

The Conflict Between Pedestrians and Right-turning Vehicles at Signal Intersections from the Psychological Level

Xinyue Ma, Hai Zou, and Yongqing Guo*

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

E-mail: mxymessi@163.com; 15183313147@163.com;
guoyongqing319@163.com

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

ABSTRACT

With the accelerating urbanization, the urban population growth, road construction by leaps and bounds, the rapid improvement of the road traffic participants formed a fierce contradiction, intersection pedestrians and right turn drivers often conflict, pose a threat to pedestrian traffic safety, also signal the overall operation efficiency and service level has an important influence. The traffic violations of pedestrians and drivers will inevitably be accompanied by a series of psychological activities, and they are dominated by their psychological activities. Therefore, from the perspective of traffic participants' psychology, it is of great significance to solve the violations of pedestrians and right-turning vehicles from the root cause. Based on psychological theory, survey data, behavioral psychology, traffic psychology, safety psychology, social psychology, criminal psychology and other relevant knowledge, this paper adopts both qualitative and quantitative analysis methods to analyze and study the traffic violations of pedestrians and right-turn vehicle drivers.

Keywords: signal intersection; right-turn vehicles and pedestrians; behavior and psychology.

INTRODUCTION

With the development of society, the number of residents and motor vehicles is increasing, and the conflict between right-turning vehicles and pedestrians in the signal intersection is increasingly obvious. Pedestrians, as a vulnerable group, lack their own safety. In addition, in China, in the distribution of road rights, the motor vehicle right of way is seriously squeezed [1], so it is common, for pedestrians and motor vehicles, to compete for the right of way at intersections. The conflict between people and vehicles not only reduces the intersection capacity and increases delays for pedestrians and motor vehicles, but also poses a threat to pedestrian safety.

Pedestrian and drivers traffic violations are caused by many factors, the objective traffic facilities are not perfect, traffic management is not standard, subjective driver and pedestrian traffic safety consciousness, fluky psychology, etc., but in general, traffic violations are accompanied by a series of psychological activities, and dominated by its psychological activities. Therefore, from the perspective of traffic participants' psychology, it is of great significance to solve the violations of pedestrians and right-turning vehicles from the root.

ILLEGAL BEHAVIOR AND PSYCHOLOGICAL ANALYSIS OF PEDESTRIANS AND RIGHT-TURN DRIVERS

The Connection Between Behavior and Psychology

Although human travel behavior is extremely complex, it can be interpreted, predicted, and controlled. First, the external environment stimulates people's needs, and they need to guide the engine and then dominate the behavior and generate behavioral responses.

The sustained and complex intermediate processes between environmental stimuli and behavioral responses are the mental processes that ultimately determine the behavioral response. Throughout the behavioral response, mental processes remain central, dominating, regulating, and controlling human behavior.

Pedestrian and Right Turn Driver Violation Performance

Pedestrian Crossing the Street Illegal Behavior Performance and Psychology:

Due to the flexibility and mobility of pedestrians, pedestrians can adjust the route and direction of walking at any time, and few people obey the traffic rules. Through field observation and analysis, pedestrian crossing behavior is mainly:

- Use electronic products when crossing the street: When an accident occurs, you can only rely on the driver to avoid it, if the driver does not notice, the traffic accident occurs.
- Empty gear: To pass the intersection more quickly, pedestrians march with the motor vehicle and do not pay attention to the passage of the right-turn vehicle, unconsciously to avoid the motor vehicle, there is a great risk of crossing the street.
- Grab the green light and run a red light: Because pedestrians have the characteristics of flexibility and fast, often the signal light just changes or even has entered the intersection. Some pedestrians are still anxious. In most cases, even if the red light is not allowed to pedestrians, pedestrians will still conflict with motor vehicles in the case of violation[2].

- Second crossing impatience: During the green light, if pedestrians stay in the middle of the road without crossing the street at once, some people will choose to pass in an acceptable gap between cars.
- Conformity behavior: When pedestrians pass with a large group, they are generally calmer in both the pedestrian signal green light time and the red light time.

Right-turn Driver Behavior Performance and Psychology:

- Push pedestrians: When the right turn the number of vehicles queue is more, the rear driver horn urged or have other reasons, the driver will gradually drive the vehicle close to the pedestrian, seize the opportunity to insert in the crowd to pass the intersection as soon as possible, easy to cause the scratch accident.
- Distraction: Most drivers smoke or call the phone while driving and drive with one hand, which is easy to be distracted and dodge in case of emergencies.
- Can not clearly use the turn signal: Sometimes in the straight right lane straight red light, and sometimes the car does not turn right and only hit the turn signal after entering the intersection so that pedestrians can not make a correct judgment in advance.
- Line of sight blocked: When the motor vehicle turns right, it is easy to be affected by the roadside barrier, flower bed, signal lamp column, and other factors, resulting in the line of sight being blocked. Especially at night or late at night, the drivers under-assess the road conditions, and the emergency treatment time interval is short, which has a safety impact on the road traffic.
- Too fast speed, endangering others: Motor vehicles right turn more do not slow down, the speed is too fast, to the roadside pedestrians caused great safety risks.

INVESTIGATION AND ANALYSIS OF VIOLATIONS BETWEEN PEDESTRIANS AND RIGHT-TURN DRIVERS

Investigation Method

This paper adopts the investigation method of combining field video recording and manual observation to observe the behavior of pedestrians and right-turn drivers at the signal intersection. Considering the types of each road, the phase of signal lights, and the number of conflicts between pedestrians and right turns, the intersection of Zibo City, Zhangdian District, Nanjing Road-Communist Youth League West Road, namely the Dongmen intersection of the Shandong University of Technology, was selected as the investigation objects. The survey area is located in the right-turn motor vehicle lane and the corresponding import crosswalk area within 15m of the south entrance. Include all of the survey areas, and clearly record the traffic situation in the area.

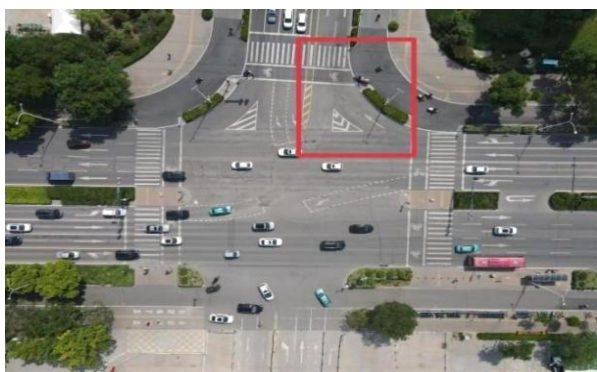


FIGURE 1: South Import Survey Area.

Data Analysis

Motor Vehicle Crossing Across the Street:

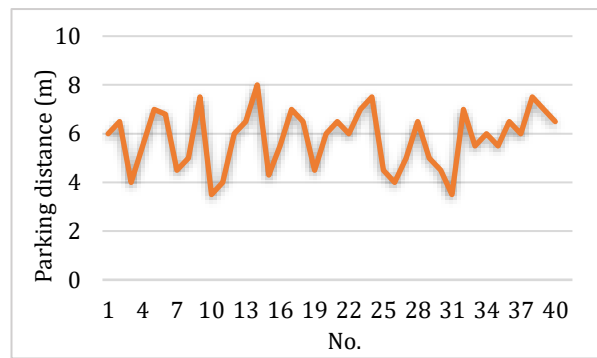


FIGURE 2: Average Parking Distance Line Chart.

As can be seen from Figure 1, the parking distance of the right turn driver is between 3-8 meters. When there are pedestrians at the intersection, most vehicles will stop around 7 meters to yield to pedestrians, and a small number of drivers will slow down and try to avoid pedestrians about 3 meters before the pedestrian cross.

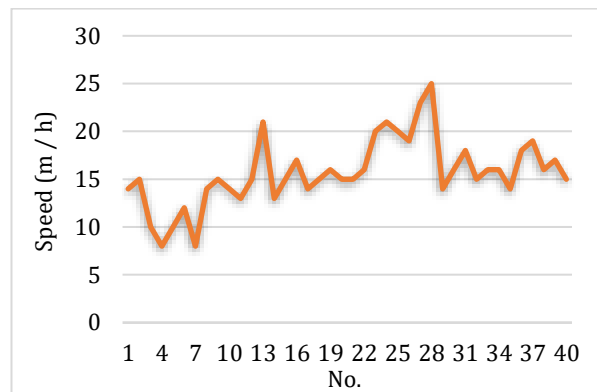


FIGURE 3: Average Vehicle Speed Folding.

Line Chart

As shown in Figure 2, when the video is recorded at 7 o'clock, it is in the morning rush hour of citizens' travel, the traffic flow is large, the number of right turn cars queuing is large and the speed is slow when passing the intersection. After a period of time, the traffic flow and pedestrians decrease, and the right turn speed significantly accelerates and stabilizes.

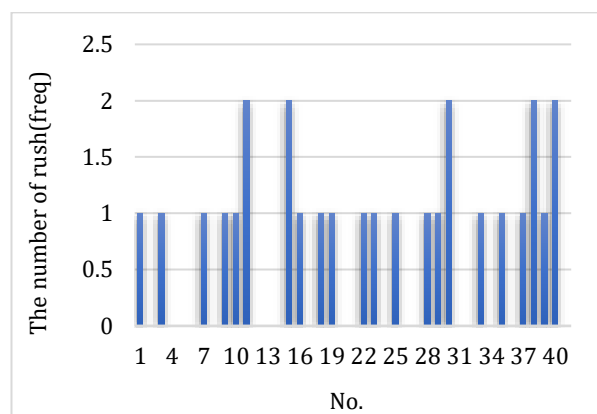


FIGURE 4: Lane Rushing Situation Per Unit Cycle.

As shown in Figure 3, there are fewer pedestrians in this direction, and the behavior of motor vehicles is not obvious. Every week, about 1-2 motor vehicles want to pass through empty.

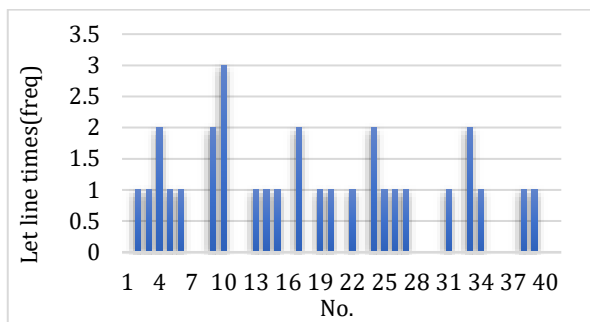


FIGURE 5: Lane Yield Per Unit Period.

As shown in Figure 4, when there are fewer pedestrians at the intersection, because the pedestrians are basically groups crossing the street, the motor vehicles only need to give way once to pass smoothly every week. When there are more pedestrians, it may need to give way twice or twice to make all the pedestrians pass. In this direction, the motor vehicles have good comity to the pedestrians.

Pedestrian Crossing Conditions:

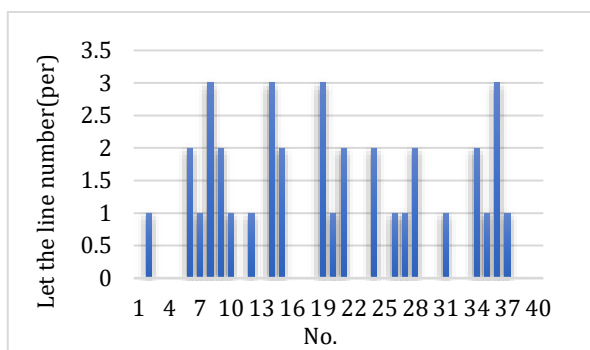


FIGURE 6: Pedestrian Green Light Giving Way To Motor Vehicles.

Can be seen from Figure 5, Shandong university of technology, the east gate north-south direction pedestrians no second crossing the street, in terms of the number of each cycle about 1-3 people, pedestrians in motor vehicle not comity because its weak will wait in the position near the motor vehicle, after conflict vehicles waiting for pedestrians will catch the first car and the gap between car through.

PSYCHOLOGICAL INVESTIGATION AND ANALYSIS OF PEDESTRIANS AND RIGHT-TURN DRIVERS

Investigaion Method

Questionaie design on the basis of the behavior characteristics from the video viewing, according to the pedestrian and the driver in the waiting stage, crossing the stage and complete the stage of different behavior characteristics, design is "from the psychological level analysis of pedestrians and right vehicle conflict" questionnaire, a total of 500 effective driver questionnaire, 500 pedestrian questionnaire.

Psychoanalysis

Through the questionnaire data analysis, the psychological changes between pedestrians and drivers were found, and the connection between behavior and psychology was found. The statistical results are in Table 1 and Table 2.

TABLE 1: A Pedestrian Questionnaire Analysis.

Question	Answer	Scale
Will you let the right turn vehicle go first when you reach the waiting area?	Yes, very frequently	58.12%
	Yes, very very often	26.37%
	Occasionally, as appropriate	15.51%
When you pass through the intersection, there will be two conflicts with the right turn vehicle. Will the right turn vehicle be polite in the first conflict?	Get together	51.27%
	Will not	48.73%
Which of the following pedestrian behavior do you think is likely to trigger traffic accident?	Suddenly cross the street before the red light ends	78.45%
	Chat or look at your phone and not pay attention to the vehicle	67.59%
	Waiting for too many pedestrians to affect the sight	15.21%
	Pedestrians completely disregard of motor vehicles	19.87%
	Other	15.36%
How many right turns can you accept continuous traffic during the pedestrian green light?	0 Cars	5.42%
	1-2 Vehicles	45.39%
	3-5 Vehicles	35.14%
	More than 6 vehicles	14.05%
What is the reason why you do not avoid the right turn?	Too many pedestrians cross the street together	45.96%
	Psychologically feel that the motor vehicle dare not rush away	28.84%
	No notice of the motor vehicle	20.57%
	There is an emergency	65.28%
	There are too many vehicles to wait for too long	60.61%

Question	Answer	Scale
What is your personality tendency?	Circumspect	45.71%
	Discretion is the better part of valor	30.10%
	Other	24.19%
When you pass the intersection, there are two conflicts with the right turn vehicle. Will you yield to the right turn vehicle in the second collision?	Get together	13.59%
	Will not	86.41%

When a pedestrian passes the intersection and has two conflicts with a right-turning motor vehicle, the proportion of pedestrians will be comity was 51.27% during the first conflict, and the proportion of no comity is 49.73%. Most of the pedestrians who will yield are from the safety aspect, that it is very dangerous to compete with the vehicle. But in this process, pedestrians are mostly full of blame, blame the driver's robbery behavior. By the time of the second conflict, the proportion of pedestrians being comity to turn right decreased significantly. Under the influence of the negative emotions accumulated in the first conflict, they almost lost patience. Some pedestrians expressed slight anger, which may reduce the awareness of protecting their own safety.

During the green light period for pedestrians, 14.05% of pedestrians accept the continuous number of right-turned vehicles for 6 vehicles or more, and pedestrians are usually cautious and stable and have a strong safety awareness 35.14% of pedestrians can accept 3-5 vehicles, and 45.39% of pedestrians can accept 1-2 vehicles, which is basically the decision of traffic efficiency and safety consideration.

Another 5.42% of pedestrians do not accept right-turn traffic, are usually impatient and sometimes pass in dangerous situations.

78.45% of respondents believe that suddenly crossing the street before the end of a red light is prone to traffic accidents, where pedestrians will pass quickly and lack attention to the surrounding environment. In the middle of the red light, pedestrians can only venture into motor vehicles. In this process, the adventure psychology of pedestrians plays a leading role, which is also the choice after the game between "safety awareness" and "efficiency consideration", and the efficiency consideration occupies the dominant role. In this process, the adventurous psychology of pedestrians plays a leading role. Only 19.87% of pedestrians believed that the accident was a motor vehicle, indicating that the pedestrian usually blamed the driver for the cause of the accident. Another 67.59% believe that watching mobile phones and chatting are dangerous, which has become an important cause of traffic accidents.

TABLE 2: Analysis Of The Driver Questionnaires.

Question	Answer	Scale
Your driving age?	Under 1 year	5.43%
	1-3 Years	15.25%
	Three to five years	20.96%
	5-10 Years	22.62%
	More than 10 years	35.74%
Your personality tendencies?	Calm type	45.38%
	Taking type	25.13%
	Mixed mode	39.49%
When the pedestrian is green, the vehicle in front of you does not yield to pedestrians. What will you do at this time?	Close to the brake	15.82%
	Stop comity to pedestrians	84.18%
How many pedestrians and non-motor vehicles do you cross the street together when you drive a motor vehicle through the right turn intersection Will let you choose comity to wait?	One person	50.76%
	2-3 People	35.54%
	4-5 People	5.27%
	More than 5 people	8.43%
Which of the following may cause you to turn right Through the intersection?	No pedestrians pass on both sides of the road	25.97%
	The rear has followed the car and urged it	25.04%
	Other vehicles are the first to pass through ahead	35.51%
	Would not pass with a fast right turn anyway	30.76%
Whether you will arrive at the intersection while driving Let pedestrians go first?	Yes, very frequently	25.28%
	Yes, very very often	10.47%
	Occasionally, as appropriate	45.63%
	Every time let	18.62%
When a pedestrian runs a red light and a right turn vehicle conflicts, who do you think is more responsible?	Motor vehicle	10.85%
	Pedestrian	89.15%

Question	Answer	Scale
Which of the following pedestrian behaviors do you think are prone to traffic accidents?	Suddenly cross the street before the red light ends	40.78%
	The pedestrian did not notice the right-turning vehicle	35.19%
	Waiting for too many pedestrians to affect the sight	10.47%
	Pedestrians completely disregard of motor vehicles	35.82%
What do you think is the biggest troubling factor in your right turn?	Pedestrian	45.39%
	The rear vehicle whistle urged	35.27%
	Go straight and share a lane with the turn right	19.34%

In the driver's questionnaire, the pedestrian conflicts with the right-turning vehicle while running a red light is larger, and only a small number of drivers agree that the driver has more responsibility than the pedestrian under any circumstances. Among the question of whether pedestrians arrive at the intersection during driving, 43.9% of drivers often or every time, but 45.63% of drivers depend on the situation, and the remaining 10.47% rarely avoid. But when the pedestrian is green and the vehicle in front of them does not yield to pedestrians, 84.18% of drivers will stop to yield to pedestrians.

Part of the same questions were set in the two questionnaires of pedestrian and driver, hoping to observe the different psychological states of the two on the same question. For example, which pedestrian behaviors are most likely to cause traffic accidents, the highest pedestrian group and driver group selection rate option is "suddenly crossing the street before the end of the red light". In the driver's questionnaire, we found that most of the rear drivers will choose to follow the front car into the pedestrian flow, while most pedestrians can accept 1-2 cars in front of them during the green light. Therefore, the next right turn vehicle will have an inevitable conflict with the pedestrian.

CONCLUSION

1. Pedestrians in the process of second crossing, let motor vehicles occurred in the first crossing, the second conflict will speed up the walking will not go, through the questionnaire survey we answer, in the first start crossing pedestrians more calmly can wait, the second because already made once and in the middle of the road to cross the street as soon as possible and negative risk psychology and luck to go with motor vehicles.

2. A large number of pedestrians and non-motor vehicles road part right turn drivers will slow empty through, through the questionnaire survey, found that because the driver waiting time is too long and the rear have car urged and impatient psychology, in its years of driving career has produced pedestrians and motor vehicles is the opposite, the pedestrians in the car even resentment, combined with their driving technology more confident and fluky psychology, in the bad psychological driven with pedestrians.

3. There are also psychological waiting contradictions between pedestrians and drivers. The maximum number of vehicles the pedestrians can accept in front of them is in conflict with the driver's following behavior, leading to the frequent competition for the right of way at the signal intersection. When there are more pedestrians, the speed of the motor vehicle right turn is significantly reduced, the driver waiting patience is limited, often vulgar close to the pedestrian forward. When there are more vehicles, pedestrians also lack patience and pass through the acceptable clearance of the vehicle.

REFERENCE

- [1] Gao Xue. Research on the psychological exploration and management countermeasures of pedestrian illegal street crossing behavior [D]. Hebei: Shijiazhuang Tiedao University, 2015.
- [2] Zhao Xuejuan. Research on non-motor vehicle and pedestrian violations at signal intersections [D]. Beijing: Beijing Jiaotong University, 2016.