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## The effect of in-car music on drivers' emotions

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**Abstract** *Objective* To investigate the effect of in-car music on drivers' emotions. Methods 540 drivers were randomly selected and questionnaires were administered on their in-car music listening status. *Results* 77.2% of the car drivers listened to music regularly ( $\chi^2 = 17.286$ ,  $P < 0.001$ ). 38.5% of the car drivers believed that music could improve alertness ( $\chi^2 = 99.304$ ,  $P < 0.001$ ), 37.6% used music to relieve monotony ( $\chi^2 = 514.809$ ,  $P < 0.001$ ), and 47.6% said that music could make them relax ( $\chi^2 = 81.943$ ,  $P < 0.001$ ), and 60.2% admitted to search=search music while driving ( $\chi^2 = 22.407$ ,  $P < 0.001$ ). Listening to music can play a certain role in emotional arousal and help to keep drivers alert, but drivers must make it wakeful and moderate and not overly pursue pleasure, otherwise danger will occur.

**Keywords** in-car music, driver, emotional state

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### 1. Introduction

As music is becoming more and more widely integrated into our lives, listening to music has become our first choice to relieve loneliness, relax and entertain ourselves in our daily lives. As a special art form, music focuses on self-perception and emotional release. Like painting and dance, it is composed of basic elements. These elements influence our psychological experience and are closely linked to the listener's objective needs and subjective emotions, which are constantly changing as the listener grows older. Through its psychological experience, music soothes people's negative emotions. This paper analyzes the influence of music on emotions by examining the relationship between music and emotions and the emotional development of listeners at different age levels.

Music can bring wonderful enjoyment to people, and different kinds of music can bring people different kinds of spiritual experience, so music therapy is also called "psychomusic therapy". Psychological experiments have shown that music is a benign stimulus that can evoke good emotions, such as liking, pleasure, euphoria, security, satisfaction, honor, and so on. Therefore, for depressed patients with depressed mood, sad state of mind, low self-esteem, self-blame and other bad emotions have a good detoxification effect.

Driving for a long time under monotonous road conditions can make drivers feel depressed, bored, anxious and angry, these negative emotions are important psychological factors that induce drivers to violate the rules, while relaxed, happy and other positive emotions are more conducive to driving safety, therefore, can reduce the occurrence of unsafe driving behavior by cultivating positive emotions in drivers. Listening to music is a common means of emotional regulation, slow music can effectively relieve stress, concordant tones, smooth and fast rhythms, major tonality and high notes are usually more pleasant and exciting, and by stimulating arousal, improve the efficiency of human work. As a result, drivers generally find listening to music a useful way to pass the time and enhance their driving performance, and it has evolved into a behavioral habit. However, police accident investigations in the United States and the United Kingdom report that music players such as radio and CDs are the most common as well as the second most prevalent source of in-vehicle distraction; for example, changing a CD takes five seconds and the car will travel nearly 156 meters without the driver being aware of the



road environment, and such behavior is the third leading cause of accidents. Few domestic studies have been conducted in this area, which is inconvenient for policy makers to regulate the in-car music market in China and standardize the content of traffic and music radio broadcasts. This study examines the effects of in-car music on drivers' emotions and accident propensity through a questionnaire survey to provide a reference for traffic management to make decisions.

## 2. How music affects mood

In neuroscience, a number of studies have shown that listening to music can cause activation of the limbic system, which is extremely closely related to emotion. The distribution of colored dots in the black-and-white diagram and the red part in the colored diagram overlap in a rough comparison between the two diagrams below. This is because it is the parasympathetic nervous system, not the sympathetic nervous system, that is activated by music. When stimulated by the external environment, the sympathetic nervous system is activated and the level of physiological arousal is significantly increased, resulting in emotional experiences such as panic, anger, tension, excitement, etc. The function of the parasympathetic nervous system is the opposite of the sympathetic nervous system, which induces the body to relieve itself from tension or high levels of physiological arousal and enter a state of relaxation. Music stress reduction and relaxation in music therapy uses this property of music.

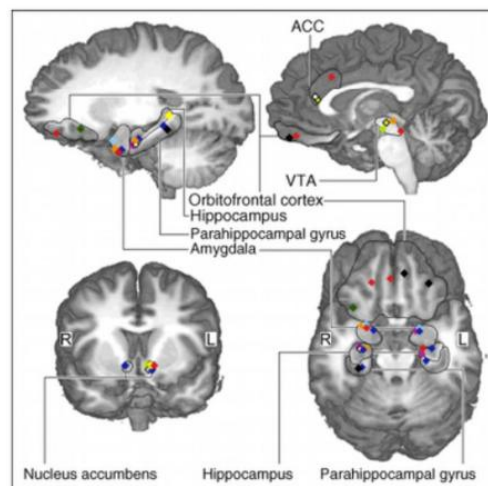


Figure 1: Activation of edge systems

Physiologically, music stimulates the body's autonomic nervous system, whose main functions are to regulate the body's heart rate, respiratory rate, nerve conduction, blood pressure and endocrine secretion. Therefore, scientists have found that soft music slows down the blood circulation in the brain, while lively music increases the blood flow rate in the body. In addition, high pitched or fast paced music makes the body's muscles tense, while low pitched or slow music makes people feel relaxed.

At the psychological level, music causes the brain, which is responsible for human emotions and sensations, to respond autonomously, resulting in a change in mood. Many studies have shown that calm or happy music can reduce anxiety. Study leader psychologist Charles Emery says that exercise produces positive changes in the nervous system that can have a direct impact on cognitive abilities. Listening to music can affect a person's cognitive function through different neurotransmission pathways in the brain. The combination of music and exercise can stimulate and improve cognitive abilities while assisting the brain in organizing its cognitive output after receiving information.

With the development of the times, society demands more and more cognitive ability level from people. The great pressure and negative emotions we face in our daily life and study will inevitably have a certain impact on our character and emotions, with increasing pressure and uncontrollable emotional changes, while music, as a special art, can regulate people's emotions. Beautiful and cheerful music can make our mood relaxed, the vision is open to people to enjoy the beauty, different kinds of music will become different to our emotions, relaxing



music can dispel the inner melancholy, music can fully affect our emotional activities. Emotional regulation has gained importance in music. Although music, as an objective thing, has no emotion in itself, it can successfully convey and influence the listener's emotion by following these general paradigms.

### 3. Emotional effects of in-car music

The effect of listening to music and radio in the car on driving has long been a concern. Surveys of a wide range of people show that most people choose to listen to music or radio while driving, especially young drivers (18 to 29 years old) who prefer to keep their ears from resting while driving.

**Table 1:** Frequency of in-vehicle listening as a percentage of each age group. Respondents could select more than one option

Listening activity (%)	18-29 (N=396)	Age 30-35 (N=760)	Over 50 (N=624)
CD/tapes	74	67	43
Music radio	76	73	57
Talk radio	27	34	39
Conversation	49	49	31
Silence	7	8	19

When asked about the purpose of listening to music while driving, they felt that listening to music can help focus and calm people, while humming along with the music is also one of the main purposes. The percentage of people who think music distracts drivers is less than one, which means that the subjective perception of the act of listening to music while driving is very positive.

**Table 2:** Frequency of musical functions in vehicles as a percentage of each age group. Respondents could select more than one option

Musical function (%)	18-29 (N=396)	Age 30-50 (N=760)	Over 50 (N=624)
Music aids my concentration	23	21	27
Music makes me calmer and more relaxed	61	58	67
Music can be a distraction	9	7	3
I often sing along to music	60	54	41
I find conversation or spoken word distracting	8	6	8

In terms of the cognitive impact of music on people, relevant scientific findings reveal that when listening to music, one's mind moves away from other things, and after listening for a period of time, we begin to imagine some music-related things, while our own past memories are also evoked. In this way, listening to music changes our mode of consciousness, manifesting as attracting attention and suppressing other irrelevant thoughts, while mobilizing memories. In terms of emotion, music is thought to have the effect of transmitting emotion, and the paradigms of transmission, including, for example, rhythm, loudness, pitch, and musical weave. Although music, as an objective thing, has no emotions of its own, it can successfully convey and influence the listener's emotions by following these universal paradigms. This is why many people use music to combat their bad emotions or to make themselves feel more miserable and lonely, such as when they fall out of love they will enjoy listening to very sad music. Throughout our years of listening to music, we become more and more familiar with the emotional paradigm of music, so that we can better "understand" the music and what the composer and performer are trying to convey.

These are the general results of the effects of music on our perceptions, but how do the results differ when listening to music or radio while driving, when the main thing we are doing is driving and the brain's response mechanism is different, as it is in general, listening to music while driving can relieve our mental stress, whether in smooth traffic or in traffic jams.



## 4. Objects and Methods

### 4.1 Target Population

There were 602 questionnaires issued in the driver group, and 540 (89.7%) were valid. The age of drivers ranged from 19 to 58 years old, with an average of 33.16 years old, including 359 males and 181 females; 146 drivers with less than 1 year of driving experience, 255 drivers with 2 to 5 years of driving experience, 113 drivers with more than 5 years of driving experience; 490 non-operating drivers and 50 operating drivers.

### 4.2. Methodology

A self-administered questionnaire on drivers' listening to in-car music was used. Through the "snowball" technique, 602 drivers were selected from 12 large and medium-sized cities in China. The drivers were first asked to fill in basic demographic information, including age, gender, and driving age. They were also asked to provide relevant driving exposure information, including mileage, number of collisions within one year and number of collisions since obtaining a driver's license, etc., and then fill out the questionnaire.

### 4.3. Statistical processing

This study used SPSS 16.0 software for statistical analysis of the data, and the chi-square goodness-of-fit test and the chi-square percentage homogeneity test were used.

## 5. Results

### 5.1. Listening frequency

When asked the driver, "driving process, listening to car music frequency?" The driver's response is shown in Table 3

**Table 3:** Driver self-assessed frequency of listening to in-car music

Preference	Item	n	Weighting
1	Listen often	165	30.6
2	Sometimes listen	160	29.6
3	Rarely	99	18.3
4	Listen every time I drive	92	17.0
5	No	24	4.4
$\chi^2$ test	$\chi^2=123.574$	df=4	P=0.000

The chi-square fit test shows that nearly 30% of drivers report that they listen to music in the car often, while only 4.4% report that they never listen to music, and if you add up the number of drivers who choose "often", "sometimes" and "every time I drive", it is 77.2%. If you add up the number of people who choose to listen to music "often", "sometimes" and "every time I drive", it is 77.2%.

### 5.2. Effects of in-car music on driver mood

Increased arousal when drivers were asked, "In what way does listening to music while driving affect your driving?" The drivers' choices are shown in Table 4.

**Table 4:** Driver's assessment of the degree of influence of in-car music

Impact assessment	Item	Number of selections	Weighting
1	enhance alertness	208	38.5
2	A little arousal effect	171	31.7
3	No effect	101	18.7
4	A little disturbance	60	11.1
5	Severe disturbance	0	0
$\chi^2$ test	$\chi^2=99.304$	df=3	P=0.000

None of the 540 subjects reported a serious disturbing effect of the behavior, and more importantly, they generally believed that listening to music in the car had some positive effects, such as anti-fatigue and increased alertness (38.5%).



### 5.2.1 Relief of monotony

When drivers were asked: "During driving, do you like the following ways to relieve boredom (multiple choice)?" The drivers' responses are shown in Table 5.

**Table 5:** Driver's preferred way to relieve boredom

Preference	Item	Number of selections	Weighting
1	Listen to car music	344	37.6
2	Listen to the radio	342	37.4
3	Talking with passengers	151	16.5
4	Calling friends	55	6.0
5	Other	23	2.5
$\chi^2$ test	$\chi^2=514.809$	df=4	P=0.000

When drivers were asked "Under what road conditions do you usually listen to music in your car?" When asked, 456 people like to listen to in-car music on rural roads or highways with traffic jams and single road conditions, 29 people like to listen to in-car music on city roads with complicated road conditions and speed limits, and another 55 people like to listen to in-car music under both road conditions. It can be seen that most drivers listen to car music for the motive of relieving boredom, breaking monotony or relieving fatigue.

### 5.2.2. Emotional Regulation

When drivers were asked: "What kind of mood do you want to pursue by listening to music while driving? (Multiple choice)" the driver's response is shown in Table 6.

**Table 6:** listening to car music to pursue the mood

Preference	Item	Number of selections	Weighting
1	Relaxation	366	47.6
2	Pleasure	240	31.2
3	Passion	163	21.2
$\chi^2$ test	$\chi^2=81.934$	df=2	P=0.000

47.6% of drivers claim that music relaxes them, 31.2% find it pleasurable, and another 21.2% listen to in-car music to seek passion.

## 6. Conclusion

Although almost all studies have proven that listening to music does not directly improve or reduce driving levels. However, due to the effect of music on mood and feelings, its driving impact is still evident, especially during long distances. Listening to music is good for suppressing irritability and maintaining attentional arousal levels, thus improving one's reaction time and benefiting driving safety.

Drivers self-reported that the main way to break the monotony was to listen to in-car music (37.6%) or radio (37.4%), especially when listening to in-car music in traffic jams, on rural roads or on highways, which accounted for almost 94% of the total population, and the main purpose of listening to music was relaxation and comfort (47.6%). This result is consistent with many previous studies abroad.

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