EXPERIMENTAL STUDIES OF THE ELEMENTS OF EXPRESSION IN MUSIC

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The experiments to be described here deal with the problem of meaning in music, or, more explicitly, with the affective value and the expressiveness of music. In some earlier experiments the author had developed an objective and quantitative method for isolating certain variables in music structure and measuring their expressiveness, and by application of the method had investigated the affective value of the major and minor modes.[1] It is the object of the present study to improve the processes for treating the results from the method, and to discover the effect of three other variables, the rising and falling of the melodic line, the firm or flowing motion in the rhythm, and the simplicity or complexity of the harmony.

Obviously, in undertaking such a study, it is assumed that there is an expressiveness in music which is so generally and consistently associated with it that it will lend itself to experimental variation and control. We find it necessary to refer to this statement as an assumption because of the fact that in the history of musical culture, there has been a lengthy controversy over the problem of expressiveness in music, and much difference of opinion as to whether music can be made to express definite emotions and concepts and sentiments, or whether it is merely suggestive and moving in a very general way and to be interpreted quite variously by the different listeners who are attending to it. On the one hand, we find the very important and successful use of musical expression in the modern opera, the tone poems, and other forms of descriptive music which have met with great popular success. The volumes upon volumes of program notes also testify to the popularity of the assumption with concert audiences. Likewise, in experimental psychology we have evidence that at least the general mood or affective state suggested by any one composition is fairly constant and universal.[2] The introspective reports of individuals who try to analyze their experience in listening also show that this interpretative activity is of very frequent occurrence,[3] and furthermore that it is often the means by which apprehension or appreciation of a more difficult type is developed. On the other hand, it is a simple matter to demonstrate that listeners often disagree markedly in their specific interpretations of music, and some of the differences of opinion of eminent critics on important symphonies have become world-famous. It is certainly clear at least, that there are different kinds of music, formal and descriptive, absolute and pragmatic, pure music and music full of symbolism, and also that there are different kinds of listeners to music. In short, there are many ways of enjoying music, and many

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[1] K. Hevner, The affective character of the major and minor modes in music, this JOURNAL, 47, 1935, 103-118.

[2] Max Schoen, editor, *The Effects of Music*, chaps. VII, VIII.

[3] Max Schoen, The aesthetic attitude in music, *Psychol. Monog.*, 39, 1928, (no. 178), 162-183.

types of music to enjoy, and of exquisitely delightful music of all varieties, and enthusiastic listeners of all kinds, there has never been any lack.

Since there has been so much confusion and disagreement attending the problem of meaning in music, it will be necessary to state clearly at the outset what phase of this complex question we are studying, and what further assumptions and theories we endorse. The limitations of expressiveness, its psychological explanation, its use in understanding and appreciating music, and the particular kind of symbolism which it employs, we shall discuss at length elsewhere;[4] for the present we shall sketch the underlying theory and method of our experiments as briefly as possible.

The presence or absence of meaning, and the particular quality of the meaning in any music is dependent on a number of factors: the form and structure of the music itself, the attitude of the listeners, their previous experience, their training, talent and temperament, and their momentary mood and physiological condition. A certain flexibility in expressiveness is therefore postulated, and experimental studies will be the means of determining the nature and limits of this flexibility.

The suggestiveness of music does not depend directly on the amount of formal training which the listener has had, but is apparent both to the trained and untrained. Previous experiments have shown that the perception of meaning is aided and facilitated to some extent by musical training, experience, and interest, but that the interpretations are affected by these factors much less than popular opinion has supposed.

Studies of a special group of students with no background or training in music have shown that they differentiate the mood effects of the major and minor mode quite distinctly and readily. The measurements show that the typical or median student in this special group has never had any private music lessons of any sort, does not play any musical instrument, has no musicians in his family and never attends operas or concerts. He can read music a little for singing, has sung two years in a high school chorus and has a piano and a radio in his home; and he is almost as suggestible to the mood effects of music as his highly trained classmate.[5]

The *O*s (450 in number) have, in the experiments to be described below, been measured for their musical interest, training, attitude, and appreciation, and they represent a very wide range on all of these scales, with the large majorities falling into the untrained and untalented groups. They include a few students who are preparing for a professional career in music (usually teaching), and a few who have an aversion to music and avoid all contact with it; but for the most part they claim only a casual interest in music, have had a lesson or two, exhibit some little preference, have no knowledge of the actual form and structure of musical compositions,

[4] K. Hevner, Expression in music: A discussion of experimental studies and theories, *Psychol. Rev.*, 42, 1935, 186-204.

[5] Hevner, *op. cit.*, this JOURNAL, 47, 1935, 115 ff.

and are strikingly lacking in a vocabulary with which to describe what they hear and with which to identify musical sounds.

The symbolism of music is obviously not as exact or as specific as verbal symbolism, but we begin with the assumption that it is not chaotic, and not entirely without system. On the contrary, we believe that it may be possible to discover the presence of definite principles together with a certain orderliness in the relation between musical structures and the various emotions and sentiments.

In our experimental search for those elements of musical structure which must be at the basis of any such orderly system, there are certain details in methodology which must receive careful consideration. Since we are looking for elements of *music* we must be sure that the material provided for observation represents real *music* and not merely *elements* trimmed down for experimental purposes to such an extent that all the *music* has been left out. The outline of a rhythmic pattern, to choose one of the possible elements, tapped out with a hard wooden stylus, is but the bare skeleton of a rhythm, rattling its dry bones in vast emptinesses, and far different from the living, throbbing rhythm that pulsates through the whole body of a musical composition. The isolation of the variable to be studied must not be accomplished by an actual isolation of the one particular element from all the relationships which make it musical, but by some better method; by the study of various compositions in which this one element predominates, or by arranging several versions of one musical composition which differ from each other only with respect to the element under consideration.

We must also recognize the importance of the *cumulative* effect which the succession of stimuli makes possible, and on which the effectiveness of some of the elements largely depends. The repetition of certain stimuli and their natural support by other qualities in the body of the music is necessary in order that the human organism may perceive them. The sadness which is so strongly associated with the minor does not reside in the minor chord alone, but only in music written in the minor mode, with all the accumulation and interrelation of stimuli which the use of that mode implies. Again, music is not a spatial, but a temporal art, and distinguished from the visual arts by its dependence on temporal rather than spatial relationships. In choosing the elements which carry the meaning of music, and which will form the basis of a system of musical symbolism we must be careful, therefore, to choose those elements which involve successive moments of time, such as rhythm and tempo, rather than intervals and chords. It is the masses of harmony, the resolutions and progressions, to which meaning attaches rather than to the triads themselves, and it is the twists and turns of the melody around its keynote, the running of the melodic line, rather than certain momentary skips or intervals, which carry the suggestiveness and meaning of the music.

In securing the responses of the individual listeners, there are also many sources of error to be avoided. The responses should be as objective and simple as possible in order that they may be summarized quickly and accurately by *E*, and treated quantitatively. But *O* must not be forced into a judgment of the meaning when he does not spontaneously respond in that particular way, and he must be provided with a wide selection of responses, so that he may be exactly suited in his final choice. From the point of view of both *O* and *E*, a most satisfactory method of recording responses is by means of a list of 66 adjectives, arranged in 14 groups,[6] from which

[6] The list of adjectives is given in an earlier study, Hevner, *op. cit.*, this JOURNAL, 47, 1935, 109.

the listener checks all the adjectives which he finds appropriate to the music. This makes the business of choosing responses easy and convenient for *O*, and allows an objective and quantitative treatment by *E*. From the original response sheets of the listeners, each of whom had a fresh copy of the adjective list for every different musical composition, it was a simple matter to tabulate all the votes for any one adjective from all the *O*s for each composition alone, or for all the compositions which are alike in certain respects. Then, by comparing the numbers of votes for different adjectives, the meanings or affective characteristics of the compositions could be ascertained.

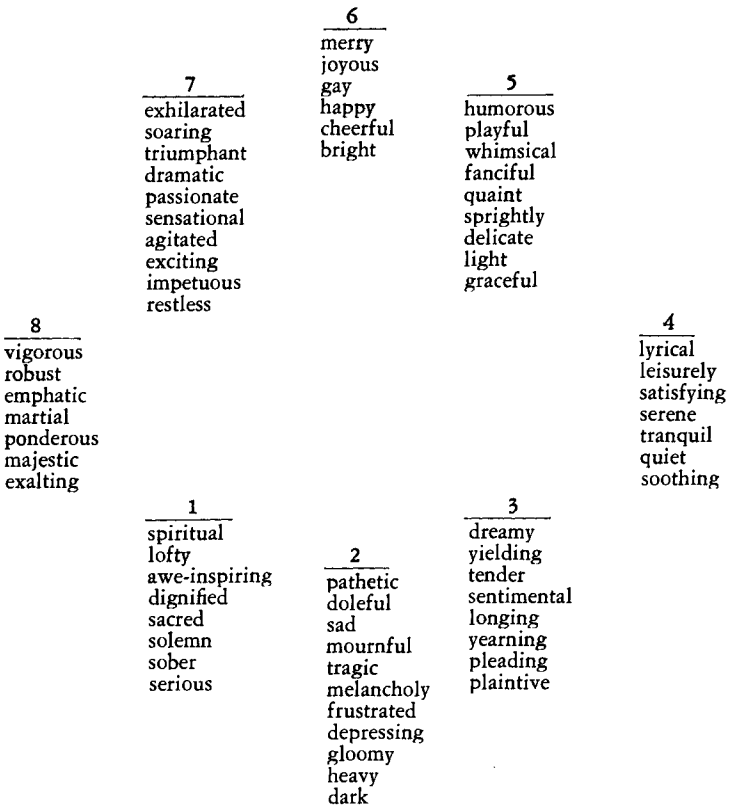


FIG. 1. SHOWING THE ADJECTIVES FROM LIST I ARRANGED IN 8 RELATED GROUPS

But a still further advantage has been gained for the use of this adjective-list method by a process of treating the data after they have been tabulated, a process of combining the individual adjectives into homogeneous groups, forming a more or less continuous scale. This process makes allowance for the errors arising either from the small disagreements on the part of the listeners about the exact definitions of words (which are important perhaps to the *O*s but certainly not to *E*), and from the effects of the momentary mood and physiological condition of the different *O*s which may modify slightly the mood-effect produced by the music. It also simplifies

tremendously the task of summarizing the data for comparing the results of different musical compositions, because of the fact that the adjectives are not treated as 66 individual entities, but are arranged into groups so that all those with the same feeling-tone may be considered together.

This grouping was accomplished in consultation with several *Os* who attempted to arrange their groups of adjectives around an imaginary circle in such a way that the adjectives in one group would be closely related and compatible with each other; that any two adjacent groups should have some characteristics in common, and that the groups at the extremities of any diameter of the circle should be as unlike each other as possible. The arrangement in Fig. 1 seemed the most satisfactory. This arrangement is not the only possible grouping along such a scale, and does not perfectly satisfy all the demands of the opposing groups. It has value merely in simplifying and summarizing the results of these studies. The adjacent groups have certain characteristics in common, and the transitions between them are made without abrupt or awkward changes in feeling tone. A complete circuit of the circle carries one quite smoothly over the range of the most common affective experiences. In studying the arrangement in the circle, we may note several details which are consistent with our usual concepts of affective states. Muscular tension is probably most strongly associated with the vigorous-robust exciting-impetuous groups, and least with the groups directly opposite, the sentimental-yearning and quiet-serene groups. Likewise, activity is associated with the four groups beginning with vigorous-robust through exhilarated-restless, merry-bright, and humorous-graceful, but quiescence is associated with the other four groups, from lyrical-soothing to spiritual-serious.

For our first experiments, we used phonograph recordings of 5 different musical compositions as follows: Debussy, *Reflections on the Water,* a piano solo played by Paderewski; Mendelssohn, *Midsummer Night's Dream, Scherzo,* played by the Philharmonic Symphony Orchestra of New York under Toscanini; Paganini, *Étude in E Flat Major,* a Liszt-Busoni arrangement, played as a piano solo by Vladimir Horowitz; Tschaikowsky, *Symphony No. 6 in B minor,* the second part of the first movement, played by a European orchestra conducted by Albert Gates; Wagner, *Lohengrin,* Prelude to Act III, played by the Boston Symphony Orchestra. These were all Victor records, and the first four were orthophonic recordings.

These 5 records were played to a group of 52 *Os*, who were directed to check from the printed list all the adjectives which seemed appropriate for describing the music and to check as few or as many words as they liked. Of course, no hint of the name or nature of the music was given by *E*, and by inquiry it was found that one person in the group could be expected to identify the music exactly, and one person more indefinitely as "something from Lohengrin," or "a Beethoven Symphony." The *Os* were students in the Elementary Laboratory course in psychology; the majority were sophomores, and about one-third of them were men. When the votes for each adjective were tabulated, it was found that in the case of each of the 5 compositions there were some *Os* who could find no adjectives appropriate, or at the most only one or two; but most of the *Os* checked 6 or more adjectives, and found it an easy and agreeable task.

The graphs in Fig. 2 show the results of this experiment. In order to plot the diagram for, let us say, the Tschaikowsky Symphony, all the adjectives used from one group were added, and plotted on a base-line, together with total number of adjectives used from all the other groups. In other words, every group of adjectives is

treated as a whole, as representing one kind of feeling tone. For convenience in plotting these graphs, the groups are arranged, not around a circle as in Fig. 1, but

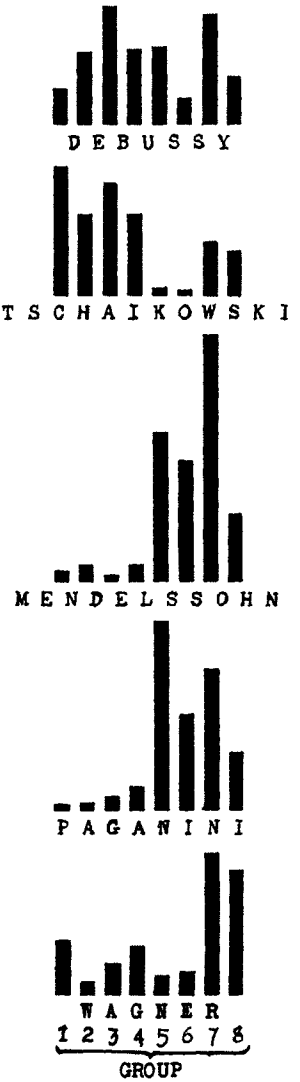


FIG. 2. NUMBER OF *Os* SELECTING ADJECTIVES FROM EACH GROUP

on a straight line, with the dignified-solemn group at the extreme left, and the robust-vigorous group at the extreme right. The reader must be warned that such an arrangement does not imply that the groups actually represent a linear scale with numerical

units. We have chosen these groupings quite arbitrarily, (1) because it was the opinion of the persons who first studied the adjectives that this was the best arrangement to bring out the logical and physiological realtionships between the groups, and (2) because empirical data, collected with these groupings on various kinds of aesthetic or affective material, poetry, music, and paintings, show a satisfactory 'patterning' which very much simplifies the work of presenting and summarizing results. The graphs in Fig. 2 represent the total number of adjectives used from each group, divided by the number of *O*s making the selection. This process of division is always necessary in order to make these graphs comparable to the graphs from later experiments with different groups of *O*s ranging in number from 20 to 100 plus. The graphs are always made in percentages, consequently the results from a group of 40 *O*s may be compared directly with those from a group of 65, etc.

In studying the graphs, the consistency and uniformity of the interpretation of the *O*s is immediately apparent. The reader must remember that adjective-groups 1 and 8 do not represent the extremes of a scale, but are as closely related as any other two adjacent groups on the scale, and that the pattern of the Lohengrin music shows as much consistency, with its concentration of votes for agitated-impetuous and vigorous-robust, its absence of votes in the central area, and its upthrust on the dignified-majestic group, as does the pattern for the Mendelssohn, where the concentration is more readily apparent to the eye. The diagrams are valuable, not only for the consistency and uniformity which they show, but also for the appropriateness of the interpretation in consideration of the composer's intention. Mendelssohn's *Scherzo,* to be played after the first act of Shakespeare's *Midsummer Night's Dream,* is outstandingly exciting-impetuous and playful-graceful, and there is a total lack of such affective states as serenity, sadness, dignity, and solemnity. The Prelude to the third act of *Lohengrin* stands out as impetuous-exciting, robust-vigorous, and it is even more interesting to find on the examination of our original tabulations that the heavy voting for this composition falls on the adjectives exhilarated, triumphant, majestic, and exalting. The Paganini *Étude* (a composition characterized by its emphatic rhythms and rapid tripping arpeggios, and presented by Horowitz with great brilliance and precision) lacks entirely the feeling-tone of sadness, dignity, or serenity, and suggests playfulness, gayety, excitement, and vigor. These interpretations are all the more significant because they have been made by listeners distinctly of the untrained type.

The Debussy composition, *Reflections on the Water,* is of especial interest because of the apparent uncertainty of the listeners, and the discrepancies which appear in the data. The adjectives used are scattered among the 8 groups with the greatest numbers from two groups in diametrical opposition to each other, viz. dreamy-sentimental and exciting-impetuous. There are two reasons which might account for these differences in interpretations. The first is the nature of the subject with which the composer is dealing. Reflections on the water are likely to be at one time clear, still, and distinct, and at another time distorted, restless, fitful, and changing, and the composer may have intended several different interpretations to be possible from his music. From this point of view the votes of our listeners may stamp this composition as a particularly successful bit of creative work. The second reason, which is important for many other compositions as well as this particular one of Debussy's, is the presence of several well-defined sections in the musical structure, sometimes quite different from each other. One of the commonest patterns for musical composition consists in a

division of the material into three parts, with the first and third similar or even identical, and the second a contrasting section, only remotely related to the preceding and succeeding parts.

In order to separate the various parts of the composition and trace the source of the votes for the different adjective groups, the experiments described above were repeated with a new group of *O*s, and with slightly different instructions. The new *O*s began to check their adjectives as soon as the suggestiveness of the music became apparent, by placing the numeral '1' before each choice. At a given signal from *E* which coincided with the beginning of a new section of the music, the *O*s indicated their choices by the numeral '2'; and so on for a third (a fourth or fifth) section, they changed to numeral '3,' etc. Tabulations were made for the three different sections of the piece, and the graphs which show these results are given in Fig. 3. The reactions occasioned by the first part of the composition appear in diagonals, for the second part in solid black, and for the third part in white areas. The separations for the *Reflections on the Water* were made at bars 22 and 75 and the sources of the different affective patterns are very clearly shown. The first and third sections are quite similar in character: dreamy-sentimental, serene, calm and slightly graceful, and playful. In sharp contrast, the middle section is very playful, rather merry, and extremely restless, exciting, and agitated.

With the two experiments carried out under two sets of directions, it would not be logical to expect that combining all the adjectives numbered 1, 2, and 3 in the second experiment would give the same pattern when plotted as the graph for the same music from the first experiment (Fig. 2). An inspection of Fig. 3 shows that if such a procedure were followed, there would be a great preponderance of votes for certain adjective groups, especially Groups 3 and 4, because the recurrence of the first section at the end of the composition makes it necessary for the listeners to vote for those adjectives twice. A comparison of the graphs in Figs. 2 and 3 does reveal, however, the fundamental agreement in the interpretations of the two groups, while the differences due to the slightly different experimental conditions are distinctly brought out. It is quite likely that the *O*s maintained a much higher degree of attention to the music in the second experiment than in the first.

In Fig. 3, results are given also for several other compositions. The Tschaikowsky *Symphony* is of especial interest, for the excitement and agitation are shown to originate in the second section which is higher, faster, and thinner than the first, and from the third section, which is a repetition of the first with much more volume and with a more elaborate orchestration, including a prominent glissando effect in the violins.

Two of Beethoven's *Sonatas* were also used in this part of the study, the *Seventh, in A major,* third movement, first half, and the *Fifth, in C minor,* first movement, first half,[7] and the results are shown in Fig. 3. In both of these compositions the first and third parts are alike and the second part is different in tempo, rhythm, theme, and orchestration. The graphs of the mood-effects bring out these factors very clearly, especially in the excerpt from the *Fifth Symphony,* where the first and third sections were identical in every way. The more complicated graph for the Mendels-

[7] The music is played by Felix Weingartner and symphony orchestra, Columbia record. In the Fifth Symphony the music is divided at the 71st and 125th bars; in the Seventh at the 145th and 237th.

sohn *Scherzo* is not included, although its five different parts showed equally interesting and consistent results.

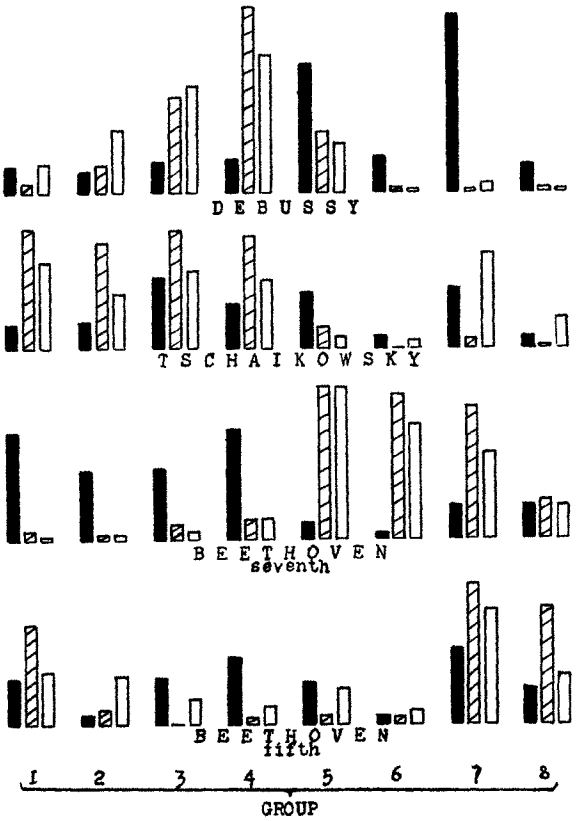


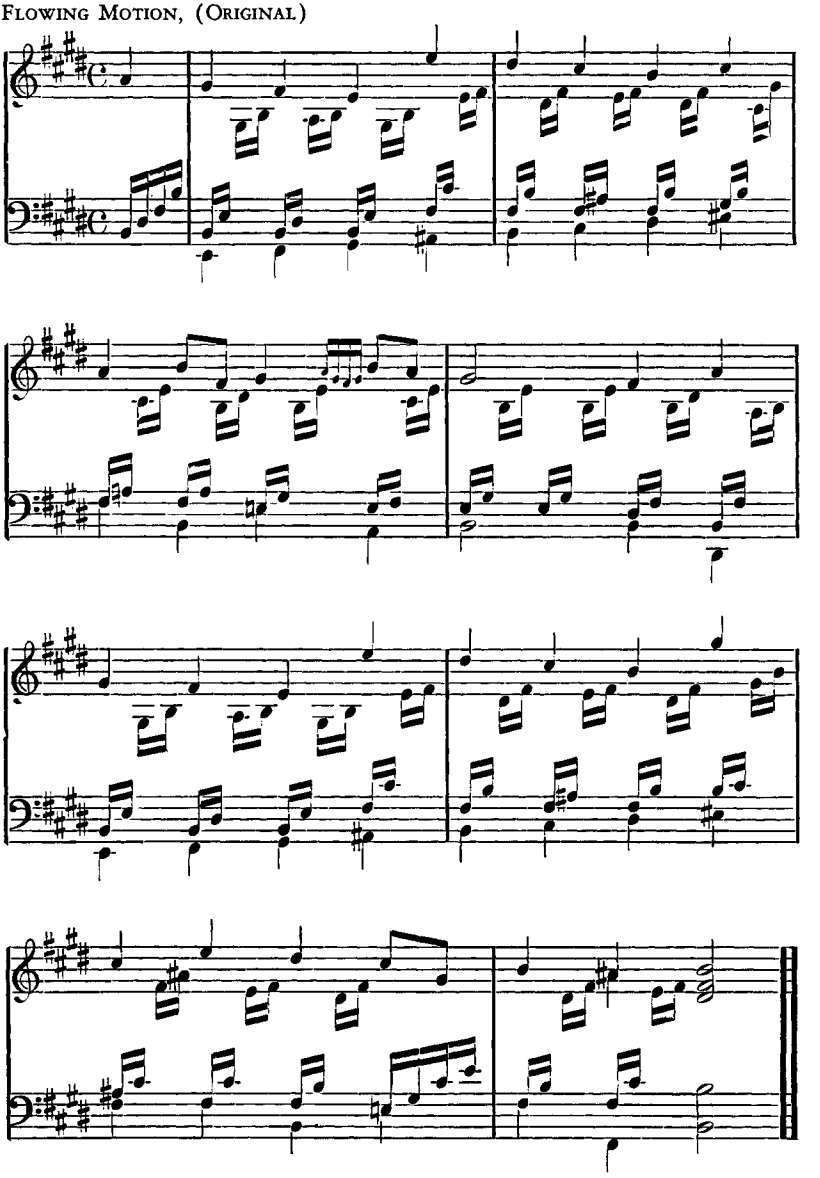
FIG. 3. NUMBER OF *Os* SELECTING ADJECTIVES FROM EACH GROUP

Since the adjective-group method was shown to be successful in handling the data from these longer compositions, the same process has been applied also to the study of the affective character of certain *elements* of musical structure. The method of isolating the element to be studied follows the method described in an earlier experiment, on the affective qualities of the major and minor modes.[8] Two versions of the same composition were presented to two different audiences who were asked to express their attitude toward the music by checking adjectives. The music in the two versions is arranged in such a way that the difference between them lies only in the one element to be studied, and the listeners indicate their interpretation of the music

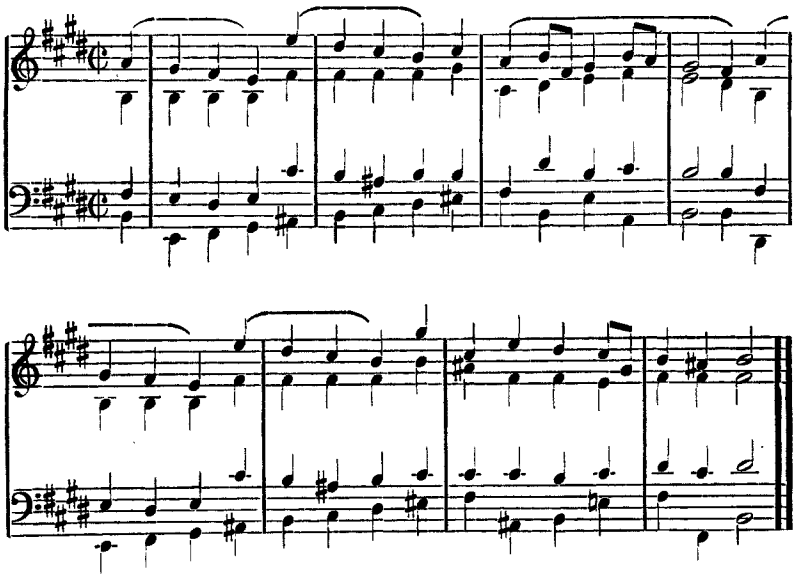
[8] For a complete discussion of the advantages and disadvantages of composing experimental music in this way *cf.* the author's previously cited article. The music must be carefully chosen, and rewritten by the most expert musicians. For invaluable assistance in this work the author is indebted to Miss Hariett Johnson, pupil of Rubin Goldmark, Lecturer for The Layman's Music, Inc., New York; and to Mr. John Verall of the Music Department, Hamline University, St. Paul.

MENDELSSOHN SONG WITHOUT WORDS
(Descending melody)

FLOWING MOTION, (ORIGINAL)



FIRM RHYTHM

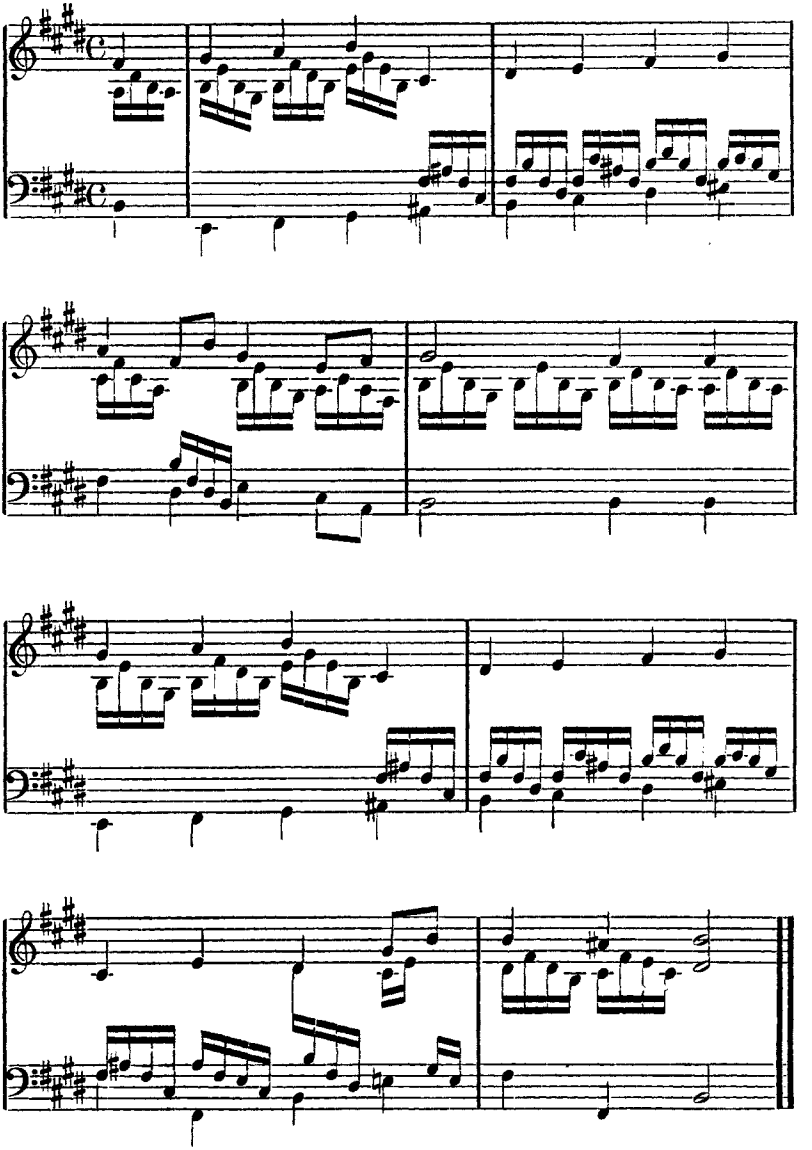


by checking all the adjectives, many or few, which they find appropriate. In no case did the same group of listeners hear both versions of the same composition. The program of music for any one group was arranged to include 10 different compositions, with a wide variety of rhythms, melodies, and harmonies. They were played by the same pianist, who had practiced under observation until the two versions of each composition were executed at the same tempo and intensity and with the same interpretative effects. The objective records of the critic observer on prepared schedule blanks show that her interpretations of the music exhibit an extremely high degree of similarity for the various performances.

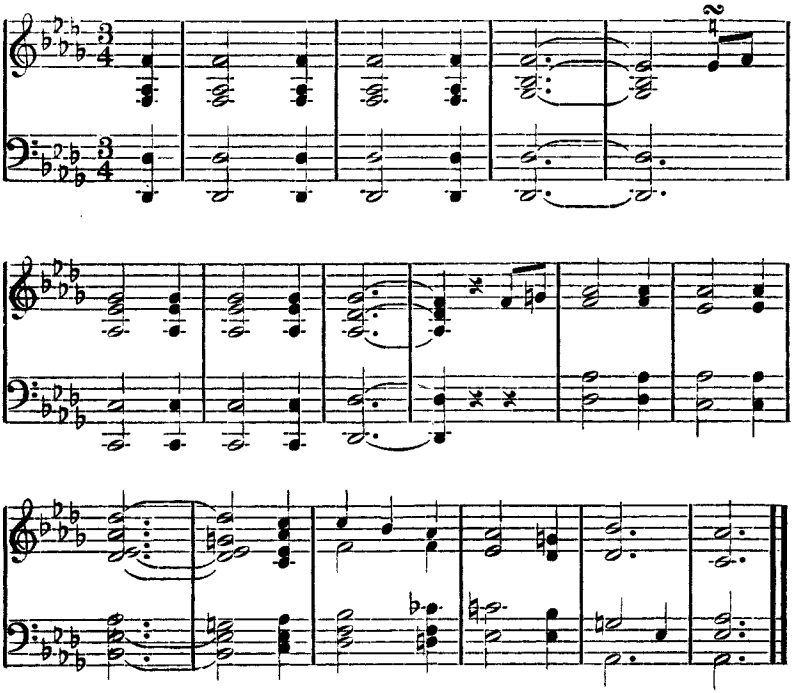
In the first group of 6 compositions the element changed was the *rhythm or motion* of the music. The motion was changed from a firm beat with a full chord on every beat as in a chorale or hymn tune, to a much more smooth and flowing motion in which the supporting chords were broken up and spread evenly throughout the measure. A part of the accompanying harmony occurred not only on each beat but on every half beat with the result that the motion of the flowing version was more continuous and less definitely accented than that of the firm version. As an example of the type of change, we will reproduce the music scores for twelve measures of a Mendelssohn *Song Without Words,* Op. 19, No. 1.

In the second group of 9 compositions the variable to be studied was the *rising and falling of the melodic line.* In preparing the experimental material, the author chose a number of short compositions representing a variety of styles and characters, sad, gay, serene, exciting, etc., and a variety of melodic lines. In the Beethoven Op. 13, for example, there is a long and vigorous rise in the melody through two octaves. In the Mendelssohn Op. 19, the melody opens with three slow climbing phrases. In the Schumann Op. 15, No. 5, the melody is strongly descending in character, a short descending motif carried down through 4 octaves. In other compositions the original

MENDELSSOHN SONG WITHOUT WORDS
(Ascending melody)



BEETHOVEN, OP. 10. SIMPLE HARMONY, (ORIGINAL)



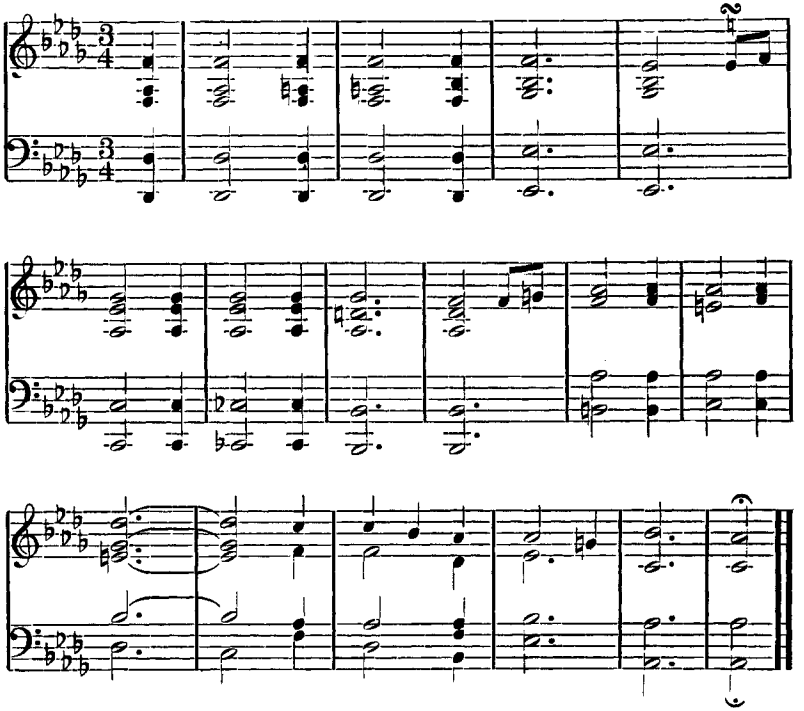
melody had but a very slight rise or fall, and in others it was practically stationary. In each of the compositions the original melody was inverted. The inversion was done as exactly as possible; the skips were of the same size and location, but in the opposite direction from those of the original melody. As an example of the treatment, we quote here another version of the Mendelssohn *Song Without Words,* Op. 19, No. 1, an ascending version, which the reader may compare with the descending melody quoted on page 255.

Of the compositions on which this process was first tried out, many melodies were found to be unsuitable, just as many melodies cannot be used as fugue themes, because they do not lend themselves to the intricate manipulation necessary in fugue composition. In choosing and rewriting the music for these studies the most important consideration was that of making the two versions different in one factor only, the ascending or descending character of the melodic line. The many difficulties that arose in performing this task were met in different ways, as follows.

(1) The new melody resulting from the inversion did not always sound sensible or logical, and was often unmusical, and even unpleasant. Many compositions were tried and discarded for this reason.

(2) The harmony demanded by the new melody was not always the same as the harmony of the original and hence, certain harmonic changes were effected in the new version. In making these changes, the general character and style of the harmony was always maintained, although the dominant triad sometimes became a dominant seventh, the VI chord was sometimes changed to the II, etc. Compromises

COMPLEX HARMONY



had to be made between the demands of the harmony and the exactness of the inversion of the melody.

(3) It was sometimes difficult to keep the relation of the melody to the tonic or keynote exactly parallel throughout the length of the two versions. The keynote is the point of reference for all parts of the melody and returns to it are important because they give a feeling of satisfaction and finality which helps to establish the form of the composition and give it balance and unity. The parallelism was always strictly maintained, however, at the ends of the phrases, since they mark off the melody into definite parts and determine the kind of symmetry it shall have. It is understood then that the inversions of the melodies were never perfect, but that they were as exact as these other considerations could allow.[9]

In the third group of 9 compositions the modifications were made in the harmonic structure of the music, changing it from simple, consonant harmonies, resolved in a very smooth and satisfying manner, to complex, dissonant harmonies, more harsh and rough, and not always reaching a satisfactory resolution. The versions which we call complex have augmented and diminished intervals and modern effects. It will be surmised from the discussion of the difficulties encountered in making melodic

[9] The difficulties encountered in inverting melodies were so great that this part of the experiment was entirely revised and repeated, with new music and new *O*s. The music for the second experiment was much more satisfactory to the music critics, but the results from the two series are very little different, and therefore only the second experiment is reported here.

TABLE I

SHOWING THE VOTES FOR EACH ADJECTIVE GROUP, FOR 6 COMPOSITIONS IN FIRM RHYTHM AND IN FLOWING RHYTHM

	Adj.-Group	Beethoven, Op. 13	Schumann, Op. 15 No. 5	Mendelssohn, Op. 19 No. 1	Schubert, *Sonata*, No. 120	Prokofieff, Op. 12	Schumann, Op. 18	Total	$\frac{D}{PE_D}$
Firm	1	11	79	126	27	3	36	282	17.7
Flowing		14	4	8	6	17	10	59	
Firm	2	30	32	20	9	10	13	114	2.7
Flowing		11	7	10	0	26	14	68	
Firm	3	5	0	37	17	15	14	88	9.5
Flowing		13	12	57	33	39	32	186	
Firm	4	2	4	73	72	21	18	190	1.9
Flowing		6	33	64	51	35	27	216	
Firm	5	5	2	14	42	94	21	178	7.7
Flowing		16	100	32	42	46	40	276	
Firm	6	11	3	1	45	50	13	123	10.4
Flowing		26	86	14	68	28	19	241	
Firm	7	143	68	4	11	13	33	272	1.7
Flowing		91	32	13	12	27	71	246	
Firm	8	68	116	8	22	4	21	239	10.4
Flowing		29	8	4	6	12	14	73	

TABLE II

SHOWING THE VOTES FOR EACH ADJECTIVE GROUP, FOR 9 COMPOSITIONS IN SIMPLE AND COMPLEX HARMONY

	Adj.-Group	Johnson, *Gigue*	Bach, *Chorale*	Gluck, *Andante*	Johnson, *Vigorous & Lively*	Verall, *Chorale*	Mendelssohn, Op. 64	Beethoven, *Sonata* Op. 10	Grieg, *Wedding Day*	Palestrina, *Choral*	Total	D / PED
Simple	1	0	75	9	2	149	4	141	11	74	465	3.0
Complex		0	59	34	3	82	39	83	48	50	398	
Simple	2	0	88	9	0	135	13	29	6	54	334	7.3
Complex		0	70	24	1	105	45	74	48	90	457	
Simple	3	0	49	84	0	6	143	31	39	26	378	3.7
Complex		1	4	83	0	19	99	27	32	48	313	
Simple	4	6	41	139	6	8	114	27	33	35	409	10.1
Complex		2	0	96	1	7	71	11	15	8	211	
Simple	5	126	3	122	91	0	19	2	31	1	395	12.0
Complex		91	0	48	32	0	9	2	2	2	186	
Simple	6	166	0	37	96	0	2	0	22	0	323	16.0
Complex		75	0	9	32	0	0	0	0	0	116	
Simple	7	39	0	1	88	2	1	4	14	1	150	14.5
Complex		114	14	4	194	10	8	42	7	7	400	
Simple	8	8	8	0	21	23	0	24	12	18	114	8.3
Complex		28	32	2	55	26	5	37	9	9	221	

TABLE III

SHOWING THE VOTES FOR EACH ADJECTIVE GROUP, FOR 9 COMPOSITIONS IN ASCENDING AND DESCENDING MELODY

	Adj.-Group	Beethoven, Op. 13	Gluck, *Caprice*	Grieg, *Wedding Day*	Verall, *Prelude*	Schumann, Op. 15 No. 5	Mendelssohn, Op. 19	Verall, *Nocturne*	Schumann, Op. 18	Mendelssohn, Op. 62	Total	$\frac{D}{PE_D}$
Ascending	1	5	56	27	15	31	5	5	2	27	173	4.5
Descending		21	8	12	15	21	9	15	0	14	115	
Ascending	2	2	10	25	28	5	6	7	0	27	110	.00
Descending		10	7	4	43	2	5	17	0	14	102	
Ascending	3	0	22	19	34	0	40	26	5	83	229	.20
Descending		2	32	30	24	0	44	52	0	27	211	
Ascending	4	1	28	14	20	0	66	17	15	55	216	3.8
Descending		1	40	17	20	0	77	63	8	23	249	
Ascending	5	0	53	14	10	0	17	31	80	4	209	2.6
Descending		0	20	9	42	0	34	65	46	11	227	
Ascending	6	2	11	8	1	6	5	8	72	1	114	2.5
Descending		4	4	6	9	9	14	15	42	4	107	
Ascending	7	65	1	10	0	78	0	2	20	3	179	6.6
Descending		178	0	0	11	42	2	1	16	1	251	
Ascending	8	38	3	12	1	130	1	0	0	1	186	1.00
Descending		115	0	3	2	61	2	1	0	0	184	

TABLE IV

SHOWING THE VOTES FOR EACH ADJECTIVE GROUP, FOR 10 COMPOSITIONS IN MAJOR AND MINOR MODE

	Adj.-Group	Schumann, *Folk Song*	Beethoven, *Minuet*	Bach, *Minuet*	Martini, *Gavotte*	Bach, *Musette*	Rameau, *Rigaudon*	Durand, *Chaconne*	Gluck, *Andante*	Arensky, *A Song*	Rameau, *Tambourine*	Total	$\frac{D}{PE_D}$
Major	1	20	20	14	8	13	10	1	95	209	5	395	4.0
Minor		43	74	20	28	46	21	4	108	144	23	511	
Major	2	7	20	4	0	7	7	0	38	163	5	251	20.0
Minor		67	95	17	30	111	56	3	122	224	23	748	
Major	3	33	68	10	13	43	16	4	75	105	8	375	12.0
Minor		107	140	32	68	111	42	9	125	84	29	747	
Major	4	53	99	49	45	82	33	30	131	127	27	676	3.4
Minor		52	124	60	40	71	29	22	94	57	25	574	
Major	5	152	104	225	210	139	108	287	47	8	245	1525	21.2
Minor		90	87	97	107	83	87	134	25	4	102	816	
Major	6	174	69	215	244	93	128	335	11	0	210	1479	24.2
Minor		64	21	67	93	25	61	155	4	0	114	604	
Major	7	42	27	102	59	17	47	84	16	11	115	519	0.00
Minor		43	24	66	22	35	95	96	32	7	125	545	
Major	8	16	6	32	31	5	34	30	15	12	57	238	0.00
Minor		20	11	23	12	9	41	22	23	18	64	243	

versions that the new harmonies sometimes wrought changes in the melodic line, so that it became a slightly different melody, even though the sequence of tones remained identically the same. To meet this argument, we can but repeat that we were aware of such dangers, and have guarded against them as far as possible in the rearrangements of our music. In order that the reader may have the opportunity of judging for himself in these matters we quote one typical example of our musical material, eight measures from Beethoven, Op. 10.

Table I shows the number of times each adjective group was selected for both the firm and flowing versions of the 6 different compositions. The total number of votes for all 6 compositions is also shown, and the ratio of the difference to its probable error for each group.[10] These ratios, shown in the last column of the table, are the most important figures for estimating the difference in the affective value or expressiveness of the two different rhythms, and therefore are expressed graphically in Fig. 4. Tables II and III present similar data for the rising and falling of the melodic line and for the simplicity and complexity of the harmony. Table IV presents data from an earlier experiment with the major and minor modes.

In Fig. 4, the significant data from all four tables are presented in graphic form. The octagonal figures represent the 8 different adjective groups designated here by one or two characteristic adjectives from each group. (The reader may refer to Fig. 1 for the full list of adjectives in each group.) There is a separate figure for each of the variables studied, modality, rhythm, harmony, and melody. The ratios of the differences to their probable errors (D/PE_D) are represented for each group in an appropriate symbol, so that the reader may see at a glance the importance of each element in differentiating the mood effects of the music.

It is apparent that the use of the major or minor mode is of the most clear-cut significance in the expression of four different mood effects, that the major mode is very strongly associated with happiness, gayety, playfulness and sprightliness, and the minor with sadness, and with sentimental yearning, tender effects. The expressiveness of modality, either major or minor, is more stable and more generally understood than that of any other element which we have studied. It is of equal interest to note also that the modality has no discoverable effect on the expressiveness of some of the affective states, on dignity, vigor, excitement, or calm. Those states can be produced equally well by means of either mode.

The firm or flowing motion in the rhythm divides the circle of adjectives exactly in two, and has its most important effects on a different axis of the circle, on the dignified and vigorous *vs.* the happy, playful, sprightly groups. These differences fall where musical tradition and custom would

[10] Calculated by Yule's formula and the Edgerton-Paterson tables, *J. Applied Psychol.*, 10, 1926, 378-391. The total number of adjectives used is taken as a percentage of the total number possible, *i.e.* the number of *O*s multiplied by the number of adjectives in the group, usually a total of between 3000 and 4000. The ratios would all be much larger save for this very conservative way of estimating the percentages, for use by every *O* of every adjective is not, after all, a real possibility.

lead us to expect them and on the whole seem quite logical and acceptable.

The differences brought about by simple *vs.* complex harmony, or we might say by consonance *vs.* dissonance or classic *vs.* modern harmony, are for the most part effective on the 5 adjective groups on the upper half

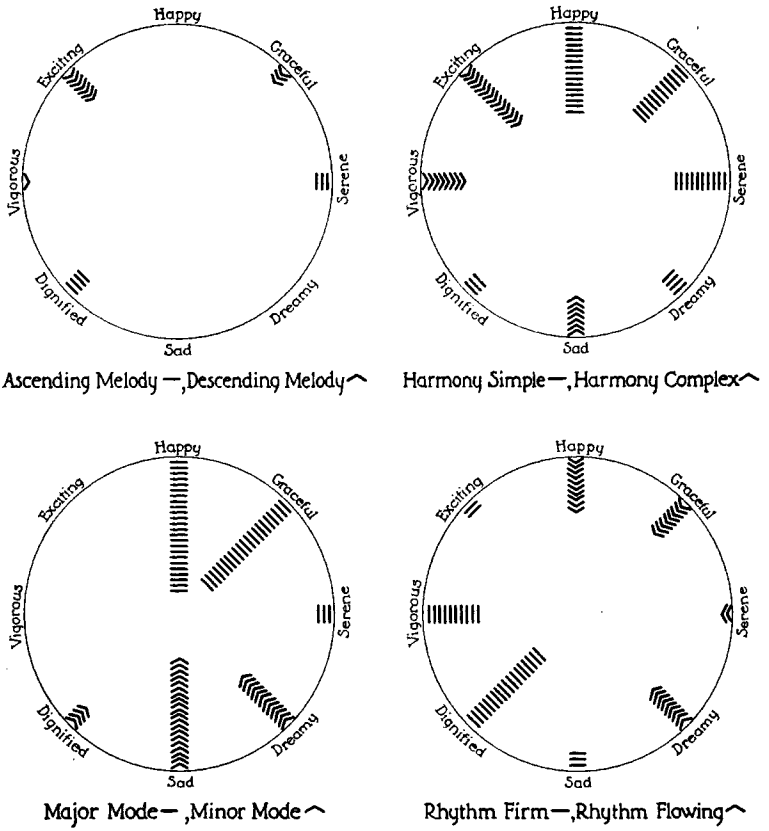


FIG. 4. SHOWING THE RELATIVE IMPORTANCE OF MODE, RHYTHM, HARMONY, AND MELODY ON THE AFFECTIVE VALUE OF MUSIC

of the circle. The simple consonant harmonies are happy, graceful, serene, and lyrical. The dissonant modern harmonies are exciting, agitating, vigorous, and somewhat sad. The differences are substantial, but not as clear-cut as those for the major and minor modes.

In comparison with the other three figures, the circle representing the effects of the rising and falling of the melodic line is particularly noteworthy for its lack of significant differences. The largest difference, indicating that the descending melodies are more exciting and impetuous,

is only 6 times its probable error. The importance of this finding is minimized by the difference likewise in favor of the descending versions, for the adjective group calm, lyrical, serene, etc. The descending versions give only one significant difference, on the dignified-serious group.

The first inference to be drawn from a study of these results is the relative importance of these four elements in expressing the affective tone of music. Apparently the melody, at least the rising or falling of the melody, is of much less importance than the harmony, or rhythm of the music, and the modality is most important of all. It must be remembered that the figures indicate the expressiveness of these elements only in relation to one another. Compositions written in the major mode are not always gay and playful and nothing else. They are only *more* gay and *more* playful than the same compositions played in the minor mode. Likewise, a composition with a firm rhythm will be much more serious, dignified and vigorous than the same composition with a flowing rhythm. But a composition in which the harmony and rhythm remain identical and only the melody is changed by inverting it, apparently does not suffer a change in its expressiveness which distinguishes it in any constant and predictable way from the original.

To some extent these differences in the definiteness of the expressiveness of these elements are the function of the complexity of the element. A change from major to minor is very simple, definite and limited, but there is an infinite variety of ways in which a melodic line may ascend—a long slow ascent, or a succession of short rises, reaching a high point very quickly, a slowly rising pattern of scale-like figures or a series of large skips with repeated climaxes. There is also a variety of ways in which rising and falling of the melody may be combined so as to give prominence to either one quality or the other. In our studies we have chosen 9 compositions which display a variety of melodic patterns, and with these compositions we do not find consistency in the results. More elaborate studies in which certain aspects of rise and fall in melodies are isolated in independence of each other, or studies of some other qualities of the melody, *e.g.* its circular or pendular motion, may demonstrate a much greater importance for the expressiveness of melody.

We believe that refinements in the method of these experiments, especially in the rewriting of the music, will yield results even more striking and clear-cut than those which we are quoting here. Although every possible precaution is taken to eliminate from the experimental material every composition whose two versions differ in more than one respect, it is difficult to anticipate every possible deviation which might affect the results. The two compositions must be matched for tempo, rhythm, harmony, and melody, and the musical beauties of both versions must not be sacrificed in any way.

The results for our studies of rhythm would give much more clear-cut differentiation were it not for one error which occurred in the use of the Prokofieff Gavotte. On every second and fourth beat in the firm version there is a grace-note introducing the chord. This grace-note was not included in the flowing version, and its presence undoubtedly causes the increase in playfulness and gayety which this one composition alone shows for the *firm* version (see Table I). A further analysis of the studies in harmony would also lead to some further details of expressiveness. A comparison of our complex versions in which the chords were diminished and those in which they were augmented leads us to the conclusion that the augmented dissonance, *e.g.* the nervous modern discords in the modern 'movie' style, makes the music more exciting and impetuous, and that diminished and minor seventh dissonance makes the music more depressed and yearning. A more detailed study of these two factors might establish these differences quite exactly.

There are certainly additional elements of expressiveness which we have not investigated here, and there are other aspects of these four elements which are no doubt of great importance in the expressiveness of music. We have left entirely untouched the effect of tempo, for example, an element which could be investigated by this method with the greatest ease. We have studied only one aspect of rhythm, and left unexplored two aspects which would probably prove to be of importance, the duple *vs.* the triple rhythm, and the smooth *vs.* the jerky rhythms. In our studies of harmony we have still to explore the effect of different kinds of resolutions and different styles of consonance and dissonance, augmented and diminished, etc. The interrelations between these harmonic styles, augmented dissonace in major *vs.* augmented dissonance in minor, may also be explored.

The relative importance of the various elements, tempo, rhythm, harmony, etc., would best be studied by an extension of our method, in which eight or more versions of the same composition would be written, embodying all the possible permutations of several variables. A half-dozen compositions, very carefully selected and treated in this way, would not completely solve all of the problems of expressiveness of music, but would certainly extend our knowledge of the field beyond its present restricted limits.

SUMMARY

(1) In these experiments, we have assumed that there is some systematic symbolism underlying the expressiveness of music, and we have been able to show that the meaning of both short and long compositions, (short themes of 8 to 12 measures and complete musical compositions such as opera preludes and symphonic movements) is generally understood by both trained and untrained listeners. There is striking uniformity and consistency in the interpretations.

(2) The *O*s report their reactions by checking adjectives from a printed list, and the process of combining the adjectives into homogeneous groups for statistical treatment has greatly simplified and clarified the results, and has emphasized the consistency and the systematic character of musical meanings.

(3) We have tried to isolate four of the elements of musical form in

order to discover the meaning or character that is associated with each. The method is that of preparing two versions of a musical composition which differ in one respect only, for example, the rhythm. In this way, the element to be investigated is left in its proper setting, and the stimulus which the *O* hears is real music, not isolated chords, or unsupported melodies.

(4) The elements studied and their associated meanings as determined by this method are as follows: (a) The major mode is happy, merry, graceful, and playful, the minor mode is sad, dreamy, and sentimental, and such qualities as excitement, vigor, dignity, serenity, etc. are not determined by either mode. (b) Firm rhythms are vigorous and dignified; flowing rhythms are happy, graceful, dreamy, and tender, and neither is particularly useful in determining such characteristics as excitement, satisfaction, and serenity. (c) Complex, dissonant harmonies are exciting, agitating, vigorous, and inclined toward sadness; simple consonant harmonies are happy, graceful, serene and lyrical. (d) Differences in expressiveness caused by the rising or falling of the melodic line are not clear-cut, distinct, or consistent. There are tendencies toward the expression of both exhilaration and serenity by the descending melodies, and toward dignity and solemnity by the ascending.