

MUSICAL PREFERENCES AND PERSONALITY DIAGNOSIS:
I. A FACTORIZATION OF ONE HUNDRED AND
TWENTY THEMES*¹

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A. THE SETTING OF THE PROBLEM

So powerful is the effect of music upon human emotions and so striking are the apparent changes in personality sometimes produced that one is surprised to find in the history of psychology and psychotherapy so little experimental, or even speculative, reference to the use of music in psychiatry. Probably the first sustained attempt to explore the value of music as therapy was made by a group of psychiatrists at the Walter Reed Hospital, during World War II, under the stimulus of the large number of psychiatric casualties requiring treatment. This first pragmatic approach has fortunately been developed into a more permanent research organization by one of the participants, Miss Paperte, in her creation of the Music Research Foundation. The present article proposes to review very briefly the nascent research in this area and to set out the results of a three-year research project supported partly by the Music Research Foundation and partly by the Graduate School of the University of Illinois.

In reviewing the first research results now belatedly blossoming it is instructive to perceive the reasons for the postponement of effective attacks. In the first place, the experimental psychologists have been in retreat from the general study of aesthetics ever since they were signally defeated by the problem at the beginning of this century. Secondly, the chief theory underlying psychotherapeutic advances, namely psychoanalysis, has been silent as to the mechanisms behind our aesthetic satisfactions. For Freud himself (to quote H. B. Lee) (20) stated, "The nature of artistic attainment is psychoanalytically inaccessible to us" and that psychoanalysis "can do nothing towards elucidating the nature of the artistic gift, nor can it explain the means by which the artist works." This did not prevent Freud himself and

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many other psychoanalysts attempting to get at the roots of literary creativity, but by contrast with fairly successful analyses of literature the realms of music and of graphic art have been significantly ignored. It is, of course, possible to point to psychoanalytic studies of musical creativity (21) and of musical satisfaction, as well as such sustained attacks on the problem of graphic art as that of Goitein (17), but the methodology and logic of these studies in general leaves one with greater admiration for the restraint of Freud, based on a wise appreciation of the difficulties of the subject, than for these attempts to fill the gap at all costs.

From a general psychological point of view, one may be more impressed by the evidence of music as a catharsis for unexpressed emotions than as an influence which can produce lasting changes of personality, despite the argument of Aristotle, and many others since, that relatively permanent effects upon personality may be produced by repeated exposure to certain kinds of music. Indeed one of the most likely theories on which to base research would be one analogous to Freud's theory of humor (15), namely, that the devices of melody and rhythm act as a fore-pleasure to bribe the censor, whereby the repressed emotional tendencies are released, in this case in the form of phantasy. That music acts as a distractor of potential conscious action upon the lower centers is indicated by the effective use of music by Cherry and Pallin (12) in anaesthesia. If catharsis of the unconscious can be continuously achieved by appropriate music, presumably some relatively permanent effects on personality would ensue.

Advance in our knowledge of psychotherapy, in any of its branches, must wait upon advance in possibilities of measurement of (*a*) the degree of improvement recorded under the influences applied and (*b*) the amount of the therapeutic activity applied. The present research concerns itself with the second of these but also very largely with the distinct problem of diagnosis. It asks: "Is there a tendency for preferences for certain kinds of music to be systematically related to the kinds of personality structure?" This is relevant to the second (therapeutic) problem above because it asks: "What type of music can in fact be regarded as an adjusting or therapeutic agent for this particular personality," and it can at least be argued as a tactically intelligent move in research, that we should begin our enquiries in this way by studying diagnosis rather than plunging directly into the harder problem of therapy. Our approach, in short, anticipates that there will be marked differences in the kinds of catharsis which different personalities will require, and argues that the investigation of these differences may be the best starting point for later work on psychotherapy itself.

We have not been able to discover any psychological research whatsoever establishing relations between musical preference and personality, but we have found one or two studies in related areas useful in directing our planning. These studies, notably by Capurso, Kerr and Rigg, are concerned with the immediate emotional effect of music. The remarkable series of studies by Rigg (22, 23, 24, 25) has attempted the ultimate goal of analysing out the characteristics of musical phrases, etc., which consistently produce specific emotions. This work, based partly on the theories of Sorantin (28), is not *directly* related to the step by step progress of the present direction of research. Kerr (19) has concentrated on the general psychological effects of music. Capurso (1), aided by the Music Research Foundation, has attempted, as we have, to make a comprehensive survey upon which long term research can build architectonically. He has asked "What are the varieties of emotion which music can produce?" and "Can we build up a library of musical excerpts classified according to the emotional mood which each may be expected to produce?" He arrived at seven or eight emotional categories (*a*) Happy, elated, triumphant; (*b*) Soothing; (*c*) Agitating, stimulating restlessness; (*d*) Nostalgic, meditative; (*e*) Reverent, prayerful; (*f*) Sad, melancholy; (*g*) Eerie, weird, frightening. In our attempt described below to get the most catholic selection of music the lists in Capurso's categories offered one valuable sampling basis.

The aim of the research report in this and two succeeding articles (9, 10), sustained partly by the author's own research resources and partly by the Bonfils Fellowship and other assistance from the Musical Research Foundation, has been to investigate relations between musical choice and personality, in normal and pathological subjects. Secondly, it aims to produce a music choice test for personality diagnosis (11).

B. THE CONTROL OF INFLUENCES EXTRANEEOUS TO PERSONALITY

Certain difficulties, sometimes asserted to be insurmountable, have from time to time been pointed out in the use of musical choices as the indicators of personality. For example, Chaplan, writing from the standpoint of a sociologist, has argued that "the written or stated reactions to music reveals semantic, culturally conditioned replies and are not necessarily conclusive" and he quotes Soibelman (27) as expressing doubts on existing methodology by saying: "What has been attempted is, in fact, the measurement of a mood which is transient and personal, by a unit that is itself evanescent and intangible." It must, indeed, be admitted that there is a considerable possible element of error in dealing with responses to music by means of the

questionnaire type of approach and that any analyses based on a literal use of the apparent meaning assigned by subjects in verbal responses is scientifically questionable. In the study which follows we have attempted as far as possible to take a "behavioristic" approach, limiting the subjects' participation to a mere indication of liking or aversion—of letting the music continue or shutting it off. The fuller interpretation of what emotional quality this liking or aversion has must be left to the pattern of responses in which it occurs.

Our aim must be to see first whether consistent, common patterns of choice exist in a set of musical excerpts and thereafter to discover what features of personality or stimulus situation are responsible for each of these. The factors, other than enduring personality traits, which might be responsible for consistent patterns are: the mood of the subjects through events prior to listening; the stimulus situation; and specific patterns of musical or general cultural education. As to the last of these, the culture to some extent determines what shall be considered harmonious in music just as it determines to some extent what shall be considered humorous in jokes.

In the main, we must address ourselves to this difficulty in music in the same way as we have done in our experimental work in humor (3), namely by aiming to establish relations to personality only within a certain culture, assuming that further work needs to be done before the tests are carried over any cultural frontier. Nevertheless, it is possible that certain patterns will be traceable to belonging to certain groups within our culture pattern. For example, the preference for jazz music in contra-distinction to classical, which appeared as a pattern in a study by Vernon (30), and which recurs in our results, seems to be part of a general cultural allegiance and is probably partly determined by social status and age.

The extent to which choices are determined by transient moods or stimulus situations was determined at the outset by repeating the choice test after a day, a month, six months. The result (below) shows that an appreciable influence must be allotted to these factors which, from the point of view of our present interest are merely annoying "error"; but it also demonstrates that enduring features of personality account for much of the variance.

In an exploratory study one must hold constant a great deal; but not anything one wishes to study. We held constant the age (and to some extent the education) of our subjects: we settled the question of how much error arises from mood and other influences which could not be held constant; and, as the following section shows, we controlled some extraneous influences in the musical choices by having all items played by the same person on one

instrument (piano) and by choosing pieces which, except for an accepted minority of definitely familiar pieces, would be new to all except persons with a musical education. The extent to which purely individual historical associations (idiosyncratic conditionings) reduce the common "temperamental" meaning of a piece of music can only be decided after factorization and the examination of the amount of common factor variance.

C. SELECTION OF THE MUSICAL ITEMS IN RELATION TO EXPERIMENTAL PRINCIPLES

The considerations governing the choice of musical items for this investigation can become clearer only now that the outline of the whole research design can be indicated. Our main hypothesis is that the dimensions of personality which have been discovered in other media, such as objective tests, questionnaires, and behavior ratings (2, 4, 5, 7) will show themselves also in musical choices. To test this, we might either correlate the musical items with measures of these personality dimensions or we might first establish independent factor dimensions within the musical choices and then correlate each of these with the personality dimensions. The second procedure seemed decidedly preferable, for it gives us independent evidence of the structure of musical choices, before we relate that to the personality dimensions, and it gives us a definite result even if the latter fails. In short, it permits us to build up two independent systems of factors which can then be interrelated, whereas the first procedure would give us no picture of the factor structure within the musical items as such.

For the reader unfamiliar with factor analysis (8) it should be pointed out that by intercorrelating the musical choices in every possible combination we shall be able to pick out certain clusters of items the members of each of which have something in common causing them to be liked by the same kind of person. Any individual can thereafter be given a score on each of these independent "dimensions" of choice according to the number of items he likes in such a cluster. The sound foundation which underlies such a score is to be contrasted with that which would result if anyone had arbitrarily put together a dozen pieces of music claiming that liking each is indicative of "introversion" or "neuroticism" or what not. Our first step, therefore, is to group choices, without *a priori* prejudice, in a way such that we know they all "pull together." The second is to relate each such cluster (factor) score to personality dimensions and to aesthetic preference patterns in other media. In this experiment we collected data for both, but are reporting here only on the first step of analysis.

From general psychological considerations we might anticipate that we should get between half-a-dozen and a dozen dimensions of musical choice by the factorization of choices. Now in order to get an adequate range of scores on any one of them, we ought strictly to have about a dozen items as measures of each dimension. That is to say, the subject could be scored from zero to 12 according to whether he liked one or all of the items which happened to be measures of that dimension. Consequently, in order to get such scales, we should have to start off with 120 to 150 choice items, even assuming that all would have some significant factor loading on a particular factor.

Anyone familiar with factor analysis will recognize that the task of factorizing 120 or more variables is a tremendous one. Nevertheless, if the foundation for future research which we have envisaged is to be set up, there is no escape from this task and we felt that we could accomplish it by availing ourselves of the latest technical resources in computing and in the design of factor analytic experiments (8). We decided, in fact, to start out with 120 musical variables, but to factorize them in two separate matrices, setting up special joints to dove-tail the two (instead of trying to factorize in one large matrix since $(2n)^2$ is greater than $2n^2$, as illustrated in Section D below). With this general experimental design in mind we shall now describe the variables used in the whole study and the guiding considerations in choosing them.

In any factor analysis attempting to structure an entirely new area, the most important consideration in the choice of variables is that they should be catholic. We need to include musical excerpts likely to appeal to every conceivable type of personality. In seeking such a very representative emotional appeal, we were aided by (a) the insights of our fellows in the Laboratory of Personality Assessment, (b) suggestions from the School of Music, (c) the groupings according to mood in Capurso's study mentioned above (1), (d) a short pioneer study in factorizing musical choices (30) which we found had been done a few years ago by Mrs. P. E. Vernon of London University, though as yet unpublished. A preliminary list of 200 musical excerpts, from different periods, countries, and styles was tried out with about 50 students and was cut down to 120 by eliminating any piece which seemed very similar to any other or which for some peculiar reason of instrument or period was deemed likely to be unreliable. We then arranged for a skilled pianist to record the 120 excerpts on piano, since we wished to eliminate any chance effects which might be due to cultural attachments of the subjects to particular instruments.

The only consideration which gave us real difficulty in this preliminary sorting of excerpts was that concerning the chance familiarity of the subject with the piece in question. There is a general principle in work of this kind, when it is desirable to eliminate as far as possible differences in familiarity with the choices offered, that one should choose items which are either likely to be known by *everyone* or likely to be known by *no one*. On the assumption that we are working for a test which can be used with the average mental hospital patient or with the population generally, we feel safe in assuming a relatively limited knowledge of music and we have accordingly taken it that even a *fairly* uncommon piece of music, as far as the musician is concerned, is likely to be unknown to our general population. On the other hand, in the minority of instances where we have had to assume that the piece of music will be known by everyone, we have chosen something which is extremely common and very likely to be known to all through radio, etc. These criteria resulted in the elimination of many pieces which might otherwise have been suitable.

The only matter remaining to be decided was the length of time that each piece of music should play. Here there are two considerations needing attention. (a) We have to play over 120 pieces to our subjects and in order to get reliability coefficients for the preferences we have in fact to play them all over again on some later occasion. The whole thing must not be so long that it becomes impossible to get subjects to sit through the procedure. (b) The mood of a piece of music may change if it is kept on too long, confusing the subject as to his emotional reaction thereto. On the other hand, it could be so short that the individual would get no definite feeling for it. Preliminary experiments indicated that less than a minute, and, indeed, about 20 seconds, was an optimum period for holding a certain mood and quality of the music. It is gratifying to find that Capurso has independently arrived at a minute or so as a suitable musical period for a definite mood. On this basis we calculated that if we allowed sufficient time between one piece of music and the next for the mood of the first to wear off for the second, and if we allowed sufficient time for the person to record his responses, about two hours would be required for a single run of our proposed series, and this seemed appropriate to Condition (a), for four hours would then be required for each of the subjects.

Particulars of the administration conditions, etc., are given in Table A. The following section is devoted simply to listing the 120 musical excerpts used. They were presented in two different orders to different groups, to attenuate any effects due to position.

TABLE A
LIST OF MUSICAL VARIABLES

1. Bebop, "Tea for Two"	
2. Violin concerto, mov. 2	Mendelssohn
3. Minuetto	Scarlatti
4. Tarrier's Song (originally sung by Irish quarry workers)	
5. Attack and Death of the Mouse	Copland
6. "I know the Lord's Laid His Hands on Me"	(Negro spiritual)
7. Boogie-Woogie	
8. Ondine	Ravel
9. Tristan and Isolde, Prelude	Wagner
10. Impromptu	Chopin
11. "Little Horse of Mine"	(Lithuanian folk song)
12. Ragtime	
13. Symphonic Rhapsodie	Liszt
14. Scherzo	Chopin
15. Girl with the Flaxen Hair	Debussy
16. "I Feel Like My Time Ain't Long"	(Negro spiritual)
17. Sweet and Low	
18. What the West Wind Saw	Debussy
19. Danza Lucumi	Lecuona
20. Fugue from Prelude and Fugue (5 voice)	Bach
21. Concerto	Liszt
22. India-folk song	
23. Sonata in B flat minor, Op. 35, Marche funebre	Chopin
24. Smoke Gets in Your Eyes	
25. Loves of New Orleans, Dance	Herbert
26. "Jeanie with the Light Brown Hair"	Foster
27. Sonata in D (development section)	Mozart
28. Fugue from Toccata and Fugue in D minor	Bach
29. La Comparsa	Lecuona
30. Toccata	Schumann
31. Classical Symphony, mov. 3	Prokofiev
32. Erinnerung, Op. 63, No. 2	Brahms
33. Hymn, "O Lord My God"	Wesley
34. Paean	Bax
35. Symphony in D minor, Mov. 1	Franck
36. Popular (Cocktail lounge)	
37. Popular (Art Tatum)	
38. The Sea	MacDowell
39. Fourth Concerto, 1st Mov.	Beethoven
40. Stancutza (Rumanian folk song)	
41. Romance	Raff
42. Goodbye, Mr. Czerny	
43. Cowboy	
44. Where Are You Going	Niles
45. Toccata, Toccata and Fugue in d minor	Bach
46. Jazz (slow)	
47. Death and the Maiden	Schubert
48. Toccata	Poulenc
49. Puerta del Vinto	Debussy
50. Romance, Op. 28, No. 2	Schumann
51. Polonaise	Chopin
52. Etude in E major	Chopin
53. Bebop	
54. Farandole (French folk song)	
55. Drei Klavierstücke, Op. 11, No. 1	Schoenberg
56. Nocturne in C sharp minor	Chopin
57. Rhumba	
58. "Thou in Thy Mercy" from Israel in Egypt	Handel
59. O Suzanna	Foster

TABLE A (Continued)

60. Swing	
61. Swing	
62. Trio from Sonata	Haydn
63. Fireworks	Debussy
64. Romantic Symphony, mov. I	Hanson
65. The Harmonica Player	Guion
66. Mood (Popular)	
67. Joy to the World	Handel
68. "Old Joe Clark" (Square Dance)	
69. Gigue	Scarlatti
70. Varmland (Swedish folk song)	
71. Rhumba	
72. Drink to Me Only With Thine Eyes	
73. Yiddish Lullaby	
74. Bebop	
75. Hungarian Dance	Brahms
76. Boris Goudonov, Coronation Scene	Moussorgsky
77. Hymn, Adagio (Hebrew Melody)	Marcello
78. Sad News	Harris
79. Sunny Side of the Street	
80. Run-run	Pinto
81. Bear Dance	Bartok
82. Last Rose of Summer	
83. Polka ("L'Age D' Or")	
84. Folk Song from India	Shostakovich
85. Sonata, Op. 2, No. 3, 2nd Mov.	Beethoven
86. Forest Murmurs	Liszt
87. Fugue, Toccata and Fugue in D minor	Bach
88. Flying Dutchman, Overture (Senta's Theme)	Wagner
89. Symphony VI	Tchaikovsky
90. Merry-Go-Round	Powell
91. Picture of an Ancient World	
92. Bruyères, Prelude	Debussy
93. Fugue	Hindemith
94. Soldier's March	Pinto
95. Overture, Midsummer Night's Dream	Mendelssohn
96. Freiheit (German Battle Song)	
97. Sonata Op. 57, 1st Mov.	Beethoven
98. Boogie-Woogie	
99. 2nd Sonata, Mov. 3	Schumann
100. Largo	Bach
101. The Ferryman of Lake Okhrida (Macedonian Folk Song)	
102. Witch's Dance	MacDowell
103. What the West Wind Saw	Debussy
104. Sonata 2	Schumann
105. Sonata in D, Exposition	Mozart
106. Epithalamium	Fuleihan
107. Entreating Child	Schumann
108. La Poule	Couperin
109. Water Cresses	Niles
110. Fantasie	Chopin
111. Symphony V, Mov. 2	Tchaikovsky
112. Smuggler's March, Carmen	Bizet
113. Sonata Op. 2, No. 3, Mov. 4	Beethoven
114. Art Tatum Style (Jazz)	
115. Ain't Misbehavin' (Jazz)	
116. Blue Danube Waltz	
117. Stormy Weather	
118. Haul Away, Joe (Sea chanty)	
119. Waltz	Romberg
120. Cowboy Song	

D. THE CONDUCT OF THE EXPERIMENT AND THE STATISTICAL ANALYSIS

The 120 musical excerpts described above were played by Miss Joan Benson of the Music Department, University of Illinois, to a tape recorder, and it was this standard recording which was used throughout all experiments, with the aid of an amplifier. The subjects were taken four to 44 at a time (four and 44 being the extremes) into a testing room and sat comfortably listening to the music with a recording sheet in front of each person upon which the following reactions were recorded immediately after the music.

1. Was your reaction to this music one of liking, disliking or something in between?
2. Have you heard this music before?
3. Did you have any visual imagery on hearing the music?

The instructions to the subject ran:

Please give your immediate reaction to the music you will hear. This is a test of music appreciation, but we do not want you to indicate which is "best" according to generally approved taste; we want you instead to say which you personally enjoy most or least. There are no right or wrong answers previously laid down in this test: it is intended simply to record your purely individual taste.

As each piece is played, underline *L* in the first column of your record sheet if you like it very much and would want it to continue. Underline *D* if you don't like it very much or actually dislike it. Underline the question mark "in-between" if you are undecided, i.e., when the feeling tone is neutral. Use *L* and the question mark and the *D* in such a way that *L* means the third that you like most and *D* about a third that you like least. There should then be about a third of all cases left over in the intermediate category. Five short pieces will be played over before the test actually begins so that you may get some idea of what variety to expect. When they are through you will be told to start putting down your reactions to the test proper. Don't forget to put about a third of *L*'s and a third of *D*'s.

Beyond the columns for the *L*'s, question marks, and *D*'s you will see two more columns. In the first the question is asked: "Do you see imagery?" Check the square following this question only if pictures come to your mind spontaneously. Do not try to see pictures.

The last column asks: "Do you think you have heard this before?" If you think you have, place a check mark in the appropriate square. Don't be disappointed if you recognize only a small percentage of the number used.

We are primarily interested in the *first* question presented. Try not to be influenced by what anyone else is choosing.

It will be noticed that although the above instructions attempted to

produce a normal distribution of responses in terms of like, dislike, and the intermediate neutral response, a precise normal distribution could not be expected.

The tests were given in all to 196 male and female normal subjects, mostly university students and also to 188 abnormal subjects in a mental hospital. In the abnormal group it did not prove possible to retain any of the subjects for the further two hours of retesting and only nine of the normal were retested for reliability, but the coefficients were sufficiently stable to indicate the general degree of re-test reliability in choices of this kind. Tetrachoric correlations on 120 choices ranged from .36 to .75, with a mean at .54 for re-test after 24 hours; from .38 to .58 with a mean at .48 for four people retested after two months, and were .33 and .39 (mean .36) for two people re-tested after the lapse of a year.

Both the normal and abnormal subjects were also tested on esthetic choices in art and architecture, and on personality tests [The 16 Personality Factor Questionnaire (5)]. The present report, however, occupies itself with the analysis of the musical reactions and with the normal group of 196 adults.

The necessity for using a very catholic array of variables in an opening study for structuring a new realm puts severe demands on the statistical services. So far as we know a matrix of as many as 120 variables has never been correlated and factored. To circumvent the difficulties we have tried an experiment, the success or failure of which may be of interest in itself to statistical researchers. It follows the procedure, advocated on theoretical grounds (8), of splitting the matrix into two equal parts (60 variables in each) factoring one first and then carrying over two marker variables for each rotated factor therein into the second matrix.

The rotations of the second matrix (consisting of variables 61-120, plus the "gusset" of 20 markers) are carried out blindly, like those of the first. If these independent searches for simple structure place the common marker variables in the same patterns of high loadings and hyperplanes one has achieved two advances over the factorization of a single 120 x 120 matrix, viz.: the number of correlations to be calculated is reduced by about a third, and the confidence in the unique correctness of the simple structure is raised. The outcome is discussed below.

In view of our sufficient population the r 's among the musical choices were worked out as tetrachorics rather than as phi divided by phi maximum (8). With this coefficient the best results are obtained if the dividing line between the upper and the lower group is drawn as near the 50 per cent point as possible. Accordingly, before calculating the correlation coefficients,

TABLE 1
ROTATED FACTOR MATRIX FIRST SET

	1	2	3	4	5	6	7	8	9	h ²
1	.65	.15	-.07	.51	.20	.11	-.01	.28	.16	.67
2	-.01	-.09	.05	.34	.50	.04	-.01	-.10	.18	.47
3	-.38	.05	.03	-.10	.22	-.04	.07	-.05	.20	.28
4	-.24	.09	.09	-.60	-.05	.08	.00	.21	.07	.50
5	.06	-.10	.12	-.06	-.14	.00	-.38	-.03	-.38	.35
6	-.06	-.05	-.12	-.09	.33	.02	.28	-.08	-.04	.36
7	.38	.15	.00	.02	-.04	.34	-.11	.18	-.14	.32
8	-.07	-.39	.43	.10	-.15	-.32	.08	-.03	-.13	.43
9	-.08	.03	-.13	.30	.07	-.36	-.25	-.04	-.04	.42
10	.05	-.05	.00	-.07	.07	.46	-.04	-.43	-.07	.42
11	-.28	-.45	.17	-.03	-.15	.13	.07	-.04	-.18	.46
12	.59	-.06	-.17	.19	-.26	.43	.01	.10	-.27	.68
13	-.42	-.12	.05	.01	.04	-.02	.29	.34	.52	.80
14	-.20	.10	.60	-.10	.05	.08	-.07	.10	.23	.56
15	-.15	-.04	.05	.49	.20	.05	.17	.02	-.07	.42
16	-.11	-.04	-.07	-.10	.36	-.25	.08	-.10	-.24	.33
17	.00	-.29	-.01	-.07	-.02	.16	.12	-.41	.14	.41
18	-.03	-.04	.43	-.06	-.04	-.12	.06	.00	-.44	.55
19	.02	-.12	-.18	-.20	.39	-.15	.00	.16	-.01	.38
20	-.51	-.02	.31	.14	.01	.30	.26	-.04	.02	.80
21	.06	-.02	.55	-.14	-.08	.01	.06	-.06	.44	.56
22	.01	.12	.09	.17	.38	.01	-.10	.15	-.08	.24
23	-.11	-.30	.22	.06	-.17	-.32	.01	.05	-.07	.24
24	-.42	-.32	.02	-.08	-.01	.01	.03	-.11	-.10	.56
25	.05	-.26	-.15	-.41	.06	.12	.04	-.06	.06	.40
26	.03	-.39	.13	-.34	-.07	.04	.17	-.21	.15	.40
27	-.12	-.23	.37	.28	.07	-.24	.31	-.04	.16	.38
28	-.35	-.13	.37	-.05	-.11	.00	.18	.11	-.13	.31
29	.03	.41	.10	-.01	.53	-.12	.01	.05	-.01	.50
30	.03	-.09	.67	.24	.08	.09	.28	-.08	.08	.54
31	-.11	-.07	.00	-.03	-.02	.08	.16	.11	.03	.11
32	.14	-.42	-.25	.06	-.07	.09	-.07	-.36	.19	.55
33	-.25	-.34	.02	.26	-.01	.03	-.01	-.01	-.09	.42
34	-.04	.25	.22	.06	.33	-.10	-.01	.25	-.36	.55
35	-.22	.15	.11	.14	.31	.02	.09	-.34	-.01	.36
36	.40	-.56	.08	-.09	.09	-.14	-.03	.00	-.10	.63
37	.67	-.24	.09	.03	-.05	.33	.04	.28	.11	.70
38	.00	-.10	.55	.12	.00	.09	-.13	-.05	-.21	.45
39	-.32	-.06	.03	.01	.04	.25	.04	-.15	-.03	.33
40	-.04	.06	.15	.12	.13	-.09	-.05	.05	-.38	.35
41	.05	-.25	.00	.21	.31	.09	.13	-.33	-.07	.45
42	-.11	.10	-.01	.07	.02	-.03	.10	.16	-.11	.07
43	.01	-.06	-.14	-.05	-.28	.42	.13	.11	-.05	.48
44	-.08	.07	.03	.10	.29	.27	-.13	-.32	-.12	.33
45	.06	.04	.26	-.07	.01	.07	-.37	-.02	.09	.33
46	-.09	-.53	.14	-.32	.04	.13	-.30	.07	-.09	.48
47	-.24	-.24	.06	-.08	.05	.03	-.49	-.04	-.02	.43
48	.09	.34	.06	.05	-.03	.01	.27	-.12	-.22	.35
49	-.07	.04	.15	-.18	.09	.24	-.45	.13	-.28	.43
50	-.06	-.27	.03	.35	-.09	.05	.30	-.28	.21	.58
51	-.09	-.04	-.01	.11	.07	.09	-.32	-.02	-.10	.17
52	.04	-.13	.00	-.02	.15	.02	-.08	-.46	-.03	.27
53	.42	.11	.03	.29	-.01	.14	.00	.59	.10	.57

TABLE 1 (Continued)

	1	2	3	4	5	6	7	8	9	h^2
54	—21	—09	—03	—24	06	03	30	13	—09	.33
55	—09	05	—04	—06	07	25	—53	—07	06	.40
56	00	04	44	16	06	—10	—10	—02	—14	.40
57	11	—05	—02	06	27	—17	05	19	—17	.25
58	—06	06	—01	17	—04	41	—21	—08	13	.37
59	07	—34	—05	—24	14	07	04	—19	04	.32
60	61	—09	—01	01	—05	58	05	02	—07	.66
121	08	—07	28	—14	52	12	—04	26	—06	.58
122	—08	—19	30	06	20	—01	—14	05	06	.23
Number in ± 10 Hyperplane.	34	32	33	33	36	33	34	32	32	

we examined the distributions and always threw the middle or neutral group of responses along with that end of the distribution which was the smaller one. Thus, in some cases, the positive section of the score is like-plus-neutral as opposed to dislike, whereas in others it is like as opposed to neutral-plus-dislike. Extraction was carried out by the multiple group method, stopped in the 60 x 60 matrix at nine factors and in the 80 x 80 at 11, according to the usual statistical tests (8).

A strikingly clear simple structure—better than that commonly obtainable either from questionnaires or ratings and at least equal to that of objective tests—was obtained after 20 overall rotations of the first matrix and 21 of the second. A very slight change was then made in one or two factors in the light of the common trends in them in the two matrices. For on inspection it was found that the loading patterns of the common variables were well matched in most of the factors, permitting eight out of nine of the first matrix at once to be matched with members of the second.

The first and second rotated matrices (reference vectors, not yet transformed to factors) are set out in Table 1 and 2, the marker variables retaining the same numbers in the second as the first. The correlation matrices, unrotated factor matrices and transformation matrices may be obtained from the American Documentation Institute, on microfilm for \$1.00 or 6 x 8 photocopies for \$2.25, by ordering Document 3418. The $\lambda\lambda$ matrices, showing the angles of the reference vectors, are given in Table 3a and 3b.

E. THE NATURE OF THE FACTORS

Our purpose here is to set out the matches in terms of the common, marker variables. The non-common variables will not be listed, except in those factors from the second matrix which have no match and which are there-

TABLE 2
ROTATED FACTOR MATRIX. SECOND SET

	1	2	3	4	5	6	7	8	9	10	11	h^2
61	.58	-.04	-.09	-.10	-.05	-.08	.03	-.08	.08	.07	-.14	.58
62	-.10	.02	.06	.18	-.07	-.14	.03	.36	.25	.47	.07	.45
63	.10	.42	-.08	.11	.04	-.11	-.06	-.13	.10	.09	-.37	.44
64	-.18	.02	.05	.10	.01	-.03	-.33	-.41	-.13	-.21	.36	.46
65	.05	-.07	-.41	-.22	-.29	.05	.02	.03	-.05	-.22	-.13	.45
66	.10	.04	.20	.07	.13	-.25	-.06	.17	-.02	-.03	-.34	.29
67	.14	.05	.15	-.05	-.26	.10	-.38	.06	-.10	.14	-.13	.40
68	-.07	.01	-.39	-.33	.10	.13	.10	-.23	-.43	.16	-.10	.50
69	-.15	.04	.23	-.50	.04	-.05	.36	.09	.12	.01	-.32	.56
70	-.40	-.19	-.30	-.11	.01	.05	.02	.31	.00	.15	.08	.50
71	.49	-.06	.01	-.16	.11	-.13	-.40	-.25	.04	-.24	-.13	.64
72	.00	.04	.34	.11	-.29	.08	-.51	-.02	-.04	.08	.19	.61
73	-.26	.03	.01	-.25	.04	-.42	-.08	-.20	-.05	-.01	.13	.52
74	.49	.08	.28	-.15	.29	.05	.00	-.16	.38	-.16	.10	.61
75	-.07	-.03	.05	-.37	.09	.19	.04	.14	.08	.06	-.50	.47
76	-.17	.45	-.16	.21	.01	.19	.04	.08	-.01	-.13	-.01	.60
77	-.31	-.09	.03	-.25	-.09	-.36	.05	.00	-.09	-.03	.01	.44
78	-.04	.00	.07	.06	-.07	-.29	-.09	.40	.04	.12	.07	.38
79	.66	-.20	.18	-.03	.31	-.03	.06	.01	.42	-.02	-.08	.67
80	.03	.12	.18	.16	-.35	-.15	-.07	-.02	.00	-.11	-.10	.23
81	.16	.00	-.17	-.05	.04	-.10	-.03	-.07	-.20	-.11	.06	.14
82	.01	-.27	-.06	.14	-.15	.07	-.55	.29	-.03	-.18	.06	.64
83	-.07	.31	-.08	-.18	-.14	.52	.22	.01	.01	-.05	.03	.48
84	.01	.16	-.12	.00	.15	-.13	-.07	.38	.05	.27	-.22	.40
85	-.28	-.31	.29	.00	-.07	-.18	-.14	.24	-.17	.11	-.24	.60
86	-.06	.01	.08	.08	-.09	-.16	.03	.03	.40	-.14	.00	.32
87	-.25	.15	.15	-.05	-.04	-.10	.03	.15	-.09	.54	-.13	.49
88	.01	.45	-.03	.04	.32	-.01	.11	.01	.05	.16	-.11	.49
89	-.22	.17	-.08	.29	.07	-.21	-.02	.00	-.08	.21	-.03	.35
90	.18	.10	-.20	-.65	.29	.05	.04	-.36	-.10	.02	.08	.60
91	.00	-.28	.16	-.12	.43	-.04	-.01	.10	.32	-.06	.01	.42
92	-.08	-.10	.03	.02	.08	-.18	-.10	.01	-.24	-.04	.29	.26
93	.00	.18	-.07	-.11	-.08	-.10	.11	.03	-.08	.12	-.26	.14
94	-.03	-.06	-.16	-.44	.04	.28	.15	-.09	-.41	-.09	.02	.48
95	.08	.28	.08	.00	-.25	-.09	.20	-.09	.26	.16	-.18	.42
96	-.14	.06	-.18	-.19	.05	-.04	-.28	-.11	-.63	.15	-.14	.62
97	-.08	-.03	.43	.02	.14	.02	-.02	.09	.36	.07	.10	.41
98	.74	.11	-.06	.07	.00	.13	-.12	.11	.24	.10	.00	.68
99	-.07	.30	-.02	.04	-.21	.05	.06	.07	.01	-.04	-.19	.24
100	-.33	.11	.16	-.07	.11	-.13	.08	.14	-.12	.06	-.07	.28
101	-.18	.00	-.07	-.06	.26	-.27	-.02	.15	.02	.10	-.23	.28
102	.00	.72	.00	.03	-.04	.06	-.37	-.21	-.01	.02	.07	.63
103	-.09	.36	-.17	.03	-.01	-.18	-.09	-.04	-.02	-.07	-.32	.35
104	-.26	-.19	.16	-.08	-.07	-.07	-.06	.33	-.21	-.18	-.10	.44
105	-.10	-.03	-.10	.04	-.56	-.01	.09	.33	.02	.10	-.09	.46
106	.05	.02	-.01	.00	.02	.02	-.10	.15	.00	-.01	.19	.15
107	-.28	-.10	-.03	.04	-.08	.19	.03	.09	-.13	-.10	.07	.13
108	.09	.29	.16	-.11	.42	-.08	.11	.00	-.02	.44	-.22	.46
109	-.03	-.23	-.18	.00	.13	-.03	-.38	.11	.03	-.42	-.04	.52
110	.02	.51	.08	-.05	.22	-.03	-.06	-.22	.13	-.02	.05	.48
111	.09	-.01	.40	.23	.11	.38	-.41	.02	.07	-.10	.16	.68
112	-.19	.12	-.07	-.08	.01	-.06	-.06	-.06	.06	.00	-.23	.16
113	-.10	.23	.05	-.03	-.41	.03	.07	.02	-.04	.17	-.15	.30

TABLE 2 (Continued)

	1	2	3	4	5	6	7	8	9	10	11	h^2
114	68	09	-25	-09	-06	-06	-07	23	06	11	00	.70
115	47	-07	58	-03	04	-03	-14	00	09	-47	09	.94
116	03	03	02	-04	-05	-01	-57	-11	05	-21	-27	.59
117	45	07	44	-15	15	16	-08	13	09	-14	06	.69
118	-23	07	-14	-09	00	04	-37	43	-04	07	03	.58
119	-07	07	-09	-23	01	-03	-42	02	-02	-11	-03	.36
120	-10	01	-04	-01	10	-23	-21	16	-04	13	-37	.31
1	43	-02	32	00	04	05	30	-03	29	-04	-12	.49
2	-01	01	41	-02	06	01	-13	01	15	36	-10	.38
4	00	10	-51	-04	11	-03	-22	-05	03	04	-11	.39
10	03	-05	-09	-15	-36	-33	-15	00	-25	-03	30	.60
12	54	-07	-02	06	-08	-07	03	-27	-13	-02	13	.62
13	-17	-05	-06	11	-32	00	-19	26	22	16	-18	.41
14	00	48	-18	00	-03	-14	-08	07	14	32	-04	.44
15	-05	05	07	09	-25	14	-04	08	02	32	14	.24
18	08	56	-03	-09	21	05	-14	-32	-22	-05	06	.49
29	-02	22	-16	-49	57	-03	16	-04	-04	15	10	.61
30	09	39	12	-01	08	06	-06	-02	-04	48	05	.36
31	-17	-09	02	-20	-14	06	07	12	-28	16	-35	.34
36	43	16	15	-12	-03	-12	-28	-19	02	-33	02	.46
37	83	-12	07	24	-04	-20	-16	06	34	-04	-01	.79
42	09	25	-23	02	-20	17	03	19	07	12	-08	.26
46	28	14	13	00	01	-44	-45	-04	03	09	-21	.46
47	-06	01	-08	28	01	-37	-10	12	10	07	04	.31
53	47	01	05	-02	08	-04	40	20	12	22	-45	.76
55	02	12	-09	27	-02	-54	04	06	16	04	-06	.52
60	70	-22	05	11	-17	03	-10	02	18	01	06	.72
Number in ± 10 Hyperplane.	45	44	41	45	45	44	45	42	48	38	41	

fore best identified by the highest variables, marker or non-marker. The factors from the second set are marked by primes. The reader may check his own hypotheses about the nature of these factors by drawing in, from Tables 1 and 2, the remaining high non-common variables.

The five highest variables in the first rotation in Table 4 are identical with those in the second and the order is almost identical, so the match is excellent. The general sense of the musical choices is that of popular, jazz-like structure, with rhythmical emphasis, fast tempo, individual interpretation, discordant harmonies, generally with a joyful but agitated mood. One might speculate that this will be associated with the surgent personality factor in later studies.

Again, from a factor analytic point of view the agreement of the markers in the independent rotations is excellent (Table 5). Here we can generalize an attachment to classical music, of a sentimental, introspective but cheerful

TABLE 3 (a)

	1	2	3	4	5	6	7	8
1								
2	-.08							
3	-.10	-.23						
4	.26	.14	.02					
5	-.02	.27	-.03	.16				
6	.34	.12	.04	.06	.00			
7	-.12	.16	.23	.13	.06	-.23		
8	-.05	.15	.03	.12	.08	-.10	.08	
9	.14	.09	.11	.08	.11	-.07	.20	.18

TABLE 3 (b)

	1	2	3	4	5	6	7	8	9	10
1										
2	.07									
3	.15	-.16								
4	.10	-.15	.15							
5	.05	-.04	.02	-.30						
6	-.22	.03	-.10	.01	-.12					
7	-.28	-.32	.09	-.14	.07	.08				
8	.06	-.24	.07	.24	-.15	.06	.05			
9	.39	-.16	.30	.25	.01	-.02	-.02	.26		
10	.07	.25	.08	.01	.12	.00	.01	.22	.04	
11	.06	-.05	-.10	.16	-.04	.15	-.17	-.23	-.05	-.17

TABLE 4
FACTOR 1

(F₁ in Set 1 and F₁' in Set 2)

Variable number	Loading in		Title
	F	F ₁ '	
37	.67	.83	Likes Art Tatum (Popular)
1	.65	.43	Likes Bebop, "Tea for Two"
12	.59	.54	Likes Ragtime
53	.42	.47	Likes Bebop
36	.40	.43	Likes Cocktail Lounge (Popular)

TABLE 5
FACTOR 2

(F₂ in Set 1; F₂' in Set 2)

Variable number	Loading in		Title
	F ₂	F ₂ '	
14	.60	.48	Likes Scherzo—Chopin
30	.67	.39	Likes Toccata—Schumann
18	.43	.56	Likes What the West Wind Saw—Debussy
46	.14	.14	Likes Jazz 2 (slow)

nature, with a tendency to color harmonies. A possible hypothesis is that this fits the I factor of personality (7). Consistent with this is the tendency for imagery and past familiarity to be involved (Variables 120 and 121).

TABLE 6
FACTOR 3

Variable number	Loading in		Title
	F_4	F_4'	
4	-.60	-.51	Dislikes Tarrrier's Song
1	.51	.32	Likes Bebop, "Tea for Two"
15	.49	.07	Likes Girl With the Flaxen Hair—Debussy
2	.34	.41	Likes Violin Concerto, Mov. 2—Mendelssohn

A slight discrepancy in loading exists here (Table 6) for Variable 15, but the total pattern (order and sign) is exactly the same, and there is little doubt of a sound match. From the associated variables (several higher than the common ones set out above) in the first and second sets (see Tables 1 and 2) one can perceive a quality of warmth and gentleness, such as might be expected to appeal to the cyclothyme Factor A or H.

TABLE 7
FACTOR 4

Variable number	Loading in		Title
	F_2	F_7'	
46	-.53	-.45	Dislikes Jazz 2 (Slow)
36	-.56	-.28	Dislikes Cocktail Lounge (Popular)
29	.41	.16	Likes La Comparsa (Lecuona)
37	-.24	-.16	Dislikes Art Tatum (Popular)
47	-.24	-.10	Dislikes Death and the Maiden—Schubert

The match here (Table 7) is not quite so good as previously, in terms of absolute loadings, but the markers from F_2 are the highest common variables in F_7' and the rank order and signs are the same, constituting a coincidence beyond the 1 per cent level of chance (8).

The musical quality is more subtle here and one senses more dislikes than likes. It is in fact striking that some factors, notably this and 11, are characterized by a great preponderance, in all the high loadings, of dislikes over

likes. Only further research can explore the meaning of this, but one may suspect Factor M of the questionnaire studies (4).

TABLE 8
FACTOR 5

Variable number	Loading in		Title
	F_7	F_8'	
55	-.53	-.54	Dislikes Drei Klavierstucke, Op. 11, No. 1—Schoenberg
47	-.49	-.37	Dislikes Death and the Maiden—Schubert
46	-.30	-.44	Dislikes Jazz (Slow)
42	.10	.17	Likes Goodbye Mr. Czerny

It will be noted that here (Table 8) and elsewhere some of the same markers occur as in other factors—since we restricted ourselves to few markers for several factors—but the pattern of loadings is different and the agreement of the two rotations is again excellent. The sense of the factor is one of conventionalism and conservatism.

TABLE 9
FACTOR 6

Variable number	Loading in		Title
	F_8	F_8'	
18	-.44	-.32	Dislikes What the West Wind Saw—Debussy
13	.52	.26	Likes Symphonic Rhapsodie—Liszt
12	-.27	-.27	Dislikes Ragtime
36	-.10	-.19	Dislikes Cocktail Lounge (Popular)

The rotation pattern is well matched though the loadings are not high (Table 9). The high scoring person likes lush, romantic, fairly conventional harmonies, with a flourish!

TABLE 10
FACTOR 7

Variable number	Loading in		Title
	F_8	F_8'	
53	.59	.12	Likes Bebop
10	-.43	-.25	Dislikes Impromptu—Chopin
13	.34	.22	Likes Symphonic Rhapsodie—Liszt
37	.28	.34	Likes Art Tatum (Popular)
1	.28	.29	Likes Bebop, "Tea for Two"

The loading pattern begins to get low in these later factors (Table 10) but the pattern is preserved. In the loadings outside the common markers one finds dislike of "Sweet and Low" (17) of "Freiheit" (96). There may be some dislike of more emotional music, suggesting possibly Q₂ in the questionnaire factors (5).

TABLE 11
FACTOR 8

Variable number	Loading in		Title
	F _s	F _{10'}	
2	.50	.36	Likes Violin Concerto, Mov. 2—Mendelssohn
15	.20	.32	Likes Girl with Flaxen Hair—Debussy
29	.53	.15	Likes La Comparsa—Lecuona

Again the loadings are getting too low for recognition of factor nature from the markers (Table 11), though the matching by pattern is beyond 5 per cent chance. From the non-common variables, more highly loaded than the above, e.g., 87, 62, 109, one gets an expression of classic elegance. Individuals high in this factor have the highest tendency ($r = .50$) to see imagery while listening to music (Variable 121).

TABLE 12
FACTOR 9

Variable number	Loading in		Title
	F _s	F _{1'}	
37	.33	.24	Likes Art Tatum (Popular)
55	.25	.27	Likes La Comparsa—Lecuona
29	-.12	-.49	Dislikes Drei Klavierstucke—Schonberg
60	.58	.11	Likes Swing

In this factor (Table 12) the matchings of the marker variable loading patterns are the poorest obtained, though we believe it still to be satisfactory. No speculation on the common musical character is possible without resort to the higher loadings in 90, 43 and 58.

This factor (Table 13), found only in the second set of excerpts, will be confirmed by further study before investigating its associations.

Again (Table 14), the pattern is in only one set, though the loadings here

are well above 1 per cent chance level. The hyperplane is adequate but not high, and the factor may be considered statistically clear even if not musically interpretable.

TABLE 13
FACTOR 10

Variable number	(F _{10'} in Second Set)	
	Loading in F _{10'}	Title
29	.57	Likes La Comparsa—Lecuona
105	-.56	Dislikes Sonata in D Exposition—Mozart
91	.43	Likes Picture of an Ancient World
113	-.41	Dislikes Sonata Op. 2, No. 3—Beethoven

TABLE 14
FACTOR 11

Variable number	(F _{11'} in Set 2)	
	Loading in F _{11'}	Title
75	-.50	Dislikes Hungarian Dance—Brahms
63	-.37	Dislikes Fireworks—Debussy
120	-.37	Dislikes Cowboy Song
64	.36	Likes Romantic Symphony, Mov. 1—Hanson

F. SUMMARY

Factorization of like and dislike reactions to 120 musical excerpts by a population of 196 "normal" men and women in early maturity has yielded 12 factors, eight of which are confirmed by two independent rotations of the material, one more moderately confirmed, and three awaiting further research.

Although the definition and soundness of simple structure for these factors is of a high order, little attempt has been made here to infer their nature from the particular association of musical likes and dislikes connected with them, though in some cases "hunches" indicated by the data are mentioned. Our general hypothesis that these independent dimensions of choice will turn out to be personality and temperament factors rather than patterns of specific musical content or school seems sufficiently sustained.

Research leading to more extensive interpretation of the psychological meaning of the factors should be possible now that I.P.A.T. has made the above excerpts available on a single, 12 ins. long-playing record (11). Our own interpretations will wait on our use of this instrument in research

directed to relating these factors to measured personality factors and pathological syndromes.²

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