THE EFFECT OF BACKGROUND MUSIC ON THE CONTROL ACTIVITY OF AN AUTOMOBILE DRIVER

by

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B.S., Kansas State University, 1966

A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Industrial Engineering

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1967

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PROBLEM

Introduction

The effects of background music have been of interest for many years. Konz (1964) tells of an early study. In 1910, L. P. Ayres, a statistician, attended a six day bicycle race in New York City. On three evenings, he recorded the average speed of the cyclists while a band was playing and while it was not. Average speed with music was 19.6 mph and without music was 17.9 mph.

Different types of music have been found to have different effects (Konz, 1964). Wyatt and Langdon in England and Harold Burris-Meyer of Stevens Institute of Technology suggest the importance of selection of music to be played. Muzak Corporation, for example, tailors its programs to compensate for the daily fatigue curve. More lively music is played when the worker is expected to be fatigued.

There have also been studies of the physiological effect of music. Podolsky (1954) cites an Italian boy who suffered an ax cut which exposed part of his brain. This permitted direct observation of his brain. Lively music (e. g., the Marseillaise) caused an increase of blood in the brain as well as a faster pulse. Soft, slow music decreased the flow of blood to the brain. Podolsky also cites changes in the pulse rate under musical stimulation. Pulse varied from 80 to 96 with waltz music, to 100 or more with the more lively waltz tango.

Hyde (1924) found music affects the cardio-vascular system

as measured by the diastolic blood pressure, the systolic blood pressure, pulse rate, and ekg (electrocardiogram). The effect depended on the personality and experience of the individual. There was more effect when the subject had musical training, was familiar with the music, liked music, etc. Even a rousing march failed to affect a "man who couldn't keep step".

Podolsky (1954) mentions a later study by Ellis, Douglas, and Brighouse. In this study, 36 subjects listened to a series of two-minute talks taken from Reader's Digest articles with different background music. A dynamic classical record (Hungarian Rhapsody No. 2) increased respiration rate significantly. Both a subdued blues selection and a soothing classical selection also increased respiration rate. The amount was not, however, statistically different from the normal rate. Respiration rate returned to normal five minutes after cessation of the music. The heart rate was not influenced significantly.

On the "activationist" hypothesis (Duffy, 1957 and Malmo, 1959) it could be predicted that listening to music would have a beneficial effect on driving performance under monotonous or fatiguing conditions.

This is confirmed by subjective experience of many road users. (Rudinger, 1961). Any detrimental effect of listening on driving is popularly thought to be negligible, possibly because most of the essential cues in driving are perceived visually and it is thought that they are little affected by auditory stimulation.

However, it has been shown that a task involving a push-

button reaction to a visual cue can be affected by auditory distraction leading to loss of speed (Cassel and Dallenbach, 1918). On the single-channel, limited-capacity hypothesis (Davis, 1957 and Welford, 1959) it could be predicted that loss of performance is inevitable as perceptual load increases beyond the driver's capacity. In such busy situations, switching attention between visual and auditory stimulation could lead to seriously prolonged response times to emergencies on the road.

In a recent study (Brown, 1965) of the effect of a car radio on driving in traffic, it was found that music of the "ballroom dancing" type reduced the frequency with which both the accelerator and brake pedals were used ($p=0.05$) in a light traffic situation. In heavy traffic, this music increased the time taken over a standard test circuit ($p<0.05$). A program of speech had an insignificant effect on both control and time measures whether listening was motivated simply by interest in the program, or by the need to remember its contents.

It remains to be decided what the observed changes mean in terms of good or bad driving. It has been suggested that low driver activity constitutes good driver behavior. In one study, total driver control activity (i. e. steering wheel + brake + accelerator usage) was compared with subjective driver evaluation by licensing examiners (Fedderson, 1965). In this study, good subjective ratings were positively correlated with low control activity.

Listening to music may have a beneficial effect in reducing the frustration produced by delays in the flow of traffic. It is possible, however, that the direction of the effect produced by an auditory program depends - to a certain extent - upon whether the man expects the music to be a help or a hinderance (for example, Baker, 1937).

Preference for music is also a variable which may influence the effect music has on driver behavior. With stereo tape players becoming more popular for automobiles, it would be good to know if the driver's favorite music is a safe musical background. It was the intent of this study to investigate the effect of background music on driver behavior.

Hypotheses

The purpose of this experiment was to study the effect of two types of background music on driver activity. The first type of music was one which was intended to be barely noticeable and non-distracting. It was a tape which was meant to be quiet background music. Instruments in the violin family were most used, and tempos were slow to moderate.

The second type of music was a tape of the "Tijuana Brass". This second tape was quite different from the first in that it was quite peppy and should have been more attention demanding. These selections were louder, and brass and percussion instruments were used extensively. Tempos of these selections were quite lively.

Four hypotheses were investigated:

1. Background music decreases the brake and accelerator activity of an automobile driver.
2. Slow music decreases the fine steering wheel activity of the driver.
3. Peppy Tijuana Brass increases the fine steering wheel activity of the driver.
4. Background music decreases the time taken over the test circuit.

METHOD

Experimental Situation

The experiment was conducted on a test circuit of 4-lane divided highway located between Manhattan, Kansas and Ogden, Kansas. In order to minimize traffic, the test circuit included only the highway outside the commercial areas of both cities. The route began at the Manhattan city limit and extended to the Ogden city limit. U-turns were made at both ends of the route to complete the 11.5 mile circuit. A map of the test circuit is shown in Figure 1.

Apparatus

Programs of music were presented by a Muntz 4-track stereo cartridge tape player installed below the dashboard of the test vehicle. The single car radio speaker was utilized to present the music programs, thus the programs were monaural. Sound was of professional quality.

A Greenshields' Drivometer was utilized to measure the following aspects of driver and automobile behavior:

DESCRIPTION OF PLATE I

Photograph shows the interior of the test vehicle. Tape equipment is installed below the dash.

Experimenter holds camera push-button for recording data.

PLATE I

1. Number of steering wheel reversals
   a. fine ($\frac{1}{4}$ inch movement)
   b. gross (1 3/8 inches movement)
2. Number of brake applications ($\frac{1}{4}$ inch movement)
3. Number of accelerator applications ($\frac{1}{4}$ inch movement)
4. Number of speed changes (4 mph)
   a. Number of times the speed of the vehicle changed by 4 miles per hour
   b. An 8 mph change is two changes
5. Total time for each leg of the experiment (running time plus waiting time in seconds)
6. Running time for each leg of the experiment (seconds)
   a. Included only the time when the vehicle was moving
   b. Does not count waiting time
7. Mileage for each leg of the experiment (hundredths of a mile)

The Driveometer is a recording apparatus developed by Dr. Bruce D. Greenshields of the Institute of Transportation at the University of Michigan. This equipment, when attached to a vehicle, provides a digital record of various driver actions and vehicle motions. The Driveometer consists of a combination of switches, counters, a timing device, and a recording camera. The counters, timing device, and recording camera are all contained in the recorder box.

The Driveometer also has the capability of measuring directional changes by means of a gyro-compass. Due to the excessive noise of the high speed motor that powers the gyro-compass, this part of the Driveometer was not utilized in the present study.

DESCRIPTION OF PLATE II

Photograph shows the steering wheel of the test vehicle with the steering wheel reversals switch installed.

PLATE II

The Driveometer's recorder box was placed in the trunk of the automobile in order to camouflage the apparatus. It was also hushed with sound-deadening material.

The vehicle used for this experiment was a 1967 Tempest. It was an intermediate sized 4-door sedan and was equipped with a V-8 engine and an automatic transmission.

Environment of Experiment

The test runs of this experiment were conducted during the weeks of February 27 through March 2 and March 6 through March 9, 1967. These dates included only Mondays through Thursdays to eliminate week-end traffic conditions. Experiments were conducted after sundown during the evenings of these days. The specific timetable for the experiment is shown in Table 1. Traffic was considered light, since in all cases fewer than five cars per mile were encountered in the opposite lane.

In a driving experiment conducted in the real world, weather conditions would be expected to have an effect on the results. With this in mind it was attempted to eliminate very extreme conditions. Thus, no test runs were made while moisture was either falling or standing on the road surface. Temperature varied between 24° and 68° F during test runs, and wind from calm to 18 mph. This was the amount of variance over all trials, but variance during an individual's different runs was far less than this. In all cases, variation for temperature was less than 10 ° F and the wind less than 6 mph during a subject's data runs. The weather conditions for each of the subjects is shown

DESCRIPTION OF PLATE III

Photograph shows the inside of the recorder box. The movie camera (a) is at the left pointing toward the mirror (b) above. The data display (c) is at the right with the timer (d) attached above.

PLATE III

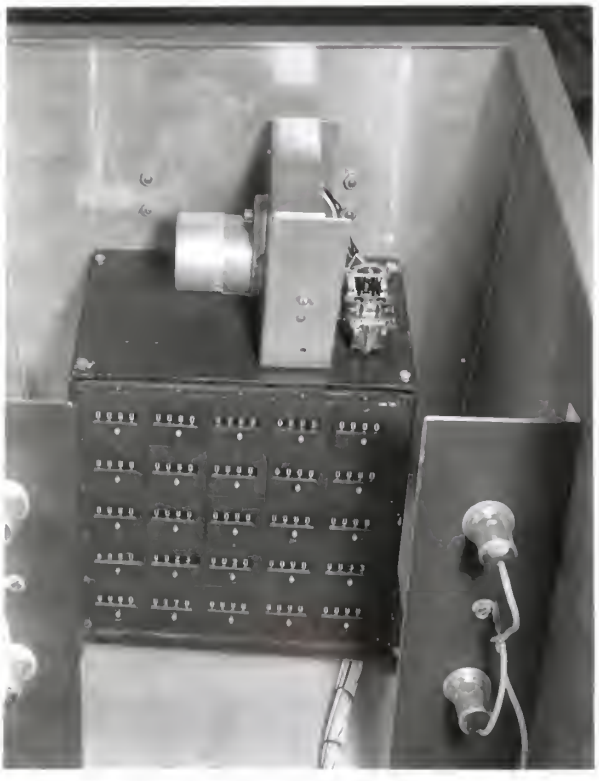
DESCRIPTION OF PLATE IV

Photograph shows a close-up of the data display. The digital counters contained in the display record different aspects of driver activity.

The motor and relay above the display record total time.

The lights in the foreground light the display for the movie camera.

PLATE IV



in Table 2.

Subjects

Twenty-four male licensed automobile drivers served as subjects. They were all members of Sigma Chi fraternity, and the fraternity received $50 for providing subjects. Subjects ranged in age from 18 to 23 years and had driven for periods of 2 to 9 years.

Subjects were told that this was a study of driver training. If specific questions were asked, the experimenter asked the subject to save them until after the subject had participated.

Subjects were instructed to drive normally and to obey all traffic laws. They were to obey the posted speed limits, but they needed not drive extremely slowly.

Procedure

In order to familiarize themselves with the test car, all subjects drove from their fraternity house to the starting point in the test car. In order to learn the route, each subject also made a trial run of the test circuit. After the trial run was completed, the first leg of the actual experiment began immediately.

Each time the subject completed the circuit, the experimenter recorded the measures of driver activity (steering wheel reversals, brake and accelerator applications), speed changes, total time, running time, and mileage by means of the movie camera mounted in the recorder box. The camera was controlled with a

remote pushbutton which was concealed from the subject. By operating the camera from the front seat of the test vehicle, data could be recorded while the car was moving. Thus, it was not necessary to stop after each leg of the experiment.

After subjects completed the driving part of the experiment, they were asked to complete the questionnaire shown in Figure 2.

Design of Experiment

In addition to a silent condition, two conditions of auditory distraction were studied:

0. Silence
1. Slow music
2. Tijuana Brass music

Each subject drove around the test circuit a total of four times - one trial run plus once in each condition. In order to balance series effects, the order of conditions was arranged as shown in Table 2. This arrangement used each of the six possible sequences four times.

Music

In order to better relate the experiment to the real world, standard stereo tape cartridges were purchased instead of custom recording the musical programs. Both cartridges were instrumentals and included no vocal selections.

For the "slow" condition, the tape cartridge Our Winter Love by the Felix Slatkin Orchestra was chosen. The selections included in this cartridge were: "Our Winter Love",

"I Left My Heart In San Francisco", "Love Letters", "Lollipops and Roses", "Fly Me to the Moon", and "Days of Wine and Roses". This first program could be termed sweet, as instruments in the violin family and woodwinds were predominant.

The second program of music was the tape cartridge What Now My Love by Herb Alpert and the Tijuana Brass. The selections "What Now My Love", "Memories of Madrid", "Cantina Blue", "Plucky", "Brasilia", and "If I Were a Rich Man", are included on this tape. These selections are generally more lively than the first program, and brass and percussion instruments are used extensively. For each of the musical conditions, the music was started as that lap of the experiment began and played continuously until the lap was finished.

RESULTS

The effects of the two conditions of auditory environment were compared by calculating the number of times each car control was used, speed changes per circuit, total time per circuit, running time per circuit, and mileage per circuit. The data averages for the three types of groupings are shown in Table 5. The complete data is shown in Table 8; the blank portions of this table were due to equipment malfunctions. Mileage was not a constant as might be expected, but varied as a measure of "weaving" for each trial. Three series of Wilcoxon Matched-Pairs Signed-Ranks test (Siegal, 1956) were made. Comparisons were made between the following

conditions:

1. Silence vs. Slow Music
2. Silence vs. Tijuana Brass
3. Slow Music vs. Tijuana Brass

When these comparisons were made for all eight types of data, four significant ($p<0.05$) differences were indicated. All four of the significant differences were for either accelerator pedal usage or time. When the silent and slow music conditions were compared, both total time and running time per circuit were significantly less during slow music. Total time averaged 931 seconds during silence and 917 seconds during the slow music program. Similarly, running time averaged 925 seconds during silence compared to 906 seconds during slow music; that is, they drove approximately 2% faster during slow music than silence.

In comparing the silent and Tijuana Brass data, the accelerator pedal was used significantly more during the Tijuana Brass program. This comparison also appears as a difference in average accelerator usage for all subjects. Subjects averaged 18.4 accelerator actions during silence and 22.3 actions during Tijuana Brass. Finally, when slow music and Tijuana Brass conditions were compared, it was found that the accelerator was used even less during the slow music program than during silence. This appears as an average accelerator rate of 17.1 actions during the slow program.

Several other comparisons were interesting although they

failed to meet the 5% level of significance. The comparison of fine steering wheel reversals under slow and Tijuana Brass conditions was quite close to the 5% level (p=0.06). This comparison indicates more fine steering wheel activity during the peppier music. This difference is also indicated in the averaged data of Table 5. In this table it can be seen that subjects averaged 415 fine steering wheel reversals during the slow background music and 426 during the Tijuana Brass.

Mileage was another variable which was close to significant. In the comparison of silent and Tijuana Brass mileages, there was more weaving with silence. Since the route was the same for both conditions, this increased weaving is indicated by greater mileage in the silent condition. The alpha risk for this comparison was 0.08. In Table 5.2, this appears as an average difference of one-hundredth of a mile over the eleven-mile circuit.

Taking into account the results of the questionnaire, the data was grouped to compare the data gathered under the "preferred" music with that from the silent condition and the alternate music. This comparison included only twenty-two of the subjects since two of the subjects expressed no preference for either type of music. As is shown in Table 7, eleven subjects preferred slow music, and eleven, Tijuana Brass. This grouping exhibited less variation between conditions than the grouping for type of background.

Finally, the data was grouped according to its order for each

subject - disregarding auditory conditions. This was done in order to find out whether or not there was a learning effect. There did seem to be a significant effect of learning as can be seen in Table 5.1. The effect of learning is especially evident in the fine steering reversal data. For the trial run, subjects averaged 465 fine steering reversals, 421 for trial A, 419 for trial B, and 413 for trial C - regardless of background. In general, subjects used the car controls less, drove more smoothly, and took less time as they grew more accustomed to the car and the route.

Results of Questionnaire

A questionnaire was given immediately after completing the driving part of the experiment. This post-experimental questionnaire is shown in Figure 2. The results of the questionnaire are shown in Table 7. These results show that the subjects were a young group with an age range of 18-23 years. They had driven for periods varying from 2 to 9 years. All subjects usually listened to a radio while driving.

In response to the distraction question, sixteen subjects felt that neither of the programs distracted them. Three subjects felt the slow music distracted them, and four felt the Tijuana Brass was distracting. One subject felt both types of music were distracting.

Finally, a question was asked concerning the purpose of the experiment. This was done to check how well the true purpose of the experiment was concealed. Evidently the purpose was not

concealed since 23 subjects guessed that it was an experiment in background music. Only one subject believed the cover story of "driver training". The responses to this question are given on the second page of Table 7.

DISCUSSION

Music did have an effect on driver behavior as measured in this experiment. The effect was not overwhelming, but an overwhelming effect was not expected. Any effect was expected to be small.

The amount of effect varied among subjects and criteria. Steering wheel and accelerator pedal usage were particularly interesting; brake pedal usage varied less than 2% between auditory conditions. Generally, total control usage (i. e. fine steering wheel + gross steering wheel + brake + accelerator usage) during slow music averaged less than the silent usage and more during Tijuana Brass than silent. The differences between slow and silent data were smaller than silent-Tijuana Brass differences. This suggested a pacing effect of the music - slow music leading to less activity than silence and faster music to more activity than silence.

The time data - both total and running - were also interesting. Even though both time measures varied less than 2% between conditions, two of the six comparisons were significant ($p<0.05$). When silent and slow conditions were compared, the silent times proved significantly larger; that is, the drivers drove more slowly during the silent condition.

The differences exhibited in this study are fairly compatible with earlier study in this area (Brown, 1965). Brown's "light traffic" data using a "ballroom dancing" music background are quite similar to the slow music conditions of the present study. In both studies, slow music led to less control activity than during silence.

Tijuana Brass music, on the other hand, seemed to affect control activity differently than slow music. In general, drivers were more active during the Tijuana Brass condition than during silence. There was even more difference between the Tijuana Brass and slow conditions.

In contrast to the activity data, both types of music resulted in faster lap times than silence. Thus, the time criteria were changed in the same direction by both slow and lively music.

It is difficult to judge whether or not the effects shown should be termed "improvements" in driver behavior. Total driver control activity (i. e. steering wheel + brake + accelerator usage) has been compared with subjective driver evaluation by licensing examiners (Fedderson, 1965). In this earlier study, good subjective ratings were positively correlated with low control activity.

With low driver activity defined as "good", the slow music led to improvements in driver behavior. On the other hand, using this definition we must term the Tijuana Brass effects as decremental. It is felt, by the author, that the amount of

effect produced is not of great enough magnitude to be termed either improvements or decrements. It is highly unlikely that the drivers license examiners in the Fedderson study would have noticed any difference in the behavior of these subjects between auditory conditions. The magnitude of the effect was simply too small for subjective discrimination.

The differences indicated in the time data are even more debateable than the control activity data. Persons concerned with highway safety have debated for many years over the effect of speed on safety. Certainly the effect of music was not so pronounced that speed limits were exceeded - due to the music. On the other hand, the background music may have led to more alert behavior, which then led to slightly faster lap times. This could be termed an improvement.

Finally, something should be said about the applicability of this experiment to the everyday driving situation. This experiment was not conducted in either stressful or extremely monotonous conditions. Instead, the conditions were somewhere between these two extremes - tending toward the monotonous extreme. It is highly unlikely that the conclusions of this study would apply to either the stressful or monotonous extreme.

The present study is not, unfortunately, the definitive study on the effect of background music on driver behavior. Certainly much more work can be done in this area. In addition, even more work can be done to possibly define the

effects as improvements or not.

SUMMARY

The effect of background music on the behavior of twenty-four automobile drivers was investigated using two types of music -- slow music and Tijuana Brass. Subjects were members of a fraternity which was paid for providing subjects. The effects of these programs on the use of the car controls, time taken over a test circuit of 11.5 miles, and speed changes of the vehicle were measured by comparison with scores obtained in a silent condition. Preference for either slow or Tijuana Brass programs was not a significant variable. Slow music significantly reduced the time taken to complete the test circuit ($p<0.05$). Use of the accelerator pedal was significantly greater during the Tijuana Brass program than during either silent or slow music conditions. There was a considerable effect of learning on the behavior of the drivers. The changes observed were not defined as either beneficial or harmful.

ACKNOWLEDGEMENTS

The author wishes to acknowledge Dr. Stephan A. Konz whose time and effort from the pilot project to the completion of the thesis was greatly appreciated.

The author also wishes to thank Dr. Frank A. Tillman for his co-operation in providing the test vehicle for this experiment.

Dr. Richard E. Christ deserves thanks for his constructive criticism of the design of this experiment.

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APPENDIX I

Table 1 - Experiment Timetable

Subject	Date	Time
1	February 27	7:00 PM
2		8:30 PM
3		10:00 PM
4	February 28	7:00 PM
5		8:30 PM
6		10:00 PM
7	March 1	7:00 PM
8		8:30 PM
9		10:00 PM
10	March 2	7:00 PM
11		8:30 PM
12		10:00 PM
13	March 6	7:00 PM
14		8:30 PM
15		10:00 PM
16	March 8	6:00 PM
17		7:30 PM
18		9:00 PM
19		10:30 PM
20		12:00 PM
21	March 9	6:00 PM
22		7:30 PM
23		9:00 PM
24		10:30 PM

Table 2 - Weather Conditions

Subject	Temperature °F	Wind direction	Wind velocity
1	35	NW	6
2	31		calm
3	26		calm
4	52	NE	6
5	42	NNE	7
6	39	ESE	2
7	68	SW	15
8	68	SW	18
9	62	SW	10-15
10	54	NE	9
11	54	NNW	4
12	47	NNE	1
13	28		calm
14	24		calm
15	32		calm
16	34	S	12
17	30	S	10
18	29	SSW	10
19	29	SSW	11
20	28	SSW	12
21	62	S	13
22	58	S	10
23	53	S	13
24	51	SSW	11

Table 3 - Sequences of Conditions

Subject	Conditions		
	Trial A	Trial B	Trial C
1	Silence	Slow	Tijuana Brass
2	Silence	Tijuana Brass	Slow
3	Slow	Silence	Tijuana Brass
4	Slow	Tijuana Brass	Silence
5	Tijuana Brass	Silence	Slow
6	Tijuana Brass	Slow	Silence
7	Tijuana Brass	Slow	Silence
8	Tijuana Brass	Silence	Slow
9	Slow	Tijuana Brass	Silence
10	Slow	Silence	Tijuana Brass
11	Silence	Tijuana Brass	Slow
12	Silence	Slow	Tijuana Brass
13	Silence	Slow	Tijuana Brass
14	Silence	Tijuana Brass	Slow
15	Slow	Silence	Tijuana Brass
16	Slow	Tijuana Brass	Silence
17	Tijuana Brass	Silence	Slow
18	Tijuana Brass	Slow	Silence
19	Tijuana Brass	Slow	Silence
20	Tijuana Brass	Silence	Slow
21	Slow	Tijuana Brass	Silence
22	Slow	Silence	Tijuana Brass
23	Silence	Tijuana Brass	Slow
24	Silence	Slow	Tijuana Brass

Table 4 - Example DATA SHEET

DATA SHEET			Driver No.
Name Date Temperature	Day Wind		Time
LEARNING RUN ---			
Fine Steering	Gross Steering	Brake	Accelerator
Speed Changes	Total Time	Running Time	Mileage
TRIAL A ---			
Fine Steering	Gross Steering	Brake	Accelerator
Speed Changes	Total Time	Running Time	Mileage
TRIAL B ---			
Fine Steering	Gross Steering	Brake	Accelerator
Speed Changes	Total Time	Running Time	Mileage
TRIAL C ---			
Fine Steering	Gross Steering	Brake	Accelerator
Speed Changes	Total Time	Running Time	Mileage

Table 5 - Data Averages

5.1 Averaged over Trials Regardless of Background

	Trial			
	Practice	A	B	C
Fine Steering	465	421	419	413
Gross Steering	259	234	244	245
Brake	4.5	4.4	4.4	5.9
Accelerator	28.1	18.2	18.8	20.7
Speed Changes	77	71	65	70
Total Time (sec.)	957	936	930	922
Running Time	925	927	914	908
Mileage	11.630	11.652	11.648	11.625

5.2 Averaged over Type of Background

	SILENT	SLOW	TIJUANA BRASS
Fine Steering	412	415	426
Gross Steering	240	238	245
Brake	5.0	4.9	5.0
Accelerator	18.4	17.1	22.3
Speed Changes	70	69	67
Total Time	931	917	922
Running Time	925	906	918
Mileage	11.653	11.641	11.643

Table 5 - Data Averages (continued)

5.3 Averaged taking Preference into Account			
	SILENT	NON-PREFERRED	PREFERRED
Fine Steering	404	417	413
Gross Steering	243	256	235
Brake	5.2	5.2	5.2
Accelerator	18.8	20.7	20.1
Speed Changes	71	71	70
Total Time	922	917	908
Running Time	919	904	905
Mileage	11.649	11.635	11.642

Table 6 - Statistical Comparisons

"t" values - Wilcoxon Matched-Pairs Signed-Ranks Test

6.1 Type of Background

	SILENCE VS. SLOW	SILENCE VS. TIJUANA BRASS	SLOW VS. TIJUANA BRASS
Fine Steering	135 SLO > SIL	106 TB > SIL	(0.0614) 84.5 TB > SLO
Gross Steering	114.5 SIL > SLO	136.5 TB > SIL	108 TB > SLO
Brake	113.5 SIL > SLO	83 TB > SIL	75.5 TB > SLO
Accelerator	105 SIL > SLO	43.5* TB > SIL	62* TB > SLO
Speed Change	139.5 SIL > SLO	124.5 SIL > TB	146 SLO > TB
Total Time	70.5* SIL > SLO	120 SIL > TB	111.5 TB > SLO
Running Time	70.5* SIL > SLO	(0.1096) 70 SIL > TB	84 TB > SLO
Mileage	96.5 SIL > SLO	(0.0784) 66.5 SIL > TB	110.5 TB > SLO

*Significant $p < 0.05$

Table 6 - Statistical Comparisons (continued)

6.2 Type of Background - taking preference into account

	SILENCE VS. NON-PREFERRED	SILENCE VS. PREFERRED	NON-PREFERRED VS. PREFERRED
Fine Steering	94.5 NP > SIL	81 P > SIL	98.8 NP > P
Gross Steering	80 NP > SIL	97 SIL > P	57 NP > P
Brake	79.5	56.5	65
Accelerator	94.5 NP > SIL	84 P > SIL	118 NP > P
Speed Change	94.5	125 SIL > P	125 NP > P
Total Time	71.5 SIL > NP	97 SIL > P	126.5 NP > P
Running Time	56 SIL > NP	45 SIL > P	79.5 P > NP
Mileage	51 SIL > NP	74 SIL > P	103.5 P > NP

Table 7 - Results of Questionnaire

Subject	Age	Years Driven	Did any of the music distract you?	Preference
1	18	4	No	Tijuana Brass
2	18	5	Tijuana Brass	Tijuana Brass
3	19	3	Slow	Slow
4	18	3	No	Slow
5	20	5	Tijuana Brass	Tijuana Brass
6	18	4	No	Slow
7	18	3	No	Tijuana Brass
8	18	6	No	Tijuana Brass
9	18	4	No	Tijuana Brass
10	18	2	No	Slow
11	19	4	No	Tijuana Brass
12	18	3	Both Types	Slow
13	19	4	No	Tijuana Brass
14	21	5	Slow	Tijuana Brass
15	21	5	No	Tijuana Brass
16	22	4	No	Tijuana Brass
17	20	4	No	None
18	19	4	No	Slow
19	23	7	No	Slow
20	21	7	No	None
21	20	6	Tijuana Brass	Slow
22	19	6	Tijuana Brass	Slow
23	21	9	No	Slow
24	19	5	Slow	Slow

Table 7 - Results of Questionnaire (continued)

Subject	What was the purpose of the experiment?
1	"Determine difference music makes on driving"
2	"See what effect music has on driving"
3	"Test driver response to music"
4	"Determine effect of music on driving speed"
5	"Influence of music on driving"
6	"Reaction of driving to music"
7	"Reaction when driving under different music"
8	"Study driving habits while listening to music"
9	"Test effect of music on drivers"
10	"See if music affects my driving"
11	"Effect of music on our driving"
12	"What music will do to drivers' general reactions"
13	"Tell if music relaxed me while I drove"
14	"Show how music affects driving"
15	"Effect of music on mental alertness"
16	"Test driver on different types of music"
17	"Effect of music on driver responses and reactions"
18	"Experiment for driver education course"
19	"Effect of music on driving techniques"
20	"See if music has a visible effect on driving"
21	"Effects of music on driving"
22	"Effect of music on driving efficiency"
23	"Test driving reaction to background music"
24	"Effect of music on driving ability"

Table 8 - Data

PRACTICE	SUBJECT 1	2	3	4	5	6
Fine Steering	419	467	413	520	463	478
Gross Steering	199	267	221	398	296	251
Brake	4	3	7	9	5	7
Accelerator	42	11	60	43	8	16
Speed Changes	80	77	84	88	69	78
Total Time	970	962	947	1130	1035	895
Running Time	967	960	940	---	578	889
Mileage	11.57	11.61	11.61	11.73	11.48	11.65
SILENT						
Fine Steering	415	430	367	347	428	363
Gross Steering	227	258	277	220	242	150
Brake	5	3	6	9	5	5
Accelerator	21	13	36	21	11	6
Speed Changes	77	67	82	64	59	62
Total Time	942	969	848	987	935	935
Running Time	942	968	847	---	935	935
Mileage	11.67	11.64	11.63	11.71	11.68	11.67
SLOW						
Fine Steering	414	403	395	394	372	415
Gross Steering	242	246	228	164	207	199
Brake	5	4	6	5	6	5
Accelerator	17	15	35	19	14	14
Speed Changes	63	72	94	72	65	57
Total Time	935	937	853	1055	949	908
Running Time	935	933	853	---	861	900
Mileage	11.65	11.52	11.62	11.72	11.68	11.69
TIJUANA BRASS						
Fine Steering	422	423	404	430	413	468
Gross Steering	238	279	280	241	225	211
Brake	6	3	8	5	6	4
Accelerator	25	19	46	26	9	16
Speed Changes	75	69	87	65	68	65
Total Time	927	980	834	1028	998	915
Running Time	925	976	834	---	998	909
Mileage	11.63	11.62	11.63	11.70	11.69	11.63

Table 8 - Data (continued)

PRACTICE	SUBJECT 7	8	9	10	11	12
Fine Steering	598	357	---	388	539	364
Gross Steering	406	190	---	116	333	192
Brake	4	3	---	6	4	5
Accelerator	18	6	---	57	4	59
Speed Changes	79	72	---	85	67	71
Total Time	1059	932	---	992	---	---
Running Time	1059	833	---	987	---	---
Mileage	11.97	11.65	---	11.64	11.53	11.48
SILENT						
Fine Steering	377	364	372	293	490	290
Gross Steering	254	219	236	179	278	128
Brake	7	5	3	5	4	3
Accelerator	19	4	18	38	4	19
Speed Changes	59	79	55	64	61	68
Total Time	925	857	931	---	953	915
Running Time	925	812	931	---	---	---
Mileage	11.58	11.62	11.62	11.67	11.64	11.68
SLOW						
Fine Steering	423	415	394	335	516	294
Gross Steering	270	293	247	199	331	164
Brake	5	6	2	6	5	2
Accelerator	17	2	17	26	6	15
Speed Changes	82	60	55	81	67	69
Total Time	874	851	950	---	945	950
Running Time	870	840	950	---	---	---
Mileage	11.60	11.58	11.65	11.69	11.64	11.66
TIJUANA BRASS						
Fine Steering	412	338	434	363	520	314
Gross Steering	211	205	261	237	293	151
Brake	4	5	2	5	5	6
Accelerator	19	4	14	34	5	33
Speed Changes	67	64	54	65	69	82
Total Time	890	846	927	---	1047	900
Running Time	882	821	927	---	---	---
Mileage	11.62	11.59	11.63	11.68	11.65	11.67

Table 8 - Data (continued)

PRACTICE	SUBJECT 13	14	15	16	17	18
Fine Steering	485	510	368	465	637	571
Gross Steering	233	280	210	312	259	261
Brake	2	2	4	3	6	4
Accelerator	17	24	14	25	29	28
Speed Changes	39	76	70	68	58	83
Total Time	952	983	980	820	978	---
Running Time	946	979	980	818	978	---
Mileage	11.66	11.57	11.70	11.62	11.56	11.73
SILENT						
Fine Steering	465	447	372	397	594	430
Gross Steering	238	267	225	163	223	298
Brake	3	2	4	5	3	9
Accelerator	10	29	14	27	23	16
Speed Changes	45	61	71	53	61	68
Total Time	930	996	914	816	984	997
Running Time	930	996	914	812	978	997
Mileage	11.68	11.70	11.67	11.61	11.71	11.70
SLOW						
Fine Steering	513	377	359	379	554	465
Gross Steering	262	232	220	206	195	267
Brake	4	3	8	3	5	7
Accelerator	12	25	17	16	14	11
Speed Changes	16	67	96	45	54	74
Total Time	910	1061	902	811	954	1001
Running Time	910	961	902	810	954	995
Mileage	11.66	11.69	11.67	11.62	11.69	11.71
TIJUANA BRASS						
Fine Steering	493	453	388	354	555	498
Gross Steering	225	237	256	211	181	272
Brake	4	2	8	4	4	6
Accelerator	16	38	30	29	26	15
Speed Changes	35	59	80	43	64	69
Total Time	926	959	895	784	987	1014
Running Time	921	959	895	781	976	998
Mileage	11.68	11.69	11.66	11.59	11.71	11.71

Table 8 - Data (continued)

PRACTICE	SUBJECT 19	20	21	22	23	24
Fine Steering	529	443	445	477	352	408
Gross Steering	285	194	275	337	189	273
Brake	2	3	3	11	3	6
Accelerator	5	9	16	110	6	40
Speed Changes	65	71	87	97	88	131
Total Time	964	1005	917	868	941	989
Running Time	964	1002	910	852	941	989
Mileage	11.69	11.69	11.50	11.50	11.64	11.57
SILENT						
Fine Steering	483	399	490	436	353	489
Gross Steering	272	193	349	317	222	315
Brake	3	3	9	8	2	8
Accelerator	3	5	9	57	5	33
Speed Changes	70	63	77	112	80	119
Total Time	953	995	921	783	957	981
Running Time	953	991	921	782	955	981
Mileage	11.70	11.69	11.64	11.55	11.57	11.65
SLOW						
Fine Steering	451	381	466	490	317	435
Gross Steering	234	187	292	344	175	299
Brake	4	2	7	5	4	8
Accelerator	6	4	9	61	14	24
Speed Changes	55	68	83	85	81	104
Total Time	952	993	913	804	844	944
Running Time	952	990	913	804	835	944
Mileage	11.67	11.68	11.63	11.51	11.52	11.64
TIJUANA BRASS						
Fine Steering	413	415	485	462	316	460
Gross Steering	225	213	348	344	172	339
Brake	2	3	5	11	2	9
Accelerator	8	5	4	75	13	25
Speed Changes	56	62	78	116	80	107
Total Time	951	1000	939	778	935	956
Running Time	951	1000	939	778	928	956
Mileage	11.69	11.68	11.64	11.54	11.52	11.59

APPENDIX II

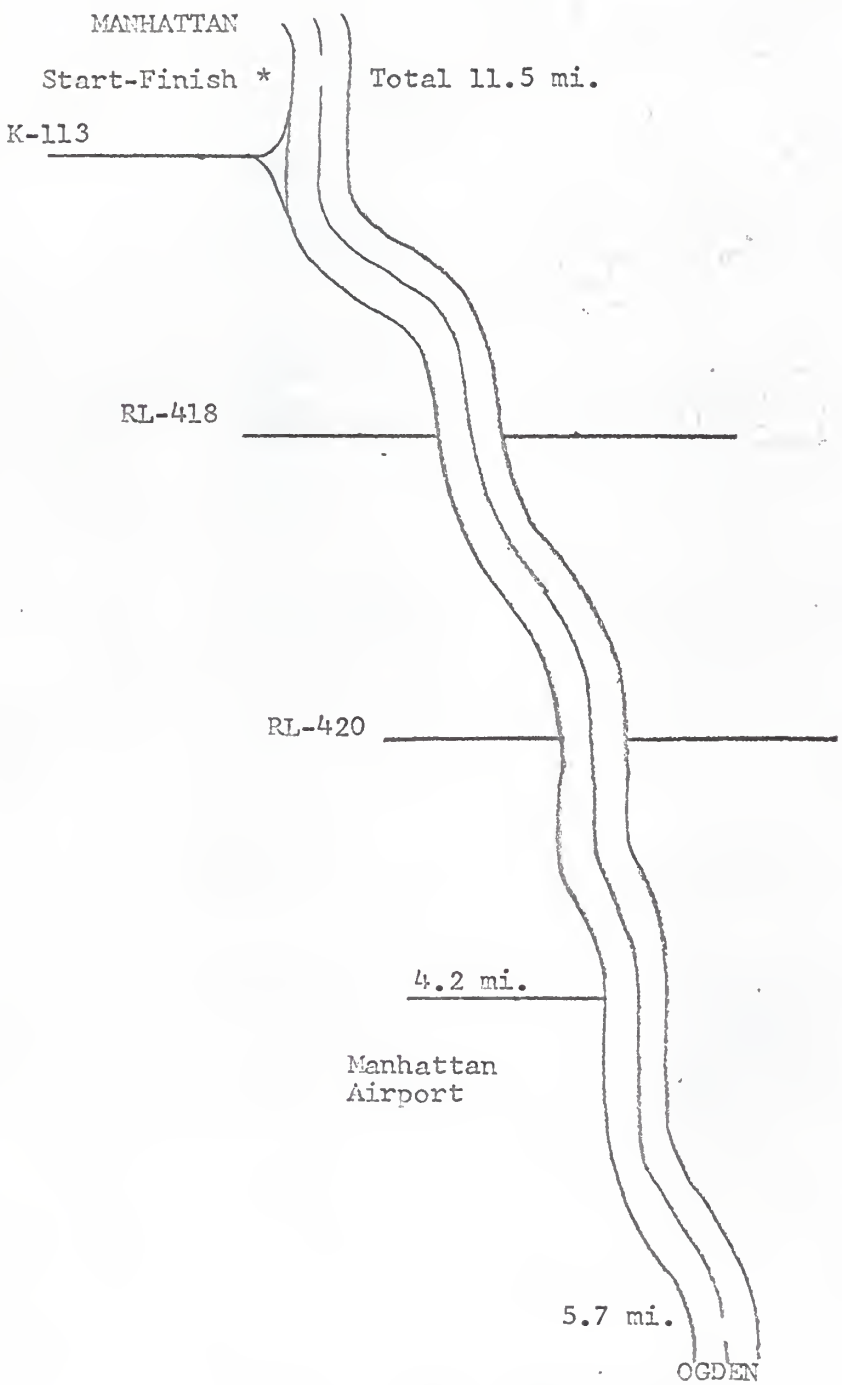

Figure 1 - Map of Test Circuit

QUESTIONNAIRE

Name

Age

What was the purpose of this experiment?

How many years have you driven?

Do you usually listen to a radio while driving? YES NO

Do you feel either, both, or neither of the tape programs distracted you while driving?

NEITHER SLOW BOTH

TIJUANA BRASS

Which of the two music programs did you prefer?

SLOW

TIJUANA BRASS

NO PREFERENCE

Figure 2 - Post-Experimental Questionnaire

THE EFFECT OF BACKGROUND MUSIC ON THE CONTROL ACTIVITY OF AN AUTOMOBILE DRIVER

by

DAVID ELLIS MCDOUGAL

B. S., Kansas State University, 1966

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

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KANSAS STATE UNIVERSITY
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1967

The effect of background music on the behavior of twenty-four automobile drivers was investigated using two types of music -- a slow type and Tijuana Brass. Subjects were members of the same fraternity, which was paid for providing subjects. The effects of these programs on the use of the car controls, time taken over a test circuit of 11.5 miles, and speed changes of the vehicle were measured by comparison with scores obtained in a silent condition. Traffic conditions were light for all subjects. The experimental situation was neither extremely monotonous nor stressful. Preference for either slow or Tijuana Brass programs was not a significant variable. Slow music significantly reduced the time taken to complete the test circuit ($p<0.05$). Use of the accelerator pedal was significantly greater during the Tijuana Brass program than during either silent or slow music conditions. There was a considerable effect of learning on the behavior of the drivers. The changes observed were not defined as either beneficial or harmful.