

# Study on signs comprehension and driving safety Based on drivers' psychology perception

**Wang Fang**

Research Institute of Highway, MOC  
No. 8 Xitucheng Rd., Haidian District, Beijing  
100088 Beijing, China  
Phone: 86-10-62356381  
Fax: 86-10-62356515  
E-mail: wf.tianlan1981@gmail.com

## Abstract

Traffic signs are the guide of the road transportation. They are the main body which delivers road information to transportation participants. The quality of signs comprehension has influence on driving safety. The article will analyze the process of drivers perception signs based on drivers' psychology perception and build a process model on drivers processing information. It studies the influences of the factors based on psychology perception. The factors include signs physical characteristics, angle of view, quantity of signs information, mental characteristics of drivers, physiology characteristics of drivers. It builds theoretical foundation for later research on evaluation index of signs setting. We hope to reduce the bad influence of the factors on signs perception and raise the safety level of driving<sup>[1]</sup>.

Key words: drivers; psychology perception; signs comprehension; driving safety

## 1. Preface

The road transportation system is complicated. It integrates four main factors which are person, car, road, environment. The conflict between these factors is main cause of traffic accidents and delay of vehicles. The research shows that about 25% traffic accidents are caused by the conflict of "person" and "road environment". Drivers are main users of road and have a very big ratio in the person's factors. The traffic signs are main guide of road transportation. They deliver road information to transportation participants and express the instruction of transportation management. Traffic signs comprehension means that the ability of information comprehended by road users during the provided time. According to the research, about 90% driving information come from vision perception. The vision perception information comes from mainly road information carried by traffic signs. Driver behavior is outside performance of the mental reaction. So the writer of this article tries to study the factors which influence traffic signs comprehension based on psychology perception. We expect to explain the factors that influence the traffic signs comprehension based on psychology. We expect to reduce the bad influence in the traffic signs setting or other aspects and to raise the level of driving safety.



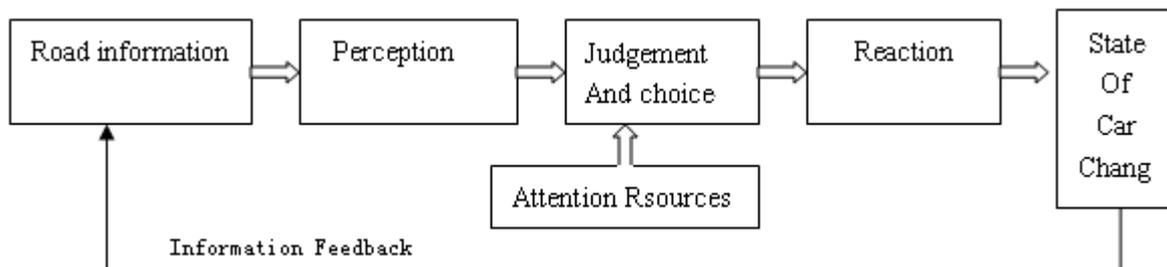


Fig. the model of drivers' processing information

Drivers receive various information from environment when driving on the road. The information includes road information and information from surrounding vehicles and so on. Drivers receive these information and deliver them to the central nervous system through vision. Drivers match the current scene with their mental scene and make a correspond judgement. The judgement may be considerate or output of reflect. The empirical drivers keep the related scene in their memory for longer. They can make reaction quickly according to the information from traffic signs. We call the response as simple response. Sometimes

road circumstance is complicated or the information of traffic signs is excessive. When the quantity of information processed is excessive, drivers can't process all information received. Drivers will neglect some information which is surplus. Such processing will cause driver to make false judgement perhaps. It will bring latent danger to driving safety. Drivers make correspond operation based on knowledge about processing information perceived. These operations include acceleration, braking, change direction and so on. The result of act reaction will have feedback to the transportation system in which drivers place. At the same time, drivers will receive information from road and surrounding environment continuously and adapt themself to new information from road environment in order to make driving safe.

We can think that the key factor which influences driver final operation is the quantity of information received and perceived. Drivers are receivers and perceptrs of information. Drivers' factors have influence on perception and comprehending of traffic signs.

### 3. The Analysis of Factors Which Influencing Perception

#### 3.1 Physical Characteristics of Traffic Signs

As the body of delivering road information, traffic signs must meet the basic physical characteristics as following:

- 1.The color, shape, size, the contrast degree of traffic signs must meet the requirement of vision perception for a person;
- 2.The relation of signs and surroundings should be simple, making traffic signs as "true" traffic signs. For example, as the advertisement and so on.

#### 3.2 The Analysis about the Influence of Angle Size of View on Perception

Angle of view is the angle of the lines from both ends of the viewed object and the two lines of centre of eyes. Drivers can discover the traffic signs only when the angle of sightlight and viewed object exceeds the angle limit required. Particularly under the situation of high

speed, the continuous time of drivers' staring at the traffic sign is limited. Namely the time of the sightline deviates from driveway is limited. High speed makes drivers' move sight descending and makes the viewed distance descending. The research shows that so-called move sight descends 10~20% to quiet sight.

The size of view angle depends on the sign size and the viewed distance. The view angle is bigger when the viewed distance is nearer. The word on the traffic signs can't be viewed and recognized when view angle can't meet the limit requirement. We give the calculation of the limit of view angle.

First, we give the sketch diagram of view angle and retina as follows.

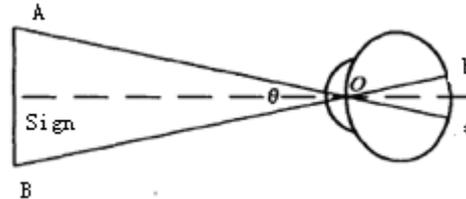


Fig. the sketch diagram of view angle and retina

Secondly, we build the calculation of the view angle limit according to the arithmetical relation of sign size and view angle.

$$\theta = 57.3 \frac{b}{L}$$

$\theta$ —the view angle limit of traffic signs, °

$b$ —the size of traffic signs, forbidding and warning signs can use the diameter and side length as the value of  $b, m$ ;

$L$ —the view distance of traffic sign<sup>3</sup>. It changes with the speed and the ray condition. It depends on the experiment

### 3.3 The Analysis of the Influence of Information on Perception

The traffic sign is the main body which carries road information. It is showed on the direction signs mainly. The writer will analyze the influence of information quantity of direction signs on perception.

Although the current national standard <the road traffic signs and marking >GB5768-1999 gives details about the layout of traffic signs (include the height of characters, form, the distance from a word to another word), it doesn't regulate the explicit quantity of information. When driving, especially the drivers who aren't familiar with the surround environment choose driving direction and adapt behavior according to the information from direction signs. Each driver has certain their special drivers' resources. The resources include the ability of vision, ability of hearing, ability of comprehending information, ability of action. In the same time, the drivers can only complete very few tasks because these driving resources are limited<sup>4</sup>. It is doubtless that excessive information will aggravate the burden of vision. Especially under high speed, the time of drivers' staring at sign is limited. The time of perception of signs increases because of the excessive information. The time of sightline deviating from driveway direction is longer. These influences will be disadvantageous to driving safety.

Traffic signs deliver transportation information to drivers through diagram or word. The quality of information has direct influence on drivers' reaction. If the quantity of information exceeds the capacity of driver' resources, drivers will neglect some information or be baffled, even making drivers nervous. Therefore, we should pay attention to the choice of information quantity when designing traffic signs.

### 3.4 The Analysis of the Influence of Mental Characteristics on Perception

Drivers' mental characteristics reflect the ability, the quality and the personality and so on. Drivers' quality and personality throw personal secret color on their mental activity. Therefore, each driver has special driving style. So drivers make different action when they face the same traffic signs. It is not strange when we connect the phenomenon with the analysis of processing information before. The differences between drivers have latent influence on driving safety. When the driver is excited, his or her mental activity is in high spirit. The visual field is spacious and the thinking is active. The driver has a good recognition to traffic signs and correspond operation is quick. But when the driver is unexcited, his or her mental activity is in low spirit. The visual field is narrow and the thinking is faint. The driver has a bad recognition to traffic signs and correspond action is slow.

The reasons that have influence on drivers mental respond can be divided into three aspects mainly

- 1.the mental respond caused by physiology reasons, such as the lack aspects of the body or some unhealthy condition;
- 2.the mental respond caused by personal motion;
- 3.the mental respond caused by environment; The beautiful environment make person relaxed and pleased. Driver can make quick reaction to information; The bad environment make person anxious even nervous. Driver will make muff reaction to information.

### 3.5 The Analysis of the Influence of Physiology Characteristics on Perception

Drivers need to make a judgement according to the information which has close relation with driving safety. Respond time is most representative in physiology characteristics. Respond time means that the time from receiving information to making reaction. The length of respond time depends on the degree of complication the training circumstance, character, age, the degree of preparation to reaction, personal body' tiredness and so on. The respond time has direct influence on perception of traffic signs. A lot of traffic accidents are caused by inaccurate reaction , inaccurate judgement to information.

The reasons that have influence on driver physiology characteristics can be divided into five aspects:

- 1.the stimulation, for the same kind stimulation, it is tenser, the respond time is shorter. For traffic signs perception, the stimulation corresponds to the attention caused traffic signs to drivers.
- 2.Speed; the speed is higher, the visual field is more narrow. The driver can't see clearly the circumstance outside. It makes driver nervous and makes respond time longer. It has influence on perception of traffic signs.
- 3.Personal motion; For drivers, when they are in pleased, judgement is accurate and the respond time is short. When they are in anxious, judgement is low and the respond time is long.
- 4.Age; The research shows that the ability of persons' comprehension and judgement is in best state during 18~29 years old. After 30 years old, the speed of reaction decends.
- 5.Driving fatigue; Drivers feel fatigued after a long time work. The fatigue has something to do with brain layer repression based on physiology mechanism. Drivers of different ages will become fatigued after long work. It makes respond time longer and has influence on perception.
- 6.Personal body character and so on.

## 4. Conclusion

There are many factors which have influence on perception. These factors include mainly the persons' factor, physical characteristics of traffic signs, relevant factors of road condition<sup>5</sup>, relevant factors of weather condition and so on. These factors integrate with each other and have influence on perception. The writer makes first—step analysis of only a few factors which have close connection with perception based on drivers' psychology perception. We analyze and explain the recognition process based on psychology perception in the article. It contributes to comprehending the related influence factors by the root. The writer will make further research on traffic signs comprehension based on psychology perception.

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