DEVELOPMENTAL CHANGES IN THE IDENTIFICATION OF MOOD IN MUSIC

by

THELMA WINIFRED ALICE FALLON

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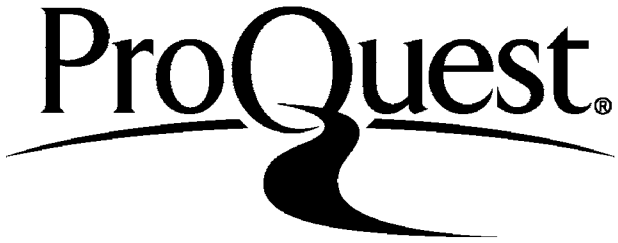

ABSTRACT

Outline of the Research.

The aim of this research was to compare the identification of mood in music by children (aged from 3 - 14 years) and adults. Previous research on adult subjects suggested that key and tempo were critical in conveying happy and sad moods: a major key and fast tempo conveyed happiness, a minor key and slow tempo sadness. In this research an attempt was made to compare the relative importance of key and tempo in establishing the musical mood. Eight pieces of music were selected for use in the experiments; in four of these key and tempo were complementary, (i.e. two in a major key at a fast tempo, and two in a minor key at a slow tempo) and in the other four pieces of music, key and tempo were opposed. The 154 subjects under 12 years of age were tested individually and heard four pieces of music each. The 108 older children and adults were tested in groups and heard all eight pieces of music. Each subject was required to indicate whether each piece of music was happy or sad.

The results of this research showed that the majority of subjects in all the age groups tested, from the three

year olds to the adults, agreed in their identification of the moods of the music played to them. Music written in a major key at a fast tempo was judged to be happy, and music written in a minor key at a slow tempo was judged to be sad. Of the two variables, key and tempo, the tempo of the music was found to have a greater effect in setting the mood for all the age groups. In the children between 7 and 13 years of age, the greater effectiveness of tempo was seen to be at its maximum.

ACKNOWLEDGMENTS

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I. INTRODUCTION

(a) General review of research on recognition of emotional expression in different age groups.

This thesis is concerned with the recognition by subjects from different age groups, of emotional mood as expressed in an art form, in this case music. As such it can be reviewed against two backgrounds. It has to take into account the theoretical background surrounding the emotions, their expression and recognition, which is far from being understood. It has also to deal with the problems which immediately arise when considering how an art form is reacted to by people, and what it is about the art form that produces the reaction. These problems are largely of limitation, such as the limitations imposed by cultural boundaries and the limitations imposed by the age ranges of the people considered.

The constant problem of cultural factors has received surprisingly inadequate treatment in experimental aesthetics, although it almost always receives its due mention in the experimental introduction. The main interest for experimental aesthetics has been the preferences of subjects when presented with selections of pictures, literary forms or musical

compositions. Such work has produced much speculation as to a possible general factor in aesthetic appreciation. Dewar (4) has shown that laymen and experts put pictures of widely different merit in a similar order according to preference. When their various rankings were correlated and the resulting table factorised, a large part of the variance was accounted for by a general factor. Williams, Winter and Woods (27) produced results which showed the existence of this general factor operating even between tests of appreciation. It was not claimed by these investigators that this general factor was independent of the cultural background of the subjects used. In a review of their work Eysenck (5) suggested that the influence of the cultural factor could be eliminated. If, in such an experiment, the results still showed evidence of this general factor, it could be of considerable theoretical importance. Eysenck attempted to do this, confining his experiment to pictorial preference. He compiled 18 sets of pictures, each set containing different subject matter e.g. Japanese pictures, mediaeval clocks, book bindings, statues etc.. Eysenck states that nearly all the pictures were new to the 18 subjects, no authority could point to one of them as superior to the others, and the standard of technical excellence was uniform throughout each set. Altogether he obtained 324 choices, after

the subjects had sorted the pictures in each set in order of liking. Factor analysis of the results showed the existence of a general factor (T) of aesthetic apreciation. This was felt to be separate from 'g' the general cognitive factor, as the correlation between T and the subjects' scores on an intelligence test of the verbal type was not statistically significant. Eysenck concludes that he found evidence for a general factor of visual aesthetic appreciation, which is independent of teaching, tradition and other irrelevant associations. His work helps support the existence of a general factor 'T'. It cannot be said to demonstrate that this general factor is unaffected by the culture of the subjects used. Selecting the material so that an unnamed 'authority' cannot point to one of a series as being superior to the rest, does not eliminate the effects of the culture which are firmly established in the subject whose preferences are being studied. It is in cross cultural studies of subjects' preferences, where the influence of different cultures can be compared, that the emergence of such a general factor would point more clearly to its freedom from cultural effects. Such a cross cultural study has been carried out by Lawlor,(18) comparing the preference of West African students in Accra and English college students when presented with 8 simple W.African designs. There was no agreement at all between the preferences of the two cultural groups, although within each group considerable agreement was shown by the subjects.

It therefore seems true to restate the starting premise, that reactions to art forms are profoundly influenced by cultural factors, and that research claiming to find universal aesthetic factors needs careful revision, with the reminder that the general factors present in the responses of these subjects extend only as far as the other members of the culture to which they belong.

The other limitation present when dealing with an art form is one of age. The question of the response of subjects at different age levels to art forms is one which needs to be considered. This research, interested as it is in the recognition of emotional moods in music by children at different age levels as well as adults, finds an interesting complement in a study of the development of musical appreciation. The results of this study by H.D.Wing (28) will be stated here without a detailed account of the experiment. Some 3,615 children were tested, with tests carefully selected so that they require no special knowledge of musical technicalities. The success of this is evident in that the results from groups of subjects with widely different amounts of musical training were not significantly different when treated separately. The test items covered a range from easy items to those which Wing asserts 'would tax the capacity of professional musicians.' The results obtained

seem to reveal a general factor of musical ability accounting for about 40% of the total variance. Most interesting for this account however, are Wing's conclusions on the development of this ability for musical appreciation. With reference to the seven tests, norms were drawn up for children aged 8 - 17 years. Using these norms the subjects' marks could be converted into terms of a musical age and a musical quotient. From this treatment the development appears to be linear and the musical quotient to be largely constant, e.g. equal to 127 at 11½ years, 128 at 12½ years and 125 at 16 years. This conclusion is confirmed by repeating the tests with individual children at intervals of one year or more. The musical quotients obtained on the two successive occasions show little difference, the correlation between the two is 0.92. This pattern of results is rather similar to that expected from a test of 'g' or general intelligence. Wing himself considered this fact and says "although success in the musical tests depends in part on general intelligence, nevertheless there is a large group factor operating in addition, which would appear to be fairly specialised. The correlation of ability in the musical tests with general intelligence is positive but low, namely 0.32 with Burts Reasoning Tests and 0.30 with the Simplex Junior Test. We may, therefore, legitimately conclude that the correlation

of the tests with 'g' cannot account for more than one-sixth of their correlation with each other." The point to keep in mind is that from this research, it appears that children possess a stable capacity for musical appreciation, (from 8 - 17 years as tested) although with development, larger numbers of the items in each test are correctly answered. This is important, for the aspects of musical form under consideration are among those which, it will be suggested later in this thesis (p.31), are responsible for conveying the emotional mood of the music.

Emotional expression has been for some time the object of much controversy. The facial expression of emotion has received most attention. The facial expression of emotion and its interpretation is of fundamental value to children and adults, existing as they must in interpersonal situations. Developmentally such expression and its recognition is prior to [illegible] expression and recognition in art forms, suggested by many (Freud) to develop as sublimation from the former. It is necessary to examine the question of facial expressions before proceeding to expression in an art form such as music. The two sides of the problem are, the expression as an overt manifestation of emotion and the recognition or judgement of such emotional expressions. Much the same argument has been raised on both sides. Is the expression of the emotions an

innate or a learned reaction? On the other hand is the ability to recognise emotional expressions innate or learned?

Whether expression of the emotions is an innate or a learned reaction will not be fully discussed in this thesis. Briefly, the majority opinion is that most of the expressions are innate reactions. The evidence upon which this viewpoint is based comes from the work of Goodenough (9,10), and Jane Thompson (25) with congenitally blind children. From photographs of the facial expressions of 26 blind and 29 sighted children, between the ages of 7 weeks and 17 years old, patterns of emotional response described as anger, sulkiness, happiness, sadness and annoyance, were obtained from both groups. It was concluded that these expressions as shown by the congenitally blind children could not have been learned but were maturational.

With regard to the recognition of emotional expression there is much less agreement. The multitude of experimental work is divided as formerly into those supporting the idea that recognition of expression is an innate ability and those who consider it is learned. It is not possible to give a complete account of the evidence for both arguments, but examples of the kind of work carried out and the conclusions reached will be given. The experimental investigations have been of two main kinds. There is the work carried out on

the smiling response in infants, and a great deal of work concerned with the recognition by children and adults of emotional expressions pictorially presented in photographs or drawings.

It has been established by many experimenters [Buhler and Hetzer (14 p 16) Kaila (14 p 17) Spitz (24)] that between the ages of 3 - 7 months, the infant will respond to a smiling face with a smile and to a frowning face with a frown. This last response is not invariable, and there may simply be no response to a frown or in rare cases a smiling response. It had also been noticed that this ready response to the experimenter's face gradually disappeared after the age of 7 months. Spitz found that this was the result of greater discrimination by the older infant which began to confine such responses to the mother and other familiar adults. Spitz therefore used infants in the age range 3 - 7 months (when ready response could be elicited by the unfamiliar experimenter) to establish the qualities necessary in the human face for the smiling response. Spitz found that the experimenter's head must be seen i) Full face

ii) With 2 eyes showing.

iii) If not actively smiling, must be in motion ie. nodding or shaking.

To see if the babies responded only to the human face itself, Spitz repeated the experiment using a life-sized dummy with

a carnival mask for a face. [see figure 3 P 82, ref 24.] Spitz found that the smiling response was obtained with this model, providing the three conditions above were adhered to. The expression on the mask is not a marked smile and in compliance with condition iii) it was always necessary for the dummy to be nodding. Spitz then tried a variety of other stimuli to see if they provoked the smiling response;

i) A smaller representation of a human, a doll 12" in height.

ii) Musical rhythmic sounds versus unrhythmic disagreeable sounds.

iii) A feeding bottle.

iv) A hollow block ($3\frac{1}{2}$ x 3") with funny faces on each of the four sides.

The infants did not smile at any of these. A few of the children would smile at the human face only and not at the dummy, but mostly the dummy proved a satisfactory stimulus for the smiling response. The conclusions Spitz draws from these results (supported by the findings of Kaila) are that the child is incapable of evaluating or understanding the expression of the human face. The stimulus for the smiling reaction is a configuration consisting of certain elements within the human face combined with motion. The configuration stimulus fulfils the role as a signal of the approach of

another human being. The reason for the response, Spitz says, is indicated by the exceptional cases where babies did not show the smiling response. In all such cases there was an unsatisfactory emotional relationship between the mother and child, usually with a marked rejection on the part of the mother. In the normal child then, Spitz feels that close emotional contact with the mother provides the child with the emotional stimulation which it expresses by smiling whenever the appropriate configuration stimulus is present. If this is so, a possible reason why the block with four faces on and the doll, were inadequate stimuli, was because they were too small. In fact, the infant responded to this configuration stimulus when presented on a dummy, but the dummy had to correspond very closely to the human face and upper body it was representing. It can be seen in the photo of the dummy Spitz used (P 82 ref.24) that it was in fact fairly life-like. Before discussing this work further, the results of other investigators using pictorial representation of expression will be examined.

Conclusions from the majority of reported experiments are that adults differ in their ability to judge emotional expression and seem to improve with practice (Hunt (15) Kanner (16) and Allport (1)), and in children the ability

increases with mental and chronological age (Gates (7,8) Kellog & Eagleson(17)). There were two main methods employed; in the first, subjects were given a list of names of expressions from which to select the one appropriate to a given photograph or drawing. (e.g. Feleky(6) Allport) In the second method, full naming of the emotion expressed was allowed. (Gates, Kellog & Eagleson. Langfeld (21) Kanner). This last method was felt to be an improvement over the former as it was free from suggestion.

The results from these experiments cannot be taken as decisive for a number of reasons. The number of subjects used was frequently very small, as few as 6 adults in Langfeld's experiment, and 12 in one of Allports experiments for example. The experimental situations have been too complicated, with too many expressions supposedly showing slight differences of emotional expression and long lists of expression names to choose from; for example Feleky showed 86 photographs to her subjects and gave them a list of 109 names of expressions to choose from.

In fact how much can one reasonably expect to find out about a person's prevailing emotional moods from his facial expression, always supposing that he is not attempting to inhibit the overt facial expression? It seems reasonable

to suppose that a photograph of a clearly recognisable expression, happiness, sadness or anger, could be produced which would result in high agreement between subjects responses. It seems equally reasonable that subjects will show less agreement when confronted with an expression of melancholy for example, showing a fine differentiation from the basic division into happy and sad emotions.

The lack of agreement among subjects has prompted Landis (19,20), among others, to say that the subject needs to know the situation that gave rise to the expression from which, in normal social life, he would obtain most clues as to the kind of emotion likely to be expressed, and that it is impossible to judge a person's emotions by his facial expression alone. Goodenough and Tinker (10) arranged a special experiment, in which the judges were required to choose between facial expressions and verbal descriptions of the situation, as a basis for identifying the emotion of the subject used. From their results they conclude that both the pictures of facial expressions and the situation descriptions influenced the interpretation of the emotions; in some cases the expression was more important and in others the situation.

The idea that adults can be taught to judge expressions

more accurately has received considerable attention (Allport, Guilford (11)). It has been said that if subjects can improve in this way the ability itself is largely a learned one. The experimental methods used have been so bedevilled by the effect of suggestion on the one hand, and the opportunity for the subjects to learn to link certain pictures with 'correct' expression names by trial and error on the other hand, that little reliance can be placed upon their results.

Honkavaara (14) favours the theory that the development of the recognition of emotional expression is not attributable to any primitive instinctive ability nor to learning through social influence alone, but to mental maturation, biological and educational factors both influencing the development to a certain extent. Honkavaara states that matter-of-fact perception develops before the perception of expressions. This is based on the fact that in her experimental results, little children, while looking at pictures with expressional content, give matter-of-fact answers to questions asking what the pictures represent. The expressional content of the pictures is recognised by the older subjects. Honkavaara also found that her subjects, especially little children, have on the average more correct

answers to the matter-of-fact questions (e.g. is the picture of a man or woman?) than to the expression questions about the same pictures (e.g. is the man or woman happy or sad?). Expression questions also require longer time. Two experiments, out of the many performed by Honkavaara, she considers to be more critical in supporting her theory. In the first, 131 subjects 3 - 15 years old were required to say whether the person in a photograph was happy or sad, and then whether he was laughing or crying. The number of correct answers given to the question concerning the action of the photo, was significantly greater than those about the expression for the younger age groups. (3 - 7 years, and significant at .01% level). Honkavaara suggests that this reveals emotion as action (crying, laughing) and emotion as expression (happy or sad) to be almost dissociated by children in this age group. This phenomenon disappeared with increasing age.

The other experiment to be mentioned is the one in which Honkavaara set out to reduce the subjects' perception of expression to its origin, which she considers to be the matter-of-fact content with grotesque sign stimuli. The material for this experiment was two pairs of rough drawings. In the first pair were girls' heads; both had sad 'eyes' and one was showing teeth. (figure 16). The subjects, children from

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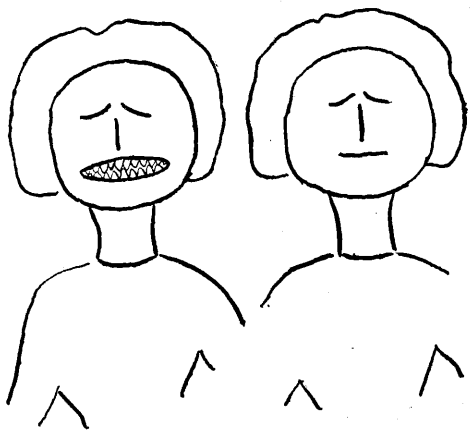

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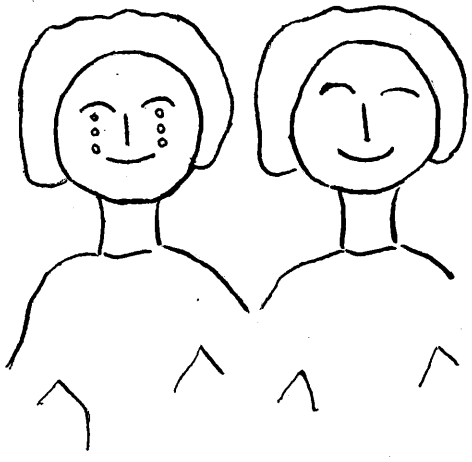

Reproduction of drawings used in an experiment by Honkavaara to assess the recognition of facial expression in children.

3 to 15 years old, were asked to say which girl was the happiest. In the other pair both faces had smiling eyes and mouth but tears were added to one face. (figure1a,b)

The same subjects were asked to say which face was the saddest. It was assumed by Honkavaara that the correct answer in both examples was that both expressions were as sad or as happy as each other. If the added teeth and tears had no effect, the number of incorrect answers would be the same for both pictures of a pair. Using the table of binomial probabilities, it was found that the difference in totals for added teeth and tears were significant for the subjects used. Honkavaara concludes that the perception of expressions, in this experiment the shape and form of the mouth and eyes, has been reduced to its origin which is matter-of-fact content with 'grotesque' sign stimuli, teeth and tears. Therefore small children do not innately recognise emotional expressions, but certain 'grotesque' stimuli which are representative of emotion as motion e.g. crying and laughing. It is with increasing age and maturation that children recognise the true expressions. On the other hand children do not learn to recognise expressions, as the graph showing the increase in correct answers with age, is smoother than a typical learning curve. Honkavaara suggests that a

gradual maturation of the individual is responsible for the increasingly correct recognition of expression, as her results suggest that such recognition is neither innate nor learned.

Whether recognition of emotional expression is an innate, learned or maturational ability was the question which prompted the review of experimental data offered above. From an assessment of the experiments it is difficult to point unequivocally to any one of the three alternatives as being of paramount importance. The main problem is the difference of opinion between experimenters on what can be accepted as true recognition of emotional expression. From the criteria adopted by Spitz, the appropriate stimulus is the human face, and response to a very life-like dummy is not accepted as true recognition of expression. In his final interpretation of his results, as mentioned already, he considered neither reaction to be true recognition of emotional expression but an expression of the babies satisfactory relationship with its mother, in response to the configuration stimulus of the eyes and mouth in a nodding head. He offers as support for this conclusion the fact that the few babies who did not show the smiling response had an unsatisfactory emotional background provided by their mother. Upon examination of these individual cases

(provided by Spitz) it appears that there were considerable fluctuations in maternal affection and rejection and a generally inconsistent emotional relationship. An interpretation could equally be offered along the lines of inadequate opportunity afforded the babies to form consistent expectancy of affectionate handling and cuddling from the mother. This could cause sufficient anxiety to make them less responsive to the facial expression,which is likely to be a less significant part of the total situation for the babies.

For the large majority of experimenters, photographs of facial expressions are accepted as suitable stimuli. The range of drawings used extends from the very detailed to the crude sketches such as used by Honkavaara [shown above (see figs 1a & b)] in some of her experiments. On these rough drawings Honkavaara distinguishes between the lines indicating the shape of the eyes and mouth, and the tears and teeth drawn on one of each pair. She considers it recognition of expression to respond to the former, and matter-of-fact perception of 'emotions as motion' to respond to the latter. The value of such a distinction is questionable. Tears and laughter are part and parcel of emotional expression and often very reliable indications of the emotions of a person. They are an especially valuable guide on such rudimentary drawings of faces.

Another obvious difference between the experiments is to be found in the responses elicited from the subjects, from the smile of a baby on one hand, to the naming of the expressions shown by the older children and adults.

It would appear that Spitz et al have not conclusively proved that recognition of expression is not innate. It would also appear from the other research reviewed that recognition is not unaffected by learning, for improvement with age is reported. The nearest that it is possible to get to an answer at this stage is probably that offered by Honkavaara in the concluding remarks, that innate learned and maturational phenomena may all play a part in the recognition of emotional expression.

The important point to be stated here in relation to this thesis is that children from the age of about 4 years do recognise facial expressions of emotion although rather less well than older children and adults. In fact, if tears and laughter are accepted as part of the emotional expression, and not treated separately as grotesque sign stimuli of emotion, children can be said to recognise facial expressions very well indeed.

Another point to be considered with reference to studies on subjects' reactions to art forms is whether the subjects' preferences or judgements are involved. In Eysenck's experiments, discussed above, an attempt was made to elicit the subjects' preferences only, it was part of the experimental design to eliminate judgement of the pictures on merit, and all the pictures in a single list were stated to be of an equivalent standard. Wing's experiment was mainly concerned with judgement e.g. whether a note in a musical phrase had been altered and if so which one. However, in the item where the subject was required to judge which rhythm or phrasing of a melody was the more fitting, preference was surely involved. In fact, preference and judgement are difficult to separate, and where one reaction alone is required care is needed in experimental design to exclude the other as far as possible. It would appear insufficient merely to instruct the subject to attend to the one and suppress the other. This is especially true when working with small children who invariably associate things and people they like with the positive qualities of good, beautiful and pleasing etc. and things they don't like with negative qualities.

(b) Discussion of the view that music is emotionally expressive.

The view that music is emotionally expressive has a long history. This view although widely held for the last 5½ centuries, has been by no means unanimous. One trouble has been the over-romanticised and verbose interpretations of pieces of music attempted by many. These frequently contained detailed accounts of minute fluctuations of emotional feelings and even vivid scenes conveyed by the music to the listener. An interpretation of this nature is quoted by Chandler;(2 p 214) it refers to the first movement of Beethoven's 5th symphony, which is associated with ideas on fate.

"Fate does not knock: it strikes man to the ground. Whenever the panting victim struggles to arise (e.g. bars 33 - 43) he is ruthlessly thrown down again (bars 43 - 56) The second theme, with its downward fifths outbids the first. Thus does fate grimd its long heel on man's neck and press it hard on the ground (the long sustained deep B flat) while man begs for mercy."

These interpretations may well have been sincere and indeed valid interpretations for the people concerned. It is hardly surprising however, that people failed to agree on such detailed accounts. The contradiction apparent in

such observations have led others to conclude that people merely project emotional quality on to the music. Stravinsky (3 p.11) goes so far as to say "Music is powerless to express anything." As Aaron Copeland (3 p.11) suggests, "If he means express it finally and in minute detail which will be agreed upon by all who hear it, then his remark is a truism, if he means convey to the listener in any way whatsoever, he is merely offering an expression of opinion without proof." That is to say, it is not improbable that music actually conveys emotional mood of a more general nature, and within these limitations the mood of a musical composition could be agreed upon by the large majority of listeners. Other associations peculiar to the individual may well be aroused by these general mood tones, and varying degrees of difficulty may be experienced in keeping these two separate.

When considering what elements of musical construction might be responsible for setting the mood of a composition, the most popular theory has been that centred on the antithesis between the major and minor key systems. Four notes of the scale 1, 2, 4 and 5 are common to both the major and minor key, the antithesis comes mainly from the other three notes 3,6 and 7 . It is a common assumption

that the positive emotions (joy,love) are expressed by major music and the negative emotions (sorrow,fear) by music in a minor key. Other factors which have been considered to play a part in conveying the emotional mood of music are tempo and pitch.

It must be remembered that the above remarks refer only to European music and then only to music written from about 1400 to the present day. The structure of earlier music did not have the bipolar system of major and minor key systems overlying a stable tonal framework. The modes of the earlier period were in pairs, one authentic and one plagal, but for some time had not been used separately, (as the major and minor modes are) the distinction being preserved only as a convention in the form of written music. Another difference is that the notes of these modes or scales were merely divisions of the particular scale in which the melody was written. There was no stable tonal framework, and change of mode during the course of the melody formed no part of the scheme of things.

In the music under consideration, from about 1400 to the present day, a movement or work has one main key which is felt to be basic. The structure depends to a great extent upon key contrasts, with sections in keys other than the basic ones.

It is relevant to mention here that some modern composers, notably those of the 12 note school, have broken away from the tonal system that has stood for so long. However, this movement, which may yet revolutionise the music of Western Europe, is still in its infancy and the familiar system is still being used to good effect by composers such as Britten. If, in the meantime, new systems are developing, these have not yet ousted the tonal system under consideration from our every day experience.

The music of other cultures far removed from our own rests on still more different frameworks. These again are not static but undergoing continuous development. All forms of music may be capable of expressing emotional moods, but the way in which particular musical systems achieve this may differ considerably. It is therefore necessary in all experimental investigations concerned with the function of any element of musical construction, that the music should be chosen with care as to the period and style of musical form. It is imperative that these details should be carefully reported, for without complete knowledge of the music used it is impossible to repeat the investigation accurately.

(c) Review of research on identification of mood in music.

The problem of the expression of emotional moods in music can be approached from three directions, through the composer, the music and the listener. Most of the experimental investigations carried out have concerned themselves with the music or the listener, and it is this group with which the following review is concerned.

Charles Myers (23 p.10) has distinguished 4 types of listener. These types are based directly on what he calls the 4 aspects of music. These are:-

i) Intra-subjective, where sensory or emotional experiences are aroused.

ii) Associative, where much attention is paid to the associations suggested by the music.

iii) Objective, where the music is considered as an object and such things as quality of tone and defects of certain instruments are observed.

iv) Character, where the music is personified as a subject and the listener attributes moods, traits and activities to the music which he may or may not share.

Myers offers in support of this classification the findings of his research carried out with adult subjects.

His method was to play music to groups of adults and to ask them to report fully their reactions to the music. Myers found that while no listener was pure to one type, all of his subjects tended to react more to one aspect of the music than to the others. Myers regards the 'character' type as the most aesthetic way to listen to music, as the experience of the 'objective' type is too cold, the 'intra-subjective' too primitive and the 'associative' too variable and irrelevant.

Myers considers it respectable aesthetic appreciation to recognise the moods and emotional qualities of music, as long as they are clearly localised in the music and not in the self. Only then, he feels, can the listener be appreciating the aesthetic beauty of the music as an entity in itself. For this review the important factor is that Myers considers the reporting of the emotional qualities of the music to be 'primitive' or basic. Most of his subjects reported emotional moods suggested by the music and when this did not occur, there were frequent reports of deliberate suppression of the emotional content in order to concentrate on some other aspect of the music. The localisation in the music of these moods, which the listener may or may not share, seems a necessary boundary line to draw between adequate appreciation of the music for itself and mere wallowing in

any feelings which may be aroused. Nevertheless the main interest for this research is the agreement of emotional mood reported by subjects in response to the music, regardless of localisation.

Kate Hevner (12,13) has carried out a series of experiments designed to show what elements of musical construction are responsible for setting the mood of a piece of music. The design of the first experiment was built around the old assumption that the positive emotions (happiness, joy) are expressed by music written in a major key, and the negative emotions expressed by music written in a minor key.

Hevner used 10 pieces of music of which there was both a major and a minor version. All other variables such as tempo, pitch and volume were constant in both versions. Her subjects were in two groups. Group I heard 10 pieces, 1 - 5 in the major version and 6 - 10 in the minor version. Group II heard pieces 1 - 5 in the minor version and 6 - 10 in the major. The subjects were provided with a list of adjectives arranged in 8 groups, as follows:-

I	II	III	IV
dignified	sad	sentimental	callous
spiritual	pathetic	longing	serene
solemn	merciful	romantic	soothing
sober	melancholy	plaintive	lyrical
serious	depressing	dreamy	poetic
	gloomy	tender	leisurely
	heavy		gentle
	tragic		

V	VI	VII	VIII
delicate	merry	soaring	forceful
light	bright	triumphant	vigorous
graceful	vivacious	elated	martial
sparkling	cheerful	exciting	ponderous
playful	happy	impetuous	emphatic
jovial	gay	restless	majestic
humorous	joyous	stirring	exalting
whimsical	carefree	spirited	
fanciful		dramatic	

The subjects were asked to put a tick beside as many or as few adjectives as they thought adequate to describe each piece of music. As all the other elements, pitch, tempo and volume were kept constant, any difference found between the adjectives applied to each tune in its two different versions would be due to key alone. Hevner found a significant difference between the adjectives applied to the major versions of the tunes and these applied to the minor versions. Major versions were described by adjectives in groups 5 - 8 and minor versions by adjectives from groups 1 - 4; there was no overlap.

Hevner next tried the same procedure, varying tempo this time and keeping the key and pitch constant. The second version of each tune was approximately twice the speed of the first, for example 104 & 63, 152 & 72. The tempo was controlled by means of a metronome. The pianist watched it at the appropriate rate for a while before playing each piece.

Hevner found that the faster versions were described by adjectives from groups 5 - 8, and the slower tunes by groups 1 - 4 . Again there was no overlap. Hevner repeated the procedure again to investigate the effect of pitch. The results showed a difference, in that a tune at a slightly higher pitch was 'happier' than at a lower pitch. The difference was not nearly as great as those obtained in the experiments on key and tempo.

Of the two variables, key and tempo, Hevner found tempo to have the most clear-cut effects. For example the shift of adjectives chosen, when a slow tune was heard at a fast tempo, was to a group or groups further removed in kind from those chosen to describe the slow tune. To illustrate this, a tune might be described by adjectives from group III when in a minor key and then be described by adjectives from group VI in a major key; whereas a tune at slow tempo described by adjectives from group I would be described by adjectives from group VIII at a fast tempo.

In the general summary Hevner reports considerable difficulty in transposing tunes from one mode to another, and from one tempo to another, while still preserving the satisfying balance of the original work. There are of course no objective criteria for deciding whether a tune has been

satisfactorily transposed. Hevner and the musicians she consulted could only decide what sounded best to them. This difficulty was greatest in the second experiment on tempo where most of the music had to be especially written for the experiment by John Verall [Instructor in music at Hamline University, Minnesota, 1937.] Added to this difficulty was the fact that the music was not recorded but played for each group by a pianist sitting behind a screen. This meant that several performances of each version were required of the pianist. The equivalence of these performances depended upon the self-discipline of the pianist in practising the two versions of any one tune until they would be played with equal ease as many times as each was required. Hevner assures us that this was most conscientiously attempted by the pianist. Whether or not it was achieved is impossible for us to judge. The quality of recording available in the 1930's was not comparable to that available at the present time. This is, no doubt, why Hevner did not attempt to record the pianist's performances and then use these recordings to obtain her results. Where such quality is available, it is preferable to use recorded music both for the equivalence of material presented to subject groups within the experimental set-up, and for the ease with which the experiment may be accurately repeated by other experimenters.

Another difficulty, arising mainly in Expt. I, was that Hevner used many well known musical compositions. For example in Expt. I she used Bach's Minuet in G.Major and Beethovens Minuet Opus 49, No.2 in G.Major. In Expt. II she used Beethovens Variations in A Minor, No. 6. Although no subject heard both versions of any one composition, hearing one of these familiar works in the 'wrong' key or at the 'wrong' tempo would sound odd to many subjects. This being so, the subjects' choice of adjectives applicable to that tune could be affected. Unfortunately Hevner did not ask her subjects whether the tunes were familiar or not, and indeed no mention is made of the possible effects of familiarity upon subjects' reactions.

Leaving the question of the variables just described; (which doubtless affected Hevners results to a degree, which it is not possible to assert but which one feels was not so large as to invalidate her general conclusions), it is now desirable to state briefly the results most relevant to this research. Firstly, the subjects, which numbered some 205 sophomore students from the University of Minnesota, were able to recognise the different emotional qualities of music produced by transposition from a major to a minor key (or vice versa) and by transposition from a slow to a fast tempo (or vice versa). This difference was significant

for all the subjects, both those considered highly musical by their scores on the Seashore test of musical ability and several years of individual training on one or more musical instruments, and those who were considered less musical using the same criteria. The second important feature of Hevner's results was the restriction of adjectives applied to any one tune, either to groups 1 - 4 or 5 - 8. Groups 1 - 4 contain adjectives of a more sad and negative quality and groups 5 - 8 contain adjectives of a more positive and joyful quality. So that all the 205 subjects agreed on the general division of the music used to the positive and negative ends of the scale, while individuals differed as to the exact adjectives chosen.

Another investigation based on the structure of the music as it is relevant in setting the mood of the music, was that carried out by Deryck Cooke.(3) He tackled the problem by meticulously dissecting music known, or rather felt, by the majority of the listening public to have very definite emotional themes. He used music of a similar kind to that already discussed and to that which will be used in this thesis; for example the Eroica symphony by Beethoven. He not only investigated the key antithesis and tempo differences, but tried to build up a minute dictionary of certain patterns

of notes and the emotional tone they convey. For example, a 1 - 3 - 5 rising major phrase indicates an outgoing active assertion of joy and happiness, the same phrase in a minor key would be a rising outpouring of pain or sadness. Cooke does not leave the matter of emotional expression at the level of simple phrases. These are only the minutiae from which complex musical works are built according to the 'laws' of musical logic. Cooke realises that his opponents will argue that a musical structure cannot function continuously as an expressive mediator, that it is a purely musical pattern made up of these fragments which may or may not seem to be expressive. This view would support Hindemiths idea that emotional moods, when present in music, appear in a 'delirious almost insane manner.' Cooke utterly refutes this idea. He analyses sections from musical works at some length to support his own idea of the function of the laws of musical construction. His idea is that the various terms of musical expression, the small phrases which he identifies with such detail and care, are presented in a significant order in musical composition, and to quote Cooke, "musical form is simply the means of achieving that order." He excepts from this the 'architectural' polyphonic works deliberately constructed out of inexpressive material,

and experiments made to discover new kinds of form to be used at a later date to develop expressive material.

A broad generalisation of his standpoint as it is relevant here, is that the major-minor antithesis equals pleasure - pain, tempo expresses the level of animation, volume expresses the degree of emphasis of the emotional tone, and pitch responsible for the ebb and flow of the emotions.

It can be seen from this that for Cooke the key is of primary importance in setting the mood of music, with tempo merely providing the intensity of the pleasurable or painful emotion. This is quite different from the results of Hevner, where both key and tempo are found to play a part in deciding which pole of the antithesis, pleasurable or painful, the musical mood will veer towards. In fact Hevner's results point to tempo having a greater effect. Their results cannot be compared in this simple way without reference to the great differences in their methods of investigation. Hevner used 205 subjects to obtain her results, upon which her conclusions as to the function of key and tempo are based. Among these subjects were included the musically trained and untrained. The results of Cooke are based, in fact, on his own knowledge of the

music he examines and his own response to it. Although he states that most people who listen to these musical selections will react similarly, he does not prove it. It seems therefore that the weight of experimental evidence offered by Hevner provides her with the stronger argument. The work of Cooke in building up what amounts to a dictionary of musical expression containing the simple melodic phrases, is not to be slighted. It could still maintain a respectable position within either theoretical framework.

So far the research reviewed has been carried out using adults as subjects, providing us with theories as to the different ways of reacting to music, and what elements of musical construction set the emotional mood of the music presented to the subjects. A question now presents itself. Would an experiment using children from different age groups as subjects, produce similar results? Most of the research carried out using school children as subjects has concentrated on the children's reactions to major and minor intervals and chords, for example the work by C.W.Valentine (26). From this it was concluded that there was no significant connection between major keys and the happier moods or between minor keys and sad moods. This sort of work merely demonstrates that the major - minor key antithesis does not hold for chords and intervals. These are the stuff

from which music is constructed but cannot be said to be music in themselves.

An investigation using children was carried out by Sylvia Honkavaara (14). This study was prompted by an incident concerning an eleven year old boy. He was unable to say whether the Schubert song 'Die Forelle' was sad or happy. He explained his difficulty by saying it was 'Because I don't know the words of the song.' Honkavaara considered this surprising, as adults readily attributed some feeling tone to music, either sadness or gaiety. To discover whether such a difference between children and adults existed generally, Honkavaara devised an experiment. This experiment was to stand as a part of a large group of experiments designed to discover which develops first in the child, matter-of-fact perception or perception of emotional expression.

The music used in this experiment included excerpts from gramophone recordings of the operetta 'The Bird Fancier' by Zeller, three Finnish melodies, and a sad aria from Tosca. The subjects were given a list of numbers, each of which stood for one of the recordings. Against each number were printed the alternatives 'gay' - 'sad' and 'man' - 'woman', this last referred to the sex of the singer and was to test the

the matter-of-fact perception. The subjects were asked to underline one word of each pair; after their decisions, the reaction time, was recorded. The ages of the subjects used ranged from 7 - 26 years. These were tested in 6 groups Forms I - II, Forms III - IV, group Forms V, VI, VII, Form VIII and a people's high school group, a County College group and a group of teachers. The lower forms were tested individually and the rest in groups.

The results showed that the expression answers of children from Forms I and II were rather arbitrary; these were aged from 7 - 10 years. The rank correlation between correct answers and developmental group was 1.0 with respect to the expression i.e. whether music was sad or gay. The corresponding correlation for the matter-of-fact answers was 0.26. In order to show whether the subjects found it easier to recognise the matter-of-fact qualities of a piece of music rather than its emotional tone the reaction times to the two types of question were compared. One group took the same time to answer both questions concerning the 'Bird Fancier', With all the other groups the expression answers always required a considerably longer time.

It is difficult to relate these results to those of other investigators which have already been reviewed. The

main reason for this is the scanty information Honkavaara gives about the musical excerpts used in the experiment. For example Hevner found that adults agreed significantly in their recognition of the emotional expression of music and that this expression was largely determined by the key and tempo of that music. We are not told the key or the tempo of the music Honkavaara used. It might be argued that Honkavaara was not interested in what it was in the music that expressed certain moods, merely whether the adults and child groups differed in their recognition of these moods. This is not a sound argument. It is well known and has been supported experimentally, since Hevner's work in 1930 at least, that there are many elements of musical construction which combine to set the mood of music. These are key, tempo, pitch and volume. It has been shown that adults are mainly affected by key and tempo in their description of the prevailing mood of the music. It is not inconceivable, however, that children might be more influenced by other aspects of the music. In this case it would be meaningless to state that children did not 'correctly' recognise the emotional mood of the music. It would be more to the point to say that while recognising the expression of moods by music, they were influenced by different factors. We cannot state that this is what in fact happened with the

groups of child subjects used by Honkavaara, because we do not know from her results whether or not the responses of the groups of children were consistent within themselves while differing from those of the adult groups. In view of this, it may be said that Honkavaara's results suggest that the responses of young children and adults differ when they are asked to recognise the emotional mood of music, and that this difference decreases with the increasing age of the children used until, at the age of 17, the responses of both are in agreement. It cannot be concluded from this account that the younger children are unable to recognise any emotional mood in music.

When an attempt is made to draw together the results from the investigations concerned with the recognition of emotional moods expressed in music, it can be seen that they are on two different levels. At one level are those findings which are well supported by experimental evidence and may be restated with some confidence. At the other level are those findings which need more conclusive experimental backing, although they provide useful indications.

It is possible to state with some confidence that adult subjects agree significantly in describing emotional moods of musical excerpts. The factors having the greatest

effectiveness in setting this mood were found to be key and tempo, where major keys and fast tempos were found to be associated with music of a happier mood, and minor keys and slow tempos with sad music. (Hevner, Cooke.)

It was suggested by Myers, on the basis of his results, that the recognition of the emotional quality of music, when these moods were evoked in the listener to some extent, was a basic and, he even said, primitive reaction. However, Honkavaara's results seem to suggest that this basic reaction does not extend further back than 17 years of age, or at least, if children recognise emotional expression in music before that age, they do not seem to be affected by the same factors as the adults tested in Honkavaara's experiment.

II DESIGN OF EXPERIMENT

a) Method

The broad design was to collect examples of music, which from the results of previous investigations would be expected to exhibit happy and sad moods (that is written in a major key at a fast tempo and in a minor key at a slow tempo). This music was played to subjects from different age groups ranging from 3 years to adults of 18 years and above. The subjects were then required to say whether the pieces of music they heard were happy or sad. The reactions of the different age groups to the emotional tone of the music as set by key and tempo were then compared.

It was also planned to play to the same subjects music in which the effects of key and tempo were opposed, i.e. music written in a major key at a slow tempo where the key would be expected to set a happy mood and the tempo a sad mood, and music written in a minor key at a fast tempo. The subjects were then required to say whether these pieces of music were predominantly happy or sad. This part of the experiment was planned to see which

of the two variables, key and tempo, were most effective in setting the mood of the music. Next, the subjects' responses were examined to see if there was any change in the relative importance of key and tempo between the different age levels.

The music used is listed below. Tape recordings were made of the short selections to be played to the subjects. The significance of the letters with each number is as follows:-

A = major key B = minor key

a = fast tempo b = slow tempo

			Key	Tempo
Aa_1	1)	The Trout Quintet by Schubert (Decca ACL 32)	A major	♩ = 126
		Timed 2½ minutes from 3rd movement.		
Aa_2	2)	Sonata for Violin and Piano No.9 (DGM 18092) by Beethoven	A major	♩. = 168
		Timed 2½ minutes from 3rd movement.		
Bb_1	3)	String Quartet No.9 by Beethoven (DGM 18367)	C minor (a minor version of the main major theme)	♩ = 40
		Timed 2½ minutes from 2nd movement.		
Bb_2	4)	String Quartet No.14 by Schubert (Mono RB 16203)	D minor	♩ = 36
		Timed 2½ minutes from 2nd movement.		

		Key	Tempo
Ab_1	5) Sonata for Violin and Piano No.9 by Beethoven (DGM 18092)	A major	♩ = 42
	Timed 2½ minutes from 2nd movement.		
Ab_2	6) Violin Sonata No.1 by Beethoven (DGM 18083)	D major	♩ = 46
	Timed 2½ minutes from 2nd movement.		
Ba_1	7) Quartet in D minor by Mozart (Columbia 33 CX 1424)	D minor	♩. = 126
	Timed 2½ minutes from 1st movement.		
Ba_2	8) String Quartet No.14 by Schubert (Mono RB 16203)	D minor	♩. = 120
	Timed 2½ minutes from 4th movement.		

The subjects were from eight age groups

I	II	III	IV	V	VI	VII	VIII	
3	4	5	7-8	10-11	11-13	13-14	18+	
35	31	16	32	40	14	32	62	Total Nos.
18	14	9	14	19	6	32	31	Female Nos.
17	17	7	18	21	8	-	31	Male Nos.

The children were from 3 schools in the London area, and the VIIIth group were drawn from College students, lecturers and laboratory technicians at London University.

b) Procedure

Subject groups I - III

These children were tested individually. Each child

heard only 4 tunes, one from each category Aa (fast major), Bb (slow minor), Ab (slow major) and Ba (fast minor). The eight tunes (two examples in each category) were randomised to produce 4 different orders.

1	2	3	4
Aa_1	Ba_1	Ab_1	Bb_2
Ba_2	Aa_2	Bb_1	Ab_2
Bb_1	Ab_2	Ba_1	Aa_1
Ab_1	Bb_2	Aa_2	Ba_2

Consecutive subjects heard consecutive orders of tunes, e.g. subjects 1, 2, 3 and 4 heard orders 1, 2, 3 and 4 and subjects 5, 6, 7 and 8 heard orders 1, 2, 3 and 4 and so on. It was found that the young children could not cope with the situation when asked directly if the tunes were happy or sad. An indirect technique was therefore devised for these young children. Four dolls were placed in the centre of a small rectangular table. Approximately 15 seconds after the music started playing the child was given the following instructions: 'You tell me if this doll is feeling happy or sad, we will put the happy dolls on this side of the table and the sad dolls on the other side'. This was repeated for each of the four dolls. The children were asked if the doll was happy or sad for the first tune, and if they were sad or happy for the second tune and so on alternately. The sides

of the table where the 'happy' and 'sad' dolls were to be placed was also alternated. The numbers of dolls said to be happy or sad were noted by the experimenter as well as any remarks made by the children. An interval of $1\frac{1}{2}$ minutes was kept between each item.

Subject groups IV and V

These children were also tested individually. Each child heard four tunes, the same four orders were used as previously described in the section on subject groups I - III. These subjects were questioned directly about the mood of the music. The instructions were: 'I am going to play you some pieces of music and when you have heard each one I will ask you if you think it is happy or sad music. There are no right or wrong answers, so just tell me whether the tune sounds happy or sad to you.' The children's responses were recorded by the experimenter.

Subject groups VI and VII

These children were tested in their class groups. They heard all eight tunes in the following random order.
Ba_1 , Bb_1 , Ab_1 , Aa_1 , Bb_2 , Aa_2 , Ba_2 , Ab_2 .
They were read the following instructions at the beginning of the session: 'I am going to ask you to listen to some short pieces of music and I want you to decide whether each piece is happy or sad. When you have listened to each

piece I shall tell you its number and will you put beside that number on the sheet of paper you have been given, whether the piece of music was happy or sad. Before we start, will you also put beside your name at the top of the paper whether you yourselves are feeling happy, sad, or just in between the two.'

As can be seen from the instructions these children recorded their own responses.

Subject group VIII

These subjects were tested in groups varying from 1 - 15 people in size. These subjects were handed forms on which were printed their instructions. 'I am going to ask you to listen to some short pieces of music and I want you to decide whether the emotional mood of each piece is in the main happy or sad. When you have listened to each piece I shall tell you its number and then will you please put that number under the heading you consider most appropriate.

In the spaces provided below would you add any comment on the mood of each of the pieces which you feel is not covered by the general classification into happy or sad. Would you also say whether you recognise the piece of music and/or its composer?'

They were then given spoken instructions, 'Would you

please put beside your name whether you feel happy or sad before we start the experiment.' Next they were asked 'Do you understand the instructions?'. Any queries were dealt with and the experiment was begun.

The subjects heard the eight tunes in the same random order as previously described in the section on Groups VI and VII.

As can be seen from the instructions this adult group recorded its own responses.

c) Treatment of Results

After listening to the music, fully listed in Design and Method, subject groups IV - VIII (aged 7 - 18+ years) were required to state whether the music was happy or sad.

Subject groups I - III (3 - 5 years) were required, while listening to the music, to say whether each of the four dolls were happy or sad. If a subject from groups I - III responded by placing an equal number of dolls in the happy and sad corners, the response was classified as undecided and not included in the main body of responses. (For Table 10 showing the undecided responses, see Appendix I). Only an unequal division (e.g. 3 - 1 or 4 - 0) of the dolls into happy and sad corners of the table were used as a definite indication of one mood as opposed to the other.

The comparison of the subjects' responses between any two of the four categories of music was carried out by using the χ^2 test of significance between the proportions of 'happy' responses out of the total responses obtained for each category.

d) Discussion of Procedure

Experimental Situation

Subject Groups I - V

These subjects were tested individually in two separate schools, which resulted in two different rooms being used, one large and the other quite small. At each school the quietest available room was chosen for the experiment. The immediate experimental area (comprising subject, experimenter and apparatus) was kept as consistent as possible in the two schools. The apparatus was always set up in a corner of the room.

Subject Groups VI and VII

These subjects, drawn from two schools, were tested in their class groups in their own rooms. As an interpersonal situation between the experimenter and subjects there was a considerable difference from the more informal atmosphere in the individual testing of subjects from Groups I - V. However testing in whole class groups was convenient for the

senior schools concerned, being less disruptive of their already crowded time-tables.

Subject Group VIII

These subjects, students, teachers and technicians, were tested when most convenient for them, and in groups which varied from 1 - 15. For the most part the groups were no larger than 4 or 5. Two testing rooms were used, depending on the size of the group. With this smaller grouping of subjects, there was a more informal atmosphere than was possible in the testing of Groups VI and VII.

Experimental Procedure

As can be seen from the description of the method given above, the testing procedures used were not the same for all the age groups.

Groups I - III

Little response was gained from directly questioning these subjects as to the happiness or sadness of the music and the indirect technique already described was devised. The limited attention span of the younger subjects necessitated reducing the number of tunes they heard to four. The four orders (of four tunes each), which are listed in the method, were arranged so that each child heard one example of each of the four musical categories and that all eight tunes were heard by that age groups as a whole. The four

different combinations of four tunes were also arranged to control any effects due to the position of a tune in a series as played to the subject.

An attempt was made to control perseveration of a mood induced by one tune by allowing an interval of 1½ minutes between each item.

Working with this test, an attempt was made to control position habits, (i.e. always putting the dolls in the same corner), by changing over the corners to be called happy and sad for each piece of music. In the same way, by alternating the order in which the words happy and sad appeared in the instructions, an attempt was made to control the tendency so prevalent in small children of accepting the first possibility suggested to them.

This indirect technique embraces the principles of projective testing and has to presuppose that the child if he identifies the basic mood of the music will then project this mood on to the dolls.

Groups IV and V

These subjects were directly questioned as to the mood of the music. For these children also it was considered appropriate to limit the number of tunes heard to four, to ensure that their interest was held to the end of the testing session and they did not become bored. To this end also, the experimenter recorded the responses instead of asking the

subjects to write them out. The instructions were carefully chosen to convince the children that the experimenter was interested in their opinions only and not giving them a test, to which there were right or wrong answers.

The same four series of tunes were used with these groups as have been discussed in the section on Groups I - III.

Groups VI, VII and VIII

These subjects wrote their own responses on the forms provided. They were directly questioned about the mood of the music and heard all eight tunes in the random order shown in the method, to present a random selection of the four categories of music used.

Certain differences in procedure were necessary for the two younger groups than that used for the adult groups. The instructions were read aloud to Groups VI and VII by the experimenter in case the subjects did not pay enough attention to them, or omitted to read them. The adult group (VIII) had their instructions printed on their answer forms. The adults were questioned about the familiarity of the music they heard (for reasons which will be discussed in the appropriate section), this was omitted from the instructions of Groups VI and VII as it was likely to suggest that the experimenter was testing their knowledge of music and composers, making them more anxious to guess a possible

'title' than listen to the music itself.

The subjects of all groups were asked to describe their own mood at the start of the test,as a possible way to check the influence of the subject's own mood on this identification of moods in the music played.

Intervals of approximately three quarters of a minute were preserved between items to reduce perseveration of the mood.

A point which needs to be discussed here is the fact that subjects are given only two mood names, happy and sad, to use in description of the music, or in the case of Groups I - III, the dolls. It could be argued that this was producing a forced simplification of the effect of key and tempo on the subjects' responses. Much music, it might be said, is neither happy nor sad. One obvious need for such simplification in this experiment was working with young children, to provide long lists of adjectives for them to choose from would simply bewilder them - and produce no results. This, of course, does not meen that the teenage and adult subjects would not have been happier with such lists. If these older subjects had been so provided, direct comparisons between their responses and those of the younger subjects would have been difficult.

There is experimental evidence to support the claim that it is permissible to limit the number of classifying

mood adjectives available to the subjects to happy and sad. This evidence has already been fully discussed in the Introduction, Part III, when dealing with the work of Kate Hevner (12) (13). It may be briefly restated here that out of the eight groups of adjectives Hevner gave her subjects to use in description of musical excerpts, Groups 1 - 4 contained adjectives of a more positive or happy mood and Groups 5 - 8 contained adjectives of a more negative or sad mood. In adjectives ascribed to any one tune, by her subjects, there was no overlap between Groups 1 - 4 and 5 - 8. In fact, one tune might be described by many of the positive adjectives other than, or as well as, happy, but none of the sadder or negative adjectives were ever included. It remains then, that the subjects in this experiment were not asked to describe the music with two meagre adjectives chosen at random. On the contrary they were asked to classify them according to two general group-adjectives, which can be taken as representative of two large groups of adjectives (fully reproduced in the Introduction). It is true that in the two large groups, many gradations of positive and negative or happy and sad adjectives are included, but it is not stretching the point to say that the one group contains adjectives of a 'happier' nature and the other contains adjectives of a 'sadder' nature.

The Experimental Material

The music used in this experiment was chosen to fulfil several requirements. The background to most of these requirements has been fully discussed in the Introduction.

1) Music was chosen which fitted the requirements of the four categories as described already in the method:

1. Aa - written in a major key at a fast tempo.
2. Bb - written in a minor key at a slow tempo.
3. Ab - written in a major key at a slow tempo.
4. Ba - written in a minor key at a fast tempo.

The fast tempos ranged from ♩. = 120 to ♩. = 168 on the metronome reading, and the slow tempos ranged from ♩ = 36 to ♩ = 46 on the metronome reading. The speed of the slow tempos was approximately $\frac{1}{3}$ the speed of the fast tempos.

It will be remembered that from the results of previous experimenters (reviewed in the Introduction), that happy moods are expressed by major keys and fast tempos and sad moods by minor keys and slow tempos. As mentioned in Part I of the Design, from the reactions of categories 1 and 2 it was expected to assess the importance of the major-minor antithesis and speed of the music in setting happy or sad moods, and to compare their effectiveness at the different age levels tested.

From the subjects' reactions to categories 3 and 4 it was expected to compare the relative importance of key and tempo when their effects would seem to be in opposition to

one another. It was also intended to compare their relative importance of key and tempo in setting the mood of the music at the different age levels tested.

The eight pieces of music for the four categories were selected from works by well known composers which are well established in the music of this European culture. This is a deliberate rjeection of the method used by Kate Hevner, (as described in the Introduction, III) where one melody was used for two opposing categories, e.g. a tune written in a major key would also be presented to subjects when it was transposed into a minor key. The differences in mood which subjects ascribed to the tune in its different forms indicated the different moods set by major and minor key signatures. Her method has the admitted advantage of keeping the melody constant for both categories while only the variable to be studied (key or tempo) was changed. It has the greater disadvantage of creating an artifactual shadow of a well established musical work to stand in opposition to it. It was felt preferable in this experiment to select music which was a part of the culture and which already fulfilled the requirements for each category.

2) Music without words was selected to prevent emotional moods expressed verbally from affecting the judgement of the mood as set by the music.

3) The music was from works written in the period from late 18th and early 19th centuries. This period was adhered to because of the constant - if gradual - change in the use of the elements of musical construction in creating emotional and musical effects which takes place. (This point has been fully discussed in the Introduction, Part II).

4) The examples of the four categories were chosen from music written for and performed by small musical groups. This was felt to be more acceptable, to the smaller child subjects, than larger orchestral pieces would have been. Solo instrumental performances were rejected as being less typical of this culture, when taking a broad view of the total range of available music extending from popular to classical examples. The resultant eight pieces of music which were chosen were judged to be reasonably unfamiliar to children, and certainly less familiar than popular light music. This has the advantage that the children were less likely to be influences in their responses by previous associations. However it could not be expected that the adult groups would be equally unfamiliar with the musical examples. To check the degree of familiarity theywere asked to state how familiar the music was to them and also if they could provide its title and composer. This check on familiarity was omitted from the teenage groups, VI and VII, for reasons of 'set' discussed in the previous section on experimental

procedure.

5) The music was tape-recorded from long playing records. This simplified the problem of earlier investigators (e.g. Kate Hevner, see Introduction, III), that of ensuring identical performances of each tune for several presentations.

Photograph of one of the dolls used
in testing 3 - 5 year olds (Groups I-III)

III STATEMENT OF RESULTS

Comparison of the responses of Subject groups I - VIII (aged 3-18+ years) to the two examples of music written in a major key at a fast tempo Aa_1 Aa_2

There was no significant difference between the responses of subject groups I - VIII to the two examples of 'happy' music Aa_1 Aa_2 written in a major key at a fast tempo. The summated X^2 quantities obtained from the 8 individual 2X2 tables performed on the subject groups' responses was $X^2 = 1{\cdot}086$ with 8 degrees of freedom. This was not significant ($P > {\cdot}1$). The subjects' responses to Aa_1 Aa_2 together with the X^2 tables are included in the Appendix I (Tables 8 and 9, and Appendix II, [illegible]).

Comparison of the responses of subject groups I - VIII to the two examples of music written in a minor key at a slow tempo Bb_1 Bb_2

There was no significant difference between the responses of subject groups I - VIII to the two examples of 'sad' music Bb_1 Bb_2, written in a minor key at a slow tempo. The summated X^2 quantities obtained from the 8 individual 2x2 tables performed on the individual groups' responses was $X^2 = 7{\cdot}783$ with 8 degrees of freedom. This

was not significant. (P>·1). The subjects' responses to Bb_1 Bb_2 together with the X^2 tables are included in the Appendix II (Tables 10, 11, and Appendix III,) - 8).

Comparison of the responses of subject groups I - VIII to the two main categories of music Aa, written in a major key at a fast tempo and Bb written in a minor key at a slow tempo

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The subjects' responses to the two examples of each category Aa_1 Aa_2 and Bb_1 Bb_2 were added together and the total responses for each category Aa and Bb directly compared. As can be seen from tables 1 and 2 and clearly illustrated by figures 1 and 2, all subject groups gave a much higher proportion of 'happy' responses to the music in category Aa, written in a major key at a fast tempo than they did to the music in category Bb, written in a minor key at a slow tempo. This difference between the responses to the two categories was highly significant for the most part, the smallest difference beingin groups II and III which was significant only at 10% level of probability, although the difference in group III closely approached significance at the 5% level of probability for which the X^2 value should exceed 3·84 (for group III the value of X^2 = 3·809). Despite the low significance of the difference between the responses of these two groups to the two categories of music, when all 8 subject groups were

Table 1

Responses of Groups I - VIII to the two categories of music written in a major key at a fast tempo Aa and written in a minor key at a slow tempo Bb

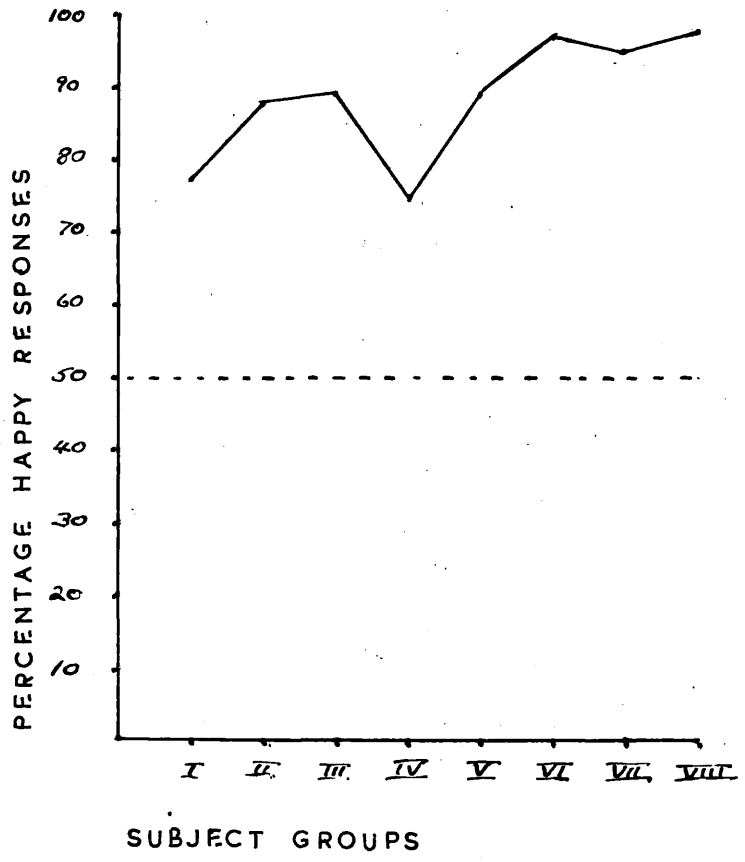
	Aa		Bb	
Subject Group	No. happy responses	Total responses	No. happy responses	Total responses
I	14	18	5	17
II	15	17	7	13
III	8	9	2	7
IV	24	32	7	32
V	44	49	3	49
VI	27	28	0	28
VII	61	64	2	61
VIII	122	124	12	124

Table 2

Showing percentages of happy responses to the Aa and Bb categories of music by Subject Groups I - VIII

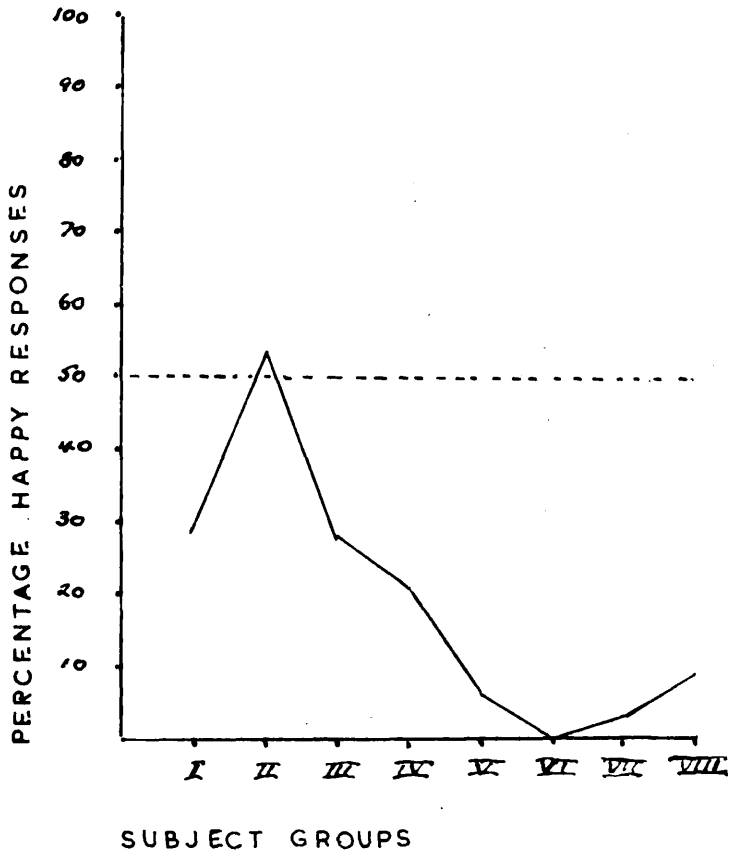
Subject Group	Aa % of happy responses	Bb % of happy responses
I	77	29
II	88	53
III	89	28
IV	75	21
V	89	6
VI	97	0
VII	95	3
VIII	98	9

FIGURE 1



Percentage of happy responses to the Aa category of music (major, fast).

FIGURE 2



Percentage of happy responses to the Bb category of music (minor, slow).

considered as a whole their responses to the two categories differed significantly. This can be seen from the table 3 where the summated quantities of X^2 values for the individual 2x2 tables gave a value of $X^2 = 264{\cdot}146$ with 8 degrees of freedom which is significant. ($P<{\cdot}001$). (The individual X^2 2x2 tables are shown in Appendix IV).

Comparison of the responses of subject groups I - VIII to the two examples of music written in a minor key at a fast tempo Ba_1 Ba_2

There was no significant difference between the responses of subject groups I - VIII to the two examples of music in category Ba written in a minor key at a fast tempo. In no subject groups was the difference significant at the 10% level of probability (for X^2 tables see Appendix V).

Comparison of responses of the subject groups I - VIII to the two examples of music written in a major key at a slow tempo Ab_1 Ab_2

There was no significant difference between the responses of subject groups I, II, IV, VI, VII and VIII to the two examples of music in category Ab written in a major key at a slow tempo. The responses of group III differed significantly at 0·1% level of probability, and the responses of group V at 5% level. (For X^2 tables see Appendix VI).

Comparison of the responses of the subject groups I - VIII to the two main categories of music Ab, written in a major

Table 3

Showing the significance of the values of X^2 for all subject groups (I - VIII) in comparison of their responses to the two categories of music Aa, Bb.

Subject Group	Degrees of freedom	X^2 value	P
I	1	6·407	< ·025
II	1	2·86	> ·05
III	1	3·809	> ·05
IV	1	16·0	< ·001
V	1	65·0	< ·001
VI	1	48·3	< ·001
VII	1	102·17	< ·001
VIII	1	19·2	< ·001
Total	8	264·146	< ·001

key at a slow tempo and Ba, written in a minor key at a fast tempo

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The responses to the two mixed categories Ab and Ba can be compared in figures 3 and 4 and tables 4, 5 and 6. In the mixed category Ab, written in a major key at a slow tempo, the key is expected to set a happy mood and the tempo a sad mood. In the mixed category Ba, written in a minor key at a fast tempo, the key is expected to set a sad mood and the tempo a happy mood. The proportions of happy responses of groups I - VIII to both examples of category Ab are shown as they differed significantly in groups III and V. It can be seen from these figures and the tables that the proportion of happy responses to the mixed category Ba (minor key, fast tempo) were all above 50% except for group VI. The proportion of happy responses to the mixed category of Ab (major key, slow tempo) were all below 50% except for group II and the responses of group III to Ab_2.

In the two categories of music Ab, Ba where the effects of key and tempo were opposed, the effect of tempo seems to have outweighed that of key in setting a happy or sad mood. The differences between the proportion of happy responses to both categories was significant only for groups IV and VI at 2·5% and 0·5% levels of probability respectively. (See Appendix VII).

Table 4

Responses of Subject Groups I - VIII to the two examples of music written in a minor key at a fast tempo Ba_1 Ba_2

	Ba_1		Ba_2	
Subject Group	No.of happy responses	Total responses	No.of happy responses	Total responses
I	4	7	4	8
II	4	6	4	7
III	5	7	3	3
IV	10	16	13	16
V	19	25	18	24
VI	12	14	7	14
VII	15	32	7	32
VIII	39	61	31	62

Table 5

Responses of Subject Groups I - VIII to the two examples of music written in a major key at a slow tempo Ab_1 Ab_2

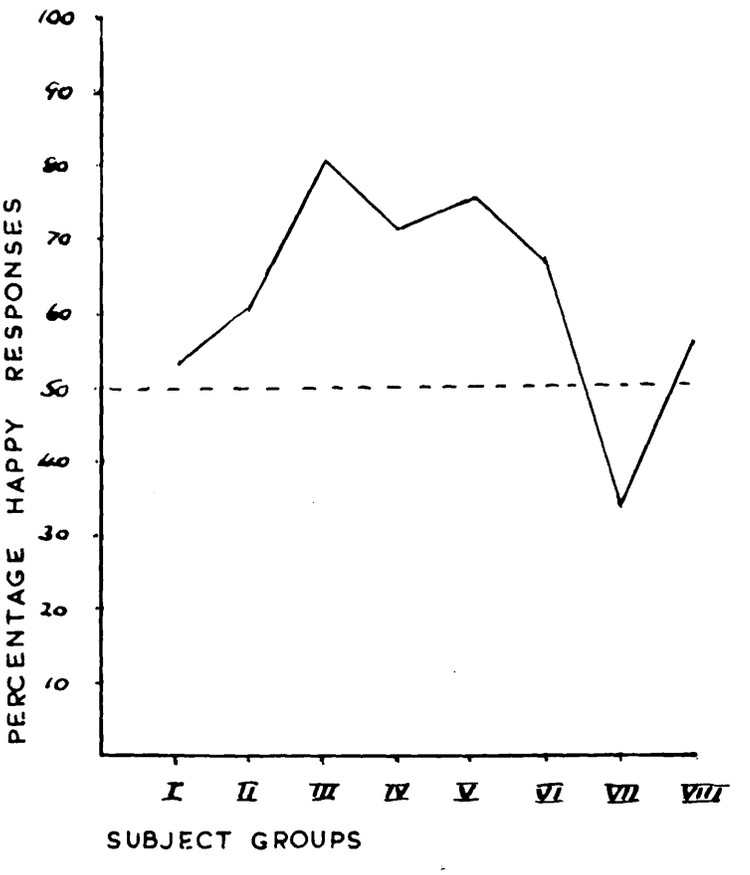
	Ab_1		Ab_2	
Subject Group	No.of happy responses	Total responses	No.of happy responses	Total responses
I	6	11	2	9
II	4	5	4	9
III	0	4	5	5
IV	8	16	6	16
V	1	24	8	25
VI	3	14	4	14
VII	11	32	5	32
VIII	29	62	30	62

Table 6

Showing the percentages of happy responses to the Ba (minor fast) and Ab (major slow) categories of music by Subject Groups I -VIII

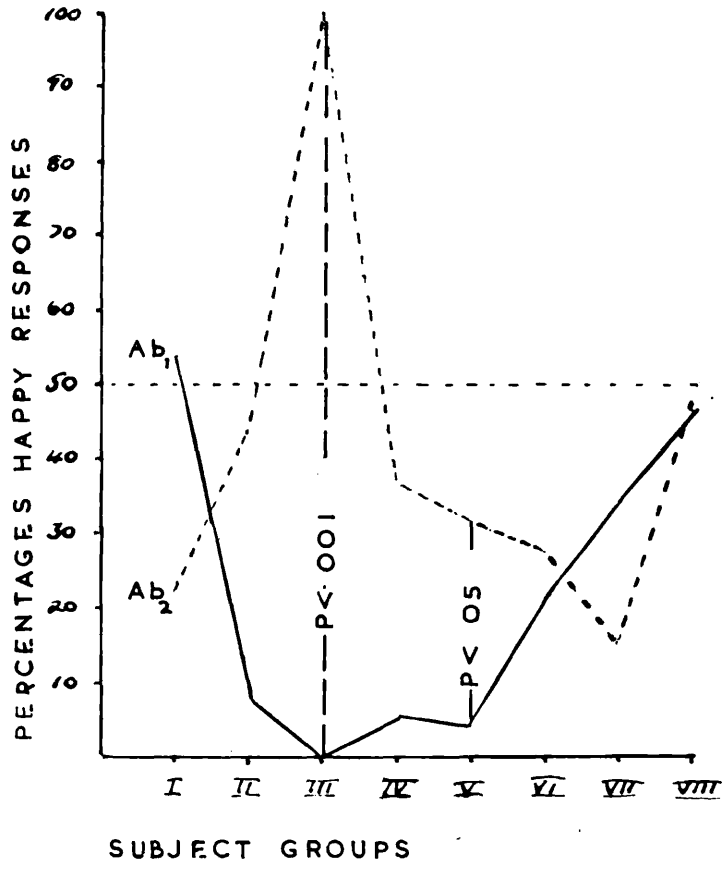
Subject Group	Ba (Ba_1 Ba_2 combined)	Ab_1	Ab_2
I	53%	54%	22%
II	61%	80%	44%
III	80%	0%	100%
IV	71%	50%	37%
V	75%	4%	32%
VI	67%	21%	28%
VII	34%	34%	15%
VIII	56%	46%	48%

FIGURE 3



Percentage of happy responses to the Ba category of music (minor, fast).

FIGURE 4



Percentage of happy responses to the two examples of music in category Ab (major, slow).

Comparison of the responses to music written in a major key at a fast tempo, Aa, between subject groups I - VIII

When the responses of the 8 subject groups to the music in category Aa were compared with one another, it was found that the proportions of happy responses given by groups I - IV were lower than those given by groups V - VIII (see table 1, figure 1). When the proportion of happy responses given by all eight groups was compared using a X^2 test of significance in a 2x8 table it was found that they differed significantly at 0·1% level ($X^2 = 27·5 > 24·32$). When the proportions of happy responses from groups I - IV was similarly compared the difference was not significant at 10% level of probability. The difference between the proportions of happy responses given by groups V - VIII was not significant at 10% level of probability when tested statistically. (For X^2 tables see Appendix VIII, 1, a-c).

Comparison of the responses to music written in a minor key at a slow tempo Bb between subject groups I - VIII

When the responses of the eight subject groups to the music in category Bb were compared with one another, it was found that the proportions of happy responses given by groups I - IV were higher than those of groups V - VIII (see table 1 and figure 2). It was found that the proportions from all eight groups differed significantly at 0·1% level of probability (X^2

probability ($X^2 = 37{\cdot}884 > 24{\cdot}32$). The proportions of groups I - IV and groups V - VIII when compared with each other did not differ significantly at 10% level of probability. ($X^2 = 4{\cdot}089 < 6{\cdot}25$ and $X^2 = 4{\cdot}92 < 6{\cdot}25$). (For X^2 tables see Appendix VIII 2, a - c).

Comparison of the responses to music written in a minor key at a fast tempo Ba between subject groups I - VIII

The proportion of happy responses obtained from the eight subject groups to the music in category Ba differed significantly. ($X^2 = 28{\cdot}72$ significant at 0·1% level $> 24{\cdot}32$). It can be seen in figure 3 that this is not due to a difference between the four lower age groups and the four higher age groups as in the response to the Aa and Bb categories of music. The difference is caused by the high proportions of happy responses obtained from groups III, IV and V and the low proportion obtained from group VII. When the proportions from groups III, IV and V were statistically compared they did not differ significantly. ($X^2 = {\cdot}05$ not significant at 10% level of probability $< 4{\cdot}61$).

When the remaining proportions for the four groups I, II, VI and VIII were similarly compared the difference between them was not significant. ($X^2 = 1{\cdot}23$ not significant at 10% level of probability as $< 6{\cdot}25$). (For X^2 tables see Appendix IX, 1).

Comparison of the responses to music written in a major key at a slow tempo Ab between subject groups I - VIII

In the reaction of the individual subject groups to the Ab category of music one notable feature is that subject groups III and V differed significantly in the proportion of happy responses they gave to the two examples of the category Ab_1 and Ab_2. In both cases the proportions of happy responses were greater for Ab_2, When the remaining groups I, II, IV, VI, VII and VIII were compared they were found to differ significantly in the proportions of happy responses they gave to the Ab category of music ($X^2 = 13{\cdot}2$ $P < {\cdot}025$). The smallest proportions of happy responses from these groups were obtained from groups VI and VII (see figure 2). When these were taken out and the remaining subject groups' (I, II, IV and VIII) proportions of happy responses were statistically compared, their differences were found to be insignificantly small. ($X^2 = {\cdot}8835$ not significant at 10% level of probability as $<6{\cdot}25$). (For X^2 tables see Appendix IX, 2).

Comparison of the proportions of happy responses given to the eight tunes by groups VI, VII and VIII

The subject groups VI (11 - 13 years) VII (13 - 14 years) and VIII (18+ years) were asked to state their mood before they began the experiment. They were asked to say whether

they were happy or sad. However, out of the 108 subjects in these groups, 55 said they were indifferent or medium. Out of the remaining 53 subjects, four said they were sad and 49 said they were happy. The proportion of happy responses given to all eight tunes for the sad group was 14/21 and the corresponding proportion for the happy group was 194/388.

Familiarity of the music used to the adult subjects (Group VIII)

The eight pieces of music were heard by 62 subjects in the adult group. In the responses of 33 subjects there was no mention of the familiarity of the music. Out of the remaining 29 subjects, 9 indicated their familiarity with some of the music. In the remaining 20 subjects, at least one attempt was made to name one of the eight pieces of music or the composer. The best known piece of music was the Trout Quintet by Schubert, and this was the only one correctly named by 10 subjects and said to be familiar by eight subjects.

In fact, the music used was not as familiar to the adult subjects as might be expected. No subjects stated that they were familiar with all eight tunes and no subject even attempted to guess at the names of all eight tunes. (For detail see Table 12 in Appendix X).

Comparison of the responses of male and female subjects to the eight tunes.

The results were examined to see if the two sexes showed a difference between their responses to the eight tunes. Any differences which did appear were too slight to be significant. (See Table 13 in Appendix XI).

IV INTERPRETATION OF RESULTS

From the findings of previous research (Hevner, 12, 13) it has been established that music written in a major key or a fast tempo conveys a happy mood to adult subjects, and that music written in a minor key or at a slow tempo conveys a sad mood to the same subjects. The basic aim of the research was to see if children between the ages of 3 and 14 years respond in the same way to such music as does a group of adults, most of whom were in their early twenties. It was found that the majority of subjects in the age groups tested did identify the mood of music written in a major key at a fast tempo as happy, and identified the mood of music written in a minor key at a slow tempo as sad. This is quite a difference from the results of Honkavaara, who found that children of 7 - 10 years of age gave 'arbitrary' answers to her questions about the happiness or sadness of the music, and that the number of correct answers increased with age, up to the adults she tested whose answers were 90% correct. However, the validity of these results is made somewhat questionable by the way she selected the music. This was selected on her own judgement of the happiness or

sadness expressed, with no apparent regard for the evidence already established by Hevner of the paramount importance of key and tempo in establishing mood. It was obvious in the present research that even the three year olds distinguished satisfactorily between happy and sad music. It was found that the proportion of happy responses to the happy music was slightly lower in the younger age groups (3 - 8 years) than in the older age groups (see figure 1.). It was also found that the proportion of sad responses to the sad music was lower in the younger age groups (see figure 1.). In the case of the 3 - 5 year old children this difference may be accounted for by the fact that they were tested by the indirect method already described, of asking them if the four dolls were happy or sad. As already suggested in the discussion of procedure, this method involves the assumption that the mood of the music would affect their judgement of the happiness or sadness of the dolls. With this method one could hardly expect a total projection of the mood of the music from the subjects on to the dolls. It is indeed remarkable that the effects of the two moods as set by the happy and sad music are so clearly marked. The large number of 'undecided' responses gained from the 3 - 5 year olds (see Table 7. Appendix I) are probably due to the indirect technique.

Although the results are at variance with the work of Honkavaara (14) they do correspond to predictions made in the introduction on the basis of the work of Wing (28). He found that children from 8 years old possess a stable capacity for musical appreciation for the various aspects of musical form, phrasing, appropriate tempo etc. It is these aspects of form which convey the emotional mood of the music as shown both in the work of Hevner and this research. The children used in this research were even younger than those used by Wing and yet distinguished clearly between the moods. The point arises whether it would be profitable to devise simple tests to assess how far down the age scale an appreciation of the elements of musical construction extends.

Another point becomes obvious in regard to Honkavaara's theory of the development of recognition of emotional expression in children. Honkavaara states that children at first recognise emotion only as a motion, eg. happiness when laughter is seen and sadness when crying is seen. She then says that recognition of emotional expression in music is also covered by this theory and that the younger children she tested did not recognise the expression in music because they were still at the stage of recognising emotional expression in the matter-of-fact way of emotion as motion. However, it might be suggested that music is the

very epitome of 'emotion as motion', certainly when the effect of tempo of the music is considered. The speed of the 'motion' of the melody has been found by Hevner and the results of this research to have a considerable effect in setting the emotional mood of the music. While Honkavaara's own results do not bear this out, it would seem that the results of this research do give support to her theory when interpreted in this way.

Another aim of this research was to see which of the two variables, key and tempo, were most effective in setting the mood of the music. For the answer to this question we must turn to the subjects' responses to the two mixed categories of music, Ab and Ba, where the effect of key and tempo were opposed. In the category Ab the key was setting a happy mood and the tempo a sad mood, while in category Ba the key was setting a sad mood and the tempo a happy mood. If the effects of key and tempo were equally balanced, there would be no difference between the proportions of happy responses given to the two categories of music Ab and Ba by the subjects tested. However, as is clearly shown in Figure 2, there was a difference between responses to the two categories. The music in category Ba (minor key, fast tempo) was given a higher proportion of happy responses than the music in category Ab (major key, slow tempo). This difference was only significant for subject groups IV

(aged 7 - 8 years) and VI (aged 11 - 13 years). As the higher proportion of happy responses occurs with the fast tempo (Ba) and the lower proportion with the slow tempo (Ab), it would appear that tempo has a greater effect than key in setting the happy or sad mood of the music. The smallest differences between the effects of key and tempo were seen in the three year olds (Group I), four year olds (Group II), 13 - 14 year olds (Group VII) and the adult group. In the five year olds (Group III), where the subjects gave significantly different proportions of happy responses to the two examples of music in category Ab (major key, slow tempo), is found a surprisingly high proportion of happy responses to the tune Ab2. This is at variance with the other results because in no other group has a tune with a slow tempo elicited such a high proportion of happy responses. However, the number of subjects in this group who heard the tune Ab2 and who gave a definite indication of mood was only five. The reason for this small number was that many undecided answers were received from this age group and these were separated from the main body of results.

In the 10 year old group (Group V), there was also a significant difference between the two examples of music in category Ab (major key, slow tempo). However, the proportion of happy responses to both the examples in this

category, Ab1 and Ab2, were lower than the proportions of happy responses to the two tunes in category Ba (minor key, fast tempo) from the same age group.

Over all the groups, therefore, tempo is seen to have a greater effect than key in setting a happy or sad mood. However, the only groups where the difference was found to be considerable were the 7 - 8 year olds (Group IV) and 11 - 13 year olds (Group VI). These results are in agreement with those of Hevner, who found that tempo had a greater effect in setting the mood of the music which she played to her adult subjects. Why the effect of tempo is so much greater than that of key for the 7 - 13 year olds is impossible to explain with any certainty on the basis of this research alone. A tentative explanation might be offered, that after the age of 6 or 7 years children are rapidly developing physically, are much concerned with learning new motor skills and are becoming more interested in games involving running and speed of movement, such as tag and other chasing games. It is not improbable that this enthusiasm should extend to a greater awareness of the speed of other things such as music. Added to this is the fact that children of this age seem to express their own moods by the speed of their movements. A child at this age when happy and excited is seldom able to keep still.

One question raised in the introduction was whether the recognition of emotional expression is innate, learned or maturational. It has been suggested (14) that it is maturational. The theory of innate recognition of emotional expression and the learning theory of recognition of expression also have their proponents (see Introduction part (a)). It is not possible on the basis of this research to give a final answer to this problem. However, a few pointers may be gained from the present results. It is shown that the youngest children tested did recognise the difference between happy and sad moods in the music as set by key and tempo. From this it is possible to conclude that if learning has taken place it has certainly been at a very early age. The question now arises whether these young children were showing recognition of emotional expression in music, which Honkavaara states they are incapable of, or showing a matter-of-fact perception of emotion as motion. It has already been suggested in the Introduction (part (a)) to this thesis, that such a distinction when applied to the recognition of facial expression of emotion is of questionable value. It was suggested that tears and laughter, which Honkavaara categorises as 'grotesque' sign stimuli of emotion as motion, are an intrinsic part of the emotional expression itself. In the case of music, however, it could be said with some

justification that the task required of all the subjects was to recognise emotion expressed as motion. This is similar to the theory of Cooke (3), who considers that the emotional tone of music is conveyed to the listener by the way in which the melody moves up and down the tones in a scale whether by the intervals of a major or a minor scale. For example, a rising major phrase 1 - 3 - 5 would express an outgoing feeling of joy and a corresponding phrase in a minor scale would express an outpouring of sorrow. The tempo was considered by Cooke to set the level of animation or intensity of the emotion carried by the major-minor key antithesis. It would appear from the results of this research, however, that Cooke's theory belittles the true effect of tempo. So far from the tempo merely serving to underline the emotion expressed by the key of the music, it was found to have a greater effect when setting a mood which contrasted with the effect of key. The greater effect of tempo in setting mood was also evident in the results of Hevner's research (12, 13).

It appears then, that the emotional mood of the music is conveyed to the listener by the 'motion' of the music, by the kind of progression through the individual notes of the melody (major-minor antithesis) and by the speed of this progression.

An attempt was made to discover the effects of the subjects' own mood on their responses to the music. This was done for all subjects of 11 years and over. The great majority said they were neither happy nor sad, but medium. Of the subjects who indicated that they were happy or sad, their mood was found to have a slight effect on responses. The five subjects who felt sad gave a proportion of 14/21 (67%) happy responses to the 8 tunes, and the 49 subjects who said they were happy gave a proportion of 194/388 (50%) happy responses to the tunes. Although the numbers in the 'sad' group were very small, it does seem that the subjects' own mood had some slight effect on their recognition of mood in the music. It might be tentatively suggested that the mood of the music was being judged in comparison with the subjects' own mood, the subjects making allowances for their mood to control its effect on their judgement of the music. The number of 'sad' subjects is very small, however, and no definite conclusion can be drawn as to the effect of the subjects' own mood on their recognition of mood in music.

It was also found that there was no difference between the responses of male and female subjects to the mood of the music.

V CONCLUSIONS

The main conclusions drawn from this research may now be briefly restated. All age groups, from the three year olds to the adult subjects, agreed in their identification of the moods of the music played to them. It was seen that the mood of the music, whether happy or sad, was determined by the key of the music and the tempo. Music written in a major key at a fast tempo was judged to be happy, and music written in a minor key at a slow tempo was judged to be sad. There was no difference between the responses of male and female subjects.

Of the two variables, key and tempo, the tempo of the music was found to have a greater effect in setting the mood for all age groups. In the children from 7 - 13 years the greater influence was seen to be at its maximum.

Generalisation from these results should be confined to members of the Western European culture to which all the subjects belong, and to the music chosen to be representative of this culture. Although the actual music chosen was written in the late 18th and early 19th centuries, the same

tonal framework with the bipolar system of major and minor keys is still used by composers today. Generalisation from these results could not be extended to cover the music of the 12 note school of composers which is being developed in this culture and which is still in the process of formalising its own laws and systems.

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APPENDIX I

Table 7. Undecided responses of Subject Groups I-VIII to the four categories of music, Aa, Bb, Ab, Ba.

Subject Groups	Number of undecided responses			
	Aa	Bb	Ba	Ab
I	17	18	22	16
II	14	18	18	17
III	7	9	5	7
IV	-	-	-	-
V	-	-	-	-
VI	-	-	-	-
VII	-	-	6	1
VIII	-	-	1	-

APPENDIX II

Table 8. Responses of subject groups I-VIII to the two examples of music written in a major key (A) at a fast tempo (a).

Subject Group	Aa_1 Number of happy responses	Aa_1 Total responses	Aa_2 Number of happy responses	Aa_2 Total responses
I	7	9	7	9
II	6	8	9	9
III	5	5	3	4
IV	11	16	13	16
V	21	25	23	24
VI	13	14	14	14
VII	30	32	31	32
VIII	61	62	61	62

A comparison of the responses of the subject groups I-VIII to the two examples of music written in a major key at a fast tempo (Aa_1, Aa2) shows that there is no difference for groups I and VIII. The remaining groups show slight differences which were tested for significance with a two by two chi-square using the yates correction for small numbers.

Example of the two by two table:-

Group II	Aa_1	Aa_2	
Happy responses	6	9	15
Sad responses	2	0	2
Total	8	9	17

$X^2 = 0.71$

The values for chi-squared for the groups are given separately in the following table.

Table 9. The results of the 2 x 2 X^2, tests performed on the responses of the subject groups I-VIII to the two tunes Aa_1 and Aa_2

Subject Group	Degrees of freedom	X^2	P
I	1	0.0	>.05
II	1	0.71	>.05
III	1	0.01	>.05
IV	1	0.16	>.05
V	1	0.80	>.05
VI	1	0.0	>.05
VII	1	0.0	>.05
VIII	1	0.0	>.05
Total	8	1.69	>.05

There are therefore no significant differences in the the subjects' responses to the two examples of music written in a major key at a fast tempo.

APPENDIX III

Responses of subject groups I - VIII to the two examples of music written in a minor key (B) at a slow tempo (b).

Table 10.

	Bb_1		Bb_2	
Subject group	Number of happy responses	Total responses	Number of happy responses	Total responses
I	4	7	1	10
II	2	3	5	10
III	1	3	1	4
IV	6	14	1	18
V	2	24	1	25
VI	0	14	0	14
VII	1	30	1	31
VIII	7	62	5	62

A comparison of the responses of the subject groups I - VIII to the two examples of music written in a minor key at a slow tempo (Bb_1, Bb_2) was made to test for significant differences between the two. To test the significance of the difference between the responses of Groups I - VIII to the two examples of music (Bb_1, Bb_2), eight X^2 2 x 2 tables were used with Yates' correction for small numbers in all cases.

Examples.

1) Group I.

	Bb_1	Bb_2	
Number of happy responses	4	1	5
Number of sad responses	3	9	12
Total responses	7	10	17

Using Yates' correction, $X^2 = \dfrac{\left\{(4 \times 9 - 3 \times 1) - \frac{17}{2}\right\}^2 17}{7 \times 10 \times 12 \times 5}$

$$X^2 = 2.42$$

2) Group II.

	Bb_1	Bb_2	
Number of happy responses	2	5	7
Number of sad responses	1	5	6
Total responses	3	10	13

Using Yates' correction, $X^2 = \dfrac{\left\{(2 \times 5 - 5 \times 1) - \frac{13}{2}\right\}^2 13}{3 \times 10 \times 6 \times 7}$

$$X^2 = 0.023$$

Table 11.

Table 11 shows the results of the 2 x 2, χ^2 tables performed on the responses of the subject groups I - VIII to the two tunes Bb_1 and Bb_2.

Subject group	Degrees of freedom	χ^2	P
I	1	2.420	>.1.0
II	1	0.023	>.1 0
III	1	0.364	>.1 0
IV	1	4.400	<.0.5
V	1	0.001	>.1.0
VI	1	0.000	>.1 0
VII	1	0.483	>.1.0
VIII	1	0.092	>.1.0
Total	8	7.783	>.1.0

When the 8 quantities of χ^2 are summed, with the degrees of freedom equal to 8, the resultant value for χ^2 = 7.783. This indicates the significance of the difference between the two lists of responses as a whole. This value for χ^2 is not significant at the 10% level, where the value for P = 0.1 is 13.36.

APPENDIX IV

Responses to the two categories of music written in a major key at a fast tempo Aa and written in a minor key at a slow tempo Bb.

Table 1.

Subject group	Aa		Bb	
	No. of happy responses	Total responses	No. of happy responses	Total responses
I	14	18	5	17
II	15	17	7	13
III	8	9	2	7
IV	24	32	7	32
V	44	49	3	49
VI	27	28	0	28
VII	61	64	2	61
VIII	122	124	12	124

The χ^2 test of significance, using 2 x 2 tables, was performed on the difference between the subjects' responses to the two categories Aa and Bb. The proportions of 'happy' responses out of the total responses to each category were tested in this way for each subject group. (For χ^2 values see Table 3.)

Examples

1) Group I.

	Aa	Bb	
Number of happy responses	14	5	19
Number of sad responses	4	12	16
Total responses	18	17	35

Using Yates' correction, $\chi^2 = \dfrac{\left([14 \times 12 - 5 \times 4] - \frac{35}{2}\right)^2 35}{18 \times 17 \times 19 \times 16}$

$\chi^2 = 6.407$

2) Group II.

	Aa	Bb	
Number of happy responses	15	7	22
Number of sad responses	2	6	8
Total responses	17	13	30

Using Yates' correction, $\chi^2 = \dfrac{\left([15 \times 6 - 2 \times 7] - \frac{30}{2}\right)^2 30}{17 \times 13 \times 8 \times 22}$

$\chi^2 = 2.86$

APPENDIX V

Responses of subject groups I - VIII to the two examples of music written in a minor key at a fast tempo (Ba_1, Ba_2).

Table 4.

Subject group	Number of happy responses	Total responses	Number of happy responses	Total responses
I	4	7	4	8
II	4	6	4	7
III	5	7	3	3
IV	10	16	13	16
V	19	25	18	24
VI	12	14	7	14
VII	15	32	7	32
VIII	39	61	31	62

A comparison of the responses of the subject groups I - VIII to the two examples of music written in a minor key at a fast tempo (Ba_1, Ba_2). To test for significant differences between the two, eight x^2 tests were performed, using 2 x 2 tables, with Yates' correction for small numbers in most cases.

1) Group I.

	Ba_1	Ba_2	
Number of happy responses	4	4	8
Number of sad responses	3	4	7
Total responses	7	8	15

$x^2 = 0.05$. Not significant, as $P > 0.1$.

2) Group II.

	Ba_1	Ba_2	
Number of happy responses	4	4	8
Number of sad responses	2	3	5
Total responses	6	7	13

$x^2 = 0.048$. Not significant, as $P > 0.1$.

3) Group III.

	Ba_1	Ba_2	
Number of happy responses	5	3	8
Number of sad responses	2	0	2
Total responses	7	3	10

x^2 = 0.02. Not significant, as P > 0.1.

4) Group IV.

	Ba_1	Ba_2	
Number of happy responses	10	13	23
Number of sad responses	6	3	9
Total responses	16	16	32

x^2 = 0.62. Not significant, as P > 0.1.

5) Group V.

It could be seen by inspection that the difference in this group's responses to the two pieces of music (Ba_1, Ba_2) would not be significant.

6) Group VI.

	Ba_1	Ba_2	
Number of happy responses	12	7	19
Number of sad responses	2	7	9
Total responses	14	14	28

x^2 = 2.61. Not significant, as P > 0.1.

7) Group VII.

	Ba_1	Ba_2	
Number of happy responses	15	7	22
Number of sad responses	17	25	42
Total responses	32	32	64

x^2 = 3.39. Significant, as P < 0.1, but > .05.

8) Group VIII.

	Ba_1	Ba_2	
Number of happy responses	39	31	70
Number of sad responses	22	31	53
Total responses	61	62	123

x^2 = 2.43. Not significant, as P > 0.1.

APPENDIX VI

Responses of subject groups I - VIII to the two examples of music written in a major key at a slow tempo (Ab_1, Ab_2).

Table 5.

Subject group	Ab_1 Number of happy responses	Ab_1 Total responses	Ab_2 Number of happy responses	Ab_2 Total responses
I	6	11	2	9
II	4	5	4	9
III	0	4	5	5
IV	8	16	6	16
V	1	24	8	25
VI	3	14	4	14
VII	11	32	5	32
VIII	29	62	30	62

A comparison of the responses of the subject groups I - VIII to the two examples of music written in a major key at a slow tempo, Ab_1 and Ab_2. To test for significant differences between the two, eight X^2 tests were performed, using 2 x 2 tables, with Yates' correction for small numbers in all cases.

1) Group I.

	Ab_1	Ab_2	
Number of happy responses	6	2	8
Number of sad responses	5	7	12
Total responses	11	9	20

$$X^2 = \frac{\left\{(6 \times 7 - 5 \times 2) - \frac{20}{2}\right\}^2 20}{11 \times 9 \times 12 \times 8}$$

$X^2 = 1.01$. Not significant, as $P > 0.1$.

2) Group II.

	Ab_1	Ab_2	
Number of happy responses	4	4	8
Number of sad responses	1	5	6
Total responses	5	9	14

$$X^2 = \frac{\left\{(4 \times 5 - 4 \times 1) - \frac{14}{2}\right\}^2 14}{5 \times 9 \times 6 \times 8}$$

$X^2 = 0.7269$. Not significant, as $P > 0.1$.

3) Group III.

	Ab_1	Ab_2	
Number of happy responses	0	5	5
Number of sad responses	4	0	4
Total responses	4	5	9

$$X^2 = \frac{\left\{(10 - 20) - \frac{9}{2}\right\}^2 9}{4 \times 5 \times 4 \times 5}$$

$X^2 = 17.41$. Significant, as $P < .001$.

4) Group IV.

It could be seen, by comparison with previous groups, that the difference between this group's responses to Ab_1 and Ab_2 was not significant at the 0.1 level of probability.

5) Group V.

	Ab_1	Ab_2	
Number of happy responses	1	8	9
Number of sad responses	23	17	40
Total responses	24	25	49

$$X^2 = \frac{\left\{(1 \times 17 - 23 \times 8) - \frac{49}{2}\right\}^2 49}{24 \times 25 \times 40 \times 9}$$

$X^2 = 4.6$. Significant, as $P < 0.05$.

6) Group VI.

It could be seen, by comparison with previous groups, that the difference between this group's responses to Ab_1 and Ab_2 was not significant at the 0.1 level of probability.

7) Group VII.

	Ab_1	Ab_2	
Number of happy responses	11	5	16
Number of sad responses	21	27	48
Total responses	32	32	64

$$X^2 = \frac{\left\{(11 \times 27 - 21 \times 5) - \frac{64}{2}\right\}^2 64}{32 \times 32 \times 16 \times 48}$$

$X^2 = 2.08$. Not significant, as $P > 0.1$.

8) Group VIII.

It could be seen, by comparison with previous groups, that the difference between this group's responses to Ab_1 and Ab_2 was not significant at the 0.1 level of probability.

APPENDIX VII

A comparison of the responses of Groups IV and VI to the categories of music Ba and Ab, where Ba is music written in a minor key at a fast tempo, and Ab is music written in a major key at a slow tempo.

1) Group IV.

	Ba	Ab	
Number of happy responses	23	14	37
Number of sad responses	9	18	27
Total responses	32	32	64

$$X^2 = \frac{\left\{(23 \times 18 - 9 \times 14) - \frac{64}{2}\right\}^2 64}{32 \times 32 \times 27 \times 37}$$

$X^2 = 5.18$. Significant, as $P < 0.025$.

2) Group VI.

	Ba	Ab	
Number of happy responses	19	7	26
Number of sad responses	9	21	30
Total responses	28	28	56

$$X^2 = \frac{\left\{(19 \times 21 - 9 \times 7) - \frac{56}{2}\right\}^2 56}{28 \times 28 \times 30 \times 26}$$

$X^2 = 10.33$. Significant, as $P < .005$.

APPENDIX VIII

1. Comparison of the responses of the subject groups I - VIII to the Happy category of music (Aa).

(a) A x^2 test of significance was used in a 2 x 8 table to compare the proportions of happy/ total responses given to this category of music by the 8 groups.

Subject groups	I	II	III	IV	V	VI	VII	VIII	T
No. happy responses	14	15	8	24	44	27	61	122	315
No. sad responses	4	2	1	8	5	1	3	2	26
	18	17	9	32	49	28	64	124	341

$x^2 = 27.5$ $p < .001$

(b) A x^2 test of significance was used in a 2 x 4 table to compare the proportions of happy/total responses given to this category of music by Groups I - IV.

Subject groups	I	II	III	IV	T
No. happy responses	14	15	8	24	61
No. sad responses	4	2	1	8	15
	18	17	9	32	76

$x^2 = 2.0192$ $p > .1$

(c) A similar test was used to compare the responses of Groups V - VIII to this category of music.

Subject groups	V	VI	VII	VIII	
No. happy responses	44	27	61	122	254
No. sad responses	5	1	3	2	11
	49	28	64	124	265

$x^2 = 6.28$ $p > .05$

2. Comparison of the subject groups I - VIII in responses to the Sad category of music Bb.

(a) A x^2 test of significance was used in a 2 x 8 table to compare the proportions of happy/total responses given by the 8 groups to this category of music.

Subject groups	I	II	III	IV	V	VI	VII	VIII	T
No. happy responses	5	7	2	7	3	0	2	12	38
No. sad responses	12	6	5	25	46	28	59	122	293
	17	13	7	32	49	28	61	124	331

$x^2 = 37.884 \quad p < .001$

(b) A x^2 test of significance was used in a 2 x 4 table to compare the proportions of happy/total responses given to this category of music by Groups I - IV.

Subject groups	I	II	III	IV	T
No. happy responses	5	7	2	7	21
No. sad responses	12	6	5	25	48
	17	13	7	32	69

$x^2 = 4.089 \quad p > .1$

(c) A similar test was used to compare the responses of groups V - VIII.

Subject groups	V	VI	VII	VIII	T
No. happy responses	3	0	2	12	17
No. sad responses	46	28	59	112	245
	49	28	61	124	262

$x^2 = 4.92 \quad p > .1$

APPENDIX IX

1. A comparison between the responses of the subject groups I - VIII to the category of music Bà (minor key, fast tempo).

a) A X^2 test of significance was used in a 2 x 8 table to compare the proportions of happy/total responses given to this category of music Ba, by the 8 subject groups.

Subject groups	I	II	III	IV	V	VI	VII	VIII	T
No. happy responses	8	8	8	23	37	19	22	70	195
No. sad responses	7	5	2	9	12	9	42	53	139
Total	15	13	10	32	49	28	64	123	334

$X^2 = 28.782$. Significant , as $P < 0.001$.

b) A X^2 test of significance was used in a 2 x 3 table to compare the proportions of happy/total responses given to this category of music Ba by the subject groups III - V.

Subject groups	III	IV	V	T
No. happy responses	8	23	37	68
No. sad responses	2	9	12	23
Total	10	32	49	91

$X^2 = 0.05$. Not significant, as $P > 0.1$.

1. c) A similar test was used to compare the proportion of happy/total responses given to this category of music Ba by groups I, II, VI and VIII.

Subject groups	I	II	VI	VIII	T
No. happy responses	8	8	19	70	105
No. sad responses	7	5	9	53	74
Total	15	13	28	123	179

$X^2 = 1.23$. Not significant, as $P > 0.1$.

2. A comparison between the responses of the subject groups I - VIII to the category of music Ab (major key, slow tempo).

a) A X^2 test of significance was used in a 2 x 6 table to compare the proportions of happy/total responses given to the Ab category of music by subject groups I, II, IV, VI, VII and VIII.

Subject groups	I	II	IV	VI	VII	VIII	T
No. happy responses	8	8	14	7	16	59	112
No. sad responses	12	6	18	21	48	65	170
Total	20	14	32	28	64	124	282

$X^2 = 13.21$. Significant, as $P < 0.025$.

2. b) A X^2 test of significance was used in a 2 x 4 table to compare the proportions of happy/total responses given to the Ab category of music by subject groups I, II, IV and VIII.

Subject group	I	II	IV	VIII	T
No. happy responses	8	8	14	59	89
No. sad responses	12	6	18	65	101
Total	20	14	32	124	190

$X^2 = 0.8835$. Not significant, as $P > 0.1$.

APPENDIX X

Table 12.

This table shows the familiarity of the adult subjects with the eight pieces of music used.

Music Category	Number of Subjects			
	Recognised music	Named composer correctly	Named title of music correctly	Named music and composer correctly
Ba_1	2	3	-	-
Bb_1	1	-	-	-
Ab_1	3	1	-	1
Aa_1	8	-	2	10
Bb_2	2	-	-	1
Aa_2	2	-	-	-
Ba_2	-	-	-	-
Ab_2	1	-	-	-

Key:

B = minor key

A = major key

b = slow tempo

a = fast tempo.

Table 13. Showing the responses to the 8 pieces of music given by the male (M) and female (F) subjects in each age group.

Aa (major key, fast tempo)

Age	3 - 4		4 - 5		5 - 6		7 - 8		10 -11		11 -13		13 -14		18+	
Sex	M	F	M	F	M	F	M	F	M	F	M	F	-	F	M	F
Happy	4	3	5	1	0	6	5	6	11	10	8	5	-	13	30	31
Total	5	4	6	2	0	6	8	8	17	16	8	6	-	14	31	31
Undec-ided	4	5	2	5	1	1										

Aa (major key, fast tempo)

Age	3 - 4		4 - 5		5 - 6		7 - 8		10 -11		11 -13		13 -14		18+	
Sex	M	F	M	F	M	F	M	F	M	F	M	F	-	F	M	F
Happy	3	4	6	3	3	0	8	6	11	12	8	6	-	31	31	30
Total	4	5	6	3	3	1	10	6	12	12	8	6	-	32	31	31
Undec-ided	4	4	3	4	1	3										

Bb (minor key, slow tempo)

Age	3 - 4		4 - 5		5 - 6		7 - 8		10 -11		11 -13		13 -14		18+	
Sex	M	F	M	F	M	F	M	F	M	F	M	F	-	F	M	F
Happy	3	1	2	0	1	2	2	2	2	0	0	0	-	1	4	3
Total	6	1	2	1	1	3	10	6	12	12	8	6	-	30	31	31
Undec-ided	4	6	8	4	2	2										

Bb (minor key, slow tempo)

Age	3 - 4		4 - 5		5 - 6		7 - 8		10 -11		11 -13		13 -14		18+	
Sex	M	F	M	F	M	F	M	F	M	F	M	F	-	F	M	F
Happy	0	1	2	3	2	0	1	0	0	1	0	0	-	1	5	0
Total	5	5	5	5	2	3	8	8	13	12	8	6	-	31	31	31
Undec-ided	3	5	2	4	0	3										

Table 13 (continued)

Ab_1 (major key, slow tempo)

Age	3 - 4		4 - 5		5 - 6		7 - 8		10 -11		11 -13		13 -14		18+	
Sex	M	F	M	F	M	F	M	F	M	F	M	F	-	F	M	F
Happy	3	3	2	2	0	0	3	2	0	1	2	1	-	11	13	16
Total	5	6	3	2	2	1	10	6	12	12	8	6	-	32	31	31
Undec-ided	3	4	3	3	1	4							-	1		

Ab_2 (major key, slow tempo)

Age	3 - 4		4 - 5		5 -6		7 - 8		10 -11		11 -13		13 -14		18+	
Sex	M	F	M	F	M	F	M	F	M	F	M	F	-	F	M	F
Happy	1	1	3	1	2	1	2	4	6	2	3	1	-	5	15	15
Total	4	5	4	5	2	2	8	8	13	12	8	6	-	32	31	31
Undec-ided	5	4	3	4	0	4										

Ba_1 (minor key, fast tempo)

Age	3 - 4		4 - 5		5 - 6		7 - 8		10 -11		11 -13		13 -14		18+	
Sex	M	F	M	F	M	F	M	F	M	F	M	F	-	F	M	F
Happy	1	3	3	1	2	3	4	7	9	10	8	4	-	15	21	18
Total	3	4	4	2	2	5	8	8	13	12	8	6	-	32	31	30
Undec-ided	5	6	7	2	0	1							-	2		

Ba_2 (minor key, fast tempo)

Age	3 - 4		4 - 5		5 - 6		7 - 8		10 -11		11 -13		13 -14		18+	
Sex	M	F	M	F	M	F	M	F	M	F	M	F	-	F	M	F
Happy	2	2	1	3	0	2	8	5	8	10	5	2	-	7	18	13
Total	4	4	3	4	0	2	10	6	12	12	8	6	-	32	31	31
Undec-	5	6	3	6	3	3							-	4		