

A Theory on the Effect
of Music on the Emotions

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Abstract

A study was performed on the effect of music on the emotions. The musical elements pitch and tempo were held as independent variables. An original piece of music was composed by the author for the experiment, and played at different pitches and tempos to correspond to a 3 x 3 design.

An analysis of variance was performed on the data. The results indicated, first of all, that actual pitch was the main influence on the subjects report of pitch. And likewise, actual tempo was the main influence on the subjects report of tempo. It was predicted that pitch and tempo would combine additively to effect mood. But the predicted interaction of pitch and tempo effects on mood was not significant. It was found, however, that pitch and tempo have direct independent effects on mood.

The experiment was replicated using a revised mood scale and these findings were essentially confirmed.

Table of Contents

Introduction.....	1
Hypothesis.....	13
Nomological Network.....	14
Method.....	16
Results.....	21
Results (Ex. II).....	28
Discussion.....	37
References.....	40

A Theory on the Effect of Music on the Emotions

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What can be said about this age old phenomena of music affecting our psyche? One does notice upon investigation that throughout the history of music a definite trend of discovery; artistic experimentation and invention of new forms that would consequently effect man in a new or different manner.

Certainly these men who have made their contribution to humankind, namely those musicians from the early Greek and Roman periods, the men of the Gregorian period, the Baroque man, the Renaissance man, the Classical and Romantic men, the Neo-Classical man and certainly the musician of the Twentieth Century, have not realized what exactly is this power they hold in effecting man's emotions. On the other hand, if one investigates the art of music itself, one finds dynamic tensions in attempt to spell out the purpose of music. Dr. Charles Burney commented in his General History of Music that "music is an innocent luxury, unnesessary, indeed, to our existence, but a great improvement and gratification of the sense of hearing." (Grout, 1960) Whereas less than a hundred years earlier, Andreas Werckmeister called music "a gift of God, to be used only in his honor." (Grout, 1960) Whether music is an innocent luxury or a gift from God might seem rather insigni-

ficant at first. But this definitely effects the manner in which man perceives this outside stimulus that will perhaps evoke a particular response.

Others, such as St. Isidore, seemed to have grasped in a more real way the relationship between music as stimulus and mood as response. In his Etymologies he states,

Music rouses the emotions, it calls the senses to a different quality. In battles, the music of the trumpet fires the riors, and the more imepuous its loud sound the braver is the spirit for fighting... Music also comforts the mind in the enduring labors, and singing lightens weariness in solitary tasks. Music also calms everwrought minds...Whatever emotions we feel within from the beating of our impulses, it is proven that they are brought into communion with the virtues through the musical rhythms of harmony.

Isidore has captures some basic principles on the effect of music on the emotions. He perceives music as a stimulant, tranquilizer, and as an antidepressant. Certainly, what he has stated above can be compared to the ancient concept of ethos.

Donald Jay Grout, a professor of Musicology at Cornell University, states the following in his book, A History of Western Music, concerning the doctrine of ethos.

The doctrine of ethos, or the moral qualities and effects of music, seems to be rooted in the Pythagorean view of music as a microcosm, a system of sound and rhythm ruled by the same mathematical laws that operate in the whole of the visible and invisible creation. Music, in this view, was not a passive image of the orderly system of the universe—hence the attribution of miracles to the legendary musicians of mythology. A later, more

scientific age emphasized the effects of music on the will and thus on the character and conduct of human beings. (Grout, 1960)

Aristotle, a member of this more scientific age, explained the effects of music on the will through the doctrine of imitation. Music, according to Aristotle, directly imitates (that is, represents) the passions or states of the soul—gentleness, anger, courage, temperance, and their opposites and other qualities; hence, when one listens to music that imitates a certain passion he becomes imbued with the same passion; and if over a long time he habitually listens to the kind of music that rouses ignoble passions, his whole character will be shaped to a ignoble form. (Aristotle, Politics 8)

Both Plato and Aristotle had described what particular type of music was proper in order to develop the "right kind of person." Their description merely indicates which one of the modes should be used so that the young man being educated, would be instructed in the proper environment.

Grout continues by pointing out that "the Greek doctrine of ethos, then, was founded on the conviction that music affects character and the different kinds of music affect it in different ways. In the distinction made among the many different kinds of music we can discern a general division into two classes: music whose effect was toward calmness and uplift, and music which tended to produce excitement and enthusiasm." (Grout, 1960)

The above notion seems then to allow us to further discern that there is a somewhat philosophical concept that would suggest this relationship between highness and lowness. If the philosophical concept can not be seen clearly, then one would admit to a definite theological concept of high and low, that does forward the notion that things that are conceptualized as high are naturally classified as "good." And quite the opposite, objects or actions that are conceptualized low are classified as "bad." Parallel to the above examples, quite often heaven, symbolizing goodness, is conceptualized as high, and hell, symbolizing badness, is conceptualized as low.

The doctrine of ethos and the comparisons that were drawn together above are very relevant to this paper, in that they served as the spring-board of this study. Before the actual hypothesis is given, an investigation of previously performed experiments by other authors might prove helpful.

In 1969 John P. Robinson and Paul Hirsch published an article entitled "It's the Sound that Does It" in the November issue of Psychology Today. The entire situation seemingly was concerned over the types of records teenagers favored back in 1967. Two communities of teenagers were surveyed; 430 students in a Detroit high school, and 340 students in a Grand Rapids high school. There was a 3.5 million population difference between the two cities. On this survey they were given three choices— "like it a lot," "O.K.," and "don't like," over 75

per cent indicated they liked the current hits "a lot." They rated (in descending order of preference) modern jazz, folk-songs, show tunes, and classical music as generally "O.K." Country-western music was rated "don't like" equally in both cities. Next, the students were asked to list their three favorite songs, their favorite artist, and the names of three records they had recently purchased. These favorites fell into four broad categories.

Table 1
Data from Robinson-Hirsch study, favorite records categories.

Detroit		Grand Rapids	
Rhythm & Blues	36%	Rhythm & Blues	15%
Protest	13%	Protest	14%
Other Hits	45%	Other Hits	63%
Square	6%	Square	8%
	100%		100%

Another interesting correlation that the experimenters discovered was that they were able to predict, with 75 per cent accuracy, whether the student likes and will possibly buy rhythm and blues, having previous knowledge of the students race. The correlation between race and musical preference was very high (.87).

The experimenters were interested in discovering whether or not the students were able to comprehend the meaning of the songs they listen to. They selected four songs that were familiar to both cities. The results indicated that the

students did not understand the meaning of the songs, but rather they responded that there is "no real meaning, just a good sound." When the students were asked if they purchased a record for the meaning or the beat, 70 per cent said they liked the records they purchase because of the "beat" rather than the message.

The value of this experiment lies in the assumption that people do listen to the "beat" rather than the message. The survey also indicated that various music effects diversified age groups and varied cultural backgrounds differentially.

Interestingly enough, less than twenty years earlier, Dr. Alexander Capurso performed an experiment which studied this phenomena of music effecting emotions in greater depth than the previously described experiment. The Capurso study used one hundred and thirty-four college and high school instructors, in order to secure the titles of certain compositions which in their opinion were associated with certain mood categories. One hundred and five of the selections mentioned most frequently by the experts were chosen to be used in listening test. There were 1,075 non-musical students tested.

The experimenters limited their choice of selections to (1) instrumental music, solo or ensemble, and (2) vocal music presented in languages other than English. A further limitation was added regarding the length of the compositions.

All of the listening tests were performed under uniform conditions, with like phonographs, unmarked records, and control of sound and volume. All of the selections were tested at least a hundred times, with some being tested up to seven hundred times.

After each selection was played the students were asked to list which of the six categories they felt would most adequately describe the effects of the compositions. The six categories are presented below:

- A. Happy, Gay, Joyous, Stimulating, Triumphant
- B. Agitated, Restless, Irritating
- C. Nostalgic, Sentimental, Soothing, Meditative, Relaxing
- D. Prayerful, Reverent
- E. Sad, Melancholy, Grieving, Depressive, Lonely
- F. Eerie, Weird, Grotesque

In order to prevent other influences to affect their choices, the experimenters waited two minutes between each selection.

The conclusions that were drawn from this experiment compared the above rating of the selections with an evaluation of the emotional strength of the selections. Emotional strength was measured by a verbal expression of the intensity of a student's response in accordance with a point scale, which was then transformed into a percentage figure.

The results of this study were arranged so that a listing was made of how the students rated the selections. The data was compiled into tables with included information of title and composer of each selection, emotional strength of the sel-

ection, per centage of listener agreement, and in some cases a few listener comments were added. The tables contain results for all six categories.

Now the significance of this experiment above, to notice in relation to the present study, is that mood ratings were used to test the effect of music on the emotions. And different music resulted in different mood responses. The present study will attempt to relate differential emotional responses, mood rating, to two musical elements, namely, pitch and tempo.

It is necessary to take into consideration the two main variables of pitch and tempo. An operational definition of pitch is that qualitative attribute of auditory sensation, which denotes highness and lowness in the musical scale and this is determined by the frequency of the sound waves.
(Seashore, 1967)

In Gundlach's paper, "Factors Determining the Characterizations of Musical Phrases," the relationship between pitch and emotional feelings was studied. After asking his listeners to characterize their responses to a considerable number of melodies, Gundlach factor-analyzed the data. A second analysis was obtained on tempo, smoothness of rhythm, and loudness. (The results on tempo will be presented in reference to an operational definition of tempo.)

Table 2 is concerned with a listing of moods that were attributed to high and low pitches. (Farnsworth, 1969)

Table 2.
Data from the Gundlach study. Adjectives attributed to high and low pitch.

High Pitch	Low Pitch
sentimentality	mournfulness
whimsicalness	somberness
gladness	tranquility
happiness	grotesque feelings
loveliness	
romantic feelings	

Obviously, there is quite a contrast between the words used to characterize high pitch and those used to characterize low pitch. The Capurso Study concluded similar result. Table 3 shows these results. (Gutheil, 1952)

Table 3.
Data from the Capurso study. Adjectives attributed to high and low pitch.

High Pitch	Low Pitch
happy	sad
gay	melancholy
joyous	grieving
stimulating	lonely

Both Gundlach and Capurso were dealing with instrumental music in their experiments.

From the Harvard Laboratory of Social Relations a study was performed in semantics which will be helpful in our understanding of pitch. Metaphorical terms were to be used from the writings of George Bernard Shaw and three contemporary

music critics which were to describe certain voice qualities. These terms were given to a group of musically naive subjects who were asked to use them to describe nine operatic voices. The results are listed below, for three of the operatic voices, in Table 4. (Farnsworth, 1968)

Table 4
Data from the Harvard Lab. of Social Relations. Adjectives which were used to describe three operatic voices.

Baritoned Voice	Tenor Voice	Soprano Voice
dull	bright	coarse
coarse	thin	soft
closed	light	light
dark		thin
heavy		
rough		
hard		
thick		

The evidence considered, once again indicated that high or low pitch differences effect the emotions and can result in systematic description differences.

It is not as easy to obtain an operational definition of tempo as it was for pitch, because of the confusion existing between the terms meter, rhythm, and tempo. And so it will be necessary to define them all.

Meter could be defined as the scheme of accents. Where as rhythm pertains to everything of a temporal or durational quality of tone, and therefore, in its broadest sense, it per-

tains to the tones and rests of different lengths within the meter. Tempo, then, refers to the speed at which a composition is executed. (Elliott, 1959)

Tempo, like pitch, also carries emotional implications. The associations that are made with tempo generally have their basis in a physiological relationship. We seemingly are affected greatly by the beat of our heart. When relaxed, the heart beat is medium in pace. When there is excitement, the pace picks up. And similarly, when we are depressed or "out of it" the heart beat tends to be slower. Taking into account this physiological implication, we can see a definite psychological relationship. Somehow what is felt on the inside, in this case the heart-beat, affects the manner in which one relates and perceives the outside world. Therefore, from this we can conclude that there is a definite relationship between tempo and mood. "Our pulse, our breathing, our entire being adjusts to the rate of movement and to the feelings engendered thereby on the conscious and subconscious levels." (Machlis, 70)

In Gundlach's paper concerning the variables which give meaning to music, he set up a table noting the effect of tempo as a variable in relationship to the emotions. The results are listed below in Table 5.

The terms used to describe tempo have a striking parallel with those used to describe the effects of pitch on the emotions. (Farnsworth, 1969)

Table 5.
Data from the Gundlach study. Adjectives used to describe attributes of tempo.

Fast Tempo	Slow Tempo
brilliant	dignified
animated	somber
uneasy	tranquil
glad	melancholy
whimsical	mournful
flippant	delicate
grotesque	sentimental

A study by Henver examined six elements of music and then studied their effect on the emotions. The results of his analysis on tempo are presented below in Table 6.

Table 6
Data from the Henver study. Adjectives used to describe the effects of tempo on the emotions.

Fast Tempo	Slow Tempo
graceful	dignified
sparkling	solemn
happy	sad
bright	heavy
exciting	dreamy
elated	sentimental
vigorous	serene
majestic	gentle

Once again it is clear that differences in a dimension that constitute an element of music can result in systematic descriptive differences.

The previously mentioned experiments point out some of the research that has taken place in the area of the effect of

music on the emotions. These experiments employed selections that are familiar to the public. It would seem then that in order to study the effects of music directly, familiarity with a musical selection would be necessary.

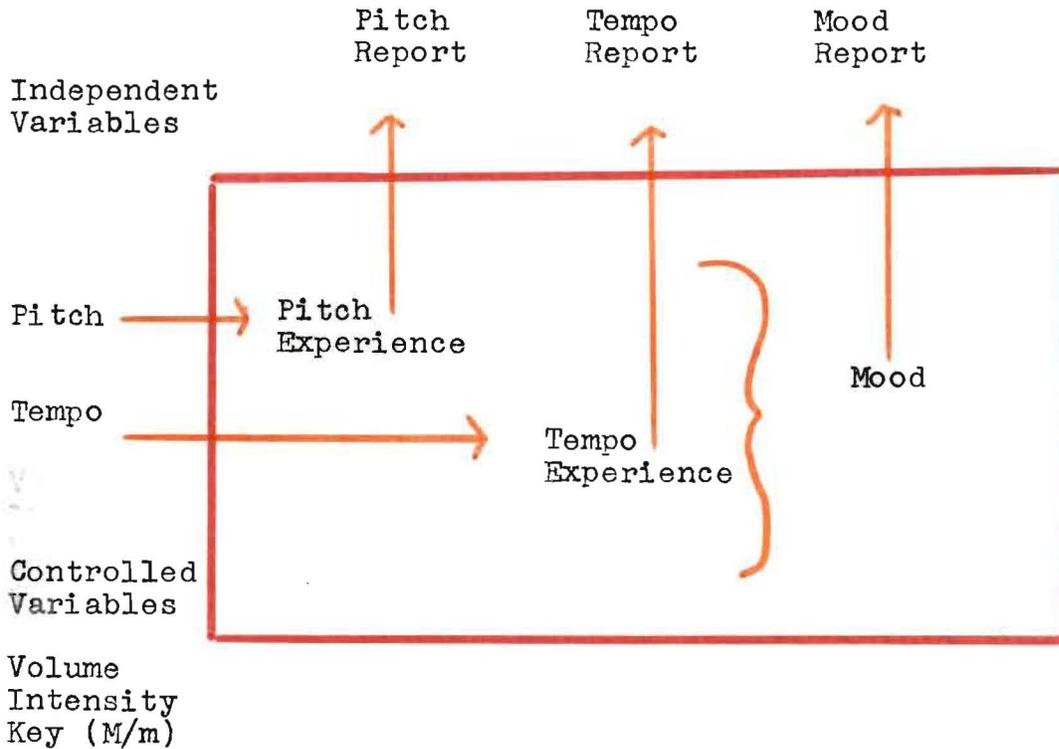
The next logical step is to present my actual hypothesis. I predict that certain components of music, namely, those of pitch and tempo, combined additively to result in a particular mood, will be reflected on a mood scale. These moods can be described by a continuum ranging from happy to sad. For example, when pitch is high and tempo is fast, the resulting emotion predicted is happiness. Whereas if pitch were low, and the tempo was slow, the predicted result would be reflected by a low score on the emotional continuum. Also I predict that a medium pitch, and a medium tempo, will produce a medium mood reflected by a middle score on the emotional scale.

The hypothesis can be described by the Nomological Network in Figure 1 (page 14). Independent and controlled variables are located in the left of the box. Terms within the box represent hypothetical subject variables. Manipulated pitch & tempo are expected to have a direct influence on the subjects experience of tempo. These experiences should be reflected in the subjects reports of pitch and tempo. A subjects experience of pitch and tempo are held to combine additively

and result in some mood.

In summation, a high-pitched, fast tempo, is predicted to result in a elevated mood. A low-pitched, slow tempo, should result in a depressed mood. And an intermediate pitch and tempo should result in an intermediate mood. Mood can also be reflected in a mood report. As mentioned before, these hypothetical subject variables within the box can be expressed by corresponding reports.

Figure 1
Nomological Network describing the predictions of manipulated pitch and tempo and the corresponding mood reports.



Thus this prediction is essentially a prediction for a significant interaction of pitch and tempo as they together influence mood ratings.

Method

Thirty students from Saint Meinrad College were randomly selected to participate in this experiment. Prior to the experiment they were told only that the experiment pertained to music and that they would be asked to listen to some music and then they would be asked to record or indicate some response.

The experiment took place in the College language laboratory. This location was selected because each subject would have his own booth, and partly because the room was fairly sound proof, and thus there would be less chance for distractions.

Before the experiment began, each student filled in a general information sheet. The questions that were given are listed below.

Name _____

Date _____

Age _____

Time _____

- 1) Have you ever participated in a psychological experiment before?
- 2) Do you feel any anxiety towards this experiment?
- 3) Do you feel tense now?
- 4) If possible, please characterize your present mood. (circle)
9 (elated) 8 (joyous) 7 (happy) 6 (relaxed) 5 (mediocre) 4 (unhappy) 3 (sad) 2 (depressed) 1 (melancholy)
- 5) Have you had any formal music training?
- 6) If yes, how many years?

While each subject was filling in the information sheet, a selection was played, which was rated neutral by the Capurso Study. (Gutheil, 1952)

The purpose of the neutral selection was to attempt to have everyone on an approximate emotional level, hoping that everyone would be at a medium mood by the commencement of the experiment. Before the selection was complete, the subjects were asked to sit and relax and put aside all distractions if possible.

Subjects were instructed that they would be listening to certain selections of music. After they heard a complete selection they were asked to record their response on the score sheets provided. The score sheets contained three, nine point, scales; one for pitch, one for speed, and one for emotional response. Each scale was accompanied by adjectives that described corresponding responses.

The subjects were then asked to circle the adjective and corresponding number that most accurately described their response to the selection. These scales are reduplicated on page 18.

For the experiment a short original selection was composed by the author, in order to secure some element of control in the experiment. We can be sure that the subjects were unfamiliar with this selection. The author attempted to compose

Figure 2.

The three (nine point) scales used in the present study. There is a scale for pitch, tempo, and mood.

<u>Pitch</u>		<u>Tempo</u>	
High	9	Fast	9
	8		8
Med. High	7	Med. Fast	7
	6		6
Medium	5	Medium	5
	4		4
Med. Low	3	Med. Slow	3
	2		2
Low	1	Slow	1

The pitch was....

The tempo was....

Mood

Elated	9
Joyous	8
Happy	7
Relaxed	6
Mediocre	5
Unhappy	4
Sad	3
Depressed	2
Melancholy	1

The mood was....

piece of music that could not be associated with any particular style or and special period of music. A selection consisted of the piece of music played at one of three pitches and one of three speeds. Thus there were a total of nine selections.

Corresponding to a 3 x 3 design, pitch and tempo remained as independent variables. In Figure 3 the 3 x 3 design is pictured.

Figure 3
The 3 x 3 design used in the present experiment.

Pitch	High	Medium	Low
Tempo			
Fast	Fast Tempo High Pitch	Fast Tempo Med. Pitch	Fast Tempo Low Pitch
Medium	Med. Tempo High Pitch	Med. Tempo Med. Pitch	Med. Tempo Low Pitch
Slow	Slow Tempo High Pitch	Slow Tempo Med. Pitch	Slow Tempo Low Pitch

It should be mentioned that each subject listened to all nine selections of music, and thus they did have some experience with the music after hearing the selection once. In order to balance the effects of experience with this music and the effects of the sequence in which the various selections were heard, there were three listening sessions, allowing the selections to be arranged in a random sequence. The three se-

quences were as follows;

Group I 5,4,8,2,3,7,1,6,9,

Group II 3,5,2,1,9,6,7,4,8,

Group III 7,3,5,4,6,9,2,1,8,

After each group of subjects completed the listening selections, they were asked to complete another information sheet concerning the experiment. Listed below are the questions that appeared on that sheet.

- 1) Were you aware of what was happening in this experiment?
- 2) Did you feel any tension during the experiment?
- 3) If possible, please indicate your mood presently. (circle)

9 (elated)	8 (joyous)	7 (happy)	6 (relaxed)
5 (mediocre)	4 (unhappy)	3 (sad)	
2 (depressed)	1 (melancholy)		
- 4) Did you feel any musical background that you have had affected you during the experiment? Please explain.

Then there was a general section for any additional comments at the bottom of the questionnaire.

After this the subjects were asked to gather up their score sheets and the two information sheets and place them in a designated place and to leave quietly in order that any of the other subjects who might still be working would not be disturbed.

Results

An analysis of variance was performed on the three variables; pitch, tempo, and mood. The analysis was concerned with the effects of the independent variables pitch and tempo on the report ratings of pitch, tempo, and mood.

Table 7.
Analysis of Variance performed in the present experiment. This table is concerned with the effects of the independent variables on the pitch report.

Source	Sum of Squares	Degrees of Freedom	Mean of Squares	F Scores
A (pitch)	1581.8741	2	790.9370	346.1186***
B (tempo)	57.0074	2	28.5037	12.4759***
AB (interaction)	10.3037	4	2.5759	1.2274
S(AB) (within cells)	596.3000	261	2.2847	

** = significant at the $p < .01$
*** = significant at the $p < .001$ * = significant at the $p .05$

In the first analysis of variance (Table 7) the F scores indicate that the main effects of pitch on subjects rating of pitch is highly significant. The rating of pitch on tempo also has a significant effect. The interaction of pitch and tempo (AB) is not significant.

In Figures 4 and 5 we can see what has happened. Pitch is directly related to the subjects report of pitch. The strength of the relationship is shown by the wide spread of the report score means. Pitch rating is also influenced by tempo. Again

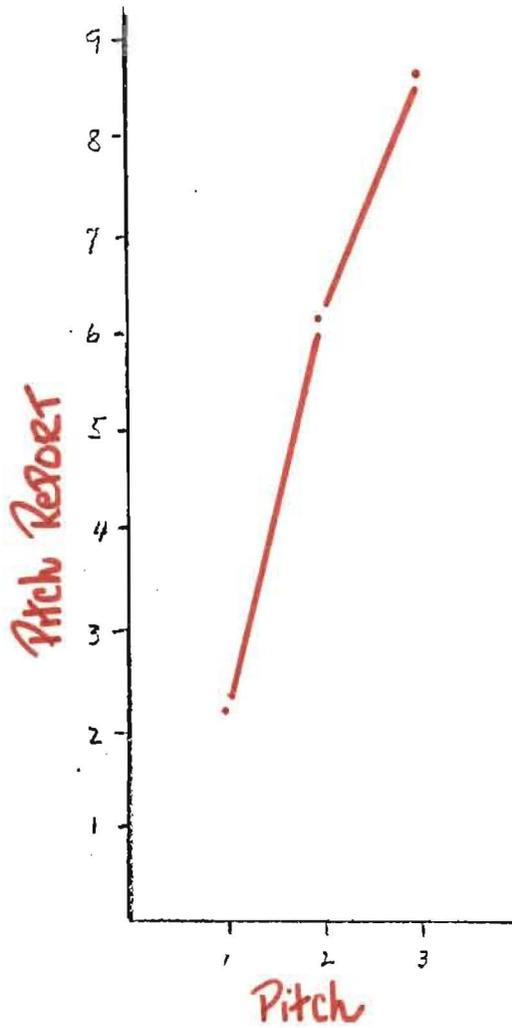
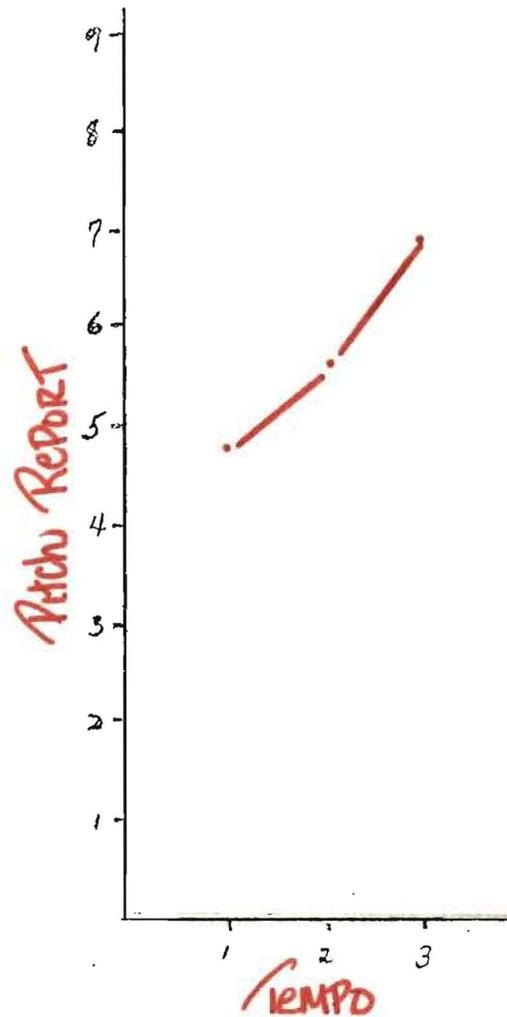


Figure 4. Effects of pitch on the subjects report of pitch.

Figure 5. Effects of tempo on the subjects report of tempo.



there is a direct relation between the two, but the weaker relationship is seen in the smaller spread. There was no interaction of pitch and tempo on the pitch rating.

Table 8.

Analysis of Variance performed in the present experiment. This table is concerned with the effects of the independent variables on tempo reports.

Source	Sum of Squares	Degrees of Freedom	Mean of Squares	F Scores
A (pitch)	22.8741	2	11.4370	5.1877***
B (tempo)	1014.0963	2	507.0481	229.9955***
AB (interaction)	7.6148	4	1.9037	.8635
S(AB) (within cells)	575.4000	261	2.2046	

** = significant at the $p < .01$

*** = significant at the $p < .001$ * = significant at the $p < .05$

Table 8 is concerned with the effects of the independent variables on tempo. The effect of pitch on the rating of tempo was significant, but not nearly as strong as the direct relationship between tempo and the subjects report of tempo. The F scores indicate that the main effects of tempo on subjects rating of tempo is highly significant at the $p < .001$. Once again the interaction of pitch and tempo (AB) is not significant.

In Figures 6 and 7 we can see what has happened. Tempo is directly related to the subjects report of tempo. The strength of the relationship is shown by the wide spread in Figure 7.

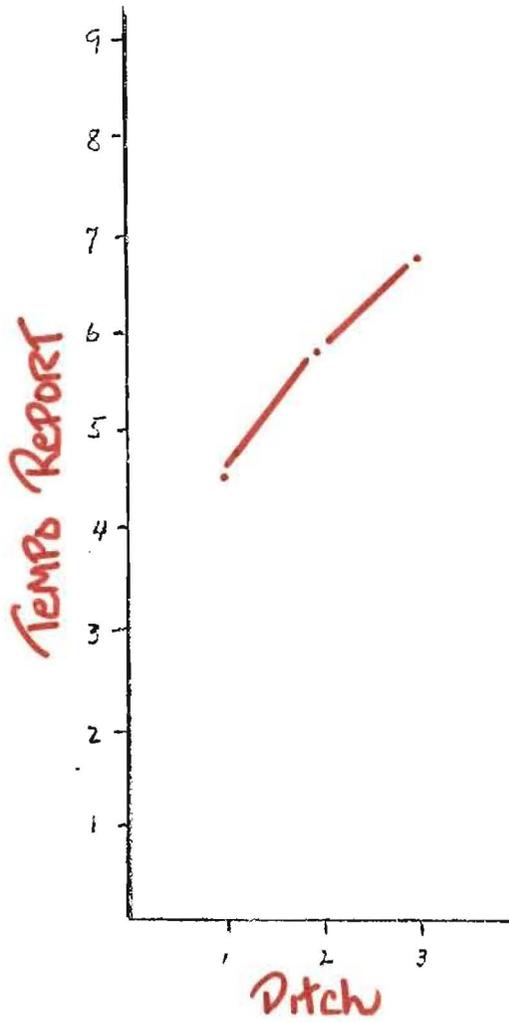


Figure 6. Effects of pitch on the subjects report of tempo.

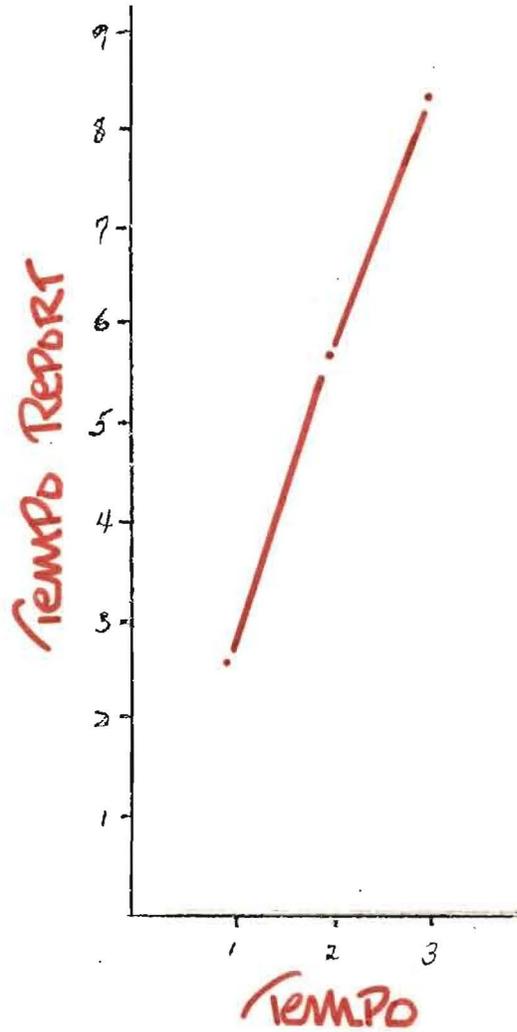


Figure 7. Effects of tempo on the subjects report of tempo.

Tempo rating is also directly related to pitch; the weaker relationship is seen in the smaller spread in Figure 6.

Table 9.

Analysis of Variance performed in the present experiment. This table is concerned with the effects of the independent variables on the mood report.

Source	Sum of Squares	Degrees of Freedom	Mean of Squares	F Scores
A (pitch)	6.1556	2	3.0778	1.2443
B (tempo)	230.2889	2	115.1444	46.5530***
AB (interaction)	3.3556	4	0.8389	.3392
S(AB) (within cells)	645.5667	261	2.4734	

** = significant at $p < .01$

*** = significant at $p < .001$ * = significant at the $p .05$

Table 9 deals with the effects of the independent variables on mood rating. The only significant effect is that of tempo on the emotional response. Pitch and interaction effects are not significant.

Figure 8 shows that tempo is directly related to mood. The absence of any significant effects of pitch in interaction with tempo upon mood is shown in Figure 9. We predicted interaction of pitch and tempo upon mood. The prediction was that they would have a commulative effect. The data presented above disconfirms that prediction. Instead, we found only the independent effect of tempo on mood.

It was felt that possibly the adjectives that were used on the mood scale might have limited the range of the nine

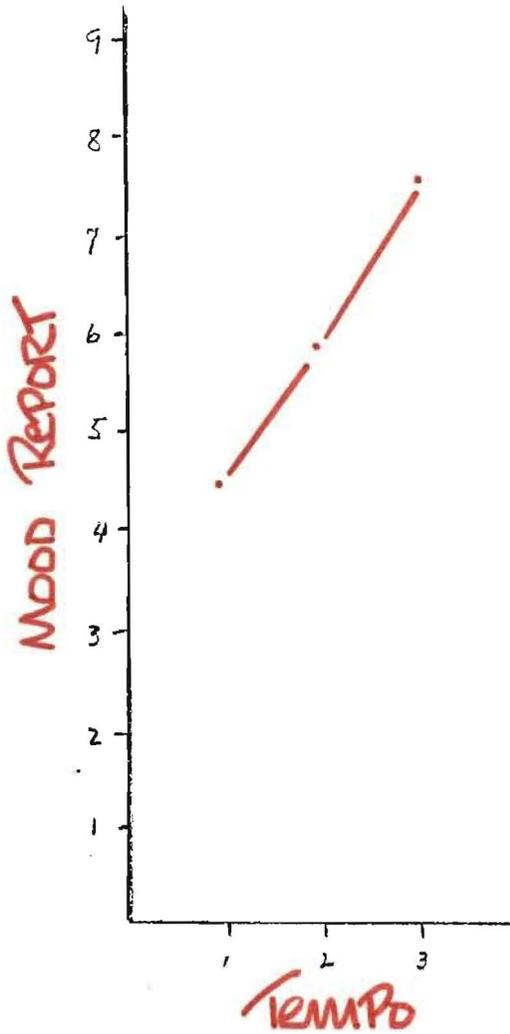
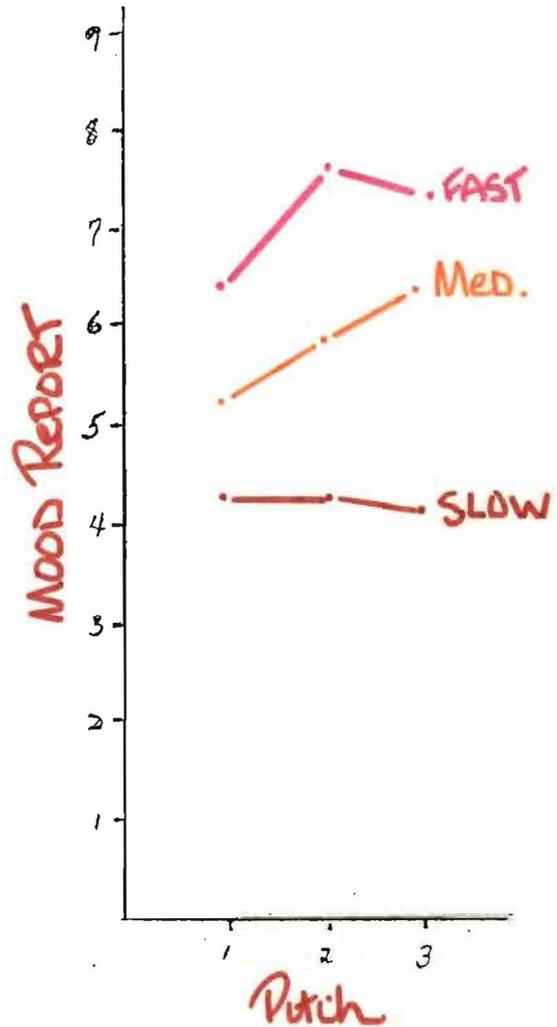


Figure 8. Effects of tempo on the subjects report of mood.

Figure 9. Effects of pitch and tempo on the subjects report of mood.



point scale, which the subjects were willing to use. This phenomena is commonly called an anchoring effect.

We changed the labels on the previous scale to range from happy to sad, since the range of the subjects responses were limited within these two categories in Experiment I. The new scale read as follows; happy, medium happy, medium, medium sad, and sad.

In doing this we are changing the subjects frame of reference and changing the context limits within which the judgements are to be made. (Underwood, 1966)

The experiment was then repeated, keeping everything constant, except that the new scale replaced the previously used mood scale.

Results of Experiment II

Once again an analysis of variance was performed on the three variables; pitch, tempo, and mood. The analysis was concerned with the effects of the independent variables pitch and tempo on the report rating of pitch, tempo, and mood.

Table 10.
Analysis of Variance performed in the present experiment. This table is concerned with the effects of the independent variables on pitch report, Experiment II.

Source	Sum of Squares	Degrees of Freedom	Mean of Squares	F Scores
A (pitch)	1897.6074	2	948.8037	1179.2240***
B (tempo)	20.4963	2	10.2481	12.7368***
AB (inter- action)	14.8593	4	3.7148	4.6169*
S(AB) (within cells)	210.0000	261	0.8046	

** = significant at $p < .01$
*** = significant at $p < .001$ * = significant at the $p .05$

In the analysis of variance (Table 10) the F scores indicate that main effects of pitch on subjects rating of pitch is highly significant. The effects of tempo on the rating of pitch are also significant. And the interaction of pitch and tempo (AB) is significant.

In Figure 10 we see that pitch is directly related to the subjects report of pitch. The strength of the relationship is shown by the wide spread. Pitch rating as influenced by tempo (Figure 11) was direct but not strong. The slightly signifi-

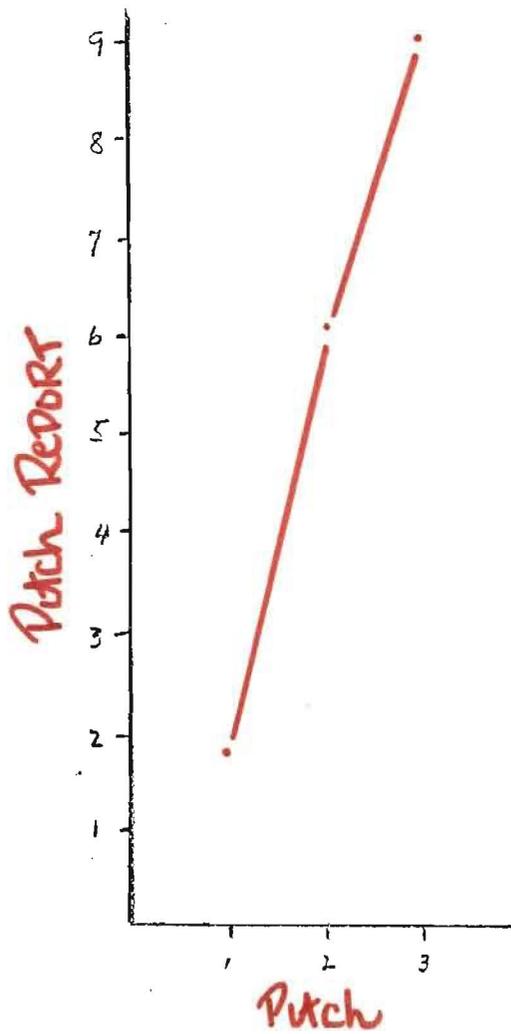
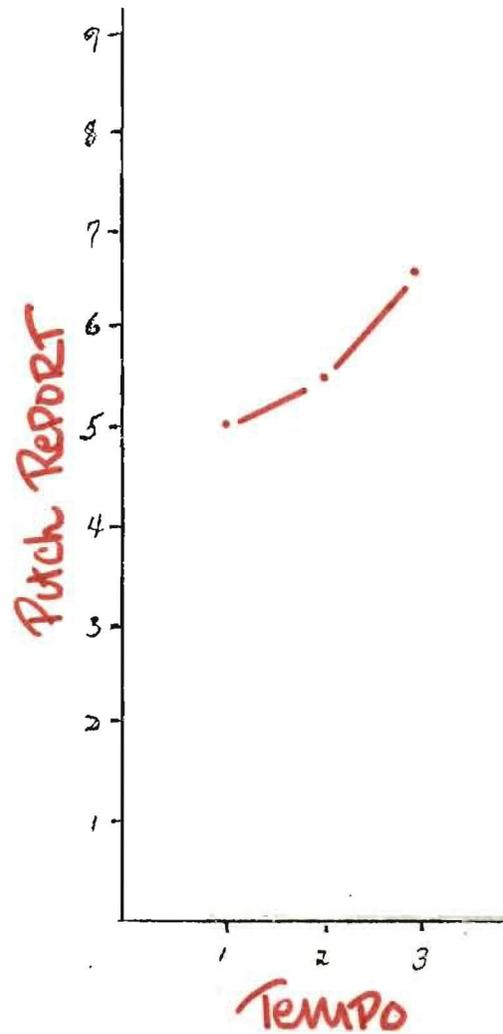


Figure 10. Effects of pitch on the subjects report of pitch
Experiment II.

Figure 11. Effects of tempo on the subjects report of pitch.
Experiment II



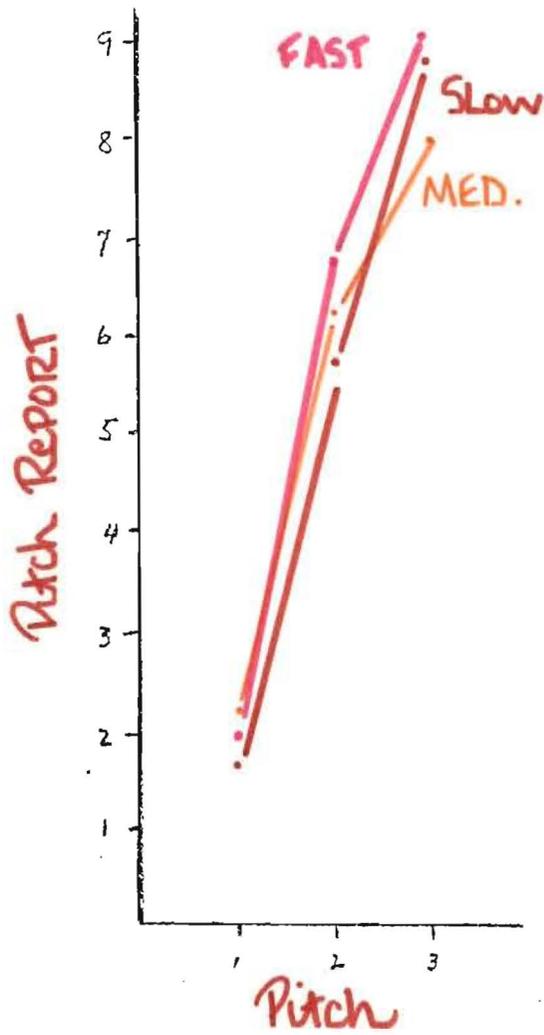


Figure 12a. Effects of subjects report of pitch as influenced by the interaction of pitch and tempo.

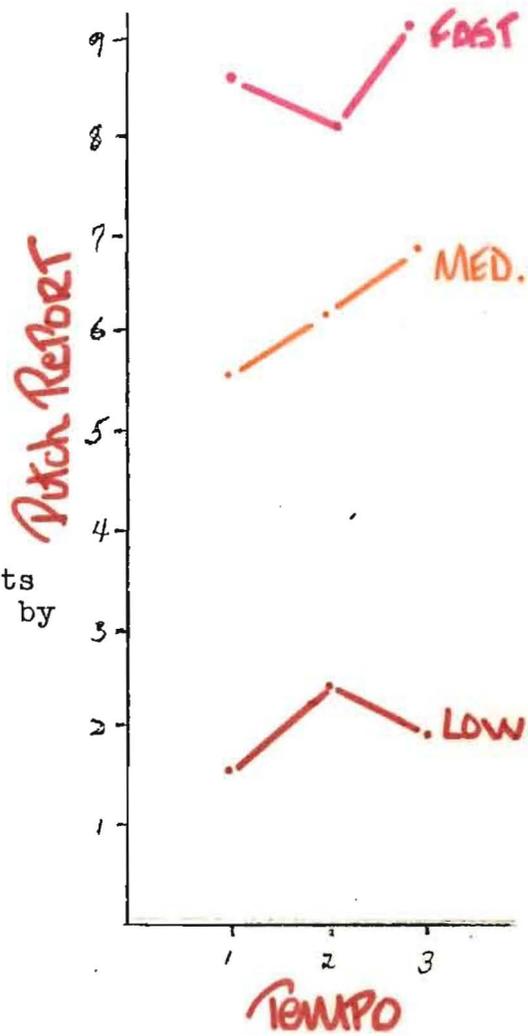


Figure 12b. Effects of subjects report of pitch as influenced by the interaction of pitch and tempo.

cant interaction of pitch and tempo on pitch reports is shown in Figure 12. Here the lines would appear to be essentially parallel, except that the effects of high pitch apparently were accentuated if played at a slow tempo, and the effects of low pitch were accentuated by a fast tempo. It is hard to give meaning to this interaction since it is so weak.

Table 11

Analysis of Variance performed in the present experiment. This table is concerned with the effects of the independent variables on tempo report, Experiment II.

Source	Sum of Squares	Degrees of Freedom	Mean of Squares	F Scores
A (pitch)	21.6222	2	10.8111	6.9699**
B (tempo)	969.8000	2	484.9000	312.6168***
AB (inter- action)	24.0444	4	6.0111	3.8753*
S(AB) (within cells)	404.8333	261	1.5511	

** = significant at $p < .01$

*** = significant at $p < .001$ * = significant at the $p .05$

Table 11 is concerned with the effects of the independent variables on tempo rating. Pitch had a significant, but small, direct effect on the subjects ratings of tempo. The effects of tempo upon ratings of tempo are strong and direct, this can be seen in Figure 14. The interaction of pitch and tempo is slightly significant and can be seen in Figures 15 and 16. Here, with this slight interaction, is a taste of what we had hoped would happen. Both slow tempo and low pitch "depress"

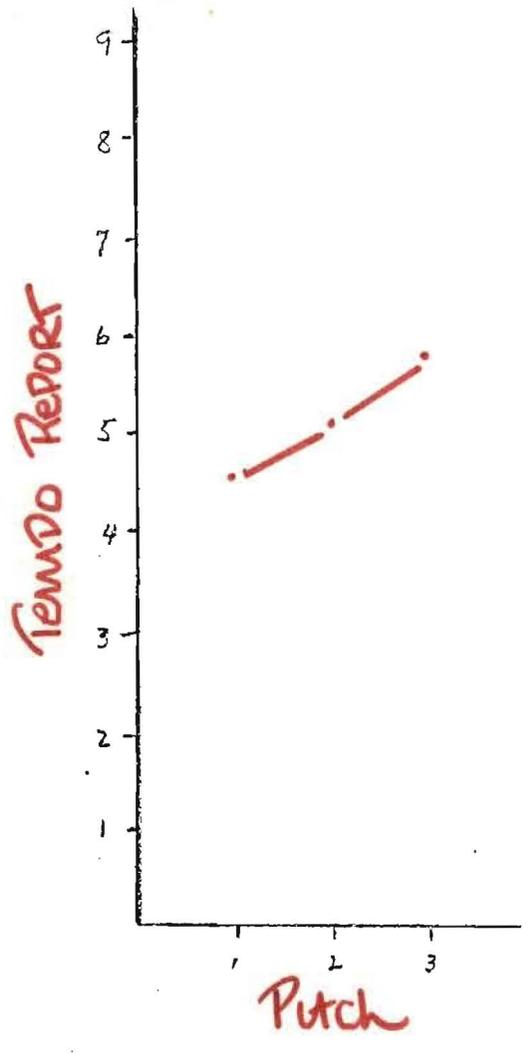
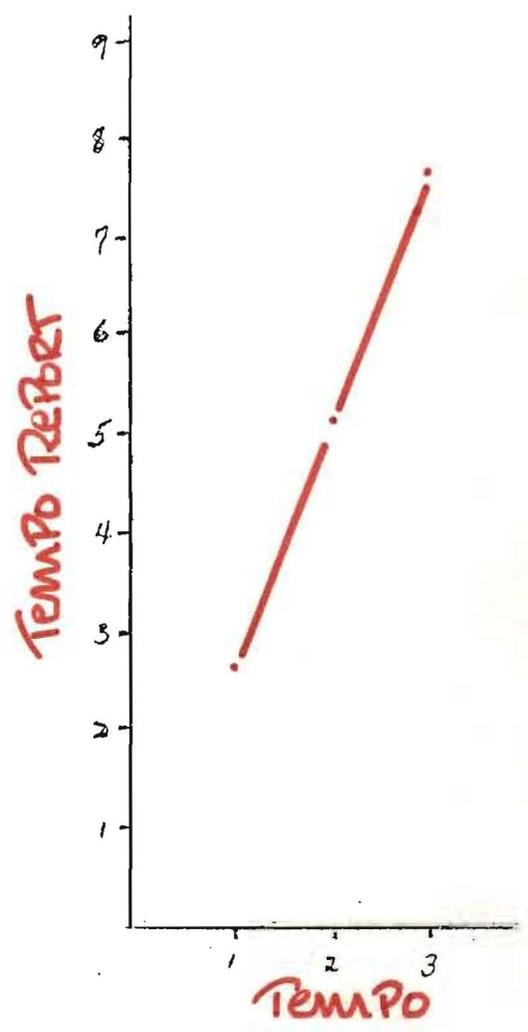


Figure 13. Effects of pitch on the subjects report of tempo.

Figure 14. Effects of tempo on the subjects report of tempo.



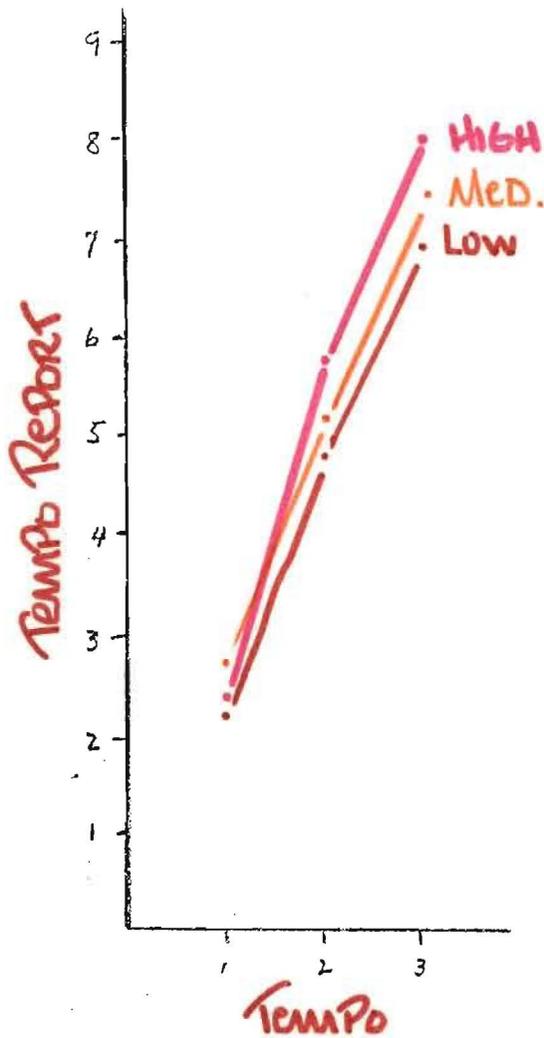
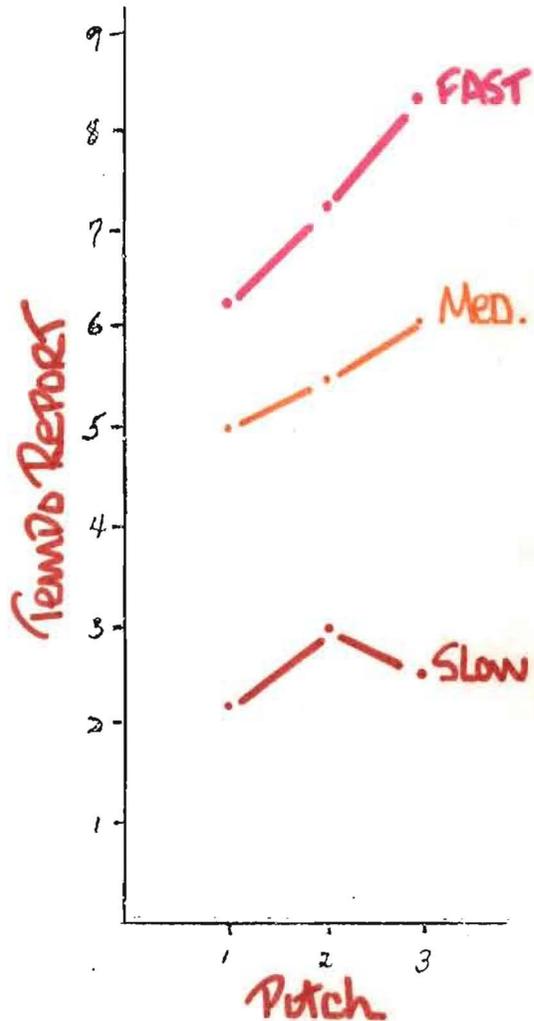


Figure 15. Interaction of pitch and tempo as they effect the subjects report of tempo.

Figure 16. Interaction of pitch and tempo as they influence the subjects report of tempo.



the tempo report, while fast tempo and high pitch "elevate" tempo ratings. Note that both Figure 15 and Figure 16 describe the same interaction, but the variable on the horizontal axis varies.

Table 12

Analysis of Variance performed in the present experiment. This table is concerned with the effects of the independent variables on tempo report, Experiment II.

Source	Sum of Squares	Degrees of Freedom	Mean of Squares	F Scores
A (pitch)	116.2667	2	58.1333	26.6580***
B (tempo)	390.2889	2	195.1444	84.9870***
AB (interaction)	8.9778	4	2.2444	1.0292
S(AB) (within cells)	569.1667	261	2.1807	

** = significant at $p < .01$

*** = significant at $p < .001$ * = significant at the $p .05$

Table 12 shows the effects of the independent variables on mood rating. Both pitch and tempo seemingly have significant effects on mood rating. However, the interaction is not significant. Tempo is the strongest influence on mood rating. This can be seen in Figure 18, which shows the direct relationship between tempo and mood report. Figure 17 shows the direct relationship between pitch and mood report. This result could be accounted for by the willingness of the subjects to use the entire range of the mood scale.

Figure 19 shows that, as in Experiment I, there was no

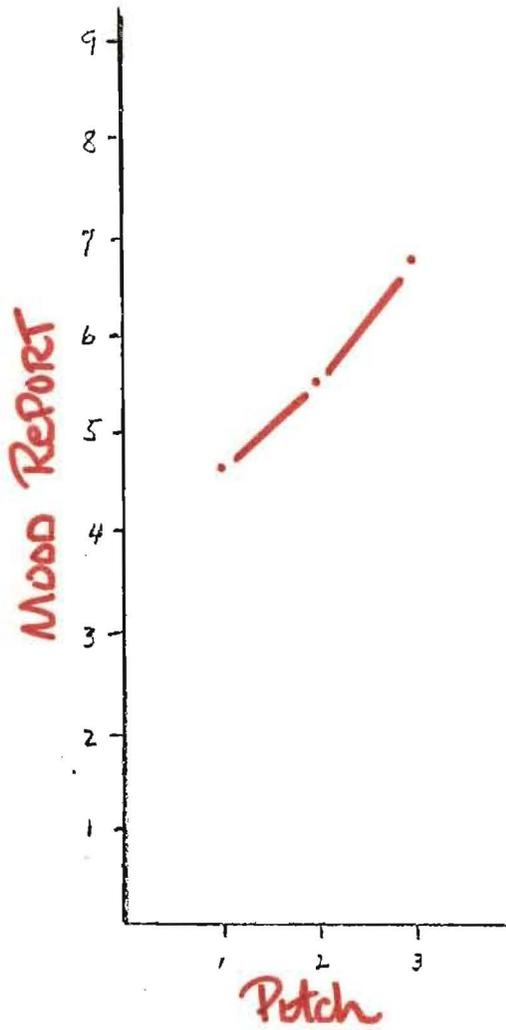
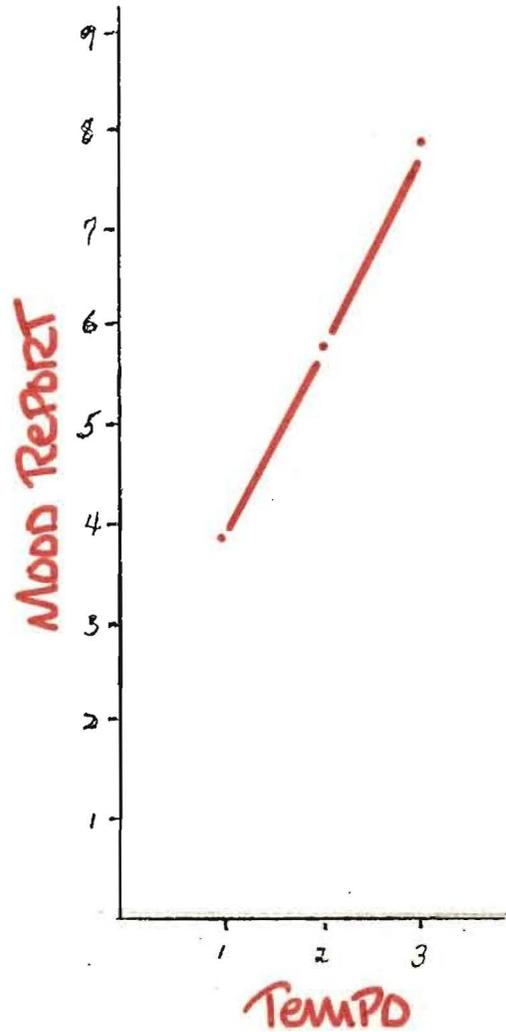


Figure 17. Effects of pitch on the subjects report of mood.

Figure 18. Effects of tempo on the subjects report of mood.



34a

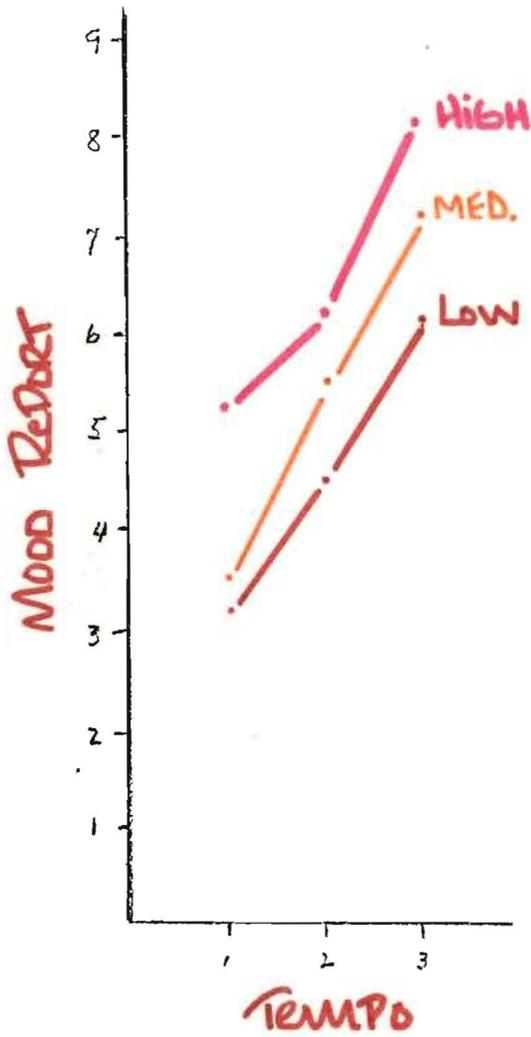


Figure 19. The absence of interaction effects of pitch and tempo on mood.

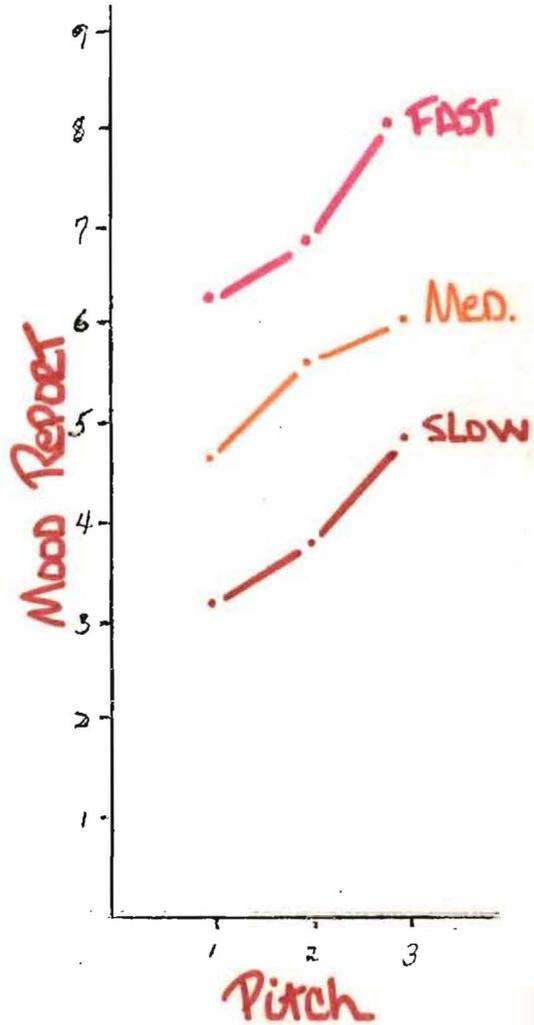


Figure 20. The absence of interaction effects of pitch and tempo on mood.

interaction of pitch and tempo effecting the mood report.

Even though the anchoring effect was used the predictions did not occur. The value of Experiment II is that the data confirms the data found in Experiment I. Thus we can conclude that pitch and tempo have independent effects on mood.

Table 13 is a listing of the information found on the questionnaires issued at the beginning and end of the experiment. There is information for the groups that participated in both experiments. The information found in Experiment II, for the most part, confirms the information found in Experiment I earlier. There was a close similarity on the following scales; average age, mood before and after, musical training, average number of years of training, and the per cent of subjects that were aware of the purpose and nature of the experiment.

From this then we can conclude that the subjects of both experiments were similar and that any significant variation in results are not accountable by subject differences on these variables.

(Table 13 can be found on page 36.)

Table 13

Data from the present study concerning the information compiled from the questionnaires issued at the beginning and at the conclusion of the experiment. The data listed below is for both experimental groups tested.

Information	Experimental Group I	Experimental Group II
Average Age (in months)	251	250
Tension		
Before	22% - yes 78% - no	13% - yes 87% - no
After	22% - yes 78% - no	17% - yes 83% - no
Mood		
Before	5.66 (Average)	5.66
After	5.75 (Average)	5.53
Musical Education		
Per cent	66% - yes 33% - no	66% - yes 33% - no
Average no. of years	3.75	3.55
Awareness of the Experiment	73% - yes 27% - no	77% - yes 23% - no
Education Helpful	53% - yes 47% - no	43% - yes 57% - no
Total number of participants	30	30

Discussion

The hypothesis predicted a significant interaction of pitch and tempo as they influenced the rating of mood. This predicted interaction did not take place, and what interaction there was, was not significant. The results from Experiment II came much closer to having this predicted interaction.

The hypothesis also stated that manipulated pitch is expected to have a direct influence on the subjects experience of pitch. Likewise, manipulated tempo is expected to have the same direct influence on the subjects experience of tempo. These experiences were then reflected on the subjects reports of pitch and tempo. As far as the subjects experience of these variables is concerned, both Experiment I and Experiment II showed them significant. Referring back to Tables 7,8,10, and 11 this can be seen.

It was further hypothesized that a subjects experience of pitch and tempo are held to combine additively and result in some mood. From the subjects experience of pitch and tempo various moods did result. The only significant variable that influenced mood in Experiment I was tempo, as indicated in Table 9. In Experiment II both pitch and tempo significantly influenced mood. This can be seen in Table 12. There was a slight interaction of pitch and tempo as they influenced mood in both Experiment I and Experiment II, but neither interaction

was significant enough to deduct any sort of conclusions.

The data from Experiment II, for the most part, confirmed the data found in Experiment I. Thus all variables found significant in the first experiment were likewise found significant in the second experiment. The only exception to this was the significance of pitch and tempo as they influenced mood. The anchoring effect that was employed seemed to indicate a noticeable difference in results. The scores from Experiment II were much higher than those in Experiment I.

Even though there were two experimental groups, the results found in Table 13 indicate that the subjects did not differ significantly. Branching from this, we can conclude that any differences in results that were found could not be accountable for due to a subject difference.

There are a few points that should be elaborated upon in respect to the information found on the questionnaires. The mood before and the mood afterwards was around 5.55, which the descriptive adjective, mediocre accompanied the numerical value. This then would seem to indicate that the "neutral" selection was effective before the actual experiment began. The mood afterwards can not be accountable for as easily. In all three of the random order sequences, the last selection heard had a predicted high response. Another point would be that the subjects tended to be rather non-musically naive

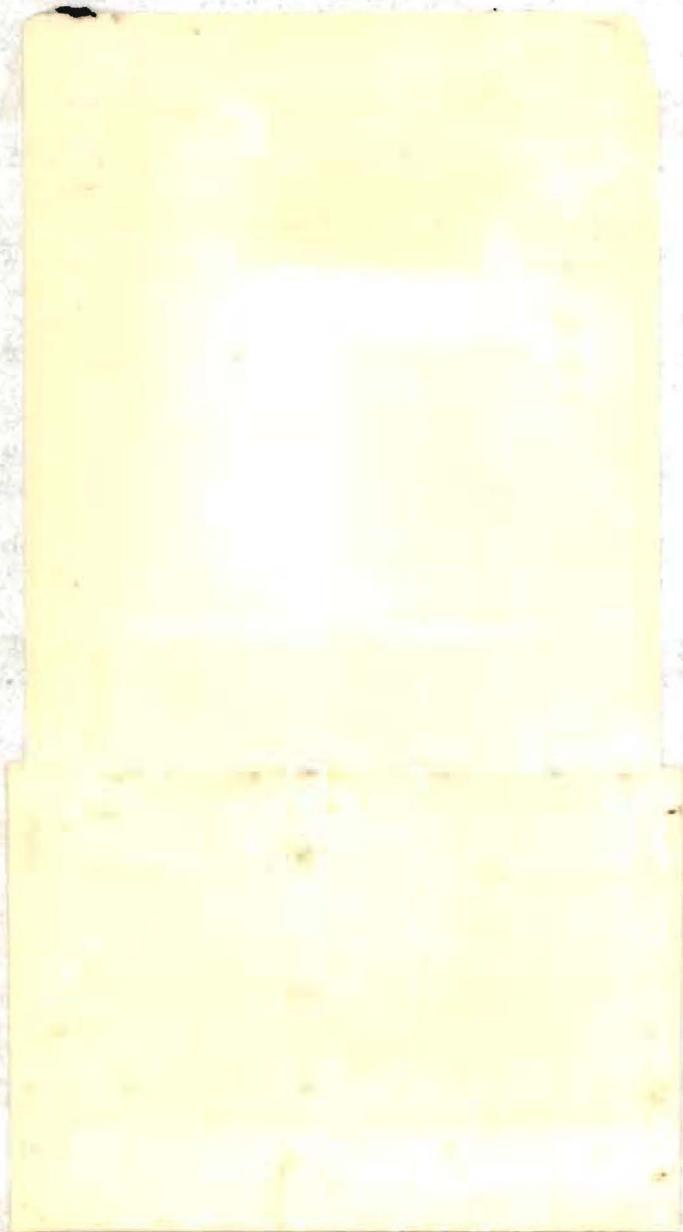
students. The average number of years of musical education was about 3.65. And whether or not the musical education that the subjects have had effected their reports, on the average 50% said it did and 50% said it didn't; this applied to both experimental groups. Thus we can safely conclude that the subjects were evenly balanced, in all aspects, in both groups.

The important discovery that this study did conclude was that pitch and tempo, being basic elements of musical composition, have somewhat of an independent effect in relation to human mood. The interesting phenomena of the power and great variety of effects that are had when listening to varied types of music, remain in the fact that the elements are free to vary independtly and consequently there are varities of moods resulting.

In conclusion, this study served as defining more clearly the actual roles which pitch and tempo do play in affecting our emotions. And perhaps when the other elements, such as duration, timbre, intensity, ect., are understood in much greater depth, the total picture then will be complete. To researchers in the future, this is the challenge which lies ahead.

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