonata in B major, K. 282. On different hearings, the listeners made judgments of when section ends occurred, when new ideas were introduced, and the degree of musical tension as it changed over time. In addition, the tempo and amplitude of the performance were measured. A number of parallels were found with intonation units. First, new musical ideas tended to be introduced at points of low tension and neutral tempo, which may correspond to Chafe’s (1994) starting points or points of departure. Second, section ends identified by listeners coincided with slowing of tempo, perhaps analogous to patterns of phrase final lengthening in speech. Third, phrase endings tended to be marked by descending contour, decreased dynamics, thinning of texture, and pauses. Fourth, tension increased within sections, reaching a peak just before the segment ending, possibly corresponding to the way a topic is elaborated and then concluded in conversation.

In a study that considered further the generality of this kind of temporal organization, Krumhansl (1997) had subjects perform similar tasks with a dance choreographed by George Balanchine to the Minuetto of Mozart’s Divertimento No. 15. Besides judging section ends, new ideas, and tension, subjects also rated the amount of emotion expressed as it changed over time and gave overall emotion quality judgments of the piece. The main focus of the study was possible parallels in the cognitive representations of music and dance. Consequently, subjects participated in one of three conditions: one in which they just heard the music, one in which they just saw the dance, or one in which they both heard the music and saw the dance. Independently of the condition, the same temporal organization appeared. New ideas were identified as occurring at section beginnings when levels of
tension and emotion expressed were low. These levels tended to increase throughout the section, reaching peaks just before the section ends and then declining rapidly. In earlier work, Lasher (1981) had demonstrated the existence of segments in dance similarly described as consisting of preparatory-unstable-completing phases. Thus, this kind of temporal organization may have quite broad generality, extending beyond speech and music to physical movement.

The focus of the present study is on a somewhat different, but related aspect of Chafe's (1994) theoretical framework for discourse analysis. He distinguished among three states that any topic (information or referent) may be in: active (the focus of consciousness), semiactive (or accessible), and inactive (available in long-term memory, but not activated). According to Chafe, the number of topics that can be active at any time is very small, and for a topic to remain active it must be refreshed repeatedly. No simple answer can be given to the question of how long a topic will remain active without being refreshed; this will depend on the role of the topic in the discussion. Of most interest here is his category of semiactive (or accessible) information. Three conditions distinguish semiactive from inactive topics. First, a semiactive topic was active at an earlier time in the discourse. Second, a semiactive topic is directly associated with an idea that is or was active in the discourse. Third, a topic is associated with the nonlinguistic environment of the conversation. Although the last condition is less relevant to music, which is largely a self-referential system, the first two conditions apply readily to music. Besides describing how topics "flow" from one state to another in conversation, Chafe introduces the notion of a hierarchy of topics in which some topics are superordinate or subordinate to others.

Turning now to the analysis of music, a long tradition of music scholarship relates music to discourse. The earliest full-scale analysis of music known, from the Middle Ages, identifies rhetorical sections and other quasi-linguistic units (Bent, 1994). A rich and varied literature, often presented in the theoretical framework of semiotics, describes topical content in music, the related meanings, and structural implications for musical organization (see, e.g., Agawu, 1991; Allanbrook, 1983; Nattiez, 1990; Ratner, 1980; Tarasti, 1979). Of particular psychological interest is the study by Gjerdingen (1988), who related topics to cognitive schemas and showed how a particular schema was introduced into the musical literature, how it was developed and transformed, and how it dropped out of fashion.

Probably the most extensive analysis of topics in 18th and early 19th century music can be found in the work of Ratner (1980). He described these as a "thesaurus of characteristic figures, which formed a rich legacy for classic composers," and provided an extensive catalogue of topics found in this style. These included various dances (such as minuet, bourrée, gigue),
styles (such as military, hunt music, Turkish music, brilliant style, gallant, or free, style), and pictorialism and word painting. Agawu (1991), following in this tradition, further elaborated the characteristics of these topics or figures, demonstrated their role in the structural organization of pieces in this style, and provided the analysis of the two pieces (among others) that are used in the present experiment. He also raised a number of theoretical questions of psychological interest. For example, he asked how topics are defined, how they are perceived, how many can be sustained in a single piece, and whether topics are organized hierarchically.

Most of this literature, either implicitly or explicitly, assumes that the topical content is available only or almost exclusively to those highly knowledgeable about the classical musical style. Extensive knowledge of the musical corpus is presumed necessary in order for the topics to be perceived and their connotations to be appreciated. This is quite explicit in Agawu’s presentation: “competence is assumed on the part of the listener, enabling the composer to enter into a contract with his audience ... it is meant to be understood by all competent listeners. There is nothing natural about this ability; it is acquired by learning.” An emphasis on the knowledgeable audience can also be found in the work of Allanbrook (1983) and Gjerdingen (1988). However, this literature often characterizes topics by their distinctive rhythmic, melodic, dynamic, and timbral characteristics. This raises the possibility that even listeners relatively unfamiliar with the style might organize their cognitive representations around the topical content. Indeed, Krumhansl’s (1996) listeners, including those who were not highly familiar with the classical style, were able to identify as new ideas the topics that were contained in the Mozart piano sonata. The present study further examines the effect of musical topics on listeners with various degrees of expertise in classical music.

Figures 1 and 2 summarize Agawu’s (1991) exhaustive analyses of the Mozart and Beethoven pieces. His analysis (his Figures 3 and 4) specifies which topics occur in which measures of the pieces, the precise boundaries of which were clarified subsequently (V. K. Agawu, 1997–1998, personal communication). These boundaries were then converted to real time for the recordings used in the experiment. Time is shown on the horizontal dimension of Figures 1 and 2, and the measure numbers of the major sections are shown at the top. The shadings indicate the times at which the different topics are played.

The Mozart piece is in sonata form with the major sections indicated at the top of Figure 1: Theme 1 and Theme 2 (which are then repeated), the Development section, the Recapitulation, and the Closing. Agawu identifies 14 topics in this piece. For example, the piece begins with alternations between Mannheim Rocket and Sensibility, followed by a brief statement of Gavotte. Mannheim Rocket and Sensibility are then repeated in alterna-
Fig. 1. Analysis of topics in W. A. Mozart's String Quintet No. 3 in C major, K. 515, Allegro, by Agawu (1991). Time (in seconds) is shown on the horizontal axis. The piece is in sonata form, and the measure numbers of the major sections are indicated at the top. The shaded regions show the locations of the 14 topics.
Fig. 2. Analysis of topics in L. van Beethoven's String Quartet No. 15 in A minor, Op. 132, Allegro sostenuto – Allegro, by Agawu (1991). Time (in seconds) is on the horizontal axis, and the measure numbers of the major sections are indicated at the top. The shaded regions show the locations of the eight topics.
tion, this time in a Sturm and Drang style. The first section ends with statements of the Learned Style, Pastoral, Bourrée, Fantasy, and Fanfare. A number of new topics are introduced in the Theme 2 section: March, Brilliant Style, Cadenza, Musette, and Alla Zoppa. Then, Mannheim Rocket, Sensibility, Sturm and Drang, and Learned Style dominate the Development section. The Recapitulation repeats all the preceding topics (except March). An extended Cadenza marks the beginning of the Closing, and Bourrée and Musette topics are restated.

The Beethoven piece contains the eight topics shown in Figure 2. The first section begins with a slow Learned Style in Alla Breve, followed by the successive introduction of Cadenza, March, Sensibility, Gavotte, Aria, and Brilliant Style. These are presented at strongly contrasting tempos, Allegro, Adagio, and Allegro again. The second section begins with a slow Learned Style figure similar to the beginning of the piece, then March dominates the rest of the section. The third section contains the same progression of topics as the first section, and the fourth is dominated by the March figure of the second section. Finally, the last section features March and Brilliant Style, and Alla Breve is also present. Although fewer topics appear in this piece than in the Mozart piece, the surface of the music is characterized by sharper contrasts of tempo, rhythm, and texture.

These figures show clearly how these topics are repeated at delays throughout the pieces. This suggests that listeners may perceive their coherence through a process of reactivating semiaactive topics that have been stated earlier in the piece, as suggested by Chafe (1994) for discourse. To investigate whether the topics influence listeners’ cognitive representations of the pieces, listeners made three kinds of judgments. In Experiment 1, listeners indicated in real time the degree to which the music was memorable; this task was repeated twice to assess the effects of the first hearing on the second hearing. Experiment 2 asked a second group of listeners to judge on different hearings the degree to which the music was open and the amount of emotion expressed (which in Krumhansl, 1997, correlated strongly with tension ratings). The data were then analyzed (by multiple regression) to determine whether the judgments could be decomposed into influences of the separate topics and to determine the relative importance of the topics for the different types of judgments. These judgments were chosen to represent a fairly wide range of responses to music that might produce different hierarchies of topics.

Method

SUBJECTS

All subjects were students at Cornell University, were run in the experiment individually, and participated for course credit. Twelve subjects participated in Experiment 1 (Memorability). On average, they had taken music lessons for 3.6 years (summed over all instru-
ments and voice; range, 0–12), had played music for 4.4 years (range, 0–12), and listened to music for 15.6 hours per week (range, 1–36), only 0.9 hours of which were to classical music. Except for the last, the measures varied widely within the group. Two subjects had taken music courses at the university level. Four subjects indicated that they thought they recognized the Mozart piece, and one said she definitely recognized it and could identify it. Four subjects said they thought they recognized the Beethoven piece.

Twelve subjects participated in Experiment 2 (Openness and Emotion). On average, they had taken music lessons for a total of 7.6 years on different instruments and voice (range, 0–19), had played music for 6.8 years (range, 0–13), and listened to music 22.6 hours per week (range, 9–44), only 2.0 hours of which were to classical music. Again, there was a wide range of expertise within the group. Three subjects had taken music courses at the university level. Three said that they thought they recognized the Mozart piece, and two said that they thought they recognized the Beethoven piece. Thus, the subjects in Experiment 2 had somewhat more extensive music backgrounds on average, but the large variability within groups meant that the two groups of listeners overlapped considerably.

APPARATUS AND STIMULUS MATERIALS

The music was played under the control of a Macintosh IICx computer with the MAX software. The MAX software was used to control the playing of the compact disk and to collect the data. The computer monitor displayed a slider whose position was controlled by the computer mouse and recorded every 250 ms (see Krumhansl, 1996, for a similar interface). The music was played over AKG headphones at a comfortable loudness level. The recordings were W. A. Mozart's String Quintet No. 3 in C major, K. 515, Allegro (13 min 05 s) played by the Alban Berg Quartett (EMI Classics 0777 7 49085 2 8), and L. van Beethoven's String Quartet No. 15 in A minor, Op. 132, Allegro sostenuto - Allegro (9 min 17 s) also played by the Alban Berg Quartett (EMI Digital 7 47135 8).

PROCEDURE

Subjects in Experiment 1 (Memorability) received the following instructions: “Your task is to adjust the slider continuously to indicate how memorable you think the music is at each point in time. Music is maximally memorable when there is a strong sense that the pattern would be easy to recognize. Music is maximally unmemorable when there is a strong sense that it would be difficult to remember. Use intermediate positions of the slider to indicate intermediate degrees of memorability.” Half the subjects performed this task first with the Mozart piece and then with the Beethoven piece; the order was reversed for the other subjects. They then performed the memorability task a second time with each piece in the same order as before.

Subjects in Experiment 2 (Openness and Emotion) received the following instructions for the openness task: “Your first task is to adjust the slider continuously to indicate how open or closed the music is at each point in time. Music is maximally open when there is a strong sense that it must continue. Music is maximally closed then there is a strong sense that a segment has ended. Use intermediate positions of the slider to indicate intermediate degrees of open versus closed.” They then performed this task with the Mozart and Beethoven pieces, with half the subjects hearing one order and the other half the other order. Then they performed the emotion task with the following instructions: “Your next task is to adjust the slider continuously to indicate the amount of emotion at each point in time. When the emotion is strong, adjust the slider to the maximum position. When the emotion is weak, adjust the slider to the minimum position. Use intermediate positions of the slider to indicate intermediate degrees of emotion.” They heard the pieces in the same order as they had previously.

All subjects were given a short practice session at the beginning of the experiment to become familiar with the display. After the second hearing of each piece, the subjects rated
(on a scale from 0 to 8) the emotions they felt during the experiment on the following scales (Krumhansl, 1997, 1998): Afraid, Amused, Angry, Anxious, Contemptuous, Contented, Disgusted, Embarrassed, Happy, Interested, Relieved, Sad, and Surprised. They also rated the pieces for Pleasantness and Intensity. At the end of the experiment, they filled out the questionnaire about their music background. Each experiment took approximately 1 hour.

**Results**

**INTERSUBJECT CORRELATIONS**

Preliminary analyses considered intersubject correlations as a measure of the consistency across subjects. For Experiment 1 (Memorability), the average intersubject correlations for the Mozart piece were $r(3106) = .23$ and $.31$ for the first and second presentations, respectively. The average intersubject correlations for the Beethoven piece were $r(2205) = .15$ and $.22$ for the first and second presentations, respectively. (Because the number of degrees of freedom is large, a low correlation is statistically significant. Thus, the meaning of the significance levels of these correlations is somewhat unclear, but the average correlations were all significant at $p < .0001$.) These correlations showed more consistency for the second presentation of each of the pieces. This would be expected given the subjects’ greater familiarity with the piece. They also showed more consistency for the Mozart piece than for the Beethoven piece, perhaps because of the greater and more rapid contrasts in the Beethoven piece.

For Experiment 2 (Openness and Emotion), the average intersubject correlations were $r(3106) = .25$ and $.22$ for the openness and emotion judgments for the Mozart piece. The corresponding correlations were $r(2205) = .18$ and $.37$ for the Beethoven piece. As for the memorability judgments, the openness judgments were more consistent for the Mozart piece than for the Beethoven piece. However, the emotion judgments were considerably more consistent for the Beethoven piece than for the Mozart piece. This may again reflect the strong contrasts that occur in the Beethoven piece. (Again, all correlations were significant at $p < .0001$.)

**DATA REDUCTION**

Because of the reasonable degree of consistency across individuals, the data were averaged across subjects for the next analyses. The individual subjects’ data are used later to examine effects of expertise. To prepare for the main analyses, the data were reduced in the following two ways. First, the data from the two presentations of each piece in Experiment 1 (Memorability) were averaged with one another. The correlations between the two presentations were $r(3106) = .82$ and $r(2205) = .75$ for the Mozart and
Beethoven pieces, again showing more consistency for the Mozart piece. Second, to smooth the data, a running average over 1 s was computed for all three kinds of data, memorability, openness, and emotion, and only the values for each second were retained for the following analyses.

DATA MODELING

The main analyses consider whether the data in the three tasks, memorability, openness, and emotion, could be modeled as contributions made by the topics identified by Agawu (1991). All the predictor variables (the topics coded as 0 = absent and 1 = present) and the dependent variables were smoothed over a 3-s interval (following Krumhansl, 1996, which found that tension judgments were influenced by events occurring over a range of approximately 3 s). Each of the three dependent variables was then entered into a multiple regression with the topic predictors.

For the Mozart piece, all three kinds of judgments (openness, memorability, and emotion) could be modeled quite well by the 14 topic predictors. The multiple correlation for openness was $R(14,767) = .73$, for memorability $R(14,767) = .67$, and for emotion $R(14,767) = .52$, all significant at $p < .0001$. Note that the lowest multiple correlation was for the emotion judgments, although it was still significant. Figure 3 shows the simple correlations for each of the topic predictor variables with the three kinds of judgments.

A relatively strong correlation, $r(780) = .70$, $p < .0001$, was found between the openness and memorability judgments, so they will be discussed together. As can be seen in Figure 3, strong positive correlations with openness and memorability were found for: Sensibility, Sturm and Drang, Mannheim Rocket, Learned Style, and Pastoral. Comparison with Figure 1 shows that these topics frequently occur at the beginning of major sections and subsections within the piece. At the other extreme, negative correlations with openness and memorability were found for Musette, Bourrée, and Alla Zoppa. These topics tend to occur at or near the ends of sections.

The correlations between emotion and openness judgments, $r(780) = .40$, and between emotion and memorability judgments, $r(780) = .37$, were relatively low (although $p < .0001$, for both). Figure 3 shows a comparatively restricted range of correlations of topics with the emotion judgments, suggesting that the topics in this piece are not strongly differentiated by the degree of emotion. In addition, the ranking of the topics is quite different from the openness and memorability judgments, consistent with the relatively low correlations of these judgments with the emotion judgments. Thus, it appears that the topics in the Mozart
For the Beethoven piece, all three kinds of judgments (openness, memorability, and emotion) could be modeled quite well by the eight topic predictor variables, although the multiple correlations were lower than for the Mozart piece. They were $R(8,545) = .54$ for openness, $R(8,545) = .61$ for memorability, and $R(8,545) = .47$ for emotion, all significant at $p < .0001$. Again, the predictor variables accounted least well for the emotion judgments. Figure 4 shows the simple correlations for each of the topic predictor variables with the three kinds of judgments.

For this piece, a relatively strong correlation, $r(554) = .63$, $p < .0001$, was found between memorability and emotion judgments, so they will be discussed together. Figure 4 shows that these judgments correlated rela-
Fig. 4. Hierarchy of topics for the Beethoven piece, as measured by the simple correlation between the listeners' judgments of openness, memorability, and amount of emotion and the predictor variables for the topics. The hierarchies for memorability and emotion were more similar to each other than either was to the hierarchy for memorability.

tively strongly with March, Brilliant Style, and Sensibility. At the other extreme were Learned Style and Alla Breve. The rank order of some of the topics, however, varied between memorability and emotion judgments. Notably, Aria was relatively strong for memorability, but weak for emotion. In contrast, Cadenza was relatively weak for memorability, but relatively strong for emotion.

Relatively weak correlations were found between the openness judgments and memorability and emotion judgments, \( r(554) = .38 \) and \( .34 \), \( p < .0001 \), respectively. Consistent with this are the different topic correlations for openness, on the one hand, and memorability and emotion, on the other. For example, Learned Style was relatively strong for openness, consistent with its occurring at the beginning of three major sections, but was low for memorability and emotion. In contrast, Sensibility had a negative correlation with openness, consistent with its appearance in the middle and toward the ends of sections, but a positive correlation with memorability and emotion. Thus, for the Beethoven piece, high levels of emotion tend to correspond to the most memo-
rable topics, whereas other topics serve to mark the opening of sections.

EFFECTS OF EXPERTISE

The same models were run for individual subjects to test for effects of expertise. The analyses considered whether the influence of the topics identified by Agawu (1991) was stronger for subjects with more musical training and familiarity with the classical style. For the analyses, the individual subject data were reduced in the same way as the averaged data, as described earlier.

For the Mozart piece, all three kinds of judgments (openness, memorability, and emotion) could be modeled quite well by the 14 topic predictors. The multiple correlation for each subject was significant at \( p < .0001 \). They averaged \( r(14, 767) = .56 \) for openness, \( r(14, 767) = .56 \) for memorability, and \( r(14, 767) = .48 \) for emotion. The multiple correlations were then correlated with all quantifiable measures of their musical background: years of instruction summed over all instruments and voice, years playing, hours listening to music, number of music courses at the university level, and familiarity with the piece. None of these correlations was significant, and some of them were negative.

The same patterns were found for the Beethoven piece. The multiple correlations, which were significant at \( p < .005 \) for all subjects, averaged \( R(8,545) = .40 \) for openness, \( R(8,545) = .50 \) for memorability, and \( R(8,545) = .38 \) for emotion. Again, none of the correlations between the multiple correlations and the subject background variables was significant, and some were negative. Thus, for neither piece was the effect of topics stronger for the more highly trained subjects.

EMOTION QUALITY JUDGMENTS

The subjects in both experiments rated their overall emotional responses to the two pieces on 13 scales. The average intersubject correlation was \( r(24) = .45, p < .05 \), although many of the individual intersubject correlations were not significant. Figure 5 shows the average rating for the 11 emotion scales that previous studies (Krumhansl, 1997, 1998) found varied across excerpts (Embarrassed and Interested were excluded). Both pieces showed relatively high ratings for Anxious and Surprised. The Mozart piece was also rated relatively high for the positive emotions of Amused, Happy, and Contented, whereas the Beethoven excerpt was rated relatively high for the negative emotions of Sad and Angry. Consistent with this is the finding that the Mozart piece was rated higher overall on Pleasantness (average rating 6.5) than the Beethoven piece (average rating, 5.2), \( t(23) = 3.58, p < .002 \).
Fig. 5. Overall emotion quality judgments for the Mozart and Beethoven pieces. These were made by all subjects after the second hearing of each piece. Both pieces had relatively high ratings for Anxious and Surprised. In addition, the Mozart piece had relatively higher ratings for positive emotions, and the Beethoven piece had relatively higher ratings for negative emotions.

Discussion

The main finding of these experiments was that the topics identified by Agawu (1991) have psychological reality that influences the cognitive representations of the two string pieces by Mozart and Beethoven. For each piece, three different measures were taken in real time: memorability, openness, and amount of emotion. These were chosen to cover a fairly broad range of responses to music. All three judgments could be modeled quite well as contributions made by the different topics. In other words, Agawu's (1991) parsing of the music into topics was reflected in all three kinds of psychological judgments. This was the case for all listeners, even for those with little training and experience with classical music. That the topics influenced the judgments suggests that their distinctive characteristics (such
as tempo, rhythm, melodic figures) established them as psychological entities. This result is likely to have considerable generality as these and similar topics appear in many different pieces of classical music. The results call into question the assumption made in the music literature that extensive stylistic familiarity is prerequisite to the appreciation of topics. The present study, however, did not assess the specific connotations of the different topics, and these may well show stronger effects of expertise.

The analysis also uncovered a hierarchy of topics, which varied depending on the type of psychological judgment. In addition, different relationships obtained among the three tasks for the two pieces. For the Mozart piece, memorability was quite strongly correlated with openness, consistent with the findings of earlier studies (Krumhansl, 1996, 1997) that new ideas tended to be introduced at the openings of segments. The hierarchies of topics were also similar for these two kinds of judgments. This correlation between openness and memorability suggests that the topics in the Mozart piece are used to define the formal structure to a considerable degree. For the Beethoven piece, in contrast, memorability was more strongly correlated with the amount of emotion, as if emotional emphasis is given to the memorable musical figures, and these judgments produced similar hierarchies of topics. In connection with this, Agawu's (1991) description of the differences between Mozart and Beethoven is noteworthy. He observed that the latter relied less on "stylized identity" and shifted more from the public to the private (possibly emotional) realm.

For neither piece did openness correlate strongly with the judged amount of emotion. This is consistent with previous findings (Krumhansl, 1996, 1997) that the level of tension tends to be low at the openings of sections and to increase toward the ends. Thus, the present results show patterns consistent with the temporal organization found in previous studies. They also give support to the idea that topics with a piece form a hierarchy. The hierarchy, however, depends on the aspect of the perceptual experience that is being considered. The hierarchy also depends on the piece. Five topics (Sensibility, Learned Style, Cadenza, March, Gavotte) are common to the two pieces, yet their rank in the hierarchies differed across the pieces (in fact, were negatively correlated). Thus, the topics do not appear to have invariant qualities, but rather their psychological effects depend on the musical context.

Besides the real-time ratings of the amount of emotion, listeners also rated pieces for their overall emotional qualities. This study found less agreement between listeners than previous studies (Krumhansl, 1997, 1998). Two explanations suggest themselves. First, these two pieces, both string ensemble pieces in the same general style, do not differ greatly from one another, so the range of responses across the scales is restricted. Second, and more interesting from a musical point of view, is the possibility that the contrasting topics used within the pieces make it difficult for subjects to
describe an overall emotional response to the pieces as wholes. This possibility is consistent with the relatively high ratings for Anxious and Surprised for both pieces, possibly reflecting the tension created by the combination of topics.

Finally, the organization of these pieces is interesting to consider in connection with Chafe's (1994) analysis of discourse. In both pieces, different topics are presented repeatedly throughout. The delays between repetitions vary from a few seconds to a minute or longer. Clearly, repetition of topics is fundamental to the compositional organization. This pattern of repetitions seems compatible with Chafe's notion that topics within conversations can be maintained for a time in a semiactive state, ready to be reactivated later. According to Chafe, “[t]ransient and nonrepeated activation is the rule” (p. 66). Nonetheless, returns to previously discussed topics occur frequently enough in his discourse analysis to propose the semiactive state intermediate between active and inactive states (which he relates to the categories of “given” and “new” in other descriptions of discourse). Thus, a cognitive process, reactivating semiactive information, is suggested by discourse analysis. This process, then, may be elaborated in an artful way in music, leading to a cognitive representation that is unified by the process of shifting between semiactive and active states.1

References


1. Kofi Agawu’s extensive consultation on the musical analysis is gratefully acknowledged. Alex Johnston assisted in running subjects and preparing the data for analysis. The article was written at the University of Jyväskylä, Finland, while the author was supported by a Fulbright Fellowship.