# Composer-Specific Aspects of Musical Performance: An Evaluation of Clynes's Theory of Pulse for Performances of Mozart and Beethoven

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# Composer-Specific Aspects of Musical Performance: An Evaluation of Clynes's Theory of Pulse for Performances of Mozart and Beethoven

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This report examines Clynes's theory of "pulse" for performances of music by Mozart and Beethoven (e.g., Clynes, 1983, 1987). In three experiments that used a total of seven different compositions, an analysis-by-synthesis approach was used to examine the repetitive patterns of timing and loudness thought to be associated with performances of Mozart and Beethoven. Across performances, judgments by trained musicians provided support for some of the basic claims made by Clynes. However, judgments of individual performances were not always consistent with predictions. In Experiment 1, melodies were judged to be more musical if they were played with the pulse than if they were played with an altered version of the pulse or if they were played without expression. In Experiment 2, listeners were asked to judge whether performances of Mozart were "Mozartian" and whether performances of Beethoven were "Beethovenian." Ratings were highest if the pulse of the composer was implemented, and significantly lower if the pulse of another composer was implemented (e.g., the Mozart pulse in the Beethoven piece) in all or part of each piece. In Experiment 3, a Beethoven piece was played with each of three pulses: Beethoven, Haydn, and Schubert. Listeners judged the version with the Beethoven pulse as most Beethovenian, but the version with the Haydn pulse as most "musical." Although the overall results were encouraging, it is suggested that there are significant difficulties in evaluating Clynes's theory and that much more research is needed before his ideas can be assessed adequately. The need for clarification of some theoretical issues surrounding the concept of pulse is emphasized.

A number of investigations have been concerned with "expression" in musical performance (e.g., Clarke, 1982, 1985; Clynes, 1983; Gabrielsson, 1974, 1985; Shaffer, 1981; Sundberg, Frydèn, & Askenfelt, 1983; Sloboda, 1983; Todd, 1985). Performance expression refers to those aspects of music playing that are not clearly indicated in the score: the use of

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rubato, the precise implementation of crescendos, accelerandos, ritardandos, and so on. Performance expression is a very important aspect of music listening. If a performer uses expression inappropriately, the music can sound awkward and unpleasant. If a performer does not use enough expression, the music can sound flat and mechanical.

The use of expression in musical performance has been linked with the analysis of music (e.g., Cone, 1962). To the extent that performers agree on at least some aspects of musical analysis, performances will share certain expressive characteristics. Cooper and Meyer (1960), for instance, have argued that an impression of grouping is often conveyed by playing unaccented beats so that they are closer in time to the accents with which they are to be grouped than is indicated by the score. Empirical work suggests that ritards are used to convey structural boundaries and that they may be applied recursively to reveal different levels in the hierarchical structure of the music (e.g., Todd, 1985; Shaffer & Todd, 1987). Crescendos may be used to illustrate the function, or *harmonic charge,* of chords with respect to the current key (e.g., Sundberg et al., 1983). Finally, Sloboda (1983) has shown that performers convey the meter of piano music through the expressive use of loudness, or timing, or both loudness and timing. Thus, it seems clear that various aspects of musical structure are embodied in the expressive actions used by performers.

Along with the structural characteristics of individual pieces, an important consideration in the study of musical performance is the overall style associated with the music (Clarke, 1985). As a simple example, more pedaling is used in piano performances of romantic music than in piano performances of early baroque music. Thus, performing music appears to depend on both an understanding of musical structure and an appreciation for the overall style of music.

But there is another important aspect of expression in musical performance. This aspect of performance relates to the composer of the piece. Beethoven is played differently than Mozart, and Bach is played differently from either Beethoven or Mozart (e.g., see Cone, 1974). This latter aspect of musical performance has been the topic of a research project conducted by Clynes (e.g., Clynes, 1983, 1986, 1987) at the New South Wales State Conservatorium of Music, Australia, and will be the focus of the present paper. First, a review of Clynes's research on composer-specific aspects of performance expression is provided, followed by a comparison of his approach to that of other researchers investigating the performance of music. Second, with a report of some pilot work, the paper addresses whether or not composer-specific aspects of performance expression are generally appreciated by highly trained musicians. Third, experimental work is presented that tests some of the predictions of Clynes's theory. Finally, some theoretical issues and difficulties associated with the theory are discussed.

## The Concept of the Composer's Pulse as Proposed by Clynes

According to Clynes (e.g., Clynes, 1983; 1986; 1987), certain aspects of expression reflect a performer's understanding of the individual characteristics of composers. These aspects of expression are not determined entirely by the musical structure of individual pieces. Rather, through an extensive experience with the works of various composers, certain expressive characteristics become associated with each composer. Clynes believes that a good performer will try to play in a way that is true to the composer's musical character, so as to make a performance sound authentic and convincing.

An understanding of the composer's character is thought to be reflected in the expressive use of both timing and loudness. Clynes argues, more specifically, that aspects of the composer's character can be conveyed by implementing a specific repeated pattern of timing and loudness. Each composer of the classic period is associated with a particular pattern. For example, in a Beethoven piece having four notes of nominally equal value within a beat of about 1 sec, Clynes suggests that the fourth note is typically lengthened compared with the other beats, whereas the second note should be soft. For Mozart, the first and third notes of such a pattern typically are accented. Using his own musical intuition, Clynes has suggested expressive patterns of timing and loudness for various composers of Western tonal music. Characteristic patterns for Beethoven, Mozart, Haydn, and Schubert are shown in Table 1.

TABLE 1
**Four-Component Pulse Values for Four Composers, as Predicted by Clynes**

| Composer | Note 1 | Note 2 | Note 3 | Note 4 |
|---|---|---|---|---|
| Beethoven | | | | |
| Duration | 106 | 89 | 96 | 111 |
| Amplitude | 1.0 | 0.39 | 0.83 | 0.81 |
| Mozart | | | | |
| Duration | 105 | 95 | 105 | 95 |
| Amplitude | 1.0 | 0.21 | 0.53 | 0.23 |
| Haydn | | | | |
| Duration | 108 | 94 | 97 | 102 |
| Amplitude | 1.0 | 0.42 | 0.68 | 1.02 |
| Schubert | | | | |
| Duration | 97 | 114 | 98 | 90 |
| Amplitude | 1.0 | 0.65 | 0.40 | 0.75 |

NOTE. The top line for each composer gives relative durations of four successive notes of the same notated length (e.g., four sixteenth notes). The bottom indicates the relative amplitudes of four successive notes of the same notated length.

Clynes calls the expressive pattern associated with each composer the composer's "pulse." The pulse is thought to be repeated, in a cyclical manner, throughout a performance. Depending on the rhythmic structure of the music, one cycle of a composer's pulse is described in terms of two, three, or four timing and loudness values. In addition, the pulse is thought to occur on two hierarchical levels. As an example, the first of every four sixteenth notes might be accented, and the first of every four groups of sixteenth notes might, in turn, be emphasized. The latter example is a $4 \times 4$ pulse structure. However, the number of components at each level depends on the rhythmic structure of the piece. For a discussion of pulse structures and the relationship between a four-component pulse (i.e., patterns containing four timing and loudness values) and a three-component pulse or two-component pulse structure, the reader is referred to Clynes (1987).

The theory proposed by Clynes suggests that, through years of musical experience, performers and listeners come to know the composer's characteristic pulse. More specifically, Clynes has argued that, for each composer, patterns of timing and loudness associated with performances can be stored accurately in memory by a neurobiological process called time-form printing (e.g., see Clynes & Walker, 1982). By performing with the appropriate pattern of timing and loudness, the performer illustrates her or his understanding of the composer's musical character. The pulse is likened to a musical "signature" of the composer (Clynes, 1986).

## Analysis by Synthesis: Creating Computer-Controlled Performances

The development of Clynes's theory of pulse has been one of analysis by synthesis. That is, Clynes has turned to his musical knowledge and experience as a professional performer to predict the kinds of changes in timing and loudness that help to convey the characteristics of composers. In order to evaluate and develop these predictions, a computer program was developed that enables users to create highly musical performances by controlling the use of various expressive actions, including the pulse.

With the exception of Sundberg and his associates (e.g., Sundberg et al., 1983; Thompson, Friberg, Frydèn, & Sundberg, 1986; Thompson, Sundberg, Friberg & Frydèn, 1989), research concerned with musical performance has tended to use an analysis-by-measurement approach (e.g., Clarke, 1982, 1985; Gabrielsson, 1974, 1985; Povel, 1977; Seashore, 1938; Sloboda, 1983; Shaffer, 1981; Shaffer & Todd, 1987; Todd, 1985). For the purposes of examining the specific effect of the pulse, however, an analysis-by-synthesis approach is preferable to an analysis-by-measurement approach. First, it should be noted that numerous factors are involved in a musical performance: crescendos, accelerandos, ritardandos,

and various other expressive devices. Because several aspects of expression may occur simultaneously, it would be difficult to use measurements of actual performances to isolate aspects of expression that specifically convey composer characteristics.

Second, Clynes (1987) has acknowledged that the composer's pulse need not be implemented in a strict manner. In an actual performance, a performer may choose to focus on composer characteristics more at certain times than at others. Moreover, natural fluctuations in the implementation of a pulse may not be distributed normally. These considerations suggest that average timing and loudness information measured from actual performances may not reflect meaningful pulse patterns. Nonetheless, the theory does predict that implementing the pulse should convey an overall expressive quality that is characteristic of the composer.

The steps involved in implementing a pulse have been outlined by Clynes (e.g., Clynes, 1983, 1987). Briefly, one must first decide what note lengths should be acted upon by the fastest moving level of the pulse. As an example, if a piece consists of sixteenth notes, eighth notes, and quarter notes, then the fastest moving level of the pulse should act upon sixteenth notes. In general, the fastest moving level should cover a time span of about 1 sec. Second, one must choose a pulse structure (e.g., $4 \times 4$, $3 \times 4$) which is consistent with the metrical structure of the piece. Third, one must decide if it is necessary to reset the pulse at certain points in the piece. The pulse is reset if there are changes in metrical structure during the piece. Finally one must decide how strongly to implement the pulse at each hierarchical level. The strength of either or both the timing and loudness components of the pulse is altered by using a weighting function.

Regarding the latter step, it should be noted that changing the weights does not alter the basic pattern of expression that results from the application of the pulse. For example, the second component of the Beethoven pulse is relatively soft, regardless of the weights chosen. The weighting function determines whether the effect of the pulse is subtle or forceful. At present there are no rules for determining the optimal weights to choose for a particular piece. Therefore, users must use their musical intuition when making this decision.

## Some Differences in Approach between Clynes and Other Researchers

There are two aspects of Clynes's theory that may help to clarify some of the differences between his approach and that of other researchers investigating musical performance. One aspect relates to the attention paid to the

musical structure of individual compositions, and the other aspect concerns the more general psychological implications of his ideas.

Research on musical performance often suggests a strong relationship between the expression used by performers and the structure of the music being performed. Empirical work has provided evidence that performers use expression to enhance and convey structural properties such as metrical divisions (e.g., Sloboda, 1983; Shaffer, Clarke, & Todd, 1985), phrase endings (e.g., Cook, 1987; Friberg, Sundberg, & Frydèn, 1987; Shaffer & Todd, 1987; Todd, 1985), or the function of tones with respect to the context chord (Sundberg et al., 1983). An implication of this research is that the use of expression in musical performance might actually make musical structure easier for listeners to perceive.

Most of this research has shown a correspondence between data on performance expression and the theoretical structure of the music. It is notable that investigators have not tended to examine whether or not performance expression enhances perceived musical structure for listeners. An exception is Sloboda (1983), who reported that listeners were more successful at identifying the meter of a piece if the piece was played by a highly experienced performer than if it was played by a moderately experienced performer.

Unlike most research on musical performance, Clynes has chosen to examine an aspect of performance expression that is not thought to relate to structural characteristics of specific compositions. Clynes denies that the pulse is entirely predictable from the structure of individual compositions. Instead, the pulse is thought to reflect knowledge of the composer's work as a whole. If Clynes is correct, then from the listener's perspective, expression can be meaningful even if it has no simple relation to the structure of the specific composition being performed.

A second important aspect of Clynes's theory relates to the more general implications of his research. As previously mentioned, investigators often have discussed or implied a connection between performance expression and the perception of musical structure (e.g., MacKenzie, VanEerd, Graham, Huron, & Wills, 1986; Shaffer et al., 1985; Sloboda, 1983; Thompson et al., 1989). Musical performance also has been discussed as a motor skill, comparable to typing (e.g., Shaffer, 1981; MacKenzie, Nelson-Schultz, & Wills, 1983). Still another approach, taken by Nakamura (1987), is to examine whether or not the expressive actions used by performers, regardless of whether or not these actions reflect musical structure, are actually heard by the listener. In contrast, Clynes's notion that there are definable patterns of expression associated with individual composers might be best understood in view of his interest in the communication and encoding of emotions (Clynes, 1978).

To understand how Clynes's theory of musical performance relates to an interest in the emotions, some background is necessary. Briefly, Clynes

(1978) has outlined a theory in which emotions are understood in terms of specific dynamic forms encoded in the central nervous system. Each emotion-related form, called a *sentic form,* is manifested in nature or in art as a specific change in a spatial or temporal dimension. Clynes has proposed that emotions often are communicated through sentic forms. Clynes & Walker (1982) provided some evidence that melodies embody these more general emotion-related forms. Critical to these ideas is the notion that affective information can be conveyed through definable forms in time or space. The theory that definable patterns of timing and loudness can convey the characteristics (affective or otherwise) of composers is clearly consistent with this notion.

Clynes has provided some thoughtful discussions on issues such as musical performance (e.g., Clynes, 1983; Clynes & Walker, 1982), the biological clock (Clynes & Walker, 1986), and the communication of emotions (Clynes, 1977). However, very little empirical work has been done to evaluate his claims. The present research, while not intended to provide a thorough evaluation of Clynes's views, was undertaken to see if some of his basic claims about musical performance can be substantiated by experimental work.

## Are There Composer-Specific Aspects of Expression?

Clynes's lack of attention to the relationship between performance expression and musical structure may seem unusual to some researchers. However, based on the results of two preliminary studies, his overall focus on composer-specific considerations in performance expression seems to be consistent with the intuitions and judgments of other trained musicians.

First, a small survey was conducted. Ten performance majors at the New South Wales State Conservatorium of Music, none of whom was familiar with Clynes's work, were given a questionnaire concerning the use of expression in musical performance. Students were asked to rate, on a scale of one (low) to seven (high), the extent to which performance expression, as distinct from composition, was related to the following:

1. understanding how the composition creates expectations for the listener,
2. conveying or enhancing the structure of the composition being performed (e.g., phrases, metrical structure, key changes),
3. the personality/character of the performer,
4. the personality/character of the composer,
5. conveying emotions.

The first two options relate indirectly or directly to the structure of the

composition being performed, while the last three options do not relate specifically to musical structure. From a repeated measures analysis of the ratings, it was determined that average ratings were significantly different for the five options, $F(4, 36) = 10.33$, $p < .001$. The mean ratings for the five options listed above were: 3.00, 3.30, 5.80, 6.00, and 5.60.

The average ratings suggest that performers themselves do not view performance expression as being largely determined by musical structure, but they do view performance expression as being highly related to the personality/character of the composer, the personality/character of the performer, and conveying emotions. As performers themselves believe that the use of expression should reflect composer-specific considerations, it is not unreasonable to assume that this goal is often realized in actual performances.

The low ratings for the first two options are somewhat surprising. A possible explanation is that the attention paid to musical structure by performers is often an unconscious phenomenon, and many musicians may not be aware of the extent to which performance expression reflects musical structure. Alternatively, the relationship between performance expression and musical structure may be so obvious to highly trained musicians that they tend to emphasize the more subtle aspects of expression. At any rate, the high ratings given to the last three options support the view that there are some very important aspects of expression that do not merely serve to convey musical structure. Thus, an examination of how expression might be used to convey overall characteristics of composers may be a very appropriate direction for research to take.

After this survey, a pilot study was undertaken to get an idea of how easily trained musicians could perform with, and recognize the use of, expression that is specifically associated with individual composers. A highly trained pianist was asked to give two performances of a Mozart piece and two performances of a Beethoven piece. The pianist chose to play excerpts from Mozart's sonata, K311, second movement, and the theme from Beethoven's six variations in F major, opus 34. For each of the two pieces, the pianist was asked to play once in a manner that would be appropriate for Mozart and once in a manner that would be appropriate for Beethoven. The pianist was asked to perform as musically as possible in all cases, regardless of whether the expression used was appropriate for the composition. The four performances were recorded on high-quality tape and played in varying order to eight other music students, who were asked to judge and make comments on the expression used in each performance.

The performer reported having no difficulty in providing two alternative performances of each piece: one in which the expression used was appropriate for Mozart and one in which the expression used was appropriate for Beethoven. For each of the four performances, eight listeners were asked to

judge whether the expression used was Mozartian or Beethovenian. Most listeners had no difficulty with this task. For the Mozart piece, all eight listeners correctly identified the Mozartian and Beethovenian performances. For the Beethoven piece, seven of the eight listeners correctly identified the Mozartian and Beethovenian performances. Thus, it appears that a performer is generally able to communicate composer-specific aspects of expression, regardless of the composition being performed.

The performer and the listeners also provided comments on what they believed to be the major differences in expression associated with these two composers. Comparing the two composers, expression typically associated with Beethoven was thought to involve more pedaling, greater dynamic range, crescendos followed immediately by soft playing, and more rubato. Expression associated with Mozart was thought to involve a feeling of forward motion, greater articulation, more 'air' between phrases, and a general emphasis on the upper register in order to create a brighter tone.

The above pilot work, although not addressing the specific claims made by Clynes, does show that performance expression is not entirely predictable from the structural characteristics of individual compositions. Perhaps a more realistic view is that there is a tendency for musicians to stylize the use of performance expression and that this process of stylization may be influenced by number of factors—not just compositional structure as defined by traditional music theory. Thus, the notion that there are typical expressive actions associated with individual composers may be a realistic hypothesis. First, highly trained musicians themselves believe that performance expression, to a large degree, should reflect the personal characteristics associated with the composer. Second, a trained musician had little difficulty in using expression associated with Mozart and Beethoven, regardless of the actual composer of the piece being performed. Finally, listeners could easily assess the latter performances in terms of expressive actions typically associated with Mozart and Beethoven.

## Evaluating the Effect of the Pulse in Piano Performances

The musical effect of the pulse can be heard on records that accompany Clynes's (1983, 1987) articles. However, very little work has been done to verify experimentally the existence, or psychological importance, of this aspect of performance expression. Some work by Repp (1989), carried out at the same time as the present examination, concerned the musical effect of the pulse in performances of pieces by Haydn, Mozart, Beethoven, and Schubert. Each piece used in his study was performed with the correct pulse, with no pulse, and with incorrect pulse patterns (i.e., the pulse of other composers). Listeners from a range of musical backgrounds provided ratings of each performance. All performances were prepared by Clynes.

Repp found that listeners had reliable preferences for certain patterns of timing and loudness over others. Some of the findings were consistent with Clynes's theory. That is, the highest ratings were sometimes given to performances in which the pattern of timing and loudness corresponded to the pulse of the composer. However, several findings were inconsistent with predictions. For instance, Repp found that listeners rated performances of the final movement of Beethoven's sonata, opus 10, no. 2, as most musical and most Beethovenian if it was performed with the Haydn pulse.

Although Repp provided some useful data on Clynes's ideas, it is clear that more research is needed to test the generality of the theory. Indeed, a thorough evaluation of Clynes's ideas would require a consideration of numerous compositions by various composers of Western tonal music, with a careful examination of the many aspects of the theory, such as the choice of hierarchical pulse structure, the weighting function, and the relative importance of the loudness and timing components of each composer's pulse.

The present investigation differed in some important respects from that conducted by Repp. First, several performances of music not used in Repp's experiments were tested. Second, while Repp tested listeners with varied musical background and training, the present examination focused on listeners with a high level of formal education in music, most of whom were studying piano at a Conservatorium of Music. Third, several conditions not examined by Repp were considered in the present research. As an example, in Experiment 1, one condition involved altering the order in which the four timing and loudness values of a pulse cycle are implemented. As another example, Experiment 2 involved a condition in which, midway through performances, pulse configurations are changed from that of one composer to that of another. A final difference between the two investigations, which will be discussed in more detail later, concerns the attention paid to the instructions and judgment task.

The pulses of Mozart and Beethoven were examined in three experiments, by using a total of seven different pieces of music. All performances used in Experiments 1 and 2 of this investigation were prepared by the author with Clynes's performance program. The pieces used in the investigation were selected on the basis that they are quite representative of the two composers, and none involves a three-component pulse structure. The latter consideration stems from the fact that Clynes has not tended to focus on three-component pulse structures, and they are not generally tabled in his articles. Thus, the present investigation focused on four-component pulse structures. (For experimental work involving three-component pulse structures, see Repp, 1989).

The first experiment was conducted to test the basic prediction that the repetitive patterns of timing and loudness suggested by Clynes have a musi-

cal effect when implemented in computer-controlled performances (see also, Repp, 1989). Two melodies by Mozart and two melodies by Beethoven were presented under three conditions: (a) with the pulse implemented correctly, (b) with the pulse implemented incorrectly (i.e., the third timing and loudness values were switched with either the second or the fourth timing and loudness values), and (c) with no pulse implemented. Listeners judged the musical quality of each performance.

In Experiment 2, pieces by Mozart and Beethoven (different from those used in Experiment 1) were presented under four conditions: (a) with the correct pulse, (b) with the incorrect pulse (e.g., the Mozart pulse in the Beethoven piece), (c) with the correct pulse in the first half of the piece and the incorrect pulse in the second half of the piece, and (d) with the incorrect pulse in the first half of the piece and the correct pulse in the second half of the piece. Listeners judged the extent to which performances conveyed characteristics associated with the composer.

Experiment 3 repeated some of the conditions presented by Repp (1989), in which ratings were inconsistent with predictions. Specifically, one of Repp's initial findings was that the final movement of Beethoven's sonata, opus 10, no. 2, was judged to be more musical if it was performed with the Haydn pulse than if it was performed with the Beethoven pulse. Following suggestions by Clynes, Repp conducted further experimentation in which the judgment task, among other factors, was altered. In the revised judgment task, listeners were asked to judge whether each performance was characteristic of the composer. The latter task was thought to be more focal to the predicted effect of the pulse. However, Repp found little evidence to suggest that this second judgment task was more sensitive to the influence of the pulse than the first judgment task.

Experiment 3 of the present investigation also considered the importance of the judgment task. However, this experiment used listeners with a higher general level of musical training than that of most listeners used in Repp's investigation. In addition, unlike in Repp's investigation, this experiment involved having a single group of listeners carry out both judgment tasks within the same experimental session, thus encouraging listeners to distinguish between two different strategies of evaluating the performances—one relating to general musical considerations and the other relating to the characteristics associated with the composer. Performances of Beethoven's sonata, opus 10, no. 2, final movement, were presented with a Beethoven pulse, with a Haydn pulse, and with a Schubert pulse. Listeners heard the set of three performances twice. After the first presentation of each performance, listeners judged the extent to which the performance was Beethovenian. After the second presentation of each performance, listeners rated the musical quality of the performance.

## Experiment 1

The first experiment was conducted in order to evaluate the basic prediction that pulse patterns are desirable in performances and that their musical effect is dependent on the specific changes in timing and loudness that occur in each pulse cycle. This experiment only considered the performance of melodies. Other work on the performance of melodies has been carried out by Sundberg and his associates (e.g., Sundberg & Frydèn, 1985; Sundberg et al., 1983; Friberg, Sundberg, & Frydèn, 1987; Thompson et al., 1989). However, the latter investigations did not consider differences in performance that are specifically related to the composer.

Pulse patterns for Mozart and Beethoven were examined. These pulse patterns were chosen because musically trained listeners are usually very familiar with the music of Mozart and Beethoven. Moreover, the pattern of timing and loudness values is quite different for the two composers. For instance, the fourth Beethoven pulse unit is longer and louder than the fourth Mozart pulse unit. It was expected that listeners would prefer performances in which the pulse had been implemented (the pulse condition) over performances in which the pulse was not implemented (the neutral condition), and over performances in which the order of the four timing and loudness values of a pulse cycle was altered (the altered-pulse condition).

For the latter condition, the order of timing and loudness values was altered as follows: for the two Mozart melodies, the fourth timing and loudness values were switched with the third timing and loudness values; for the two Beethoven pieces, the third timing and loudness values were switched with the second timing and loudness values. These particular changes were chosen because they seriously disrupted the musical effect of the Mozart and Beethoven pulse patterns, without affecting the average or range of timing and loudness values, and without resulting in an expressive pattern that contradicted the meter. The altered pulse condition and the correct pulse condition should convey the meter equally well, because points of metrical stress always coincide with the first timing and loudness values, and these values were the same for the two conditions.

The altered pulse condition was included for two reasons. First, the condition provides a test for the possibility that a pulse is effective merely because it results in a performance that differs, within a certain acceptable range of loudness and timing variation, from a strictly mechanical realization of the music. Second, the condition provides a test for the possibility that the effect of a pulse is merely related to conveying the meter, and the only significant component in a pulse cycle is that which coincides with points of metrical stress. If either of these latter possibilities is the case, then ratings for the altered-pulse condition should not significantly differ from ratings for the pulse condition. However, if the precise pattern of all four

timing and loudness values for a given pulse configuration is critical, as Clynes would suggest, then ratings for the pulse condition should be significantly higher than ratings for the altered-pulse condition.

## METHOD

### Subjects

Ten musically trained listeners participated in the listening task. Listeners were students at, or graduates of, the New South Wales State Conservatorium of Music, Sydney, and were paid five dollars for participating in the experiment.

### Apparatus and Stimuli

Performances were produced by the author, using the performance program developed at the Research Center, State Conservatorium of Music, Sydney. Tones were produced by a Roland MKS-20 digital piano (piano 1), under the control of a PDP 11/73 host computer. The performances were recorded with Dolby on high-quality cassette tape and played on a Technics tape deck. Listeners heard the performances through Sennheiser headphones.

### Conditions and Procedure

Two Mozart pieces and two Beethoven pieces were selected for use in the experiment. The pieces and their pulse structures are as follows:

1. Mozart sonata, K333, Allegretto, bars 1–16, melodic line, 4 × 4 pulse structure, fastest moving pulse unit = sixteenth note.
2. Mozart sonata, K331, Allegretto, bars 8–24, melodic line, 2 × 4 pulse structure, fastest moving pulse unit = sixteenth note.
3. Beethoven sonata, opus 13, Rondo, bars 1–18, melodic line, 2 × 4 pulse structure, fastest moving pulse unit = eighth note.
4. Beethoven sonata, opus 31, #1, Rondo, bars 1–9, melodic line, 4 × 4 pulse structure, fastest moving pulse unit = sixteenth note.

Three conditions were prepared. In the first condition, called the pulse condition, the correct pulse was implemented in each piece. In the second condition, called the neutral condition, the pieces were played without implementing any expressive actions. That is, there were no changes in loudness, and durations were exactly as notated in the scores. In the final condition, called the altered-pulse condition, pulse patterns were altered in the following way: for the two Mozart melodies, the fourth timing and loudness values were switched with the third timing and loudness values; for the two Beethoven pieces, the third timing and loudness values were switched with the second timing and loudness values.

Sequences were blocked by melody. The order of blocks and the order of sequences within blocks was random. Listeners were asked to rate the musical quality of each performance on a scale of 1–7.

## RESULTS AND DISCUSSION

Figure 1 displays the average ratings across the four melodies for each of the three performance conditions. Ratings were subjected to an analysis of variance with a two-factorial repeated-measures design, with three per-

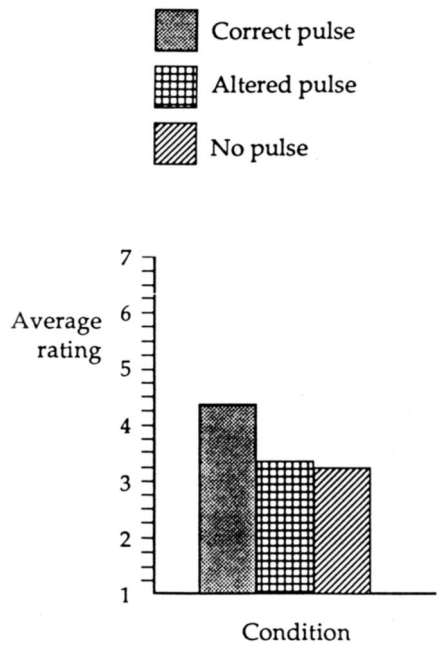


**Fig. 1.** Mean ratings of the musical quality of performances under three performance conditions. Each mean represents the average rating across four melodies. The altered-pulse condition involved changing the order of the pulse component values as follows: for the Mozart melodies, the third component values were switched with the fourth component values; for the Beethoven melodies, the second component values were switched with the third component values.

formance conditions (i.e., pulse, neutral, altered pulse), and four melody conditions (two pieces by Mozart and two pieces by Beethoven). Across the four melodies, ratings of the different performance conditions were significantly different from each other, $F(2, 18) = 8.51$, $p < .01$. There was no significant interaction between the performance condition and the melody presented.

Orthogonal contrasts revealed that ratings given to the correct pulse condition were significantly higher than ratings given to either the neutral condition or the altered-pulse condition, $F(1, 9) = 16.79$, $p < .01$. There was no significant difference between the neutral condition and the altered-pulse condition.

The low ratings assigned to the altered-pulse condition suggest that the pulse patterns under consideration were not effective merely because they helped to convey points of metrical stress, or because they differed from a mechanical or neutral performance. For if either of these possibilities were

the case, then the altered pulse condition should have yielded ratings that were as high as the correct pulse condition. Thus, the findings suggest that the effect of the pulse is dependent on the correct ordering of the four timing and loudness components of the pulse cycle.

The altered-pulse condition involved accents (in loudness) at points of metrical stress. Thus, the meter was clearly marked in the performances of this condition. Nonetheless, ratings for this condition were not significantly higher than those for the neutral condition, which involved no accents at all. This rather surprising finding suggests that the implementation of expression that helps to convey the metrical structure will not be effective unless timing and loudness is musically sensible within metrical divisions and subdivisions.

Although the above analysis revealed no statistically significant interaction between the performance condition and the melody presented, an examination of the ratings for each melody suggested that separate analyses for each melody also would be informative. Average ratings assigned to each condition for each melody are shown in Table 2. Analyses of ratings for individual melodies yielded significant effects for both Mozart melodies, but not for the Beethoven melodies. The correct pulse condition was given significantly higher ratings than the other two conditions for judgments of Mozart's sonata, K333, $F(1, 9) = 32.04$, $p < .001$, and Mozart's sonata, K331, $F(1, 9) = 13.98$, $p < .005$. Across the two Beethoven melodies, average ratings also were highest for the correct pulse condition. However, this effect was not statistically significant for either piece when data for each Beethoven melody were analyzed separately.

The overall data are consistent with the notion that performances with

TABLE 2
**Mean Ratings of the Musical Quality of Four Pieces Presented under Three Performance Conditions**

| | Performance Condition | | |
|---|---|---|---|
| Piece | 1 Correct Pulse | 2 Altered Pulse | 3 No Pulse |
| Mozart sonata K333 | 4.5 | 2.9 | 2.5 |
| Mozart sonata K331 | 4.8 | 3.5 | 2.8 |
| Beethoven sonata opus 13 | 4.4 | 3.9 | 4.5 |
| Beethoven sonata opus 31, no. 1 | 3.9 | 3.2 | 3.3 |

the pulse are more musical than performances without the pulse, or performances in which pulse components have been reordered without contradicting the meter. However, when data for each of the four melodies were analyzed separately, significant effects were found for only two of the melodies. Thus, while the findings of Experiment 1 provide general support for the importance of pulse patterns in musical performance, the data also suggest that implementing the pulse may not have a significant musical effect for every melody.

## Experiment 2

The first experiment provides some support for the notion that repetitive patterns of timing and loudness may be an important aspect of performance expression. The overall findings were consistent with one of the basic predictions of the theory: implementing the correct pulse pattern has a musical effect on a performance, and this effect does not seem to be merely a matter of conveying the meter or introducing variety in timing and loudness.

However, several issues remain unclear. First, it should be noted that only four melodies were examined, and the generality of the findings is not well established. Thus, further experimentation involving other pieces of music would be useful.

A second issue concerns the specific prediction that a composer's pulse is only appropriate in performances of that composer's music. Experiment 1 showed that altering the order of timing and loudness values of a pulse configuration can disrupt its effect. However, it is possible that these altered patterns of timing and loudness, although not in conflict with the meter, were awkward in comparison to any of the pulse configurations proposed for composers. For instance, for both composers, the third component was weakened in the altered-pulse condition. Therefore, the altered-pulse conditions may have been given low ratings because they involved expression that is inconsistent with the hierarchy of stress common in a four-beat measure. Thus, the findings of Experiment 1 do not rule out the possibility that one composer's pulse would also work well in another composer's piece.

A third issue concerns the fact that actual performances involve various expressive actions, such as crescendos, accelerandos, micropauses, and ritardandos. Such expressive actions were not considered in Experiment 1. However, it is of interest to examine the effect of the pulse when it is applied in addition to numerous other expressive actions.

A final issue concerns the rating task and the proposed effect of the pulse. While a basic interest in the study of musical performance is the identification of expressive actions that help to make a performance musical, Clynes has tended to emphasize the role of the pulse more in terms of conveying, or

signifying, the composer's overall character. Of course, it is likely that the musical quality of a performance would coincide with the extent to which the composer's musical character was captured in the performance. However, for a precise examination of the pulse, it may be useful to devise a judgment task that is focal to the predicted effect of the pulse.

The second experiment was conducted in order to address some of these issues. A Mozart sonata and a Beethoven sonata were chosen for the investigation. These pieces had not been used in Experiment 1. Performances were created with both melodic line and accompaniment. Both levels of the pulse were implemented. In addition, various other expressive actions were implemented, so as to create fairly realistic performances. Listeners were asked to rate the extent to which performances embodied the expressive characteristics typically associated with the composer. Thus, upon hearing a performance of a Beethoven piece, listeners were asked: "how Beethovenian is this performance?" Upon hearing a performance of a Mozart piece, listeners were asked: "how Mozartian is this performance?"

Four conditions were examined. For a given piece, these conditions differed only with respect to the implementation of pulse patterns. All other expressive actions, such as crescendos and ritardandos, were held constant. In the first condition, the correct pulse was implemented. In the second condition, the incorrect pulse was implemented. That is, the Mozart pulse was implemented in the Beethoven piece, and the Beethoven pulse was implemented in the Mozart piece. In the third condition, the correct pulse was implemented in the first half of the piece and the incorrect pulse was implemented in the second half of the piece. In the fourth condition, the incorrect pulse was implemented in the first half of the piece and the correct pulse was implemented in the second half of the piece.

Listeners rated the extent to which performances involved expressive characteristics associated with the composer. It was expected that ratings would be high when the correct pulse was implemented in performances and relatively low when the incorrect pulse was implemented in performances. For performances containing changes in the pulse, it was expected that ratings would be moderately low.

## METHOD

### Subjects

Ten musically trained listeners participated in the listening task. Listeners were students at the N.S.W. State Conservatorium of Music, Sydney. Subjects were paid seven dollars for participating in the experiment.

### Apparatus and Stimuli

The apparatus and stimuli were the same as in Experiment 1.

### Conditions and Procedure

Two pieces were selected for use in the experiment. The pieces and their pulse structures are as follows:

1. Mozart sonata, K330, first movement, bars 1–34, full score, 4 × 4 pulse structure, fastest moving pulse unit = thirty-second note.
2. Beethoven sonata, opus 53, first movement, bars 1–42, full score, 4 × 4 pulse structure, fastest moving pulse unit = sixteenth note.

Four conditions were prepared. In the first condition, the correct pulse was implemented in the piece. In the second condition, the incorrect pulse was implemented. That is, the Mozart pulse was implemented in the Beethoven piece and vice versa. In the third condition, the correct pulse was implemented in the first half of the piece and the incorrect pulse was implemented in the second half of the piece. In the fourth condition, the incorrect pulse was implemented in the first half of the piece and the correct pulse was implemented in the second half of the piece. Sequences were blocked by composer. The order of blocks and sequences within blocks was random. Listeners were asked to rate, on a scale of 1–7, the extent to which performances seemed to capture the musical character of the composer. None of the listeners reported having difficulty with this task.

## RESULTS AND DISCUSSION

Figure 2 displays mean ratings for each of the four conditions, averaged across the two pieces. Ratings were subjected to an analysis of variance with a two-factorial repeated-measures design, with four performance conditions and two pieces. Across the two pieces, ratings for the four performance conditions were significantly different from one another, $F(3, 27) = 3.96, p < .02$.

Using orthogonal contrasts, it was found that the correct pulse condition was given significantly higher ratings than the other conditions, $F(1, 9) = 10.27, p < .02$. This effect did not interact significantly with the piece performed. The difference in average ratings assigned to performances with the correct pulse implemented (condition 1) and performances with the incorrect pulse implemented (condition 2) was 1.5 and 1.4 for the Mozart and Beethoven piece, respectively.

Across the two pieces, there was no significant difference between average ratings given to the three control conditions (i.e., the incorrect-pulse condition and conditions in which the pulse changed midway through performances). There are two possible explanations for this finding. First, listeners generally may have been critical of performances in which there was a change in pulse, simply because the transition from one pulse to another was quite noticeable and generally disrupted a performance. This explanation is unlikely, however, because the transitions from one pulse to another did not sound abrupt or obvious at all. Instead, the perceptual effect of changing pulse configurations was one of a gradual shift in the overall feel of the performance. A second possible explanation of the finding is that, in

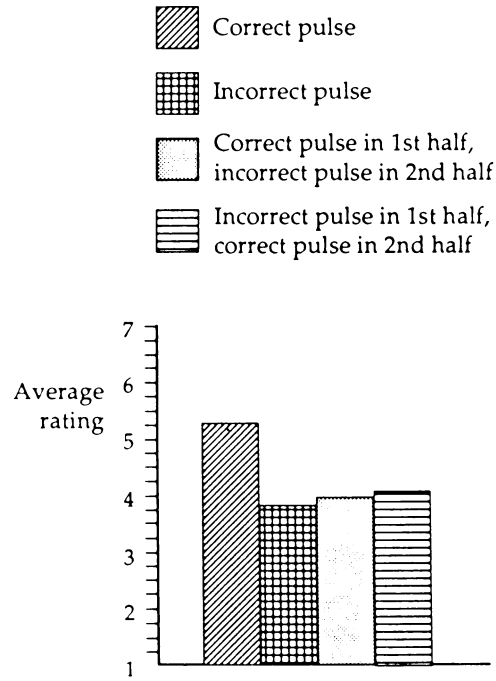


**Fig. 2.** Mean ratings of the extent to which performances involved expression typically associated with the composer, under four performance conditions. Each mean represents the average rating across two pieces. For the "incorrect pulse," the Mozart pulse was used in the Beethoven piece, and vice versa.

general, listeners tended to be just as critical of performances in which part of the piece was played with inappropriate expression as they were of performances in which the entire piece was played with inappropriate expression.

Table 3 displays the individual means assigned to each performance condition for each piece. Although not statistically significant, there was a trend in the direction of a Performance × Piece interaction, $F(3, 27) = 2.53, p = .078$. Of particular interest is an asymmetry for conditions in which the pulse changed during the piece. For both the Mozart piece and the Beethoven piece, ratings were higher when the pulse changed from Mozart to Beethoven than when the pulse changed from Beethoven to Mozart. In Table 3, the former performance conditions are represented by condition 3 for the Mozart piece and condition 4 for the Beethoven piece. This preference for pulse changes from Mozart to Beethoven may relate to the fact that the Mozart pulse, in comparison to the Beethoven pulse, has a pattern of expression that is more consistent with the hierarchy of stress typically associated with a four-beat bar, whereby the first beat is stronger than the third beat, and the second and fourth beats are soft. Thus, when perfor-

TABLE 3
**Mean Ratings of "Composer-Appropriateness" for Two Pieces Presented under Four Performance Conditions**

| | Performance Condition | | | |
|---|---|---|---|---|
| Piece | 1 | 2 | 3 | 4 |
| Mozart sonata K330 | 5.4 | 3.9 | 3.9 | 3.3 |
| Beethoven sonata opus 53 | 5.2 | 3.8 | 4.1 | 4.9 |

NOTE. Performance condition 1 = with the correct pulse, 2 = with the incorrect pulse, 3 = with the correct pulse in the first half and the incorrect pulse in the second half, and 4 = with the incorrect pulse in the first half and the correct pulse in the second half.

mances involved a change in the use of expression, listeners preferred movement from a more conventional expressive pattern to a less conventional expressive pattern.

## Experiment 3

The primary reason for conducting Experiment 3 was to replicate and clarify some results on the pulse reported by Repp (1989). As one part of Repp's first experiment, the final movement of Beethoven's sonata, opus 10, no. 2, was presented under several conditions. The presentations included performances of this piece with the Beethoven pulse, the Haydn pulse, the Mozart pulse, the Schubert pulse, and with no pulse. Other expressive actions also were implemented (e.g., crescendos, ritardandos) and were the same for all conditions. Repp reported that listeners judged the piece to be most musical if it was performed with a Haydn pulse, and least musical if it was performed with the Beethoven pulse.

Subsequent to this finding, Repp repeated the experiment using a different judgment task. For each of the above performances, listeners were asked to judge the extent to which the performance was Beethovenian. Repp found no evidence to suggest that the latter task was more sensitive to the predicted effect of the pulse than the first judgment task. In the present experiment, the importance of the judgment task is further examined by using three of the abovementioned conditions used by Repp. The present study differed in some important respects to the study conducted by Repp. First, while Repp tested a group of listeners consisting of both musically trained and less trained individuals, the present experiment focused on highly trained individuals, most of whom were studying piano at a Conservatorium of Music. Second, whereas Repp used a different group of listen-

ers for each judgment task, the present experiment involved asking the same individuals to make both judgments within the same experimental session, thus encouraging the listeners to make a distinction between two different strategies of assessing the performances.

In view of Repp's findings, it was expected that ratings of the musical quality of performances would be highest when the Haydn pulse was implemented. This effect reported by Repp is, of course, somewhat troubling for Clynes's theory. However, it is not necessarily inconsistent with the predicted effect of the pulse; it could be argued that some early Beethoven works do have a Haydn-like character. Based on general musical considerations, it may not be surprising that the Haydn pulse, rather than the Beethoven pulse, works best in some early Beethoven pieces. Clearly, though, only the Beethoven pulse should result in a performance that is perceived to involve expression specifically characteristic of Beethoven.

Although Repp did not find support for this latter prediction, many of the listeners used in his study may not have been able to distinguish between judgments based on general musical considerations and judgments based on the expressive characteristics associated with the composer. Possibly, listeners with a higher level of training in musical performance, making both types of judgments within the same experimental session, would be better able to make this distinction. In view of these methodological and subject-pool considerations, it was predicted that judgments of the Beethovenian character of performances would be highest when the Beethoven pulse was implemented.

## METHOD

### Subjects

Ten musically trained listeners participated in the listening task. Listeners were students at the N.S.W. State Conservatorium of Music, Sydney. None of the subjects had participated in Experiments 1 or 2. Eight of the subjects were studying piano performance. One subject was studying violin, and one subject was studying cello. Subjects were paid eight dollars for participating in the experiment.

### Apparatus and Stimuli

The apparatus and stimuli are the same as in Experiment 1, except that tones were taken from a Prophet 2000 sound module.

### Conditions and Procedure

The following piece and pulse structure was used in the investigation: Beethoven's sonata, opus 10, no. 2, Presto, all bars, full score, $4 \times 4$ pulse structure, fastest moving pulse unit = sixteenth note.

The piece was played with the Beethoven pulse, with the Haydn pulse, and with the Schu-

bert pulse. Other expressive actions, such as crescendos, ritardandos, and micropauses, were the same for all conditions. Performances were prepared by Clynes and were identical to performances presented by Repp (1989). The presentations were blocked by instructions. For each subject, and for each block, the order of the three performances was randomized. In the first block, listeners were asked to rate the extent to which each performance was Beethovenian—that is, how well each performance conveyed characteristics associated with Beethoven. In the second block, listeners were asked to rate the musical quality of each performance. Ratings were made on a scale of 1–9.

## RESULTS AND DISCUSSION

Figure 3 displays the average ratings given to each condition for each judgment task. First, ratings for both judgment tasks were combined, and the judgment task was treated as a within-subjects variable. This analysis of variance (ANOVA) used a two-factorial design with three performance conditions and two judgment conditions. The relevance of the judgment task to the effect of the pulse was evident in a significant interaction between the performance condition and the judgment task, $F(2, 18) = 13.37$, $p < .001$.

Second, the data for the two judgment tasks were treated separately with ANOVA, each using a one-factor repeated-measures design with three performance (pulse) conditions. When listeners were asked to judge the musical quality of performances, ratings differed significantly depending on the performance condition, $F(2, 18) = 6.22$, $p < .01$. By using orthogonal contrasts, it was found that, as when Repp used this judgment task, the performance with the Haydn pulse was given significantly higher ratings than the other two conditions, $F(1, 9) = 14.70$, $p < .01$. There was no significant difference between ratings of the Beethoven and Schubert conditions.

Ratings of the extent to which performances involved expression associated with Beethoven were consistent with the predicted effect of the pulse. Ratings were again significantly different depending on the performance condition, $F(2, 18) = 8.38$, $p < .01$. For this judgment task, orthogonal contrasts revealed that the performance with the Beethoven pulse was given significantly higher ratings than performances with the Haydn or Schubert pulse, $F(1, 9) = 59.22$, $p < .001$. There was no significant difference between ratings of the Haydn and Schubert pulse conditions.

The latter findings differ from those reported by Repp (1989). Using the same musical materials and the same two judgment tasks, Repp (1989) reported similar results for the two judgment tasks. There are two considerations that may help to account for this discrepancy. First, the present experiment used only listeners who were currently studying music at a Conservatorium of Music, and most of these listeners were studying piano performance. In contrast, Repp's investigation involved a substantial proportion of listeners without a great deal of formal musical training. It is pos-

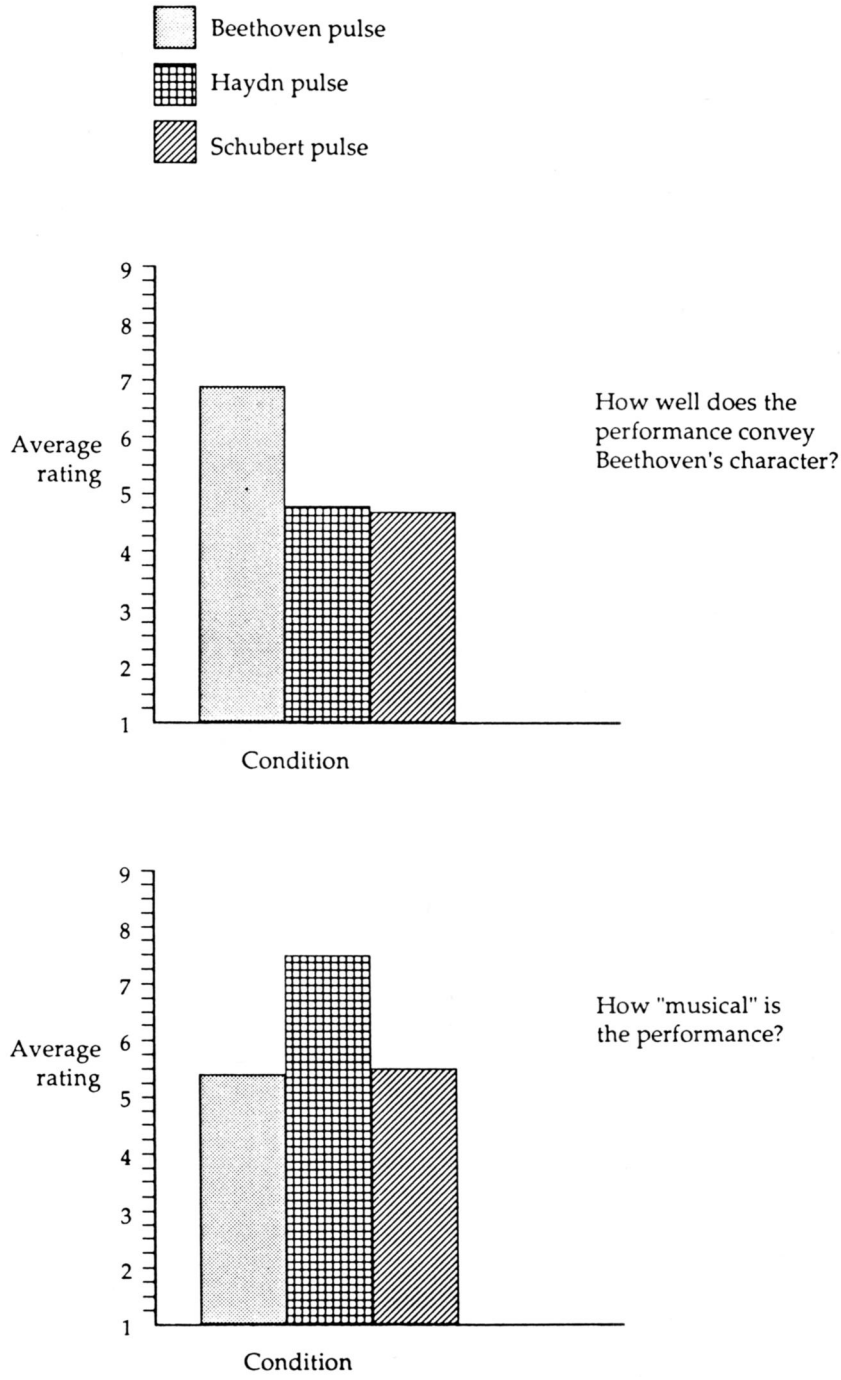


**Fig. 3.** Mean ratings of a Beethoven piece under three performance (pulse) conditions with two different instruction tasks.

sible that the listeners used in the present investigation, in comparison to those used in Repp's investigation, were better able to make a distinction between judgments that relate to specific composers and judgments that reflect more general musical considerations. Second, the difference between musical considerations and Beethovenian characteristics was emphasized in the present investigation by the fact that listeners were asked to make both types of judgments within the same experimental session. This procedure may have encouraged listeners to use different strategies for the two judgment tasks.

The findings of Experiment 3 may suggest that a distinction should be made between two possible effects of repetitive patterns of timing and loudness. The results of Experiment 1 suggest that implementing a correct pulse can make a performance sound more musical than it would be if an incorrect pulse had been implemented. However, the findings of the present experiment, and those of Experiment 2, implicate another effect of the pulse: to convey expression typically associated with, or characteristic of, the composer. In the present experiment, the latter effect of the pulse did not coincide with the more general effect of making performances more musical. The two judgments appear to be made independently of each other.

## Conclusion

The present investigation examined judgments by trained musicians of performances of several compositions by two major composers of Western tonal music, in an attempt to evaluate some of the predictions of Clynes's theory of musical performance. First, the overall concern of Clynes with composer-specific aspects of performance expression was found to be shared by other trained musicians. Trained musicians judged the character of the composer to be a major factor influencing the use of expression in performance—a factor given higher ratings of importance than the structure of the specific composition being performed. Moreover, in four musical performances, a performer was easily able to communicate composer-specific aspects of expression to other trained musicians.

A most basic prediction specifically related to Clynes's theory of pulse is that listeners should reliably prefer certain expressive patterns of timing and loudness in musical performances over other patterns of timing and loudness. This prediction was supported by the present experiments. For all seven Mozart and Beethoven pieces tested, listeners had reliable preferences for certain patterns of timing and loudness over others.

Many of the findings suggest that the specific timing and loudness values suggested by Clynes for Mozart and Beethoven are appropriate. In Experiment 1, conditions in which the composer's pulse was implemented in per-

formances were judged to be more musical than conditions in which no pulse was implemented or conditions in which the timing and loudness values of the pulse were reordered without disrupting the metrical accenting provided by the pulse. In Experiment 2, implementing the incorrect pulse (i.e., that of another composer) in all or even part of a piece resulted in a performance that was judged to be less characteristic of the composer than if the correct pulse was implemented.

The results of Experiments 2 and 3 are consistent with Clynes's notion that an important effect of these repetitive patterns of timing and loudness is to convey an understanding, or to capture the essence, of the composer. Implementing the composer's pulse in a performance had the effect of making that performance seem more characteristic of the composer than it would be if another composer's pulse was implemented. However, the results of Experiment 3 suggest also that when listeners are not asked to focus on the composer, but are simply asked to judge the general musical quality of performances, the composer's pulse may not always yield the highest ratings. The latter finding was reported also by Repp (1989).

The results of Experiment 3 suggest that research on musical performance should involve careful attention to the instructions and judgment task. The Performance × Judgment task interaction indicates two possible effects of implementing expressive patterns of timing and loudness. Judgments relating to the specific composer and judgments of overall musical quality were made somewhat independently of each other. This independence may be partly artificial: the judgment task was treated as a within-subjects factor, and subjects may have inferred that different tasks should necessarily be approached by different rating strategies. However, this possibility cannot account for the specific finding that ratings for the Beethoven pulse, in comparison to ratings for other conditions, were reliably high under one set of instructions and reliably low under the other set of instructions.

The findings reported by Repp and the present author are encouraging, but it should be emphasized that some of the findings were problematic or difficult to interpret, and that much more empirical research is needed before Clynes's theory can be evaluated thoroughly. In this investigation, not all of the results provided convincing support for the theory. For instance, although implementing the Mozart pulse in a Mozart piece did always yield high ratings of musical quality, this result could merely reflect the fact that the Mozart pulse involves a general pattern of loudness typically associated with all Western tonal music, whereby the first beat of a four-beat bar is strongest, and the third beat is stronger than the second or fourth beats. Notably, judgments relating to the musical quality of performances yielded no statistical support for the timing and loudness values of the Beethoven

pulse. Of course, the results of Experiments 2 and 3 do provide support for the Beethoven pulse by using a different judgment task. Nonetheless, it is difficult to account for the fact that Beethoven pieces performed with a Beethoven pulse were not judged to be significantly more musical than Beethoven pieces performed without a pulse, or Beethoven pieces performed with another composer's pulse.

Some general difficulties arise in attempting to design an adequate test of Clynes's theory. Along with the issue of choosing an appropriate judgment task, a consideration in evaluating Clynes's theory is that there are some important free variables, such as the choice of hierarchical structure and the weighting function. Consequently, evidence either consistent or inconsistent with predictions may partly reflect decisions concerning these variables. Unless the theory becomes more tightly constrained, empirical work on Clynes's ideas must be interpreted cautiously.

Several theoretical issues surrounding Clynes's notion of pulse need further clarification. For instance, it does not seem likely that the patterns of timing and loudness suggested by Clynes for each composer would be independent of current performance style or fashion. However, it is often implied by Clynes that the pulse values tabled in his articles are actually related to what the composer intended. For example, Clynes has proposed that the "thought of the composer contains the microstructure, but he cannot put it on paper" and has then gone on to claim that the pulse makes it "possible to fill the missing gap between thought and notation" (Clynes, 1987, p. 202).

Another issue concerns the precision with which Clynes has proposed pulse matrices. While Clynes acknowledges that performers cannot be expected to implement pulse matrix values with complete accuracy, the exact timing and loudness values tabled in Clynes's articles imply the belief that a precise quantification of "optimal" expression is theoretically possible. This kind of precision, although understandable in view of Clynes's notion of "time-form printing" and his analysis-by-synthesis approach, seems overly prescriptive: it appears to disregard the freedom of the performer to be spontaneous and to interpret a composer in her or his own way.

A third issue concerns the relative importance of the pulse as a musical "signature" of the composer. Although numerous aspects of expression are assumed to have a general importance in musical performance, Clynes seems to suggest that repetitive patterns of timing and loudness play a special role in signifying, or capturing the essence of, the composer. The pulse is presented as a simple means by which performances may be understood as Beethovenian, Mozartian, and so on. That the pulse is essential is emphasized by Clynes; using the pulse can "bring music to life" and neglecting the pulse "leads to lifeless music" (Clynes, 1987, p. 219). But it seems likely, and was suggested in the pilot study, that there are many aspects of per-

formance expression related to, and hence suggestive of, specific composers. For example, performances of Beethoven and Mozart can be differentiated generally in terms of the use of pedaling, articulation, rubato, and dynamic range. Thus, even if one accepts the hypothesis that repetitive patterns of expression are associated with individual composers, it is far from clear that this particular feature of expression is of primary importance in signifying the composer.

A final concern relates to the idea that expressive patterns associated with individual composers should occur in a cyclical manner throughout entire performances. The experiments reported here do provide some general support for the notion that implementing composer-specific patterns of expression can benefit a performance, but it is quite possible that performances would have been better had the implementation of these patterns of expression been limited to certain passages.

These concerns aside, the notion that performance expression may be used to convey characteristics of the composer represents a challenging line of investigation for the psychology of musical performance. Aside from Clynes's work, psychological research on performance has tended to ignore the composer and focus on the relationship between performance expression and musical structure as defined by music theory. Clynes has introduced a unique idea in proposing that musical performances may involve patterns of expression that, rather than being entirely determined by musical structure, seem to signify the overall character of the composer.[1]

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