THE ROLE OF DYNAMICS IN MUSICAL EXPRESSION:
A PSYCHOLOGICAL ANALYSIS

by
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A thesis
submitted in partial
fulfillment of the requirements for the degree of
Masters of Arts in the Department of Psychology
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May, 1972
If one is to make music, others must occasionally be silent.
ACKNOWLEDGMENTS

The writer is indebted to Dr. Thomas Breen for his continuous support and encouragement throughout all aspects of this project. Dr. Breen availed himself to the task of answering questions and offering considerable advice. Additional gratitude is expressed to Dr. Samuel S. Franklin and Dr. M. Bruce Fisher for their suggestions concerning methodological difficulties.

The thoughtful consideration of Dr. James Winter of the Music Department should be recognized. Appreciation is expressed to Dr. Jack Fortner and John Heard, for devoting class time to the study, and to their students, who were kind enough to participate as subjects.

Gratitude is also expressed to Jack Baker, a fine musician and music technician, who helped in the manipulation and presentation of the musical selections.
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CHAPTER 1
INTRODUCTION AND OVERVIEW

The importance of dynamics in music has been pointed out by many writers: aestheticians, musicologists, and those concerned with the psychology of music. Fay (1947) has pointed out that change in dynamics is an element which produces expressive tensions. Farnsworth (1969) notes that increases in loudness call attention to what otherwise would tend to slip by the listener unnoticed.

Dynamics is a term that refers to the degrees of loudness of musical sounds. Composers have come to use certain words and signs to indicate various sound levels and changes in dynamics. Common examples include:

- **pp** (pianissimo) -- very soft
- **p** (piano) -- soft
- **mp** (mezzo piano) -- medium soft
- **mf** (mezzo forte) -- medium loud
- **f** (forte) -- loud
- **ff** (fortissimo) -- very loud
- crescendo -- gradual increase in loudness
- decrescendo -- gradual reduction in loudness
- diminuendo -- diminish in loudness

These are only relative terms, with no absolute indicator of sound level, such as a certain number of decibels or phons, given. It is difficult for the composer or performer to specify a particular loudness, although conductor Leopold Stokowski is said to interpret his scores as follows:
The loudness level in phons of any tone is the intensity measured in decibels above reference level (0 db) of a 1000-cycle tone of equal loudness. The contours in Figure 1 relate human sensations of loudness (phons) to intensities and frequencies of sound. Consider, for example, the curve labeled 40. To the listener, a sound at any point on this curve seems as loud as a sound at any other point, although the frequencies and intensities of the two will be different. Thus, in viewing the contour from the 1000-cycle tone with an intensity level of 40 db, a 100-cycle tone must be increased in intensity about 28 decibels to be judged equally loud; and a 10,000-cycle tone must be increased about 32 decibels to be judged equally loud. In other words, if the intensity of sounds of equal loudness is increased equally, the sounds are no longer of equal loudness. In turning the volume of a phonograph up or down, the relative loudness of various pitches is also changed. It is for this reason that audiophiles turn up the bass as they turn down the volume. They should turn up the treble as well. (The indication of "volume" on the ordinary radio dial is a misnomer. The dial should really be labeled "loudness," since this is what it regulates.) The reader is referred to Fletcher (1953) and Stevens (1951) for a detailed explanation of the psychophysical relationships involved here.
Figure 1. Equal Loudness Contours (Phons). The changes in intensity (dynes/cm²) required to maintain a constant loudness for different frequencies. The numbers on each contour give the loudness-level in phons. Data from Fletcher and Munson (1933).
One naturally finds large differences in the interpretation of dynamics, since the exact sound level remains a subjective matter. Often in amateur and school ensembles the dynamic range varies somewhere between a mezzo forte and forte. Such groups encounter many difficulties, such as note reading, finger technique, rhythm, and intonation; the question of dynamic change seems to be one of the last considerations approached after these other skills have been developed.

Changes in loudness may produce changes in pitch. Fletcher (1935) observed a change as large as a minor third for a pitch in the middle register made extremely loud. Usually an increased loudness tends to increase the pitch of low or middle register vocal tones. Soft tones are flattened (slight decreases in pitch) generally. A very loud dissonance, then, because of its extreme loudness, may have pitch relationships other than those the composer intended. Conversely, it is conceivable that in a rare circumstance the pitch change may lead to less dissonance.

Farnsworth (1969) notes that performers do not follow the written pitches exactly. They unintentionally (due to lack of skill or idiosyncrasies in their instruments) and intentionally sharp and flat slightly and make use of a wealth of melodic ornamentation. However, when compared to intensity control, these inaccuracies are indeed relatively slight. With the crudeness of intensity indicators (both in the score and in the performer), the
control of loudness reveals much more about the performer's musical ability than it does that of the composer.

**Literature**

In order to understand how dynamic change might lend meaning to a composition as a whole, an examination of at least one music aesthetician's theory is in order. Meyer (1956), in considering the meaning of music and specifically what constitutes musical connotation, states that no single element of the sound organization is a sufficient cause for defining a given connotation. Melodic character (range and nature of melodic intervals), tempo, dynamics, rhythmic characteristics, and texture are necessary elements always present if there is any music at all.

According to Meyer, a specific connotation depends upon the divergence of the elements of sound from a neutral state. A pitch may be neither high nor low, a sound may seem neither loud nor soft. In general then, the more markedly the elements of sound diverge from neutrality, the greater chance of their evoking specific connotations.

Such divergence may be based on a single element deviating from the neutral state, or one divergence may be built upon another. For example, if tempo is slow and pitches are low, very loud dynamics will be experienced as a divergence, not only from the neutral state of moderate softness, but also from what Meyer calls "contingent neutrality" in which a slow tempo and low pitches are generally accompanied by soft dynamics.
Meyer applies Koffka's (1935) concept of saturation to his own "expectancy" hypothesis (music arouses tendencies of affect when an expectation is temporarily inhibited or permanently blocked). The meaning of any musical sound is related to the previous and consequent sounds, a listener's expectation is one of progressive change and growth. When a musical figure is repeated over and over again, it arouses an expectation of change because continuation is inhibited and the figure is not completed. Meyer points out a clear example of this in Beethoven's Symphony No. 6, where in measures 16-26 of the first movement, the same motive is repeated ten times with only minimal dynamic and textural changes. One need only to listen to any rock and roll composition in order to clearly observe the use of saturation. The listener goes along with the composer in this apparently meaningless repetition because of his expectation of change, and the beliefs that art is purposeful, and that the composer has serious intentions. The listener comes to expect that the dynamic level will change. Koffka writes that there is an intimate relationship between saturation and emotion: "Saturation is emotional behavior. Its analysis revealed an interplay of forces leading to increasing tension within the Ego system . . ." (Koffka, 1935, p. 414).

In factor analytic studies, it has been shown that there is a difference in appreciation of dynamic changes between males and females (Shuter, 1968). From Shuter's
In 1964 study, a broad factor of general musical ability was found, but with the following interesting difference between sexes: appreciation of changes of intensity appeared to be lacking in the main factor for the men. Appreciation of phrasing and of rhythm seem to have a much more prominent place in their musical ability, while appreciation of the appropriateness of intensity changes appeared to be much stronger among the women.

Shuter, following Herbert D. Wing's (Shuter, 1968) thesis that women make better listeners than men (Wing utilizes C. G. Jung's statement that women are more introverted than men), proposes that the extrovert (men) is more sensitive to and interested in the rhythmic movement of the music. If women are more introverted, more interested in music as a means of expressing feeling, it might well follow that changes in intensity would be a more important component of their musical ability. "It is, after all, by changes in intensity, indicated by 'expression marks,' that emotion is most obviously made overt in music" (Shuter, 1968, p. 91).

Shuter suggests that it might be interesting to investigate whether persons scoring well on the Wing intensity test would also score high on the introversion side of an objective personality scale, and those scoring high as extroverts would be more successful with the rhythm test, irrespective of the sex of the subject.
Ortmann (1928) investigated responses such as pleasantness-unpleasantness as reported by subjects for various intensities. He found a range from mild unpleasantness for very low intensities, greater pleasantness for the middle range, and marked unpleasantness for the extremely loud tones.

Gordon (1960) was interested in the difference in dynamic ranges between various groups, as well as the practical method of how a public school teacher can study the dynamics of his own musical group and others. After recording the performance of several junior-high and high school musical groups, he found considerable differences in the dynamic ranges of the groups. Gordon was also able to show that groups with a large dynamic range were rated superior as a whole to ensembles with a narrower range. Gordon agrees that beauty in music comes from many things, and proper performance of dynamics is one element.

It is this latter study which led the writer to undertake the present investigation. Why were the groups with the larger dynamic range rated as superior? The experiment is intended to isolate the role of dynamic range as an independent variable, while keeping other musical elements (such as rhythm, intonation, and technique) constant. The hypothesis to be tested can now be stated.
Hypothesis

Dynamic changes are an element of expression in music. The greater the dynamic range (the difference in amplitude in going from the softest to the loudest sounds in musical performance), the more musical expression will be available to the listener.

This general hypothesis can be applied to any type of music. The investigator proposes, however, that dynamic change is more a part of expression in classical music than in rock and roll. It may be that rock and roll relies on other, more overt elements for expression, or that the listener himself attends to these aspects of the musical stimulus (i.e., melodic, rhythmic, and textural changes). This, then, is a secondary hypothesis:

Dynamic change is more effectively an element of expression in classical music than in rock and roll. (Operational definitions of classical and rock music will be presented in the method section.)
CHAPTER 2

METHOD

Subjects

One hundred and sixty human subjects were used. It was decided to use Music 9 ("Introduction to Music," a basic-theory and understanding course not designed for music majors) students, since they were large groups available at one time for a presentation of one set of the experimental comparisons. Four separate classes were available for the experiment, containing from 30 to 46 students. There was no reason to believe that Music 9 students differ from the college population on any systematic basis.

Experimental Design

The experimental design which was utilized in testing the hypothesis is presented in Table 1. As the table indicates, each of the musical selections was subject to three conditions of loudness change:

1) Minimum change of loudness, 55-75 phons.
2) Maximum change of loudness, 25-95 phons.
3) Maximum, but loudness changes manipulated oppositely to the score indications, 25-95 phons.

All conditions had a median of 65 phons (approximately mf).

Condition I had a loudness range of 20 phons. It was decided to use such a minimal change condition because as music changes in pitch, the loudness in phons changes, so
that it would be improbable, even with the most sophisticated of equipment, to attain an exact, constant loudness. Condition I should be conceived of then, as essentially a minimum change in loudness, independent of the composer’s indications as to changes in dynamics. Condition II had a dynamic range of 70 phons, a maximum range attained by only the world’s finest symphony orchestras.

The inclusion of Condition III requires some explanation. This condition was included to assess the role of loudness changes qua loudness changes. Are changes in dynamics expressive because of the ability of the composer in placing them in an optimal relationship, or is expression due merely to the change itself? The manipulation was such that each time the composer indicated a certain dynamic level, the opposite dynamic was recorded:

<table>
<thead>
<tr>
<th>Score Marking</th>
<th>Manipulated Version</th>
<th>Score Marking</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>ppp</td>
<td>fff</td>
<td>Score</td>
<td>crescendo</td>
</tr>
<tr>
<td>pp</td>
<td>ff</td>
<td>crescendo</td>
<td>decrescendo</td>
</tr>
<tr>
<td>p</td>
<td>f</td>
<td>decrescendo</td>
<td>crescendo</td>
</tr>
<tr>
<td>mp</td>
<td>mf</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mf</td>
<td>p</td>
<td></td>
<td></td>
</tr>
<tr>
<td>f</td>
<td>pp</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ff</td>
<td>ppp</td>
<td></td>
<td></td>
</tr>
<tr>
<td>fff</td>
<td>PPP</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As Table 1 indicates, the manipulation of the four selections into the three loudness conditions generated 12 one-minute recordings.

The musical selections were numbered as follows: \( C_1 \) (classical music number 1); \( C_2 \) (classical music number 2);
### TABLE 1
SUMMARY OF EXPERIMENTAL DESIGN

<table>
<thead>
<tr>
<th>Musical Selection</th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classical 1 (C₁)</td>
<td>MiLC</td>
<td>MxLC-C</td>
<td>MxLC-O</td>
</tr>
<tr>
<td>Classical 2 (C₂)</td>
<td>MiLC</td>
<td>MxLC-C</td>
<td>MxLC-O</td>
</tr>
<tr>
<td>Rock and Roll 1 (R₁)</td>
<td>MiLC</td>
<td>MxLC-C</td>
<td>MxLC-O</td>
</tr>
<tr>
<td>Rock and Roll 2 (R₂)</td>
<td>MiLC</td>
<td>MxLC-C</td>
<td>MxLC-O</td>
</tr>
</tbody>
</table>

Note-- Abbreviations: MiLC = Minimum loudness condition; MxLC-C = Maximum loudness as the composer intended; MxLC-O = Maximum loudness opposite of composer's intention.
When each selection was paired with itself under the loudness conditions, and each order of presentation was produced once, this resulted in 36 pairings as follows:

1) IC₁ - IC₁  4) IIC₁ - IIC₁  7) IIIC₁ - IIIC₁
2) IC₁ - IIC₁  5) IIC₁ - IC₁  8) IIIC₁ - IC₁
3) IC₁ - IIIC₁  6) IIC₁ - IIIC₁  9) IC₁ - IIIC₁
10) IC₂ - IC₂  13) IIC₁ - IIC₂  16) IIIC₁ - IIC₂
11) IC₂ - IIIC₂  14) IIC₂ - IC₂  17) IIIC₂ - IC₂
12) IIC₂ - IIIC₂  15) IIC₂ - IIC₂  18) IIIC₂ - IIC₂
19) IR₁ - IR₁  22) IIR₁ - IIR₁  25) IIIR₁ - IIIR₁
20) IR₁ - IIR₁  23) IIR₁ - IR₁  26) IIIR₁ - IR₁
21) IR₁ - IIIR₁  24) IIR₁ - IIIR₁  27) IIR₁ - IIIR₁
28) IR₂ - IR₂  31) IIR₂ - IIR₂  34) IIIR₂ - IIIR₂
29) IR₂ - IIR₂  32) IIR₂ - IR₂  35) IIIR₂ - IR₂
30) IR₂ - IIIR₂  33) IIR₂ - IIIR₂  36) IIIR₂ - IIIR₂

Since there were four groups (classes) of subjects, each group received 9 musical pairs, or 18 minutes of music. The pairs were randomized within each musical selection. Then, subject to the restriction that a pair from each selection must be presented before a pair from a given selection can be presented a second time, a counterbalanced order was chosen. The order of presentation is now given:

Group i:  21, 34, 8, 15, 25, 29, 3, 10, 27. (pair numbers)
Group iii: 1, 18, 23, 31, 5, 17, 26, 28, 6.
Group iv: 14, 22, 35, 9, 16, 24, 33, 4, 12.
Selection of Musical Materials

There were four musical selections, two classical and two which conform to the rock and roll idiom. It is appropriate here to define these types of music as used in this study. Classical music is used to denote only the "Viennese classics," that is, Haydn, Mozart, Beethoven, and, to some extent, Schubert. This period embraces the decades from 1770 to 1830 (Apel, 1944). Rock and roll music as used here denotes a general type of popular music developed in the late 1950's, characterized by a strong beat and much melodic and rhythmic repetition. Instrumentation includes drums, electric guitars, organ, and often a solo instrument, such as flute, sax, trumpet, etc.

The selections were approximately one minute in length. This allowed the subject sufficient time to be exposed to the various aspects of the selection, and was not too long, which prevented the subjects from becoming fatigued.

It was decided that the selections should be seldom-heard compositions, in order to minimize any familiarity effects. The classical selections were chosen in consultation with members of the music department faculty, in order to establish the construct validity that they are somewhat indicative of classical music in general, and such that the selections fulfill the requirement that they are infrequently heard in popular performance. Classical selection number 1 was taken from Haydn's Symphony #90 in
C-major; the Andante movement (II), measures 17-24, repeated, and measures 25-38. Classical selection number 2 was taken from Mozart's Symphony in G-minor (#40, K550); the Allegro Assai movement (IV), measures 246-308. Thus there was a slow tempo (Haydn) and a fast tempo (Mozart).

Rock and roll selection number 1 was taken from "It Shall Remain" by Randy Hall; the first two verses. Selection number 2 was taken from "Red Dress Ladies" by John Cates; the lead guitar solo, bridge, and beginning of the coda. These two songs were recorded in the summer of 1971 by a group called "Band of America," and of which the writer was a member. The tapes were never released by a record company, nor played on the radio, thus meeting the requirement that they be unfamiliar to the listener. The representativeness of these songs was again subject to faculty approval.

**Preparation of Musical Material**

Both kinds of selections (more readily available on phonograph record) were played on standard reel-to-reel recording tape and projected through loudspeakers monaurally (to eliminate phase differences created by stereophonic reproduction). An intensity-indicator and the microphone doing the recording was placed at a constant distance from the speakers, 15 feet. The experimenter memorized the dynamic levels of the selections, and in
consultation with the musical score, thus manipulated the desired loudness levels by turning the loudness dial on the second tape recorder, which was doing the recording. In this manner all four selections under the three conditions of loudness were recorded on a single master tape. The relative location of the various manipulations on the tape were encoded by the revolution indicator on the tape-deck. This enabled the experimenter during the experiment to merely turn the master tape to the prepared manipulation, while keeping the loudness dial constant for all conditions.

The crudeness of this technique is justified both by its simplicity of duplication and the fact that ranges of dynamics are being manipulated, rather than any constant, exactly-specified intensity level.

Presentation of Musical Material

Music 9 classes are held in rooms of the music building which are equipped with a speaker system, tape recorder, and power amplifier. In order to insure the proper range and median of the loudness conditions, that is, to be sure that the experimental conditions bear the same loudness levels as the preparatory conditions, the rooms were monitored by an assistant as the experiment proceeded.

Procedure

When all of the subjects came into the room, they were given the questionnaire-data sheets (see Appendix A) and
were asked to complete the questionnaire section (part I). The following instructions were then read to the subjects of all four classes:

This is an experiment which deals with musical expression. A series of musical selections, approximately 1 minute in length, will be presented in pairs. Both members of a given pair are the same selection of music. However, the first member of a pair may be a different version than the second. You will be asked to judge whether the first version (A) or the second version (B) is the more musically expressive of the two... whatever you may personally consider musical expression to be. If you cannot determine which version is more expressive, then indicate 'no difference' on your sheet. In fact, in some of the pairs there is no difference at all. You will be given sufficient time to fill out the appropriate part of the questionnaire after each pair is presented. Are there any questions?

Then, with the help of an assistant (who was at the tape recorder and responsible for the presentation of the appropriate musical pair), the first pair was presented, and the subjects were asked to complete the first data section, which corresponds to the first musical pair. This procedure was repeated eight more times for all of the four groups of subjects. The entire procedure required approximately forty minutes. The experimenter then collected the data sheets.
CHAPTER 3
RESULTS

Rationale of Data Analysis

Since the subjects were asked to judge if there was some kind of relationship between members of a selection-pair, i.e., "more expressive than," an ordinal scale was being utilized. Therefore, order statistics are relevant. Although the actual individual frequencies obtained fell into discrete categories (A, B, or no-difference), it is reasonable to assume that underlying such categories there is a continuum of possible results. Thus, non-parametric tests are applicable.

Primary Hypothesis

The observed and expected frequency judgments of greater musical expression generated by multiple comparisons of the three loudness conditions (independent of order of presentation) are presented in Table 2 (classical selections) and Table 3 (rock and roll selections). It should be noted that above the columnar totals are numbers in parentheses. These are the expected frequencies, which represent those frequencies which would be expected if dynamic range does not affect judged musical expression.
### TABLE 2

**Chi-Square Values of Observed and Expected Frequencies of Judged Greater Musical Expression for Classical Selections**

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>Not I</th>
<th>ND</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-II</td>
<td>20</td>
<td>99</td>
<td>36</td>
<td>155</td>
</tr>
<tr>
<td>I-III</td>
<td>40</td>
<td>24</td>
<td>87</td>
<td>151</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>123</td>
<td>123</td>
<td>306</td>
</tr>
</tbody>
</table>

\[ x^2 = 25.9 \]

<table>
<thead>
<tr>
<th></th>
<th>II</th>
<th>Not II</th>
<th>ND</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>II-I</td>
<td>99</td>
<td>20</td>
<td>36</td>
<td>155</td>
</tr>
<tr>
<td>II-III</td>
<td>92</td>
<td>22</td>
<td>26</td>
<td>140</td>
</tr>
<tr>
<td>Total</td>
<td>(98.3)</td>
<td>(98.3)</td>
<td>(98.3)</td>
<td>295</td>
</tr>
</tbody>
</table>

\[ x^2 = 133.06 \]

<table>
<thead>
<tr>
<th></th>
<th>III</th>
<th>Not III</th>
<th>ND</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>III-I</td>
<td>24</td>
<td>40</td>
<td>87</td>
<td>151</td>
</tr>
<tr>
<td>III-II</td>
<td>22</td>
<td>92</td>
<td>26</td>
<td>140</td>
</tr>
<tr>
<td>Total</td>
<td>(97)</td>
<td>(97)</td>
<td>(97)</td>
<td>291</td>
</tr>
</tbody>
</table>

\[ x^2 = 42.0 \]

**Note**—Abbreviations: Not I, II, or III indicates the other member of the presented pair; ND = No difference in judged expression. Parentheses indicate the expected frequencies which would be expected if dynamic range does not effect judged expression.
TABLE 3

CHI-SQUARE VALUES OF OBSERVED AND EXPECTED FREQUENCIES OF JUDGED GREATER MUSICAL EXPRESSION FOR ROCK AND ROLL SELECTIONS

<table>
<thead>
<tr>
<th>Loudness</th>
<th>I Not I</th>
<th>ND</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-II</td>
<td>71</td>
<td>38</td>
<td>60</td>
</tr>
<tr>
<td>I-III</td>
<td>81</td>
<td>18</td>
<td>52</td>
</tr>
<tr>
<td>Condition I Total</td>
<td>152</td>
<td>56</td>
<td>112</td>
</tr>
</tbody>
</table>

\[x^2 = 44.63\]

<table>
<thead>
<tr>
<th>Loudness</th>
<th>II Not II</th>
<th>ND</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>II-I</td>
<td>38</td>
<td>71</td>
<td>60</td>
</tr>
<tr>
<td>II-III</td>
<td>61</td>
<td>37</td>
<td>52</td>
</tr>
<tr>
<td>Condition II Total</td>
<td>99</td>
<td>108</td>
<td>112</td>
</tr>
</tbody>
</table>

\[x^2 = .85\]

<table>
<thead>
<tr>
<th>Loudness</th>
<th>III Not III</th>
<th>ND</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>III-I</td>
<td>18</td>
<td>81</td>
<td>52</td>
</tr>
<tr>
<td>III-II</td>
<td>37</td>
<td>61</td>
<td>52</td>
</tr>
<tr>
<td>Condition III Total</td>
<td>55</td>
<td>142</td>
<td>104</td>
</tr>
</tbody>
</table>

\[x^2 = 37.93\]

Note—Abbreviations: Not I, II, or III indicates the other member of the presented pair; ND = No difference in judged expression. Parentheses indicate the expected frequencies which would be expected if dynamic range does not effect judged expression.
In order to determine if the distribution of frequencies for each individual loudness condition is different from what would be expected by chance, chi-square values were computed among the columnar values in each of these tables. For the classical selections, these values are 25.9, 133, and 42, for loudness conditions I, II, and III, respectively. For the rock and roll selections, the values are 44.63, .85, and 37.93, for conditions I, II, and III. All values are significant at the .001 level of confidence, with the exception of loudness condition II for the rock selections. These values are also presented in Table 4.

Thus, judged musical expression of both classical and rock and roll selections appears to be influenced by differences in dynamics.

The Mann-Whitney U-Test was utilized to determine where these differences occurred. This test enables direct comparisons to be made between conditions I-II, I-III, and II-III. The frequency with which each member of these pairs was judged to be more musically expressive was ranked by assigning the higher frequency the higher rank (Spence, et al., 1968). Each of these pairs occurs four times in the classical selections, and four times in the rock selections. Figure 2 (classical) and Figure 3 represent graphically the sum of the rankings of each comparison.

For classical music, loudness condition II was chosen as being significantly more expressive than condition I (Figure 2A); $U=0$, $p \leq .014$. This finding directly supports the
### TABLE 4

CHI-SQUARE VALUES FOR THE COMPARISONS OF THE EXPECTED AND OBSERVED FREQUENCIES OF THE INDIVIDUAL LOUDNESS CONDITIONS FOR CLASSICAL AND ROCK AND ROLL SELECTIONS

<table>
<thead>
<tr>
<th>Loudness Condition</th>
<th>Classical Selections</th>
<th>Rock Selections</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>25.9*</td>
<td>44.63*</td>
</tr>
<tr>
<td>II</td>
<td>133.06*</td>
<td>.85</td>
</tr>
<tr>
<td>III</td>
<td>42.0*</td>
<td>37.93*</td>
</tr>
</tbody>
</table>

*p < .001
Figure 2. Summed-ranked Frequency of Expression for Classical Selections. (A) compares loudness conditions I-II; (B) compares I-III; and (C) compares II-III.
hypothesis. There was a tendency for condition I to be judged more expressive than condition III, though not significantly (Figure 2B); U=3, p > .1. The subjects tended to prefer the minimum change condition to the experimenter's "opposite" version, which had a maximum dynamic range.

Condition II was significantly more expressive than Condition III (Figure 2C); U=.5, p < .021. This finding, in conjunction with the results of comparisons I-II, and I-III, indicates that dynamic range is expressive not merely because of the change qua change, but rather appears to be a function of its relationship to the context of the musical score.

For the rock and roll selections, the findings are somewhat different. Condition I was judged more expressive than Condition III (Figure 3B); U=0, p < .014. There was a tendency for Condition I to be judged more expressive than Condition II, although here the difference in expressiveness was not significant (Figure 3A); U=3, p > .1. Thus, for the rock selections, a minimum loudness range tends to be judged more expressive than a wide dynamic range; and the optimal change tended to be more expressive than the reversed dynamic version.

As a convenience to the reader, Figure 4 presents the total summed ranked frequencies of judged expression of the loudness conditions for the classical selections (4A) and the rock selections (4B).
Figure 3. Summed-ranked Frequency of Expression for Rock and Roll Selections. (A) compares loudness conditions I-II; (B) compares I-III; and (C) compares II-III.
Figure 4. Total Summed-ranked Frequency of Expression for Classical Selections (A), and Rock and Roll Selections (B).
Secondary Hypothesis

All of the data presented thus far has been reported separately for the two classical selections combined and the rock selections combined. This was done in view of the idea that the role of dynamics in musical expression is different in classical music than in rock music as the above data implies. To test the secondary hypothesis, the judged frequency of expression of each loudness condition for classical versus rock music was compared in three sets of rankings: classical I-rock I, classical II-rock II, and classical III-rock III. The Mann-Whitney U-Test was again used to determine if the classical music selections were stochastically larger than the rock and roll selections, as far as the role of dynamics in musical expression is concerned. Figure 5 presents the summed ranked comparisons between the classical and rock selections for each loudness condition.

The minimum dynamic range appeared to play a far greater role in musical expression in the rock selections than in the classical selections; \( U=6.5, p \leq 0.0025 \). The maximum loudness change condition was judged more expressive in classical music; \( U=12, p \leq 0.005 \). There was no significant difference in the way the reversed maximum dynamic range was judged for either kind of music; \( U=30, p > 0.439 \). Thus, the secondary hypothesis is supported.
Figure 5. Summed-ranked Frequency of Expression. Frequencies of each loudness condition are compared between the classical selections and the rock selections.
Ancillary Data

As a check on order-of-presentation effects, the chi-square test was employed. This was done in order to determine if, for example, Condition I when presented as the first member of a pair differed significantly in judged expression from the same condition when presented as the second member of the pair. There was, indeed, an order effect. In the comparisons for the classical selections of loudness conditions I-II, II was judged more expressive, but the magnitude of this difference was significantly greater when Condition II was presented as the second member of the pair, $x^2=4.7$, $p \leq .05$. However, this effect of order did not obscure the relationship; Condition II was judged significantly more expressive.

In the comparisons of I-II for the rock and roll selections, order effects were again significant. When loudness Condition I was the first member of the pair it was judged as being more expressive, but was judged roughly equal in expressiveness as Condition II when presented as the second member of the pair; $x^2=4.9$, $p \leq .05$. This unexplained order effect may thus have contributed to the lack of statistical significance in the comparisons of Conditions I-II.
Primary Hypothesis

The primary hypothesis, that the greater the dynamic range the more the musical expression will be available to the listener, was only partially supported in the present study. Greater dynamic range increased the judged musical expressiveness of classical selections, but it did not enhance expression for rock and roll selections. For the classical selections, the maximum loudness change as the composer intended (condition II) was judged more expressive than both the minimum change (condition I) and the maximum opposite change (condition III). There was a tendency for the minimum change condition to be judged as being more expressive than the maximum opposite change condition. It might have been predicted from Meyer's "expectancy" hypothesis that the listeners would judge condition III as being more expressive than condition I, since a listener's expectation is one of progressive change and growth. The results of the present experiment, however, suggest that Meyer's "expectancy" should be qualified to include only those dynamic changes which are placed in an optimal location and direction within the context of the musical score by the composer. It appears that even the relatively naive musical listeners who served as subjects in this study have the ability to respond differentially to optimal dynamic-contextual relationships.
For the rock and roll selections, the minimum loudness change tended to be judged more expressive than the reversed maximum range (statistically significant) and the maximum range (not significant). As mentioned in the ancillary data section, this lack of significance may have been due to the differential effect of the order or presentation which occurred here; or possibly that, for rock music, there might be some medium change condition, where the optimal musical expression might be available with a dynamic range of less magnitude than the maximum change condition but of slightly greater magnitude than the minimum change condition. This possibility is indirectly supported by the tendency of the maximum loudness change to be judged more expressive than the reversed maximum change, although this difference was not statistically significant. Analysis of the questionnaire indicated that the majority of the subjects were most familiar with rock and roll music; they spend over 50 percent of their own musical listening time listening to rock and roll music. Since the current rock music employs a relatively narrow dynamic range, it seems likely that the subjects have learned that too wide a dynamic range is inappropriate. The wide range may have seemed to be artificial when compared to the narrow range.

**Secondary Hypothesis**

The secondary hypothesis was fully supported. The maximum loudness range condition was judged to be more
expressive in the classical selections than in the rock selections. The minimum dynamic range was judged as being more musically expressive for rock and roll than for the classical selections.

If dynamic change is an element of musical expression, why then is its role as such not nearly as significant for rock and roll music as it is for classical music? Most of rock music has a narrow range of dynamic change. The changes that do occur in rock and roll are usually instrumentation changes, tempo and rhythmic changes, and key changes. Further, most rock music compositions are from three to five minutes in duration, a good deal shorter than the works of the classical period. If a selection is relatively brief, it may require less dynamic change to be musically expressive.

There was no difference in judged expressiveness for the reversed maximum dynamic range between rock and classical music. The improper contextual relationship of the dynamic changes in the classical selections is paralleled by the inappropriate and unusual wide range in the rock selections.

**Experimental Factors**

Different testing conditions and degree of involvement of the subjects constitute two classes of variables which, potentially, may have influenced the results of the present experiment. Consideration will now be given to each of these two classes of variables.
Group iii was not tested in the same room as the other three experimental groups. The rooms differed in height, width, and length. An attempt was made to control for this, however. Before the experiment began, both rooms were monitored with an intensity indicator at a point 20 feet equidistant from the two speakers. The equipment was identical in both rooms. Since the experimental tape was recorded monaurally, there was no phase difference in the two rooms. Group iii's judgments did not differ significantly from those of the other groups.

Another possible variable is that of seating. The room where groups i, ii, and iv were tested was very large and the subjects were evenly distributed throughout the room. Thus, it is likely that some subjects heard a maximum range of 15-85 phons, and others a range of 30-100 phons. This difference is very slight, indeed, is less different than the conditions resulting from the seating arrangements in a concert hall.

The four groups were all tested on the same day, but not at the same hour. Group i was tested at 8:00 a.m., group ii at 9:00 a.m., group iii at 2:00 p.m., and group iv at 3:00 p.m. There is no indication that this time difference had any effect upon the responses.

A word should be mentioned concerning the subjects. They were in no sense required to participate in the experiment. The investigator merely informed the subjects that their participation was appreciated. From observations made
during the experiment, it seems reasonable to believe that nearly all subjects were attentive listeners. There were, however, a few subjects who obviously did not give their complete attention. Due to incomplete questionnaires or ambiguous responses, the investigator was forced to drop seven subjects, leaving a total $N$ of 153.

**Future Research and Implications**

As was indicated earlier in the discussion, a further analysis of the role of dynamics in musical expression would benefit with the inclusion of a condition of medium dynamic range, for example, 45-85 phons. Such a condition might further clarify the role of dynamics in classical music, and might help resolve the questions left unanswered concerning dynamics in rock music.

The effects of learning on how one judges musical expression should be investigated. Is rock music really more expressive with a minimum dynamic range? Or, and more likely, have listeners to rock and roll merely learned that since most music they hear has a minimum range, a selection with a large dynamic range is artificial and inappropriate? What, then, is the relative contribution of learning versus innate skills in determining musical expressiveness?

Are there certain personality or sex characteristics which effect the role of dynamic change in musical expression?

Of what practical value is the present study to the musician, the music educator, and the listener? The present
experiment was not designed to assess the relative importance of dynamic change in musical expression. No attempt was made to identify whether other factors, such as tempo change, timbre change, and so on, might be more or less powerful variables. Experimental assessment of the role of these variables upon musical expression constitutes a fruitful area of future research in the psychology of music.

The results of the present study provide experimental support for, and serve to reinforce and emphasize what good music performers, composers, educators, and listeners already know from experience. The performer is aware that increasing dynamic range (from the most quiet of pianos to the loudest of fortés) will increase his power of musical expression. The composer realizes that maximum effectiveness is obtained by means of dynamic change in optimal relationship with the musical context. The musical educator understands that stressing the importance of playing dynamics optimally is time well-spent in the classroom. The good listener realizes that he increases his enjoyment of music by attending to changes in dynamics, thereby finding more aspects of musical expression.
BIBLIOGRAPHY


APPENDIX

QUESTIONNAIRE - DATA SHEET
QUESTIONNAIRE

Part I

Sex: M F Age: _____
Year in college ____________________________
Years of musical training:
private instruction and college courses _______
self-instruction and other training _________
Do you play a musical instrument? Yes No
If so, how long? _________________________
When you listen to music, what percentage of that time do you listen to each of the following kinds of music:
Classical _____% Semi-Classical _____% Jazz _____%
Rock and Roll _____% Popular (soft-rock, ballads, etc.) _____%

Part II

Musical Selection I
1. Have you heard this selection before? Yes No
   If so, how many times? _________________________
2. Which of the versions, if either, was more expressive?
   (whatever you may personally consider musical expression to be)
   A B No-difference
3. If you marked A or B above, which of the many features of the selection most influenced your choice? __________________________

Musical Selection II
1. Have you heard this selection before? Yes No
   If so, how many times? _________________________
2. Which of the versions, if either, was more expressive?
   A B No-difference
3. If you marked A or B above, which of the many features of the
Musical Selection III

1. Have you heard this selection before?  Yes  No
   If so, how many times?  

2. Which of the versions, if either, was more expressive?
   A   B   No-difference

3. If you marked A or B above, which of the many features of the
   selection most influenced your choice?  

Musical Selection IV

1. Have you heard this selection before?  Yes  No
   If so, how many times?  

2. Which of the versions was more expressive?
   A   B   No-difference

3. Which feature of the selection most influenced your choice?

Musical Selection V

1. Which of the versions was more expressive?
   A   B   No-difference

2. Which feature of the selection most influenced your choice?

Musical Selection VI

1. Which of the versions was more expressive?
   A   B   No-difference

2. Which feature of the selection most influenced your choice?

Musical Selection VII

1. Which of the versions was more expressive?
   A   B   No-difference

2. Which feature of the selection most influenced your choice?
Musical Selection VIII

1. Which of the versions was more expressive?
   A  B  No-difference

2. Which feature of the selection most influenced your choice?

Musical Selection IX

1. Which of the versions was more expressive?
   A  B  No-difference

2. Which feature of the selection most influenced your choice?