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EFFECT OF MUSIC TEMPO ON TASK PERFORMANCE [1]

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Summary.—Two studies were conducted to evaluate the effect of music tempo on task performance. In Study 1, 44 undergraduate business students were asked to be "workers" in a stock market project by collecting closing stock prices and calculating the percentage of change in the price from week to week. Subjects were randomly divided into groups such that they either listened to fast-paced music while they worked, to slow-paced music, or to no music. Analyses of variance and covariance were conducted on both the quantity and quality of the subjects' work, using music listening habits as a covariate. There were no differences in either the quantity or quality of the work produced by the groups. There were some methodological concerns regarding Study 1, so a second study was conducted. The 70 undergraduate business students in Study 2 completed the same task under the same music conditions as in Study 1. Analyses of variance indicated women performed significantly better than men, performance was significantly higher in the rock condition than in the heartbeat condition, and subjects in the rock condition had a significantly higher perceived level of distraction by the music.

Prior examinations of the effects of music on performance have been inconclusive. Some researchers have reported music to have positive objective and subjective effects on performance, some to have no impact on performance; still others have shown music had negative effects on performance. Of the four conditions in Wolf and Weiner's (1972) study, an evening newscast, a "hard rock" song, industrial noise, or quiet, the group who listened to music had the highest performance on simple arithmetic problems. Schreiber (1988) found that college students who heard popular background music for 20 min. at the beginning of a class earned higher course grades than students in a comparable class who heard no music. Playing music in the workplace reduced boredom, frustration, fatigue, errors, and turnover, and increased production in the firms that Roberts (1959) discusses. Ross (1966) found that keypunch operators experienced an 18.6% increase in productivity and a 37% decrease in error rate as a result of listening to music from an installed system.

In addition to the above research indicating positive objective effects of music on performance, music has also been shown to have positive subjective effects on workers. For example, McGehee and Gardner (1949) found that female workers performing a "complex industrial job" believed that music was beneficial to them in the performance of their jobs, even though

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no objective performance differences were observed. In a review of several nonquantitative ethnographic studies of the effects of music in the workplace, Uhrbrock (1961) concluded that most factory workers prefer to have music playing while they work, even though the effects of music on the quality and quantity of productivity were not clear at that time. Jacoby (1968) argues that music may affect the morale of workers but that most of the evidence indicates no differential effect on performance.

As Jacoby suggests, a number of studies show music to have no effect on performance. Madsen's (1987) experiment, for example, indicated that subjects who perceived background music as being very distracting did not have lower scores than others on a reading-comprehension test. Perrewé and Mizerski (1987) observed that music had no effect on task perceptions but suggested that music may have some effect on performance of the task. In an eye-hand coordination task, classical, jazz, and popular music had no effects on performance (Sogin, 1988).

Music has also been shown to have negative and distracting effects. Fogelson (1973) found music distracting to eighth graders as their scores on a reading test were lowered. In addition, Parente (1976) found that college students performed better on the Stroop color-word task without music than they did with either their most or least preferred type of music.

A possible explanation for these inconsistencies was given by Hevner (1937), who claimed that tempo is the most important aspect of any response to music. Subsequent studies have examined the effects on performance of different types of music. For instance, Fried and Berkowitz's (1979) results show that certain types of music positively affected subjects' helping behavior. Pearce (1981) found that certain types of music affected the physical strength of subjects. Milliman (1982) noted that different types of music, while played in a supermarket setting, had differential effects on the pace of in-store traffic flow and dollar sales volume. As already mentioned, there were no differences in the performance of groups who listened to classical, jazz, popular or no music on Sogin's (1988) study. It has been reported, however, that background music is less distracting when the subject habitually listens to music while studying (Etaugh & Michals, 1975) and when the music is the subject's preferred type (Parente, 1976).

Previous examination of the effects of music and types of music on task performance have used tasks that were of relatively short duration, such as 10 min. (Etaugh & Michals, 1975), 4 min. 57 sec. (Sogin, 1988), and 3 min. (Wolf & Weiner, 1972). Tasks of this length are less representative of work situations than one of greater duration. Since previous results have been inconclusive and since short times on task have been measured, it was the purpose of this study to examine whether different types and tempos of music have differential effects on performance of a longer task.

STUDY 1

Method

Subjects.—The subjects were 44 undergraduate students who were recruited from two upper-division management classes. Subjects agreed to participate with the understanding that they would receive additional class credit for their participation.

Prior to participation, an announcement was made in their classes that several professors in the College of Business were conducting a research project designed to collect and analyze data on the stock market. Students were then told that these professors needed "workers" to help collect data and that they would be given class credit for volunteering. This covering story was expected to be well received since the stock market crash of October, 1987 was relatively recent. It was expected that the subjects would think that the project was, in part, an effort to analyze the data from that event. Various anecdotal incidents indicated that the subjects believed the story and were interested in the stock market project.

Procedure.—The task was derived from that described in White and Mitchell's (1979) article. The task was comprised of two related activities, looking up and recording closing stock prices from the October-December, 1987 issue of the Daily Stock Price Index, and calculating percentage changes for each week (using Week 1 as a baseline).

When subjects arrived at the experimental location, they were asked to enter the room and take a seat. Subjects were given a copy of the Daily Stock Price Index and a "stock price-coding sheet" on which they were to record the stock prices they looked up. The task was explained in detail, and they were given the opportunity to ask questions. Questions were occasionally asked, but it appeared that no subject misunderstood the task. The instructional period lasted approximately 10 min. and then subjects were given 50 min. to work on the task.

The three experimental conditions included a control condition in which no music was played, experimental Condition 1 in which slow-paced (approximately 60 beats/min.) music was played, and experimental Condition 2, in which fast-paced (approximately 140 beats/min.) music was played. Neither type of music had lyrics. For the 15 subjects in the slow-paced (heartbeat) music condition and the 16 subjects in the fast-paced (rock) music condition, it was announced after task instructions that music would be played while they worked on the task. In experimental Condition 1, the music was expected to simulate the rhythm of the heart. It has been suggested that heartbeat rhythms are the equivalent of contact and of being rocked, a sensation that is soothing (Fontana & Loschi, 1979). In experimental Condition 2, the fast-paced music was expected to distract the subject and inhibit performance. In addition, a control condition was added to assess whether performance in the music conditions was significantly different from performance when there was no music. Since some employers disallow employees to listen to music while they work for fear that their task performance might suffer, it was deemed important to compare conditions with and without music.

Measures.—Two aspects of performance were measured. First, objective quantitative performance was measured by counting the number of completed boxes on the stock-price-coding sheet. Second, qualitative performance was measured by determining the percentage of correct answers on the stock-price-coding sheet.

After the task was completed, three questions were asked of the subjects in the two music conditions and two questions were asked of the subjects in the control condition. Question 1 asked subjects in the music conditions, "To what extent did the music affect your performance on this task?" Responses were measured on a 7-point Likert scale ranging from (1) "enhanced my work" to (4) "had no effect" to (7) "distracted me." Question 2 asked all subjects, "How often do you listen to music while you study?" Responses were measured on a 7-point Likert scale ranging from (1) "Always" to (7) "Never." For those responding between (1) to (6) on Question 2, Question 3 asked, "What kind of music do you listen to when you study?" Subjects were given free form to respond to this question. Responses were later coded into two dichotomous categories, (1) Slow/Classical/Soft, and (2) Fast/Rock/Progressive.

Results

A preliminary analysis was conducted on the responses to the question "How often do you listen to music while you are studying?" to determine whether there were differences in the listening habits of the groups. Surprisingly, the analysis of variance indicated that there were significant differences among the groups in their responses. The control condition had the highest group mean (6.00), with the heartbeat condition next (5.00) and the rock group having the lowest mean (4.40) ($F_{2,39} = 3.90$, $p < .05$). Listening habits were used as a covariate in all further analyses to control for this possible biasing effect. It is possible that the difference in the groups' answers is attributable to a priming effect (Salancik & Pfeffer, 1978) in which the experimental groups had just listened to music and were thinking about it more than the control group, who had heard no music.

Group means for performance quantity for each condition were: Control = 216.69, Heartbeat Music = 202.20, Rock Music = 194.38. An analysis of covariance among the groups on both the quantity and quality of their work indicated that there were no differences on either of these variables (Quantity: $F_{2,38} = .54$, $p > .05$; Quality: $F_{2,38} = 1.49$, $p > .05$). There was almost no variability in quality of performance, so means are not reported. It appears that everyone understood the task and performed almost perfectly. A further analysis of the perceptions of the subjects regarding whether the music enhanced or distracted from their work also indicated no significant differences among the groups ($t = .72$, $p > .05$).

Discussion

The finding that the groups were significantly different in their listening habits is somewhat perplexing, since the subjects were randomly assigned to groups. Although this difference was used in the analysis as a covariate so that it could not bias the results, further work should examine the same questions with groups which are, for all practical purposes, equivalent with respect to listening habits.

Present findings concerning the proposed questions do not support the hypothesis that music affects performance on a cognitive type of task. This finding would imply that supervisors need not arbitrarily ban music in the workplace because they assume that it has a detrimental effect on performance. However, the results should be interpreted cautiously because the sample is small.

It appears that listening to either fast-paced or slow-paced music had no effect on either the quantity or quality of copying and simple arithmetic calculations. A second study was conducted to obtain a larger sample and to alleviate any possible priming effects that might have had an impact on the results in Study 1.

STUDY 2

Method

Subjects.—The subjects were 70 undergraduate students who were recruited in the same fashion as in Study 1. Two of the subjects reported difficulty with their calculators, causing them to perform poorly. They were subsequently dropped from the analyses.

Procedure.—The experiment was conducted using exactly the same procedures as in Study 1 with two exceptions. The questions asking, "How often do you listen to music while you study?" and "If you listen to music while you study, what type is it?" were asked *before* the experiment to control for the priming effects suspected in the first experiment. In other words, the subjects in Study 2 were not asked about their music listening habits immediately following exposure to music. Also, the second question was asked in a 7-point Likert format with responses ranging from (1) slow/classical/soft to (4) moderate tempo to (7) fast/rock/progressive. This was done based on our knowledge of subjects' range of music preferences from Study 1 and to avoid losing variance by categorizing them into one of the two categories used in Study 1.

Measures.—In Study 2, the same basic measures from Study 1 were used with a few exceptions. Quality of performance was not assessed in the second study for two reasons. First, it was evident in Study 1 that there was almost zero variance in the quality measures. All subjects had very high quality performance ranging from 98% to 100% accuracy with only one or two outliers. The subjects with poor quality scores appeared to have trouble understanding the decimal notation on their calculators. After randomly sampling several subjects' work, the same high quality performance appeared to be true in Study 2. Further, it appeared that dropping the two subjects having calculator difficulties would eliminate any unusual cases. It simply appears that subjects are accurate on this particular task leaving only variability in performance quantity.

Another difference between Study 1 and Study 2 was in the question asking subjects, "To what extent did the music affect your performance on this task?" In Study 2 two separate questions were asked: (1) "To what extent did the music distract you from the task?" and (2) "To what extent did the music enhance your performance?". Subjects in the two music conditions responded on 7-point scales ranging from (1) Not at all to (4) Somewhat to (7) Very Much. Subjects in the control condition were not asked these questions.

Finally, it appeared from observation of the data that women performed better on this task than men (M = 195.12 for women and 151.52 for men). As a result, sex was included as a variable in the analysis. Men and women were coded dichotomously.

Results

As in the first study, an analysis of variance was performed to determine the equivalence of the groups on listening habits. In contrast to Study 1, there were no differences between the groups on this variable ($F_{2,52} = .392$, $p > .05$). There were also no differences between the groups with respect to the types of music they listened to ($F_{2,50} = .392$, $p > .05$).

Given the suspected sex differences a 3×2 analysis of variance was performed with three music conditions (control, heartbeat, and rock) and two sex conditions (men and women). See Table 1 for means and standard deviations. The analysis showed that both experimental factors were significant and that there was no interaction between sex and music. The analysis of variance indicated that women performed significantly better than men ($F_{1,62} = 19.60$, $p < .001$). The analysis of variance also indicated that there

TABLE 1
MEAN PERFORMANCE SCORES*: STUDY 2

Condition	Men	Women	Combined
Control	169.80	191.78	180.21
Heartbeat	128.50	168.15	150.91
Rock Music	158.29	215.16	199.85
Combined	151.52	195.12	
Over-all Mean Performance: 177.81; *SD* = 44.94			

*Measured in numbers of correctly completed responses on the stock-price-coding sheet.

were significant differences between subjects in the three music conditions ($F_{2,62} = 9.17$, $p < .001$).

Additional t tests gave an interesting finding. Performance was significantly higher in the rock condition than in the heartbeat condition ($t = -4.14$, $p < .001$). Also, performance was not significantly higher in the rock condition than in the control condition ($t = -1.62$, $p > .05$). Finally, performance was significantly higher in the control condition than in the heartbeat condition ($t = 2.51$, $p < .05$).

TABLE 2
MEAN ENHANCEMENT AND DISTRACTION SCORES*: STUDY 2

	Enhancement	*Distraction*
Music Conditions		
Heartbeat	3.42	2.42
Rock Music	3.00	3.78
Sex		
Men	2.58	3.21
Women	3.56	3.09
Over-all Mean Distraction Score: 3.14; *SD* = 1.86		
Over-all Mean Enhancement Score: 3.20; *SD* = 1.95		

*Measured on a 7-point scale.

While the main focus was to examine the effects of different music tempos on objective, bottom-line performance, subjects' perceptions of the music were also obtained. Mean rated distraction and enhancement scores for subjects in the two music conditions were analyzed and are reported in Table 2. A t test on the differences in perceived distraction indicated that subjects in the rock condition reported a significantly higher distraction than subjects in the heartbeat condition ($t = -2.84$, $p < .01$). A t test on the enhancement scores showed no significant difference between these two groups with respect to the reported performance enhancement attributed to the music ($t = .76$, $p > .05$).

Further, because the difference between the performance of men and women was significant, it was interesting to see whether there were differ-

ences in their reported distraction or enhancement. This analysis yielded no significant differences in enhancement or distraction between women and men.

Discussion

The finding of sex differences on this task is difficult to explain. For some reason, women significantly outperformed men. It is possible that they enjoyed the task more than the men which helped them better concentrate on the task. Other studies might be designed with the objective of attempting to explain these sex differences. Perhaps satisfaction with the task is such a variable (Uhrbrock, 1961).

The results of Study 2 were quite different than those in Study 1 with respect to performance quantity. It is possible that there were true performance differences in Study 1 which were masked by the small sample. Study 2 was an improvement over Study 1 with respect to sample size. What appears to be happening in Study 2 is that the two different types of music have quite different effects on the task performance of listeners. Compared to subjects in the control condition, those in the heartbeat condition performed more poorly. Based on these findings, it seems that heartbeat music on this particular type of task has a calming effect on the individual making him more relaxed and less hurried. This is consistent with other findings which have suggested that heartbeat music causes people to slow down and take their time in supermarkets and to relax them sufficiently that their physical strength is reduced. It may be concluded that music with the approximate number of beats per minute as the heart should not be played while subjects are working on a task where the quantity of output is essential. If, on the other hand, an individual feels pressure and stress in the work environment, it may be beneficial to play heartbeat-paced music during break times to counteract the effects of stressors in the organizational environment.

While those subjects in the heartbeat condition may have been more relaxed due to the calming effects of the music, those subjects in the rock music condition may have felt more hurried due to the fast-paced, hard-driving beat of the music. It seems that the fast music led them to work faster.

Perhaps the most interesting finding is the apparent inconsistency between subjects' perceptions and performance. This inconsistency sheds light on a potential managerial paradox. While those in the rock music condition performed better than subjects in the heartbeat condition, they reported that they were significantly more distracted by the music than those in the heartbeat condition. It appears that what is actually occurring is that the fast-paced music may enhance performance but also acts as a stressor in the work environment. It is likely that, had we measured heart rate and re-

ported anxiety, those in the rock music condition would have experienced more stress and anxiety than those in the heartbeat music or control conditions. Similarly, while those in the heartbeat music condition showed lower performance, they may have experienced less stress and anxiety.

The problem for the manager lies in the fact that a healthy respect for bottom-line performance and a need for physically and psychologically healthy workers may be mutually exclusive when considering the effects of music in the workplace. Perhaps the best bet *is* to play no music at all.

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