

Research and Analysis of Driving Behavior Characteristics Under Anger Emotion

Yiming Yang, Zhihong Chen, Anlin Liu, Siyuan Ma,
Kunmei Zhang, and Yongqing Guo*

School of Transportation and Vehicle Engineering
Shandong University of Technology, 255000, Zibo, Shandong, China

E-mail: inexoboy@163.com; cccchenzhihong@163.com; masiyuanmia@163.com;
lin1012808566@163.com; 17852739659@163.com

*Corresponding author details: Yongqing Guo; guoyongqing319@163.com

ABSTRACT

With the rapid progress of society, the number of automobiles in our country is also increasing day by day. The resulting traffic jams and traffic accidents are also increasing. Under the dual pressure of work and life, drivers tend to accumulate some negative emotions, resulting in a certain degree of anger in the driver. When a driver drives with a bad mood like anger, it is likely to cause a car accident. Therefore, it is particularly necessary to study the driving behavior characteristics of drivers in the state of anger. In this paper, the driver's anger is stimulated by means of emotion stimulation, and the driving behavior characteristics of the driver under the anger are collected through a simulated experimenter. By analyzing the characteristics of speed and acceleration, the relationship between speed characteristics and dangerous driving behaviors under anger is discussed. Finally, through the detection and analysis of the speed characteristics under anger, it can be seen that the perception of the driver's actual behavior and the recognition of emotions while driving are to provide an early warning for judging whether the driver is angry and potentially dangerous driving behavior, thereby reducing accidents. rate key.

Keywords: driving behavior; anger emotion; speed characteristics; driving simulation experiment

INTRODUCTION

Entering the 21st century, traffic safety has become an important issue of common concern to all countries and mankind. Since the advent of the automobile, tens of thousands of people have been killed and countless others injured around the world. Leading comrades of the Central Committee have repeatedly pointed out that we must adhere to people-oriented, governance for the people, adhere to the height of scientific development, safe development and harmonious development, and conscientiously implement the road traffic safety regulations of the Party Central Committee and the State Council from the perspective of scientific development, safe development and harmonious development. Work decisions and deployments to further strengthen and improve road traffic safety.

According to data from the Traffic Management Department of the Ministry of Public Security, in 2020, China's car ownership will reach 395 million, of which 320 million will become car ownership. Among them, the growth rate of new energy vehicles is the most significant. By the end of 2021, the number of new energy vehicles in my country will reach 7.84 million, accounting for 2.60% of the total number of vehicles; compared with 2020, 2.92 million new vehicles will be added, an increase of 59.25%. The rapid growth rate is evident. At intersections, the road becomes more congested. Some drivers frequently changed lanes and whistled non-stop, and the effects of the smog made them even more irritable. They also become more stressed while driving. Once anger occurs, it will have a certain impact on visual search, reaction speed, etc.

Anger is the driver's acceptance and judgment of road information, which has an important impact on their risk assessment and driving behavior. The emotional changes of drivers caused by anger during driving have resulted in many traffic accidents. Therefore, it is very necessary to fully, deeply and correctly understand the driver's anger and effectively control the traffic accidents caused by anger.

EXPERIMENTAL DESIGN

Experiment Apparatus

In this experiment, a simulated driver was used to conduct the simulated driving experiment. The experimental equipment included the Logitech racing steering wheel seat set and the simulated driving through the construction of the simulated road environment through UC-win/Road simulation software. The simulated experimental scene is shown in Figure 1 below.



FIGURE 1: Simulation driving experiment scene

Anger Emotion Inducement

The methods commonly used to stimulate anger in the laboratory mainly include two types of anger material stimulation and anger situation stimulation. The former includes visual stimuli, auditory stimuli, olfactory stimuli, and multi-channel material stimuli. The aim of this study is to reliably stress an angry group to be in an angry state during simulated driving.

In the anger stimulation experiment, the anger group experimenters were required to watch movie clips with emotional stimuli that evoked anger.

Emotional experience self-reporting method refers to a method of evaluating their emotional state by asking subjects to self-report their emotional state or fill in some emotional experience questionnaires after stimulating the experiment. Studies have found that this method is the most convenient, easy-to-understand, well-organized, and targeted method among the existing ways of eliciting and evaluating emotions. After the stimulation experiment, the experimenters were asked about their feelings, and it was found that all the experimenters felt anger, and it was concluded that the anger had been stimulated.

Experiment Process

First, in order to familiarize the driver with the simulator, the 20 drivers recruited for the experiment have to conduct a simulation experiment. The 20 drivers were divided into two groups, one group was simulated driving under angry emotion, and the other group was simulated driving under neutral emotion. Each driver drives for 5 minutes to ensure they are fully familiar with the simulated system and simulated driving environment, in line with their driving habits, and to ensure they are in good physical condition.

Second, before the simulated driving experiment, the anger group conducted the anger stimulation experiment. After the experiment concluded that the anger had been stimulated, the simulated driving experiment was conducted at the same time to ensure that the experiment was correct.

Third, after the driving simulation starts, the driver must autonomously complete the simulated driving behavior in the scenarios set in advance in the driving simulation system. Each group of drivers completed the experiment by performing two scenarios in sequence. After entering different simulated environments, the facilitator recorded the current time, and the speed characteristics of all subjects' driving behavior were stored on the device. When faced with different experimental simulation scenarios, the subjects made decisions based on their own driving experience, the whole process was not disturbed by the outside world, and the relevant data were recorded and stored after the experiment.

During the entire simulated driving experiment, all the speed characteristic data were recorded in real time, including the position, speed, acceleration, steering operation, braking and interaction with surrounding vehicles of the target vehicle. Speech, expressions and reactions are recorded by the recorder.

DATA ANALYSIS

Speed Analysis

Figure 2 shows the corresponding data for the average speed of simulated driving under free-air conditions for both groups of drivers under the condition of angry emotion and neutral emotion.

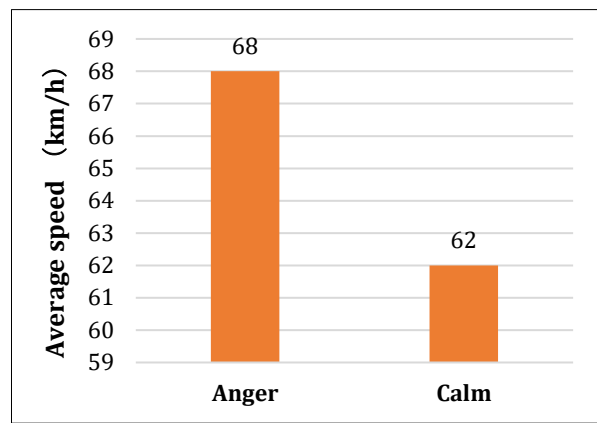


FIGURE 2: Average speed during driving under different emotions

According to the analysis of the obtained data, the amplitude of the speed fluctuation shows that the average speed of the driver in the angry emotion is higher than that of the driver in the neutral emotion.

TABLE 1: Speed comparison under different emotions

Group	Minimum	Maximum	Mean	Standard Deviation
anger	63	75	68	3.0912
calm	59	64	62	1.1767

Combining with Table 1, it can be seen that the speed of the driver in anger varies from 63 to 75 km/h, and the interval span is 12 km/h; in contrast, the speed of the driver in neutral is 59 to 64 km/h. The interval span is 5km/h. Judging from the size of the standard deviation, the speed difference between the drivers in the neutral group and the angry group is obvious, which are 1.1767km/h and 3.0912km/h, respectively. On the whole, in the same scenario, the driver of the neutral group drives the vehicle more smoothly and the speed is more reasonable and safer.

In contrast, during the driving process, the angry group drivers prefer to drive at high speed, and are more likely to produce dangerous driving behaviors such as following the car too close, emergency braking, etc., thus affecting driving safety.

Acceleration Analysis

Table 2 shows the corresponding data of the acceleration of the two groups of drivers when the surrounding environment is open and without interference.

TABLE 2: Acceleration comparison under different emotions

Group	Minimum	Maximum	Mean	Standard Deviation
anger	3.22	3.91	3.63	0.1989
calm	1.02	1.62	1.34	0.1218

By analyzing Table 2, it can be concluded that the acceleration under angry emotion varies from 3.22 to 3.91m/s², and the interval span is 0.69m/s²; in contrast, the acceleration of neutral emotion is between 1.02 and 1.62m/s². Change, the interval span is 0.6m/s². The standard deviation of the angry group was 0.1989m/s², while the standard deviation of the neutral group was 0.1218m/s², the difference between the two was obvious.

Under the same driving environment, the driver in the angry group has a short acceleration time, and the frequency of acceleration changes is fast. In a short period of time, the vehicle speed rises to a high value and remains at a high level, which is likely to cause dangerous driving; while the neutral group has a low acceleration and is in the operation is cautious during the driving process, and the speed of the vehicle has been tending to a stable state. In the event of an emergency, such as a sharp turn ahead, it can be smoothly passed, and the driving is safer.

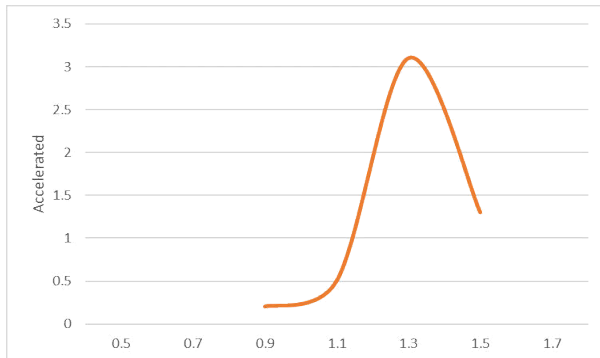


FIGURE 3: Changes in acceleration under anger

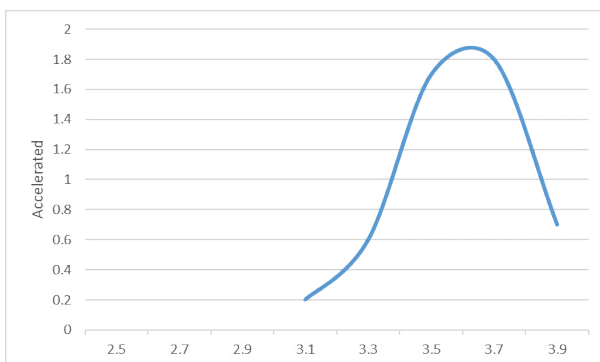


FIGURE 4: Changes in acceleration under calm emotions

According to the analysis of Figure 3 and Figure 4, the acceleration under anger is mainly concentrated between 3.4 and 3.8m/s², while the acceleration of the neutral group is mainly distributed between 1.2 and 1.4m/s². It can be seen that the anger group's acceleration the acceleration was significantly higher than that of the neutral group. Therefore, the drivers in the angry group accelerate faster during driving, and are more likely to slam the accelerator to accelerate overtaking, etc., resulting in dangerous driving behaviors.

CONCLUSIONS

In this paper, using the simulated driving simulation system, the influence of the driver under the angry emotion and the neutral emotion on the speed characteristics and driving behavior is discussed. The use of the vehicle driving simulation system makes the environmental variability and real-time performance required for the experiment well reflected. Based on the analysis and discussion of the test results, this paper conducts a deep research on the driving behavior of the driver under the anger emotion. The above results provide scientific theoretical basis and technical methods for in-depth discussion of various factors that affect drivers' emotions, and contribute to the safety and development of highway traffic.

REFERENCES

- [1] Lei Hu. The characteristics of angry driving behaviors and its effects on traffic safety[D]Wuhan: Wuhan University of Technology, 2011.
- [2] Roseborough, J.E. and D.L. Wiesenthal, Roadway justice-Making angry drivers, happy drivers. Transportation research part F: traffic psychology and behaviour, 2014. 24: p. 1-7.
- [3] Dahlen, E.R., et al., Driving anger, sensation seeking, impulsiveness, and boredom proneness in the prediction of unsafe driving. *Accid Anal Prev*, 2005. 37(2): p. 341-348.
- [4] Zhong Ming en , Hong Hanchi , Yuan Zhiqun . Experiment research on influence of angry emotion for driving behaviors[J]. *Journal of Chongqing University of Technology: Natural Science*, 2011, 25(10): 6-11
- [5] Potegal, M. and G. Stemmler, Constructing a neurology of anger, in *International handbook of anger*. 2010, Springer. p. 39-59.
- [6] Litvak, P.M., et al., *Fuel in the Fire: How Anger Impacts Judgment and Decision-Making*. 2010, Springer New York: New York, NY. p. 287-310.
- [7] Richer, I. and J. Bergeron, Differentiating risky and aggressive driving: Further support of the internal validity of the Dula Dangerous Driving Index. *Accid Anal Prev*, 2012. 45(2): p. 620-627.
- [8] Roseborough, J.E. and D.L. Wiesenthal, Roadway justice-Making angry drivers, happy drivers. Transportation research part F: traffic psychology and behaviour, 2014. 24: p. 1-7.
- [9] Dahlen, E.R., et al., Driving anger, sensation seeking, impulsiveness, and boredom proneness in the prediction of unsafe driving. *Accid Anal Prev*, 2005. 37(2): p. 341-348.