iCSC International Cycling Safety Conference

10th Annual International Cycling Safety Conference
08-10 November 2022, Dresden, Germany

Importance of safety and road surface for route choice when riding shared e-scooters vs. bicycles

Madlen Ringhand*, David Schackmann*, Juliane Anke*, Iwan Porojkow#, Tibor Petzoldt*

*Chair of Traffic and Transportation Psychology
Technische Universität Dresden
Hettnerstr. 1, 01069 Dresden, Germany
email: madlen.ringhand@tu-dresden.de
juliane.anke@tu-dresden.de
david.schackmann@mailbox.tu-dresden.de
tibor.petzoldt@tu-dresden.de

#Chair of Transport Ecology
Technische Universität Dresden
Hettnerstr. 1, 01069 Dresden, Germany
email: iwan.porojkow@tu-dresden.de

Keywords: micromobility, route choice, cycling safety.

1 INTRODUCTION

The rise of micromobility, most notably electric standing scooters (e-scooters), has resulted in new challenges for traffic planning and road safety. One such issue is the fact that in most European countries, e-scooter users are obliged to ride their vehicle on cycling infrastructure and thereby share this infrastructure with bicyclists. This increases the use of and, subsequently, demand for bicycle lanes, which is an obvious challenge for transport planning [1]. However, for adequate planning and construction of cycling infrastructure, information on route choice behavior of bicyclists and e-scooter users and its influencing factors is necessary. While research on bicyclists' route choice is well advanced, research on e-scooter riders is still in its infancy. For bicyclists, the presence of bicycle facilities, traffic volume, and travel time are among others particularly important for route choice [2–4]. However, the question arises whether this also applies to e-scooter riders as vehicle dynamics are different and riders are, at least for now, less skilled due to lack of training and exposition. In order to fill this research gap, we aimed to analyze the determinants for route choice of e-scooter users in comparison to bicyclists in a field study.

2 METHODS

Within the field study, participants had to ride with either a shared e-scooter or a shared bicycle to reach four destinations. The riders chose the appropriate routes themselves and were subsequently asked to report about the reasons and circumstances of their decisions. The first part of the study was conducted with shared e-scooters in August and September 2021 [5] and the second part with shared bicycles in April 2022. When selecting the four destinations, the aim was that each of the origin-destination (OD) pairs would result in a length of the routes to be driven of approx. 1.5 - 2 kilometers which represents the average trip length of e-scooter rides in Germany [6]. The four OD pairs differ regarding relevant route choice criteria, especially in terms of directness (number of turning maneuvers), presence of a (separated) bike lane, available scenic routes, roadway condition, and traffic volume.

Appointments for study participation were given for working days either at 2 p.m., 4 p.m. or 6 p.m. At the beginning of the study, subjects were instructed with the procedure and their riding task. After a brief introduction to the vehicle's features and, in the case of the e-scooter, a short practice parkour, the subjects started the test ride either with a shared e-scooter or a shared bicycle in the city of Dresden. The ride was instructed as a leisure trip without cost or time pressure and participants were asked to ride as they normally would. Participants then had to ride to four destinations in succession. After completing the ride and parking the vehicle, they answered questions about the ride and completed a questionnaire on demographic characteristics and other variables.

A total of 52 subjects participated, split evenly between the two studies. Participants were acquired via social media through the university's' Twitter and Instagram channels. The subjects of both the e-scooter study (18 male, 7 female, 1 diverse) and the bicycle study (20 male, 6 female) were on average 23 years old. The majority of them held a driver's license (92 % and 89%) and reported an above average local knowledge of the city (between 6 and 7 on a scale from 1-very bad to 10-very good). No statistical differences existed between both samples regarding sociodemographic features except for the frequency of use of e-scooters which was significantly increased for participants riding with the e-scooter.

The data obtained consisted of GPS position for the four ODs and questionnaire data, specifically (1) ratings of the importance of route choice factors, (2) the number of alternative routes that the participants considered, other the one ridden, and (3) a subjective rating of how difficult or easy it was to decide. Due to ongoing data analysis, riding related measures cannot be presented in this abstract. However, at the ICSC 2022 we aim to present mean distances, mean velocity and percentage use of secondary roads.

3 RESULTS

The importance of thirteen possible route choice factors was rated on a 10-point Likert scale. Figure 1 (left) shows the results of the median ratings for both studies and all factors. E-scooter riders considered safety and road surface much more important than bicyclists [safety: U = 162.50, z = -3.22, p = .001, r = -.45 / road surface: U = 191.00, z = -2.70, p = .007, r = -.37]. In fact, safety and road surface were the overall most important route choice factors for e-scooter riders. Further differences between both user groups existed in terms of importance of rule compliance (how easy / difficult it would be to follow traffic rules along a certain route) [U = 220.50, z = -2.16, p = .031, r = -.30] and travel distance [U = 451.50, z = 2.09, p = .001, r = .29]. E-scooter riders rated rule compliance more important for route choice than bicyclists, while bicyclists rated travel distance more important than e-scooter riders did.

Participants reported between zero and four alternative routes that they considered for each trip. Results for all four route choices are shown in Figure 1 (top right). The average number of reported alternative routes ranged mostly between 0.5 and 1. Only for one of the OD pairs (No. 2), e-scooter riders reported a higher number of alternative routes [U = 220.50, z = -2.16, p = .031, r = -.42], however, medians for both groups were equal (1). No differences in reported number of routes were found between e-scooter riders and bicyclists for any of the other OD pairs.

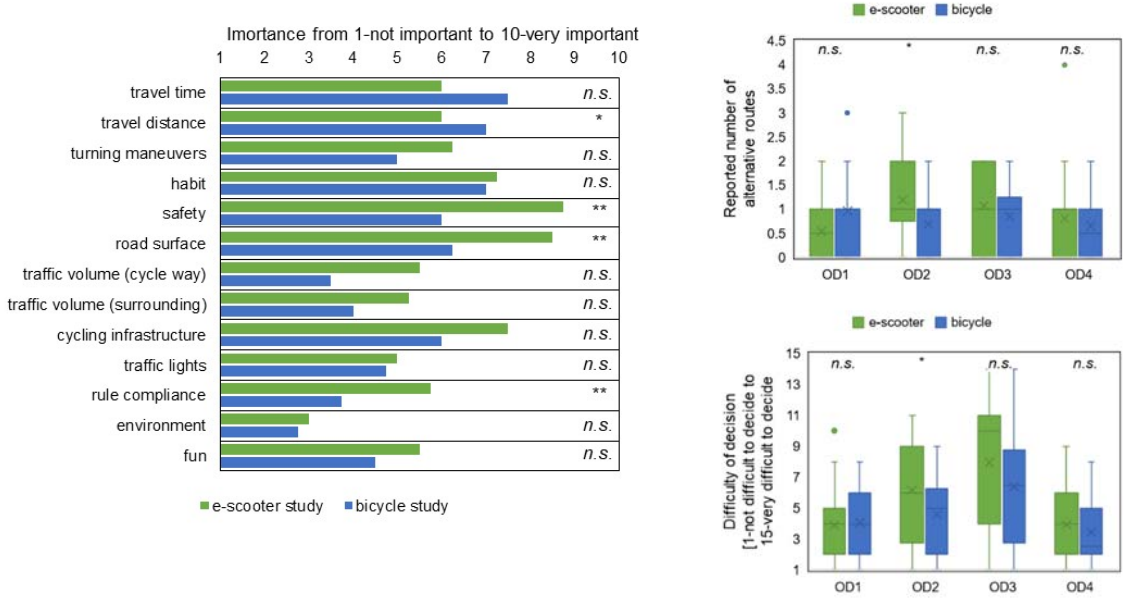

*Figure 1: Medians of importance of route choice factors for both studies (left). Box plot for reported number of alternative routes (top right). Box plot for subjective estimation on difficulty of decision (bottom right). Significance * - p >.05, ** - p > .01, n.s. – not significant. OD – origin-destination pair.*

In order to test whether decision-making might be more difficult when riding an e-scooter, we surveyed how easy or difficult it was for the subjects to make a route choice decision for each OD pair. Results are shown in Figure 1 (bottom right). One can clearly see, that decisions for some OD pairs were easier to make than for others. Differences in ratings of e-scooter riders and bicyclists were found for one OD pair with a rather small effect showing that e-scooter riders found the decision slightly more difficult than bicyclists [$U = 231.50$, $z = -1.97$, $p = .049$, $r = .27$]. For all other OD pairs, no difference between e-scooter riders and bicyclists were found.

4 DISCUSSION AND CONCLUSION

The results of both studies showed that e-scooter riders and bicyclists clearly differ regarding the importance of factors determining route choice. Although e-scooter riders did not really consider more or fewer route options for their route choice, the factors they considered important in making the decision were different from those relevant to bicyclists. In contrast to bicyclists, safety and road surface as well as the question of how easy or difficult it would be to follow traffic rules along a certain route were much more important to e-scooter riders for route choice. This suggests that high-quality and safe cycling infrastructure is even more important to e-scooter riders than for cyclists which may be due to the fact that the handling of the small wheels is more difficult on uneven surfaces. Accordingly, the road surface condition of bike lanes should be improved and regularly maintained. Nevertheless, it is not known at this time which other aspects are relevant for e-scooter riders' perception of safety and the following of traffic rules. It can be assumed that the inexperience of e-scooter riding is one reason for increased importance of safety and complying with traffic rules in route choice when choosing routes. These safety concerns could, in turn, tempt e-scooter riders to use footpaths when cycling infrastructure is lacking or poor. Further research should check the influence of riding experience and the interrelationship with road infrastructure use for route choice. Regarding the management of transport, future transport planning needs to consider differences between bicyclists and e-scooter riders. In order to construct new bike lanes and upgrade existing ones, the results of this study provide a helpful basis for considering the requirements of both user groups.

5 REFERENCES

[1] S. Gössling, Integrating e-scooters in urban transportation: Problems, policies, and the prospect of system change, Transportation Research Part D: Transport and Environment 79 (2020) 102230. https://doi.org/10.1016/j.trd.2020.102230.
[2] A. Misra, K. Watkins, Modeling Cyclist Route Choice using Revealed Preference Data: An Age and Gender Perspective, Journal of the Transportation Research Board 2672 (2018) 145–154. https://doi.org/10.1177/0361198118798968.
[3] M. Hardinghaus, R. Cyganski, W. Bohle, Attraktive Radinfrastruktur. Routenpräferenzen von Radfahrenden, Deutschland, 2019.
[4] M.A. Stinson, C.R. Bhat, Analysis Using a Stated Preference Survey, Transportation Research Record: Journal of the Transportation Research Board 1828 (2003) 107–115.
[5] M. Ringhand, J. Anke, D. Schackmann, T. Petzoldt, Determinants of route choice when riding e-scooters – an empirical study, 2021.
[6] Civity, E-Scooter in Deutschland, 2019. https://scooters.civity.de/ (accessed 21 September 2021).