

When Cycling Again - Comparison of Safety Behaviors of Between Cyclists of Shared Bike, Private Bike and Public Bike in China

Fan Zhou

School of Management, Zhejiang University, Hangzhou, Zhejiang Province 310058, China

ABSTRACT

Although great convenience has been brought to hundred millions of commuters by bike sharing schemes in recent year in China, safety issues of shared bikes received a lot of concerns. The ever rising number of cyclists make the investigation of safety in riding shared bike an imminent task. We compare the accidents and safety events rate between cyclists of different shared bikes and private bikes, as well as the safety relevant behavior, such as compliance to traffic regulations, and violations like calling mobiles while riding. The survey results indicated that cyclists of commercial shared bike reported more safety incidents, compared to cyclists of private bike and public shared bike, and that cyclists of commercial shared bike also reported more malfunction in brakes and worse maintenance of bikes. However, no significant differences in wearing protection equipment between different bike cyclists. And cyclists of commercial shared bike indicate higher propensity to check information to assist bike riding. Our findings that cyclists of commercial shared bike reported more safety incidents more problems in brakes and worse maintenance may provide suggestions for practitioners in the field.

Keywords: Shared bikes, Near miss, Cycling

INTRODUCTION

Bike cycling is considered to be both healthy as a lifestyle and friendly to environmental sustainability. The past thirty years in China presented a condensed history of bike cycling first as a major traffic tool, then being replaced by private and public automobiles with the pace economic development, and revived as a popular traffic tool for the short distance commute and a vogue of sharing lifestyle in recent years. However, the traffic safety issues of bike as commuting tool has not been seriously considered, as can be showed that barely few cyclists ever wear a helmet in road (Wu et al., 2019). And the problem of cycling safety could be exacerbated by recent booming bike sharing projects which released thousands of millions bikes into traffic, because much more bike commuters have to cycle amid crowded automobiles. It is urgent and important to investigate the traffic safety of shared bike cycling to provide suggestions for commercial bike sharing practitioners and traffic

policy makers. In this study we conducted a survey to examine traffic safety issue of bike commuting.

BIKE SHARING IN CHINA

Chinese commuters witnessed a stunning boom of bike sharing projects since 2016. Yet bikes as traffic tool were nothing new for most Chinese people when just three decades ago streets in China were crowded with commuters on bikes. Automobiles gradually replaced bikes as result of economic development and city expansion in recent years and it is expected that bikes as a commuting tool may be marginalized. However, a boom of sharing business model in 2016 brought about millions of shared bikes pouring into street side and neighborhoods of most Chinese cities within several months. Commuters were attracted to ride bikes for short range commuting by the convenience of usage, great availability and low cost of bike sharing schemes. Actually, several years before the prosperity of commercial bike sharing projects, some cities have already initiated some bike sharing scheme as one of effective solution for the deteriorated traffic jams caused by exponentially increasing automobiles. But these government-run public bike sharing lost vantages in convenience, availability and interface-friendly, compared to the newly popular commercial bike sharing. Unlike the public shared bike, commercial bike sharing projects run without dock and bikes can be parked in any street side by utilizing GPS tracing technology and mobile payment system. These commercial dockless shared bikes can be easily unlocked by scanning a quick response code (QR code) on bike mostly through most popular payment or social network applications in smartphone. No prerequisites such as registration or deposit are needed. In addition, availability is extremely high after 16 millions of shared bikes have been ejected into major Chinese cities during the year of 2016 after massive investments (China Academy of Social Science, 2017). And the continuing huge investments on bike sharing scheme bring hundreds of thousands new bikes into every major city in China, largely promoting the availability and convenience of bike sharing and changing the way of the last mile commuting for many urban citizens across the country.

ANALYSIS OF TRAFFIC SAFETY OF SHARED BIKES CYCLISTS

Bike cyclists are regarded as vulnerable traffic participants. The accident rate per kilometer of cycling has been showed to be much higher than the rate of driving (Aultman-Hall and Hall, 1998). Additionally, the accident rate of cycling may be underestimated, since several studies showed very high level of under-reporting of bicycle crashes (Robartes and Donna Chen, 2018). And the perception of risk was found to be a major barrier for cycling (Lawson et al., 2013). Safety hazards like the unfriendly cycling infrastructure (Manton et al., 2016), lack of bike lanes and traffic signs (Morrison et al., 2019) are risk factors for all cyclists. Yet compared to private bike, bike sharing may raise several idiosyncratic challenges for cyclist safety.

First, many cyclists are not as adept to operate shared bike as to private bike. Due to the expectation of heavy usage load by dense populations

in major Chinese cities, most bike sharing schemes re-design bikes to promote durability. But these changes may decrease maneuverability for cyclists. Second, uncertainty of maintenance condition may trap shared bike cyclists. Shared bikes have to endure much longer time of cycling than private bike. Maintenance of shared bike can be a challenge for business carriers. In the fever of bike sharing business schemes in China when millions bikes have been injected into the markets in just a few months, it is extremely difficult for carriers to have adequate time and resource to improve the maintenance system, thereafter add much potential risks to riders. Third, current bike sharing schemes fail to check and stop under-qualified users. Anyone with a smartphone can easily scan code and unlock a bike. Thus even children under 12 can unlock a bike and ride in traffic time.

In this study, we will investigate traffic safety of bike sharing in China. The mass market acceptance and popularity of bike sharing programs may overshadow potential safety hazards for cyclists. The main objective this study is to examine safety hazards for shared bikes, with a random sampling survey among shared bike cyclists in China to answer the research question, “what are the safety hazards for QR-code bike sharing and how to improve it”. By investigating the safety issues in QR-code bike sharing, our study may offer insights for commercial decision and public policy makers in IT-powered shared cycling practice.

METHOD

We conducted a survey on cyclists in Hangzhou where not only major commercial bike sharing schemes (e.g., Mobike, Ofo, Hellobike) but also a public bike sharing system are in service. Before the prevalence of QR code bike sharing, Hangzhou has already developed a large public bike sharing system with 60,600 bikes operating from 2,416 stations. The public bike system was launched by the Hangzhou government as part of its public transit network to offer the last mile transportation. Riding is free for the first hour in a day and one RMB (\$0.15 approximately) is charged for every additional hour. Public bikes and QR-code sharing bikes currently co-exist in Hangzhou and thereafter make the city an ideal spot to host a comparative study.

We collected data via questionnaire survey on cyclists to investigate the safety issues of QR-code sharing bikes, as compared to both public sharing bikes and private-owed bikes. There were altogether 1,894 participants filled the questionnaires. Cyclists' behaviors and attitude towards safety riding were collected. Riding accident and near miss questions asked participants how frequently they committed an accident or near miss. Questions of safety issues on bikes were about the likelihood of malfunction or damage of bikes when riding. Questions of safety issues on roads were about the likelihood of potential hazardous conditions of riding lanes. And Questions of safety behavior and risk perception asked participants how likely they conduct unsafety behavior while riding such as using mobile phone, and their general perception of risk level of riding bikes.

Table 1. Percentage of accidents of different bike cyclists.

	Collision	Fall	Near miss
QR bike	13.9%	8.4%	30.6%
private bike	6.5%	3.3%	19.9%
public bike	6.2%	4.3%	15.2%

Table 2. Percentage of near misses of different bike cyclists.

	<i>almost hit by a car</i>	<i>almost hit by a bike</i>	<i>almost fall</i>	<i>almost hit others</i>	<i>other near misses</i>
QR bike	7.6%	5.7%	2.7%	2.5%	8.8%
private bike	5.0%	3.2%	1.6%	0.9%	4.4%
public bike	2.4%	3.2%	0.8%	0.8%	3.2%

Table 3. Percentage of near misses of different bike cyclists.

	<i>cycling in vehicle lane</i>			<i>loading people</i>		
	rarely	occasionally	often	rarely	occasionally	often
QR bike	84.1%	15.3%	0.6%	98.7%	1.3%	0.0%
private bike	85.3%	13.7%	0.9%	49.4%	26.0%	24.6%
public bike	85.9%	13.3%	0.8%	99.2%	0.6%	0.2%

	<i>running the red light</i>			<i>calling mobile phone</i>		
	rarely	occasionally	often	rarely	occasionally	often
QR bike	64.8%	29.2%	6.0%	71.7%	23.2%	5.1%
private bike	66.4%	29.1%	4.6%	75.6%	20.6%	3.8%
public bike	74.5%	23.4%	2.1%	77.7%	18.2%	4.2%

RESULTS

The accident rates of collision with people, bikes or vehicles, and falls during riding, mounting, and dismounting were listed in Table 1. The rate of near miss, defined as unplanned events in cycling with non-trivial expectation of ending in accident but because of luck did not (Tinsley et al., 2012). Comparison of accident and near miss rate between different bike types indicated significant results: 1) for collisions, $\chi^2 = 29.61$, $p < 0.001$; 2) for falls, $\chi^2 = 17.92$, $p < 0.01$, and 3) for near misses, $\chi^2 = 46.11$, $p < 0.001$.

According to the theory of safety pyramid (Heinrich, 1959), near misses are much more frequent than accidents and thereby provide more information for management intervention to promote safety. As indicated by Table 2, cyclists of QR code shared bikes reported more near misses in all categories. In the listed four types of near misses, the highest scenario of near miss was “almost hit by a car” and second was “almost hit by a bike”. This pattern indicated no significant difference between different bike cyclists, $\chi^2 = 5.01$, $p = 0.76$.

Safety relevant cycling behaviors were investigated and compared between different bike types, including cycling in vehicle lane, loading people in back seat, running the red light, and calling mobile during cycling. There were no significant differences in risky behavior of calling mobile or cycling in vehicle lane between cyclists of different bike types (Table 3). However, private bike cyclists indicate higher propensity of loading people than QR code shared bike cyclists and public bike cyclists, $\chi^2 = 440.59, p < 0.001$. This result was consistent with the fact that most shared bikes had no back seat in design. And public bike cyclists indicated lower propensity to risky behavior of running the red light, $\chi^2 = 21.69, p < 0.001$.

CONCLUSION

By the results of a survey on cyclists of QR bikes (commercial bike sharing schemes), public bikes and private bikes cyclists, cyclists of commercial shared bikes indicated they may commit more accidents and experience more near misses than both private bike and public bike users. And cyclists indicated different kinds of risky behaviors. Cyclists of QR bikes showed more tendency of running the red light and calling mobile phone during cycling, while private bike users were much more likely to loading others in back seats. As the bike sharing become very popular in recent years in urban areas in China, our findings may provide information for practitioners of bike sharing schemes to promote the safety measures for their users.

ACKNOWLEDGMENT

The authors acknowledge the research was funded by NSFC grant no. 71172113.

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