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Digital Geographies of Women's Mobilities in Constrained Urban Contexts

Pauline Baudens

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Declaration:
Hereby I declare that this doctoral thesis, my original investigation and achievement, submitted for the doctoral degree at Tallinn University of Technology has not been submitted for doctoral or equivalent academic degree.

Pauline Baudens

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List of publications

The list of author's publications, on the basis of which the thesis has been prepared:

I **Baudens, P.**, Masso, A., & Soe, R. M. (2023). Women's (im)mobility strategies and digital platform adoption: the case study of employees doing desk work in Pune, India. *Gender, Technology and Development*, *27*(3), 423–443. DOI: 10.1080/09718524.2023.2260651 **ETIS 1.1.**

II **Baudens, P.**, Hassen, M., Pasini, J., & Mawussi, A. (2024). Mobility capacities and smartphone use of students in Kinshasa, Democratic Republic of Congo. *Mobilities*, 1–19. DOI: 10.1080/17450101.2024.2445307 **ETIS 1.1.**

III **Baudens, P.** (2025). The food delivery apps, a blessing for working women? *Gender, Technology and Development*, *29*(2), 287–303. DOI: 10.1080/09718524.2025.2514976 **ETIS 1.1.**

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V **Baudens, P.**, Purandare, U. Digital Safety Tools: An Unmet Promise of Safety? (Under review).

VI **Baudens, P.**, Pasini, J., Masso, A., Hassen, M. Navigating Fear of Violence in Insecure Urban Spaces. (Under review).

Author's contribution to the publications

Contribution to the papers in this thesis is:

I The author of this thesis designed the study, developed the conceptual framework, conducted interviews, analysed the qualitative data, wrote the paper, and created the map.

II The author led the research group. She collaboratively designed the study and conceptual framework, conducted the fieldwork, analysed the data, and wrote the paper.

III The author designed the study, developed the conceptual framework, conducted the interviews, analysed the qualitative field data, and wrote the paper.

IV The author collaboratively designed the study, developed the conceptual framework, conducted the interviews, analysed the qualitative field data, and wrote the paper. She was responsible for collecting and analysing the data in Pune.

V The author jointly designed the study, developed the conceptual framework, and conducted the interviews with the experts. She conducted all the interviews with women. Data analysis and paper writing were carried out jointly. She was responsible for leading the research.

VI The author designed the study, supported the development of the conceptual framework, conducted the fieldwork and interviews, led the data analysis, and wrote the paper.

1 Introduction

Mobilities in cities of the Global South often take place in highly constrained urban contexts[1]. In these contexts, mobilities are challenging and costly in terms of money, time, energy, and health due to poor transportation infrastructure, growing traffic congestion, pollution, and safety concerns (Cervero, 2013; Kwan & Schwanen, 2016; Oviedo & Nieto-Combariza, 2021). These urban constraints contribute to shaping inhabitants' spatial practices[2] and experiences (Foley et al., 2022; Kayisu, Joseph, & Kyamakya, 2017).

In this thesis, the term *highly constrained urban contexts* refers to the mobility constraints that characterise these contexts. It is adapted from literature describing difficult mobilities in the Global South, which emphasises the notion of *constraint* (Borker, 2024).

By reorienting the usual focus away from Western experiences toward the highly constrained urban realities of the Global South, this thesis emphasises the importance of contextual specificities (Collyer, 2018; Priya Uteng & Lucas, 2017). Spatial practices differ significantly from those in the Global North, meaning that research grounded in Western urban contexts may not reflect the experiences of populations living in more constrained urban contexts (Fenton, Wafer, & Fitchett, 2020; Giddy, 2019; Porter & Turner, 2019). Of note, the North-South divide is largely political and socio-economic, representing a hegemonic worldview (Confraria, Mira Godinho, & Wang, 2017). The Global North, typically North America, Western Europe, Oceania, and parts of East Asia, contrasts with the Global South, which includes Africa, Asia, Latin America, and the Middle East[3] (Confraria, Mira Godinho, & Wang, 2017). Although this binary view simplifies complex realities (Trefzer et al., 2014), this thesis uses this terminology to frame its focus on rapidly urbanising contexts and to emphasise the critical lack of studies on spatial and digital practices in the Global South (Collyer, 2018). This research seeks to move beyond generalisation, focusing on local realities rather than reinforcing stereotypes of the Global South (Trefzer et al., 2014).

In highly constrained urban contexts, increasing access to and use of digital technologies in everyday life transform spatial and temporal experiences (Ash, Kitchin, & Leszczynski, 2019; McLean, Maalsen, & Prebble, 2019). Many urban residents now rely

[1] A constrained urban context is characterised by inadequate transport, limited pedestrian and cycling infrastructure, high pollution, and other factors complicating mobilities. The capacity to move is also determined by: (1) access to modes of transport (e.g., financial resources, infrastructure availability); (2) physical and practical ability to move; and (3) cognitive appropriation of mobilities, including psychological, social, and cultural aspects that make travel choices meaningful. These dimensions are developed within the concept of *motility* (Guitton et al., 2025; Kaufmann, Ravalet, & Dupuit, 2015), which links mobility capacity to constraints (e.g., unreliable transport systems require higher skills to navigate urban spaces). While useful analytically, this research does not adopt *motility* as a framework to remain grounded in everyday experiences of mobilities and maintain clarity.

[2] The notion of *practices* was preferred, as it better captures the spatial and socially situated nature of everyday mobilities than the framing of *mobility behaviour*, which tends to focus on choices and patterns rather than meanings and lived experience (Di Méo, 2011).

[3] This division roughly corresponds to OECD versus non-OECD countries, or high-income versus lower-middle-income countries as classified by the World Bank (Confraria, Mira Godinho, & Wang, 2017).

on mobile applications to travel, whether to find public transport or order e-hailing[4] taxis, as well as to avoid travelling, for instance, by ordering meals or groceries (Dodel & Hernandez, 2025). This thesis uses the framework of digital geographies[5], which explores the interactions between digital technologies and space. It applied this framework to analyse how digital technologies, particularly mobile applications intended to support urban travel, reshape spatial practices, as well as experiences and perceptions[6], in highly constrained urban contexts (Ash, Kitchin, & Leszczynski, 2019; McLean, Maalsen, & Prebble, 2019; Osborne & Jones, 2023). As a remark, the term *reshaping* is used here to describe the transformative effects of mobile applications, as commonly employed by digital geographies scholars (Ash, Kitchin, & Leszczynski, 2016; Fenton, Wafer, & Fitchett, 2020; Liu, Chen, & Xue, 2023). The concept of *spatial practices*, central to this research, originates from Lefebvre (1974), who used it to describe how people interact with and produce space in their everyday lives. Following Reckwitz (2002), such spatial practices are understood as routine ways of doing, shaped by learning and everyday experience. As Cresswell (2006) notes, the concept is particularly valuable for understanding individual experiences of mobilities and immobilities. Building on this conceptualisation, the thesis connects spatial practices directly to (im)mobilities, enabling the analysis of people's movements, while also linking them to perceptions and, at another level, to intersectional factors of identities[7] and contexts. Throughout the thesis, mobility and immobility are written together as *(im)mobility* to capture the continuum between them, emphasising their interrelation rather than treating them as binary opposites (Adey et al., 2021; Cresswell, 2006). Overall, this thesis adopts a mobility-centred understanding of *geography* as conceptualised in digital geographies. Instead of viewing geography as fixed places, it emphasises how individuals move through and experience urban spaces, highlighting mobilities as central to spatial understanding (Cresswell, 2006; Sheller & Urry, 2006).

Despite the growing adoption of mobile applications, which are intended to facilitate spatial practices, access to and use of these technologies continue to reflect persistent inequalities, shaping who can benefit from them and to what extent in their daily (im)mobilities and planning within highly constrained urban contexts (Dodel & Hernandez, 2025; Heeks, 2022). These disparities are shaped by social factors, with gender emerging as one of the key determinants of both access to and use of mobile applications (Cassitas Hino & Cunha, 2021), thereby reproducing and eventually amplifying gender inequalities (Elwood & Leszczynski, 2018; McLean, Maalsen, & Prebble, 2019). Prior studies show that women typically have less access to digital technologies than men (Tsetsi & Rains, 2017). Their digital use for everyday mobilities also tends to differ due to diverse mobility needs (Cassitas, Hino, & Cunha, 2021; Sagaris, 2019). Studies conducted worldwide demonstrate that women generally complete

[4] E-hailing refers to ordering taxis through smartphone applications (Mawussi, Aguilera, & Aholou, 2024).

[5] Further description below and in section 2.1.

[6] In human geography, the term *perception* lacks a unified understanding and has been employed in many ways across studies without coherence (Bunting & Guelke, 1979). The term *perception* refers here to the ways individuals subjectively evaluate, interpret, and experience places, modes of transport, mobilities, risks, and digital usage. Studying *perception* in this way contributes to a better understanding of the behavioural transformations involved, as stated by Bunting and Guelke (1979).

[7] Further explanation is provided in the next paragraph and in section 2.2.

more, but shorter, trips per day than men, mainly because of more household responsibilities (e.g., care-related travels, grocery shopping) (Borker, 2024). Women commonly face higher mobility constraints due to more safety concerns and fewer financial means (Hidayati, Tan, & Yamu, 2020; Joshi et al., 2022; Priya Uteng & Turner, 2019), especially in highly constrained urban contexts lacking adequate street lighting and reliable transport (Borker, 2024; Law, 1999; Loukaitou-Sideris, 2016; Priya Uteng, 2021). Nuances within these general patterns are context-specific and intricately linked to intersectional factors of identities such as socio-economic status, race, and age, on top of gender (Foley et al., 2022; Hanson, 2010; Sheller & Urry, 2006). The concept of *intersectionalities* (referred to as *intersectional factors of identities* above) is here used to acknowledge that individuals hold multiple, interacting identities that determine their everyday unique experiences across a spectrum of privilege and oppression (Crenshaw, 1990; Hopkins, 2017). The thesis focuses on women without systematically comparing them to men, recognising that women constitute a highly heterogeneous group with a multitude of intersectionalities. This approach highlights the diversity of women's experiences and adds nuance to broader tendencies (McCall, 2005). Overall, the research seeks to emphasise women's voices, contributing to broader discussions on the shaping of fairer digital societies (Osborne & Jones, 2023).

In the literature, women's urban mobilities and their use of mobile phones are relatively well explored (Broker, 2024; Porter et al., 2012; Priya Uteng & Turner, 2019), including in the Global South (Law, 1999; Pei & Chib, 2020). However, as technology, society, culture, and practices constantly evolve, these topics require ongoing research. Similarly, several studies have analysed the use of mobile applications, including e-hailing and multimodal navigation services, though the focus has predominantly been on the Global North (Hall, Palsson, & Price, 2018; Liimatainen & Mladenović, 2021). Research in the Global South has recently increased (Gupta et al., 2022; Mawussi, Aguilera, & Aholou, 2024; Pasquali, Commenges, & Louail, 2022), but further work is needed to deepen contextual understanding (Osborne & Jones, 2023; Pei & Chib, 2020). Studies specifically on women's use of mobile applications for everyday mobilities also exist, but are mostly focused on the Global North (Cardoso et al., 2019; Cassitas Hino & Cunha, 2021). This reveals a clear research gap at the intersection of gender, digital technologies, mobilities, and the Global South (Fenton, Wafer, & Fitchett, 2020). The main contribution and novelty of this thesis lie in addressing this gap by analysing, through the lens of digital geographies, how different groups of women use mobile applications and how these practices shape their daily spatial practices and perceptions in highly constrained mobility contexts (Cassitas Hino & Cunha, 2021; Hoan, Chib, & Mahalingham, 2016).

Within the framework of digital geographies, scholars have identified three interconnected dimensions that structure the field (Ash, Kitchin, & Leszczynski, 2016; Osborne & Jones, 2023), and consequently, this research. These dimensions are:

(1) **Geographies of the digital**, which look at where digital technologies are found and how digital infrastructures are connected across space (e.g., locations of digital infrastructures, mobile networks, spatial inequalities of digital access).
(2) **Geographies produced by the digital**, which refer to how new spaces and opportunities are created through the adoption and usage of digital technologies (e.g., mobile applications reorganising social locations and mobility patterns by offering navigation, transport options, and virtual spaces). Here, the digital is analysed as the main driving force that shapes geographies.

(3) **Geographies produced through the digital**, which refer to how digital technologies influence individual experiences, social interactions, and perceptions of space (e.g., social media influencing the reputation of areas and consequently the emotion of fear and (im)mobilities).

Within this framework, the thesis mostly engages with the second and third dimensions while also addressing aspects of the first. The main focus is on **geographies produced by the digital** (the second dimension). This dimension is developed in **Articles I, II, III, IV,** and **V** by analysing how the use of mobile applications reshapes spatial practices across intersectionalities. The second focus is on **geographies produced through the digital** (the third dimension). This dimension is explored in **Articles I, III, IV,** and **V** by examining how perceptions of space, time, and emotions evolve through the use of mobile applications, as well as smartphones themselves as devices (**Article II**). The thesis also touches on **geographies of the digital** (the first dimension), but more marginally: **Article II** provides a brief overview of the digital infrastructures and their unequal spatial access in Kinshasa, and **Article V** analyses the evolution of digital use as a solution for urban security. This dimension of digital geographies is not developed further in this thesis introduction.

Positioned within the field of digital geographies, this thesis adopts a feminist approach as developed by scholars such as Elwood and Leszczynski (2018) and McLean, Maalsen, and Prebble (2019). Recognising the diversity and complexity of feminist perspectives and the varied connotations associated with the term and its approaches (Rosser, 2005; Valentine, 2008), feminist digital geographies specifically provides a critical lens for analysing how digital technologies participate in (re)producing power and socio-spatial inequalities at the intersection of individuals' multiple identities (Elwood & Leszczynski, 2018; Nelson, Hawkins, & Govia, 2023; Richardson, 2018). This perspective draws attention to the ambiguous consequences of digital technologies, highlighting both their promise for empowerment and their potential risks (McLean, Maalsen, & Prebble, 2019). This thesis mobilises a feminist lens in several interrelated ways. First, it analyses how the use of mobile applications across intersectionalities results in empowerment, contributing to discussions on *empowerment* and *intersectionalities*[8] which are concepts extensively developed in feminist studies (Crenshaw, 1990; Hancock, 2013; Kanai, 2021). It responds to feminist digital geographers' calls to integrate intersectionalities into research (Bonner-Thompson, 2023; Elwood & Leszczynski, 2018). Second, it emphasises the importance of emotions and perceptions in comprehending the experiences of (im)mobilities and digital usage, which has long been explored in feminist research (Malakar, 2015; Van Wijnendaele, 2011). Third, it involves reflexivity at every stage of the research process, maintaining a critical awareness of how the author's presence and perspectives influence data collection, interpretation, and analysis. This methodological approach aligns with feminist scholarship emphasising the importance of self-reflection in research (Gorelick, 1991; Hubbard, Backett-Milburn, & Kemmer, 2001; Rose, 1993). Fourth, it addresses the visibility of women. Recognising female invisibility in research was one of the foundational concerns of feminist scholarship in the 1960s (Gorelick, 1991; Rose, 1993). Finally, the thesis seeks to extend feminist digital geographies by contributing empirical findings to a field often dominated by theoretical and reflexive work (Richardson, 2016;

[8] The concepts of *empowerment* (also written *empowering*) and *intersectionalities* are defined in section 2.2.

Hanson, 2010; Valentine, 2008) and by centring women's experiences in under-represented Global South contexts (Elwood & Leszczynski, 2018).

Positioned at the junction of digital technologies, gender, mobilities, and highly constrained urban contexts, and contributing to the growing body of knowledge within the field of feminist digital geographies, this thesis participates in answering the following research questions:

(1) How are women's spatial practices reshaped *by* using mobile applications for everyday mobilities in highly constrained urban contexts?

(2) How are experiences and perceptions of empowerment influenced *through* using mobile applications for everyday mobilities in highly constrained urban contexts?

The first research question addresses 'geographies produced *by* the digital', while the second research question explores 'geographies produced *through* the digital' (Ash, Kitchin, & Leszczynski, 2016; Osborne & Jones, 2023). The findings are also organised in accordance with the research questions and thus with the two dimensions of digital geographies.

In addressing these research questions, this thesis calls on urban and transport decision-makers to recognise that their actions can significantly influence the *empowering*[9] of citizens. This *empowering* can be supported by addressing the '4As: affordability, accessibility, availability, and acceptability' (Priya Uteng, 2021), through inclusive urban, mobilities, and transport policies (Diaz Olvera, Plat, & Pochet, 2021; Dodel & Hernandez, 2025; Hook et al., 2025; Priya Uteng, 2021). Achieving this requires a deeper understanding of the mobility constraints faced by women, particularly how gender intersects with factors such as socio-economic background, residential location, and physical or mental capacities, which shape mobility practices (Priya Uteng, 2021). Urban and transport decision-makers should also acknowledge the potential of mobile applications to help address these challenges while remaining mindful of their limitations and possible harms (Cassitas Hino & Cunha, 2021; Tanikawa Obregón, Coulaud, & Ninot, 2022). With this knowledge, decision-makers can identify relevant context-specific solutions, both digital and non-digital (Cassitas Hino & Cunha, 2021), and more effectively address transport disadvantages through targeted policies, interventions, and ongoing critical evaluations (Hook et al., 2025; Schwanen et al., 2015). Such efforts can improve access to urban spaces and their amenities, increasing overall quality of life (Schwanen et al., 2015), while also addressing women's differentiated mobility needs across socio-economic groups (Foley et al., 2022; Hook et al., 2025).

This thesis is composed of three articles published in peer-reviewed journals (**Articles I, II, III**) and three manuscripts in the review process (as of 03.10.2025) (**Articles IV, V, VI**). Although they focus on diverse aspects, the articles help address the two research questions. **Articles I, II, III, IV,** and **V** focus on the effects of using mobile applications on spatial practices and perceptions of defined groups, contributing to the first research question. More precisely, **Articles III** and **IV** analyse specific mobile application types (e.g., e-hailing, food delivery), while **Articles I** and **II** cover multiple types for daily travel (e.g., navigation, transport offer). **Article V** adopts a more macro view on the usability of safety-related mobile applications. These five articles also

[9] Further explanation is provided in section 2.2.

explore experiences and perceptions *through* digital usage across intersectional identities, contributing to the second research question. **Article VI**, while not focusing on mobile applications themselves, complements **Articles II, IV, and V** by exploring fear and mobilities at night, which enriches the analysis of empowerment and spatial practices under constraints.

The six papers are empirical case studies. The research is based on qualitative semi-structured interviews conducted with multiple stakeholders, experts, users, and non-users of mobile applications, and on participant observation. The interview questions varied across studies, as did the participants, depending on their expertise or mobility and digital practices. Comparing individual stories through qualitative data collection enabled a deeper understanding of how the use of mobile applications for everyday mobilities reshapes spatial mobilities and perceptions within different social groups (Schwanen, 2015; Yeager & Steiger, 2013). The findings resulted in unique narratives, mostly confirming existing theories while revealing nuances and contradictions in particular contexts. Participant observations were conducted during several fieldwork sessions to better grasp context-specificities. The research was carried out in two highly constrained urban contexts: Pune, a secondary city in India, and Kinshasa, the capital of the Democratic Republic of the Congo (DRC). Both cities were characterised by high mobility burdens, disparities in access to and usage of mobile applications, different socio-economic settings, and distinct gender norms.

2 Literature

2.1 Digital geographies addressing the use of mobile applications

The field of 'digital geographies' is relatively recent and emerges from growing questions about the relationship between digital technologies and spaces. It overall questions how digital technologies reshape our lives at multiple scales (including at the governmental level and in the creation of new norms), and how we, in turn, shape digital technologies (Ash, Kitchin, & Leszczynski, 2016; Elwood & Leszczynski, 2018; McLean, Maalsen, & Prebble, 2019). As McLean, Maalsen, and Prebble (2018) state: "[Digital geographies] provides a way to understand how digital technologies shape, and are shaped by, space and place". Digital geographies need to be understood as diverse, complex, evolving, and context-dependent, explaining why *geographies* is written in the plural form (Ash, Kitchin, & Leszczynski, 2019, p. 3-4). Digital technologies were studied before the creation of the field. As an example, Harvey (1996) was already observing and analysing the way the spread of digital technologies in societies affects traditions, cultures, values, norms, and perceptions of space and time. In this thesis, digital geographies are approached through the effects of mobile applications on users' spatial practices and perceptions, effects that generate constraints, needs, expectations, and norms which, in turn, guide the development of (new) mobile applications. It should be noted that this thesis adopts Lupton's (2020) definition of mobile applications as "small bits of software designed for devices such as smartphones, tablet computers, smartwatches, and other wearable devices", which perform specific tasks and provide services for users (Light, Burgess, & Duguay, 2018). The focus is on smartphone-based services (**Articles I, II, III, IV, V**), although most of the articles examined mobile applications that are also accessible via web-based platforms. This distinction does not affect the research findings, as smartphone use remains far more prevalent than computer-based access in the Global South (Heeks, 2022; Mammen, Rugmini, & Girish, 2023; Tanikawa Obregón, Coulaud, & Ninot, 2022).

Within the scope of digital geographies, mobilities take many forms, including movement, representation, and practice, which are determined by unequal socio-political dynamics (Cresswell, 2006; Priya Uteng & Lucas, 2017; Sheller & Urry, 2006). For this reason, the plural *mobilities* is used here to reflect the diverse forms of mobility (Sheller and Urry 2006). In the early 2000s, the 'new mobilities' paradigm expanded the concept of mobilities beyond transport and spatiality to enable a deeper understanding of the complexities of relations and interconnections between social, physical, virtual, and symbolic (im)mobilities. This understanding opened the door to studying how (im)mobilities are culturally constructed and experienced (Fenton, Wafer, & Fitchett, 2020; Sheller, 2018; Sheller & Urry, 2006). This thesis aligns with a similar understanding; however, for greater precision, it narrows the definition of mobilities to refer specifically to the act of physical movement through space. It also understands mobilities and immobilities as intrinsically linked, each shaping the other (Adey, 2006; Kwan & Schwanen, 2016; Priya Uteng & Lucas, 2017). To avoid ambiguity, immobilities are here understood as spatial practices that do not exclude physical movement within private spaces (usually the home) but limit interaction with the outside world. Like mobilities, immobilities interconnect with perceptions, emotions, ideas, and more (Sheller & Urry, 2006). This thesis analyses (im)mobilities across the use of mobile applications (**Articles I, II, III, IV, V, VI**). The literature has also explored virtual (im)mobilities, such as those facilitated through social media mobile applications, and their role in shaping social,

educational, and other experiences (Cheng, Yeoh & Yang, 2023; Hill, 2023). However, analysing their effects on practices is not the purpose of this thesis.

Of note, the analytical framework of time geography, which analyses mobilities through the prisms of time, space, and constraints (Hägerstraand, 1970; Sui, 2012), was not mobilised in this thesis. Although feminist scholars have used it to highlight gendered mobility inequalities (Schwanen & Kwan, 2008), they have also criticised its masculinist framing of social reality (Rose, 1993; Sui, 2012). The decision not to use time geography in this thesis results not only from the type of data generated but also from the study's epistemological orientation. Time geography relies heavily on spatial-temporal data, for instance, by keeping a precise track of individuals' daily practices (Sui, 2012). The focus here was on capturing the subjective and situated experiences of (im)mobilities, considering the role of multiple contextual and intersectional factors, including temporalities as one of the key contextual elements (Hägerstrand, 1970; Sui, 2012). In that sense, the absence of collected precise time geography data in this thesis is not simply a methodological limitation but the outcome of a deliberate choice to favour qualitative methods with semi-open questions, not enabling such time geography precision.

Considering the framework of digital geographies and given the thesis's focus, a more detailed exploration of the literature on how mobile applications interact with mobilities in fast-growing cities is presented below. This helps to clarify what is already known and what remains unexplored. Not all of the literature falls within the field of digital geographies, but in many cases, the research aligns with its framework topics, even if not explicitly mentioned.

In the literature, access to mobile phones, smartphones, and internet connectivity has been extensively studied across continents. This includes the availability and affordability of devices and networks, digital literacy, and usage patterns (Fenton, Wafer, & Fitchett, 2020; Gupta et al., 2022; Tsetsi & Rains, 2017). Over a decade, the reflection has developed on how mobile applications benefit societies at different scales. Several studies demonstrate the potential of mobile applications to address mobility challenges, particularly in highly constrained urban contexts. For instance, mobile applications might support or even replace traditional transport infrastructures by expanding transport options, optimising navigation, and others (Fenton, Wafer, & Fitchett, 2020; Główczyński, 2023; Mawussi, Aguilera, & Aholou, 2024). Other studies highlight failures of mobile applications in addressing urban transport challenges and improving living conditions. Mobile applications might reinforce social reproduction through unequal access and might propose solutions not adapted to mobility needs (Boutueil & Lesteven, 2024; Dodel & Hernandez, 2025; Tanikawa Obregón, Coulaud, & Ninot, 2022). As an example, Dodel and Hernandez (2025) show that mobile applications in Montevideo, Uruguay, exclude citizens due to barriers like internet access and digital literacy, reinforcing socio-economic inequalities. Furthermore, the literature acknowledges that mobile applications are culturally biased by "serving the cultural aspirations of their creators", as written by Light, Burgess, and Duguay (2018). Their creators, belonging to specific social and cultural backgrounds, influence the design of mobile applications, together with users' norms (Light, Burgess, & Duguay, 2018). Often, mobile applications are designed to scale up their operations across larger geographic coverage (e.g., Uber, Google Maps, Yango) (Boutueil & Aguiléra, 2019, p. 178; Leszczynski, 2020). Through their market extension, these mobile applications influence

users across societies, leading to a certain cultural standardisation (Leszczynski, 2020; Parkar, Zérah, & Mittal, 2023; Schwanen, 2015).

Overall, the thesis contributes to this discussion by analysing the positive and negative effects of mobile applications on women's (im)mobility practices in highly constrained urban contexts (**Articles I, II, III, IV, V**). It participates in shedding light on cities in the Global South that are typically less studied (Collyer, 2018; Fenton, Wafer, & Fitchett, 2020).

2.2 Gender associated with digital and mobilities in highly constrained urban contexts

The term *gender* had been used in the social sciences before the 1970s. In 1972, Oakley (2016) played a key role in popularising it as an analytical tool to distinguish biological sex from socially constructed gender roles (Oakley, 2016). Over time, the concept was enriched with social, cultural, and relational dimensions. Unlike the word *sex*, which refers to biological differences, *gender* refers to the culturally constructed relationships and power dynamics between people of distinct genders (Butler, 2006; Hanson, 2010; Jacquet, 2000). As a social construct, *gender* results in arbitrary inequalities between men and women (Oakley, 2016) and has ideological and political dimensions (Jacquet, 2000). This thesis understands *gender* as one of multiple identities within the self that plays a significant role in shaping social interactions and experiences. For instance, (im)mobility and digital practices and experiences differ not only according to gender but also through the intersection of gender with other identities (Crenshaw, 1990; Hananel & Berechman, 2016; McCall, 2005). While this research mostly analyses women's practices and perceptions (**Articles I, III, IV, V**), it gives less emphasis to comparative approaches to gender inequalities (**Articles II, VI**), focusing instead on the diversity of experiences among different groups of women (McCall, 2005).

The notion of *gender* raises important questions about *intersectionality* (Elwood, 2020) and *empowerment* (Elwood & Leszczynski, 2018). These two concepts, central to this thesis and to which it seeks to contribute both theoretically and practically, are further explained below.

In the 1970s, feminist movements in the Global South and from African Americans in the US appropriated the concept of *empowerment*, placing it at the centre of their political agendas. By the late 1990s, however, *empowerment* had become increasingly vague and overused, often serving as a politically correct label adopted by international organisations (Biswas & Kabir, 2004; Ibrahim & Alkire, 2007). In response, scholars proposed multiple definitions. Stein (1997) frames *empowerment* as a social action process that enables individuals and communities to gain control over their lives, while Kabeer (1999) emphasises the ability to make strategic life choices. Broadly, the scientific community agrees that *empowerment* should be understood as a dynamic, multidimensional process (Richardson, 2018), aiming to reduce inequality and increase decision-making power for women, though not exclusively (Hoan, Chib, & Mahalingham, 2016). This thesis aligns with this understanding, conceiving *empowerment* as a process along a continuum, moving toward an ideal or utopian 'empowered final step' (**Articles I, III, IV, V**). While several indices and indicators exist to measure levels and aspects of *empowerment* (Biswas & Kabir, 2004; Malhotra & Schuler, 2002; Richardson, 2016), this thesis does not employ such metrics. Instead, it focuses on whether the female interviewees experience and feel gains in decision-making power and access to space. To highlight its significance as a process, the term *empowering* is used here, even

though this usage is uncommon in the literature. It should be noted that in this thesis, *empowerment* is preferred over *agency*, which generally refers to the ability (e.g., having sufficient skills, good physical condition), power (e.g., being supported by a community, possessing self-confidence, having opportunities), and desire (which requires both ability and power) to make decisions and take actions (Mackenzie, 2012). Agency is usually considered a component of *empowerment* (Richardson, 2018). As a broader concept, empowerment emphasises an ongoing process rather than a single act, which is fundamental to the approach taken in this thesis.

The concept of *intersectionalities* understands identity as a complicated fusion of several characteristics, resulting in multiple differential experiences (Crenshaw, 1990; Hancock, 2013; Valentine, 2008). Gimenez (2024) understands *intersectionality* as a critical tool for analysing how structural inequalities emerge from the interaction of multiple identity factors, such as gender, class, and race, within systems of oppression. Hopkins (2017) offers a broader interpretation of *intersectionality*, which this thesis adopts. She viewed it as a way to recognise the interconnections between gender and other identity markers (e.g., socio-economic status, race, age, education) in shaping everyday experiences. She also highlights how identities are shaped by context, with power working through relationships and specific situations. Social phenomena can be better understood when various identities are considered in the analysis according to their significance. Elwood's (2020) calls for further research on 'intersectional digital geographies' within feminist digital geographies. This thesis aligns with that direction and aims to contribute to the development of intersectional approaches at the scale of the doctoral study.

It is worth noting that *super-diversity* is also a *multi-dimensional* concept that recognises diversity within populations (Vertovec, 2017). Both *super-diversity* and *intersectionalities* acknowledge several factors differentiating individuals. However, *super-diversity* focuses on population-level heterogeneity (originally in the context of migration studies) (Vertovec, 2017), whereas *intersectionalities* analyse how identities intersect at the individual or group level (Ciobanu, 2023). The concept of *intersectionalities* was only included in the analyses because of the thesis's focus.

Building on the concept of *gender*, *empowerment*, and *intersectionalities*, feminist digital geographies have recently emerged as a distinct and critical subfield within digital geographies. This subfield focuses on the gendered experiences of digital technologies (McLean, Maalsen, & Prebble, 2019; Kanai, 2021; Nelson, Hawkins, & Govia, 2023; Richardson, 2016; Rosser, 2005). As a continuation of feminist geography, feminist digital geographies aim to reveal both the opportunities and challenges that digital technologies represent for women and other vulnerable social groups (e.g., Queer, Indigenous, Black populations, and others) (Elwood & Leszczynski, 2018). Overall, the literature clearly shows that digital technologies, including the internet, smartphones, and mobile applications, all offer opportunities for some but reinforce existing inequalities of gender, age, and socio-economic background, among other intersectionalities (Osborne & Jones, 2023; Schwanen & Kwan, 2008).

In the literature, the few studies that explicitly reference the framework of feminist digital geographies have mainly focused on how mobile applications, mostly used for communication, produce geographic knowledge while also reproducing, and at times reinforcing, masculinist representations of space (Leszczynski & Elwood, 2014). For example, McLean, Maalsen, and Prebble (2019) analysed how social media applications (e.g., Facebook, Twitter) have transformed cultural and social practices in

feminist activism (Leszczynski & Elwood, 2014; McLean, Maalsen, & Grech, 2016). Similarly, Leszczynski and Elwood (2014) observed the reproduction of gender inequalities in geosocial applications designed for meeting people, while Stephens (2013) showed the gender gap in mapping contributions to open-source software (e.g., OpenStreetMap).

Many other studies align with the feminist digital geographies framework without mentioning it as such (Malakar, 2015; Pei & Chib, 2020). They addressed diverse topics including: the transformation of gendered power relations in work, social life, politics, and virtual spaces (Richardson, 2016; Tuzcu, 2016); the complex effects of digital spaces on gender and sexuality, both challenging and reinforcing social norms (Cockayne, Leszczynski, & Zook, 2017); the digital technology's potential to support feminist movements (McLean, Maalsen, & Grech, 2016; Morrow, Hawkins, & Kern, 2015); the way that online gaming environments and experiences are shaped by gender (Woods, 2021); the reorganisation of socio-spatial relations across activities (e.g., work, leisure, and mobilities) (Holloway & Valentine, 2001; Longhurst, 2016); the reproduction of social and spatial inequalities through digital usage across intersectionalities (Elwood & Leszczynski, 2018; Nelson, Hawkins, & Govia, 2023; Richardson, 2018); and, the transformation of spatial experiences and mobilities through digital usage (Elwood & Leszczynski, 2018). This thesis mostly contributes to the last three topics through the case studies (**Articles I, II, III, IV, V**): (1) the reorganisation of socio-spatial relations in everyday activities such as mobilities; (2) the reproduction of intersectional inequalities *by* and *through* digital practices; and (3) the transformation of spatial experiences *by* and *through* the use of mobile applications. Feminist digital geographies scholarship continues to fill in the gaps with ongoing research on digital practices (Elwood, 2020; Elwood & Leszczynski, 2018; Osborne & Jones, 2023).

The literature discusses women's use of mobile applications (Dodel & Hernandez, 2025; Giddy, 2019). However, how such mobile applications, designed to support mobilities, reshape daily spatial practices and perceptions for women remains, to the author's knowledge, underexplored, especially in the contexts of the Global South (Divall et al., 2020; Elwood & Leszczynski, 2018; Fenton, Wafer, & Fitchett, 2020). Most research on the use of mobile applications from a gender perspective has emerged in the Global North, where infrastructural, institutional, and social contexts drastically differ from those of the Global South (Osborne & Jones, 2023). Two studies illustrate the limited existing work in this area. The first study identified distinct technology-use behaviour profiles among literate women using mobile applications to navigate urban spaces in Brazil (Cassitas Hino & Cunha, 2021). The second study investigated the use of e-hailing among students across genders in Johannesburg (Fenton, Wafer, and Fitchett, 2020). In addition to addressing this geographic imbalance, research in the Global South is crucial for comprehending how intersectionalities determine mobile applications' usage and how these technologies reshape spatial practices in urban contexts that are more constrained than those in the Global North. Such contexts impose additional challenges on women's mobilities, shaping both their movement and their digital practices, and reflecting gender-specific mobility needs (Borker, 2024; Kwan & Schwanen, 2016; Sheller & Urry, 2006).

Therefore, the intersection between gender, spatial practices, and mobile applications for everyday mobilities in highly constrained urban contexts remains underexplored and deserves further attention (Singh, 2020). This gap raised pertinent questions, such as: What does the use of mobile applications mean for women? To what extent are

they able to benefit from these services? To answer these concerns, consideration must be given to how social structures and cultural norms are changing in relation to the adoption and usage of mobile applications (Hoan, Chib, & Mahalingham, 2016). This thesis aims to contribute to this gap by analysing the effects of using mobile applications for (im)mobility purposes in reshaping women's daily lives in the contexts of highly constrained urban contexts, through the frame of feminist digital geographies.

3 Methodology and fieldwork reflection

3.1 Research design

This research is situated within the constructivist and critical paradigms[10] (Denzin & Lincoln, 2017; Rehman & Alharthi, 2016). The constructivist approach helps to understand how women make sense of their daily mobilities and mobile application experiences, and how their adaptation to new practices influences their sense of *empowering* in daily life (Schwanen, 2015; Yeager & Steiger, 2013). Because this approach focuses on people's own meanings and perspectives, it aligns well with the use of qualitative methods such as interviews and observations (Yeager & Steiger, 2013). By using qualitative methods instead of numbers and statistics, the research aims to give space to personal stories and lived experiences. This research adopts a critical approach, focusing not only on the institutional, infrastructural, and socio-economic constraints that shape women's mobility in the Global South (Denzin & Lincoln, 2017; Law, 1999; Rehman & Alharthi, 2016) but also on the broader role of digital technologies in societies (Osborne & Jones, 2023).

The methodology was planned as empirical case studies, analysing the 'why and how' of social and spatial phenomena (Paillé & Mucchielli, 2021). The different case studies, complementing each other, look at multiple aspects of mobile applications' adoption and practice (see the column named 'study focus' in Table 1). Their approach differs. In **Articles I and II**, the emphasis was not on specific mobile applications but rather on any eventual use of them. In **Articles III, IV, and V**, the focus was on specific types of mobile applications: food delivery (**Article III**), e-hailing (**Article IV**), and safety (**Article V**) mobile applications. Only **Article IV** used a comparative method to observe differences in the use of mobile applications by diverse women at night across two cities, Abidjan[11] (Ivory Coast) and Pune (Vigour, 2005). The other articles (**Articles I, II, III, V, VI**) adopt a single case study, either in Pune or Kinshasa, to explore the effects of mobile applications' usage on a defined group in a specific context (Paillé & Mucchielli, 2021).

[10] According to Denzin and Lincoln (2017), research is framed by diverse paradigms, each grounded in distinct ontological and epistemological assumptions. These include:

- The positivist/post-positivist paradigm, which seeks objective truths through hypothesis testing.
- The constructivist/interpretivist paradigm, which views reality as socially constructed.
- The critical theory, which interrogates power structures and aims for social justice.
- The participatory paradigms, which prioritise collaboration and ethical engagement with communities.

[11] In **Article IV**, the findings from the interviewees in Pune and Abidjan were compared. However, the author chose not to include Abidjan in this thesis introduction to simplify the study to two case studies only: Pune and Kinshasa.

Table 1: Methods used in each of the articles.

Publications	Study focus	Method(s)	Case approach	Field location	Sample[12]
Article I	The use of mobile applications to commute by desk-working women in a multinational company	Semi-structured qualitative interviews, participant observation	Single case	Pune	Interviews with 15 women and 9 'experts' (institutional actors and operators)
Article II	The use of smartphones in spatial mobilities by students	Semi-structured qualitative interviews, participant observation	Single case	Kinshasa	Interviews with 26 female and 26 male students, and 15 'experts' (operators, researchers, NGOs)
Article III	The use of food delivery mobile applications by women	Semi-structured qualitative interviews	Single case	Pune	Interviews with 22 women
Article IV	The use of e-hailing mobile applications at night by women	Semi-structured qualitative interviews	Comparative cases	Abidjan, Pune	Interviews with 44 women from highly heterogeneous backgrounds
Article V	Purposes of developing safety mobile applications and their effectiveness in improving safety	Semi-structured qualitative interviews	Single case	Pune	Interviews with 54 women from highly heterogeneous backgrounds and 17 'experts' (operators, institutional actors, researchers, NGOs, activists)
Article VI	Students' mobilities at night	Semi-structured qualitative interviews, participant observation	Single case	Kinshasa	Interviews with 26 male and 26 female students

Source: The author.

[12] Further information about the samples and participant recruitment is provided in section 3.3.1.

3.2 Research setting and context

3.2.1 Selection of field locations

Three main criteria guided the selection of field locations. First, the selected locations needed to present urban contexts with highly constrained mobilities. Second, mobile applications intended to support (im)mobility practices had to be operational. Third, the local cultures needed to reflect different social norms and values regarding women and gender roles.

Kinshasa and Pune were selected as they met these three criteria while also offering contrasting contexts. Both cities experienced highly constrained mobilities resulting from factors including rapid urbanisation, lack of public service performance, and corruption (Malukisa, 2018; Rehena & Janssen, 2019; Yoka & Jacquemot, 2019). In both cities, e-hailing and navigating mobile applications, among others, were in operation (**Articles I, II, III, IV, V**). However, the progression of digital adoption differed significantly: Pune has experienced faster digital adoption with a wider offer of mobile applications compared to Kinshasa (Butsch et al., 2017; Pype, 2021; Rehena & Janssen, 2019). Despite lower digital penetration, Kinshasa remains a valuable case due to the presence of digital practices and the growing use of mobile applications. The two cities also contrasted in terms of gender norms. Pune was marked by stricter behavioural expectations for women and a higher concern with female safety, while Kinshasa, although often perceived as less secure, demonstrated comparatively more relaxed norms around women's mobilities (Alam et al., 2017; Annavarapu, 2022; Parikh, 2017). For instance, in Kinshasa, women commonly rode mototaxis seated between two men (the driver and a male customer), a practice that would have been viewed as inappropriate in Pune (**Articles I, II, VI**).

These differences situated Pune and Kinshasa at relatively distinct positions along two intersecting axes: the rigidity of gender norms (from stricter to more relaxed) and the level of digital adoption (from higher to lower). While not representative of all contexts in the Global South, these two cities illustrate how differing digital and socio-cultural conditions shape usage and spatial practices. Therefore, they provide a useful comparative lens for analysing the interaction between the use of mobile applications and (im)mobility practices.

3.2.2 Selection of mobile applications for the use cases

This thesis focuses on mobile applications that were operational in the field locations and were intended to facilitate (im)mobility practices. By facilitating (im)mobilities of users, this thesis refers to how users engage with mobile applications to, for instance, eventually improve access to urban space, support task planning, and reduce stress. Depending on mobile application types and their usage, this facilitation took different forms. While mobilities are not their core function, food delivery mobile applications were also included in the study because they enable immobilities. By reducing the need to travel for food, such mobile applications may offer short-term improvements in time management and street-safety feeling (**Article III**). However, communication and social media mobile applications, which also directly impact (im)mobilities, were not explored due to the relatively high coverage of the literature on this topic and the lack of resources to do so.

The table below presents mobile applications that were operational during the fieldwork and that interviewees mentioned using. Most of these mobile applications were tested by the author herself.

Table 2: Mobile applications used by the interviewees.

	Pune	**Kinshasa**
Transport offer	- E-hailing: Ola, Uber, Rapido - Private: Company shuttle	- E-hailing: Yango - Bus for students: TransAcademia
Multimodal navigation services	Google Maps	Google Maps
Navigation	Google Maps, TomTom	Google Maps
Food delivery	Zomato, Swingy, Uber Eats, Zepto, Dunzo	-

Source: Participant observations and interviews.

3.3 Methods of data collection and analysis

This research adopts a qualitative, ethnographic approach, using semi-structured interviews and participant observations (Porta & Keating, 2008). Each method is described below.

3.3.1 Semi-structured interviews

Data collection was done through semi-structured interviews with two types of participants: experts and citizens.

The **interviews with experts** included policymakers, operators, associations, activists, and researchers. In total, up to thirty-two experts were interviewed. Their interviews were mainly conducted at the beginning of the research to provide contextual information. Questions varied and were highly dependent on each expert's field and context. The experts were selected through internet search and word of mouth, based on the relevance of their expertise, and were contacted through LinkedIn, email, or WhatsApp. Since many experts were contacted, enough of them consented to be interviewed; therefore, there were no major problems getting responses. Most interviews with officials required official proof of support from local research institutions (e.g., the University of Pune, the French Institute of Pondicherry). The interviews were carried out both online and in person, depending on the experts' locations. On average, interviews lasted between one and two hours and were often followed by informal discussions. The interviews were recorded, except for several high-ranking policymakers who were concerned about potential repercussions if their statements were documented. The table below provides an overview of the interviews conducted with experts in three case studies.

Table 3: Overview of interviews with experts.

Study focus	Participants	Question asked	Justification for selection
Article I – The use of mobile applications to commute by desk-working women in a multinational company	9 'experts': 7 institutional actors (Smart City Pune, chief data officer, bus and metro operator directors, and police commissioner) and 2 operators of mobile applications (managers at Rapido and Yulu)	Mobility and transportation access, technological adoption, social cohesion and inclusion, governance	To gain a better understanding of the urban context and challenges related to mobility access and the digital usage of women
Article II – The use of smartphones in spatial mobilities by students	15 'experts': 4 operators (managers from Yango, TransAcademia, Heetch and Digital Kinshasa), 9 researchers (anthropology, criminality, law, sociology, transport politics, and urban planning in the DRC), 2 NGOs (female empowerment and digital education)	Mobility and transport, operation of digital services, urban insecurity, social norms regarding gender, and governance	To better understand the context of digital transformation in Kinshasa related to mobility and transport
Article V – Purposes of developing safety mobile applications and their effectiveness in improving safety	17 'experts': 6 operators of safety services (Safetipin, Red Dot Foundation, OneScream), 1 operator of e-hailing mobile application (Rapido), 4 institutional actors (bus and metro operator directors, Police Commissioner, The World Bank), 2 researchers on women's safety, 2 NGOs (Ishanya Foundation, City for All), 2 urban activists	Safety mobile applications, urban safety, social norms regarding gender, social cohesion and inclusion, governance	To understand the proliferation of digital safety solutions and assess their practical usability for women's mobility in public spaces

Source: Articles I, II, V.

In total, over **128 interviews with citizens** were conducted across the different studies, with each article presenting the interpretations of 15 to 54 interviews. The analyses of these interviews provided insights into the use of mobile applications and their effects on (im)mobility practices, lifestyles, cultures, and perceptions across intersectional identities. The selection of interviewees was meant to be as diverse as possible, considering constraints and limited resources. The key common criteria to recruit the participants were decided before the fieldwork and were study-dependent. Examples

of criteria included adult women, professionally active, and users of food delivery mobile applications.

In **Articles I, II, and VI**, the interviewees worked or studied within the same organisations: (1) an IT corporation (**Article I**) and (2) the University of Kinshasa (**Articles II, VI**). Several organisations were contacted. Of those, these two agreed to support the research by helping to recruit participants, organise interview schedules, and provide quiet spaces for the interviews. In **Article I**, the IT corporation emailed all female employees to ask if they wished to participate in the study. Interviews were conducted only with those who volunteered. In **Articles II** and **VI**, the recruitments were conducted by the student delegates of each faculty, who randomly selected four students to interview. Reduced freedom to address sensitive topics to conform to the values of the supporting organisations was one of the fieldwork's limitations. The questionnaires required approval from the head of HR at the IT corporation and from the rectorate at the University of Kinshasa. At the IT corporation, this meant avoiding direct questions on religion, income, and caste. In contrast, the University of Kinshasa permitted more freedom.

In the other studies (**Articles III, IV, V**), participants were identified and recruited through multiple strategies, including social media (Instagram posts and Facebook groups), word of mouth, snowball sampling, and direct approaches in locations such as cafés. As a result, the participants appeared more heterogeneous compared to the first technique involving an organisation. However, this method was more time-demanding, as the participants had to be found, interviews scheduled, quiet locations identified, and trips done across highly constrained urban areas to reach the places where interviews were conducted.

The table below summarises key details of the interviews conducted with citizens across the six case studies.

Table 4: Overview of interviews with citizens.

Study focus	Participants	Recruitment	Eligibility criteria	Justification for selection
Article I – The use of mobile applications to commute by desk-working women in a multinational company	15 women aged 26–46, employed in various roles within the same multinational company, from diverse social, economic, and ethnic backgrounds, with varied commuting practices, all residing in Pune.	Through the multinational company, with interviews conducted on-site.	Female employees, experienced with digital tools, living in Pune, who speak fluent English.	Interviewing 'digitally experienced' women about their commuting journeys and digital use enabled an understanding of the roles played by mobile applications in their mobilities.
Article II – The use of smartphones in spatial mobilities by students	26 women and 26 men, aged 18–43, studying at the University of Kinshasa, enrolled in various levels and fields, and originating from multiple regions of the DRC and Cameroon.	Through the University of Kinshasa, with interviews conducted on-site.	Students of varied ages, genders, origins, and fields of study who speak fluent French.	Students' mobility reflects socio-economic differences and generational patterns in smartphone adoption, making them a relevant group for studying smartphone use in mobility.
Article III – The use of food delivery mobile applications by women	22 women aged 18–44, with diverse educational backgrounds, occupations, marital statuses, and household compositions, all residing in Pune.	Social media, word of mouth, snowball sampling, and direct approaches; interviews conducted on-site and online.	Women over 18, employed or in studies, regular users of food delivery apps, living in Pune, who speak fluent English.	This diversity in age, background, and household context enabled analysis of how food delivery influences daily planning (e.g., mobilities, domestic responsibilities).

Article IV – The use of e-hailing mobile applications at night by women in Pune (and in Abidjan)	22 women in Pune and 22 in Abidjan, aged 21–46, with diverse education, occupations, marital statuses, and household compositions, all residents of their respective cities.	Social media, word of mouth, snowball sampling, and direct approaches; interviews conducted on-site.	Women over 18, employed or studying, regular e-hailing users who travel at night, living in Pune or Abidjan, who speak fluent English.	The diversity in age, background, and household context enabled analysis of how e-hailing reshapes night-time mobilities.
Article V – Purposes of developing safety mobile applications and their effectiveness in improving safety	44 women aged 18–54, with diverse education, occupations, marital statuses, and household compositions, all residing in Pune.	Social media, word of mouth, snowball sampling, and direct approaches; interviews conducted on-site.	Women over 18 residing in Pune; most interviews in English, with 11 translated from Marathi.	Diversity of participants enabled an understanding of the usefulness of digital safety tools in reducing fear in mobilities.
Article VI – Students' mobilities at night and the perception of insecurity and fear	26 women and 26 men, aged 18–43, studying at the University of Kinshasa, enrolled in different levels and fields, and coming from multiple regions of the DRC and Cameroon	Through the University of Kinshasa, with interviews conducted on-site.	Students of varied ages, genders, origins, and fields of study who speak fluent French.	Given their constrained mobility (e.g., limited finances, commuting) and night-time activities, students are a key group for analysing how fear affects mobility practices.

Source: ***Articles I, II, III, IV, V, VI.***

For each case study, an interview table was created to register the participants' details (age, gender, profession, education, time of the interview, and more) to keep track of diversity. Below is an example of this table.

*Table 5: Example of the research diary (**Article IV**).*

n°	Anonymised code	Recruitment date	Contact	Interview date	Length of interviews	Sex	Age	Degree	Marital status	Consent form signature
1	1	18/04/2023	Cafe	18/04/2023	30 min	F	30	Bakery studies	Single	Oral consent
2	2	19/04/2023	Alliance Française	19/04/2023	35 min	F	44	Master	Divorced	Oral consent
3	3	20/04/2023	Cafe	20/04/2023	35 min	F	31	Medicine studies	Married	Oral consent
4	4	20/04/2023	Cafe	20/04/2023	30 min	F	30	Bachelor	Single	Oral consent
5	5	20/04/2023	House	20/04/2023	33 min	F	44	Master	Single	Oral consent
6	6	20/04/2023	House	20/04/2023	33 min	F	40	Master	Married	Oral consent
7	7	21/04/2023	Food Court	21/04/2023	45 min	F	27	Bachelor	Single	Oral consent

Note: The column with the interviewees' names is not shared.

Except in **Articles II** and **VI**, only women were interviewed. In Kinshasa (**Articles II and VI)**, men were also included because, in a context of high insecurity, everyone adopts precautionary (im)mobility strategies. In Kinshasa, most individuals felt vulnerable in public spaces, with access inequalities linked to socio-economic status rather than gender (Foley et al., 2022). In high-insecurity contexts, a woman travelling by private vehicle faces fewer insecurity risks than a man using public transport or walking (Foley et al., 2022; Li, Guan, & Wang, 2022). Thus, men were also interviewed in Kinshasa to explore potential similarities or differences in (im)mobility practices across genders. It should be noted that both **Articles II** and **VI** draw on the same empirical data, which was sufficiently large to enable multiple analyses.

The interviews were conducted in person during fieldwork, except for five participants in **Article III** who were interviewed online due to a lack of resources. By conducting interviews in person, non-verbal communication (e.g., gestures, facial expressions) was better observed, and it helped in building trust with the interviewees.

The number of participants was not strictly decided in advance. The aim was mainly to ensure the saturation of observations (Rahimi & Khatooni, 2024) while including a variety of participants to capture diverse perspectives and viewpoints. The length of the interviews varied from 20 minutes for the shortest to one and a half hours for the longest. It depended on semi-structured interview questions and the interviewees' willingness to share their experience. When participants consented and the location conditions allowed it, interviews were recorded (see section 3.4.2).

Although interview questions varied depending on the study focus, they consistently addressed the use of mobile applications, spatial practices, travel safety, and demographic information. The questions were designed in an open and reflexive way that encouraged the participants to share their experiences, practices, and perceptions. With the *expert and citizen interviews*, the transcription and interpretation processes were similar:

- when recorded in English, the interviews were transcribed using Otter.ai (**Articles I, III, IV, V**),
- when recorded in French, the interviews were manually transcribed (**Articles II, VI**),
- when not recorded, the notes taken on paper were transcribed on the laptop (**Articles I, II, III, IV, V, VI**).

In each study, the ethical principles applicable to qualitative research were carefully followed (Paillé & Mucchielli, 2021; Sanjari et al., 2014). Before each interview, the participants (experts and citizens) were orally briefed about the nature and objectives of the study, their right to withdraw at any time, and how the findings would be used and published. This process ensured informed consent. Anonymity was guaranteed to protect the participants' identity through the pseudonymisation of names. Collected datasets were kept safe and were exclusively shared among the co-authors to ensure confidentiality. Once the paper finalising the research process was published, the data were erased (Behrendt & Sheller, 2023; Mitchell & Irvine, 2008).

3.3.2 Participant observations

Participant observation was conducted through immersion in the field sites, with the length of stay determined by available funding (Li, 2008). In both Pune and Kinshasa, this observation took two specific forms. First, the participant observation implied testing different modes of transportation at various times and locations to better understand mobility constraints. Different mobile applications relevant to the study were also tested to assess their usability and utility. Second, the participant observation involved observing social interactions between people, especially interviewees (e.g., within families, companies, and administrations), and integrating local communities (e.g., joining events, regular informal meetings with locals, and exploring neighbourhoods). A better comprehension of the contexts and their role in defining practices and perceptions was made possible by taking part in activities and observing behaviours, routines, norms, and values. This approach also helped identify both the researcher's and interviewees' cultural biases, thereby minimising their potential impact on the quality of the research (Sultana, 2007). As an example, in Pune, an interview took place at a woman's home. Although not expected, her husband joined the interviews. Because of his presence, the woman was hesitant to speak. He then answered several questions meant for her. This dynamic introduced bias, making the interview unsuitable for use in the research. However, it still offered valuable evidence of her position within the household. Observations and impressions were systematically noted in a research diary. They were later analysed to provide a better understanding of the interview findings, keeping the analysis grounded in its context (Li, 2008; Sultana, 2007).

3.3.3 Methods of analysis

Due to the large amount of qualitative data collected (interviews and observations), the analysis was always a challenging step (Dierckx de Casterlé et al., 2012). Each fieldwork resulted in pages and pages of data (transcriptions and research diary). The analysis process for each research project followed several phases. As a first phase, and throughout the analysis until the final writing stage, the transcriptions and the research diary notes were read multiple times to become familiar with the content and grasp initial impressions (Dierckx de Casterlé et al., 2012).

Using MAXQDA software, text segments from the transcriptions were coded to organise interviewees' responses. Codes represented specific themes and sub-themes, often linked to interview questions (Example of theme: Use of modes of transport; Sub-themes: Personal vehicle, Cab without mobile application, Cab via mobile application, Buses, Walking, etc.) (**Articles I, III, IV, V**). In two papers, the interviewees' responses were organised using an Excel table. This is because it appeared sufficient for managing the data and easier to use collaboratively within a research team of four who were accustomed to different software tools (**Articles II, VI**). Organising the data in this way helped to draw parallels between the participants' unique narratives and to identify both similarities and differences (Graue, 2015). An aspect difficult to handle was the presence of 'special cases': a few interviews with unusual or unexpected responses that challenged the emerging storylines (Dierckx de Casterlé et al., 2012). However, these cases revealed playing a key role in the elaboration of the findings, as they enriched the analysis by offering contrast and nuance, pushing to rethink and deepen some interpretations (Graue, 2015).

Within the central research topic, several dimensions were identified based on recurring elements in the transcriptions, codes, and field observations. For each of the dimensions, draft texts were written in a new Word document, describing and interpreting the data, while capturing the evolving interpretation. This 'report-style' writing helped give form to an initial layer of analysis. These texts included participant quotes and references to relevant codes, making it possible to trace where these interpretations were rooted in the data. This stage served to articulate connections between the interview's narratives and observations and to shape what later became the findings. It is also at this stage that the need for visualisations emerged, and maps were created (**Articles I, II, VI**). These maps enabled overviews of the collected data, which supported the interpretation.

At this point, the first draft of the paper took form. The research questions, initially defined prior to fieldwork, were continuously revised to adjust to the evolving understanding of the data. The literature review, partly drafted during the research planning phase, was revised with a narrower selection of relevant concepts based on the interpretation of the data. It supported the interpretation of the data and led to more concrete and articulated findings. At this stage, the findings section was also structured, and parts of the draft analysis text were polished in the findings section of the paper. Throughout the writing process, the storyline continued to evolve, leading to repeated returns to the original transcripts, research diary, and the first draft analysis texts.

3.4 Reflection on the fieldwork experiences

3.4.1 Brief description of the fieldwork

In total, I[13] spent about five months in Pune in autumn 2022 and 2023, and three weeks in Kinshasa in June 2023. I had a historical perspective on Pune's urban evolution, as I spent eight months there in 2016 to conduct my master's thesis's fieldwork. By comparison, before the fieldwork, I had never been to Kinshasa. Each fieldwork was conducted under different conditions. While Marie Hassen (co-author in **Articles II** and **VI**) and I carried out the fieldwork in Kinshasa, I carried out the fieldwork alone in Pune.

Fieldwork was conducted following a research plan elaborated beforehand. The main goals were to explore the city and to collect as many interviews as needed with relevant participants. Every day was planned ahead with interviews or with identifying and contacting potential interviewees, together with field observation. A typical field day included one to four interviews, as well as many unexpected events, requiring constant adaptations (e.g., interview cancellations, noises, official authorisation).

3.4.2 Highly constrained urban contexts as *difficult environments*

Pune and Kinshasa are highly constrained urban contexts and, as such, can both be considered *difficult environments*[14] for conducting fieldwork (Boumaza & Campana, 2007; Villeneuve, 2018). The term *difficult environment* refers to the work of Boumaza and Campana (2007), who describe different contexts in which fieldwork can be considered *difficult*, keeping in mind that the level of difficulty is subjective. According to them, difficulties can arise in many ways, including linguistic challenges, political instabilities, cultural differences, and focus on marginalised groups (e.g., queer communities, lower castes) (Villeneuve, 2018). Conducting fieldwork in a *difficult environment* implies certain physical, moral, or psychological risks. The risks encountered during the fieldwork in Pune and Kinshasa are described below and align with the concept of *difficult environments*, which could also be referred to as *constraining environments*, linking to the idea of *highly constrained contexts*.

Leading research in a *difficult environment* involves developing strategies to carry out the research despite the challenges of the field (Porta & Keating, 2008). Boumaza and Campana (2007) talk about "the researcher's ability and skill to navigate between methodological requirements and the realities of their field". As an example, in both cities, I had to adopt flexible approaches when scheduling interviews. First, mobility constraints had to be expected. Second, interviews were frequently cancelled at the last minute. Then, finding quiet spaces for conducting them was often challenging. When recording was impossible due to noise, interviews were taken by hand and later expanded with comments on the interaction, my impressions, and the context. Without recording, interviewees often seemed more comfortable and spontaneous. Moreover, some appreciated that I took notes, while others appeared stressed about it. As literature shows, recording and note-taking are not neutral and shape researcher-participant relationships (Gorman, 2016).

[13] Section 3.4. intentionally breaks from the formal style to adopt a more personal mode of expression, because it addresses the author's experiences and reflections.

[14] I am aware that describing Kinshasa and Pune as a 'difficult environment' reflects a situated perspective, shaped by my position as a researcher from the Global North. This terminology risks reinforcing a distance between the observer and the observed, and I use it here with this awareness in mind.

Before the fieldwork, multiple experts[15] were interviewed online to better apprehend context-specificities. I immersed myself in the local culture through novels, philosophy, and music. Still, once in the field, cultural misunderstandings kept emerging. For instance, on my second day in Kinshasa, after 17 hours without eating, I urgently asked the students accompanying me to take me to a restaurant. However, they did not share the same sense of urgency. I came to realise later that my reaction reflected how unfamiliar I was with a context where abundance is not a given. Many students eat only once a day for financial reasons (interviews with experts and students). Building awareness about my own ethnocentrism was challenging but necessary to minimise judgemental thoughts (Hubbard, Backett-Milburn, & Kemmer, 2001).

In the fields, I was always in a situation of *visibility* due to divergent physical aspects (white skin) and gender (woman) (Henderson, 2009; Townsend-Bell, 2009). I could sense that my skin colour granted me a certain social status, influencing the respect I received and, consequently, the support for conducting the interviews (Ghosh, 2018). It helped in accessing the people, especially operators and bureaucrats. Though it came with some limitations. Several local researchers discouraged me from interviewing the police and bureaucrats in Kinshasa due to the risk of bribery (Ghosh, 2018). It was also not easy every day to cope with being perceived as 'abnormal' and as an 'outsider'. It implied frequent staring and catcalling (Townsend-Bell, 2009). My skin also evoked memories of the colonial era, often bringing this topic into conversations with locals, at times taking the form of direct accusation. Remaining unnoticed was a lost cause.

Risks were evaluated beforehand (Ghosh, 2018). By being aware of most potential risks, I was able to prepare as much as possible to prevent their occurrence. For instance, Kinshasa presented political risks. In 2022, the DRC ranked 181st out of 193 countries on the 'Political Stability' index, placing it among the most politically unstable nations (source: The Global Economy). Thus, fieldwork was scheduled well before the upcoming elections to avoid potential instability. Accommodation was chosen based on district reputation, proximity to interviewees to reduce mobility constraints (**Articles II, VI**), and costs (commonly very high for outsiders) (Ghosh, 2018). During fieldwork, I travelled mainly by day, ensuring local accompaniment at night, and avoided risky transport such as mototaxis (risks of road accident) and shared taxis (kidnapping risks) (Verger et al., 2020). Fortunately, no incidents occurred during my stay.

In Pune, one of the main challenges was verbal communication, as I cannot speak Marathi or Hindi. I chose to avoid using translators to minimise the risk of translation bias. However, this decision impacted the scope of the case studies, which could focus only on specific female groups with certain educational levels and socio-economic statuses. A comparable situation occurred in Kinshasa, where French (my native language) is widely spoken among educated individuals only, again limiting the range of participants.

3.5 Reflection and ethical questions surrounding the fieldwork practices

The fieldwork was a time of self-reflection (Markham, 2006). Interviews especially provoked critical reflection on my role and assumptions, with self-questioning: To what extent does my own cultural background and worldview bias the way I interpret what I observe? How might my presence or research practices reproduce colonial or dominant

[15] At this stage, mostly researchers were interviewed, but not exclusively.

power dynamics? Can observing and questioning people from another culture be considered a form of voyeurism? What is my legitimacy in asking these questions? The key was to remain aware of the ethical implications and be respectful and humble toward the people I met during fieldwork. Ensuring the consent of the participants and local institutional support prevented me from being perceived as intrusive.

My position as a researcher has probably brought unexpected disturbances (Verger et al., 2020; Villeneuve, 2018). Being interviewed may have been enriching for some participants but disconcerting for others (Mitchell & Irvine, 2008; Scheyvens & Leslie, 2000). My questions likely influenced them, encouraging reflection on aspects of their lives and societal norms that they may not have considered before (Mitchell & Irvine, 2008). Moreover, being a woman seemed to have mostly played a role in building trust with female interviewees (Scheyvens & Leslie, 2000). On the other hand, building trust with male interviewees to discuss street safety was more challenging. Intersectionality is relevant here because my multiple identities and those of the interviewees interacted, both consciously and unconsciously (Kanai, 2020). As Rodriguez and Ridgway (2023) explain, the researcher is an *intersectional data point* where various power dynamics inevitably come into play during the interview. Contextual and social factors (e.g., location, circumstances, researcher's Western or local clothing) should also be considered when reflecting on eventual biases in interviewees' answers and behaviour. Sometimes, interviewees seemed to adjust their responses to what they thought I wanted to hear or to influence how I perceived them. In Pune, one woman felt the need to justify having four housekeepers, as if fearing my disapproval. Then, several policymakers tried to convince me of the success of their programme initiatives. At times, interviewees seemed to view my research as a means to denounce inequalities (e.g., domestic responsibilities of women). These experiences also raise questions about how the interviewees perceived me as the researcher, potentially as a dominant figure. Conversely, some interviews, particularly with high-ranking officials (e.g., Commissioner of Police, Director of Public Transport), were intimidating. Conducted in ostentatious offices, symbolic of their professional rank, and often squeezed between meetings, these interviews were brief (20–30 minutes maximum), adding pressure to cover the questions as well as circumstances permitted. On top, questions had to be carefully framed to encourage information sharing without sounding accusatory, for example, when discussing the severe lack of public infrastructure. To avoid the feeling of power imbalance and to encourage interviewees to open up by feeling more comfortable, I tried to conduct the interviews more as conversations, rather than being strictly question-and-answer based (Nilan, 2002). While using this interview technique, I still aimed to maintain the rigour of conducting a research study (Nilan, 2002). Overall, biases were minimised by multiplying interviews, cross-checking the findings, and reflecting on participants' potential reasons for adopting a subjective speech. When biases were unavoidable or not noticed ahead of time, they were mentioned in the papers (Markham, 2006; Sanjari et al., 2014).

Reciprocally, the interviewees impacted me emotionally (Hubbard, Backett-Milburn, & Kemmer, 2001; Mitchell & Irvine, 2008), a dimension less explored in the literature than the emotional potential impacts on participants, though it deserves further attention (Hubbard, Backett-Milburn, & Kemmer, 2001). Certain revelations were particularly affecting. For instance, in Kinshasa, a student revealed being raped. In Pune, women living in a slum described food scarcity during the COVID lockdown (interviews not used in any paper). Hearing these stories evoked in me a sense of

powerlessness in confronting the reality of others (Mitchell & Irvine, 2008; Woon, 2013). It raised ethical and personal questions about the role of research when individuals in distress are listened to but not supported in any meaningful way (Ghosh, 2018; Mitchell & Irvine, 2008).

Nevertheless, based on my field experience, I could sense that the emotions arising during the interviews, both from the interviewees and myself, were essential for later interpreting the phenomenon I was studying as accurately as possible. These emotions guided my overall understanding of the data (Hubbard, Backett-Milburn, & Kemmer, 2001; Markham, 2006).

4 Main findings

4.1 Women's spatial practices *produced by* the digital

Access to mobile applications is enabled or restricted by socio-economic factors, decision-making power, digital literacy, and other contextual and individual factors, which interrelate in complex ways (**Articles I, II, III, IV, V**'s findings confirm the literature: Behrendt & Sheller, 2024; Sheller, 2018). Users' willingness to use a mobile application also matters and partly depends on how useful and reliable they perceive it to be (**Articles I, III, IV, V**).

Their use of mobile applications reshapes (im)mobility practices, as the services they provide can both facilitate immobilities and mobilities, ultimately producing new geographies (**Articles I, II, III, IV, V**). Mobile applications can influence transport mode choice, trip frequency, timing, distance, and other travel-related practices (**Articles I, II, IV, V**). For example, e-hailing mobile applications can enable new trips by offering more travel options (**Articles I, IV, VI**), while delivery mobile applications might encourage more immobility practices (**Articles I, III**).

These changes in spatial practices also shape emotions, perceptions, and feelings of empowering (**Articles I, II, III, IV, V, VI**'s findings confirm the literature: Fenton, Wafer, & Fitchett, 2020; Ho, 2024; Porter & Turner, 2019). For instance, increased immobility enabled by mobile applications may amplify fear of the outside[16](**Articles II, III, IV, VI**). Conversely, e-hailing services tend to raise the feeling of safety by recording trips and enabling real-time sharing with relatives. Such reassurance may enable women to travel at night, a time typically viewed as inaccessible to 'good women' (**Articles I, IV, VI**). This does not only involve leisure activities but can also facilitate trips such as commuting to work or reaching the airport (**Article IV**).

This process forms a feedback loop in the sense that these reshaped practices of (im)mobilities influence back socio-economic factors and other conditions. For example, more efficient and reliable mobilities may improve access to urban amenities, education, and employment opportunities. Similarly, feelings of *empowering* resulting from more reliable daily planning may grow decision-making power within households and social environments (**Articles I, III, IV,** and **V**'s findings confirm the literature: Porter & Turner, 2019; Scharff, 1992). The mechanisms of this loop, described above in terms of geographies produced by digital technologies, are illustrated in Figure 1.

[16] This argument is developed further in the following Section **4.2.**

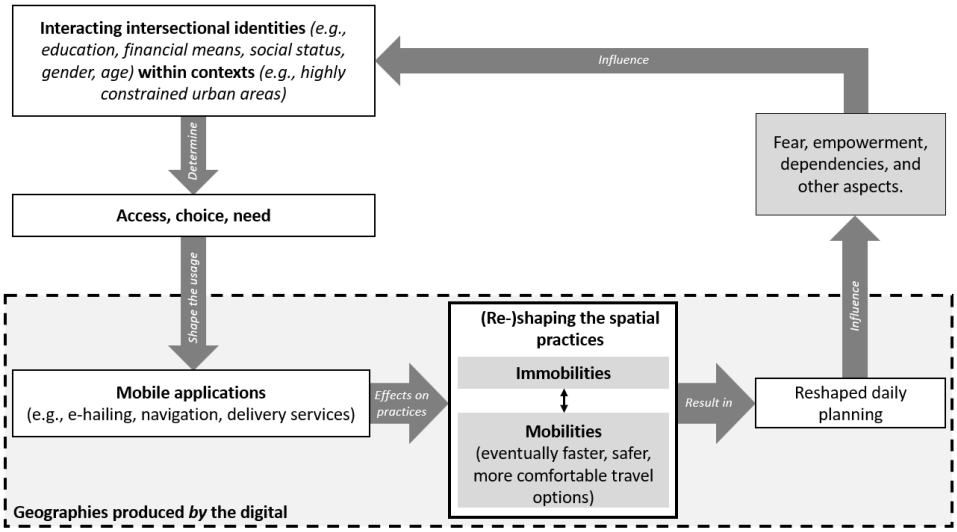

*Figure 1: Mechanisms of spatial practices reshaped **by** the use of mobile applications. Source: The author's findings.*

The highly constrained urban context is important because it affects many aspects of mobile applications' usage. For instance, **Article III** shows that, due to these constraints, interviewees often preferred ordering food at home rather than travelling to restaurants or grocery shops. **Article I** further highlights that some participants preferred working from home. These preferences are not only related to time saving but also to avoiding the burdens of navigating hectic traffic, pollution, crowds, and other constraints. In a less constrained urban context, the same participants might have been more willing or able to travel across the city (**Articles I, III**). Thus, the urban context influences both the needs and choices associated with mobile applications. It also affects the practical functioning of digital services, which often remain challenging, leading to cases of spatial injustice and isolation (**Articles II** and **IV**'s findings confirm the literature: Behrendt & Sheller, 2024; Fenton, Wafer, & Fitchett, 2020; Sheller, 2018).

Case studies illustrate these mechanisms, starting from the idea that access, choice, and needs regarding the use of mobile applications are shaped by intersectional identities, among other factors (**Articles I, II, III, IV**). For instance, in all the case studies presented in this thesis, socio-economic background proves to be a highly determining factor not only in access, choice, and needs, but also in the daily mobility practices and effects on the use of mobile applications (**Articles I, II, III, V, IV, VI**). Across the interviews, differing levels of access, usage, and preference for various mobile applications reveal inequalities and privileges among individuals. For instance, e-hailing mobile applications were mostly used by higher socio-economic interviewees in both Pune and Kinshasa (**Articles I, II, III, IV**), whereas mobile applications targeting specific populations, such as student transport or worker shuttles, appeared more inclusive but still served largely economically advantaged users. These disparities, evident in both cities (**Articles I, II**), demonstrate how digital mobility services can reinforce existing social and economic inequalities (Behrendt & Sheller, 2024; Giddy, 2019). More specific examples follow.

In Kinshasa (**Article II**), six students had tried the e-hailing mobile application called *Yango*, five of whom were women. These students were enrolled in highly selective faculties and often relied on relatives for financial support. They frequently commuted

by mototaxis, a more expensive mode of transport compared to buses, and went out at night for entertainment. Although they did not use Yango for night travel, these factors suggest they were likely in a better economic position than peers who had never tried or even heard of the mobile application. It should be noted that attending university already indicates a higher socio-economic status, given the presence of poorer populations in Kinshasa (Mpofu, 2015).

Similarly, in Pune (**Article I**), e-hailing mobile applications were more commonly used by the women in senior professional roles, while the other female employees who did not hold such positions mainly relied on company shuttles. This pattern could be explained by higher salaries, which expanded access to a wider range of transportation options (Borker, 2024; Hananel & Berechman, 2016). In **Article IV**, most of the participants reported using e-hailing services for late-evening travel, perceiving them as more convenient and safer than other transport options aside from private vehicles. Almost all 22 women interviewed in Pune came from relatively advantaged backgrounds (**Article IV**).

Even mobile applications designed to appear more inclusive, such as company shuttles in Pune and student transport services in Kinshasa, reflected socio-economic advantages (**Articles I, II**). In Pune, the shuttle service was reserved for employees holding professional roles within the IT multinational companies where the interviews were conducted (**Article I**). External workers, such as canteen staff, cleaners, and security personnel, were likely excluded, relying instead on separate shuttles, private vehicles, or unreliable buses. Based on observations, mixing across social statuses seems uncommon in India (**Articles I, III,** and **V**'s observation confirms the literature: Madheswaran & Singhari, 2016). Booking shuttles through a mobile application offered more flexibility, potentially faster travel, and overall optimisation compared to earlier non-digital booking systems. The option to work from home several days a week was likely even more valued. In a city where informal employment is widespread, especially among women, having a regular salary, remote work options, and office employment remains a clear socio-economic advantage (Butsch et al., 2017; Zhang, Zhao & Tong, 2022).

In Kinshasa, TransAcademia, a public bus service introduced in March 2023 exclusively for students, also illustrated the link between the use of mobile applications and financial resources (**Article II**). Access required a student card, which in turn necessitated full payment of the annual university fee, a requirement not met by many students. Among the interviewees, only four students (two women) reported using TransAcademia. Limited adoption was attributed to both financial constraints and the need to expand the service, highlighting how access to transport via mobile applications reflects economic privilege.

Depending on their design, intended use, and how users engage with them, mobile applications may generate new spatial practices and perceptions, on the condition of accessibility, which is largely determined by financial means that enable or constrain choice and frequency of use (Giddy, 2019; Vega-Gonzalo et al., 2023) (**Articles I, II, III, IV, VI**).

Interestingly, the use of these mobile applications did not appear to improve collective urban planning in highly constrained urban contexts (**Articles III, V**). Their positive effects seem to mainly occur at the individual level. However, they also seem to influence road usage, especially in the case of mobile applications offering delivery services and e-hailing, potentially contributing to congestion with an eventual increase

in the number of vehicles on the road (Chalermpong et al., 2023; Giddy, 2019) (**Articles III, V**). That said, there is potential in this area. Many studies have explored these dynamics (Chalermpong et al., 2023; Eskenazi & Boutueil, 2016; Shaheen & Cohen, 2019), which this thesis only briefly addresses, as it focuses on the micro level.

4.2 Experiences and perceptions: reshaping geographies *produced through* the digital

Building on the findings presented in Section 4.1, this section examines how experiences and perceptions of using mobile applications contribute to reshaping geographies produced *through* digital, and thus *through* mobile applications.

Figure 2 illustrates the cyclical process whereby mobile applications shape mobility practices, and mobility practices in turn shape the digital (Figure 1 as well). It provides a more detailed understanding of the mechanisms through which the effects of using mobile applications are produced *by* and *through* the digital, continuing this feedback loop. Their usage produces emotional effects such as empowerment, fear, or dependency (e.g., loss of control regarding the use of mobile applications), which also participates in shaping spatial practices in a certain determined way. These practices and emotions, in turn, influence the use of mobile applications, feeding back into users' intersectional identities and contexts. For instance, a growing use of delivery mobile applications may lead to more immobilities, which may reinforce fear of travelling in public spaces, with consequences for well-being, self-confidence, and perhaps even professional opportunities, among others. It may also reconfigure the individual's context by, for instance, reinforcing a household-centred focus due to an increased time at home (**Article III**). These dynamics, in turn, condition the subsequent use of mobile applications, thereby sustaining the feedback loop.

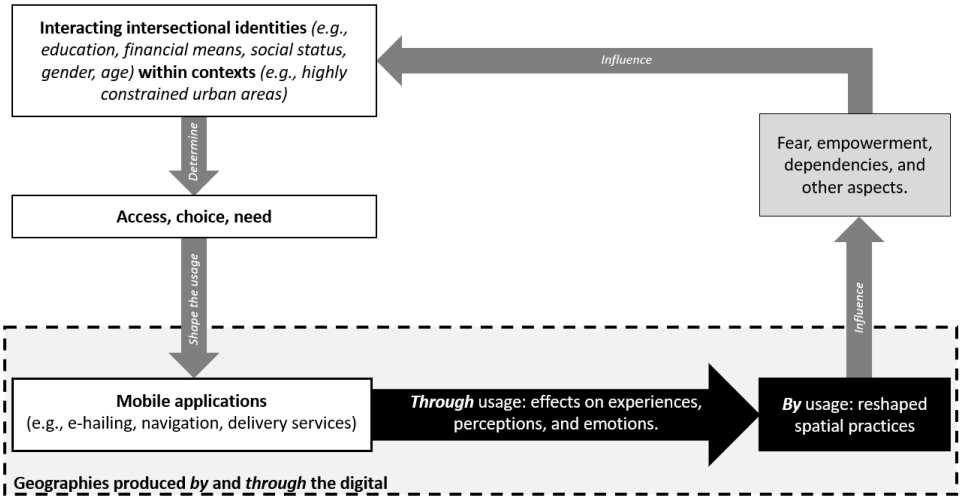

*Figure 2: Mechanisms of spatial practices reshaped **by** and **through** the use of mobile applications. Source: The author's findings*

In line with Figure 2, **Articles I** and **III** showed that in Pune, interviewees with certain financial means felt that using mobile applications helped them save time, which they could then reallocate. Some used this time for responsibilities, such as professional,

educational, or household duties, while others devoted it to relaxation, recreation, or social activities. These different time reallocations reflect the scheme's emphasis on how the use of mobile applications produces varied experiences and emotions, ranging from feelings of *empowering* to dependencies. Earlier analyses in section 4.1 (**Articles I, III**) suggested that interviewees spending more time on recreation tended to experience a stronger sense of empowerment than those focused on duties (e.g., domestic, professional), though this requires further investigation. After all, spending more time on professional tasks may feel empowering if aligned with personal goals, but less if driven by managerial pressure. These experiences and emotions, in turn, influence future digital usage and mobility practices.

This thesis has addressed the *geography of fear* as produced *through* the digital by examining mobile applications related to safety. It analyses how perceptions of insecurity influence fear in mobility practices and how fear, in turn, shapes and produces space, impacting (im)mobilities (**Articles II, IV, VI**). Fear is here understood as an emotion shaped by perceptions of space, time, and social context, actively feeding the feedback loop between the use of mobile applications, spatial practices, and intersectional factors and contexts (Ho, 2024; Koskela & Pain, 2000). By being spatially and temporally specific, perceptions of insecurity that lead to fear are shaped by the intersection of multiple factors such as gender, socio-economic status, residence, age, physical abilities, skin colour, caste, personal experiences, how strongly the media influence, and contextual factors such as time or area reputation (**Articles I, II, IV, V,** and **VI**'s findings confirm the literature: Kennedy & Coelho, 2022). Paradoxically, a place can be statistically safe yet still feel threatening due to stories, past experiences, poor design, or the presence of particular social groups. While analysing (im)mobilities at night in Kinshasa, **Article VI** shows that fear strongly influences how individuals travel through space (Fenton, Wafer, & Fitchett, 2020). In the literature, women generally report higher insecurity when travelling in public spaces compared to men (Ceccato & Loukaitou-Sideris, 2022; Koskela & Pain, 2000; Priya Uteng, 2021). However, in Kinshasa, fear of public spaces was reported by all, regardless of gender (**Articles II, VI**). Interviewees who could afford private vehicles, especially enclosed ones like cars, or e-hailing and taxi services (including mototaxis in Kinshasa or auto-rickshaws) faced fewer risks than those travelling on foot or using public transport (Foley et al., 2022; Li, Guan, & Wang, 2022). As a consequence, they felt less fear when navigating public spaces, which may have led them to travel more frequently, even for less essential purposes (**Articles I, II, IV, V, VI**).

The use of mobile applications also interacts with the feedback loop mechanism (Figure 2) by shaping mobility practices and *through* generating emotions, perceptions, and experiences, which in turn shape future use of mobile applications (**Articles II, IV, V**). However, the case studies show that mobile applications (including mobile application features) designed to reduce insecurity risks (e.g., emergency buttons, trip sharing, street maps informing about high-risk areas) did not substantially lower perceptions of insecurity. Therefore, they did not significantly reduce fear in public spaces (**Articles I, II, IV, V, VI**), with the exception of recording trip and trip-sharing features available on e-hailing mobile applications. In Pune, only three of 57 female interviewees had downloaded safety mobile applications, and none had used them. The only feature regularly employed was trip sharing with relatives through e-hailing mobile applications (**Article V**). Even when mobile applications offering shuttles or public transport service (e.g., TransAcademia) claimed they provide safe rides, they did

not reassure the women entirely, as these services did not provide door-to-door services. The women still had to walk or find other means to reach the stops. Then, they had to wait and possibly return the same way, exposing them to potential risks which did not reduce their perception of safety and feeling of fear (**Articles I, II**'s findings confirm the literature: Priya Uteng, 2021; Verma et al., 2017). In Kinshasa, mobile phones supported users in multiple ways, such as communication, navigation, and education, but rarely functioned as tools for personal safety (**Article II**). Only a few interviewees reported calling relatives when feeling scared, and use was highly situation dependent. They all felt that carrying a phone in public increased vulnerability to theft or crime, with over half reporting having their phones stolen at least once. Thus, in such an urban context, mobile phones simultaneously generated feelings of *empowering* by providing more travel options and information but paradoxically increased perceptions of risks, and thus fear (**Articles II, VI**).

Regarding empowerment, this thesis observed a contradiction. Literature suggests that increasing access to mobility (e.g., e-hailing mobile applications may increase transport options) facilitates access to urban amenities, expands opportunities, and boosts self-confidence, which in turn improves feelings of self-power, thereby *empowering* (Di Méo, 2011; Hanson, 2010). By contrast, increased immobilities could reduce self-confidence and social interactions, grow fear of harassment, accidents, or traffic, and eventually lead to disempowerment (Di Méo, 2011; Hanson, 2010; Shliselberg, Givoni, & Kaplan, 2020; Biswas & Kabir, 2004). **Articles I** and **III** show that many interviewees preferred staying at home, facilitated by mobile applications such as food delivery services or the ability to work remotely (e.g., when desk working with VPNs). Paradoxically, the interviewees reported that increased immobilities, enabled by their use of mobile applications, increased their sense of empowerment. Mobilities themselves are not always voluntary. In both Pune and Kinshasa, most commutes were long, difficult, and stressful (**Articles I, II, VI**). Mobile applications enabled women to reduce these burdens, reclaiming their time and energy, even if it meant limiting urban and mobility practices. At the same time, the interviewees staying at home out of comfort might have preferred mobilities over immobilities if the urban environment were less constrained (Alizadeh et al., 2022; Yassein, 2024). Thus, perceived 'chosen' immobilities may also be constrained. This illustrates that immobilities are neither fundamentally good nor bad. What matters is having the possibility and the power to choose between mobilities and immobilities, a choice strongly shaped by financial means and urban conditions (**Articles I, II, III, IV, V, VI**).

Overall, across all the case studies, the findings confirm the processes synthesised in Figure 2: intersectional identities and contexts shape the use of mobile applications; usage produces emotional effects that participate in influencing spatial practices; and the adoption of new practices together with the perceptions and experiences produced, feeds loop into intersectional identities and contexts. This cycle result is the constant production of geographies *by* and *through* the digital, marked by paradoxes and persistent socio-economic inequalities.

5 Conclusion

Within feminist digital geographies, this thesis explores how mobile applications (e.g., e-hailing, navigation, delivery) reshape women's mobility experiences in cities where mobility is highly constrained for all due to inadequate transport planning and a lack of infrastructure. It shows how mobile applications transform their (im)mobility practices by eventually reducing mobility barriers, enabling new possibilities, improving time management, and helping women feel more in control of their daily lives (Cassitas Hino & Cunha, 2021; Hoan, Chib, & Mahalingham, 2016; McLean, Maalsen, & Grech, 2016). This thesis is composed of six empirical case studies. Each of the case studies focuses on different effects in mobility practices and perceptions *by* and *through* the use of mobile applications in the urban contexts of Pune (India) and Kinshasa (Democratic Republic of Congo). This thesis does not claim to represent all women living in highly constraining urban contexts but participates in comprehending the effects of digital in today's world at the microlevel.

Digital geographies enabled framing the research around two of its dimensions, which interact and overlap (Ash, Kitchin, & Leszczynski, 2016; Osborne & Jones, 2023):

1. Geographies produced *by* the digital with the analysis of the effects of the use of mobile applications on (im)mobility practices (**Articles I, II, III, IV, V**).
2. Geographies produced *through* the digital with the study of perceptions and experiences (**Articles I, III, IV, V**).

Within digital geographies, this thesis adopted a feminist approach by questioning the empowering effects of mobile applications across intersectionalities and within patriarchal societies where social norms get triggered by the digitalisation of practices (Elwood & Leszczynski, 2018; Kabeer, 1999; Richardson, 2018). It contributes to the literature on digital empowerment and to the understanding of the roles played by intersectional factors (e.g., socio-economic background) and contexts (highly constrained cities) in determining the use of mobile applications and their effects on mobility practices and perceptions (Elwood & Leszczynski, 2018; Nelson, Hawkins, & Govia, 2023; Richardson, 2018). Like the other scholars in the field of feminist digital geographies, this thesis contributes to the argument that technology is never neutral (Elwood & Leszczynski, 2018; Iapaolo, Certomà, & Giaccaria, 2023) by showing how the use of mobile applications reproduces and even reinforces spatial and social inequalities (**Articles I, II, III, IV, V**). This thesis also contributes to providing more nuanced understandings of digital effects reshaping mobility practices by recognising the diversity of women's mobilities and digital experiences (McCall, 2005). Finally, this thesis seeks to contribute to Elwood and Leszczynski's (2018) agenda by centring women's experiences in under-represented Global South contexts.

The findings (**Articles I, II, III, IV**) show that these mobile applications can provide additional opportunities by facilitating the choice of both mobilities and immobilities optimising daily planning, and offering new ways of navigating the city (e.g., increasing transport offers with faster, more flexible, or perceived safer modes), even within highly constrained urban contexts (Fenton, Wafer, & Fitchett, 2020). In fact, several mobile applications, especially those organising transport modes (e.g., e-hailing, shuttle), appeared to suit women's specific mobility needs (**Articles I, IV**). Women typically make shorter but more frequent trips. Thus, these mobile applications could offer more adaptable, point-to-point travel options in response to their specific needs (Cassitas

Hino & Cunha, 2021; Foley et al., 2022; Mahambare & Dhanaraj, 2022). However, despite the existence of multiple mobile applications designed for diverse types of users, their usage is not equally accessible to all, especially in terms of frequency. They mainly serve the most privileged ones (**Articles I, II, III, IV, V**), as their usage requires a certain level of access (e.g., internet connectivity, the ability to make online payments, digital literacy, and others) and financial means (e.g., purchasing a smartphone capable of supporting these mobile applications, paying for e-hailing rides, buying TransAcademia tickets, and others) (Fenton, Wafer, & Fitchett, 2020). For some, costs or digital illiteracy limit their mobile application access. For others, mobile applications become fully integrated into their daily routines and affect how, when, and where they move in the city (**Articles I, II, III, IV, V, VI**). Differences in access and usage reflect larger mobility inequalities that exist even without digital options. Gender intersects with multiple identities and contextual factors to shape differentiated experiences, including how individuals engage with mobile applications and the effects generated *by* and *through* the use of mobile applications on their mobility practices and perceptions. This argument aligns with mobility theories that emphasise how intersectionalities affect access, needs, decisions, and mobility practices (Borker, 2024; Fenton, Wafer, & Fitchett, 2020; Foley et al., 2022; Priya Uteng, 2021). As Pei and Chib (2020) note, the use of mobile phones, and by extension mobile applications on smartphones, does not in itself guarantee social change (positive or negative). Instead, their effect depends on how individuals appropriate and use these tools within their social and spatial contexts. This thesis similarly argues that mobile applications do not universally reshape women's spatial practices but instead influence them in complex and often contradictory ways, determined by intersectionalities and the urban contexts in which they evolve (**Articles I, II, III, IV, V**). Moreover, Liu, Chen, and Xue (2023) demonstrate that individuals using mobile applications often reorganise their daily mobility routines toward efficiency, but they may also adapt their practices in response to the constraints imposed by the mobile applications they use. A similar analysis emerged in this thesis, as the interviewees' narratives showed varying degrees of adaptation to the constraints imposed by mobile applications, as would be the case with any mode of transport (**Articles I, III, IV**).

There is no simple answer regarding how experiences and perceptions are influenced *through* the use of mobile applications and influence back. Experiences and perceptions depend on how and why mobile applications are being used, and whether mobile applications meaningfully address needs. For some women, mobile applications provide more independence and self-confidence to navigate the city. For others, even when mobile applications influence their mobility practices, they may not offer meaningful benefit and could even have negative impacts (e.g., growing fear of public spaces from staying home more due to frequent online ordering, discomfort with public transport after relying on the 'private' space of e-hailing, trouble finding e-hailing taxis at night) (**Articles I, III, IV, V**). Fear offers an interesting example of paradoxical *empowering* experiences (**Articles II, IV, V, VI**). On one hand, mobile applications offer tools such as live tracking (e.g., real-time trip sharing with relatives) that generate a feeling of reassurance among the women (Główczyński, 2023). On the other hand, these same tools may be consciously or unconsciously imposed by relatives as a condition for allowing women to travel. Relatives can then monitor their movements, while ironically these tools are being presented as a way to ensure safety (Kennedy & Coelho, 2022). Fear and exposure to risks related to urban insecurities are also finally deeply personal and shaped by intersectionalities (e.g., financial means partly determine

destinations and transport modes), as well as by spatial and temporal factors (Diaz Olvera et al., 2021; Hidayati et al., 2020; Verma et al., 2017).

Thus, intersectionalities determine (im)mobility practices, the use of mobile applications, individual experiences, and perceptions of insecurity and fear, among other dimensions (Kanai, 2020; Valentine, 2008). In turn, these elements interact and influence each other, potentially influencing back intersectional identities themselves, as well as contexts (McLean, Maalsen, & Prebble, 2018). Within this dynamic, mobile applications play a significant role by reshaping daily mobility experiences, planning, emotions, and perceptions (Ash, Kitchin, & Leszczynski, 2015). While debates on digital geographies and mobility continue to evolve (Osborne & Jones, 2023), this thesis contributes to them by demonstrating how everyday spatial practices are reshaped *by* and *through* digital practices and conditioned by intersectionalities. Drawing on empirical insights from highly constrained urban contexts, it highlights the value of situated, context-specific analysis.

This research moves beyond viewing mobile applications simply as enabling technologies by emphasising the complex and contradictory mechanisms through which their usage transforms the experience and perceptions of users as they navigate the challenges of highly constrained urban contexts. It enriches feminist digital geographies by showing how these digital technologies reshape the everyday lives and experiences of vulnerable groups, particularly women. Taking this further, it contributes to the evolving field of digital geographies by offering a critical and nuanced understanding of the multiple and often ambivalent ways digital technologies impact our lives.

5.1 Thesis's limitations

Over the articles, several limitations stood out. As a qualitative study, the findings cannot be generalised (Yeager & Steiger, 2013). The analyses were limited to one category of individuals (**Articles I, II, VI**) or several (**Articles III, IV, V**), but without exhaustivity. This led to limited exploration of diverse socio-economic and intersecting factors across groups.

Moreover, to avoid discomfort around societal taboos, direct questions on sensitive topics had to be avoided during interviews. For such a reason, the focus on caste had to be abandoned. Similarly, asking about income turned out to be difficult. After a few attempts with different strategies (e.g., ranking household income), the approach shifted to asking indirect questions about vehicle ownership, domestic help, and living comfort. Those questions provided indications but left room for interpretation. For instance, some interviewees seemed to interpret the question about 'how comfortable they feel in terms of living conditions' as 'how satisfied they are with their lives,' not relating it to their incomes and needs.

Finally, as described in the methodology section, observations and interpretations of the findings were inevitably influenced by the author's life experiences, which include a middle-class background in France and the perspectives gained through travels. At the same time, these diverse travel experiences were a strength, as observing different contexts enabled a finer view of what is comparable and what is different. Living for one year in the busy city of Yogyakarta, Indonesia, contributed to a deeper understanding of Pune, which in turn facilitated a better comprehension of Kinshasa. These travel experiences brought more openness in exploring and accepting different logics without judgement, especially toward the interviewees whose life experiences differed markedly from those of the author.

5.2 Avenues for future research

The articles confirmed and nuanced existing knowledge but were also exploratory, aiming to open further research (Yeager & Steiger, 2013). Thus, future studies could carry on this research work by exploring other aspects.

As societies evolve, it remains highly relevant to continuously study the evolution of practices, perceptions, emotions, and norms, among others. Future research shall adopt an intersectional and comparative approach, possibly expanding to other mobile applications such as service aggregators of transport offers and 'super apps' (e.g., Grab, Gojek, Bolt, or Wolt) that integrate multiple services beyond mobility services (Hasselwander, 2024). Mixed-methods and cross-group comparisons would increase understanding of how the growing use of various mobile applications reshapes the mobility practices of diverse groups of people in distinct contexts. This approach would identify emerging patterns between groups, considering intersecting factors, through the use of more quantitative methods (Yeager & Steiger, 2013). Moreover, exploring trust between users, mobile applications, and delivery workers would also deepen understanding of safety concerns (Annavarapu, 2022). An interesting point raised in **Articles IV** and **V** to explore further is the ambiguity surrounding the use of mobile applications regarding surveillance risks (Adam, 2020; Behrendt & Sheller, 2023; Bonner-Thompson, 2023; Zhang, Zhao, & Tong, 2022).

Another research interest is to explore the effects of the caste system in the context of digitalisation. Caste still participates in determining everyday life and privilege in India (Madheswaran & Singhari, 2016). Higher castes, with better jobs and socio-economic status, tend to have more access to digital tools (Datta, Endow, & Mehta, 2020; Mosse, 2020; Subramanian, 2015). As a result, local mobile applications are often created and used by these groups, reinforcing caste-based inequalities (e.g., through language, service coverage) (**Articles I, III, IV, V**). Lower castes remain largely excluded from the expanding digital sphere (Deshpande & Sharma, 2013; Mosse, 2020). Moreover, mobile applications tend to reduce social interactions, which matters in a context where delivery service workers often come from lower castes. In **Article III**, some interviewees expressed distrust toward delivery workers, revealing wider societal biases (Annavarapu, 2022). Thus, the growing popularity of delivery mobile applications raises questions about caste, purity, and shifting social norms.

The proposed next phase of this research is elaborated below.

'Queer', understood as an 'umbrella term' (Dutoya, 2016), refers to a heterogeneous community generally excluding heterosexual or cisgender individuals (Debnath, 2017). Members of this community face specific daily mobility challenges, such as constant staring and, at times, violence in public spaces for those visibly transgressing societal norms (Weintrop et al., 2021). In cities, they may use social media mobile applications to participate in various events where community members can meet (Debnath, 2017). Accordingly, social media mobile applications may facilitate queer community members' mobility toward safer spaces (Miles, 2018). Mobile applications, particularly e-hailing services in cities, can offer a safer mode of travel with reduced visibility in public spaces, which may be especially beneficial for those who can afford these services and wish to attend events organised by their local community (Raj & Juned, 2022).

The effects of mobile applications on the spatial experiences of queer communities remain underexplored in the field of digital geographies and, more broadly, across related disciplines (Elwood & Leszczynski, 2018; Osborne & Jones, 2023). Given the

existence of such a wide literature gap and the relevance of this group, this research would add to the literature on queer mobilities and contribute to feminist digital geography scholarship by critically analysing how mobile applications reshape the spatial practices of vulnerable groups such as queer members (Elwood & Leszczynski, 2018). While using the framework of digital geographies, which explores the interactions between digital technologies and space, this study would be guided by the following research question: How are the spatial practices, strategies, and perceptions of queer individuals reshaped *by* and *through* the use of mobile applications when travelling to and from social events organised by queer communities?

To address this question, a qualitative approach is considered, with Pune selected as the field location. Pune has an active queer community organising weekly social events which provide spaces for the queer community to meet and support one another (Mist LGBTQ Foundation). Given the sensitivities and unique vulnerabilities of the queer members regarding daily mobilities (Weintrop et al., 2021), this study would prioritise creative qualitative methods over traditional semi-structured interviews. Direct questioning could feel intrusive or distressing to the participants. Moreover, the study aims to capture perceptions, feelings, and emotions related to the navigation of public spaces, which justifies using methods that encourage creative thinking through individual experiences. One potential approach is mental mapping, where participants would be asked to map their trips and how these trips have evolved since the use of mobile applications. Mental mapping would provide information about daily (im)mobilities and about the eventual use of mobile applications such as e-hailing. Such a method would enable the participants the possibility to express their feelings, emotions, perceptions, and frustrations regarding their (im)mobility practices and use of mobile applications. Another potential and complementary approach is to ask participants to first read a short comic presenting different situations commonly faced by queer community members, to then open discussions. This method would be followed by semi-structured interviews and aims to help participants open themselves and better understand the scope of the research (e.g., *Fanzines* used to study gender violence in the UK and Mexico: Murray et al., 2025 (ongoing study)). The interviews will be needed to dig into (im)mobility practices and to analyse how socio-economic distinctions within the queer community determine certain mobility and digital practices (Elwood, 2020; Yue & Lim, 2022). Other intersectionalities could also be explored through interviews. This research will require ethical validation by the academic ethics committee.

This research aims to contribute to increasing the visibility of marginalised members of society, supporting policymakers in improving policies with greater inclusivity concerns, and, more importantly, understanding the needs of this marginalised social group (Elwood & Leszczynski, 2018; Priya Uteng, 2021). By combining ethnographic depth with creative, participant-centred methods, the study will produce insights relevant to scholars across human geography, urban studies, and social sciences.

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References

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Abstract

Digital Geographies of Women's Mobilities in Constrained Urban Contexts

In urban contexts around the world, increasing access to and use of digital technologies generate a multitude of evolving effects across multiple scales. Today, many of our daily trips involve the use of mobile applications, whether to find public transport, order taxis, or for other purposes, as well as to avoid travelling, for instance, by ordering meals or groceries. Mobile applications progressively transform how we navigate and perceive space. This research, grounded in digital geographies, analyses how mobile applications designed to facilitate (im)mobilities, such as e-hailing, navigation, and delivery mobile applications, reshape the spatial practices, experiences, and perceptions of women in highly rapidly expanding and constrained urban contexts.

The methodology draws on six empirical case studies. It combines participant observations and semi-structured interviews with 128 interviewees in Pune (India) and Kinshasa (the Democratic Republic of Congo), as well as 32 experts, including operators, institutional actors, researchers, and NGOs. The study analyses two Global South cases with varying degrees of digital penetration and usage.

The findings show that mobile applications can provide additional opportunities for women by facilitating (im)mobilities, optimising daily planning, and eventually offering safer, faster, and more flexible ways to navigate the city, thereby creating *empowering* experiences. At the same time, mobile applications may fail to provide meaningful benefits and may even generate negative effects on well-being, self-confidence, and decision-making power by, for instance, causing dependence. This research argues that mobile applications do not universally reshape women's spatial practices but instead influence them in complex and often contradictory ways, determined by intersectional factors of identities (e.g., gender, socio-economic background, education) and the contexts in which they evolve (e.g., urban, temporal, societal, familial). These intersectional factors of identities, together with contexts, determine access to, need for, and willingness to use mobile applications. Their use reshapes users' spatial practices, experiences, and perceptions, while also reproducing and even amplifying socio-economic inequalities among other intersectional factors of identities. In turn, all these elements interact and mutually shape one another, influencing not only their own identities but also the identities of others, as well as contextual elements. Within these dynamics, mobile applications play a significant role *by* and *through* reshaping daily mobility practices, influencing not only experiences and planning routines but also perceptions, emotions, and imaginaries.

This research moves beyond viewing mobile applications simply as enabling technologies by emphasising the complex and contradictory mechanisms *by* and *through* which their use transforms the experience and perceptions of users as they navigate the challenges of highly constrained urban contexts. It contributes to the evolving field of feminist digital geographies by critically analysing how mobile applications reshape the spatial practices of vulnerable groups like women. It also provides a nuanced understanding of the effects of mobile applications on (im)mobilities, as well as on social norms, emotions, and empowerment, illustrating the multiple, often ambivalent ways digital technologies transform and impact our lives.

Lühikokkuvõte

Naiste linnalise liikuvuse digitaalsed geograafiad

Digitaalsete tehnoloogiate, eriti mobiilirakenduste, üha laialdasem kasutus tekitab mitmesuguseid muutusi linnakeskkondades üle maailma. Paljud meie igapäevased liikumised on seotud mobiilirakenduste kasutamisega – need aitavad planeerida teekondi, leida ühistranspordi ühendusi või tellida sõiduteenuseid, aga ka vältida liikumist, näiteks toidu või esmatarbekaupade koju tellimise kaudu. Seeläbi kujundavad mobiilirakendused järk-järgult ümber seda, kuidas me ruumis liigume, ruumi tajume ja kogeme.

Käesolev uurimistöö tugineb digitaalse geograafia raamistikule ning analüüsib, kuidas liikuvust ja liikumatust hõlbustavad mobiilirakendused kujundavad ümber naiste ruumilisi praktikaid, kogemusi ja tajusid. Uurimus keskendub globaalse lõuna linnadele, kus digitaalsed tehnoloogiad levivad kiiresti, kuid kus linna infrastruktuurist, kultuurist ja ühiskonnast tulenevalt võivad liikumisvõimalused olla piiratud. Uurimus analüüsib soolisi erinevusi kontekstis, kus uued tehnoloogiad võivad naistele pakkuda senisest suuremat autonoomiat ja liikumisvabadust, kuid samas taastoota või süvendada varasemaid ebavõrdsusi.

Empiiriline uurimus põhineb kuuel juhtumiuuringul, kombineerides osalusvaatlust ja poolstruktureeritud intervjuusid. Kokku viidi läbi 128 intervjuud Indias (Pune) ja Kongo Demokraatlikus Vabariigis (Kinshasa) mobiilirakenduste kasutajate seas ning 32 ekspertintervjuud platvormide operaatorite, ametnike, teadlaste ja kodanikuühenduste esindajatega. Uuringu võrdlev lähenemine võimaldab analüüsida erinevaid digitaalse leviku ja kasutuse mustreid kahes kultuuriliselt ja tehnoloogiliselt erinevas linnas.

Tulemused näitavad, et mobiilirakendused võivad naistele avada uusi võimalusi igapäevaseks liikumiseks ja varasema liikumatuse ületamiseks, pakkudes turvalisemaid, kiiremaid ja paindlikumaid liikumisviise ning luues võimestavaid kogemusi. Samas võivad need rakendused jätta osa eelistest kättesaamatuks või avaldada negatiivset mõju heaolule, enesekindlusele ja otsustusvõimele, näiteks tekitades sõltuvust. Uuring näitab, et mobiilirakendused ei kujunda naiste ruumilisi praktikaid ühetaoliselt, vaid mõjutavad neid mitmekesiste ja sageli vastuoluliste mehhanismide kaudu, mis on seotud nii identiteedi (nt sugu, sotsiaalmajanduslik taust, haridus) kui ka kontekstiga (nt linnakeskkond, ühiskondlikud ja perekondlikud raamid). Need tegurid määravad juurdepääsu platvormidele ning kujundavad nende kasutamise viise ja valmisolekut. Seeläbi võivad mobiilirakendused muuta varasemalt piiratud liikumisvõimalustega naiste kogemusi, kuid samal ajal taasluua või võimendada sotsiaal-majanduslikku ebavõrdsust.

Uurimus panustab digitaalse geograafia ja feministliku geograafia kui uurimissuuna arengusse, pakkudes kriitilist arusaama sellest, kuidas mobiilirakendused kujundavad naiste ruumilisi praktikaid ja tajusid haavatavates linnakeskkondades. Töö aitab paremini mõista, kuidas digitaalsed tehnoloogiad mõjutavad liikuvust ja liikumatust, sotsiaalseid norme, emotsioone ja võimestamise kogemust, tuues esile nende tehnoloogiate ambivalentse mõju igapäevaelule.

Publications

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RESEARCH ARTICLE

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Women's (im)mobility strategies and digital platform adoption: the case study of employees doing desk work in Pune, India

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ABSTRACT

This paper investigates the shift in (im)mobility through the digitalization of practices, based on the views of women working in a multinational IT company in Pune, India. The digital phenomenon, accelerated by the Covid-19 pandemic, influences all areas of society, pushing forward the online economy and transforming daily strategies by facilitating mobility and enabling immobility. Qualitative interviews were conducted with 15 digitally active female participants to determine the role of digital tools in transforming their daily planning strategy, and in motivating their (im)mobility decision. The results demonstrated that the evolution of commuting practices and the adoption of digital platform solutions, as seen by the women themselves, were closely related to their desire for comfortable mobility implying time control and optimization to better complete professional and household duties. The task of driving appeared to be the main avoidance due to inevitable hectic traffic, favoring the use of taxis or company cabs presuming financial status. A preference was given to work from home, and basically to immobility as mobility was regarded as time-consuming. Overall, these digitally privileged women carried out diverse (im)mobility strategies according to their perceptions and multiple structural factors.

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Introduction

The massive digital transformation influences all areas of society, including transport and mobility, and redefines practices (Reis et al., 2020). The Covid-19 pandemic intensified digital platform adoption due to strict mobility restrictions during the lockdowns, pushing forward the online economy (Prashant et al., 2022; Zvarikova et al., 2022).

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This paper aims to investigate the perception of the shift in (im)mobility through the digitalization of female practices in "emerging cities"[1] of the "Global South",[2] using the example of a female group doing desk work in a multinational company in the IT sector and already strongly imbued with digital practices in Pune, India.

With the advent of digital technologies resulting in the consumption increase of mobile applications, the transformation of practices is a growing topic (Kellerman, 2022). In "northern" countries[3] such a theme is relatively well covered (Reis et al., 2020), while it has begun to flourish more recently in the "Global South" (Datta, 2018; Pei & Chib, 2021). Existing gender studies related to digital mobility mostly focus on denouncing gender inequalities in access and usage of technologies such as smartphones or mobile applications (Cassitas-Hino & Cunha, 2021; Shaheen et al., 2017). Recent research was dedicated to enhancing women's sense of safety in public spaces through the implementation of various technologies, potentially rising surveillance, and social control (Kennedy & Coelho, 2022). Moreover, there is a growing body of research that specifically examines the impact of digital transformation on women's mobility practices, with a particular focus on "emerging cities" (Cabañes & Uy-Tioco, 2022). Studying female usage of digital mobility platforms is a relatively new research area, as before it was not considered a significant one, despite its high relevancy (Wajcman, 2000). In fact, such research helps us, as human beings, to better perceive how the digitalization phenomenon influences our practices and reshapes our societies. Women are part of these evolving societies. Their mobility patterns traditionally differ from men, as their digital practices (Hananel & Berechman, 2016; Loukaitou-Sideris, 2016). Thus, specifically observing female practices is fundamental to comprehend technological bias and digital usefulness. This paper, forming part of a reflection at the junction of three concepts: gender, mobility, and digitalization, aims to enrich the scientific literature in this regard. Consequently, this paper falls within this expanding literature informing about female specificities regarding digital platform adoption through the example of commuting in the context of "emerging cities".

Pune located in India was selected to be the field of study as it well represents the dynamism of the "emerging cities". In fact, Pune is a fast-growing city, economically dynamic, hosting multiple multinational IT companies such as IBM, Amazon, and Google in several high-tech hubs (Butsch et al., 2017) with a strong automotive industry. It was the second-selected city in the national program "Smart City Mission" to deploy a "smart" urban project for five years starting in 2016. Despite the critics (Datta, 2018), Pune's project was used in many aspects as a model (Butsch et al., 2017; Rehena & Janssen, 2019). In parallel, Pune experienced rapid population growth. In 10 years, the city population has grown by 24% from 2011 to 2021, and the metropolitan area by 35% from 5,057,709 inhabitants in 2011 (Census of India, 2011) to 6,807,984 in

[1]"Emerging cities" was defined as urban processes evolving through the different societal mutations generated by digitalization (Charmes & Léger, 2009). The geographical growth of "emerging cities" increases opportunities and extends urban resources but creates a dependence on transport modes to reach places (Donzelot, 2009), reiterating the importance of studying the transformations of urban mobility practices.

[2]Despite the high criticism of the "north/south" binary concept better reflecting the geopolitics of power relations more than any economic or geographical reality, "northern countries" and "Global South" are here used with the sole objective of highlighting the global inequalities in digitalization of mobilities (Dados & Connell, 2012).

[3]See footnote 2.

2021 (World Population Review, 2023). Such an increase puts great pressure on public services, multiplying shortcomings in terms of urban infrastructures and facilities. Digital technologies are being used in Pune, like in most "emerging cities", with hopes of solving urban challenges (Butsch et al., 2017). In addition, living standards are profoundly disparate between inhabitants. Extreme poverty coexists with great wealth. These inequalities are reflected in the access to digital platforms. The rising digital economy in "emerging cities", particularly in the area of mobility, is changing habits, making research on digital appropriation pertinent.

The methodology is based on a case study as a type of qualitative research, triangulated with participatory observation. Interviews were conducted with 15 women doing desk work in one multinational IT company, in Pune. This particular type of female employees was selected due to their relative autonomy and well-established digital platform practices, compared to less fortunate women who might have very little access to them (Datta, 2018; Kellerman, 2022). Although they all worked in the same multinational company, the 15 female participants belonged to diverse social, economic, and ethnic groups. Their digital practices kept evolving following trends and contexts, pushing through the adoption of new digital platforms, influencing their daily planning and their (im)mobility decision. For the purpose of this research, the inclusion of digital platforms is limited to taxi and navigation platforms considering available services during the fieldwork period (Shaheen et al., 2017). This selection allows for a specific focus on digital platforms designed explicitly for urban mobility. In this paper, immobility is characterized by an absence of travel when mobility corresponds to physical travels (Kellerman, 2022). Digitalization appears to facilitate mobility and to enable immobility. Since the Covid-19 pandemic incited social distancing, it became extremely common for people doing desk work to work from home (Prashant et al., 2022), and to get deliveries at home using digital platforms. The study focuses on commuting trips to observe (im)mobility strategies, considering the transformative daily mobility practices that have emerged recently. Strategies related to commuting are understood here as everyday conscious decisions evaluating options and constraints to reach the workplace to perform daily professional activities (Jiron & Carrasco, 2019). In the framework of this research, such a methodology was adopted to examine evolving commuting practices applying digital platforms, which result in new (im)mobility habits, and overall to better understand the digital transformation of women in their daily lives to enrich a scientific literature that is still weak in this regard.

This paper aims to examine how commuting practices of female employees doing desk work have been transformed through the digitalization, revealing new societal trends in "emerging cities", and prompting the following interrogations:

1. What are the commuting strategies of female employees doing desk work in Pune, and to what extent are these strategies representative of a highly digitalized working class in "emerging cities"?
2. How and why do the digitalization and Covid-19 pandemic reshape the commuting plans of these working women, keen on adopting new digital practices, and do these have a role to play in motivating immobility?

3. How does contextual information like personal preferences, perceptions, and structural factors (e.g., age, professional status, dwelling place) explain the expressed variations in commuting strategies among a working female group strongly imbued with digital platform practices?

Literature review

Distinct female (im)mobility

In 1972, Oakley (1972) made the distinction in the usage of the concept of "gender" between its biological dimension, referring to the word "sex", and its cultural and social dimension. Gender needs to be understood as a social construction, which emphasizes inequalities between the sexes (Oakley, 1972). According to Coutras (1993), gender inequalities partly determine our spatial representation, influencing in turn urban landscape.

In India, various studies described women's specific needs and practices in mobility (Hidayati et al., 2020; Mahadevia & Advani, 2016). In her thesis, Vasudevan (2019) compared the daily mobility strategies of mothers between Indian and French cities. In another research program, Mehta and Sai (2021) focused on "the freedom of movement", by examining the mobility of women in Patna, Dhanbad, and Varanasi, through quantitative surveys. They concluded that the more a woman had the ability to move, the more she was likely to work and to commute. Working might give her certain negotiation power within her household. Unequivocally, the scientific literature had demonstrated the existence of inequalities based on gender in travel practices (Coutras, 1993; Hananel & Berechman, 2016; Hanson, 2010). Due to distinct traditional gender roles, women's mobility is strongly related to domestic responsibilities (Loukaitou-Sideris, 2016), resulting in more frequent shorter trips, and in the accompaniment of dependents (e.g., children, seniors) (Loukaitou-Sideris, 2016). Women with lower financial status access cheaper and slower modes of transport with uncertain timings (Anand & Tiwari, 2006). As soon as they can afford it, women generally choose to travel using individual transport modes like private vehicles or taxis, as they can prioritize their comfort and safety over the cost (Massot & Orfeuil, 2005; Vasudevan, 2019). Travel distance and time also influence the selection of transport modes (Esztergár-Kiss et al., 2021).

In this paper, the concept of mobility is employed in its "displacement" dimension and needs to be understood as the ability of people to be mobile in space, which translates to effective physical movements (Levy, 2013). Several researchers interpret immobility as mobility's opposite, which is interpreted by the absence of mobility in space (Adeel & Yeh, 2018; Kellerman, 2022). More importantly, these two concepts, mobility, and immobility, are apprehended as interdependent, in addition to having a social and cultural dimension related to their acceptance (Mata-Codesal, 2015).

In the scientific literature, the (im)mobility strategy appears mostly studied in a context of unequal access to mobility (Jouffe, 2014) or in the adoption of certain transport modes (Vandenbulcke et al., 2011). In this paper, (im)mobility strategies, including commuting understood as a daily mobility task, are comprehended as the conscious choice of selecting the most convenient options among all available transport modes.

Patriarchal tradition plays a role in limiting female mobility, encouraging their immobility. In fact, women often experience a feeling of discomfort in being alone in public spaces (Adeel & Yeh, 2018). They usually then justify their presence with clear reasons, avoiding loitering (Coutras, 1993). Street harassment and unsafe feeling are flourishing themes that constrain and limit female mobility, along with the construction of gender urban spaces (Ceccato & Loukaitou-Sideris, 2022). Consequently, studies showed that in many cases women perceive the interior of their home as more comfortable than outside, and feel safer there (Haridasan & Muthukumaran, 2021). In Indian traditions, private spaces (e.g., the house) are women's main living space, while men's living space is outside, in public spaces (Vasudevan, 2019). Describing paternalist traditions, Hanson (2010, p. 6) wrote:

> Much of this thinking about how mobility shapes gender ideologies, meanings and practices has its origins in the observation that mobility/immobility stand at the core of traditional gender ideologies […]. These ideologies echo the familiar dualism that on one side equates women and femininity with the home, the private, with domestic spaces, and restricted movement […]. and on the other side equates men and masculinity with the not-home, the public, with urban spaces and expansive movement […].

Despite the importance of studying immobility to better apprehend mobility, the scientific literature is not wide on this topic. Manifestly, only a few studies combined immobility with gender (Azmi & Lund, 2022; Mata-Codesal, 2015). Understanding the levers of women's mobility and immobility, taken as interdependent practices, is essential to apprehend the digital transformation of practices and daily planning. Looking at commuting habits is relevant as they evolve through (im)mobility patterns and digitalization. Therefore, this paper contributes to the growing reflection on female (im)mobility, taking the example of a unique working female group with evolving commuting practices (Azmi & Lund, 2022). It aims to provide some understanding of women's digital platform adoption and of their perceptions leading to (im)mobility decisions.

The transformative digitalization in the debate

In digital-oriented societies, technology is envisioned to transform practices and influence (im)mobility. In the literature, researchers confront each other in an old and well-established debate, evaluating the benefits of such a phenomenon partially driven by the increasing adoption of mobile applications and digital tools (Reis et al., 2020). In the domain of mobility, technophiles observe a quality increase in transport services while using digital platforms. For instance, processing certain datasets could provide relevant transport information to users of mobile applications, guiding them across their travels (Eskenazi & Boutueil, 2017; Shaheen et al., 2017). Starting in 2011, Uber made a big change by functioning as a platform connecting taxi drivers with passengers over the interface of a mobile application (Eskenazi & Boutueil, 2017; Gaponenko & Hvoevskaya, 2022; Rajesh & Chincholkar, 2018). Such a platform connects close-by drivers with customers by using GPS technology (Gaponenko & Hvoevskaya, 2022). Overall, the processing of big data made possible the deployment of such "optimizing" services. Confronting this digital solutionism,

technophobes denounce the belief that digital platforms could solve every urban issue, especially when major infrastructures are lacking (Datta, 2018; Esztergár-Kiss et al., 2021; Zérah, 2020). There is also the belief, that digital platforms would have the capacity to contribute to poverty reduction to meet the Millennium Development Goals (Reis et al., 2020). However, several researchers have demonstrated that digital technology increases the intergenerational and socio-economic gap, excluding people despite its promises of social inclusion (Pojani et al., 2021; Vecchio et al., 2022). Digital penetration is also geographically unequal. Disparities can be observed between "North" and "South", urban and rural areas, and among urban neighborhoods themselves (Datta, 2018). Several researchers denounced a postcolonial appropriation of "northern" solutions worldwide, often unsuitable in other contexts (Datta, 2018; Jandrić & Kuzmanić, 2015). For instance, many "digital" solutions introduced by private companies in Indian cities were previously developed and tested in "northern" countries. In addition, digital services that increase transport options (e.g., Uber) are often at the initiative of private companies, questioning authorities' engagement and role in managing public transport services and in ensuring inclusivity (Hall et al., 2018).

Researchers observed that the Covid-19 pandemic through strict lockdowns has accelerated the spread of digital platforms among the population of India, bringing out new practices (Zvarikova et al., 2022). During this period of uncertainty, the use of online banking became extremely common. Delivery services of all kinds grew in popularity despite the fact that they primarily serve higher socioeconomic groups (Prashant et al., 2022). The pandemic also appeared to have long-term impacts on the mobility of many individuals doing desk work (Jasrotia & Meena, 2021). During the lockdowns, most individuals doing desk work were incited to work from home to limit the pandemic propagation. This practice of working from home continued after the end of the lockdowns, encouraging immobility to a certain extent (Kellerman, 2022). Consequently, many company offices changed form. Sharing desks on a rotating basis appeared the new norm in multinational companies (Parker, 2020).

Enriched by social geography (im)mobility was presented by several researchers as a vector of exclusion or integration (Orfeuil, 2002), connected with the notion of empowerment. In this context, empowerment should be strictly understood as written by Stein (1997):

> [The empowerment is] a social action process that promotes the participation of people, organizations, and communities in gaining control over their lives in their community and larger societies.

Theoretically, the more mobile people would be, the more they would have access to urban resources resulting in better professional opportunities (Orfeuil, 2002), boosting self-confidence (Hanson, 2010). Such a statement immediately raises certain questions like: might a gain in immobility following the personal choice of working from home lead to disempowerment? More generally, could digitalization, by encouraging to some extent immobility, be the indirect cause of any disempowerment? This discussion deserves further exploration in future studies as it falls beyond the scope of the present paper. Taking another perspective, the researcher Mata-Codesal (2015) insisted

on the normal dimension of (im)mobility varying through cultures. However, she still observed strong divergence of practices between genders. Accordingly, (im)mobility is culturally, socially, and economically gendered.

This paper takes part in this ongoing reflection on digitalization as a transformative practice and contributes to developing the gender dimensions of this research. This study intends to observe the evolution of digital platform practices of a female group commonly using mobile applications by taking the example of commuting habits (Mariscal et al., 2019). It aims to enrich the literature on the digital transformation of female mobility in "emerging cities", understudied compared to "northern" cities.

Materials and methods

We used a qualitative method intending to observe commuting strategies, which included the usage of digital platforms that women used daily to support their mobility, and to examine perceptions. Following the case study method, it was crucial to designate a female social group with characteristics such as having an advanced usage of smartphones, having financial stability and a relatively high professional status, being relatively autonomous and highly educated (Radhakrishnan, 2011). Women with higher economic backgrounds have a larger choice of modes to commute (Anand & Tiwari, 2006), and they usually are regular users of mobile applications. Female employees doing desk work for a multinational company in the IT sector meet all requested characteristics as they work in a globalized and digitalized environment and possess a relatively high professional status (Radhakrishnan, 2011). Accordingly, all multinational companies specifically in the IT sector located in Pune were targeted. Obstacles were encountered in identifying points of contact during fieldwork time. Eventually, we were able to establish contact with two multinational companies, and fortunately, one of them kindly agreed to support the research. In this multinational company, all the female employees were asked to participate in the study. Interviews were conducted until saturation of ideas was reached. In total, 15 female volunteers were individually interviewed for one hour.[4] Despite the apparent similarities regarding the organization, the sample was diverse in terms of professional roles, commuting and (im)mobility practices, household, commuting distances and time, mobility perception, etc. Table 1 highlights the background information of the15 interviewees (using pseudonyms) showcasing significant diversity within the sample.

The interview aimed to analyze participants' commuting strategies examining the evolution of their chosen modes of transport in relation to their preferences such as comfort, safety, time, and price, while also seeking to understand their usage of mobile applications to support their mobility. It also aimed to determine the evolution of the digital presence in commuting practices of these 15 women who were already digitally experienced. The questions were designed accordingly. The questions were

[4]On top of the 15 interviewed women, 22 other women coming from significantly different backgrounds were interviewed with the same questionnaire. Such a sample enabled a certain understanding of female mobility practices. Unfortunately, the sample composed of the 22 women was too disparate to allow the comparison, explaining the decision of presenting the interview results of the 15 women in this paper.

Table 1. Profile of the 15 female interviewees.

#	Pseudonym	Age	Job position	Commuting mode	Commuting times
1	Adya	35	Senior software engineer	Company cab, auto-rickshaw	12–30 minutes
2	Amrita	28	Software engineer	Company cab	35–80 minutes
3	Arya	39	Director software engineer	Personal car, cab	15–35 minutes
4	Chaitaly	34	Map manager	Cab, auto-rickshaw	30–80 minutes
5	Divya	29	HR advisor	Company cab, auto-rickshaw	15–40 minutes
6	Ekani	32	Team coordinator	None	10–25 minutes
7	Garima	32	Team lead	None	–
8	Gayathri	37	IT manager	Personal car/scooter	20–40 minutes
9	Harini	40	Management assistant	Company cab	40–100 minutes
10	Kamya	31	Customer support	None	–
11	Lajita	46	Senior project manager	Cab, auto-rickshaw	10–25 minutes
12	Lipika	36	IT support	Personal car	10–25 minutes
13	Lopa	26	Customer support	Company cab	50–100 minutes
14	Mitali	30	Finance advisor	Company cab	35–60 minutes
15	Nikita	39	Data analyst manager	Cab	40–90 minutes

also inspired by indicators derived from the literature including a review conducted by Solava Ibrahim and Sabina Alkire at the University of Oxford (Ibrahim & Alkire, 2007). They were organized into five categories of indicators based on prior research:

1. "Demographic questions" serve as icebreakers and aim to better know the participants (Paillé & Mucchielli, 2021).
2. "Access to mobility" analyzes mobility habits and strategies (Ibrahim & Alkire, 2007).
3. "Decision-making power" evaluates autonomy in terms of (im)mobility (Jejeebhoy & Sathar, 2001).
4. "The level of security" measures level of self-confidence in traveling (Shah et al., 2018).
5. "The pandemic's impacts on mobility" to understand how the interviewees' (im)mobility was affected during the periods of high restrictions (Jasrotia & Meena, 2021).

The indicators mentioned in (1), (4), and (5) were inspired by other studies (Jasrotia & Meena, 2021; Paillé & Mucchielli, 2021; Shah et al., 2018). Organizing the questions within indicators mostly helped to structure the interview. The authors exclusively shaped the questions, ensuring that no sensitive questions causing potential participant discomfort were included. The interviews were conducted in English without the need for translation, and each individual interview took place in a comfortable private meeting room provided by the multinational company.

In parallel with interviewing the women doing desk work, we questioned seven institutional actors and two operators of mobility platforms. The questions being asked were divided into four dimensions selected from the "Cities in Motion Index" (CIMI), conceived by the IESE Business School from Navarra University in Spain. The dimensions were mobility and transportation access, technological adoption, social cohesion and inclusion, and governance (IESE Business School, 2020). The questions were adapted according to the interviewees' expertise. These interviews aimed to gain a deeper understanding of the urban context and its associated challenges related to gendered mobility access and digital platform adoption.

In this study, the ethical principles applied in qualitative research were carefully respected (Paillé & Mucchielli, 2021). The selected multinational company was kept confidential. Before each interview, participants were provided with a consent form outlining the study's purpose and data usage. Their signature was not required as no sensitive data were collected and as their names were pseudonymized using common Indian female names. With the objective of facilitating the interpretation of the results and the understanding of the reader, age, job position, and professional status were mentioned when referring to interviewees. Permission was orally asked of public figures (commissioners, CEOs, directors, etc.) to refer to them in this paper. The interviews were taken by hand or recorded. All recordings were transcribed. The software MAXQDA was used to apply a qualitative thematic analysis method on the research outputs. From the interview transcripts, text segments were coded under specific themes to identify repetitions and similarities, following an inductive approach. Themes were then organized, reviewed, and compared to determine the guidelines of the study based on the results of the analysis.

To conduct the interviews and observe the societal environment, a dedicated period of two months was spent on-site in Pune, while adhering to time restrictions. Participant observation consisted of testing various modes of transportation at different times and evaluating the performance of digital platforms. It aimed to better understand mobility practices and to take notice of cultural bias to limit their potential impact on the quality of the research results. The fieldwork was followed by four months of analyzing interview outputs.

Results

Divergent commuting strategies

Among possible alternatives to commuting, the 15 participants selected their transport mode considering perceptions and personal priorities. Overall, we observed that none of the women participating in the study used public transport as a daily transport mode. In Pune, the public transport network is composed of bus lines lacking reliability and two new metros not fully deployed yet. Considering the urban size of Pune, the public transport network is insufficient. As a result, public transports are mostly used by people with relatively low financial resources. On 28 March 2022, the Managing Director of the public bus operator PMPML in Pune reported during the interview that bus users are mostly students and workers from low economic backgrounds. Thirty percent are female users (interview with the Managing Director of PMPML, 28 March 2022). The choice of transport modes reflects social conditions (Hananel & Berechman, 2016; Orfeuil, 2002).

Figure 1 visualizes the selected commuting modes of every woman taking part in the study, considering available transport options and preferences. In the map, lines were traced between all the living areas, represented by black points, and the workplace, represented by a unique gray point surrounded by black border, to examine all commuting routes from a bird's-eye view. The commuting modes of the women are displayed along the lines with a logo characterizing each of the transport modes they used, following their answers to the questions related to their commuting habits. The women exclusively

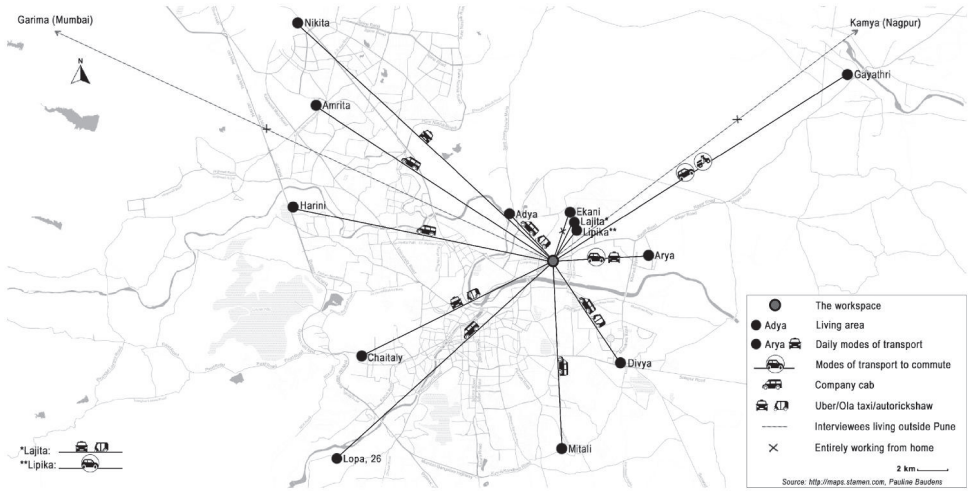

Figure 1. Usage of transport modes by the female participants.

used three transport modes to commute, which were company cabs, private vehicles and taxi services. The crosses marked on the lines showed the cases of Garima, Kamya, and Ekani, who did not use any transport mode to commute.

The three women were excluded from the commuting strategy analysis as they solely worked from home, eliminating the need for a commute. In the interests of precision, the commuting modes of the twelve women were described below.

Out of 12 women, six women took the company cab to come and return from work at peak hour times. The company cab is a minivan, exclusively reserved for the employees of the multinational company where the investigation was conducted. It picks up employees along its route. Trips are free. Several women complained about the strict schedules and detours. During the interviews, Ekani and Gayathri explained their reluctance to use the company cab:

> Before COVID, I was taking the company cab. My drop was the last stop, which was so annoying because I live only twenty minutes away from the office. It always took me more than thirty minutes to reach home. Such a waste of time. (Ekani, 32 years old, team coordinator)

> I do not take the company cab because I am not ready on time. (Gayathri, 37 years old, IT manager)

Out of 12 women, 10 owned at least one vehicle (motorbike and/or car), but only three commuted using it. By driving their vehicle, they perceived gaining autonomy. Such a mode of transport freed them from the strict scheduling of the company cab. However, they still had to attend meetings or respect working schedules. Finally, their autonomy was mainly reflected in being able to organize a commuting route to enable a combination of parallel activities (e.g., bringing children to school, doing grocery shopping, etc.), and by having a little flexible leeway in deciding commuting times. Gayathri's interview illustrated such observation:

> Every day, it takes me 40 min to commute with traffic. While going home, I usually stop along the way to buy food, groceries, and art things. (Gayathri, 37 years old, IT manager)

Driving in traffic jams generates stress, especially during the rainy season when road conditions get worse. Rain encourages people using cars over motorcycles when they possess both vehicles. Such an increase of cars on the road worsens traffic, accidents, and driver stress. Pune was ranked 21st most congested city in the world, among a classification of four hundred cities (*Source*: TomTom Index, 06 September 2022). Traffic is a real burden for drivers, explaining why most of the interviewed women refuse to drive themselves.

Out of 12 women, six ordered taxis as a commuting strategy. It was the sole commuting mode for three of them. For the others, requesting a taxi was common but not the only mode they used. Taxis can include cabs, auto-rickshaws, or bike taxis. However, bike taxis were not used by any of the women. In Pune, bike taxis were a relatively new service, compared to other cities such as Hyderabad where bike taxis were deployed for a longer period (interview with a manager at Rapido,[5] 3 April 2022). Several reasons could explain the selection of taxis as a commuting strategy. During the interviews, the women's main argument was that taxis were convenient and comfortable. By traveling in taxi, the women mentioned being free from several worries such as searching for parking spots and driving in traffic. Sitting in taxis, they could read emails, call, or play with their smartphone. This quote from Arya illustrated this convenience:

> Sometimes, I take a cab when I need a bit of time for myself, when I do not want to bother with driving and parking the car, and when I am coming late in the evening because we had some catering or office events. I prefer to get a cab, because I want to relax. (Arya, 39 years old, software engineering director)

Although it evidently freed the women from driving, it did not free them from being stuck in heavy traffic jams at peak hours. The main difference was that in a taxi the women could concentrate on other parallel activities. Moreover, ordering a taxi could be challenging whenever the demand for taxi service is greater than the supply. Taxis often become difficult to find at peak hours. It also regularly happens that drivers refuse to offer a ride for various reasons. During the interview, Lajita mentioned her struggles to find a taxi at peak hours:

> The availability of auto-rickshaws is a big issue, especially during morning peak times. Drivers cancel. I need to be lucky. (Lajita, 46 years old, senior project manager)

As a result, the comfort and convenience provided by using taxis differed based on circumstances and on women's individual perceptions. Another main disadvantage in using taxi services is the price. Such service is costly and not affordable for everyone, especially as a daily transport mode. While conducting the study in May 2022, it was found that the cost of traveling a distance of 5 km with an auto-rickshaw ranged from \$0.94 to \$1.08, while using a cab started from \$1.6. Riding a cab was roughly twice as expensive as riding an auto-rickshaw. During the interview, Adya testified:

> Cabs are an expensive way of traveling. Now, I live very close to the airport, but still, each time I go to the office by cab (4 km), I pay 350 INR (≈ 4,3\$). (Adya, 35 years old, senior software engineer)

[5]Company offering bike and auto-rickshaw rides on a taxi platform.

Clearly, the company cab and taxi services were the predominant selected modes of commute for the women taking part in the study. The company cab was appreciated as the ride was free for employees, but it prevented schedule flexibility. On the contrary, ordering a taxi enabled more schedule flexibility but it was a costly service. Obviously, the women had selected their transport mode to commute based on their own needs and preferences.

Change in commuting and use of platforms

We observed that there had been two main transformative phenomena encouraging the adoption of new commuting practices: the phenomenon of digitalization and the Covid-19 pandemic. Digitalization caused the multiplication of mobile applications and digital practices. The Covid-19 pandemic has accelerated the practice of using digital platforms and working from home, motivating immobility.

Adoption of multiple mobile applications to commute

In the study, out of 12 women who started commuting again after the lockdowns, 11 used mobile applications daily to commute, either to book a ride or to double-check traffic information along the way.

For a few years already, traffic information and navigation companies have integrated the Indian market and proposed mobile applications. Among three women driving their own vehicle to commute, one uses a navigation application daily to be kept informed about traffic. Accordingly, she tries to take the less congested itinerary. She explained:

> I use navigation apps such as Google Maps and TomTom Nav to commute, navigate, and be aware of traffic info. (Gayathri, 37 years old, IT manager)

Women utilizing the company cab have to digitally adapt by booking their seat in advance through a dedicated mobile application for next-morning pickup. The change happened during the Covid-19 pandemic. Before, the company cab's round-trip was fixed and regular. Amrita explained:

> Nowadays, I must book the company cab in advance. At 7:30, I get the cab. I reach the office around 8:30-9:00 AM. The ride is shared with colleagues that the cab collects all along the way. I guess, the cab calculates its optimal way. The route keeps changing every day. (Amrita, 28 years old, software engineer)

One major turning point of new digital practices happened in the first half of the 2010s with the arrival of taxi platforms in Pune (e.g., Ola, Uber) (Rajesh & Chincholkar, 2018). Ordering a door-to-door ride within a few clicks on the smartphone became possible. Before, traditional taxis had to be hailed or called over the phone. During the interview, Chaitali explained:

> If I want to get an auto-rickshaw without any app, I need to walk to the main road. It is not convenient. (Chaitali, 34 years old, map manager)

With taxi platforms, the price of rides became fixed and non-negotiable. On top of recording trips, these platforms enable sharing GPS location with relatives, offering

some sense of security. During the interview, the manager at Rapido[6] explained the relative success of taxi platforms:

> Uber, Ola, and later Rapido […] have created a change. They offer door-to-door services by enabling the demand to meet with the offer. […] Since the pandemic, more people started to use auto-rickshaws, bike taxis, and cabs, as they feared sharing trips by taking public transport. These platforms enable women to share their location with relatives, and to book individual rides. (Interview with a manager at Rapido, 03/03/2022)

Since the pandemic, the rise of working from home might have to some extent encouraged the usage of taxi services ordered through Ola or Uber. Using taxis to commute twice a week is more affordable than every day. For instance, before the pandemic, Nikita used to commute by driving her car. Since the pandemic, she mostly worked from home and opted for a cab when going to the office was required:

> If I go to the office, I use OLA or Uber. I prefer cabs because I go once per week to the office. […] pre-covid time, I used to drive my car to the office. (Nikita, 39 years old, data analyst manager)

Most of the interviewed women used mobile applications to plan their commutes. Booking taxis though platforms became more popular than street hailing. The company cab also followed this digital trend by being bookable via a designated platform. Within such a sample, digitalization seemed to reorganize commuting strategies and transform practices.

A growing tendency toward "immobility"?

The pandemic of Covid-19 has disrupted habits and brought new practices. During lockdown, the company office where we conducted the research was closed. All work was fully done online. During fieldwork (from March to April 2022), employees were encouraged to return to the office a few days per week. They were provided with shared desks on a rotating basis in a newly designed and pleasant workplace in a new location. This initiative aimed to foster spontaneous interactions, collaboration, and a stronger sense of teamwork, ultimately resulting in increased productivity and creativity. Despite the efforts, the office mostly stayed empty as most employees enjoyed working from home (interview with the office site owner, 31 March 2022).

In the study, we observed that eight women out of 15 came to the office less than twice a week. During the lockdown, two even moved back to their hometown in other cities in the region of Maharashtra: Nagpur and Mumbai. One of them came once a month to meet face-to-face with her team. Both considered coming back to live in Pune if required. Overall, there was a notable difference between the interviewed women as those coming to the office more than twice a week had distinct motivations to do so. They were required by their working team to work from the office, or they simply enjoyed the office for its social environment. Out of 15 only two women mentioned being bored while working from home and enjoyed going to the office to meet with colleagues. While being interviewed, Mitali mentioned:

[6]See footnote 5.

> Pandemic was bad. I don't like staying a long time at home. I prefer to go to the office. It was boring. (Mitali, 30 years old, finance team)

Such enthusiasm for working from home had multiple reasons. The main arguments given by the women were its conveniency and not wasting time commuting in heavy traffic. Their office was located on a highly congested main road. Even the women living near the office suffered from traffic in addition to repetition, as expressed by Arya during the interview:

> I like traveling but commuting is different. There is no fun in making the same trip every day. (Arya, 39 years old, software engineering director)

By working from home, the women felt they were saving time and gaining self-organization and flexibility, enabling them to better fulfill potential domestic responsibilities while lowering their mental stress. Arya explained:

> It makes a lot of sense to work from home. This hour of traveling you are saving is valuable. You have more time to work and do something else. This was the learning of the pandemic. (Arya, 39 years old, software engineering director)

However, this extra time did not appear to be used by the women to enjoy recreational activities. Not to mention that some of them used it to complete working tasks as they were overwhelmed by work. In this context, saving time did not necessarily relieve stress as it could lead to a task reorganization based on professional and domestic responsibilities.

A second strong argument mentioned by the women was that by working from home they saved money not commuting. Unless they were using the company cab service offering free rides, commuting required spending money driving a private vehicle or riding a taxi. This idea was expressed by Adya who used company cabs and taxis to commute:

> I worked from home, so I saved time and money. (Adya, 35 years old, senior software engineer)

In conclusion, most of the interviewed women perceived working from home as increasing their comfort and reducing traveling costs, despite the radical loss of social interaction with colleagues. The immobility these women experience was growing due to the rise of digital services enabling staying at home. In Pune, mobile applications of delivery services (e.g., food, groceries, etc.) are multiplying. Chaitali testified:

> Today, people don't do groceries, or even go outside. All is online with Myntra, Amazon, Dunzo, etc. Those apps save us lots of time. For three years I order from these apps and all is delivered at the door. (Chaitali, 34 years old, map manager)

Such a rise in immobility challenges the theory that immobility disempowers where mobility empowers. This theory was presented in the literature review section of this paper.

Explanation of commuting strategies and practices

The question emerged to explore potential patterns among the commuting habits of the 15 interviewed women explaining their (im)mobility strategies, keeping in mind the

high diversity of the sample regarding professional positions, ages, etc. The commuting strategies of each woman were compared with factors such as age and professional status to draw potential explanations regarding certain practices. During the experiments, it became obvious that the age was irrelevant as the women participating in the study were only 20 years apart, and most of them had worked several years in the multinational company, regardless of their age. On average, the 15 women worked there for more than six years. Another attempt was conducted to observe any possible relationship between working from home and commuting strategies. But no connection could be made despite the example of Nikita[7] previously described who, after the lockdowns, started to commute by cabs despite the high cost as she did not have to commute every day anymore. Since the 15 women had divergent professional roles, we thought we could draw and compare patterns between their job titles and the practice of working from home, but found no significant results. The decision of working from home seemed more related to job types and team requirements. For instance, customer support could work 100% at home, while other teams required regular physical meetings (e.g., technical support teams).

Following this comparative analysis between the interviewees' characteristics, we examined the link between commute times and commute modes. The results showed that personal vehicles appeared mostly used when commuting time was relatively short. A threshold of 20 minutes without traffic seemed to be the difference between what is described as short and medium commuting times. As explained earlier, driving in Pune is unpleasant because of heavy traffic jams. Due to relative financial comfort and the presence of the company cab as a free option, the women we interviewed had a large commuting choice. Even though most of the women owned at least one personal vehicle, they seemed to have a strong preference for being driven, especially when the commuting time took over 20 minutes. Therefore, they either ordered a company cab or a taxi, despite driving their own vehicle, which would have potentially given them more navigation flexibility. Comparing individual practices also showed that the women selected auto-rickshaws or cabs according to distance. The women seemed to prefer auto-rickshaws to cover relatively short distances, and cabs to cover long ones. Auto-rickshaws are less comfortable, but they navigate faster through traffic, compared to cabs. The feeling of safety might also explain the choice of taxi. The interviews revealed that the sense of safety was highly subjective and varied for each mode of transportation, reflecting individual perceptions.

We then sought explanations for individual commuting strategies by looking at the professional status and managerial hierarchy of the 15 women. Distinct professional status might lead to different choices of commuting transport mode. To simplify, we used a binary system differentiating "managers" in leading positions (e.g., managers, directors, or team coordinators), and "non-manager", those not in leading positions. While dividing the results of the female interviews this way, we noticed that out of the 12 women still commuting, "managers" and "non-managers" had two distinguishable habits.

In fact, we found out that six out of the seven "non-managers" used the company cab to reach the office as their first commuting mode, while none of the "managers"

[7]See Section "Adoption of multiple mobile applications to commute".

commuted using the company cab. Among the five "managers", four of them used taxis as a commuting strategy with a preference for cabs. Out of these four women who chose cabs, two occasionally utilized auto-rickshaws when they offered quicker pickup. Overall, their choice seemed to depend on taxi availability at the time of the order. Among the seven "non-managers", two of them explained using taxis to commute as a second but more exceptional option due to pricing. Amrita explained:

> Sometimes, when I miss the company cab, I take Ola or Uber, but it is very expensive and I try to avoid it. (Amrita, 28 years old, Software engineer, "non-manager")

One of the "non-managers" and two "managers" commuted by car. These three women lived relatively close to the workplace. The usage of personal vehicles appeared to be influenced partially by commuting distance and the desire for flexibility, rather than higher salaries or professional status. No comparative findings were available.

As a qualitative study, one limitation is that the results cannot be generalized. The results of these observations simply showed that professional status might influence commuting preferences in the sense that being a manager typically engenders a higher status in the corporate hierarchy, meaning more responsibilities and a higher salary. Increased earning facilitates the access to costly services such as taxis. For instance, Chaitali was a map manager leading a team who exclusively commuted using taxis, taking the first coming taxi without differentiating between cabs or auto-rickshaws. She lives 30 minutes away from the office. When traffic occurs, she can easily spend more than one hour commuting. Despite this constraint, she goes to the office more than twice a week. Her commuting cost is consequently relatively high, but her salary affords her the comfort of being driven whenever she commutes. Such commuting practice stood out as compared with the seven "non-managers" who only exceptionally used taxis to commute and seemed to prefer the free option of the company cab before opting for paid options.

The key finding was the variation in commuter strategies based on factors such as commute time, professional status, and personal characteristics. Domestic and household responsibilities also played a major role in the selection of commuting modes as the women might have strict schedule obligations such as bringing the children to school. During the interview, Arya explained that she needed to wait for the nanny before commuting:

> I wake up early, around 6-6:30. Then, I eat. I get my son ready to go to school. The nanny comes at 9:30. When she comes, I can go to the office, because my little one is still very dependent on me. (Arya, 39 years old, software engineering director, "manager")

As she needs to wait for the nanny to come at 9:30 AM before leaving for work, she cannot take the company cab that collects the employees before 9:00 AM. Domestic and household responsibilities should be considered when studying female mobility as women often manage both professional and domestic roles simultaneously.

Discussion and conclusions

The goal of this paper was to investigate the transformation of female commuting practices through the adoption of digital platforms, and to examine the perception of the shift in

(im)mobility. The study used the example of a specific female group doing desk work with relatively high digital practices evolving through trends and contexts, in the "emerging city" of Pune. The results were not intended to be representative but to illustrate the female adoption of mobility digital platforms taking the example of one specific female group.

This paper highlights the evolution of commuting strategies among the female interviewees, focusing on the influence of digital mobility services in enabling them to book taxis or company cabs and access real-time traffic information. Due to a desire to avoid driving in the usual hectic traffic, many interviewees actively sought alternative options among digital platforms.

One alternative was to commute by selecting travel options beyond driving. The interviewees mostly commuted by company cab, which provided free rides but made detours to pick up employees, and by taxi, which was costly but gave them more control of their time over potential externalities caused by domestic or professional duties (Loukaitou-Sideris, 2016). At the time of fieldwork, they mostly used platforms to organize their commutes, hailing was seen as too constraining and perceived as a waste of time. The digitalization of these transport services has enabled a certain facilitation, encouraging digital practices. Nowadays, a few clicks on the smartphone enable ordering a taxi and reserving a seat in the company cab (Eskenazi & Boutueil, 2017).

Another alternative observed among the interviewees was the preference for working from home, indicating a strong preference for remote work. Paradoxically, while digital platforms appeared to facilitate mobility by optimizing transport services they also simultaneously encouraged the practice of immobility by making working from home possible (Kellerman, 2022). The Covid-19 pandemic has accelerated this tendency, as companies had to ensure that their employees work from home in compliance with governmental guidelines (Jasrotia & Meena, 2021). Following lockdown, most of the interviewees went to the office only when their professional obligations required it. They often expressed feeling comfortable and saving time and energy by working from home (Haridasan & Muthukumaran, 2021), despite reduced social cohesion with colleagues. At home, they redistributed the usual allocated time to commute toward other activities. However, time saved was not always utilized for recreational activities but instead was spent on completing domestic tasks (Faiz, 2015) or fulfilling professional work obligations.

Additionally, results from the interviews' and the literature show that commuting strategies are very individually-based and depended on multiple structural factors and perceptions (Massot & Orfeuil, 2005). For instance, the choice of transport modes seemed, among other factors, influenced by travel distance and travel time (Esztergár-Kiss et al., 2021). The women who lived near to the workplace were more likely to drive themselves to work than the others who opted for transport modes where they were driven by somebody else. The scientific literature suggested that the choice of transport modes might be influenced by social status (Anand & Tiwari, 2006; Hananel & Berechman, 2016). In this case study, we observed a preference among women in leading positions to commute by taxis, whereas others showed a preference for the company cab. The explanation could be found in the managers' desire for greater time flexibility due to their increased professional duties, in addition to personal and familial considerations. Their higher salaries also expanded their access to more transportation options (Massot & Orfeuil, 2005).

The transformation of female (im)mobility practices through the adoption of technology raises questions about the evolution of traditions and acceptances, as well as empowerment and disempowerment effects (Hanson, 2010). In the study, the women interviewed seemed discouraged to travel outside because of constant heavy traffic restricting their access to the city and consuming time. It raises concerns about the free choice of (im)mobility and the potential effect on empowerment (Azmi & Lund, 2022; Orfeuil, 2002). Future studies would benefit from adding a comparison with more financially and socially vulnerable groups to underline digital exclusion (Pojani et al., 2021). Digital penetration is unequal and highlighting such inequalities among the female population in Pune might result in observing disparate perceptions and behaviors regarding (im)mobility as digitalization and mobility influence each other in transforming practices.

This research had certain limitations due to the challenging conditions of the fieldwork. Indian culture is very diverse and difficult to apprehend for outsiders.[8] Such a cultural gap creates biases, adding to language difficulties. By questioning working women in a multinational company, the translation task of Marathi language was avoided as all interviews could be conducted in English. Another limitation was that interview questions had to fit the company values, requiring the suppression of direct interrogation related to religion, income, and caste. Further studies should explore the impact of the Indian caste system on the female mobility strategies, offering intriguing insights.

Credit authorship contribution statement

Pauline Baudens: Conceptualization, Formal analysis, Investigation, Methodology, Writing - original draft, Writing - review & editing.
Anu Masso: Methodology, Supervision, Review & editing.
Ralf-Martin Soe: Methodology, Supervision, Review & editing.

Disclosure statement

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Pauline Baudens is a Public Administration PhD Candidate at the Tallinn University of Technology. Her research is centered on exploring how digital technology is reshaping the practices of women in India.

[8]The researcher conducting the survey is a white woman. Being a woman enables establishing a certain level of trust with the interviewed women. However, the western origin and cultural background of the researcher might have influenced the interviews and research outputs (Funder, 2005). The research was conducted knowingly, with the intention to limit bias impacts.

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Mobility capacities and smartphone use of students in Kinshasa, Democratic Republic of Congo

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ABSTRACT

Many African cities have been experiencing a digital transformation over the past few years. As people become more familiar with digital tools, particularly smartphones, in their daily lives, their uses and practices in terms of mobility are also evolving. This paper aims to explore the impact of smartphones and digital platforms on mobility capacities by targeting students at the University of Kinshasa (UNIKIN). The methodological approach combines observations and semi-structured interviews with fifty-two students, as well as fifteen experts involved in the field of mobility and transport. The results of our study reveal that students in Kinshasa have constantly adapted complex mobility behaviour, that result from challenging transport conditions and relatively high insecurity in public space. In contrast to observations in other African cities, this study reveals limited adoption of digital tools and navigation applications among the students, mainly due to the lack of digitally-enabled transport services, their high cost, and the context of perceived insecurity in public space.

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Introduction

In most Sub-Saharan African cities, transport and mobility pose significant challenges (Diaz Olvera et al. 2016). In the first decades following independence (1970–1990), newly independent states struggled with public transport management and maintenance in cities (Cissokho 2022; Godard 2002; Kassi-Djodjo 2010). The structural adjustments imposed on them by the Bretton Woods institutions (World Bank, International Monetary Fund), which involved their disengagement from the transport sector (Godard 2002; Behrens et al., 2016), led to the further decline or inefficiency of existing public transport services in most countries (Lombard, Steck, and Cissokho 2013; Lombard and Ninot 2012). In response to these challenges, privately owned paratransit services have become prevalent in nearly all African cities to address the mobility needs of urban residents (Boutueil, Lesteven, and Nemett 2020; Cervero and Golub 2007).

Meanwhile, the process of digital transformation began in Sub-Saharan Africa with the widespread adoption of mobile phones, later followed by smartphones, thus facilitating communication, as well as the proliferation of digital platforms (Akindès and Kouamé Yao 2021; Boutueil and Aguiléra 2018).

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Since the 2010s, large African cities have witnessed a remarkable development in smartphone-enabled transport services for daily mobility (Boutueil and Aguiléra 2018). The mobility practices of users are reshaped by the emergence of digital platforms offering a range of mobility services such as navigation and travel aids (Acheampong, Agyemang, and Asuah 2023; Akindès and Kouamé Yao 2021; Quillerier and Boutueil 2021). Without endorsing a solution-oriented discourse, it can be argued that mobile technologies have the potential to bring about improvements in urban mobility systems in Africa through changes in mobility services and mobility practices, yet the sustainability impacts of said changes remain to be examined over the medium to long term (Boutueil and Aguiléra 2018).

While smartphones are widely used for transport in Africa, particularly by young city residents typically comfortable with digital technology (Acheampong, Agyemang, and Asuah 2023; Akindès and Kouamé Yao 2021), it is essential to recognise that young people face specific mobility challenges that are often overlooked. Several studies emphasise the difficulties young people, including students, face in accessing transportation, which can lead to financial constraints and spatial limitations (Luke 2018; Porter, Gina, and Jeff Turner, 2019).

Recent literature has started to document the adoption and use of smartphones in daily mobility in Francophone African cities (Akindès and Kouamé Yao 2021; Kassi-Djodjo, Gnankon, and Vakaramoko 2019). Other studies, conducted in both Anglophone and Francophone contexts, specifically investigate the practices and use of taxi digital platforms, revealing their popularity among urban, young and educated populations (Acheampong et al. 2020; Fenton, Wafer, and Jennifer 2020; Sagna 2019). Yet, the majority of research on the topic so far has focused on English-speaking cities only. However, this literature remains limited for cities in Central Africa, including Kinshasa, despite it being one of the largest cities in the region (Longondjo 2015). One factor is the difficulty in accessing local literature and the lack of interest from international researchers, likely due to the challenging conditions in the city (Kayisu, Joseph, and Kyamakya 2017). Thus, this paper contributes to the scientific literature on digitalisation's effects on the mobility of young people in Sub-Saharan African cities, and more generally on the mobility practices in an insecure and burdensome environment missing adapted transport infrastructures.

In many respects, Kinshasa is an interesting place to study the effects of digital technology on mobility. As the capital of the Democratic Republic of Congo (DRC), with its 16 million inhabitants, the city has recently witnessed the introduction of international e-hailing platforms such as *Yango* and *Heetch*. Despite the numerous challenges related to digital access, including the cost of mobile credit, frequent power outages, and network limitations (Pype 2021), Kinshasa is expected to experience an increase in smartphone ownership, with a national penetration rate for mobile subscriptions reaching 50.9% in 2022 (ARPTC 2022), and the ongoing deployment of 4G and 5G networks in Kinshasa (Pype 2021). To minimise the costs of accessing telephone calls and mobile data, which are essential for utilising digital platforms and social media, many residents of Kinshasa have developed strategies such as using multiple phones or one phone with multiple SIM cards from different operators (Ayimpam 2014; Pype 2017).

The limited deployment of digital technology is paradoxical given that the DRC is a significant source of essential components (e.g. coltan, cobalt) for manufacturing digital equipment (Gallagher 2020). Due to its mobility challenges, insecurity, and the introduction of e-hailing services, Kinshasa is a relevant case study for studying the adoption of digital technology in student mobility (Malukisa 2018; Yoka and Pierre 2021). The choice to focus on students at University of Kinshasa (UNIKIN) is based on research conducted in African cities, which suggests that digital-based mobility services are primarily used by educated urban youth (Acheampong et al. 2020; Sagna 2019). Moreover, students are easily accessible for survey recruitment.

The methodology is based on a case study as a type of qualitative research, triangulated with participant observation, aiming to observe the commuting and digital practices of university students in Kinshasa, at a microlevel.

Firstly, this paper aims to observe how students in Kinshasa demonstrate resourcefulness and adaptability in response to transportation and security challenges, engaging with the concept of

'mobility capacities', which signifies the acquisition of skills for mobility (Kaufmann, 2003; Stock 2006). More specifically, it explores 'emotional management capacities' and 'procedural capacities', related to the ability to manage emotions and adapt to varying conditions, enriching the literature in this regard (Le Breton 2015). Secondly, this paper seeks to analyse the adoption and use of smartphones and digital services by Kinshasa's students for their commute. These objectives lead to the central question: How do students adapt their practices and utilise smartphones to navigate and overcome challenges related to their commuting and fear of insecurity?

Background

In the face of inadequate transport supply in relation to demand in several African cities, including Kinshasa, adaptability and resourcefulness have become common practice in the population for day-to-day mobility purposes (Ayimpam 2014; Yoka and Pierre 2021). Every day in Kinshasa, people have to figure out how to get around while dealing with insecurity, transport problems and traffic (Malukisa 2018). Fear about moving in public spaces can lead to anxiety, restrict mobility, encourage avoidance of certain areas, and prompt the development of strategies like changing clothing choices, all of which impact people's travel behaviour, and overall limit life opportunities (Hidayati, Tan, and Yamu 2020; Listerborn 2016).

Flouriot (2013) observed among the population of Kinshasa a 'remarkable adaptability and faith in the future', despite the multifaceted and pervasive poverty faced by a majority (Longondjo 2015; Sen 1999). This 'resourcefulness' (or 'art of makeshift') has been described in the literature as the constant reinvention of means to survive (Yoka and Pierre 2021). Indeed, the people of Kinshasa demonstrate ingenuity and creativity in tackling the deficiencies of the State by developing an informal economy, constantly finding creative solutions (Braun 2018), and placing significant importance on solidarity and thus on developing social networks (Longondjo 2015).

Yoka and Pierre (2021) drew a parallel between the 'art of makeshift' and the trendy concept of *Smart City* by writing: 'Confronted with the prevailing circumstances, Kinshasa's residents exhibit resilience. They frequently encounter paradoxical situations. […] Necessity fosters ingenuity. They choose repair over disposal, engage in exchange, and pass on 'Do It Yourself' knowledge… the principles of what's currently referred to as a 'smart city' have been active in Kinshasa for quite some time. Local solutions addressing global chaos.' In the face of government failures, the art of makeshift has become a general mindset in Kinshasa (Ayimpam 2014).

The strategies of the population with regard to resourcefulness and adaptability in daily mobility in Kinshasa resonate with studies revolving around 'mobility capacities' (Kaufmann 2003; Stock 2006; Baffi 2017; Flouriot 2013). According to Le Breton (2015), 'mobility capacities' consist in advanced psychomotor abilities, skills in 'reading' the organisation of spaces, mastery of social times, and respect for the many and varied social norms that govern everyone's access to the territories of everyday life. Individuals acquire three types of mobility capacities from their family, schooling, and past mobility experiences:

1. 'Operational capacities,' which enable them to perform a movement (e.g. following a route, assessing a distance);
2. 'Emotional management capacities,' which imply the ability to handle feelings and emotions like stress or fear;
3. 'Procedural capacities,' which consist in the ability to adapt to different conditions, spaces, or populations.

The concept of 'mobility capacities' establishes a link between daily mobility and social stratification, as not all individuals have the same ease in acquiring skills for mobility depending on their background (Le Breton 2015), nor does everyone enjoy identical access (Fol 2009;

Mawussi 2020). From this perspective, social exclusion can be seen as the relative lack of capacities needed to access opportunities and social networks (Sen 1999; Van Dülmen 2022).

The main issue with this approach is that it assumes that improving an individual's navigation, emotional regulation, or adaptability, automatically makes them more capable of mobility. While movements were not solely determined by competence, mobility also reflected individuals' aspirations and perceptions. People might have all the conditions to move but remain immobile because their goals or ideas do not encourage them to move (Kellerman 2022). Ureta (2008) conducted a study in Santiago, Chile, where he observed that low-income families primarily use their mobility capacities for essential trips (professional, educational), and often avoid less prioritised trips due to cost constraints.

Today, the global phenomenon of digitalisation, fostered by the increasingly widespread adoption and use of smartphones and social media, has profoundly reshaped customs and practices across various aspects of life, including mobility and social interactions (Akindès and Kouamé Yao 2021; Hannam, Sheller, and Urry 2006; Porter and Turner 2019). While the literature has demonstrated that the widespread use of smartphones tends to reproduce social and gender inequalities in Africa (Akindès and Kouamé Yao 2021; Kohnert 2021), it is also argued that it could lead to emancipation, particularly for women (Fogue Kuate 2020). 'Resourcefulness' as a capacity can also leverage technologies like smartphones, to access services that support 'mobility capacities' such as navigation or taxi platforms (Pasini 2021). These technologies have the potential to facilitate mobility and reduce perceived insecurity (Boutueil, Lesteven, and Nemett 2020; Pasini 2021).

Research on digitalisation in the context of African cities is growing, driven by the rapid adoption of smartphones and the proliferation of digital services on the continent. In the 2000s and 2010s, studies emerged on the impact of mobile phones on various aspects of daily life in sub-Saharan Africa, including mobility. These early studies often adopted a livelihoods approach, aiming to understand how mobile phones can improve people's access to resources (Said Sife, Kiondo, and Lyimo-Macha 2010). Some publications questioned the revolutionary impact of mobile phone use at the individual level (Alzouma 2008), as well as its effects on the performance of transport systems at the policy level (Aguilera and Boutueil 2019; Klopp, Delattre, and Chevre 2019).

Since the late 2010s, research has evolved toward examining digital mobility platforms, which provide users with more reliable on-demand transport options (Cirolia et al. 2023; Quillerier and Boutueil 2021). Failures in adoption were also observed, such as the *Safemotos* app in Rwanda (Boutueil and Lesteven 2024). Generally speaking, research on the digitalisation of transport and mobility is more extensive and established in East, West, and South Africa compared to Central Africa, largely because strategies to modernise transport with digital tools were implemented earlier (Quillerier and Boutueil 2021).

Despite the increasing research focus on many African cities, the literature on digital transformation, particularly in mobility, remains underdeveloped in Kinshasa. This is partly attributed to the relatively slow development of service digitalisation in the face of various types of challenges, alongside the observation that university research remains mostly locally published. In a series of papers, Katrien Pype (2021) explored the adoption of mobile phones in Kinshasa, highlighting challenges such as costly mobile credit, frequent power outages, and network limitations. In response, people have shown creativity in developing strategies such as using multiple SIM cards to access promotions and reduce communication costs (Akindès and Kouamé Yao 2021). The integration of smartphones and digital platforms into resourceful strategies is growing.

Thus, this paper takes part in this ongoing reflection on digitalisation as a transformative practice. It contributes to the growing literature on the effect of smartphones on mobility practices in urban Sub-Saharan Africa. This study also intends to identify and address the challenges related to insecurities and fears in daily mobility. It thereby contributes to the research on 'emotional management capacities' (Le Breton 2015), by examining the example of students who commute daily to the university, face mobility challenges, and hypothetically use

smartphones to support their mobility. This study aims to enrich the literature on digital transformation in a highly challenging urban environment such as Sub-Saharan African cities, which are understudied compared to 'northern cities'.

Research context and methods

Context of the transport supply in Kinshasa

With an annual growth rate of 4.4% and an area of 996,500 hectares, the city-province of Kinshasa is currently the second-largest city in Africa, and the thirteenth largest globally, with over sixteen million inhabitants (Ministère du Plan 2023; World Population Review 2023). Due to obsolescence and low maintenance, the city's entire road network faces challenges such as a lack of paved roads, hectic traffic and accidents, especially during the rainy season (He et al. 2021; Kayisu, Joseph, and Kyamakya 2017). Asphalted roads are concentrated in the city centre, mainly in the municipalities of Gombe, Ngaliema, and Limete, whereas residents of the peripheral municipalities have to contend with unpaved and poorly maintained roads (Malukisa 2017).

As of June 2023, Kinshasa offers a diverse range of transport options, from mototaxis to buses (Malukisa 2019). Individual motorised modes remain very limited due to the lack of financial resources of residents (Ministère des infrastructures and travaux publics et reconstruction 2019). While a public transport system exists, transport services are mostly provided by multiple private operators (Malukisa 2017; interview with a transport and mobility researcher, 10.03.2023).

In 2013, the public establishment 'Transports au Congo' (TRANSCO) was created by the Congolese government to provide road transport for people and goods (Malukisa 2017). At the time of this study, it was the official provider of public transport in Kinshasa. The authorities established the *Spirit of Life* programme in 2014 in reaction to the lack of safety of privately operated minibuses, commonly referred to as the 'spirit of death' due to their poor safety. This programme consisted of selling minibuses in good condition on credit to private operators as long as they met certain conditions, such as belonging to a drivers' association (Malukisa 2017). However, with only three hundred fifty buses and minibuses and nearly four million trips made per month in 2017, TRANSCO and *Spirit of Life* could not offer Kinshasa residents a satisfactory transport service (Ministère des transports et voies de communication 2017).

In March 2023, the government launched *TransAcademia*, a national bus service providing transport through digital platform for students in all their academic activities: commuting to the university, doing internships, visiting cultural sites or libraries (Interview with a manager at TransAcademia, 27.06.2023). To access the service, students had to install the digital platform onto their smartphones and visit a designated point on the university campus for identity verification and receive the *TransAcademia* card. The card cost one dollar, payable in cash at the designated point or through mobile money services (e.g. *Airtel Money*, *M-Pesa*).

After receiving the card, students had to select the package that best suited their mobility needs. Seven packages were offered, ranging from a daily package of CDF 1,000 (around USD 0.42[1]) for two trips to a monthly package of CDF 58,500 (around USD 24.89). To access the service, students had to go to the dedicated *TransAcademia* bus stops and show their cards to be checked by the verifier at the bus entrance. Public transport services (e.g. TransAcademia, TRANSCO, *Spirit of Life*,) in Kinshasa follow pre-established routes, and drivers are not allowed to deviate from these routes. The fare structure is set by the Ministry of Transport and Communication (CDF 500 (around USD 0.21) per trip). Drivers are prohibited from charging passengers more than the regulated fare, unlike those operating for the private sector (Malukisa 2017; interview with a manager at TransAcademia, 27.06.2023; interview with a researcher specialised on digital mobility platform, 29.06.2023).

In Kinshasa, private paratransit services of various forms, constituted the main available transport options, compensating in the supply gap left by public operators (Malukisa 2017).

During the fieldwork in June 2023, the predominance of mototaxis was observed in the transport landscape. Additionally, it was observed that three-wheelers have recently appeared on the streets of the capital (interviews with the students and experts). Besides, minibuses of various kinds, locally called *Spirit of Death* or *207*, operated on both main and secondary roads. Despite their average capacity of around twelve individuals, these minibuses often carry up to twenty passengers (Malukisa 2017).

Shared taxis, locally referred to as *ketch*, have received little to no attention in the literature. Observations during the fieldwork enabled us to describe them as small Toyota cars (e.g.: IST or Starlet models) offering taxi services, with shared rides with four passengers or more. *Ketch* was associated with the prevalence of kidnappings, which could occur at any time, day or night (interviews with the students and experts). In addition, the digital platform *Yango* started offering ride-hailing services, connecting customers to drivers via a smartphone app, since 2022. *Yango* operated on top of traditional taxis, mostly in central municipalities (interview with a manager at *Yango*, 21/03/2023). The French taxi digital platform *Heetch* made two attempts to establish a presence before finally leaving the capital in March 2023, for reasons undisclosed by the platform (interview with manager at *Heetch*, 18/04/2023).

This diverse variety of transportation options reflects the complex mobility landscape in Kinshasa. However, insecurities, ranging from road accidents and common robberies to kidnappings and murders, add another layer of challenges that directly impact mobility capacities by necessitating new mobility strategies, increasing immobility, and intensifying fear (Yoka and Pierre 2021).

Methods design

This qualitative study is based on semi-structured interviews with students from UNIKIN, and experts in the field of transport and mobility, as well as participant observation. The choice of focusing on students was motivated by the understanding that students' living conditions, including their mobility strategies, can reflect their socio-economic status, as they often rely on their family's financial support. Additionally, as most students belong to younger generations, they are more likely to own smartphones and adopt new practices related to digital platforms (Acheampong, Agyemang, and Asuah 2023). We therefore investigated the potential effect of smartphone usage on students' commuting patterns. The home-to-university commute was chosen because we assumed it was the most common journey carried out by students in their daily lives, which was later confirmed by our interviews.

Regarding the choice of university, the decision was made to concentrate our research on students at UNIKIN, the largest public university in the country, which attracts students from diverse socio-economic backgrounds (Lututala 2012). This diversity stems from the university's lower entry fees compared to private institutions and the selectivity of programs like medicine and mathematics, which attract students from wealthier backgrounds (Lututala 2012; interview with several researchers).

The study initially focused on female students to better understand female mobility, particularly considering the safety concerns often associated with women. (Listerborn 2016). However, shortly after commencing the fieldwork, it appeared that insecurity in Kinshasa affected everyone emotionally, regardless of gender. Consequently, we decided to adapt the scope of our study and opted for a sample with an equal number of male and female students. This approach enabled us to compare and analyse potential gender-based differences, ultimately increasing our understanding of perceived insecurity in mobility and associated coping strategies.

Our objective was to obtain a highly heterogeneous sample regarding factors such as age, gender, place of origin, year and field of study. Within each of the thirteen faculties that compose UNIKIN, the interviews were conducted with two to ten students, considering the varying size of the faculties. Support of each faculty administration of UNIKIN was obtained to select a diverse group of students and identify quiet areas for conducting individual interviews. Most of the interviews were recorded,

unless a participant refused. Detailed notes were taken during the interviews and completed by the recordings to ensure greater precision. To guarantee voluntary participation, the students were asked for their consent before each interview. Since no sensitive data was collected and the names were pseudonymised using common congolese names, the participants were not required to sign the consent document shared with them for prior information.[2]

In total, fifty-two students were interviewed, with an equal gender distribution. The students ranged in age from eighteen to forty-three years old, with a median age of twenty-three. They were enrolled in various grades, ranging from the first year of study to the sixth. Twenty-nine of the interviewed students originally came from Kinshasa, twenty-one students from other DRC provinces, and two students from Cameroon (neighbouring country to the northwest of the DRC). Selection of these students was based on non-probability sampling.

The interview plan was elaborated according to standard practices in qualitative surveys in social sciences (Paillé and Alex 2021) and divided into four parts:

1. Practices and perceptions of daily mobility during the day and night;
2. Usage of (smart)phones linked to mobility practices;
3. Safety perceptions and potential mobility limitations;
4. Profile data related to studying conditions.

As a projective technique, the questionnaire was accompanied by a city map enabling the students to expose their living area pointing out their area of residence, their commuting trips, and the places they avoid for safety reasons. This method enabled the reconstruction of daily mobility tracking maps to better assess the students' appropriation of geographical space and analyse their daily commuting patterns.

Besides conducting student interviews, we also engaged with fifteen experts, varying the level of formality of the meetings. Managers from *Yango*, *TransAcademia*, *Heetch*, and *Digital Kinshasa* were interviewed to gain a better understanding of the context of digital transformation in Kinshasa related to mobility and transport. Additionally, interviews were conducted with several researchers specialising in fields such as anthropology, criminality, law, sociology, transport politics, and urban planning in DRC. The aim was to gain deeper insights into the fieldwork and its specificities. A total of nine expert interviews were conducted online, while six were carried out in person. In-person interviews provided room for more informal conversations which enhanced our understanding of local context.

Due to time restrictions, the research team dedicated three weeks to on-site fieldwork in June 2023, during the dry season, to conduct the interviews and observe the urban and social environment. While extending the study to include the rainy season could have been beneficial for more comprehensive research, the constraints guided our focus on maximising the use of available resources and opportunities, considering the city's complexity. Participant observation was conducted through testing different modes of transport at different times and assessing the functionality of digital platforms. The goal was to get a better grasp on the conditions of the student commuting experience. After the fieldwork, three months were spent analysing the interview material.

Results

Adaptability of student mobility practices in response to transport and safety challenges

Based on the interviews, it was concluded that the students had two main concerns related to their mobility. Their first fear was about encountering dangerous situations, while their second fear was about experiencing delays, whether when heading to university in the morning (as it

could result in professors refusing them entry) or when returning home at the end of the day. These two fears were interconnected as students worried about ending up in a dangerous situation due to delays and feared being delayed because of a potential danger. We observed that these two fears were related with two aspects of transport: the lack of reliability of transport services and the lack of safety in public spaces, both of which significantly affected the respondents' mobility.

Complex mobility behaviours in response to transport challenges

Out of fifty-two interviewed students, only twenty-one students had vehicles in their household, which belonged to their parents in almost all cases. However, vehicles were rarely used by the students for commuting to UNIKIN for lack of availability. For instance, Simon rented his motorbike to a mototaxi driver, and Emmanuel's parents were prioritised in car usage. Accordingly, most of the students relied on public transport or paratransit services for their commuting needs. Issues such as insecurity and road problems, including heavy traffic, frequent accidents, and police checkpoints, were omnipresent. These challenges resulted in complex and arduous commutes (see on Figure 1), especially for students living further away.

Figure 1 illustrates examples of students' commuting experiences. The following section describes the specifics of their journeys. Hélène, residing in Mbudi, had a commute that took between 2.15 to 2.45 hours, involving four modes of transport: mototaxi, *ketch*, *207* minibus, and public buses (TRANSCO or *TransAcademia*) (see on Figure 1). Her costs ranged from CDF 3,000 (around USD 1.22) to CDF 6,000 (around USD 2.44) each way. Charlotte from Gombe typically commuted by *ketch* and mototaxi at a cost of CDF 7,500 (around USD 3.04) to CDF 10,000 (around USD 4.06) each way (see on Figure 1).

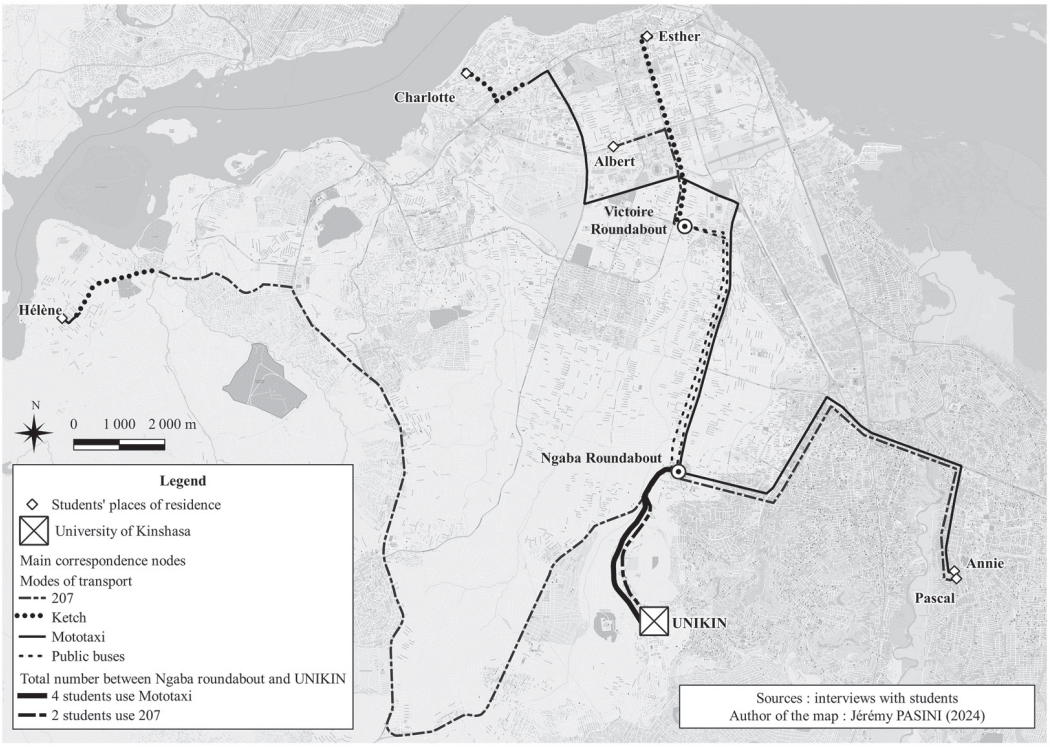

Figure 1. University student mobility in Kinshasa: a complex combination of transport modes.

It is important to note that mototaxis were banned in the city-centre of Gombe since January 2014 (Malukisa 2018), leaving *ketch* as the only available means of transport. The reasons for the ban included the intention to improve the city's appearance and ensure better security in this economic, political, and tourist centre. Whenever Charlotte required a mototaxi, she had to contact a familiar driver who would discreetly pick her up.

Esther, also a resident of Gombe, had various commuting options that provided flexibility in case of delays or price fluctuations. The first option was to take a *207* minibus to the Ngaba roundabout before transferring to another *207* minibus or a mototaxi to save time. The second option was to take a *ketch* to the Victoire roundabout and connect to a TRANSCO bus directly to UNIKIN (see on Figure 1). Her costs ranged from CDF 5,000 (USD around 2.03) to CDF 7,500 (around USD 3.04) each way. Her commuting generally required one to two hours, while Charlotte, who opted for faster but more expensive modes of transport, could complete the journey in about one hour.

Albert, residing in Lingwala, also had various commuting options. Similar to Esther, he could take a *207* minibus to Victoire and then transfer to a TRANSCO bus (see on Figure 1). Alternatively, he could go to the Ngaba roundabout by *207* minibus and then take a mototaxi. Another option was to go directly by mototaxi to the campus. This option costed CDF 3,500 (around USD 1.42), when for the same trip using public or private buses the price was approximately CDF 1,500 (around USD 0.61). Sometimes, Albert has to walk either due to heavy traffic or because he lacks money. He explained: 'Sometimes, there is too much traffic, and I am forced to walk from Limete. It's difficult to get around. My journey to the university can take over two hours by road. […] Sometimes, I don't have money, so I walk to the university'.

To reach the university, inhabitants of N'Djili such as Annie and Pascal had to cross one of the two highly congested bridges (see on Figure 1). They adopted different strategies. Pascal opted for a combination of *207* minibuses and mototaxis, costing about CDF 2,000 (around USD 0.81 and taking more than one hour and fifteen minutes. While Annie opted for a single mototaxi, completing the journey in around forty minutes, but with a higher cost of CDF 5,000 (around USD 2.03). Thus, Annie travelled almost twice as fast but spent more than double the amount compared to Pascal's commute.

Overall, most students preferred travelling with mototaxis, regardless of their place of residence, due to their faster speed and ability to navigate through traffic. For some, they suffered from a lack of options due to the inaccessibility of their place of residence (e.g. narrow and muddy paths), forcing them to use motorcycle taxis who sometimes charged monopoly prices. Out of the fifty-two interviewed students, forty regularly used mototaxis.

Their usage varied depending on the types of journeys. While a few students with higher financial means opted for direct 'express' mototaxis such as Annie for relatively long distances, it was more common for students to change mototaxis at crossroads to reduce fare costs, as observed with Charlotte. Mototaxis drivers usually transported two passengers on a single ride, unless the first passenger agreed to pay double the fare for the exclusive use of the vehicle for longer distances.

For most students, mototaxi rides were a necessity driven by the fear of being late or by the lack of alternative transport due to narrow or non-paved roads (participant observation). In the morning, mototaxis were selected to ensure punctuality, while in the evening, they were used to quickly return home and to avoid potential insecurity. André, residing in the reputed dangerous municipality of Masina, expressed the necessity of arriving home prior 10 p.m., sometimes forcing him to select the pricier yet quicker 'express' mototaxis.

During our analysis, it was observed that to reduce long commuting, a strategy was to rent accommodations near UNIKIN. It appeared more common among male students than female students. In total, eleven male students rented accommodations either on their own, with their siblings or friends, or within a religious community. In contrast, only five female students lived away from their families and rented a place with their siblings or other relatives, but never alone. The reasons for this choice were multifaceted, with safety considerations and cultural norms being two of them.

Students demonstrated resourcefulness and adaptability in response to the challenges of commuting in a complex and demanding context. They adjusted their mobility strategies according to diverse factors such as weather conditions, traffic levels, transport availability, safety, financial resources, or time of the day. This showcased strong procedural capacities among the interviewed students, enabling them to deal with highly challenging commutes. During the interviews, a strong motivation to attend university was detected. One of the interviewed professors explained: 'Many students might have money for transport, but not for food. They don't eat. They think: 'Today I'm hungry. By going to the university, tomorrow I won't be hungry." They perceived the university as a way to offer a better future. Such motivation of succeeding at university pushed the students to commute despite the challenges they daily face, demonstrating undeniable emotional management capacities.

Adaptability and 'art of makeshift' in response of safety challenges lack of safety in public spaces

Insecurity in Kinshasa emerged as a major concern for the interviewed students. Most interviewees noted that safety levels varied across municipalities, with areas considered unsafe even during the day, while others were perceived as relatively safe even at night. Interestingly, both male and female students expressed common apprehensions, highlighting the same municipalities they perceived as dangerous areas. The top three municipalities most frequently mentioned as unsafe were: Makala, Kisenso, and Masina, likely due to the prevalence of various criminal activities. The students also pointed out that the level of insecurity varied across different areas within these municipalities.

Interviews with experts, especially professors specialising in criminality, provided an understanding that danger often developed in obscure areas with frequent power outages, although not exclusively. There were also instances of criminal incidents occurring during daylight hours (Figure 2).

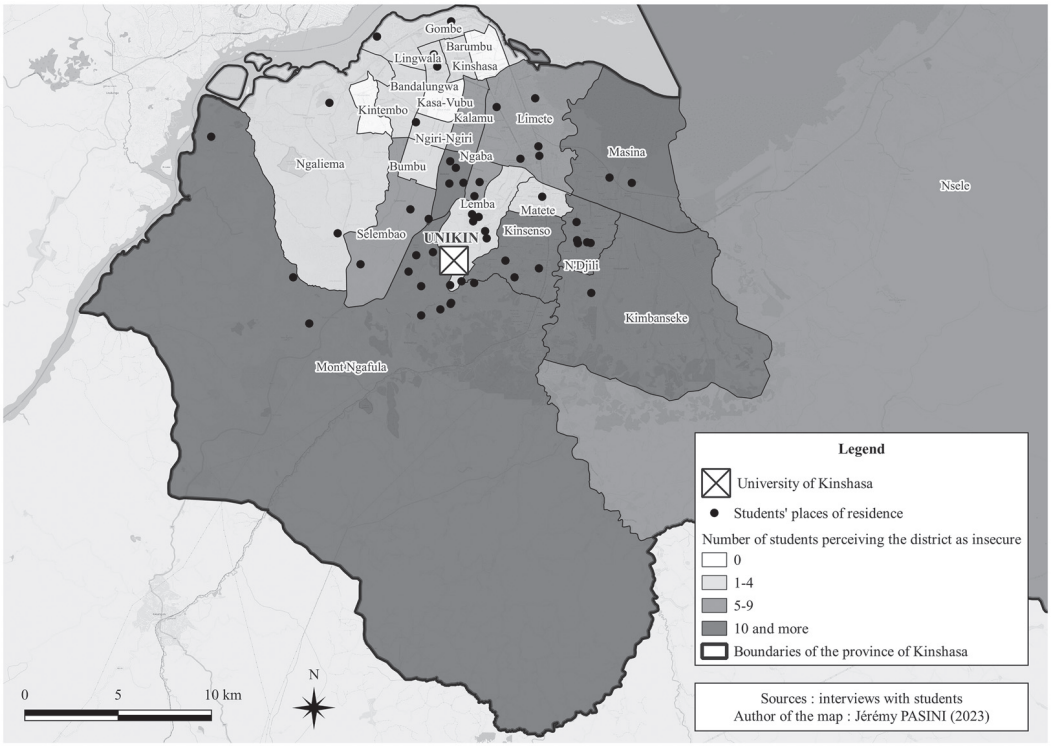

Figure 2. Municipalities ranked as the 'most dangerous' by the interviewed students.

As illustrated on Figure 1, the municipalities perceived as unsafe by the interviewed students were nearby UNIKIN. This instilled fear among the interviewees, particularly when they had to return home late in the evening or at night. It is important to note here that it was the arrival of darkness brought by sunset that determined when the students would start to feel insecure. This situation frequently happened when they were studying after class at the library or if they had faculty events. Albert frequently studied late at the campus library due to noisy conditions at home, and felt scared while coming back home: 'Sometimes I stay over until 2 a.m. It happens quite often, especially during exam periods. Usually, I stay at the library until 10 p.m., and then I have to go home. The studying conditions at home are not good, so I study at the library. When I return home, I avoid certain places to protect myself. I am afraid. It is easy to lose your life in these places.'

In the interviews, three main types of insecurities that generated fears among the students could be distinguished, whether in terms of being in danger, or being delayed. The first and most common insecurity involved thieves stealing phones, bags, money, vehicles, and even wigs. The students shared various strategies to avoid theft such as using crossbody bags and refraining from using smartphones in public spaces, particularly in crowded areas.

The second insecurity involved groups of relatively young individuals armed with machetes and razors, engaging in extortion and violence against people. These groups, locally named *Kulunas*, were reported to be more active at night and to be located in specific neighbourhoods, mostly in the peripheral municipalities of the city, but also in certain areas near UNIKIN (see Figure 1). During the interview, most of the students mentioned their fear of meeting with *Kulunas* showing how impactful this threat is. Emmanuel expressed: 'Several times, I've witnessed assaults committed by the *Kulunas*. Some of my former friends are now Kulunas.'

The third insecurity that instilled fear in the students was related to kidnappers who mostly used *ketch* to carry out kidnappings. Victims were often discovered drugged, robbed, and left in various parts of the city. During her interview, Charlotte related her sister's kidnapping: 'My sister was kidnapped around 6:30–10:00 PM on Boulevard du 30 Juin. They took everything from her. She filed a complaint with the police, but the police did not react. It seemed like they knew these criminals.'

Out of the fifty-two interviewed students, one experienced an attempted kidnapping while five others had witnessed kidnappings, whether involving a friend or a family member. According to the interviewees, such incidents appeared to be relatively common, particularly because kidnapping could occur at any time of the day. It is important to note that this list is not exhaustive, as other forms of criminal activity, including cases of rape, were also reported during the interviews.

Interestingly, fear levels and the impact of safety issues did not necessarily correlate with the students' residential areas but were mostly influenced by their personal experiences, the experiences of those around them, and what they saw in the media (including social media). In the interviews, the fear of road accidents was constant, regardless of the selected transport mode, due to their recurrence. Several of the interviewed students related accidents they had experienced or witnessed. However, they did not seem to adopt any specific strategy to address this concern, except when selecting drivers.

During their commutes, the students felt anxious. Most of them tried to reduce insecurity risks by avoiding certain areas and being cautious about the areas they passed through, by carefully selecting their modes of transport and drivers, or by keeping an eye on the time. Out of the fifty-two surveyed students, thirty-nine had strategies for selecting their drivers and/or vehicles, particularly when they opted for mototaxis. Of these, ten students, including seven women, had trusted moto taxi drivers whom they would call when they needed transportation services, meaning drivers they knew and regularly travelled with.

Emmanuel explained: 'I have about seven trusted drivers. If none of them are available, then I prefer to walk for 35 minutes instead of riding for 8 minutes on a mototaxi.' For the others, an

observation phase of the drivers and/or vehicles based on perception was first carried out before making a choice. 17 students opted for drivers who appeared older (e.g. a man of around fifty), believing they would have better driving experience and would be less threatening. But others had different criteria. For instance, Simon chose younger drivers because he found them less distracted and less prone to accidents. Overall, the students stayed vigilant and avoided drunk or rude drivers.

Nevertheless, the students continued to commute despite the risks of insecurity and their perceptions of danger, by developing conscious strategies to overcome their fears and respond to any potential challenges. Travelling in groups was a commonly adopted strategies, but mostly for late-evening trips. At a personal level, they had to manage their fear and stress to successfully commute by developing a high level of vigilance, directly related to their emotional management capacities.

Digital adoption and usage of smartphones to commute

As smartphones had become an integral part of many people's daily lives, their use had the potential to impact mobility behaviour. In Kinshasa, although the adoption of smartphones among younger generations was widespread, their use appeared to be limited, especially for mobility purpose. Digitally-enabled transport services (e.g. *TransAcademia*, *Yango*) were introduced by both private and public operators to offer innovative transport options for everyone, including students. However, their integration into the complex mobility behaviour of students appeared almost non-existent.

Snapshot of smartphone use in students' mobility

Excluding Thérèse, who had her smartphone stolen, all of the fifty-two interviewed students possessed at least one smartphone. In addition, twenty-eight students used multiple SIM cards. The reasons for having multiple smartphones and SIM cards could be attributed to various factors. For the majority, it enabled to access different networks, facilitate improved internet connectivity, and allow for more cost-effective communication by using the same operator network as their contacts. Several of the students highlighted challenges associated with smartphone usage such as: lack of network coverage in certain areas, charging problems due to electricity shortages, high cost of credit units, low connectivity, and poor quality of smartphones. Most students used their smartphones for communication via social networks (e.g. *WhatsApp*, *Facebook*, *Snapchat*) and for conducting *Google* searches.

When examining the influence of smartphones on students' travel safety, paradoxical responses were observed. On the one hand, the smartphone was perceived as a tool to inform relatives about potential dangers during journeys. Twenty-eight interviewees believed that the smartphone could be helpful in such situations, but none of them mentioned using tracking options. On the other hand, smartphones were also vulnerable to theft, particularly in crowded areas like Ngaba and Victoire roundabouts (see Figure 1), and could even trigger acts of aggression. As many as twenty-seven of the participants had experienced at least one phone being stolen. For some, this was a recurring event. As a result, there was a shared apprehension of smartphone theft. Three students explained that their smartphone could potentially serve as a bargaining tool in case of aggression. In contrast, for thirteen interviewees, the smartphone was perceived as risky, potentially attracting thieves.

Aside from the safety aspect, a total of twenty-four students, regardless of gender, recognised that the usage of their smartphone had an impact on their mobility. The use of *Google Maps* as a navigation tool was mentioned in twenty-seven interviews, with ten students using it for navigation, especially when they had to go to a place for the first time. Among these ten students, three were from other provinces of the DRC and two from Cameroon (Bernadette and Samuel).

The students who were not native to Kinshasa, thus lacking familiarity with the city's geography, appeared more inclined to use *Google Maps*.

Moreover, seventeen students mentioned having interacted with *Google Maps* before, either trying it once or multiple times, or as entertainment, like Joseph who played by zooming in and out on the map. *Google Maps* was also used by some of the students, such as Thérèse, for navigation and identifying potential escape routes. In total, twenty-five students never used *Google Maps,* as they did not perceive its usefulness, feeling familiar with the city. One possible explanation for the reluctance to use *Google Maps* was the observation that, in Kinshasa, *Google Maps* was relatively accurate in terms of roads, but lacked many points of interest, and did not recognise some areas (interviews with the students, participant observation).

During commutes, smartphones were also used by the students to contact trusted drivers. Charlotte could call two or three of them, or Antoine who contacted a trusted driver when he did not have enough money to pay for transport. Overall, the smartphone played a role in facilitating communication and organising daily activities. Simon, who had political responsibilities within UNIKIN, highlighted the importance of social media in planning his schedule and travel: 'I move around thanks to my smartphone because I get called, invited, or told to come to student delegate meetings. I'm always in touch with my family, my friends. They know where I am.'

Through the use of social media platforms, the smartphone kept students informed about course cancellations or schedules. Such information was particularly valuable for the students who lived a long distance from UNIKIN. Thus, the smartphone enabled the students to be reachable in some unsafe situations, but it seems to be an added source of fear and stress. Nevertheless, the lack of digital infrastructure, frequent power shortages, and the high costs of smartphones and mobile plans, limited the smartphone use, even as basic communication tools.

Existing yet underutilised digitally-enabled transport services

As described in the context of the transport supply (Section 2.1), at the fieldwork time, there were two main digital platforms providing mobility services accessible through smartphones: *Yango* and *TransAcademia* (interviews with the experts).

Yango, in operation for almost a year since its launch in July 2022, adopted an active marketing strategy, using numerous billboards across Kinshasa to promote its services. As a result, forty-three out of the fifty-two interviewed students surveyed were familiar with the platform's name. However, only five students had tried the service, but less than three times, whether for personal use or as accompanying passengers. While their experiences were generally positive, they found the service expensive. For instance, Francine had stopped using *Yango* after taking advantage of the initial discount offer for the first three journeys.

Overall, the students were not frequent users of *Yango*. Firstly, the service costed an average estimated price of CDF 1,200 (around USD 0.50) per kilometre with fluctuations according to traffic conditions and demand. Comparatively, one public transport trip costed CDF 500 (around USD 0.18). Secondly, although the *Yango* service was officially available across the entire city-province of Kinshasa, it had mainly been available in the northern municipalities, considered to be the city centre, due to the higher concentration of potential customers with sufficient income to afford the service. Municipalities close to UNIKIN, such as Lemba or Mont-Ngafula, had not been effectively covered by the digital platform (interview with a manager at *Yango*, 21/03/2023). Despite *Yango*'s emphasis on safety in its marketing campaign, with a taxi service enabling real-time tracking and voice recording during the ride, none of the five students who tested *Yango* had mentioned a noticeable improvement in safety perception when using the service.

TransAcademia was launched by the government in March 2023. This scheduled bus service officially aimed to facilitate subscription, ticketing, payment, and access to buses for all students

in higher education institutions in the DRC. It provided a digital platform for users to monitor their journeys (interview with a manager at *TransAcademia*, 2023). Regarding pricing, students could not purchase single tickets but had to select packages from a range of options, from daily to monthly subscriptions. However, the interviews revealed that many students managed their expenses, particularly those related to transport, on a day-to-day basis.

Moreover, the price differences between one *TransAcademia* trip (in the monthly subscription) and one usual bus ticket were minimal, of about 11% reduction. Following the *TransAcademia* system, each bus trip was counted as a deduction from their card. If a student rode two *TransAcademia* buses to get to the university, two trips would be deducted from the card. This meant that students who lived away from the university and therefore needed to use several *TransAcademia* bus lines to complete their travel had to opt for a package with a large number of daily trips, which resulted in a higher cost.

Once purchasing *TransAcademia* trips, the students were limited with their transport options, as they then had to wait for the TransAcademia buses which were not as frequent as other bus services, leading to increase travel times. Among the interviewees, only four students reported using *TransAcademia* either for their entire commute or, like Hélène, for specific trips to campus (see on Figure 1). Moise appreciated the service while visiting family at weekends due to consistent schedules and available seating. Hélène found that *TransAcademia* was a safer, more cost-effective, and direct service compared to other private options, though she noted occasional long waiting times up to two hours.

Only four students actively used the service, while others found it acceptable but not suitable for their needs. Béatrice was dissatisfied with *TransAcademia*'s inconvenient schedules, and Christine highlighted the unavailability in Limete, where she resided. Jeanne faced challenges accessing the service due to specific registration requirements, which included obtaining a student card she had not received because of the outstanding university registration fees. In UNIKIN, students have one year to complete the yearly registration fee, giving them access to the student card. Similarly, Thérèse expressed interest but was unable to use *TransAcademia* after her phone was stolen, as registration and necessary operations were facilitated through the *TransAcademia* platform.

Overall, none of the students have demonstrated a strong adoption for digitally-enabled transport services. This seemed mostly the result of the inadaptation of these services for student population.

Conclusion and discussion

The aim of this paper was to explore the role of smartphones on everyday mobility within the context of unreliable transport and significant urban insecurity. The study focused on the student population in Kinshasa as an illustrative example of how digital practices are adopted to cope with the challenging commutes. Our observation covers the commuting and digital practices of these students. The results were not intended to represent the entire student population but rather to showcase the growing influence of digital technology and the adaptability of this specific group.

Among the students, two primary concerns were identified: the anxiety of experiencing delays that might compromise their university studies and the fear of encountering dangerous situations. These fears were closely linked to two aspects of transport and mobility: the unreliability of transport leading to complex commutes and the lack of safety in areas surrounding the university that were perceived as 'dangerous.' It is worth noting that similar concerns and challenges were documented among young people in sub-Saharan African cities over two decades ago (Godard 2002) and were also observed among students in South Africa, where perceived insecurity gave rise to comparable anxieties (Fenton, Wafer, and Jennifer 2020).

To address the transport challenges, the students employed various strategies to minimise the risk of delays. Many opted for mototaxis, despite their higher cost, to ensure faster travel. Additionally,

some students, mostly males, relocated closer to the university to ensure relatively shorter and easier daily commutes. This result can be compared to the observations made by Mawussi (2020) in Togo, where men tend to have a dual residence to address transport issues, while women, in contrast, tend to remain confined to spaces near their primary residence. Overall, the students demonstrated resourcefulness and adaptability in selecting their modes of transport, considering factors such as travel time, financial means, and safety (Porter et al. 2023; Schwanen et al. 2015). Their strategies, which often involved a combination of different transport modes for the same journey, closely parallel the intermodality experiences observed among residents of Conakry, Douala and Lomé, as studied by the research group led by Diaz Olvera et al. (2016).

With regard to safety concerns, the students, regardless of gender, developed avoidance strategies such as avoiding certain transport modes, areas, night-time travel, or unknown drivers to protect themselves from distressing situations. In the students' representation, insecurity was multiple and originated from delinquents in public spaces and within transport, and from road accidents. Both male and female students demonstrated a shared interest in using smartphones as a tool to reduce travel risks, highlighting the potential role of digital technology in increasing travel safety. Smartphones were indeed used by a few to seek help in emergencies, reaching out to relatives for location updates, sometimes using *Google Maps* and *WhatsApp* to share routes and identify escape options if necessary. Paradoxically, the students unanimously agreed that openly using smartphones in public spaces increased the risk of theft and potential aggression. Thus, the smartphone added a source of stress and fear. These findings align with Pasini's (2021) research in Cameroon, which highlights the practice of using phones for guidance during trips and the associated risk of street theft due to smartphones being visible in public.

While there is potential for the development of digital practices, this potential is currently constrained by various factors, primarily the high levels of insecurity. Despite the presence of digital platforms offering mobility services in Kinshasa, the impact of these services on the mobility behaviour of the interviewed students was found to be low. For *Yango*, this limitation could be attributed to the high pricing set by the digital platform and the unavailability of the service in the peripheral municipalities where UNIKIN was located. For *TransAcademia*, the issue was primarily related to the inflexibility of the service in terms of pricing, waiting times, availability, and registration requirements. Overall, students used smartphones mostly as a communication tool (e.g. *WhatsApp*, *Facebook*, *SnapChat*).

We observed a rapid adaptability of the students in the quest to optimise travel time, price, and personal safety. They continuously adopted new strategies, some of which increasingly incorporated digital technology. Such constantly evolving practices demonstrated their impressive resourcefulness and, overall, emotional management and procedural capacities (Kaufmann 2003; Le Breton 2015). Such adaptability could be explained by the daily complex challenges the students faced. For instance, the fear led them to reactions, such as remaining immobile or developing strategies to travel despite the constraints, maintaining a certain level of spatial awareness to prevent and avoid dangers, as well as managing their stress and fear (Guinard 2015; Yoka and Pierre 2021).

From a theoretical perspective, this study enabled us to understand that mobility capacities are highly dependent on individual aptitudes, as well as on infrastructures and configurations (including the availability and accessibility of digital resources). While the existence of resources does not necessarily mean that they can be used to build mobility skills (Kaufmann 2003; Le Breton 2015), their non-existence limits the scope for building adaptability.

In upcoming research, it would be interesting to study why Kinshasa, despite its 16 million population and significant mobility needs, attracts fewer digital transport platforms compared to other African cities. Unlike other regions with emerging local platforms, Central Africa, particularly the DRC, lacks such initiatives. Is the DRC compatible with endogenous innovation? Have decades of political instability deterred market entry and negatively impacted the business climate? Further studies should observe how digital tool adoption affects mobility practices and evolves over time in this region.

Notes

1. USD 1 corresponds to CDF 2,350 according to the average exchange rate on the date of the study. (https://www.oanda.com/currency-converter/fr/?from=USD&to=CDF&amount=1).
2. In this study, the ethical principles applied in qualitative research were carefully respected with all interviewees, including the experts (Paillé and Alex 2021).

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Research ethics and consent

The objective of the study was clearly explained to each participant, and all participants provided their oral consent to take part in the research.

Credit authorship contribution statement

Pauline Baudens: Supervision, Conceptualisation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing.

Marie Hassen: Supervision, Conceptualisation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing.

Jérémy Pasini: Conceptualisation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing, Map design.

Ayité Mawussi: Conceptualisation, Methodology, Writing – original draft, Writing – review & editing.

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Data availability statement

Due to the nature of the research and ethical restrictions, supporting data is not available.

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The food delivery apps: a blessing for women?

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ABSTRACT

Technology could hold the promise of empowering women in reshaping daily practices and traditional gender roles. However, the potential effects of food delivery on women's daily practices and traditional cooking responsibilities remain mostly underexplored. This paper explores how women use food delivery apps to free themselves from the daily task of cooking, and the addictive risks of such technology. India, while widely regarded as a society with traditional values and strong gender role distinctions, is also one of the largest and fastest-growing digital markets globally, including for food delivery services. Therefore, an in-depth interview study in Pune, India, involving twenty-two women, was conducted to observe the dynamic shift in societal norms. The paper demonstrates how food delivery apps can provide a sense of liberation for some women, by partly relieving them of the daily burden of cooking, though without redistributing gender roles. However, the risk of experiencing a loss of control through the use of food delivery apps challenges the idea of gaining empowerment through these platforms, which are supposed to provide increased independence and decision-making power. Thus, the empowerment process appears to reach its limits when food delivery apps shift from assisting with cooking duties to causing a loss of control.

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Introduction

Digitalization has the potential to reshape practices and traditional gender[1] roles in patriarchal societies (Aagaard, 2023). The increasing popularity of delivery service apps has, at least in appearance, the capacity to support users in their daily duties, disrupting practices and traditions. By offering an alternative to cooking, food delivery technology may play an empowering role for women, who traditionally handle household responsibilities (Kumar & Shah, 2021).

In theory, technology, including digital advancements, holds the promise of empowerment (Ash et al., 2019; Hoan et al., 2016; Pei & Chib, 2021). While the literature suggests that digital platforms[2] have facilitated women's empowerment in domains such as employment,

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education, and entrepreneurship (Elwood & Leszczynski, 2018; Pei & Chib, 2021), these platforms do not consistently succeed in empowering women, particularly in the realm of household duties (Elwood & Leszczynski, 2018; Huws, 2019). The importance of this question arises for food delivery apps, a digital platform that may assist with cooking tasks or even serve as a substitute, freeing women from cooking responsibilities at specific times (Chaturvedi & Karthik, 2019; Natesan & Venkatesalu, 2020).

The literature on food delivery practices has recently started to expand, mirroring the widespread adoption of the apps (Raina et al., 2019). This body of research covers diverse perspectives, ranging from the adoption and practices of food delivery apps (Akter & Disha, 2021) to the working conditions of delivery personnel (Verelst et al., 2022) and the marketing strategies employed by operators (Kapoor & Vij, 2018). Despite all these, the social implications of integrating food delivery apps into household practices still lack comprehensive understanding. The increasing trend of ordering meals via smartphones undoubtedly creates changes within households, particularly in cooking activity, depending on how often the apps are used and for what purpose (Kumar & Shah, 2021; Wen et al., 2022). Thus, this paper contributes to the literature by exploring the effects of digital platforms on traditional practices originating from patriarchal beliefs. By analyzing the effects of food delivery apps on women's empowerment—understood as a multidimensional process that leads to increased autonomy, independence, and decision-making power (Malhotra & Schuler, 2002)—the study not only highlights the potential for empowerment but also sheds light on experienced deviations in behavior caused by the adoption of such technology. This aspect has also not yet received sufficient attention in the literature. Research on women's use of digital platforms is relatively recent and often underestimated although women's digital practices commonly differ from men's (Pei & Chib, 2021; Wajcman, 2000). Closely observing the evolution of women's practices is essential for understanding technological bias and digital utility.

Hong et al. (2021) define online food delivery as a service that enables users to order food through a website or an app. Within online food delivery, two types of services stand out. The first type aggregates restaurants (e.g., Swiggy, Zomato) offering a variety of food options (Saad, 2020), while the second type focuses on specific restaurants (e.g., Domino's Pizza app) (Kapoor & Vij, 2018). In this research, we focused on food delivery services of the first type, where restaurant meals can be ordered through a mobile app. This is because such services were more commonly used by the interviewees and were more frequently observed during fieldwork.

As a starting point for our reflection, food delivery plays an essential role in reshaping practices (Natarajan et al., 2019), but the novelty of food delivery apps is not in the act of using delivery services despite the constantly increasing pressure for faster service. It is in the convenience of ordering using a well-designed, easy-to-navigate app. The simplicity of the ordering process, together with attractive pricing (e.g., discounts) and food choices, can motivate a desire to order more frequently, which can partly explain the emergence of behavioral addictive effects, thereby challenging the empowering process (Kapoor & Vij, 2018; Wen et al., 2022). In this study, the term "behavioral addiction" should be understood as excessive and uncontrollable behaviors, experienced as such by the interviewees themselves and not medical experts (Gordon et al., 2018).

The methodology is based on a qualitative research approach using semi-structured interviews. A total of twenty-two full-time employed and/or student women in Pune,

India, were interviewed about their cooking responsibilities and usage of food delivery apps (Saad, 2020; Vecchio et al., 2014). The interviews provided insights into a diversity of experiences and changes in daily practices to better understand the role that food delivery apps play in the women's lives.

The Indian case is particularly relevant, given the long-standing tradition of food delivery services like the Dabbawallas, who have been delivering meals prepared by wives for their husbands at work in Mumbai since the 1890s (Ray et al., 2019). While this service is not the only one of its kind in India, it holds historical significance. Over the past decade, meal delivery apps such as Zomato, Swiggy, and others have emerged in the Indian urban market, which is one of the largest business markets worldwide (Raman, 2018). These apps are mostly accessible to certain socio-economic backgrounds due to financial costs and the necessity of digital literacy (Ray et al., 2019). While the adoption of digital platforms is rapidly growing and Indian society is evolving digitally, it remains traditionally rooted in strong gender roles. This contrast highlights the intriguing coexistence of traditional values and modern digital advancements (Ashok & Veerababu, 2023).

The selection of Pune as the field research location was influenced by its status as a major Indian city, where delivery services are widely deployed, constituting a highly competitive market. As a result, a sizable portion of Pune's population frequently utilizes food delivery apps in their daily lives (Upadhye & Sathe, 2022).

In traditional Indian families, wives residing in their husbands' households are responsible for domestic tasks, including cooking (Bulbeck, 2010; Vecchio et al., 2014). Indian cuisine involves sophisticated dishes requiring hours of preparation. Cultural beliefs require that meals are freshly prepared daily, as most food cannot be preserved (Vecchio et al., 2014). This makes cooking time-consuming and challenging for working or student women with families. While having a household cook is common, it requires financial means. During the COVID-19 pandemic, with household cooks unavailable, food delivery apps became a convenient alternative providing a break for women from cooking duties (Akter & Disha, 2021). After the pandemic, maids resumed their cooking duties, but food delivery apps remained popular. Thus, researching the role played by food delivery apps in women's daily lives can provide a better understanding of their effects on cooking responsibilities within households, and more broadly, on the capacity of digital platforms to shape evolving traditions.

This article explores the effects on daily practices and domestic responsibilities of the current trend to use of food delivery apps in a traditional society, by addressing the following questions:

1. How do the women appropriate food delivery apps to potentially empower themselves from domestic responsibilities?
2. How can the use of food delivery apps result in the experience of a loss of self-control, thereby contradicting the concept of empowerment?

Literature review

Expanding research on food delivery apps

The literature on food delivery apps is extensive, covering a diverse range of topics globally. Multiple papers have investigated customer behavior, experience, and usage,

often aiming to identify strategic factors that encourage service adoption (Hong et al., 2021; Kapoor & Vij, 2018; Lin et al., 2024; Ray et al., 2019). Interestingly, in their quantitative study involving 250 respondents, Singh and Kaur (2020) found no differences in customer experience based on age or gender. They found that all customers were attracted by similar factors such as app design, promotions, and ease of use. Other studies confirm their findings (Kapoor & Vij, 2018; Saad, 2020; Wen et al., 2022). Studies related to marketing strategies seemed to direct their attention to the impacts of advertisements and mobile app designs on potential customers (Vajjhala & Ghosh, 2022). It is worth mentioning that a few studies comparing food delivery providers have occasionally raised concerns about impartiality, as they tended to emphasize the quality of one service over another, thereby introducing bias in their findings (Raina et al., 2019). Furthermore, numerous studies have highlighted the poor labor conditions of delivery workers, including pressure to deliver increasingly faster service to satisfy customers (Verelst et al., 2022).

Recent papers have addressed the growing adoption of food delivery apps following the COVID-19 pandemic, partly attributed to the fear of public spaces as well as their convenience (Lakhani et al., 2022; Wen et al., 2022). Some studies found that food delivery apps tend to encourage a sedentary lifestyle by facilitating food delivery to the doorstep (Gupta & Duggal, 2021; Hong et al., 2021; Saad, 2020). However, Saad (2020) claimed that time constraints faced by working women make ordering food a convenient option. A few studies have identified women as a key target demographic. They either highlight that food delivery services provide them with a means to escape daily kitchen responsibilities (Chaturvedi & Karthik, 2019), or show that their active participation in the workforce boosts family incomes, thereby improving access to such services (Srinivas, 2021). Some studies have specifically addressed gender differences and, in some cases, inequalities in delivery app practices (Lakhani et al., 2022). In a survey of 220 students using food delivery apps in Coimbatore, India, Natesan and Venkatesalu (2020) found gender disparities in usage frequency, with male students ordering prepared meals more often than female students. Thus, the literature highlights some intersectional differences in the usage of food delivery apps, particularly across genders. However, a gap remains in understanding the effects of food delivery apps on people's daily lives, particularly related to their usual routines (e.g., cooking habits, restaurant visits, money spent on food).

Empowerment and behavioral addictions related to mobile apps

The concept of empowerment traces back to J.S. Mill's 1869 work on women's education in "The Subjection of Women." While evolving, it gained prominence in the 1970s feminist movements in the Global South and among African Americans in the US (Kabeer, 1999; Richardson, 2018). The contemporary interpretation has expanded and, to some extent, deviated from its original meaning (McLaughlin, 2016). Without a universal definition, scholars have provided various but complementary interpretations of the concept, especially as empowerment is a multifaceted concept (Kabeer, 1999; Logie et al., 2017; Malhotra & Schuler, 2002). In the context of this paper, empowerment is defined as a process of acquiring capacities to take control of one's

own life and destiny in their communities and societies (Richardson, 2018; Stein, 1997). This translates into an increase in autonomy, independence, and decision-making power (Lama, 2014). In practice, multiple academic, institutional, and non-governmental organizations have developed indexes to model and quantify the empowerment process. Among the indicators listed by Ibrahim and Alkire (2007), two were particularly essential in the elaboration of this present research: the importance of decisions made by women within their households and their freedom regarding household obligations.

The literature linking empowerment and digital platforms mainly focuses on identifying gender inequalities in access and usage (see Section "Expanding research on food delivery apps"), while also discussing the technology's benefits, limitations, and risks in addressing these issues (Aagaard, 2023; Elwood & Leszczynski, 2018; Mariscal et al., 2019). Multiple authors have portrayed the adoption of new digital technologies as avenues for women's advancement, at times bordering on digital solutionism (Datta, 2018; Yadav, 2022). For instance, several studies show that access to smartphones or to certain digital platforms providing services (e.g., navigation apps, safety apps) can generate new professional, social, or educational opportunities, eventually helping empower women with more decision-making power and autonomy (Mariscal et al., 2019; Pei & Chib, 2021). However, a growing literature also shows the limitations of such technologies in empowering or reducing gender inequalities (Elwood & Leszczynski, 2018). According to Huws (2019), technology has not successfully empowered women as houseworkers, despite its promise, as it fails to give them extra personal time. One reason is the growing trend of nuclear households made up of first generation parents and children, which isolates mothers who often handle household duties alone.

The literature still lacks studies on the empowering or non-empowering effects of food delivery apps. As well, very limited attention has been given to the potential behavioral addiction effects of these apps on users (Mohite et al., 2022; Yang et al., 2025). Research to date has mostly confirmed addiction risks associated with smartphones and social media platform usage, eventually leading to a loss of self-control and behavioral addictions (Kwon et al., 2016). Generally speaking, the business models of app operators, including food delivery services, often capitalize on and may even encourage such addictive behavior to boost sales (Mohite et al., 2022; Noë et al., 2019). Food delivery apps provide easy access to a wide variety of dishes, which may stimulate preexisting food addictions, eating disorder, or even foster the development of new ones (Rejón-Guardia, 2024; Yang et al., 2025).

In this paper, our objective is not to quantify empowerment or behavioral addiction through indexes and scales, but to explore whether food delivery mobile apps empower women with full-time professional or educational responsibilities by potentially freeing them from domestic duties, thereby increasing their empowerment. We also aim to identify when the usage of these apps leads to experience behavioral addictions that disrupt this empowerment process. Thus, this paper aims to enrich the literature on the effects of digital platforms on women's empowerment by analyzing individual experiences as well as their impact on traditions, practices, and perceptions. This places the reflection at the intersection of the three concepts: gender, digital practices, and empowerment.

Methodology

This paper adopts a qualitative approach to study the practices of food delivery apps among women and their experiences. This allows to comprehend better how these apps assist daily planning and cooking responsibilities, and to explore the evolution of practices.

It was essential to ensure data saturation (Rahimi & Khatooni, 2024) by selecting a relatively diverse group of women for interviews, varying in socio-economic backgrounds, professions, household composition, age, etc., while sharing common characteristics. These common characteristics were being over eighteen, employed or enrolled in studies, and regular users of food delivery apps. Working or studying was a key criterion for selecting the participants. In many cases, working married women suffer from the double responsibility of managing domestic tasks and properly accomplishing their work (Saad, 2020; Vecchio et al., 2014). While single women might not necessarily have cooking tasks, they still face time constraints due to their professional or educational activities. Analyzing the routines of employed or studying women, whether married or single, helped understand the potential effects of food delivery apps on the traditionally time-consuming daily tasks of cooking. One extra condition was the ability to speak English to avoid translation bias and complications, as the author conducting the interviews did not speak the local language. An exception was made with the interviewee named Eshana due to her unique situation. Her interview was translated from Marathi to English by a professional translator. Despite being illiterate, Eshana was comfortable with digital platforms and frequently enjoyed the use of delivery service apps. She came from a less privileged socio-economic background compared to the other women able to speak English (Highet, 2021). At the time of the interview, she lived in a slum but had a stable job, ensuring some income. Her interview helped reflect on the socio-economic and educational conditions for using digital platforms.

To ensure a certain heterogeneity, the participants were identified and recruited through various methods, including social media (Instagram, Facebook groups), word of mouth (via the author's network and their contacts), and direct approaches in places such as cafés. The interviews were conducted one-on-one on-site in workplaces, cafes, or at the women's homes, except for five interviews, which were led online via Zoom and Instagram calls. The divergence in interview formats was due to limited resources and time during the March to May 2023 fieldwork, meaning that five participants were interviewed slightly earlier, in February. All interviews were therefore conducted between February and May 2023. The interviews lasted between 40 min and an hour and a half. In total, 22 women from various backgrounds and statuses were interviewed. Eight women were married, thirteen were single, and one was divorced. Within this group, five lived in "joint families,"[3] another five in "nuclear families,"[4] seven with their own families, and five resided alone or with flatmates. They all had different levels of studies, starting from no education to PhDs, and their professional activities were very diverse. Out of the 22 women, three were students, with one of them also holding a part-time job. Moreover, several of the women were partially or almost entirely dependent on household cooks to handle the cooking duty. These women were included in the study because their use of food delivery

apps might have influenced their expectations and needs concerning the work of hired household cooks.

Interviewing a relatively diverse group of women enabled capturing various types of customers using food delivery apps, though the sample was not intended to be representative.

The table below highlights the relative heterogeneous background information of the female participants.

Table 1. Profile of the 22 interviewees.

The interview questions were organized into four sections to gather insights into women's usage and experiences of food delivery apps:

1. Dining habits and the frequency of visiting restaurants or utilizing food delivery apps,
2. Patterns of food delivery app usage,
3. Experiences concerning the use of food delivery apps and potential impacts on daily habits,
4. Sociodemographic characteristics.

The questions were aimed to reveal how each of the female participant's unique circumstances shaped the practice of food delivery apps, considering a spectrum of adoption levels. While some women consistently relied on these apps, others displayed more resistance. The politically neutral nature of our research, together with purposefully casual interviews, encouraged the participants to freely express critiques of both the food delivery apps and traditional expectations tied to women's roles in cooking for the family. Overall, they showed considerable enthusiasm in sharing their personal experiences.

Before each interview, the participants were orally briefed about their right to withdraw at any time, and the study's guarantee of anonymity through pseudonymization of names using common Indian female names. After this explanation, they confirmed their willingness to take part in the study. Given that no sensitive information was gathered, they were not obligated to sign the consent form provided.

Most interviews were recorded unless the participant refused or background noise made recording difficult. In such cases, detailed notes were taken to ensure precision. When recordings were available, they were transcribed using Otter.ai. The software MAXQDA was used to analyze both transcriptions and detailed notes using the qualitative thematic analysis method. Each interview's transcription was coded under specific topics such as "advantages," "disadvantages," "favorite apps," "addictions," and "saving time," to identify patterns and similarities. The coding, following the questions and interview answers, helped determine the study's direction.

This research had constraints. Due to limited time and resources, the sample was exclusively focusing on women already using food delivery apps. Comparing this sample with women not using food delivery apps would have provided a better understanding about their choices of using or not using such a delivery service. In addition, including male interviewees could have revealed potential gender differences. Moreover, to maintain the comfort of the interviewees, sensitive questions about demography such as household income or caste were avoided. Instead, interviewees were asked

Table 1. Profile of the 22 interviewees.

#	Pseudonym	Age	Studies	Status	Job	Household composition
1	Gayatri	36	Undergraduate	Married	Marathi and German teacher	"Joint Family:" Husband, daughter, family-in-law
2	Anjali	23	Highschool	Single	Office employee at a corporation	"Nuclear family:" Parents, sister
3	Lakshmi	38	Bachelor	Single	Business head	Mother
4	Kanti	39	Master	Single	Manager at a corporation	Alone
5	Lalita	44	Master	Divorced	Librarian	Parents
6	Lavanya	30	PhD	Married	Postdoctoral researcher	Daughter
7	Reshmi	22	Undergraduate	Single	Undergraduate	Alone
8	Parvati	18	Highschool	Single	Highschool student	"Joint family:" Grandparents, mother, others
9	Saira	30	Bakery studies	Single	Owner of a pastry shop	Parents
10	Disha	27	Bachelor	Single	Cultural coordinator	Alone
11	Kashvi	44	Master	Single	Office employee	"Joint family:" Parents, nephew
12	Lasya	40	Master	Married	Teacher at a public school	Husband, son
13	Mahika	43	Master	Married	Librarian	"Nuclear family:" Husband, sons
14	Sapna	26	Hairdresser studies	Single	Hairdresser	Parents
15	Priya	30	Master	Single	Professional dancer	Mother, sister, brother, nephew
16	Diva	34	PhD	Single	Doctor at the hospital	Parents, brother
17	Eshana	40	No education	Married	Shop assistant in a store	Mostly alone, but often visited by her daughter, and sometimes her husband
18	Jiya	43	Bachelor	Married	System administrator in a high school	Parents-in-law, husband, daughters
19	Sita	21	Master (on-going)	Single	Student and Charter audit accountant	Parents, brother
20	Aditi	30	Master	Married	HR in a construction firm	"Joint-Family:" Husband, son, mother-in-law
21	Devi	32	Bachelor	Single	Manager at a corporation	Flatmates
22	Durga	40	Master	Married	Second generation entrepreneur	"Nuclear family:" Husband, son

about vehicle ownership, household composition, domestic employees, and perceptions of life comfort relative to their household income. Consequently, precise socio-economic data were lacking.

Findings

The effects of food delivery apps on daily practices and domestic responsibilities

Cooking obligations are influenced by the household composition. Within the sample, varying levels of cooking responsibility were observed based on a woman's status.

In households with in-laws, cooking responsibilities appeared generally shared among the women. This trend seemed less prominent when the women lived alone or with their immediate family. The married women, whether in a "joint family" or a "nuclear" setup, had distinct cooking dynamics. In a "nuclear" family setting, cooking was only their responsibility, whereas in the "joint" family, the mother-in-law and possibly sisters-in-law usually shared the duty. The single women residing with their family shared cooking duties with their mother or grandmother. They might enjoy cooking, take the time to do so, or find alternatives. Often, the mother held the main cooking responsibility, with others occasionally assisting, sometimes with the help of a household cook. The women living alone either cooked for themselves or enlisted the help of a household cook. In fact, regardless of the household setting, maids for cooking or specifically for cleaning cooking utensils were commonly hired. In total, four women had a maid to assist with cleaning, and eight women had at least one household cook.

Although the women's profiles diverged, we identified four tendencies among the interviewees based on two criteria: household composition in relation to cooking responsibility and the enjoyment associated with cooking activity. Firstly, four women loved cooking, and it was their daily duty. They were all married with one or two children. Secondly, eight women loved cooking as a hobby, with the actual cooking duty being handled by another female family member or a household cook. These women mostly lived in larger households. Thirdly, six women did not enjoy cooking but had the duty of cooking every day for their household or themselves, even though three of them received support from maids (mostly cleaning tasks). Two of them were mothers in "nuclear families," one was a mother in a "joint family," and three were women living alone. Fourthly and lastly, four women did not enjoy cooking and had no obligation to cook, because someone else in the household already had the duty.

The third group of women, tasked with the duty of cooking but without enjoying this responsibility, faced serious difficulties. This became evident in the experience of Lavanya and Mahika, both residing in "nuclear families," and Aditi, living in a "joint family." Mahika expressed during her interview: "I have to cook, but I don't enjoy it. […] For Indian women, it's their duty to cook for the household. But when it comes as an obligation, it's always boring." She expressed enthusiasm for participating in the study, viewing it as an opportunity to denounce the forced duty endured by her and many other women. Despite feeling privileged to receive daily assistance from a household cook, there were still days when she had to cook on her own for her husband and two sons, each following a specific diet. The single women who did not enjoy cooking still faced the duty when living alone, but without external expectations and family pressures.

Among the four women who found joy in cooking and held the responsibility for it within their families, two were assisted by household cooks, and one received help from a maid for cleaning. Only Eshana was not supported by anyone. However, unlike the others who were assisted, and although married, Eshana mostly lived alone due to her husband's and daughter's regular absences. This means she did not have the strict daily responsibility of providing meals for a husband and children, as Gayatri, Lasya, and Jiya did, with Gayatri and Jiya also having in-laws to care for. While the four of them generally found joy in cooking, Eshana and Gayatri felt that the daily task was not always enjoyable due to its repetitive nature and the pressure of responsibility.

The interviews showed that the women were using food delivery apps in two main ways. Some, such as Mahika and Aditi, preferred ordering full meals, providing them with a break from cooking tasks. Others, like Lavanya, usually ordered dishes to complement the meals they cooked or that were cooked, with minimal impact on their cooking responsibilities. On top of reducing the cooking duty more or less frequently according to each interviewee, the women indicated that these apps were convenient, citing time and energy savings. They also shared various specific conveniences they experienced. Besides keeping the kitchen clean, this service option was helpful during events with guests or when the women felt tired or unwell (interviews with Lavanya and Lasya). It allowed them to avoid stepping outside to do grocery shopping (interviews with Mahika, Sapna, and Lakshmi). They felt they were saving time with no need to handle children outside (interviews with Parvati and Lavanya). It enabled the single women, especially the students, to have a late-night meal when going out might be seen as indecent or intimidating (interview with Lavanya). In addition, ordering provided the option to experiment with various food preferences (interviews with Jiya and Sapna). In her interview, Reshmi exclaimed, "I can get food whenever I want, and I just pay money to get it."

To explore the time-saving dimension, the interviewees were asked how they spent the time they gained by using digital food delivery apps instead of cooking. Most of the women explained that the extra time gained from ordering food positively influenced their ability to concentrate on full-time work. Diva, a doctor with weekly night shifts, could now enjoy fresh meals at any time without the necessity of cooking while saving time. Others, like Sita, Lasya, and Lavanya, used the extra time for quality moments with their children or to pursue personal hobbies, especially during weekends when their orders were more frequent.

Eshana frequently ordered food for herself, her colleagues, and her daughter. Utilizing food delivery apps was not about reducing cooking activities, rather it offered her more time to spend with her family. Her interview showed that embracing these digital tools represented a form of empowerment for her and seemed to provoke admiration and jealousy in her economically modest neighborhood, where illiteracy was common among women.

Food delivery apps emerged as a supportive, even in some cases liberating, tool for some of the women, especially those who disliked cooking. They partially freed them from the guilt of not enjoying cooking. For women like Mahika and Aditi, who did not find joy in cooking, these apps appeared to them as invaluable. Interviews highlighted feelings of "independence," "happiness," and "released pressure."

From frequent usage to behavioral addiction

Throughout the interviews, distinct patterns emerged in the participants' behaviors surrounding the ordering of delivered food. Each of the women had her specific habits and preferences, whether ordering in the morning, afternoon, or evening, and on weekdays or weekends. Kashvi chose to order approximately once a month, using the occasion to celebrate special events. Others like Saira, Priya, Diva, Aditi, and Devi boldly reported ordering "all the time."

The weekly or monthly expenses for food delivery were mirroring the women's ordering habits. During the interviews, the women were asked about their spending habits. Most of them indicated that they aimed to keep the cost of a single-delivered meal around USD 2.45. Fourteen women reported spending more than USD 6.13 per week on food delivery for themselves. Most of the interviewees considered the pricing of available food on apps quite high, despite frequent discounts, especially when they compared it with the regular cost of outside food, or with the regular cost of hiring a household cook. In fact, considering USD 2.45 per meal and assuming that two meals would be enough for one day, this would result in approximately USD 147 per person per month (calculated for 30 days) in order to almost entirely rely on food delivery apps. Such pricing appeared not negligible and discouraged some of the interviewed women in ordering very frequently. Only Mahika and Aditi stood out by perceiving the price as secondary as this service enabled them not to cook, giving them peace of mind.

When questioned about their relatives' attitudes toward ordering food through delivery apps, five women encountered resistance from their families, particularly from older generations having certain caste-related beliefs, although this resistance was not extensively explored in this study. Sita pointed out her family's suspicions regarding the delivery boys: "We don't know who these delivery boys are who come to our door. In the news, there are so many bad stories." Disha emphasized her family's belief in prioritizing home-cooked food, where Gayatri, Anjali, and Lalita expressed the concern of their relatives about the consumption of unhealthy or "junk" food. Regarding this last point, one recurrent concern highlighted in several interviews by the women themselves was the issue of overeating and gaining weight. The ease and speed of food delivery services led some of them to develop a habit of ordering by reflex. During her interview, Priya exclaimed: "It's not like I am hungry, but I crave for. So, I will just order." Disha revealed that because consumption has been made so easy, on top of making her feel lazier and eating in front of the TV, she started to order more frequently and eat more than necessary.

Several of the interviewed women identified themselves as "foodie," describing this trendy term as someone who constantly tries out new culinary experiences and who loves eating on the edge of eating disorder or food addiction.[5] The concept of "foodies" has gained prominence partly with the rise of food delivery apps, which promote diverse cuisines and make them easily accessible (Setia et al., 2022). It raises questions about addictive behaviors, whether it involves a fascination with food or the use of food delivery apps (Setia et al., 2022). Aditi explained that she and her family got "addicted to this hotel taste" as she called it. They ordered every day as a complementary meal. The same happened with Lasya's household, but her husband started to criticize her cooking, claiming that the food she made was not as tasty as delivered food. Thus, while ordering meals from food delivery apps provided relief for Lasya, it also diminished the value of her cooking in favor of meals from restaurants.

In their interviews, Anjali, Diva, and Sapna explained ordering more food through the apps when they felt moments of solitude or boredom to feel better. Anjali explained: "I am not proud of ordering all the single time. It's unhealthy because, when you're working and think about eating, you often crave something that satisfies your soul, which can contribute to the overall unhealthiness of your eating habits

throughout the day." Diva, living with her parents, shared that while her relatives approved of her use of food delivery apps for their efficiency, they disapproved when it was clear that emotional comfort was her primary motivation.

Three interviewees, Sapna, Devi, and Priya, described their recurring habit of uninstalling and reinstalling food delivery apps. They uninstalled the apps because they perceived them as a threat to their well-being. Later they reinstalled the apps to order meals again, highlighting a struggle with what they termed as addiction. Priya claimed: "It's an addiction. Sometimes, I uninstall the app, so I don't order. But then, like yesterday, I ended up installing the app again. Today I uninstalled the app again. There is no stopping, you continuously become addicted to these apps." Interestingly, the interviewees demonstrated awareness of being targeted customers by food delivery operators, who employed various business strategies, such as offering discounts and scrolling images of delicious-looking food. Despite acknowledging that they were ordering more than necessary, the women expressed a persistent tendency to engage in such behavior. Disha explained: "I do use food delivery apps a lot, it is a disease! It became like a habit to just scroll through the app. I'd go through the various options even though I am not hungry. Thinking about what I am going to order next became a hobby." She concluded her thoughts as follows: "There is no such limit on the number of times you can order a day, you can just order as much as you want. I would say that it encourages mindless consumption and way too frequent consumption. The vehicles circulating to deliver meals in the streets have an impact on individual carbon footprints, there is no magic."

Throughout the interviews, it became evident that these behavioral addictions originated from the easy accessibility of ready-prepared meals and from the different strategies employed by food delivery apps to encourage users to reuse the apps and order frequently. A loss of self-control leads to unhealthy eating habits, which, despite partially easing the domestic task of cooking, cannot support empowerment in terms of independence. When ordering feels uncontrolled, food delivery apps lose the empowering support they originally provided.

Discussion and conclusions

While researching about how food delivery apps potentially support the women in their cooking duty, this paper aims to research the effects of digital platforms on women's empowerment. The study relied on a heterogeneous group of twenty-two women engaged in either work or studies, residing in Pune, India, and regularly using food delivery apps. The findings were not intended to be representative but to better comprehend the role that food delivery apps play in reshaping practices and social norms, enriching the literature in this regard.

During the interviews, it appears that food delivery apps had an ambiguous impact on the women's daily routines, shaped by the frequency of their usage and the specific choices in their orders. For several of the women, their cooking activities remained mostly unchanged. Food delivery apps offered them with an extra option, which did not replace the services of a household cook (Craig et al., 2016). For most, the relief from cooking responsibility came first from hiring a household cook who could partially or even almost fully handle this daily duty. Hiring a

household cook, or even several, has a certain cost which depends mostly on the frequency of the service (Craig et al., 2016). It also means trusting the hired persons and relying on their cooking skills and limitations (e.g., the risk of limited dish diversity). However, compared to having a household cook, food delivery apps appeared not widely used among the interviewees to fully take over their cooking duty. Instead, the interviewed women mainly seemed to use them as a pleasant complement to home-cooked meals. Only a few of the women who disliked cooking managed to partly escape this duty by using food delivery apps. In this scenario, food delivery apps appeared to support a form of growing empowerment, partially offering some relief from traditionally imposed responsibility, while providing access to a wide variety of dishes, both Indian and International. This confirms that food delivery apps can be used as a strategy to avoid cooking duty, but it comes with limitations (Chaturvedi & Karthik, 2019; Pathak & Saraf, 2020; Srinivas, 2021). Due to its financial cost, using such a service daily was not accessible to all the interviewees. Comparatively, hiring a household cook for daily cooking generally appeared much more affordable. Moreover, the tradition of assigning women the household responsibility of managing food remains unchanged. Even if a woman orders food every day from delivery apps to help her, ensuring that her family members are well-fed would remain her responsibility. However, it is worth noting that, to some extent, the use of food delivery apps, even sporadically, appeared to provide some extra time for recreational or relaxing activities, contributing to their overall well-being. Thus, this finding adds nuances to Huws's (2019) study, which affirms that technology fails to empower women from their household duties, by exploring a specific context and type of digital platform.

Throughout the study, it became evident that food delivery apps can tend to cause a loss of control over the frequency of ordering meals. Several of the women experienced such type of addiction. This finding confirms the quantitative study led in China by Yang et al. (2025), which suggests that food delivery apps may contribute to excessive food consumption and even food addictions. As also reflected in the interviews, this addictive tendency could be attributed to the variety of food options offered by the apps, such as the convenient ordering system allowing users to quickly get what they want despite the large number of choices involved (e.g., selecting a restaurant, choosing a dish, deciding on discounts), appealing discounts, and the promise of fast doorstep delivery (Vajjhala and Ghosh 2022; Yang et al., 2025). We conclude that the entire experience of ordering from food delivery apps appears to be designed in a way that encourages more frequent ordering, which, in extreme cases, could lead to a loss of control and consequently behavioral addictions. These behavioral addictions lead to frequent ordering, poor eating habits, and a significant loss of independence, challenging the reasoning that food delivery apps, as a digital technology, empower individuals. Indeed, independence, as described by Stein (1997) and Lama (2014), is a key component of empowerment that behavioral addictions compromise.

Overall, this study demonstrated that the dynamics vary on an individual level, leading to paradoxical observations regarding the potential empowerment resulting from the use of food delivery apps. These digital platforms appear to present a double-edged sword: they can provide convenience and, to some extent, major support, but they

can also lead to uncontrolled behaviors and potential consequences of a sedentary lifestyle (e.g., health, confidence) (Hanson, 2010; Shah et al. 2017). In this paper, the empowering process seems to reach its limit when food delivery apps shift from assisting cooking duties to causing a loss of control, leading to behavioral addictions, or when access is restricted by high costs.

Further research should focus on the growing use of delivery services among individuals from underprivileged communities to analyze the connection between literacy and digital literacy (Mariscal et al., 2019). Comparing these findings with those from more socio-economically advantaged individuals would highlight disparities in access to digital practices and empowerment. Additionally, observing gender differences between lower and higher socio-economic groups would provide insights into how delivery services are used differently and how they impact women's daily routines and duties. It would also be important to explore the household resistance some women face when using food delivery apps, resistance shaped not only by gendered norms related to domestic roles, but also deepened by cultural and caste-based beliefs. Including the caste system as a critical intersecting dimension to gender and socio-economic status in India would further deepen the understanding of this digitalization phenomenon and its paradoxical role in empowering women.

Notes

1. In this study, gender is defined according to Ann Oakley as a social construct that highlights the inequalities between men and women (Oakley, 1972).
2. Digital platforms can be defined as virtual socio-technical infrastructures with user interfaces that provide access to various services, often commercialized (Leszczynski, 2020; Light et al., 2018). They include mobile apps, websites, and software (Van Dijck et al., 2018). In this paper, "digital platforms" is exclusively understood in its mobile application form.
3. In an Indian context, a "joint family" refers to a conventional extended family setup where multiple generations cohabit within the same residence.
4. In an Indian context, a "nuclear family" is parents and children living together, a trend growing compared to the traditional "joint family" norm, as reported by interviewed women.
5. The interviewees did not give any medical meaning to this term (Gordon et al., 2018).

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Appendix

Publication IV

Mawussi, A., **Baudens, P.**, Bamba, V. E-hailing and Women's Night Mobility: Abidjan (Ivory Coast), Pune (India). (Under review).

E-hailing at Night: Women's Urban Mobility in Abidjan (Ivory Coast) and Pune (India)

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Abstract

The advent of digital mobility platforms has transformed travel habits worldwide, with significant effects on women's mobility in urban areas, particularly at night. The aim of this article is to analyse the effects of the adoption of e-hailing taxi services on women's safety and perceived safety and night-time travel practices.

This research is based on a qualitative survey, including semi-structured interviews with forty-four women using e-hailing taxi platforms in the urban contexts of Abidjan, Ivory-coast, and Pune, India.

The results of this research highlight that e-hailing taxi platforms facilitate mobility for women, provided they have the financial resources to do so. These applications offer them the possibility of accessing a wider variety of urban resources at night, with a comparatively improved sense of security. On the one hand, applications increase the feeling of security. on the other hand, their effects on perceived safety are still limited by their restricted geographical coverage and their potential use by men in order to control women's mobility.

Keywords: E-hailing, digital platform, nighttime, women, safety, right to the city

1. Introduction

The aim of this article is to analyse the effects of the adoption of online taxi services on women's safety and night-time travel practices. The night offers a range of urban resources, including work, entertainment, and networks of festive venues (Fouquet, 2021; Chipungu, 2021). However, compared to the day access to the resources of urban nights is difficult because of limited transport offer and insecurity that lead to immobility (Smeds, et al., 2020). These inequalities in access to the transport and city which become more pronounced at night depend on gender (Plyushteva and Boussauw, 2020; Zhang, Zhao, and Tong, 2022). Some studies suggest that inequalities in mobility at night are more pronounced among women, who, for fear of being mugged, avoid public transport and prefer to take taxis (even though they are often more expensive), drive their own vehicle or have someone else drive them. (Plyushteva and Boussauw, 2020; Baufeld and Vanderschuren, 2023). Zhang, Zhao, and Tong (2022) show that fear of violence limit women's mobility at night. These limitations constitute an obstacle to the right to the city, understood here as access to urban resources (Lefebvre, 1972).

E-hailing platforms, defined by Dhawan and Yadav (2018) as mobile applications compatible with smartphones or websites allowing users to book various modes of transportation (such as motorcycles, autorickshaws, or cars), are experiencing rapid expansion in world metropolises (Boutueil et al., 2022). Several studies also indicate that e-hailing taxi platforms offer a transport experience often described as fast, optimal, comfortable, and guaranteeing a certain level of safety for customers day and night frequently highlighted in sales pitches (Giddy, 2019; Mat et al., 2019). In fact, safety and security emerge in several studies as a determining factor influencing the adoption of e-hailing services (Nguyen-Phuoc, et al. 2021; Liu, Gao and Rau, 2022; Agina and Iluno, 2023). Consequently, e-hailing taxi services are an offer that fills the gaps (insecurity, discomfort, problems matching drivers and users) in existing public transport, traditional taxis and paratransit services (Sogbe and Susilawati, 2024; Vega-Gonzalo and al., 2023.). Paratransit services, refers to a set of transport services (minibuses, tricycles, motorbike taxis, etc.) that operate on flexible routes (Boutueil et al., 2020). E-hailing services are usually appropriated and used by categories of users who have financial and geographical access to these services (Mahambare and Dhanaraj, 2022).

Regarding the effects of e-hailing taxi services on women's night-time mobility, the literature remains ambivalent. While some studies in South Africa and Nigeria reveal that these services are massively used by women for their night-time travel, ensuring greater safety (Fenton et al., 2020; Agina and Iluno, 2023), others conclude that women prefer to drive their own vehicles rather than use e-hailing services in South Africa (Baufeldt and Vanderschuren, 2023). Given this paradox in the literature, the aim of this research is to contribute to this debate by studying the effects of using e-hailing services on women's mobility patterns and their perceived safety when travelling at night in Global South cities. We hypothesise that women's appropriation of e-hailing platform services enables them to access urban resources at night in complete safety. This study is based on a qualitative survey using structured interviews with forty-four women who regularly use e-hailing applications in Abidjan, Ivory Coast, and Pune, India. This comparison provides a cross-sectional view of two cases from the global South that are rarely compared. Both towns have a strong nightlife (leisure, work, etc.). Also, Pune has a public transport service available at night, whereas in Abidjan the public buses available work until only 8.30pm.

This article aims to answer the following two questions: (1) How do women use e-hailing services for their nocturnal mobility? (2) How do the night-time mobility opportunities offered

to women by e-hailing services enable them to exercise their right to the city?? The article presents the literature review and the theoretical framework, the context, and the methodology before exposing the results of the research and finally discuss them.

2. Literature review and theoretical framework

2.1. Women's feelings of security and night-time mobility

The restrictions and inequalities in women's mobility in the South and their causes have been documented (Uteng and Turner, 2019), but their mobility at night remains a blind spot in research. In many societies, the night is seen as a time of deviance, not conducive to women of 'good morals' (Alam et al., 2017; Lapalud and Blache, 2019). They are often restricted to the private domestic space (Hanson, 2010; Hidayati et al., 2020) and forced into a form of immobility (Zhang et al., 2022). Indeed, Sheard (2011) observes a gender disparity in access to night-time travel to the disadvantage of women, reinforcing gendered inequalities in access to mobility (Mahambare and Dhanaraj, 2022). Research by Plyushteva and Boussauw (2020) carried out in Sofia, Bulgaria, reports that if a new night-time public transport service is introduced, the benefits are not the same for women and men, as women, concerned about safety, often choose more expensive modes of transport, such as taxis. On the other hand, those with limited financial means are unable to make these modal choices, and often resort to unsafe public transport. (Mahambare and Dhanaraj, 2022). Farina, Boussauw and Plyushteva (2022) reveal the role played by feelings of insecurity and personal experiences in women's mobility. Faced with the fear of being a victim of harassment, many women develop survival strategies enabling them to avoid uncomfortable situations that are detrimental to their autonomy (Loukaitou-Sideris, 2014; Dirsuweit et al., 2021).

2.2. Use of e-hailing and night-time mobility

In Global South cities, recent academic literature is beginning to document the mobility practices associated with e-hailing taxi services and reveals that in African, Asian and South American countries these services are generally used by young, educated populations for leisure and daily travel (Giddy, 2019; Chalermpong et al, 2023; Jais and Marzuki, 2020). Several studies highlight that the adoption of these services is linked to the facilities they offer, based on a greater sense of security, convenience, economic benefits, reduced expectations, and a high level of comfort (Arora et al., 2021; He and Shen, 2015; Liu, Gao and Rau, 2022). The safety provided by these platforms is explained by the implementation of features for rating drivers, alerting them in the event of insecurity, and tracing and sharing routes (Boutueil, 2020; Arora et al., 2021; Mahambare and Dhanaraj, 2022). A few recent studies have highlighted the key role played by e-hailing services in redefining and transforming the daily travel patterns of people living in cities in the South (Giddy, 2019; Hamdan et al., 2022), as well as in highlighting inequalities in access, particularly of a gendered and socio-economic nature (Vega-Gonzalo et al., 2023). For all the reasons mentioned above, e-hailing services appear to be widely used by women, especially for night-time travel (Giddy, 2019; Fenton et al., 2020). A study carried out by Fenton et al (2020) in the very specific context of Johannesburg in South Africa showed that of the eighty students questioned who used e-hailing platforms, both men (12%) and women (60%) said they used them to go out at night. However, another study conducted in New Delhi by Dhawan and Yadav (2018) also shows that taxis managed by e-hailing platforms can be subject to scenes of sexual harassment and verbal and physical violence towards customers and drivers. According to their study of 120 frequent e-hailing

users in several Indian cities, 40% felt unsafe using the service at night. Similarly, recent research in South Africa shows that, given the unsafe conditions in Cape Town, women with cars prefer to use them for night-time travel rather than use e-hailing services (Baufeldt and Vanderschuren, 2023).

Although there is a wealth of literature on the practices of users of e-hailing platforms, it provides little information on the changes brought about using e-hailing services on women's mobility practices at night, and on women's safety and sense of safety. Our article proposes to fill this knowledge gap.

2.3. Safety for women and the right to the city

The conceptual and theoretical framework used in our article is based on the concept of safety and the right to the city. In this article, safety is conceived both as lived safety, resulting from the victim's experience, and as perceived safety, which may or may not be linked to a lived experience (Pearlstein and Wachs, 1982; Currie et al., 2010). In concrete terms, perceived unsafety refers to situations such as verbal abuse, physical and sexual assault, and theft (of money, phone, bag, etc.). While personal safety depends on the intentional act of a third party, road safety is accidental (Nordfjærn et al., 2015). Various studies have shown that unsafe in transport restricts modal choices, leading to the use of more expensive modes such as taxis, and can result in immobility (Baufeld and Vanderschuren, 2023; Zhang, Zhao and Tong, 2022). Similarly, Carro et al. (2010) reveal that unsafe in public spaces reduces access, especially for women. Differences in access to mobility and urban resources have been theorised in terms of mobility inequality (Adey et al., 2014), mobility justice (Sheller, 2020; Verlinghieri and Schwanen, 2020; Smeds et al., 2020), as well as the right to mobility understood as an extension of the right to the city (Giband and Siino, 2013; Verlinghieri and Venturini, 2018). The right to the city has been theorised as: ‘the right to urban life, to renewed centrality, to places of meeting and exchange, to rhythms of life and timetables that allow full use of these moments and places’ (Lefebvre, 1972, p. 146). In recent years, some researchers have begun to draw links between the right to the city and mobility. They conceptualise the right to mobility as a functional means of accessing the city (Giband and Siino, 2013; Verlinghieri and Venturini, 2018). However, it is limiting as it does not take into account the political aspect dear to Lefebvre (1972). The political aspect of the right to the city can take two forms, among others: mobilisation to gain access to the city or the exercise of the right to the city through ordinary, everyday practices (Harvey, 2012; Spire and Morange (eds), 2020). From this point of view, organising mobilisation to enable cyclists to access the city (Castañeda, 2020) is a concrete way of exercising the right to the city, as is developing strategies for accessing the city when the transport supply is inadequate (Mawussi, 2020). The right to the city is defined here as access to urban night-time resources, including party venues, nightlife and the opportunities offered by the night. The lack of access to the city and its resources at night due to the lack of access to transport and mobility is an obstacle to the exercise of urban citizenship and the appropriation of urban space. Unsafe therefore leads to exclusion in the enjoyment of these urban resources. From this point of view, in our article we consider the fact that e-hailing platforms can, through the safety they can induce, ensure access to the urban resources of the night as a right to the city. Being mobile in the city at night is a way of redrawing a different geography of mobility at night, one that challenges the limitations on travel associated with mobility problems.

3. Selection of case studies and method

3.1. Abidjan (Ivory Coast) and Pune (India) as case studies

Abidjan and Pune were selected because of their differences, their widespread use of e-hailing services, and the proven and perceived security concerns at night (Kern, 2010; Listerborn, 2015; Crizoa et al., 2017).

3.1.1. Abidjan

The Autonomous District of Abidjan is Ivory Coast's largest metropolis, with a surface area of 2,119 km² and a population of 6,321,017, 48% of whom (3,110,034) are women (source: Institut national de la statistique, 2022). Comprising thirteen municipalities, Abidjan is home to 36% of the country's urban population and most of the economic, industrial, and tertiary activity (idem, 2013). Abidjan is a vibrant hub for nightlife, characterised by lively festivities and a variety of specific professions. However, as Table 1 shows, transport services are limited at night. The public buses of the Abidjan Transport Company (SOTRA) operate only from 5.30am to 8.30pm. On SOTRA buses in Abidjan, women are victims of verbal, moral, physical, or sexual violence (Crizoa et al., 2017). Wôrô-wôrô (collective taxis with five seats) and Gbakas (minibuses with between twelve and thirty-six seats), even though they operate on fixed routes from 5am to midnight, are not reputed to be safe at night. In addition, Abidjan has crystallised the after-effects of armed and electoral conflicts and political violence, with the phenomenon of gangs and incidents of kidnapping of taxi customers (Crizoa et al., 2017; Kouame, 2017). In this context, the reliable transport options for night-time travel are metered taxis or e-hailing services. Metered taxis, also known as red taxis, can have prices that tend to rise at night. E-hailing services like Hestia, Yango, Uber, and Heetch, with Yango and Uber operating since 2018 and Heetch since 2022.

3.1.2. Pune

Pune covers an area of 331.26 km² and has an estimated population of 7,166,374, 48% of whom are women (source: World Population Review, Pune District Population Census 2011). Pune is less studied than other major Indian cities such as Bangalore, Mumbai, or New Delhi, despite being a major economic hub, with a large automotive and pharmaceutical industry, and a high-tech centre hosting many multinationals such as IBM, Amazon and Google (Butsch et al., 2017). These sectors of activity attract a cosmopolitan, rather young, educated population with a medium or high standard of living, who, because of their relocation to Pune and the distance from their family of origin, often enjoy greater freedom from tradition (Patel, 2006; Parikh, 2017). This autonomy is reflected, among other things, in an increase in nightlife, particularly among women (Patel, 2006; Parikh, 2017). Moreover, there has recently been a growth in the supply of night-time entertainment, particularly in new districts such as Baner and Balewadi (Parikh, 2017).

At the time of the field study in April-May 2023, Pune had a public transport network officially comprising 2080 buses serving 381 routes, including one hundred and seventeen BRT routes, from 5.30am to midnight. In addition, five night-time routes were in operation on the main routes. In addition, since 2022, two metro lines have been in the process of being extended, operating from 6.00am to 10pm (source: PMPML, Pune Metro Rail). Buses are still the most frequently used mode of public transport since the metro lines have not yet been completed and appear to be used mainly by the economically less well-off. The relatively well-off classes do not consider this transport option for their personal travel, as indicated in previous studies (Butsch et al., 2017). The e-hailing platform Uber appeared in Pune as early as 2010, followed by Ola in 2013, and then Rapido in 2020 (Rajesh and Chincholkar, 2018). These services

integrate car taxis and autorickshaws, except for Rapido, which offers travel only by autorickshaws. These transport services have become an integral part of the urban landscape and are commonly used mainly by relatively well-off social classes because of the cost of the service (Rajesh and Chincholkar, 2018; Baudens et al., 2023), particularly at night (Parikh, 2017).

Table 1. Comparative transport offer in Abidjan and Pune

Offer	Offer in Abidjan	Abidjan timetable	Abidjan rates	Offer in Pune	Timetable Pune	Prices Pune
Public bus transport	74 SOTRA bus routes	5.30am. to 8.30pm.	Bus fare: 200 CFA francs ($0.32) to 500 CFA francs ($0.85)	381 regular routes, including BRT and 5 night bus routes	5.30am to midnight.	Bus fares: from INR 10 ($0.12) to INR 65 ($0.80) Prices vary according to the distance travelled.
Metro	-	-	-	2 metro lines	6am to 10pm.	15 INR ($0.18) to 35 INR ($0.43)
Tricycle	Tricycle taxi (Salomi)	No night-time services.	-	Autorickshaw (Off-application)	Presence at night in specific locations.	Negotiation or price defined by the meter. The official price: INR 25 ($0.31) for the first 1.5 kilometres, plus INR 17 ($0.21) for each additional kilometre travelled.

Taxi-car	Meter taxis	The service operates at night, but on a reduced scale	Special night fares from 1000 CFA francs ($1.67), increasing the fare. Possibility of negotiating the price of the journey.	Taxi-car Need to call the taxi in advance as it cannot be hailed.	This service is available throughout the city at night, but often requires a waiting time of more than ten minutes.	Specific to each car-taxi company.
Paratransit	-Wôrô-wôrô or communal taxis - Gbaka available	These services operate exclusively between 4am and midnight all days of week.	200 CFA francs ($0.33) to 1,000 CFA francs ($1.67).	No information		-
E-hailing	Uber, Heetch, Hestia, Yango	Available at night	-	Uber, Ola, Rapido. E-hailing takes the form of autorickshaws and taxi-cars.	Available at night	Prices vary according to the type of vehicle and real-time supply-demand.

Source: @Authors

3.2. Methodology

This article is based on qualitative interviews with women in Abidjan (Ivory Coast) and Pune (India). These two cities are different (in terms of their mobility systems) but the women there face similar problems of night-time mobility. These two case studies provide an opportunity to analyse and compare practices in two different contexts.

Participants were identified using a variety of methods, including social media, word of mouth and interview requests.

A total of twenty-two women were interviewed in each of the two cities. They were selected based on specific criteria: being over 18, travelling at night, using e-hailing applications regularly and at different times of the day, including at night. The places of residence were varied to understand the variety of practices depending on the neighbourhood. For example, in Abidjan, certain neighbourhoods such as Abobo and Yopougon are considered less safe for women, whereas Cocody is considered safer.

The interviews lasted between 25 and 43 minutes on average and took place in different locations (café, campus, home, respondents' place of work, etc.).

The interview guide was structured around several themes: (1) safety and the feeling of safety when travelling at night, (2) changes in night-time travel practices since the appearance of e-hailing applications, (3) the uses of e-hailing applications in night-time mobility and their effects, and finally (4) socio-demographic data. The focus was on the experiences of insecurity and the practices of the surveyed women. The following table presents the profiles of the interviewed women in the two sites.

Table 2. The profiles of the interviewed women in Abidjan and Pune

Name	City	Age	Diploma	Civil situation	Professional position	Ownership of a private car	Residential area
Interview 1-P	Pune	30	Bakery studies	Single	Owner of a pastry shop	Yes (car)	Pune Camp
Interview 2-P	Pune	44	Master	Divorced, one child	Librarian	No	Aundh
Interview 3-P	Pune	31	PhD	Wedding	Doctor Generalist	Yes (car)	Hadapsar
Interview 4-P	Pune	30	Bachelor	Single	Project manager	Yes (two-wheelers)	Koreagon Park
Interview 5-P	Pune	44	Master	Single	Office employee	Yes (two-wheelers)	Kothrud
Interview 6-P	Pune	40	Master	Married, one child	Teacher at a public school	No	Kothrud
Interview 7-P	Pune	27	Bachelor	Single	Cultural coordinator	No	Aundh
Interview 8-P	Pune	26	Highschool	Wedding	Unemployed	No	Baner
Interview 9-P	Pune	43	Master	Married, two children	Librarian	No	Kothrud
Interview 10-P	Pune	43	Master	Single	Executive director	Yes (car)	Hadapsar
Interview 11-P	Pune	30	Master	Single	Professional dancer	Yes (two-wheelers, car)	Viman Nagar
Interview 12-P	Pune	25	Bachelor	Single	Program manager	Yes (two-wheelers)	Hadapsar
Interview 13-P	Pune	46	Master	Married, one child	Chartered accountant	Yes (two-wheelers)	Kothrud
Interview 14-P	Pune	43	Bachelor	Married, one child	System administrator in a college	No	Kothrud
Interview 15-P	Pune	23	Undergraduated	Single	Office employee at a corporation	Yes (two-wheelers)	Wadgaon Sheri
Interview 16-P	Pune	28	Bachelor	Single	HR employee	No	Chandan Nagar
Interview 17-P	Pune	38	Bachelor	Single	Fashion designer	Yes (car)	Pune Camp
Interview 18-P	Pune	32	PhD	Single	Biologist researcher	Yes (car)	Panchwati
Interview 19-P	Pune	21	Master (on-going)	Single	Student and Chartered accountant	Yes (two-wheelers)	Sanunke Vihai

Interview 20-P	Pune	36	Interrupted Bachelor	Married, one child	Marathi and German teacher	Yes (two-wheelers)	Shaniwar Pune
Interview 21-P	Pune	30	Master	Married, one child	HR in a construction firm	Yes (two-wheelers, car)	Swargate
Interview 22-P	Pune	31	Interrupted Master	Married, one child	Street food vendor	No	Koreagon Park
Interview 1-A	Abidjan	33	BAC+1	Single, one child	Trade	No	Yopougon
Interview 2-A	Abidjan	32	Licence	Single	Commercial Banking	No	Marcory
Interview 3-A	Abidjan	38	Master	Married	International organisation consultant	Yes (Car)	Yopougon
Interview 4-A	Abidjan	32	BAC+1	Couple, two children	Industrial worker	No	Koumassi
Interview 5-A	Abidjan	23	BTS	Single	Financial advisor	No	Yopougon
Interview 6-A	Abidjan	24	BAC+3	Married	Health agent	No	Cocody
Interview 7-A	Abidjan	43	Master	Married, four children	Evaluation officer	Yes (car)	Route d'Attoban
Interview 8-A	Abidjan	33	4th	Couple	Sewing room	No	Marcory
Interview 9-A	Abidjan	33	2nd year	Couple	Chicken seller	No	Abobo
Interview 10-A	Abidjan	41	BAC+1	Couple	Police officer.	No	Yopougon
Interview 11-A	Abidjan	32	Tle	Couple	Bar waitress	No	Yopougon
Interview 12-A	Abidjan	32	Master	Single	Student teacher	No	Angré
Interview 13-A	Abidjan	28	Tle	Single, two children	Sex worker	No	Marcory

Interview 14-A	Abidjan	28	1st	Single, two children	Pharmacist	yes (car)	Yopougon
Interview 15-A	Abidjan	32	Tle	Married, two children	Hairdresser	No	Riviera 2
Interview 16-A	Abidjan	30	BAC+1	Two children	Retailer	No	Two trays
Interview 17-A	Abidjan	32	CEPE	Single, one child	rice seller	No	Abobo
Interview 18-A	Abidjan	24	Master	Single	Student	No	Yopougon
Interview 19-A	Abidjan	28	Licence	Single	Commercial banker	No	Riviera
Interview 20-A	Abidjan	21	Master	Single	Student	No	Faya
Interview 21-A	Abidjan	37	Phd	Fiancée	University teacher	Yes (car)	Markory
Interview 22-A	Abidjan	34	Master	Married, one child	Interior designer	Yes (car)	Riviera 3

There is an acknowledged difference between the profile of the women interviewed in Pune and that in Abidjan. Most of the women interviewed in Pune appear to belong to a relatively higher socio-economic background than those in Abidjan. In Pune, 7 respondents own a car. 9 have a motorbike. In Abidjan, 5 respondents own a car. This difference can be explained by the fact that author 2 interviewed mainly English-speaking women to avoid translations that might introduce bias. However, we are aware that this difference may have led to a bias in the socio-economic profile of the respondents, which differs between the two cities. These differences in women's socio-economic profiles and the differences in night-time mobility systems in the two cities raise questions about the 'universality' of women's unsafety at night.

To ensure that respondents participated in the study of their own free will, we asked for their consent before each interview. As we did not collect any sensitive information and we used pseudonymisation, the interviewees did not need to sign the consent form we gave them.

The fieldwork in Abidjan took place between February and April 2023 and in Pune in April-May 2023. The interviews were recorded and then transcribed. The data was analysed for content and cross-referenced between the two sites.

4. Results

4.1. Night-time activities influenced by feelings of unsafety

People's spatial practices are often influenced by their perception of safety or unsafety in the spaces they want or need to frequent (Zhang, Zhao and Tong, 2022). In the case of our research, we were interested in the spatial practices of women at night and the effects of insecurity on their practices.

Whether in Abidjan or Pune, women's spatial practices at night are similar. In Abidjan, the women interviewed had a wide range of nocturnal practices. Some go out at night mainly for professional activities. This is the case, for example, of respondents 10-A (41 years old, municipal policewoman), 14-A (28 years old, pharmacist), 11-A (32 years old, bar waitress) and 13-A (28 years old, sex worker). In Pune, some women work late at night, like interviewees 22-P (31 years old, street vendor) and 15-P (23 years old, office worker) who follows British office hours and usually finishes work around 9:00-10:00 pm. As an executive director, respondent 10-P (43, executive director) regularly attends business dinners. It also happens that some of the interviewed women need to take a flight late at night, whether for professional reasons like interviewee 10-P (43 years old, general manager) or to visit their family like interviewee 6-P (40 years old, secondary school teacher).

In both cities, a significant proportion of women's nocturnal movements are for leisure or entertainment purposes. In Abidjan, many women go out at night to parties, to maquis[1], to nightclubs and so on. In Pune, most of the respondents said they liked to go to the cinema, shopping centres, restaurants with friends and family, nightclubs and bars, and family events (weddings, birthdays, etc.).

The attention to certain details of the mobility of some women reveals that they are guided by fears and feelings of insecurity that they may experience in their spatial practices.

This can be seen in the places they frequent and the times they go out. In Abidjan, some women, such as respondent 5-A (23 years old, financial adviser), say they avoid certain neighbourhoods

[1] Mainly in Ivory Coast and Burkina Faso, these are popular places where food and drink are served, and where there is music to dance to. They are generally open from midday to the following morning (6am-7am).

such as Yopougon, a nightlife hotspot, with the 'Princess street'[2], which they consider unsafe. If they have to go there, they do so in groups. They prefer to go out in the Cocody and Marcory neighbourhoods, which they consider safer. Other women, perceiving the night as unsafe, do not go out after 10pm. Others, living in neighbourhoods such as Yopougon or Adjamé, tend to go out at night in the areas where they live. These practices and fears are based on their own experiences of insecurity. In fact, some of the women interviewed spoke of instances of insecurity or violence directed at them in the public space, such as being followed or being the victim of attempted kidnapping by drivers.

According to the interviews conducted in Pune, the feeling of danger at night seems to manifest itself after 9.00-10.00pm for some people, and even after 11.00pm for others. For some of the women interviewed, the time of day was not a determining factor, as Pune is generally perceived as safe at all hours. Overall, the women interviewed agree that Pune is perceived as a safe city, even at night, especially in comparison with cities such as New Delhi. This is particularly marked among those who travel late at night for work or leisure. Despite this feeling of safety, the interviewed women take precautions. Some avoid travelling alone, especially after 9-10pm, due to concerns about perceived risks of sexual harassment or violence. These precautionary measures remain in place despite the general perception of safety throughout the city. To illustrate this idea, interviewee 17-P (38 years old, fashion designer) stressed during her interview: "Pune, in all aspects, is a pretty safe city for women, and even at night, in bars, in night clubs. Of course, you always need to take basic precautions as we never know."

4.2. Modes of transport and feeling of (un)safety

The sense of (un)safety that influences nightlife also influences women's choice of means of transport.

In Abidjan, the interviewed women said that they mainly used metered taxis for night-time journeys. For short journeys within the same commune, some respondents said they used communal taxis, also known as Wôrô-wôrô. However, whether they use metered taxis or communal taxis, they say they have strategies for identifying non-suspect drivers. Respondent 6-A (24 years old, health worker) explains: "Before I get into a taxi, I have a good look at the taximeter. When they (drivers) are too young or look like they've been drinking, I don't take them. With the kidnapping stories, you have to be careful which car you get into". On the other hand, the interviewed women who had their own vehicle or one provided by their household preferred to travel in it, or to be accompanied by a driver, their parents or their companions, when travelling at night.

In Pune, some of the respondents prefer to use their own vehicles because they feel safer travelling at night. Others go out at night mainly accompanied by their family or get a lift from their husbands. However, most of the women interviewed also said that they enjoyed travelling at night by autorickshaw for short distances and by car taxi for longer distances. Car taxis are more comfortable and often faster at night, as less traffic means that cars can go faster than autorickshaws. Safety is not the only factor pushing women to us personal cars in both

[2] "Rue princesse" is an old street in the city of Yopougon, about 2 km long, renowned for its maquis, bars, gastronomy and sex workers.

cities.Traveling in a personal car also means for these women being free in their travels but also showing their belonging to high social categories.

In both cities, the choice of means of transport for night-time travel is guided by safety concerns. In Abidjan, for example, the women said that transport and stationcan be unsafe. Two of the interviewed women explained that they had already been sexually assaulted (touched and rubbed) on the SOTRA bus or in a Wôrô-wôrô and had been abducted by a taxi driver. During the interview, respondent 4-A (32 years old, industrial worker) expressed herself as follows: "It must have been over a year ago now, I was going to Yopougon, when the taximeter, after taking the entrance at the banco, instead of continuing to my destination, took a strange route into the woods. I had to start shouting for people to look at us and for him to stop. Luckily, I soon realised that there were people there otherwise. I don't know what he was going to do to me." Most of the interviewees, even if they have not been victims of insecurity, have heard about attempted kidnappings in the media. It is because of these experiences that the majority opt for metered taxis when travelling at night, or, in rare cases, for short distances, wôrôs-wôrôs. Even when they make these choices, the women have strategies to ensure their safety. This may involve identifying suspect drivers, as already mentioned. Others pretend to make a call during the journey or make a call.

In Pune, we observed that some women feel safer in an autorickshaw, benefiting from the ease with which they can get out of the vehicle if they need to, while others prefer to be in an enclosed space such as a car with a driver. The perception of potential danger from inside or outside a vehicle depends on each respondent. Interview 8-P (26 years old, unemployed) revealed that for some women, drivers, especially autorickshaw drivers, are often associated with poverty, which is indirectly linked to lower castes (Annavarapu, 2022). This association contributes to the sense of unease felt by some customers, such as participant 8-P (26 years old, unemployed), who established a significant link between poverty, low caste, and the risk of sexual harassment. As Annavarapu (2022), shows in her research on Hyderabad, although the fear of women is legitimate, it is more a question of classism.

4.3. Adoption and use of e-hailing by women for night-time travel

Most of the women interviewed in Abidjan and Pune said that they had used e-hailing taxi platforms, particularly for their night-time journeys, since these services have become an integral part of the transport offer. These services offer them either an alternative to a private vehicle, or a means of transport in cases when they do not own a vehicle.

We observed a variation in the choice of transport modes among the respondents. In Abidjan, while most of the respondents systematically adopted e-hailing for their night-time journeys, others used it more randomly depending on the availability of other means of transport, such as metered taxis or private vehicles. In Pune, most of the women interviewed have adopted e-hailing services as their main means of travel or as a complement to their private vehicle at night. Some still prefer to use their own vehicle exclusively at night, such as respondent 10-P (43 years old, general manager), who uses e-hailing services mainly to get to the airport and on business trips. Only 7 women in Pune and 5 in Abidjan are able to choose their own car for travel. The choice of private vehicle for nighttime travel concerns only those with high incomes.

While safety is an important factor in the adoption of e-hailing, it is not the only one. In both cities, women adopt these services mainly because of the safety, security and comfort, the social representations they send out. The women interviewed mentioned the fact that using e-hailing meant they did not have to negotiate the price of the journey, since this was given by the platforms. Furthermore, the interviews, particularly in Abidjan, showed that the use of e-hailing taxi services is also explained by the need to be fashionable, as shown by this exclamation from respondent 20-A (aged 21, student): 'It's stylish and classy to arrive at a party with your Heetch and get off like a star arriving at a party with your driver. Even if he's not my driver, it's like I'm someone important. It's chic.' Another reason given for using e-hailing taxis by respondents in both towns was that they were not dependent on the driver or a family member for their journeys. Also, some women explained that using e-hailing taxis enabled them to go out and drink without worrying about driving after the evening, without having to look for a parking space or to avoid traffic jams. A few cases in Abidjan and Pune reveal that the respondents take advantage of the time they have available during the journey to, for example, apply make-up or carry out work-related tasks, particularly when they have business appointments.

Analysis of mobility practices shows that women's mobility has been qualitatively improved by e-hailing services in several respects in terms of comfort and safety. Compared with metered taxis and autorickshaws, which most of the time involve going out into the street to hail the vehicle, thereby exposing oneself to the risk of harassment, e-hailing provides a door-to-door service that avoids this type of exposure. The information that the platforms provide about the drivers, the possibility of sharing the journey with friends and family in real time and the warning systems in the event of danger are all elements that, according to our respondents, increase their feeling of safety when travelling via e-hailing platforms. Some e-hailing applications in Abidjan (Yango, Uber, Heetch) and Pune (Ola, Uber, Rapido) also have a virtual SOS button that alerts the local police. None of the interviewees mentioned having used it. The feelings of insecurity (including road insecurity) generally expressed by women depend on the behaviour of e-hailing drivers,particularly in the case of Abidjan. Although not in the majority, at least three women mentioned reckless driving that had led to an accident or harassment by Yango drivers. The situations described by these women also relate to the feeling of road safety. This type of setback is because in its early days (2020-2021), to dominate the market, the Yango platform let drivers onto the platform without really checking their background or character, according to interviews with the e-hailing drivers' union in Abidjan and some drivers. As a result, some women in Abidjan have indicated that they prefer one e-hailing service over another for their night-time journeys. They felt that this choice was safer because, according to their personal experience, the drivers were better selected and more rigorously screened, as well as being more professional. Respondent 7-A (aged 43, Evaluation Officer) explained herself as follows during the interview 'I prefer Uber when I go out at night. The drivers are professional, and it is reassuring. Two years ago, there were all kinds of drivers on Yango, they drink, they take drugs to work long hours'. In the same vein, some women say they prefer to use Yango's 'comfort' option exclusively, which means a more comfortable vehicle, often driven by drivers they feel are more responsible. Unlike the women interviewed in Abidjan, those in Pune did not perceive any marked difference in terms of safety between E-hailing operators. Furthermore, in Abidjan, some women said that charging prices during busy periods at night led them to resort to taxis and expose themselves, as interviewee 20-A (21 years old, student) explained: "Two or three months ago, I don't remember, we were at a concert. At the end, with my friends, we ordered a Yango, oh..., the price was multiplied by three or four than when we came. We preferred to negotiate a taxi home. We don't know who the driver was, we were scared because we were all girls, but we had no choice". The fact that the respondents in

Pune are generally from the middle or upper classes explains why they do not necessarily pay attention to the high fares due to dynamic pricing.

4.4. Effects on the feeling of safety and on night-time activities

In both Abidjan and Pune, the security provided by e-hailing platforms enabled most of the women interviewed to go out and about to different places without worrying too much about the safety of the transport, and their relatives felt more reassured. For example, in Abidjan, the interviewee 20-A (21 years old, Student) explained that the availability of e-hailing services reassures her parents, who, on the rare occasions when she goes out at night at the weekend, order her a car via Uber. They use the location sharing option to keep track of their daughter's movements. Previously, they had refused to let her go out at night. In Pune, respondent 20-P (36 years old, German and Marathi language teacher), married and living with her in-laws, can now "travel in peace", as she puts it. Before, her in-laws didn't feel comfortable with her going out dancing in the evening. Now she can go out and come home in E-hailing, and her in-laws are reassured. Apart from these two cases involving family or relatives, many women in Abidjan said that they had previously restricted their night-time activities and the leisure areas they frequented to their hometowns or neighbourhoods, fearing that they would have difficulty finding transport to get home, whereas with the e-hailing option they can go further afield than their home neighbourhoods.

In Abidjan, however, this does not seem to be the case with all the surveys. Despite announcements of 24/7 availability, e-hailing services are not accessible at night in all the city's areas. Several women reported that their Yango or Uber orders were cancelled by drivers, particularly at night when they requested journeys to certain districts such as Treichville, Abobo, Yopougon and Adjamé. Within these areas, often perceived as unsafe where past incidents have seen drivers trapped, platforms like Yango provide drivers the option to cancel journeys to such locations without facing any penalties[3]. In Pune, the question of the availability of services and waiting times arises. The e-hailing service is particularly well developed in the evenings around entertainment venues. At all hours, the waiting time for autorickshaws is generally short, between one and three minutes. On the other hand, waiting times for car taxis are often more than ten minutes, due to traffic jams and the limited number of taxis available. Remote areas are naturally less well served than central areas. According to respondent 18-P (32 years old, biology researcher): "It depends on the area. In some places it's very easy to find a taxi, and in others it's more complicated. I live in Panchwati, which is mainly a residential area inhabited mainly by older people. As a result, there are fewer autorickshaws and taxis at night".

Also, for some women in Abidjan, the availability of the e-hailing service does not make night-time travel any safer. For these women, the e-hailing driver himself is identified as potentially dangerous to their safety. A concrete example is provided by respondent 5-A (23, financial adviser) who explained: "No, I never take Yango alone. I prefer two or three girls together. I

[3] Drivers who consistently accept a high rate of journeys gain access to valuable customer information and priority in receiving future journeys. Platforms penalize cancellations by revoking these benefits and may even suspend the driver from the platform.

don't even trust these drivers". And respondent 19-A (28 years old, bank clerk): "No, it hasn't changed much for me. For me, night-time in Abidjan is always risky. And Yango or not, drivers can still behave badly. Generally, when I go out at night it's until 10pm at the most. If I stay out longer, I prefer to sleep at my friends' place and go home the next morning". This highlights the fact that of the forty-four women interviewed, three in Abidjan, compared with just one in Pune, admit that they do not feel safe, either alone or in a group, when using e-hailing to travel at night.

Finally, the issue of surveillance is specific to the Indian context. A number of women in Pune spoke of the need to share their location with their friends and family while e-hailing. For most, this is considered a normal practice, but some question the fact of being constantly followed by their loved ones thanks to the location being activated and shared, justified by safety concerns. This situation raises questions about the right and freedom to take risks and appropriate public space, a dynamic that is specific to Indian culture, which stresses the importance of women taking precautions to minimise the risk of aggression in public space.

5. Conclusion and limitations

The aim of this article was to understand women's use of e-hailing services, particularly for night-time travel, considering risk and perceptions of insecurity. It also aimed to analyse the transformation of night-time practices made possible by e-hailing services as a right to the city. The interviews conducted with women in Abidjan and Pune helped to meet these research objectives. Overall, it emerges that in Abidjan, more than in Pune, women have in the past been confronted with situations of insecurity, particularly harassment and sexual violence. This difference can be put down to the difference in profile observed between the respondents in Pune and Abidjan. As the women in Pune were from relatively better-off backgrounds than in Abidjan, they used their own vehicles and avoided public transport, so they were less exposed to street harassment or rubbing. Indeed, compared to other Indian cities such as New Delhi (Dhawan and Yadav, 2018), which are reputed to be unsafe for women, respondents in Pune did not mention any experiences of insecurity in public spaces or on public transport. Surveys of women from modest social backgrounds could reveal different results in terms of safety and appropriation of e-hailing platforms.

This does not prevent us from observing that in both cities, women share similar practices of going out at night, motivated by reasons such as social life, leisure, and professional obligations. Prior to the deployment of e-hailing services in both cities, the women surveyed were accustomed to using taxis or their private vehicles where they had them. In Pune, most of the women surveyed did not use public transport to travel at night. This habit remains unchanged for the time being. In Abidjan, some of the women said that they rarely used paratransit transport (Wôrô-wôrô and Gbaka) at night for short distances. While for all of them this is due to a lack of safety in using these modes, some do not consider it as a means of travel, even during the day, because its use is associated with poverty. These results are in line with the work of Mattioli (2014), which shows that the avoidance of public transport by the well-off is a means of avoiding the socio-economically more vulnerable populations and even of being stigmatised as 'poor' when they use this type of transport. Overall, despite the differences observed in the two cities, the feeling of unsafety at night is similar. The contraction of night-time transport services and the insecurity of para-transit hinder women's mobility, thereby calling into question their right to the city and their access to urban resources at night.

In both Abidjan and Pune, the women interviewed have begun to make e-hailing part of their daily routine, particularly for night-time journeys, in view of the convenience and safety gains they perceive and are experiencing. Other studies in Nigeria and South Africa have produced similar results, according to which women appreciate e-hailing services for night-time travel (Agina and Iluno, 2023; Fenton et al., 2020). In the case of Abidjan, our research also reveals that the women surveyed attribute to the use of e-hailing services social imaginary of 'upmarket' transport. As shown by Diaz Olvera et al. (2020), these results are close to the social representations associated with the car as a luxury mode of transport. While these researchers reveal that the car is inaccessible to the majority, e-hailing is accessible to people of even modest means and allows them to visibilise a high position in the social hierarchy that they do not necessarily occupy.The interviews reveal that while there may be safety gains for women when travelling via e-hailing platforms, and that for some this allows access to areas frequented at night. However, the advantages in terms of safety and access to space do not apply to all the women interviewed in the two cities. On the one hand, the driving practices of drivers (reckless driving, harassment of customers), particularly in Abidjan, and the exorbitant prices charged during periods of high demand, lead women to use taxis, which they consider unsafe. Similarly, in the case of Abidjan, e-hailing services do not serve certain neighbourhoods (Adjamé, Abobo, Yopougon) at certain times of the night, forcing respondents who have to go there to use other modes of transport, which may be less safe if they do not have a vehicle. Despite an increased perception of safety with e-hailing services, some interviewees in Pune associated taxi drivers with lower castes, stereotyping them as possible criminals because of their social hierarchy. These results confirm the study previously carried out by Annavarapu (2022) with thirty-four women and twenty-six drivers, highlighting the mutual suspicions between women and drivers. Some women who could not travel further than their neighbourhoods can now do so at night, and some whose families or parents did not allow them to go out at night for fear of something happening to them can now go out because their families trust these services. This is the case in both cities. However, in Pune we observed that some women felt that their mobility was controlled by e-hailing services. By enabling women to move around safely at night, and to access urban resources from which some were excluded because of transport problems, e-hailing services provide respondents with a right to mobility. The insecurity of space (as in certain districts of Abidjan) or the control of women's mobility by relatives (in Pune) can limit the potential of e-hailing services to ensure greater safety and ease of spatial practices, particularly at night. The right to the city therefore depends not only on e-hailing services and their quality, but also on other factors such as the means of using them and the security of the space itself.

To go further and provide a more comprehensive view of women's mobility practices, it would be relevant to compare women using e-hailing services with those who do not for night-time travel. Ultimately, to what extent is the mobility potential offered by e-hailing inclusive and beneficial for all women? What access does it provide to space and mobility for women from modest backgrounds?

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CRediT authorship contribution statement

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Publication V

Baudens, P., Purandare, U. Digital Safety Tools: An Unmet Promise of Safety? (Under review).

Title: Digital Safety Tools: An Unmet Promise of Safety?

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Abstract:

As solutions to urban safety, especially for women, become increasingly digital, crucial questions arise regarding access, privacy, and surveillance, and the effectiveness of relying on technology. While there is some research on how the three strands of digital technologies, public space, and gender come together, there is a noticeable gap, especially when it comes to empirical insights from cities in the Global South.

This paper seeks to contribute to discussions on women in public spaces by investigating how digital safety tools have been developed, why city officials are increasingly employing these solutions, and how women themselves view the usefulness of these technologies when it comes to mobility and access to public space. The research has largely been conducted in Pune, India, and includes interviews with fifty-seven women and seventeen experts among city officials, researchers, and representatives from firms and nonprofits that use technologies ostensibly to improve women's safety.

Findings suggest that some safety tools, like sharing information of one's cab ride, are becoming more prevalent and may offer reassurance. However, most tools respond to situations after the fact rather than attempt to prevent violence in public spaces. These interventions tend to be surveillance-based and tend to beget further surveillance.

Keywords: Safety, digital safety, women's safety, urban safety, gender.

1. Introduction

For the first time, more people in the world live in cities than those who do not (The World Bank, 2023). Not only are cities in the Global South growing, more and more areas are urbanizing. City governments across the world are introducing policies and programmes in order to better plan urban development, improve urban services, and ensure that basic amenities are accessible to all. As cities grow, their economies and social structures also change. While this brings new opportunities and scope for innovation, it also raises a number of challenges. These range from impacts on the climate to access to basic amenities. Cities around the world – and groups within cities – are impacted differently by these challenges. One such issue, that has gained much traction, is that of urban safety–and women's safety in particular (Gupta et al., 2022).

Growing urbanization and the increasing focus on urban safety has coincided with the burgeoning digitalization of public services and governance, including urban digitalization. This is a broad trend that includes the use of apps and platforms, the collection of large amounts of city and citizen data that is used for decision-making, the digitisation of urban services, and the increasing automation of urban governance (Cardoso et al., 2019). With concepts like the digital city and the smart city becoming increasingly popular, there has been an attempt to digitize more and more aspects of urban life from traffic management to waste disposal, from municipal services to emergency response (Cardoso et al., 2019; Amairany Montiel Fernandez et al., 2020). In the same vein, there has been an attempt to make cities safer, more secure, and more accessible with the use of digital technologies and various IT-based tools. This includes emergency buttons on public transport, tracking and tracing apps, and surveillance cameras (Ramachandiran et al., 2019; Woodburn & Griggs, 2022).

These trends, of increasing urbanization, the growing concern for women's safety in cities, and the upsurge of urban digitalization, have coincided in India as well. The 2012 gang rape case in Delhi raised important questions of whether Indian cities had in fact become safer for women and significantly influenced perceptions of women's safety in India, fostering heightened concerns and justifications for increased surveillance and control measures (Cardoso et al., 2019; Gupta et al., 2022). This tragic incident also served to justify the development of digital safety tools visibly aimed at preventing similar tragedies. With the launch of India's 100 Smart Cities Mission in India, digital solutions to urban problems gained popularity and there was a concerted effort to find technological interventions that would ease the lives of citizens. With the rapid growth of smartphone usage, these tools have become increasingly ubiquitous (Burke et al., 2011; Kennedy & Coelho, 2022). Safety, which is often conflated with surveillance and the ability to inform people of one's whereabouts, has become a selling point for various goods and services, from phones to electric scooters, from public transportation to a gamut of mobile apps and interventions (Just et al., 2019; Kennedy & Coelho, 2022). Overall, only a handful of studies have examined how prospective users perceive the usage and effectiveness of digital safety tools in specific contexts (McCarthy et al., 2016). This study, therefore, aims to deepen the reflection on the utility and appeal of digital safety tools.

The primary research was predominantly conducted in Pune, India, encompassing interviews with a cohort of fifty-seven women and seventeen individuals identified as experts. These experts include city officials, researchers, experts, and representatives from diverse organizations and businesses that utilize technologies aimed at enhancing women's safety. This methodology was employed to assess the popularity, adoption, and efficacy of digital safety tools. Additionally, a benchmarking study was undertaken to identify and appraise various digital safety tools.

Overall, this paper aims to contribute to discussions on women in public spaces by investigating:

1. How have digital safety tools been developed and implemented through various initiatives?
2. Why are city officials increasingly opting for these digital safety solutions, which seem to be growing in popularity?
3. How useful and impactful are digital safety tools in enhancing women's safety in terms of mobility and access to public spaces?

The paper is structured as follows. In the next section, we review the limited literature that exists on digital safety tools and their efficacy. We ask what has been left out of these conversations and what questions remain unanswered. Section 3 introduces the methodology while Section 4 presents the findings. This is divided into three subsections. First, we classify the two types of digital safety tools that have emerged, namely preventative apps, and emergency apps. We then attempt to understand why these tools have gained in popularity, particularly with government authorities. Finally, the discussion section summarizes the contributions of the paper, critiques the approach of techno-solutionism when it comes to urban safety, and offers further avenues for research.

2. Contextualizing digital safety tools: A review of the literature

Digital safety tools is a fairly broad term that encompasses a variety of interventions, from CCTV cameras to mobile apps, and from emergency buttons in public places to alert systems that may send a warning to select individuals or public authorities. Further, the providers of these tools also vary from city governments, and the police to private companies, NGOs, and startups.

The scientific literature related to digital safety tools is mostly composed of conference papers, often written at the occasion of IEEE conferences (Tripti et al., 2018; Rai et al., 2018; Tahmidul Kabir et al., 2020). Most of the research was conducted in India, Bangladesh, Pakistan, and the US (Sarosh et al., 2016; Tahmidul Kabir et al., 2020). A large number of the papers have aimed to present the technical conception of various safety tools (Tripti et al., 2018), explaining the architecture of these solutions. In several cases, the neutrality of the presented research is questionable, especially because benefits were often explained whereas disadvantages and reflection on effectiveness were not, if not denied, overlooked and understudied. The products

and services presented in these conference papers were often still prototypes, not yet available in the market (Cardoso et al., 2019). In the US, the main use case differed slightly as most studies presented technical solutions to improve the security of people on campuses who face the risks of shootings (Majumdar et al., 2014; Glass et al., 2015; Mohammed et al., 2021). In Bangladesh, the development of some anti-harassment apps seemed to often focus on kidnapping without proposing specific features for such a purpose (Hossain et al., 2019). In India, the studies have largely emphasized female safety by proposing all kinds of digital safety tools as individual solutions to face street harassment and threats of violence (Ramachandiran et al., 2019; Rai et al, 2019).

What can be inferred from the literature is that the main justification for the development and introduction of safety tools has been to improve the safety of individuals, commonly women (Yarrabothu & Thota, 2015; Chand et al., 2015), in public spaces. These interventions have promised to prevent potential situations or offer support during specific situations like street harassment (Blom et al., 2010), rapes, and intimate partner violence (Decker et al., 2020). Most of the time, however, these statements lack clear data or sources to support them. While insecurity can be a concern in some areas for various reasons, it is important to provide specific information for better scrutiny of the efficacy of these interventions. Otherwise, these general claims can mistakenly make people believe that insecurity is increasing everywhere. The usage of these solutions might directly influence the perception of safety as it highlights the existence of a risk, amplifying fear and diminishing self-confidence, and therefore access to public spaces (Cardoso et al., 2019).

In fact, several researchers have strongly critiqued the deployment of these safety tools (Danaher, 2018). As a first example, Lauren F. Cardoso and her research group criticized how digital tools often inadequately comprehend harassment risks, contributing to the perpetuation of stereotypes. Their study showcased a bracelet alert system promoted in a marketing campaign that featured Little Red Riding Hood in the forest. They argued that such imagery reinforces the fear of strangers and public spaces. It is crucial to note, however, that sexual assaults frequently involve individuals known to the survivor (Bivens & Hasinoff, 2016; Cardoso et al., 2019; Gupta et al., 2022). As a second example, John Danaher claimed that these tools did not significantly contribute to solving the problem of sexual consent, and so of sexual harassment and rape. From his point of view, education and legal reforms should lead the way to better clarify what consenting means and reinforce gender respect and equity within society (Danaher, 2018).

Similarly, a study in Delhi on the increasing ‘CCTV-ization’ of the city revealed that even the police did not consider surveillance cameras as an effective means to prevent crime, despite the common marketing portrayal of increased surveillance in that light (Rathi & Tandon, 2019). Furthermore, there are significant discrepancies regarding which areas of the city are subjected to greater surveillance, influenced by notions of who should be protected and from whom. These decisions are made in the absence of stakeholder inputs and with little regard for how such surveillance technologies might exacerbate inherent inequalities in urban spaces, making them even more discriminatory (Rathi & Tandon, 2019).

Only a few studies have looked at how potential users of digital safety tools perceive their usage and usefulness in specific locations (McCarthy et al., 2016). Orla Thérèse McCarthy and her research group ran a survey in Dublin, Ireland, showing that most of the respondents would consider using a safety digital app in case they felt unsafe. More generally, this study shows that such digital tools mostly attract younger generations and females, who can better perceive the benefits and are more commonly comfortable using apps (McCarthy et al., 2016).

This paper aims to comprehend the development, implementation, and practical effectiveness of digital tools by examining their appeal to researchers, businesses, and authorities who advocate for their use, as well as their practical utility. The goal is to enhance the existing literature on this subject in order to generate more points for discussion.

3. Methodology

The methodology employed consists of multiple approaches aimed at comprehending the trend that has resulted in the proliferation of digital safety tools and their incorporation into public policies.

Following a literature review to familiarize ourselves with the research that had been done and the arguments surrounding the use of digital safety tools, a benchmarking study was carried out. It consisted of listing identified Indian and International digital safety apps within Google Play and Apple App Stores in an XLS table. Once listed, apps were downloaded and tested when possible. In several cases, we noticed many bugs and local restrictions not allowing any testing outside of the zone, limiting the examination. Overall, the objective was to learn about the diversity of safety apps and to observe similarities and differences between the various interventions.

Next, we conducted qualitative interviews with seventeen experts in India, with a focus on the city of Pune. Overall, the aim of these interviews was to gain insight into diverse approaches from several stakeholders, enabling a more comprehensive understanding of the proliferation of digital safety solutions and to conclude their practical usability for women's mobility in public spaces. After conducting a web search, we listed experts possessing relevant expertise in digital safety solutions. Experts were contacted through LinkedIn or email. We encountered difficulties in receiving answers, especially from app operators. However, we managed to interview a large variety of experts among researchers, activists, public administrators, and app operators, involved in the development of digital safety solutions. The interviews were managed individually and took place either online or in-person. The questions were customized to align with the unique specialties of each expert, leading to a wide array of specific inquiries. The interviews were either recorded or detailed notes were taken. The recordings and notes were then transcribed. We requested the consent of participating experts to engage in the study, and we asked them for permission to quote their statements.

Lastly, we incorporated findings from the analysis of qualitative interviews with fifty-seven women representing diverse socio-economic backgrounds. This approach aimed to enhance our comprehension of how digital tools have reshaped mobility practices at the individual level for women, and to assess whether the interviewees integrate digital security tools into their daily mobility. Furthermore, the results from these interviews allowed us to supplement the insights from experts by incorporating observations from the female population regarding the potential use of digital tools to enhance their feeling of safety, as well as their access to these digital services. All the interviews were led on site. Interviewees were recruited from various areas and social circles through word of mouth. All the participants were at least eighteen years old and residents of Pune. Most interviews were conducted in English and eleven interviews were translated from Marathi to English. Translations were avoided as much as possible to limit interpretation loss. However, this approach led to a clear imbalance in the representation of different social levels, assuming that less privileged groups tend to speak less English (Highet, 2021). This disparity did not significantly affect the study, as our primary objective was to investigate the utilization of digital safety apps among women who owned smartphones and thus shared a specific socio-economic background (Doron, 2012). Interviewing women from less privileged backgrounds confirmed that many of them did not have smartphones, making it challenging for them to share their real-time location or download safety apps. Consent was asked, and data management was clarified and explained, to all the interviewees. Sensitive data was not collected, and interviewee names were anonymized.

We selected India for our study due to the concentration of scientific papers on digital safety tools in the region. This highlights a distinct emphasis on public space safety and a notable enthusiasm for digital solutions in the existing literature. In India, Pune, with its significant population of up to 7 million inhabitants (World Population Review, 2023), was selected as the fieldwork location. First, Pune is a major economic hub with significant industries, a high-tech center hosting multinational corporations, and a renowned academic presence, making it a vibrant multicultural environment (Leducq, 2011; Butsch et al., 2017). Secondly, Pune has played a pivotal role in governance concerning smart city initiatives and digitalization, owing to its active engagement in national programs like the Smart Cities Mission launched in 2015 (Butsch et al., 2017). Some of these smart initiatives have included the introduction of digitally-driven safety measures for women in the city. During the study period, Pune was reputed as a relatively safe city (Interview with the Commissioner of Police, 09.05.2022). Through its involvement in various digital programs, there is a commitment to further advance digitalization across various public sectors, aiming to address challenges such as public space insecurity.

4. Results: Digital safety tools and women's safety in public spaces

4.1. The emergence of digital safety tools

Various businesses and researchers have introduced a wide range of digital safety tools to address different aspects of personal security and emergency response. During the benchmarking of existing safety apps, we began to distinguish between two types of digital

safety tools focusing on different action types: preventive and emergency. Both preventive and emergency tools have been quickly multiplying, offering a variety of solutions.

Preventive measures aim to identify and address potential risks, including where these are most likely to take place, and typically involve training, reporting, etc. These interventions are designed to curtail instances of harassment or violence and improve urban access for vulnerable individuals in the long-term. Below are two examples of notable preventive tools that originated from India.

First, Safetipin is a social organization dedicated to addressing safety concerns. It collaborates with donors, partners, and funding agencies. Aside from other activities, Safetipin gathers a host of data through different avenues and creates reports for city governments or other organizations. In fact, Safetipin works directly with city governments across the world to improve urban safety without a disproportionate dependence on surveillance. The organization has created applications such as Safetipin Nite and Safetipin Site, enabling authorities to assess areas for potential improvements in cities, ultimately enhancing the overall sense of security for residents. People can also download the Safetipin app to report on how safe they feel in different parts of the city, and to navigate across the considered safest streets according to the audits (Safetipin, n.d.; interviews with Safetipin, 01.11.2021, 01.03.2022).

Second, Red Dot Foundation, an NGO primarily funded by the US embassy in India, offers an app that allows women to report minor and major incidents on a map by pinning the location of the event and providing a description. When a significant number of incidents are reported in a specific area, the Foundation's employees attempt to locally solve the recurrent issue by working with the local community to raise awareness, mediate issues, and offer training (Red Dot Foundation, n.d.; Interview with Red Dot Foundation, 04.04.2023).

Overall, both organizations have a specific focus on women's safety and strive to bring about long-term changes that can be periodically reviewed and further improved. The organizations work with multiple stakeholders and attempt to bring about changes in attitudes in addition to improving urban infrastructures.

Emergency measures aim to address sudden critical situations as a reactive response. There are a plethora of emergency tools developed both internationally and locally for research or business purposes. Below are two examples of basic "emergency" apps developed in India.

First, the Abhaya app was developed by a research group at Vignan University, Andhra Pradesh, in 2015. The app was primarily tested and deployed within the campus. Users could press a virtual "SOS button", thereby triggering the sending of messages indicating the emergency and location updates every five minutes to pre-registered contacts. Such a solution relied on functional smartphones. The plan involved integrating the local police, which presented challenges due to their existing emergency channels (interview with the operator of Abhaya app, 03.04.2023).

Second, the I'm Safe app, originating in Tamil Nadu, is also a basic tracking app with an emergency button to inform relatives about potential encountered danger. Additionally, the app

allows users to rate areas based on perceived insecurity but does not provide a navigation tool to avoid areas considered unsafe (I'm Safe, n.d.).

Overall, these tools offer a multitude of features, with the "SOS button" for informing relatives and tracking live location standing out as the most prominent among them. These two mentioned features have been implemented within digital taxi platforms such as Ola and Uber to potentially improve the safety of their transportation service and reassure their customers. Sometimes, there is a "SOS button" in the taxi itself, but it is unclear what these buttons do, and as detailed in a news report (Mohan J, 2022), these buttons often do not work in the intended way (Interviews with the women). However, the fact that digital taxi platforms have adopted such safety features within their mobility services shows a real concern for the comfort of customers selecting this specific mode of transport and for their personal safety (interview with a digital taxi platform operator, 03.04.2022; Interviews with the women). In fact, the commitment to safety through digital tools has evolved into a selling point for digital taxi platforms, in addition to being a core aspect of their business strategy. By prioritizing and enhancing customer safety, particularly women's safety, these platforms not only attract more users but also foster a loyal and secure environment for their services, which is crucial in the competitive digital taxi platform industry. As the manager of a digital taxi platform operator expressed during our interview: "High taxi availability alone doesn't motivate women to go out more at night. However, integrating reassuring features like SOS buttons and trip-sharing with relatives fosters a sense of safety, making women more inclined to use these taxis for travel, even at night." While these digital safety tools have proliferated, it is important to note that the effectiveness and success rates of such features in real-world situations are not always rigorously measured. Despite this, the focus on enhancing safety and security through digital means continues to grow, reflecting the increased importance placed on these aspects in modern society.

Our observations also revealed that the development and implementation of various digital safety tools, encompassing both preventive and emergency features, primarily stem from the initiatives of businesses and researchers. Surprisingly, these tools have seen relatively minimal involvement or direction from governmental authorities. In many cases, governmental entities seem to be notably absent from the process of creating and deploying these safety measures, leaving it to private enterprises and academic institutions to take the lead in this domain. And yet, governing bodies in India, from the local to the national level, all encourage digitalization and digitally-led solutions to a host of problems.

4.2. Popularity of digital safety tools and public initiatives

Digitalization is portrayed as the silver bullet solution by the Indian government to address massive urbanization and the challenges faced by cities. Public initiatives of digitalization began in the early 2000s but accelerated significantly in June 2015 with the launch of the "Smart City Mission" by the Ministry of Housing and Urban Affairs. Pune's smart city proposal was ranked second among the cities. The city was one of the earliest to start receiving funding from the Ministry to implement a Smart City program involving digital technologies with specific

priorities among urban safety. This program, which ended in December 2022 in Pune, was governed by a newly-set up body separate from the city's local government, known as the Pune Smart City Development Corporation Limited (PSCDCL). A close study of smart city initiatives in Pune revealed that there were only two initiatives related to safety in public spaces.

The first initiative involved the installment of 136 emergency call boxes with "SOS buttons" across the city to enable citizens to connect with public emergency services (police, hospital, firehouse). However, such an initiative appeared unpopular, as none of the fifty-seven interviewed women were aware of the existence of such services. Furthermore, in order to use these emergency call boxes, users have to know where they are located, along with daring to push the button and receiving an actual answer from the emergency call box.

The second initiative involved the publication of a public report in association with Safetipin, the organization described earlier. Safetipin worked with PSCDCL to audit the levels of safety in Pune's streets. The audit, conducted in 2019, involved recruited volunteers going around the city and evaluating every street based on nine parameters defined by Safetipin. These parameters included aspects such as the presence of street shops, street lighting, police presence, and walk paths (Safetipin, n.d.). The resulting report described the perception of safety across the streets of the city (Safety Audits in Pune, 2019). Unfortunately, once the report was published and Safetipin was paid for its service, there was no follow-up by the authorities. According to a Safetipin representative, these audits are only useful when there are follow-up studies conducted to assess whether the interventions recommended have helped improve access and perceptions of safety (interviews with Safetipin, 01.11.2021, 01.03.2022). In fact, the audits were not taken over by the residents of Pune, who could have continued to report updates and share their feelings for every street on the Safetipin apps. Concretely, there was a lack of awareness among the population regarding such initiatives. Additionally, there was a lack of motivation, as such a service would require crowdsourcing proactive actions, which individuals often do not prioritize due to other commitments (interview with a manager in PSCDCL, 31.03.2022). Of the fifty-seven interviewed women, no one knew about the existence of this Safetipin report for Pune or about this initiative from the PSCDCL, more broadly. As a result, it became evident that such "little digital actions" do not significantly contribute to making streets safer at any time of the day.

The initiative undertaken by PSCDCL to conduct a safety road analysis with Safetipin seems to be a gesture aimed at projecting an image of concern for women's safety, but it lacks tangible action to address safety issues in public spaces. Such an initiative had no follow-up and had no concrete impacts on citizen safety. There was no real involvement from the police, who take other types of actions such as undercover patrols at night in areas considered unsafe based on internally developed identification systems within the police department. The lack of concrete actions from PSCDCL might potentially result from a lack of budget and a lack of real interest as Pune is reputed relatively safe regarding other Indian cities (interview with the police commissioner, 09.05.2022). The authorities might not have prioritized the improvement of safety in public spaces while there is always room for improvement.

According to the Red Dot Foundation, PSCDCL together with Pune Municipal Corporation and the Pune Police have never shown a willingness to develop any form of training related to gender equality and respect to reduce gender violence in the long-term. Thus, prevention efforts for Pune Municipal Corporation and PSCDCL remained limited to safety street reporting based on historical data from 2019. There was no concrete plan in place to develop further projects aimed at improving street safety. While the police had taken certain initiatives parallelly, they took the form of patrols as a preventive approach and involved the development of communication channels, mostly emergency phone lines, to provide counseling to victims. The police did not take part in the deployment of safety digital tools as such (interview with the police commissioner, 09.05.2022).

In addition to these initiatives, there were others that were also presented as improving safety and access in the city like an increase in the number of CCTV cameras, improved street lighting in certain parts of the city, and public restrooms especially for women. These initiatives, much like the ones discussed above, are more cosmetic than impactful. Importantly, such initiatives present digital solutions as silver bullets but do not make a concerted effort to change attitudes or mindsets that in no small way impact women's safety and access to urban spaces (Purandare 2023).

4.3. Usefulness and impacts of digital safety tools on women's safety

Through the research, we observed that certain digital solutions, especially emergency tools, seemed to raise the feeling of security in public spaces, more than concretely improving safety.

Emergency tools in the form of apps might offer the feeling of having options, and to potentially receive some help. Such digital services could thus positively impact self-confidence, offering more freedom to travel with peace of mind. During interviews, an illustrative case emerged: Interviewee 20 began using Uber and sharing her trip, leading her in-laws to permit her to travel alone at night. The reassurance comes from her relatives being informed of her whereabouts and safety through the tracking service. Our interviews showed that several women felt safer when being tracked by their relatives, using different apps such as Uber/Ola or WhatsApp. However, none of the interviewees used other digital safety features (including "SOS buttons" in Uber, Ola, buses, etc.).

In the end, these digital tools have fundamental limitations, including technical (e.g., network, battery) and social-economical ones (e.g., digital illiteracy, possession of a smartphone, language). Due to the fact that harassment and sexual violence can take multiple forms, none of the digital safety tools could be used for all types of scenarios that might potentially take place. The scenarios are fantasized and depend on the representations that the creators of these apps have regarding the variety of potential situations in public spaces. These digital safety tools mostly focus on very specific situations, and need a reactive action coming from the user once they feel unsafe. They do not guarantee an instant reaction from informed relatives about the danger via the emergency communication channel. In addition, the response to the solution

from the authorities and local police is difficult to set up and requires specific infrastructures on top of trust (interview with the operator of Abhaya app, 03.04.2023; Interview with Red Dot Foundation, 04.04.2023). The interviewee 32 described regularly testing communication safety channels to ensure their functionality when needed: “Whenever I notice traffic or weird things, I try to call emergency services to inform them. I also try to reach them to test if their services function. However, many times, no one picked-up the phone to answer my calls.”

Moreover, taking specific actions using the smartphone might be difficult for potential victims. First, taking out the smartphone, to push a “SOS button” in front of the aggressors or potential one, can be delicate if the intention is to steal phones. Second, it is very difficult to, for instance, in the case of Uber/Ola, to push the digital emergency service as the driver will notice the passenger is afraid. The driver might then take advantage of the situation. Similar challenges arise in taxis equipped with “SOS buttons”, as well as buses. Third, tracking tools do not help prevent potential assaults as the aggressors are not aware the victim is being tracked (Interview with a political activist, 11.04.2023). The Interviewee 28 exemplified the challenges described in the first and second points, emphasizing: “On my phone, I have the emergency push button. But when there is an emergency, like a guy being too touchy, you rarely have the chance to call the emergency service to say "this guy named X, is touching me. We are exactly at this X location".

Insisting on the necessity of these digital safety tools, through advertisements and political discourses, to ensure personal security, might indirectly increase fears and inadvertently reduce urban access. In addition, problematic references are made when it comes to who people need to be kept safe from. For example, “pin your creep” was a slogan used by the Red Dot Foundation. This slogan might assume a certain image of who the creep is. In the public imagination, the creep has the portrait of a lower caste or Muslim man from a disadvantaged economic background, exactly like the *auto-rickshaws wallahs*[1] or Uber/Ola drivers. These apps appear, to certain extent, to build on stereotypes and even to reinforce them (Interview with a political activist, 11.04.2023). A research paper authored by Annavarapu (2022) explores this very question of the tussle between men who drive these taxis and the women passengers who are driven by them. Both feel they are at a greater disadvantage or in greater danger (of being attacked or of being falsely accused) (Annavarapu 2022). These complex interrelations cannot be captured or addressed by these fairly simplistic digital safety tools. While Pune is an example of a relatively safe Indian city where women seemed to feel fairly safe, many interviewed women were cautious with safety. However, only three of the women had downloaded safety apps and none of them had ever used the tools. The interviewee 35 explained: “I have set up this emergency SOS button on my phone, but I’ve never used it until today.” Overall, women develop their own safety strategies, which may or may not include digital tools.

Promoting non-digital solutions might be more efficient, and more future-oriented than promoting the usage of digital safety tools offering instant emergency services. According to

[1] *Auto-rickshaws wallahs* refers to the drivers of local *tuk-tuks*, known in India as auto-rickshaws.

the research study “City For All” conducted in 2022 in Pune, street vendors and better lighting make cities safer as the vendors are the “eyes” of the place. “Safety is a number”: women feel safer when they see other women, even just one, in the street as well (Social Design Collab, 2022; Gera & Hasdell, 2023).

On another hand, these digital safety tools might lead to more surveillance. Such surveillance can take several shapes at different scales. For instance, at micro-level husbands, members of families or in-laws, might take advantage of these digital safety tools by requiring the woman to constantly share her location when she moves, ostensibly for her safety but indirectly for controlling her movements. At another scale, in India, we could observe in gated communities monitoring systems enabling controlling entries and exits forcing residents to adopt residential norms involving digital practices such as face recognition, shared phone numbers to the residence management (of visitors as well). There is a lack of clarity on what data privacy measures, if any, are in place, who this data is being shared with, and how this sensitive data might be used in the future (interview with an expert, 01.03.2023). During the interview this idea was summarized by the expert in the following manner: “It was this ironic thing where people are seeking out physical security and putting themselves at risk for like other types of vulnerability.”

According to the professor leading the Abhaya app research project, there has been an increase in cybersecurity issues in recent years, raising concerns about data privacy. “Technology and digital enables more criminality, creativity, and possibilities. [...] Digital can help but it can also be misused, like the double side of a coin” (Interview with the operator of Abhaya app, 03.04.2023).

Preventive and educative solutions such as Safetipin and Safecity (Red Dot Foundation) support a potential improvement in terms of street safety by raising awareness as a long-term process. However, there is still the risk of fostering vigilantism by mapping “unsafe” locations, reinforcing stereotypes, and encouraging discrimination and marginalization of certain populations (Interview with an expert, 01.03.2023).

5. Discussion & Conclusion

This study contributes to the discourse on women in public spaces by investigating the development of digital safety tools, the motivations of city officials in endorsing these digital solutions to enhance public safety, and women's perspectives on the utility of these technologies for their mobility and access to urban areas. Conducted in Pune, the research includes interviews with fifty-seven women and seventeen experts, including city officials, researchers, and representatives from firms and nonprofits involved in safety digital tools.

In recent years, there has been a proliferation of digital safety tools, predominantly developed by private companies and research organizations (Chand et al., 2015). Among the most commonly offered safety tools are “SOS buttons” and live location tracking services, typically

integrated into digital taxi platforms, as a business technique seducing users by reassuring them. These tools aim to provide an emergency solution in cases of insecurity, enhancing the perception of safety. However, it is crucial to note that while these tools may boost one's sense of security, their actual effectiveness in addressing and preventing risky situations remains uncertain. A comprehensive analysis of their impact on violence prevention is notably lacking (Woodburn et al., 2022). Moreover, many of these safety tools rely heavily on smartphones to function effectively. Issues such as dead batteries, malfunctioning devices, or forgotten phones render these apps ineffective (Pawar et al., 2018). Additionally, while features like "SOS buttons" and live tracking may offer support in suspicious situations, they could potentially distract the user and increase overall risk (Just et al., 2019). Furthermore, even if the police and relatives are notified, they may not be able to respond quickly enough to resolve the situation (Ramachandiran et al., 2019).

One of the downsides of live tracking location apps is that such tools can be used to monitor and control partners or family members, more especially women with the fear of being harmed in public places who accept giving up some of their freedom for the sake of safety, as these digital safety tools reveals their location (McCarthy et al., 2016; Cardoso et al., 2019; Kennedy & Coelho, 2022; Gupta et al., 2022). As noted by Lauren F. Cardoso et al. (2016), "technology can extend abuse."

Furthermore, these digital safety tools were designed primarily for women who own smartphones, excluding those without access to such devices or who are digitally illiterate. This limitation not only exacerbates existing inequalities but also perpetuates stereotypes by assuming that only unknown individuals pose a threat, disregarding the reality that harassment and violence often occur within known relationships (Cardoso et al., 2019). Paradoxically, underprivileged populations are often at a higher risk of street insecurity and violence due to their residence in densely populated, economically disadvantaged areas. One expert remarked: "Technology is a solution for certain things and certain audiences" (interview with a social justice activist, 12.04.2023).

Public authorities are increasingly promoting safety digital tools as part of their urban planning efforts. However, this appears to be a superficial solution designed to showcase their responsiveness, rather than taking more substantial and costly initiatives to enhance urban safety through improvements in areas such as street lighting and pavements. These more fundamental enhancements would likely be more effective in improving urban safety (McCarthy et al., 2016; Danaher, 2018).

In conclusion, it would be more effective to improve the safety of the entire public space instead of concentrating solely on individual security by deploying specific apps with very limited responsive features (McCarthy et al., 2016; Gupta et al., 2022). This requires focusing on changing attitudes and expectations, and on challenging patriarchal norms that determine whether and the extent to which women can access and navigate public spaces (Danaher, 2018).

In recent years, social media has played a growing role in exposing sexual discrimination, though at times to excess (Interview with an expert, 01.03.2023). While technology can bring

change and awareness, it can also perpetuate fear through media consumption. It is important to temper these fears with the reminder that cities and urban spaces have afforded women both freedom and safety, and have played an important role in advancing women's rights and liberties (Wilson 2001). Furthermore, it is crucial to consider the risks associated with depending heavily on smartphones for safety in public areas. This reliance can either exacerbate fears or become our sole source of reassurance, leading us to question the extent of our dependence on these devices.

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Uttara Purandare: Conceptualization, Formal analysis, Methodology, Writing - original draft, Writing - review & editing.

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Publication VI

Baudens, P., Pasini, J., Masso, A., Hassen, M. Navigating Fear of Violence in Insecure Urban Spaces. (Under review).

Navigating Fear of Crime in Kinshasa, Democratic Republic of Congo

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Navigating Fear of Crime in Kinshasa, Democratic Republic of Congo

Insecure urban environments discourage mobilities or add complexity by necessitating the adoption of strategies to manage fear. This paper contributes to the growing field of the geography of fear by investigating how fear of travelling in public spaces is constructed and how it shapes mobility practices and strategies. Conducted in a context of social inequality, poverty, and insecurity, this research highlights the link between fear, space, and time, raising awareness among urban planners and policymakers about the importance of improving public space access everywhere, at all times.

Focusing on Kinshasa, the capital of the Democratic Republic of Congo, known for its vibrant yet unsafe nightlife, the study examines how fear shapes spatial mobilities. Semi-structured interviews with fifty-two students from the University of Kinshasa reveal that risk perception is both spatially and temporally specific and is shaped by area reputation and social representation, among other aspects. Despite prevalent fear, many students navigate the city at night for both obligatory and recreational purposes, employing various strategies to manage fear, including adjusting their travel times, routes, transport modes, and behaviours.

Keywords: Mobility, Immobility, Night-time, Emotional geography, Crime, Fear.

1. Introduction

> We were born into such a dangerous place, so we're used to it. We move despite street-insecurity, especially because we've been taught that intelligence is the ability everyone has to adapt to any situation they face (interview with Alain, a student).

As described in this quote, the fear of crime does not necessarily prevent travelling across space. However, it shapes, as a result of perceptions, how to move and strategies to adopt in order to manage fear (Koskela and Pain 2000; Ho 2024).

Fear of crime is a complex and context-dependent phenomenon (Pain 2000). In this paper, we understand it as an emotional response caused by awareness or expectation of crime (Ceccato, Langefors, and Näsman 2023). Here, perceptions refer specifically to this expectation. As a result of multidimensional perceptions, fear not only influences individual mobility practices, but also shapes urban and transport planning (e.g., the development of gated communities with defensive architecture) (Pain 2000; Ceccato, Langefors, and Näsman 2023). This fear is not simply a matter of fear or no fear, it varies in intensity, from slight discomfort to strong worry (Scorgie et al. 2017). The focus in this research is on how such a varying degree of fear can result in immobilities[1] or more cautious mobilities, thereby disrupting the freedom of movement and access to public space (Koskela 1997; Guinard 2015; Ceccato, Langefors, and Näsman 2023). By crime, we refer here to specific acts of physical violence that occur in particular urban spaces (including during mobilities) and generate feelings of fear (e.g., kidnapping, assault, theft, sexual harassment) (Sparks, Girling, and Loader 2001; Diaz-Olvera, Plat, and Pochet 2018).

The geography of fear, building on concepts such as affective spatiality (Ho 2024) and emotional geographies (Van Wijnendaele 2011; Davidson, Smith, and Bondi 2012), provides an understanding on how perceptions and experience shape fear, and how fear, in turn, produces and shapes space (Koskela and Pain 2000; England and Simon 2010; Ho 2024). Thus, analysing the constructions of fear, through perceptions, explains its

[1] In this paper, mobility is defined as the capacity for physical movement in space (Levy 2013). Immobility, used here relatively, refers to the absence of movement outside the home (Teo 2025). The plural form is employed for (im)mobilities to reflect the diverse forms, practices, and experiences of movement across time, space, and social contexts (Sheller and Urry 2006).

consequences on spatial practices (Loukaitou-Sideris 2016). At the macro level, constrained and limited mobilities due to fear can impact the overall economy by reducing consumer and professional activities (Porter and Turner 2019). Therefore, this research shall benefit urban planners and policymakers in taking conscious of the importance of the relation between fear, space, and time, to take action to improve public space access everywhere, at all times.

This paper contributes to enriching the literature of the geography of fear by applying this concept to spatial mobilities at night, within a city known for high risk of crime, ensuring the experience of fear. Applying the geography of fear to mobilities leads to an exploration of immobilities as forms of non-travelling practice, which remains underexplored, at night especially (Porter et al. 2010; Diaz-Olvera, Plat, and Pochet 2018; Mawussi, Baudens, and Bamba 2025). The night was described by a few researchers as a distinct temporal and spatial entity from the day, with its unique dynamics (Gwiazdzinski, Maggioli, and Straw 2018; Hernández-González and Carbone 2020). In most cities worldwide, as the night progresses urban services diminish, with activities concentrated in very few specific locations (Plyushteva and Boussauw 2020). Thus, the night raises many interrelated issues regarding mobilities. By specifically looking at the night, this paper explores a period marked by increased fear, exacerbated by rising perception of risk of crime, while also expanding knowledge on mobilities at night (Diaz-Olvera, Plat, and Pochet 2018; Mawussi, Baudens, and Bamba 2025).

Kinshasa, the capital of the Democratic Republic of Congo (DRC), was selected to contribute to the field of African studies on the geography of fear (Guinard 2015), because of its interesting contradictions. This megapolis is reputed throughout the African continent for its festive neighbourhoods and its music scene (De Boeck 2006; Tsambu 2023). Parallely, the city is rapidly growing, about 16 million inhabitants in 2023, and spatially expanding, resulting in high urban poverty with high income inequalities (Batana et al. 2021; World Population Review 2023). Outside of the famous nocturnal neighbourhoods where parties are held, and of a very few wealthier areas, streetlights are lacking and power shortages are frequent (Batana et al. 2021). In 2018, 41% of the population had no regular access to electricity, resulting in large areas plugged into darkness from approximately 6 p.m. to 6 a.m. (Batana et al. 2021). Late at night, only a few “private” transport options remain available such as mototaxis (Malukisa 2017).

Transport infrastructures are lacking: roads are mostly unpaved and often impracticable (e.g., frequent flooding) (He et al. 2020). Although the city has a developed nightlife, awareness or expectation of crime remain high (Yoka and Jacquemot 2019; Batana et al. 2021). Despite all, mobilities to access amenities, work, education, and entertainment happen both day and night (Geenen 2023). This paradox reinforces the relevance of studying how (im)mobilities, perceptions, and fear interact and influence one another.

The methodology is based on a case study as a type of qualitative research. Interviews were conducted with fifty-two students at the University of Kinshasa (UNIKIN). Given their constrained mobilities (e.g., limited financial resources, commuting obligation), and their relatively frequent night-time activities (as confirmed by interview data), students represent a particularly relevant population for analysing the construction of fear and its effects on mobility practices and strategies (Ceccato, Langefors, and Näsman 2023).

To explore fear, perceptions, (im)mobility practices and strategies (Guinard 2015; Farina, Boussauw, and Plyushteva 2022), the following questions were formulated: (RQ1) How is fear constructed through multidimensional perceptions of risk of crime? (RQ2) How does fear shape practices of spatial (im)mobility? (RQ3) How does fear shape strategies to enable certain forms of mobilities?

2. Literature: the Fear in Mobilities

The role that fear plays in limiting urban mobilities have been documented (Helen Phosho and Gumbo 2022). Fear has been mostly approached as a constraint that needs to be reduced to facilitate travel (Koskela and Pain 2000; England and Simon 2010). However, fear can also serve as a lens to explore urban populations' relationship with the spaces and temporality, a path notably explored by Guinard (2015) and followed in this paper.

According to Rothbart (2021), fear is a matter of perception, and therefore of meaning. Fear denotes a reaction to a perceived threat, usually translating into diverse physical manifestations (e.g., increased heart rate, trembling, sweating, accelerated breathing), shaped and fed by interrelated factors across multiple dimensions (e.g., individual, collective, urbanistic) (Rothbart 2021). For instance, collective discourses can construct the reputation of a particular place or time (Diaz-Olvera, Plat, and Pochet 2018), while personal experiences of aggression or witnessing crimes as well play a significant role

(Guinard 2015). The observation of darkness and of empty streets can also influence perceptions and provoke fear. These factors, constructing perceptions and feeding fear, can reinforce the belief that any movement within certain spaces is risky (Guinard 2015). Thus, fear is the result of perceptions, which are themself the result of an interaction between individuality, integration of collective narratives (e.g., reputation of areas, media), spatiality (e.g., urban design), temporality (e.g., day or night, rush hour) (Ceccato, Langefors, and Näsman 2023).

Work exploring how fear influences people's relationship with urban space concerns the whole of the global South. For example, women in underprivileged neighbourhoods of Mexico City experience a gendered sense of place marked by fear due to constant threats of harassment and sexual violence (Soto-Villagrán 2012). Public transport in the city can also feel constrained and threatening, resulting in what Lindón (2020) calls an "alert sense of place", meaning a state of constant vigilance when navigating urban mobility.

In Africa, geography of fear is beginning to emerge, with work on Senegal (Diaz-Olvera, Plat, and Pochet 2018), South Africa (Robert 2010; Guinard 2015), and Nigeria (Agbola 1997; Badiora et al. 2013). Agbola's book “The Architecture of Violence” (1997) interestingly explores how urban form (e.g., neighbourhood density, building age, and presence of fences) relates to urban violence in Lagos, Nigeria. While this causal link may seem deterministic, it highlights how planning policies significantly impact urban insecurity. Thus, fear can be partly understood as a consequence of inadequate urban planning policies, framing it as a social rather than just an individual issue. In Senegal, Diaz-Olvera, Plat, and Pochet (2018) examine how perceptions of risk of crime relate to poverty, identifying two key factors in mobility-related insecurity: the environment (e.g., poor vs. wealthy areas) and individual characteristics (e.g., age, gender, socio-economic status). They found that poorer areas are often perceived as more insecure, especially by those from higher socio-economic backgrounds. However, research on the role of fear in people's use of urban spaces is not limited to sub-Saharan Africa (Davidson, Smith, and Bondi 2012). Research conducted by Vania Ceccato, Langefors, and Näsman (2023) involving 1,122 students in Stockholm shows that students are particularly vulnerable to crimes and sexual assaults on public transport. The study also finds that women adopt more precautionary measures than men. Perceiving risks of theft and assault leads people to apply strategies such as avoiding certain places and times, dressing differently, and carrying their bags discreetly, what the authors refer as “behavioral responses to fear of

crime". Moreover, experiencing or witnessing other people's victimisation may also increase an individual's sense of insecurity, especially in highly insecure contexts (Ceccato, Langefors, and Näsman 2023).

Gender, age, physical conditions, race, class, and other social but also spatial and temporal factors, shape perceptions of risk, and consequently travel behaviour (Anderson and Smith 2001; Ho 2024). This paper examines several of these dimensions, such as gender and financial conditions, to explore how fear is constructed by perceptions and how it shapes (im)mobilities. In doing so, it contributes to the literature on (im)mobilities in fear, and more broadly to the geography of fear.

3. Methodology

This paper adopts a qualitative approach to analyse the construction of fear through perceptions, and the ways it shapes (im)mobility practices and strategies of all kinds to eventually reduce the risk of crime.

We focused the research on students because they tend to be more mobile at night (Fenton, Wafer, and Fitchett 2020) and have specific mobility needs, such as commuting to the university (Ceccato, Langefors, and Näsman 2023; Baudens et al. 2025). This population also includes individuals from diverse socio-economic backgrounds, which translates into varying levels of access to transport (Baudens et al., 2025). Indeed, given their common dependence on financial support from their families, students' mobility practices tend to reflect their socio-economic status (Lututala 2012; Mpofu 2015; Fenton, Wafer, and Fitchett, 2020). It is important to note that, in a city marked by poverty, attending university indicates a relative socio-economic advantage (Mpofu 2015).

To ensure diversity of socio-economic backgrounds and travel practices, we randomly recruited between two to ten students from each of the thirteen faculties at UNIKIN, the largest public university in the country. Faculties like medicine and mathematics are highly competitive and mostly attract wealthier students with access to better quality education compared to other faculties (Lututala 2012). The recruitment was carried out with the support of student delegates and faculty administrators. As a result, fifty-two students were interviewed. The sample was equally split between genders, with ages ranging from eighteen to forty-three, and an average age of twenty-three. The students

were in diverse academic years from first to sixth. Twenty-nine students were from Kinshasa, twenty-one from other DRC provinces, and two from Cameroon. Their residences were spread across the city, though many tended to live in neighbourhoods around UNIKIN.

The interview questions were formulated for the participants to describe their perceptions regarding space and time, (im)mobility practices at night, their strategies to cope with fear, and experience of relatives with crimes. Participants were also asked demographic questions to contextualise their family and personal backgrounds.

The interviews were conducted in French (official language in the DRC and relatively widely spoken) and one-on-one, in classrooms, and lasted between 30 to 50 minutes. The interviews were kept relatively short because of the challenging conditions in which they were often conducted (e.g., several students skipped their class to attend the interview, noise, presence of many mosquitos).

This study adhered to ethical principles of qualitative research[2]. Before each interview, the students were provided with a consent form which was also presented orally. It informed them about the study's objectives, data usage, and their right to withdraw from the study at any time. To avoid discomfort of the participants, questions on sensitive issues like crime experiences and personal income were indirectly asked (e.g., have you ever witnessed a crime, such as an accident or kidnapping?). When consented, interviews were recorded. Handwritten notes were systematically taken because recording was not always feasible given the interview conditions (e.g., some recordings were difficult to listen afterward due to background noises). Both recordings and notes were then transcribed. The students' names were pseudonymised with common Congolese names.

The fieldwork in Kinshasa, which involved conducting the interviews, was conducted during three months in June 2023. It was followed by the analysis of the interview data. By using Excel[3], themes were identified to organise and compare the interview results

[2] All the participants were adults at the time of the study. According to ethical regulations at UNIKIN and the authors' institutions, no validation from ethical committees was required for research on non-vulnerable groups and non-sensitive topics.

[3] Excel was selected to support the analysis as it appeared a sufficient tool to manage the analysis with the research team.

and enable the analysis, resulting in findings. Quotes from the interviews were translated into English, with an effort to minimise the risk of losing their original meaning.

4. Findings

4.1. The construction of fear

The interviews showed that the students' fear of travelling in public spaces at night was the result of a combination of multidimensional reasons. Reasons such as the cultural representation of the night, the awareness of dangers, the lack of adequate urban infrastructures, and insufficient enforcement of policies ensuring street safety, provided a broader contextual frame to their fear. Individual factors, such as personal experiences, stories from relatives, and media reports, appeared to also play a role in validating and amplifying fear. Several of these reasons are further described below to better understand the role they play in shaping perceptions, resulting in fear.

The cultural representation of the night in DRC is associated with deviance, death, and the occult (De Boeck 2006). This appeared in the interview with Hélène, when she exclaimed:

> It's not advisable to go out at night, especially not after 10 p.m. At night, it's the time of witches, the time when criminals are active, and they cross paths at night.

Generally, the students appeared to associate the notion of "night[4]" as a period characterised by darkness and by increased risk of crime, predominantly perceived after 9 p.m.

The interviewees consistently expressed awareness of the risk of crime present in the streets of Kinshasa, describing their concerns through personal experiences, observations, and well-known events reported in the media. The danger manifested in four main forms. Firstly, students feared assault by the *Kulunas*, youth gangs known for terrorising, extorting, and sometimes killing with weapons like machetes. Secondly, kidnappings, mostly in mototaxis and shared cabs, were carried out by organised groups who robbed and abandoned victims on the outskirts. Unlike the *Kulunas*, kidnappings could happen anywhere. Thirdly, robberies of items (e.g., bags, money, wigs, phones) were common,

[4] Defining when starts and ends the night is challenging, and depends on societal perceptions and contexts (Hernández-González and Carbone 2020). In this paper, we define 'night' as beginning after 9 p.m., as most interviewees perceived mobilities to become significantly more dangerous from that hour on.

especially in crowded areas like markets. Fourthly, several interviewees described corrupt police as part of the risk of crime, citing frequent extortion at roadblocks through fabricated infractions. During his interview, Moise explained how the police criminality interrelated with the *Kuluna* activities:

> The drivers, the other transporters, and me also, we are victims if the bus is blocked by the police. The police often create infractions that don't even exist. Some police recruitments don't comply with the law anymore. They 'recycle *Kulunas'*. People who are criminals are sent to rehabilitation camps. Afterwards, they're often integrated into the police to change their mindset, but they keep their mentality full of violence and are given weapons. For the government, it's a way to re-educate the *Kulunas* with some ethics. The nation's values are being disrupted, with the population becoming victims of their own suffering with low wages and a violent, underpaid police force.

All of these crimes seemed to commonly occur in Kinshasa. But the level of security varied across areas within districts, and time of day. Louis described:

> In Kinshasa, there are zones where it's truly catastrophic, where young *Kulunas* cooperate with public forces. It depends on the area, the time, and the circumstances. The least secure areas are high-density ones, like the Ngaba roundabout and Victoire, mainly for theft. For harassment, it's the more remote areas, like Makala, which are the least secure. I can't say there's a place that's completely safe or free from issues.

According to most students, some areas remained unsafe during the day, while others provided a certain level of safety at night. Several of them perceived here a direct link between urban poverty and risk of crime, as Christine explained:

> The more money the residents of a neighbourhood have, the safer it is; And, the less money the residents have, the less safe the neighbourhood is.

In Figure 1, the three areas identified by the students as the riskiest also appear among the poorest neighbourhoods. These areas are named: Makala[5], Kisenso, and Masina. They appear as darker grey areas in Figure 1. These areas had in common the alarming absence of urban infrastructures among streetlights, frequent power shortages, and absence of

[5] Makala est une commune officiellement reconnue de Kinshasa, bien que souvent marginalisée dans les représentations administratives et perçue comme une zone d'extension urbaine. Elle se situe entre les communes de Ngaba, Selembao, Bumbu, et à proximité de Mont Ngafula.

police patrol. Plunged into darkness, delinquencies and criminal activities may easily arise. Thus, the presence of urban poverty and low-income populations may contribute to fear, while recognising that poverty does not inherently lead to insecurity. Interestingly, perceptions of the most dangerous neighbourhoods in Kinshasa did not differ between genders.

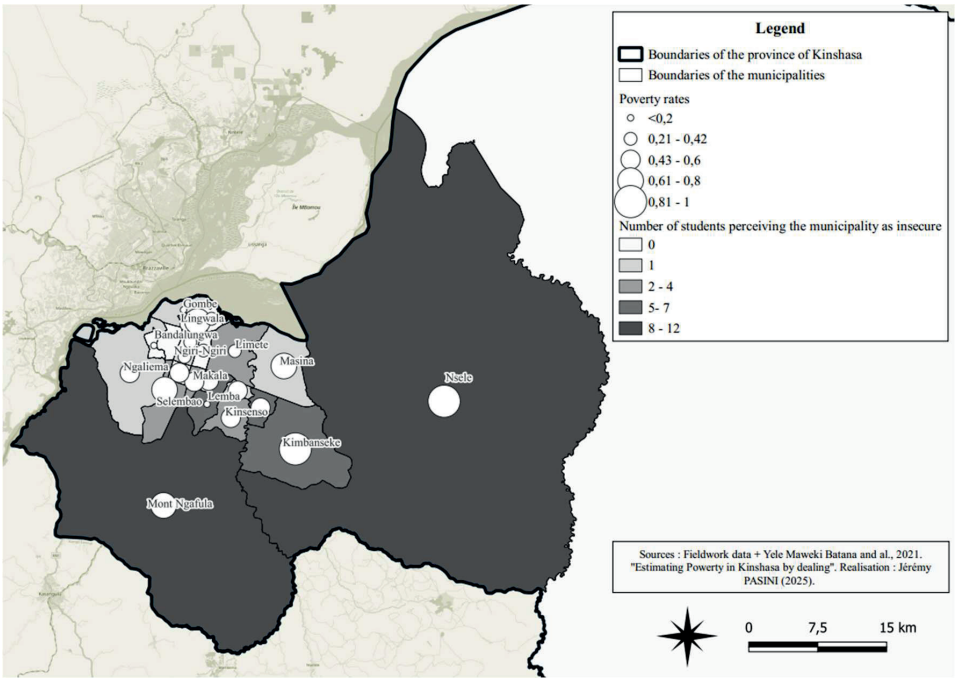

Figure 1: Students' perceptions of risks of crime and poverty rates by commune of Kinshasa

Personal experiences and stories from surrounders strongly influenced perceptions and, in turn, fear. During the interviews, we asked the students to share stories of crimes they or their relatives were victims of. All had at least one story to tell, either about kidnappings, robberies, unfortunate encounters with the *Kulunas* or the police, or rapes and sexual harassment. Jacques, for instance, described a kidnapping:

> A friend was kidnapped around 9 p.m. He disappeared for a few hours. He was later found drunk and drugged somewhere far away. The kidnappers had taken everything from him.

Antoinette described a daily reality of violence in her neighbourhood that she closely experienced:

> Security in Kinshasa is not sufficiently reinforced. Every day, there are problems. Recently, in my neighbourhood, a gang beat someone to death. There are sometimes gunshots, and the police are not committed. They don't come at night even if you call. They wait until morning to show up.

Medias inform but also reinforce and amplify fear by repeatedly describing disturbing events. They might perpetuate prejudices and reinforce negative reputations of certain localities. When asked about his feeling of safety, Martin described social media as a common way to be informed about happenings:

> Here in Kinshasa, we are not safe. There are the *Kulunas* who kill and steal. I've seen videos. They circulate on social media. People film them and then share them.

Perception of risk of crime around certain places at specific times results in fear, affecting mobility practices. These reasons influencing perception appear diverse and depend as well on factors such as residence and financial means.

4.2. The (Im)Mobility Practices Resulting Fear

All the students, despite their diversity, were very well aware of the different delinquency activities, conditioning their mobilities, especially at night. In the analysis, we defined two criteria: (1) whether the interviewed students travel at night or not, and (2) whether their mobility decision resulted from external constraints or personal choice. As a finding, we identified four profiles of (im)mobility practices, which were: forced immobilities, chosen immobilities, forced mobilities, and chosen mobilities. We present here the "forced" and "chosen" aspects under the two following sub-headings: "immobility practices at night" and "mobility practices at night", distinguishing immobility and mobility practices to facilitate the presentation of the findings.

4.2.1. *Immobility Practices as a Response to Fear*

A third of the interviewed students explained that they never go out at night, with most citing safety as the main reason. Albert summed up:

> The best strategy to ensure safety is to not go out at night.

If night mobilities were "safer" with reduced risk (especially *Kuluna* assaults and kidnappings), several of the students said they would be more likely to attend events. For

instance, Alain refrained from going out due to a recent rise in *Kulunas* activity during the fieldwork, altering his usual routine:

> Lately, insecurity has been increasing. Since then, I have limited my journeys.

Several students who practised immobility lived in areas reputed "unsafe", where urban poverty resulted in strong obscurity at night. They always tried to return home as early as possible. For example, Emmanuel usually came back home before 5 p.m, as Kisenso, where he lived, was both high risk of crime and widely perceived as dangerous. Furthermore, Solange mentioned that curfews were imposed in certain risky areas, penalising students living there by further restricting their mobilities:

> In some neighbourhoods, curfews are imposed following murders, during which people can't go out for hours or even days. The *Kulunas* prevent people from going out.

The interviews reveal that fear of crime was common to all. However, women appeared frequently perceived to face slightly higher risks, particularly to sexual assault and theft, and physically less capable to defending themselves. Albert's interview illustrated this opinion:

> Women are more affected by insecurity, especially at night. Men can fight, but women cannot. They can be assaulted, even raped.

Rose nuanced Albert's statement as she did not perceive any gender differences regarding risk of crime:

> The security of men and women is the same. It depends on each person's strength. The stronger a person is, the better they can defend themselves.

Our findings revealed that the students renting accommodation in Kinshasa, mostly those from more distant regions, enjoyed greater freedom in their mobilities. Most of those living away from their close families were male and often lived alone, while female students from distant regions were typically residing with extended relatives, eventually disapproving of night mobilities. Traditional norms seemed to discourage women from living alone and travelling at night, which may explain (though cautiously due to the small sample) that more female students reported staying home, especially after 9 p.m. This was expressed in Thérèse's interview:

> My father doesn't like me to go out at night. He tells me: "You're a girl and going out at night exposes you to danger. At night, only girls having Kilelo[6]'s life go out".

Some students described that their immobilities at night were not a response to fear, but a personal choice. André pointed to limited transport options as a reason not to go out at night, together with the lack of motivation as he preferred focusing on his studies. In such cases, immobility appeared to result from personal preference rather than external constraints.

4.2.2. Mobility Practices despite Fear

Interestingly, the majority of the interviewed students were travelling after 9 p.m., either regularly or sometimes. As for immobilities, reasons for mobilities were diverse. During the interviews, three profiles stood out.

First profile: Several students, who avoided going out at night and tried to return home early because of fear regularly found themselves travelling after 9 p.m., because of road issues (e.g. traffic jams, flood, driving incivilities). Every day Bernard tried to come home before 8 p.m., but he was frequently blocked until late evening:

> I usually stop going out by 8 p.m., but sometimes, because of traffic jams, I often end up reaching home around 11 p.m.

Anne usually left campus around 6 p.m., but with a two-hour commute, she often got stuck in traffic well past 9 p.m. Bernard and Anne's experiences appeared common in interviews. In such cases, mobilities at night appeared forced and involuntarily.

Second profile: Several students had obligations at night. Studying until late at night at the library seemed a common practice. Albert explained that he could not study elsewhere due to unfavourable conditions at home. Some other students worked after classes, evening or even night time. Augustin worked at the laboratory of his faculty. Jacques gave private classes. Marcel helped his brother at his pharmacy until 10 p.m. Antoine was regularly called to nocturnal psychological support missions that could happen anywhere in Kinshasa. He explained that he had to travel despite his fear:

[6] *Kilelo* refers to prostitution.

> I can be called at night to help someone with psychological issues, but the problem is that travelling at night is complicated due to insecurity. I might risk my life.

Two students were engaged in university politics, involving regular evening meetings. As another form of obligation, José often needed to travel to pharmacies at night to buy medication whenever he sensed a malaria crisis approaching:

> I live alone. It happens that I have to go out if I have a fever to get medication. But because of fear, I sometimes don't go out.

In all these cases, mobilities appeared forced as these students had to travel at night to fulfil their academic, professional, or medical obligations, despite fear.

Third profile: Several students were going out at night for entertainment and/or family gatherings with very various frequencies. Four students regularly went to bars and clubs. Some, like Elisabeth, exclusively attended private parties held in private spaces, mostly for security reasons. Others had late hobby activities. For instance, Michel enjoyed running around his neighbourhood at night. Louise had musical repetitions with her music choir after classes. Others visited church in the evening. Despite fear, these students still attended entertainment and family gatherings. In such cases, mobilities appear chosen, as for entertainment purposes, in contrast to mobilities driven involuntarily or by obligation.

4.3. Coping with Fear by Adopting Mobility Strategies

All the students, who sometimes or often practised mobilities at night, demonstrated having various adaptive strategies to cope with fear and limited transport options. During the interview, these students were asked about their "strategies", by which we meant their individual tactics shaped by their perceptions and beliefs to manage fear when travelling. Five key aspects were addressed through the different interview questions:

(1) favourable and avoided times to travel,
(2) favourable and avoided areas to travel through, to, or from,
(3) preferred modes of transport to travel at night,
(4) preference or neutrality regarding travelling in groups,
(5) any other personal tactics.

The next five paragraphs describe each of these aspects in detail.

Most of the students had a strict time frame to return home, or find alternatives to avoid travelling too late. Monique described:

> When I hang out with friends, I usually return by 10 p.m. at the latest for safety reasons.

Antoine, regularly called to nocturnal supportive psychological missions, explained sometimes staying overnight to his friends or patients' places:

> If I come back late, then there's the issue of insecurity. I'm scared. Sometimes I'm forced to sleep wherever I am. Or I call someone from my family to come pick me up by car.

This strategy of postponing travel until a safer time appears connected to a practice of immobilities.

Regardless of modes of transport, most students explained avoiding places they considered dangerous, even if this meant taking long detours. Albert described:

> I avoid certain places to protect myself because I'm afraid. It's about protecting yourself. With these incidents, you know, you can lose your life.

Thérèse added avoiding areas that she did not know:

> I avoid going to places that are unfamiliar to me. I don't go out much. Since I've been at university, my friends make me go out. […] There are places to avoid, like Makala and Selembao. The *Kurunas* operate there, especially at night.

The students mostly use mototaxis or, when available in their household, family vehicles (cars or motorbikes) to travel at night. These modes enabled faster travel in a relatively private setting and avoiding interactions with people on the street and thereby reducing the exposure to crime. Antoine's interview illustrated this point:

> I sometimes go out for celebrations or protocol service. I sometimes come back home at 2 a.m. Often, I arrange my own transportation. It depends on the events because I also sometimes use the mototaxis in the evening.

Most mototaxis served specific hubs, which means that long-distance travel might require several mototaxis to reach the destination. For a higher price, a longer trip (door-to-door) can be requested. This refers to the *express mototaxis*. André, who resided in the reputedly insecure Tshangu area, mentioned using *express mototaxis* to return home safer and faster:

> It is imperative to return before 10 p.m. So, when classes end at 7 p.m., I opt for *express mototaxis*, despite being more expensive, because they provide a direct route.

However, mototaxis or private vehicles require financial means, often beyond the reach of many students, especially for frequent use. Moreover, these modes did not eliminate the risk of road accidents or police checks. Although road accidents were not a central focus of this research, they also contributed to fear (Ayimpam, Kobongo Okito, and Michel, 2022; Baudens et al. 2025). Buses, in contrast, were generally unpopular for night travel. Only one student, Samuel, reported using them:

> I go out to have fun on Saturdays. I usually stay out a bit late. It depends on the availability of transport. Sometimes I wait until 5 a.m. in the city centre to catch a bus.

In addition to the higher perceived risk of crime, buses were quite rare at night, which was one reason why Samuel had to wait until 5 a.m. to catch one. Walking was also generally avoided. Only two interviewees reported walking at night. Marcel did so when returning home from work, as the distance was short and he was accompanied:

> When the pharmacy closes at around 10 p.m., I walk back home with my brother because the pharmacy isn't far from home. In my neighbourhood, there were *Kulunas*, but they were neutralised, I believe, by the police. But I am still scared.

Joseph also walked but before a certain hour and in specific locations:

> I sometimes go out at night to see friends, but not after 11 p.m. There are certain places where I can walk safely. It all depends where I go out and the areas I have to cross. I don't go everywhere. There are places that aren't safe.

Travelling in groups appeared a common strategy to reduce fear. When asked about his preferences regarding travelling alone or in group, Albert answered:

> Alone or with someone. I'm a big boy. But at night, not too much, not too alone.

Several female students specified preferring travelling in the company of men to better ensure their safety. Bernadette's statement illustrated this idea:

> I often travel alone. But at night, I prefer to be accompanied. If there's an unexpected event and it gets late, especially if there's a party, I try to be escorted by men to go home.

Finally, several individual strategies to cope with fear deserved attention. For instance, Julienne tried to always look comfortable in her neighbourhood hosting *Kulunas*, because according to her the *Kulunas* mainly target outsiders rather than residents:

> Every day, I return home no later than 8 p.m. […] I try not to appear new in the neighbourhood.

Joseph adopted similar strategies:

> I pretend not to hear. I scream or I run away. […] That I run away happens often.

Another strategy was to avoid recalling attention. Chantal described avoiding looking too wealthy not to attract attention of thieves and kidnappers:

> It's not safe to appear wealthy in neighbourhoods where people don't have money.

Jeanne and Christine also pointed out the necessity to "dress decently", with "no cleavage or skirts".

The interviewed students employed multiple strategies at night, but in fact also during the day. They seemed accustomed to risk and fear while travelling and mentally prepared to react the best they could in case of threat to their safety. The two words "stay vigilant" came up in multiple interviews as a must during mobilities.

5. Conclusion

This research shows how fear, associated with mobilities in insecure contexts, is constructed and expressed, and how fear resulting from perceptions shapes (im)mobility practices and strategies. The study was illustrated with the example of a diverse group of fifty-two students from UNIKIN. Our findings participate in enriching the literature on (im)mobilities in fear. It aligns with the geography of fear, which analyses the production of space by incorporating a sensitive and emotional dimension often lacking in geographic analysis (England and Simon 2010; Guinard 2015; Ho 2024).

The findings emphasised the complex multidimensional nature of fear. The fear appears to be influenced, first, by the existence of risks and the awareness of them, along with inadequate urban design (which is also shown by Agbola (1997)) and weak enforcement of safety policies. The reputation of spaces plays a major role. For instance, areas with a poor reputation often suffer from high urban poverty that might provide the ground for criminal activities. Social media and word of mouth can spread rumours of criminal events, reinforcing and perpetuating reputations, perceptions of risk, and fear (Kennedy and Coelho 2022). At an individual level, several aspects contribute, including personal experiences, exposure to news, surroundings, and socio-economic background (Anderson and Smith 2001; Diaz-Olvera, Plat, and Pochet 2018). The students residing in "reputedly

dangerous" neighbourhoods (as designated by the interviewees), most of whom came from less wealthy backgrounds, seemed to experience a higher sense of fear compared to those living in more affluent areas (Diaz-Olvera, Plat, and Pochet 2018; Foley et al. 2022). Regarding gender, while female students were perceived slightly more vulnerable to sexual assault and theft, male students also reported fear when travelling at night. This context nuances findings by Porter et al. (2010) and Zhang, Zhao, and Tong (2022), which reported higher fear among women during mobilities at night. In situations of high perceived risk of crime, both genders appear to experience fear (Robert 2010; Baudens et al. 2025). This perceived risk leads to what Lindón (2020) calls an "alert sense of space". Because the other people are perceived as potential attackers, people try to stay aware of their surroundings and remain constantly on guard.

Fear constrained the students' movements, resulting in immobilities or limited mobilities (Ceccato, Langefors, and Näsman 2023). We found that at night, their mobilities were often constrained by road issues, causing the students to return home unexpectedly late while experiencing fear (Baudens et al. 2025). Several students persisted to travel at night for academic, professional, or medical reasons, which were important priorities in their lives. A few students travelled for entertainment until late. Such practices, despite fear, raise several questions: are these students less aware of the risks than others, or simply more indifferent to them? Do they have access to safer travel options? Higher socio-economic resources may, in fact, offer one possible explanation (Anderson and Smith 2001), together with individual psychology and perceptions of risks (Ho 2024). The persistence of mobilities despite fear aligns with Guinard's (2015) argument that fear, resulting from perceptions, leads to the renunciation of certain forms of mobilities while simultaneously encouraging the development of strategies to continue travelling. Our findings show that fear actively shapes mobilities, together with precocious strategies (before and during travel) to cope with it (Guinard 2015; Ceccato, Langefors, and Näsman 2023). As strategies, termed as "behavioural responses to fear of crime" by Ceccato, Langefors, and Näsman (2023), all the students had identified areas to avoid, planned their destinations in advance, and ensured they had enough money for a return trip, mostly with mototaxis for faster and safer travel (Ho 2024). While travelling, they remained conscious of the local geography (Lindón 2020). They avoided attracting attention (e.g., mobile phones were hidden to avoid thieves (Baudens et al. 2025)) and held themselves mentally prepared for possible confrontations with delinquents. Our findings align with

Farina, Boussauw, and Plyushteva (2022) and Zhang, Zhao, and Tong (2022), who demonstrate that mobilities at night require precautious preparation. However, safer and quicker travel options (e.g., private vehicles, *express mototaxis*) were often too costly and thus inaccessible to many students, resulting to immobilities or more constrained forms of mobilities that demanded greater strategies to cope with higher risk and fear (Diaz-Olvera, Plat, and Pochet 2018; Foley et al. 2022).

Further research could compare these findings by conducting similar studies with other social groups in other similarly unsafe cities at night, to how narratives and cultural contexts shape (im)mobilities and related strategies resulting from fear. This would deepen the comprehension of the complex interconnection between fear, space, time, and risk perception, and help inform concrete, context-relevant recommendations to urban planners and policymakers for improving urban safety and mobility for all.

This research faced limitations, including budget and time constraints. During the fieldwork, our mobilities were constrained by safety concerns. We were strongly advised not to travel after dark. Contextual and social factors, such as our identities as two white women leading the fieldwork, may have influenced the study's conduct, participants' responses, and our interpretation (Rodriguez and Ridgway 2023).

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In this paper, we have used ChatGPT to help improve the grammar, as none of the authors are native English speakers.

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Declaration of Interest Statement

The authors certify that there are no competing interests to declare for this submission.

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