Gender Equitable Human Factors and E-micromobility

Katie J. Parnell[1], Siobhan E. Merriman[1] & Katherine L. Plant[1]

[1]Human Factors Engineering, Transportation Research Group, Faculty of Engineering and Physical Sciences, University of Southampton, UK.

SUMMARY

Human Factors methodologies and principles can help to close the 'gender data gap' through equitable, user-centered research approaches and sociotechnical systems analysis. This paper presents research conducted into the use and uptake of electric micromobility (e-micromobility) through a gendered lens. Qualitative research is combined with systems methodologies to provide gender-equitable recommendations that highlight how this mode of travel can be more gender-equitable.

KEYWORDS

Gender Equitable Human Factors, E-micromobility, Gender data gap, Mixed methods

Introduction

The 'gender data gap' (Criado-Perez, 2020) refers to the lack of gender disaggregated data that enables the needs of males and females to be identified independently, in order to understand and develop systems that provide equitably for their differing needs (Criado-Perez, 2020). The 'gender data gap' is responsible for the design of systems, procedures, technologies and equipment that do not enable females to have equal levels of safety, opportunity or well-being in comparison to their male counter parts. This includes critical issues such as females increased injury risk when travelling in road vehicles (Linder & Svedberg, 2019) and poor fitting personal protective equipment (PPE) equipment (Fidler, 2020; Niemczyk et al, 2020).

As a discipline, Human Factors and Ergonomics (HFE) holds considerable opportunity to close the gender data gap (Read et al, 2022). HFE is defined by the International Ergonomics Society as "*the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data, and methods to design in order to optimize human well-being and overall system performance*.". When we consider the human, their interactions, well-being and impact on system performance, we must consider the individual characteristics that influence these human experiences in order to be inclusive. This is the aim of Gender Equitable Human Factors (GE-HF, Parnell et al, 2022).

The gender data gap is particularly pertinent to the transportation domain, where only 22% of workers are female (European Commission, 2021), and where these female employees are less likely to be in the higher paid decision-making roles (Department for Transport, 2020). Previous work has identified key gender equity issues within our current transport systems (Parnell et al, 2022), yet new modes of travel are emerging in the form of electric micromobility (e-micromobility). This includes small, lightweight, electric powered and personally driven transportation modes, specifically electric bicycles (e-bikes) and electric scooters (e-scooters). Although they are a relatively new mode of travel, the literature has identified that e-micromobility

platforms are more likely to be used by males (Reck et al, 2021). Young, white males in particular tend to be early adopters of new technologies and are more willing to expose themselves to the higher level of risk which are characteristic of the mode. Females tend to be more safety conscious, which limits them from feeling comfortable when using micromobility due to the inadequate infrastructure for these modes of travel (Haynes et al, 2019). E-micromobility offers the opportunity to enhance model shift away from personal road vehicles, especially within more built-up urban areas, yet this will only be effective if the uptake is significant. Therefore, e-micromobility must be an attractive transport option to a diverse range of the population. Early uptake by males suggests there may be some gender factors influencing e-micromobility use.

We present work that aimed to review of the role of gender in e-micromobility transport by conducting an analysis of the motivating factors, as well as the barriers, to e-micromobility use. This work applied a combined top-down and bottom-up research approach to generate guidance that can help to ensure our future transport systems are gender-equitable. We conducted interviews and focus groups to collect user-centred qualitative data that we disaggregated by gender to identify any differing motivations and barriers to e-micromobility use. We then combined this analysis with sociotechnical systems approaches (cognitive work analysis and actor map analysis) to identify the actors and sources of responsibility in tackling gender-equity within this transportation mode. This combined approach is a valuable method for developing impactful recommendations that target gender-equity issues, something that current transport policy recommendations do not do.

Methodology

Interviews and focus groups were conducted with 24 members of the public. An equal gender split was recruited, and participants were matched on age characteristics (average age=44.33 years Range: 22-68 years, SD: 19.02 years). Online and in-person options for participation were given to enhance the inclusivity of research participation. The semi-structured interview questions aimed to obtain insight from users and non-users of e-micromobility transport on their motivations, perspectives and barriers to using both e-scooters and e-bikes. The transcripts were qualitatively analysed and deductively coded to the gender factors framework developed from more traditional transportation modes (Parnell et al, 2022). This aimed to understand how gender factors such as family roles, perceived safety, infrastructure, ergonomic design and user behaviour relate to e-micromobility travel. We combined this qualitative data with sociotechnical systems methodologies, including an abstraction hierarchy, from the cognitive work analysis tool kit, to capture the values and priorities of e-micromobility travel. An actor map analysis was also applied to identify responsible actors in the broad sociotechnical system comprising e-micromobility.

Findings

Qualitative insights into e-micromobility were reviewed with respect to key gender factors that have previously been identified within the transport domain. Combining these qualitative outputs with the wider sociotechnical systems analysis led to the generation of key recommendations that account for gender and make e-micromobility more accessible to both males and females. The recommendations target the future design and integration of e-micromobility and highlight how it can encourage more inclusive and safe use, which would in turn incentivise greater modal shift away from privately owned cars. Through the actor map analysis, key actors that hold responsibility for helping to close the data gap are also identified, enabling the recommendations to be directed to those who have the impact to inform required changes.

Conclusion

This work strives to close the 'gender-data gap' within the development of future transport modes and identifies the key role that a Human Factors approach can play in providing equitable research practises.

Acknowledgements

We are grateful for support from the Decarbonising Transport through Electrification (DTE), A whole system approach Network+ funded by EPSRC grant reference EP/S032053/1 for funding this work. In addition to this, Dr. Katie Parnell acknowledges support from University of Southampton Anniversary Fellowship programme. We would also like to give thanks to the support of the Close the Gender Data Gap group at the University of Southampton (http://closethedatagap.soton.ac.uk/).

References

Criado-Perez, C. (2019). *Invisible women: Exposing data bias in a world designed for men.* London, Penguin Random House.

Department for Transport (2020) Gender Pay Gap Report and Data https://www.gov.uk/government/publications/dft-gender-pay-gap-report-and-data-2020/dft-gender-pay-gap-report-and-data-2020 [Accessed 01/02/2023]

European Commission (2021). Women in Transport. https://transport.ec.europa.eu/transport-themes/social-issues-equality-and-attractiveness-transport-sector/equality/women-transport_en [Accessed on 01/12/2022]

Fidler, H. (2020). PPE:'one size fits all'design is a fallacy. *Nursing Standard. 35*(6), 23.

Haynes, E., Green, J., Garside, R., Kelly, M.P. and Guell, C. (2019) 'Gender and active travel: a qualitative data synthesis informed by machine learning', *International Journal of Behavioral Nutrition and Physical Activity, 16*(1), p. 135

Linder, A., & Svedberg, W. (2019a). Review of average sized male and female occupant models in European regulatory safety assessment tests and European laws: Gaps and bridging suggestions. *Accident Analysis & Prevention, 127*, 156-162.

Niemczyk, S. E., Arnold, L., & Wang, L. (2020). Incompatible functions: Problems of protection and comfort identified by female police officers required to wear ballistic vests over bras. *International Journal of Fashion Design, Technology and Education*, *13*(2), 165-172.

Parnell, K. J., Pope, K. A., Hart, S., Sturgess, E., Hayward, R., Leonard, P., & Madeira-Revell, K. (2022). 'It'sa man's world': a gender-equitable scoping review of gender, transportation, and work. *Ergonomics*, 65(11), 1-17.

Reck, D. J., & Axhausen, K. W. (2021). Who uses shared micro-mobility services? Empirical evidence from Zurich, Switzerland. *Transportation Research Part D: Transport and Environment, 94,* 102803.