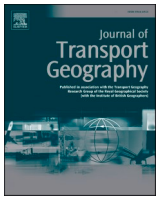
Journal of Transport Geography 108 (2023) 103573

Contents lists available at ScienceDirect

Journal of Transport Geography

journal homepage: www.elsevier.com/locate/jtrangeo



The potential of combining qualitative GIS and map elicitation in daily mobility studies

Ragnhild Dahl Wikstrøm *

Department of Sociology and Human Geography, University of Oslo, Postboks 1096, Blindern, 0317, Oslo, Norway.

ARTICLE INFO

Keywords:
Mobile methods
Daily mobility
GPS tracking
Qualitative GIS
Map elicitation
Mobility transitions

ABSTRACT

Mapping daily mobile experiences is a way to counter-map the mainstream status quo in transport planning and thus produce alternate 'truths' of mobility. Studies on the microgeographies of daily mobility and situational perspectives on transport can generate crucial knowledge, which might be used by planners and policymakers in facilitating low-carbon mobility transitions. There is great potential for rethinking and exploring new methods and techniques to study the mobile experiences and lived dimensions of mobility interventions. This paper explores the potential of an approach consisting of visualizing user-generated GPS tracks and geolocated photos in GIS and using the output for map elicitation in interviews. The participants are actively involved in the data production by using GPS trackers and taking photos. In turn, map elicitation enables the participants to be actively involved in analyzing the maps in retrospect. Thus, the method presents a bottom-up mapping tool for producing mobile knowledge, which in turn might be implemented in transport planning as a participatory planning support tool. The strengths and challenges of the proposed combination of methods are evaluated by considering (i) its potential at different stages of an idealized research process and (ii) how it can facilitate the production of microgeographical and im|mobile knowledge. This paper focuses on the practical and methodological implications of the proposed method and uses examples from a previously conducted study of an electric bike intervention in Norway to discuss the potential of combining these methods.

1. Introduction

Until recently, transport studies have largely been dominated by quantitative methods and positivistic epistemologies and have largely ignored the complexity of movement and daily life (Banister, 2011; Cresswell, 2010; Kwan and Schwanen, 2016; Røe, 2000). Travel in such approaches is generally seen as a cost, a calculable demand derived from the utility gained by individuals by participating in activities at various locations, based on the assumption that people make rational decisions to maximize utility. However, an extensive body of literature within transport geography has questioned the overdependence on the land use, time, and cost aspects and introduced the mediating role of attitudes and social influences on travel choice. The theory of planned behavior (Ajzen, 1991), for example, explores how subjective norms, attitudes, and perceived control of behavior can predict and explain travel behavior. Another example is the use of hybrid choice models that extend the typical discrete choice models and add attitudinal components, such as the degree of environmental awareness or attitudes towards road pricing, in explaining travel behavior outcomes (Ben Akiva et al., 2002; Kim et al., 2014). Behavioral studies, such as planned behavior and hybrid choice models, try to make up for the lack of attention given to human dimensions in much of transportation research. However, the one-sided focus on individual's attitude, behavior, and choice misses a deeper understanding of the complexity of people's actions and how social change happens (Shove, 2010) and how daily mobility practices are part of sociotechnical mobility systems (Dennis and Urry, 2009). Therefore, social change and mobility transitions might be better understood by using approaches that capture the complex entanglements of im|material elements constituting the prevailing mobility system, including technology, institutions, infrastructure, norms, cultures, and practices (Schwanen, 2015; Sheller, 2018). Moreover, it has become increasingly important to understand microgeographies and people's experiences of daily mobility practices beyond quantitative and positivistic approaches, as this can help planners and policymakers facilitate successful low-carbon mobility transitions (Shaw and Hesse, 2010). There is a need for more research that explores the links between daily mobility and the political economy of transport geography and planning. In relation to this, adequate and innovative

* Corresponding author.
E-mail address: r.d.wikstrom@sosgeo.uio.no.

https://doi.org/10.1016/j.jtrangeo.2023.103573
Received 23 June 2020; Received in revised form 14 December 2022; Accepted 21 March 2023
Available online 28 March 2023

methods are needed to produce this knowledge. The proposed method discussed in this paper is an example of a method that can be used to explore the connections and disconnections between daily mobility and the politics and structures guiding overall transport planning, which is turned into material infrastructures experienced by people.

There has been a growing interest in new ways of studying and conceptualizing movement and transport in the fields of geography and social science in the last decades. The mobilities turn, which emphasizes the central role of movement in society, has been an essential part of this renewed focus (Sheller and Urry, 2006; Urry, 2007). The mobilities literature has called for mobilizing methods used to study mobile phenomena, questioning the dominant role of sedentary methods in studies of movement (Büscher and Urry, 2009). Examples of mobile methods include walking interviews (Kusenbach, 2003), which are sometimes combined with GPS tracking (Evans and Jones, 2011) or travel diaries (Middleton, 2018); ride-along on bikes (Spinney, 2006); multi-sited ethnography following objects (Cook and Harrison, 2007); and mobile video recordings (Laurier, 2010; Laurier et al., 2008; Spinney, 2011). This is by no means an exhaustive list of mobile methods but rather a selection that displays different ways of studying mobile and spatial practices.

Mobile methods are often associated with studies wherein the researcher is present and actively travelling with the particiapants, such as in walking interviews. However, as evident in the examples listed above, mobile methods also include methods of tracking or recording the mobility of things, ideas, or people, thus studying mobilities "in proximity at a distance" (Southern, 2012) or in an "absent–present" way (Büscher, 2018). Global positioning system (GPS) technology is a way of generating travel data without the researcher having to travel with the participants, and the spatial patterns can then be analyzed and visualized using geographical information systems (GIS). When GIS was first introduced to the social sciences, it was critiqued for "reducing places to digital dots and enabling those in power to make decisions without involving local communities" (Pavlovskaya, 2009 p. 16). Since then, such skepticism has been addressed by developing critical GIS (Pavlovskaya, 2018; Sheppard, 2005), various forms of mixed-methods and qualitative GIS approaches (Elwood, 2009; Kwan and Knigge, 2006), and participatory GIS (Elwood, 2009). Despite the potential of GIS in producing and visualizing spatial and mobile knowledge that can enrich our understanding of mobile experiences, there are few examples of mobilities scholars who have used and discussed GIS. To date, GIS has been mostly used in quantitative transport studies of spatial travel patterns with an absolute account of space (Evans and Jones, 2011). Some exemptions include a study of children's school journeys that uses GIS to combine GPS data with air pollution measurements, participatory photos, written memos, and interviews (Pooley et al., 2010; Walker et al., 2009) and studies by Evans and Jones (2011, 2012), who GPS-tracked mobile interviews to connect the conversations with locations after the interviews using GIS.

The use of GIS in transport planning often represents an idealized and top-down view of material environments, infrastructures, and urban form without considering aspects of people's everyday lives. Accordingly, there is a potential value in exploring ways of including participants in mobilities and transport research using GIS. Therefore, the current paper discusses a qualitative mixed-methods approach consisting of visualizing user-generated GPS tracks and geolocated photos in GIS and using the output for map elicitation in interviews. Which can be used to create analytical representations of people's mobile and spatial experiences, which can be contrasted with the spatial patterns that are mapped out in transport plans.

Unlike photo elicitation, map elicitation is not widely discussed in the literature, and the few examples that exist mainly use premade maps, such as zoning maps (Moore-Cherry et al., 2015), or mental mapping techniques (Clark, 2011; Jung, 2014). Unlike other types of map elicitation, the proposed combination of methods described in this paper involves participants who produce the data through movement, thus representing the mobilization of map elicitation. As the participants have produced the data used for map elicitation (by travelling the routes visualized on the map), they are presumably familiar with the tracks. The map represents a form of experiential mapping, which differs from conventional maps of pre-made travel routes. Based on my experience interviewing people regarding their travel practices and mobile experiences, participants can better re-enact trips vocally and give detailed accounts of their journeys when they have a map for reference. I find that this feature is reinforced when using an experiential map (of the trips undertaken by the participant) compared to using an ordinary map that visualizes routes, paths and roads in a static in-room interview. Furthermore, being familiar with the routes can make it easier for many to use the visualization of their tracks (maps) as a reference in subsequent interviews, and thus be used to understand different route choices and may help participants to discuss the seemingly mundane aspects of mobility.

Maps are also a great way to identify and locate places of interactions affecting their mobile experiences, especially those between the participant and the environment and between the participant and other road users. Locating such places of encounters or non-encounters can potentially be useful for planners and policymakers seeking to facilitate low-carbon mobility transitions. Furthermore, exploring transport from the mobile experiences of users can contribute to a more grounded and bottom-up mapping of mobility and highlight some of the perceived and lived barriers and enablers for low-carbon mobility interventions and transitions. Experiential cartography of spatial experiences and micro geographies can be contrasted with maps used in transport planning and material infrastructures. Illuminating such contrasts can be used to explore connections and disconnections between daily mobility and overall planning or between individual experiential cartography and the cartography of political economy in transport geography. The method is thus a way of counter-mapping the mainstream status quo of transport planning.

This paper explores the proposed combination of methods by considering (i) its potential at different stages of an idealized research process and (ii) how it can facilitate the production of microgeographical and im|mobile knowledge. These objectives are addressed by drawing on a previous study of an e-bike trial (Wikstrøm and Böcker, 2020) that used this combination of methods and then comparing the approach to other studies and methods exploring mobile phenomena. The approach showed promising results for producing detailed microgeographical knowledge of im|mobility. However, because of this method's novelty, there is a need for a detailed discussion of its potential. Thus, section two discusses the process of combining mobile methods and visual elicitation techniques with interviews. Section three briefly introduces the abovementioned e-bike study and discusses the potential of the proposed combination of methods at different stages of an idealized research process, including the stages prior, during, and after the interview. Idealized in this context means that the research process is a simplified presentation of the messy reality of a research process. The methods' strengths and challenges discussed in this paper (Table 1) are discussed in existing literature concerning other methods. However, it is not discussed in detail in relation to the specific combination of methods that are described in this paper. This specific combination of methods has specific strengths and challenges that are useful to explore and develop this approach further. The paper ends with a concluding discussion including suggestions for further developments of the method.

2. Mobile methods and visual elicitation in interviews

Interviews are one of the most common methods for studying transport qualitatively. In particular, qualitative interviews are a great way to produce knowledge about people's attitudes, meanings, and their own social and discursive practices of daily mobility (Røe, 2000). However, mobilities scholars have questioned whether the use of sedentary methods is the best way to study mobile phenomena (Büscher

Table 1
Strengths and challenges of map elicitation in daily mobility studies.

	Strengths	Challenges
Before the interviews	a. Curiosity from the participants b. Participatory production of spatial data c. Generating maps of travel patterns	1. Geosurveillance and data privacy 2. Time consuming
During the interviews	d. Icebreaker activity e. Engagement and ownership of the geovisualization f. Making corrections to the maps g. Triggering place-specific and mobile memories and reenacting trips and routes h. Actively involved in analyzing maps and photos i. Geolocating photos i. Locating mobile experiences	3. Relying on participants' memories 4. Mediated study of mobile experiences 5. Excessive focus on spatial and material settings
After the interviews	k. Participatory planning support tool l. Geovisual dissemination of daily mobility to policymakers and planners m. Create analytical representations of people's mobile and spatial experiences n. Constrast experiential maps of daily mobility with maps used in transport planning	6. Generalizability 7. City marketing tool

and Urry, 2009), proposing to use mobile methods instead. This is because moving with the mobile respondent can foster rich narratives of movement and shed light on how daily movements are practiced and shaped. In this paper, "mobile methods" is used as a collective term for different methods used to study mobile phenomena and spatial practices, such as move-along and tracking methods, which are not all new methods. While welcoming the upsurge of mobile and mixed-methods approaches in mobilities studies, Merriman (2014) also critiques the mobile methods literature for disregarding traditional methods and for framing mobile methods as enabling the researcher to gain more authentic knowledge of mobile experiences compared to more traditional approaches. His intention, however, is not to reject mobile methods altogether but to encourage a view that sees them as complementary to—rather than a replacement of or superior to more traditional methods, such as sedentary interviews and text or archival studies. This is a perspective echoed in recent works by mobilities scholars, highlighting how, for example, historical accounts of movement can "enable a deeper understanding and richer description of emergent and interconnected, pasts, presents and futures" (Büscher, 2018, p. 3). Arguably, combining methods can contribute to foster rich accounts of daily mobility, representing another 'reality' than the one represepnted in the maps traditionally used in transport planning. However, this is not to suggest that mixed-methods approaches can capture better or more authentic knowledge, as: "methods, their rules, and even more methods' practices does not only describe the reality, but also help to *produce* the reality that they understand" (Law, 2004, p.5).

Move-along methods, such as walking interviews, are useful for studying spatial practices *in situ* and can evoke the participants' feelings or memories, thus stimulating the conversation, as respondents might find it easier to verbalize attitudes and perceptions when "in place" (Evans and Jones, 2011; Kusenbach, 2003). These methods are often used in phenomenological, more than representational and ethnographic studies (Spinney, 2011). Nonetheless, methods focusing on people's experiences and their accounts of mobilities do not limit one to solely discussing "movement in itself" (D'Andrea et al., 2011) but can also be used to explore everyday sub|urban politics and the politics of im|mobility (Middleton, 2018). This section highlights three challenges of using move-along methods for studies on daily mobility, which are addressed in this paper by combining qualitative GIS and map elicitation. The first shortcoming of move-along methods are that they are limited in terms of scope and are highly resource-intensive. This is because the researcher needs to be present with the participants, which makes it difficult to follow the daily movements of a larger group for an extended period. Second, the researcher's presence can alter the natural and spontaneous nature of daily travel, such as the routes taken or the trips made. However, this is a common risk with any observation approach: When participants are aware that they are part of a research project, this awareness may alter their subsequent actions. Nevertheless, replacing the presence of a researcher with a GPS unit might reduce this alteration to a certain degree. Third, there are challenges related to conducting research while moving outside in the real world. In particular, noise and distractions could be challenging during walking interviews, while factors such as speed, fatigue, noise, and traffic can make it difficult and unsafe to communicate with the interviewees during ride-along methods (*e.g.*, biking). Some of these drawbacks, such as noise, can be overcome with specific technical equipment (Evans and Jones, 2011), while other aspects, such as traffic and speed, might be more difficult to address. The latter challenges may even be intensified when studying active travel modes at higher speeds, such as e-bikes. As an alternative, other researchers have drawn inspiration from auto-ethnographic methods that require researchers to draw on personal accounts and experiences. Some examples include studies on biking (Spinney, 2006), running (Edensor and Larsen, 2018), and riding cars (Edensor and Larsen, 2018). However, one shortcoming of auto-ethnographic studies is that they cannot capture the multiple meanings and experiences of moving. Thus, in their works, Spinney (2006) and Edensor and Larsen (2018) combined auto-ethnographic accounts with mobile interviews and co-movement, because sharing a journey with the participant can allow a comparison between the experiences of researcher and participants, thus revealing specific differences in perceptions.

Spinney (2011) has also used mobile video ethnography, which combines videos of cycling practices and interviews, as an option for cycling research. Video-ethnography eliminates some practical issues, such as moving together with the participants and the disturbances encountered while in traffic. Accordingly, one solves the problem of not being there by "seeing" there (Laurier, 2010), although it also raises new epistemological questions about constructing and interpreting videos (Spinney, 2011; Vannini, 2017). Scholars discussing mobile video-ethnography have argued that using videos can help the researcher get closer to the experience than on a ride-along because of practical issues related to the latter (Delyser and Sui, 2013). However, it is important to reflect critically on the implications of bringing technology, such as video and GPS, into the research. As Vergunst (2011) argues, "turning too readily to high technology has the danger that we actually distance ourselves from the experience of movement, in the very act of trying to get closer to it" (p. 210). In addition, simply assuming that technology can contribute to more authentic and better knowledge is problematic. Following Merriman (2014) argument, it is not a question of getting closer to the experiences but of using different ways to explore and engage with experiences. Meanwhile, in traditional interviews, the researcher relies a great deal on a participant's ability to recollect and describe events. In comparison, bringing visual materials into the interview can help generate insights regarding various social phenomena and evoke different kinds of memories and conversations, such as detailed reflections on daily life and mundane activities. Moreover, such materials have the potential to empower research participants by allowing them to narrate the topic being investigated. The visual materials brought to the interview can either be prefabricated or produced by the participants themselves. The most common visual materials used for elicitation are photos. Participatory photos and photo-elicitation techniques are a good way of including participants, thereby generating sensorial and situated knowledge, and enabling conversations of meaning and experiences in interviews (for a detailed discussion, see Rose, 2016). These strengths can also apply to maps.

Visual material, including maps and photos, can be used in interviews to spark conversations about the qualitative experience of travelling. Maps also have specific capacities as they can foreground spatial relationships, flows and patterns and can be used to locate interactions between mobile subjects and the built environment. In a study of older adults' experiences of mobility barriers, Cinderby et al. (2018) used photo diaries to capture user requirements. This study shows how the use of participant taken photos can be helpful to elicit experiences and moments of barriers while travelling. In the study they also used participatory mapping, by letting the paricipants mark challenging locations along their routes. This is useful when studying challenges and barriers, but relying on remembered travel patterns does not give the same accurate spatial travel patterns as the ones gained by using GPS data. GPS data can be used to map out the exact travel routes and contributes to more detailed and accurate information on travel patterns, which can be used for elicitaiton in interviews. Photos can elicit a snapshot of the travel, and GPS tracks visualized on a map can elicit the routes and patterns, thus subsequently contextualizing each other.

The maps used in the previously mentioned e-bike study were made using GIS software. Qualitative GIS, which combines GIS with other types of data, such as audio, video, text, or photographs, has gained increased interest in recent years, because it can help represent

Fig. 1. Qualitative map of mobile e-bike experiences.

knowledge that is not explicitly cartographic or spatial, such as emotions and experiences (Cope and Elwood, 2009; Kwan and Knigge, 2006). Furthermore, it can bring together different ways of knowing, thus strengthening research findings and help discover inconsistencies in partial knowledge (Nightingale, 2003). Combining GPS technology with qualitative research methods is one way of bringing together different ways of knowing to explore and analyze the production of spatial knowledge and practices.

3. Qualitative GIS and map elicitation at different stages of an idealized research process

The e-bike study (Wikstrøm and Böcker, 2020) that is used as an example in this paper involved 21 participants who all took part in a municipality-initiated scheme wherein they borrowed an e-bike for 7–14 days. The e-bike study aimed to explore the potential of e-biking in the suburban context and the capacity of low-carbon mobility interventions to trigger changes in daily mobility. The study thus explored connections and disconnections between the scale of microgepgraphies and the scale of overall planning through interventions. The findings were conveyed to the initiators of the scheme after the trial, giving them feedback on the e-bike-users' experiences. The municipality recruited the participants by asking if those who said yes to participate in the trial also wanted to participate in the study. Recruiting those who were already recruited for the trial into the research project was a means to avoid any involvement from the municipality in selecting specific participants. The municipality recruited participants to the trial by inviting local businesses—both public and private—to participate. They were also asked to pass on the invitation to the employees who could participate if they wanted to. The recruitment thus represented a form of self-selection, as those who chose to participate were curious and motivated to try an e-bike, which might have influenced the findings of the study. The e-bikes were GPS-tracked during the trial period, and the GPS tracks were visualized using GIS software. Maps of the participants' trips were printed out and discussed in semi-structured interviews after the trial period. The participants also took photos during the trial period, and the interviews included map- and photo-elicitation. All the individual GPS tracks, selected photos, and captions based on quotes and information from the interviews are visualized in one map (Fig. 1)

Based on experience from conducting this empirical study, some of the strengths and limitations of combining qualitative GIS and map elicitation were identified at different stages of an idealized research process. The research process is divided into three stages of a research process: before, during, and after the interviews.

3.1. Before the interviews

In the e-bike study, the stage prior to the interview consisted of three phases: before, during, and after the trial period. Before the trial period, my colleague and I met with local planners working with sustainble transport. We explained the method to them and asked for feedback on our interview guide. They were thus given the opportunity to suggest additional questions and topics that they found interesting and relevant. This step helped secure the relevance of the data and is an important strategy if the research aims at influencing policy and planning (Kahila and Kyttä, 2009). The planners were keen on the project and found it interesting; however, they expressed some concerns about the relevance of the study, as it was qualitative and did not aim to produce generalizations. This echoes a general challenge of disseminating qualitative research to stakeholders (Davoudi, 2006).

Studies using GPS need to critically and ethically consider that it is a digital tracking technology with geosurveillance potential (Kitchin, 2017). In the e-bike study, the challenge of geosurvelliance and data privacy (Table 1-1.) related to using GPS was tackled by consulting with legal advisors at the University specializing in data privacy. The legal advisors suggested checking out different suppliers of GPS-trackers as well as examining the type of data gathered and how they were stored and used. After checking out different suppliers, we decided on a GPS tracker meant for tracking cats and dogs, as this device gathered the least amount of personal data from the user and thus ensured that data privacy was handled in a sufficient manner. The GPS tracker was registered and managed from one user account in an associated online software. The participants had to download an app on their smartphones, and a sharing function in the software gave them access to a GPS tracker during the trial period. I had access to the GPS locations through the online software, and the geolocations were easy to download and transfer to the GIS software. The data were deleted from the online software immediately after they were downloaded. The GPS trackers were handed out to the participants in person, allowing me to explain how they worked and answer questions they may have. The participants were curious about the GPS trackers and raised questions about how it worked and its main purpose (Table 1-a.). While being intrigued, some also expressed skepticism pertaining to data privacy and surveillance. The participants received an information letter describing the type of data to be collected, how they will be stored, and how they will be used. They also had to sign an informed consent form. The study was approved by the Norwegian Center for Research Data. It is essential to ensure that data privacy regulations, such as the General Data Production Regulation (GDPR - a legal framework, that sets guidelines for the collection and processing of personal data from indviduals who reside in the EU or EEA), are followed when using this type of technology in data collection. It is also important that researchers have the time and knowledge to explain how it works and anonymity are secured, and thus ensure rapport

During the trial period, the participants could use the e-bike as they wanted, making it possible to obtain knowledge on the different routes people travel, and not predefined routes, or solely getting feedback on cycle routes planned by transport planners (Lock and Pettit, 2022). The participants could turn the GPS trackers on and off using an app on their phone. They were encouraged to turn it on every time they used the e-bike. The participants thus generated the data themselves and were in charge of the routes that were tracked, this is a form of particaptory map making (Table 1-b.). During the trial period, some technical and practical issues occurred. On a few occasions, the participants forgot to recharge the GPS trackers or turn it on at the beginning of a trip. This led to trips not being tracked or tracked inaccurately. However, this only happened a few times, and it did not have significant consequences for the research findings as the main objective for tracking the e-bikes was to enable conversations about the participants' mobile experiences and not produce representative and generalizable findings. Allowing the participants to turn on and off the GPS tracker gave them the power to decide if they do not want to be tracked on specific trips. This could be valuable for the participants as it can protect their privacy and allow them to decide which data they want to share. However, this option could also cause data collection biases and affect the study's results. This is predominantly an issue when using GPS tracking for a representative study, and in such studies, another type of GPS tracker might be preferable. On the other hand, when combining GPS-tracking with map elicitation in interviews, the interviewee has the opportunity to ask if and why they turned off the GPS. These untracked routes might also provide valuable information. The GPS used in this study depended on the participants having a smartphone. Different GPS trackers have benefits and disadvantages, which must be considered in relation to the specific study. It is vital that the researcher has knowledge or seeks assistance to learn how different GPS trackers collect and handle data to ensure that data privacy is secured sufficiently and that the GPS that is chosen is appropriate for the study's aim.

The generated GPS data were downloaded, and ArcGIS was used to generate maps of the travel patterns. Date stamps connected to the GPS locations were used to distinguish between weekend and weekday trips, which for the interviews were visualized in blue and red, respectively. The maps of GPS routes visualized descriptive data of travel patterns,

including where the participants had biked, destinations visited, how often they had biked, and if the trips were undertaken during a weekday or a weekend (1-c.). By studying the maps prior to the interview, I gained insights into how the participants used the e-bikes. However, maps and GIS do not merely visualize spatial data in a neutral way. Rather, map representations "are flexible and fluid, holding the potential for map makers and map users to interpret and reinterpret them to produce different meanings" (Elwood, 2009, p. 8). Accordingly, combining it with interviews is important, as doing so includes the participants in analyzing the maps and can help generate more grounded knowledge about mobile experiences related to their travel patterns and routes. Combining these different methods is time consuming (Table 1-2.) when compared to sedentary interviews or spatial tracking without interviews. However, it gives a unique opportunity to produce detailed knowledge of the microgeopgraphies of daily mobility, which is discussed in the next section.

3.2. Combining map and photo elicitation in interviews

Maps can have different functions during an interview. It worked as an icebreaker activity (Table 1-d.) and engaged the participants (Epstein et al., 2006). On several occasions, participants started telling stories before any questions were posed. Accordingly, bringing the maps and photos into the interview gave them the power to narrate the topic that was asked about. Moreover, the participants expressed familiarity and ownership of their travel patterns visualizing the distances they covered and the places they visited (Table 1-e). Furthermore, when discussing and looking at the maps, some participants identified errors in the data. For example, several participants had detached the GPS (to keep it safe) from the e-bike and brought it with them when they left it; thus, the device kept tracking their movement after they had left the e-bike. On the basis of the information provided by the participants, the errors were corrected after the interviews (Table 1-f.). Notably, these errors would not have been detected as easily without analyzing the maps together with the participants. Nevertheless, there is no guarantee that all such errors will be corrected.

Overall, the presence of maps in the interviews triggered mobile memories and experiences and made it easier for the participants to re-enact their travels. Some participants explicitly highlighted the fact that the map helped them remember, as in this excerpt from one of the interviews:

> Interviewer: "And here [pointing at the map], this route is different from your usual commute?"
>
> Participant 10: "Yes, yes, that's right! I have, oh, now I remember! Yeah, I went down to Aker Brygge with the e-bike. Yeah, that's right. It was a weekend, I had the bike with me, and I went there to buy some stuff(…)."

This remembrance led to a detailed account of the whole trip in the interview, in which she explained why she took a different route that day and how she experienced e-biking in that area and shared her reflections on how the e-bike worked for chained trips, including the challenges of parking the e-bike at this location when going shopping. These reflections were triggered by looking at the map, thus enabling the participants to illuminate the details of the spatial practice, and mobile experiences of e-biking. Triggering memories is a general strength of visual elicitation, but bringing a map helped evoke mobile and spatial memories as well as accounts of journeys undertaken in the trial period. On the other hand, participants referenced the photos when talking about specific experiences at a specific location or time. Photos thus depict a snapshot of the trip, but is not as well suited for generating knowledge of the whole trip. Combining maps of routes and photos of moments was helpful as they contextualised each other thus helping to produce detailed knowledge of the microgeographies of daily mobility. In some cases, the particiapnts expressed that the photos and tracked routes also triggered memories of cycling in the past and reflections on how the socio-material surroundings had changed. However, solely relying on the participants' memories and reenactment of past events can create challenges, because people do not always remember past experiences (Table 1-3.). In fact, in the e-bike study, there were cases in which the participants looked at the maps in the interviews but were unable to remember having cycled specific routes or what it was like to cycle there. Instead of reenacting the travel in an interview, travelling with participants could help solve this, but there are other shortcomings of move-along methods, as discussed in section two of the paper.

The maps allowed the interviewer to ask questions about a specific route or pattern, for example, "Why did you take a loop?" or "How was it like to e-bike on *this* specific distance?" The maps thus enabled a type of conversation that presumably would have been harder to carry out without the presence of the map. The maps, combined with photos taken by the participants, evoked conversations and triggered place-specific memories, contributed to rich narratives, and helped generate knowledge of complex immobile experiences, including mobile interactions with other road users and the built environment (Table 1-g.). Sometimes, such moments were captured in photos, which helped giving context and details to the mapped tracks. The maps also triggered conversations about roads that were avoided by the participants due to several factors, such as busy roads or roads without bike lanes. Some participants were able to explain their trips from A to B in detail and how they experienced different parts of the route, highlighting places that were pleasant and nice, as well as those that were perceived as chaotic and unsafe. This is exemplified in the following excerpt from an interview wherein the participant shares details of her commute while using the map for geographical referencing:

> The trip from home to Bekkestua is very nice and really all the way up to Nadderud [continuously pointing at the route]. But there, I'll have to ride my bike on those small roads, and I kept to the sidewalk there also, narrow, narrow sidewalks, many people walking, and I had to make several stops. But it's lovely with an e-bike compared to a regular bike. With a regular bike, it takes me forever to gain speed again, especially uphill, but with the e-bike, I can just ride. And then up from Nadderud to *here* [ponting at the map], I usually bike on a lot of small roads, but the bus also drives there, right. So, I rode my bike on a really long road up *here* [pointing at the map], which is called Wilhelmsen Wilhelmsens vei. It starts *here* and ends *here*, actually. But, as I said, the bus drives there, and so I had to choose either to bike on the narrow sidewalk on the left side and meet a lot of children, or take the road, but there were cars parked all the way up, right. Also, I was so scared that I would end up getting caught between the bus and the parked cars and get squeezed. So those are the kinds of decisions you'll have to make.

This excerpt exemplifies how the map can be used to reference mobile experiences at specific locations and to stimulate a detailed conversation about these experiences and place-specific memories. Details that are easier to capture using an experiential map produced through the movement of the participant. Map elicitation thus gives participants a unique opportunity to be actively involved in analyzing their trip patterns (Table 1-h.). At the same time, the researcher can more easily learn about and "take part in" the situational mobile experience without being at the scene or travelling with the participants (Southern, 2012). The quote also illustrates how the participant experiences the overall structures and planned infrastructure. It represents a critique of unsafe and absent cycle infrastructures and the conflict between the bike and other road users, and what traffic groups are prioritized. In an interview, this can be followed up with questions on how the participant perceives transport planning and politics.

Furthermore, equipping the participants with a GPS is unobtrusive, as they can travel without any interruptions from the researcher, and the map elicitation facilitates a shared remote spatial experience. However, reliance on technology might diverge the focus from other types of

experiences, practices, and biographical narratives. A possible implication of tracking technologies available through apps, smartwatches, smartphones, or GPS units is that they might create a more distant sense of place and a disembodied relation to experiences, places, and surroundings (Table 1-4.) (Vergunst, 2011). This can be reinforced by presenting geodata in GIS, through which the knowledge produced in the interviews may be more distanced from the actual mobile experiences than would have been the case if one traveled and gained experiences together with the participants and talked about them in the same environment *in situ*. Furthermore, the use of maps might shape conversations about mobile experiences that are overly focused on geographical representations as well as spatial and material settings (Table 1-5.) (Middleton, 2018). Nevertheless, the excerpt from the interview also includes some affective accounts of the complex and unsafe interactions and encounters between different travel modes and the sociomaterial environment. The maps, therefore, help foreground conversations about how the moving body interacts with others, technologies, material objects, and the surroundings while travelling. Map elicitation can thus be beneficial for producing detailed knowledge of complex mobile experiences, which, presumably, would be more difficult to generate without using maps in a sedentary interview. At the same time, detailed knowledge of mobile experiences would not be possible to produce by solely mapping spatial patterns with GIS, which is why combining it with qualitative interviews is advantageous. Qualitative interviews gives the opportunity to include questions that are not solely related to the map, which can help avoid an excessive focus on material and spatial settings.

Maps highlighting GPS tracks can also make it easier to locate experiences and place-specific events, such as the experiences evident in the excerpt of how different road users are more or less accommodated for in the existing spatial arrangements. By using GIS, such information, along with photos and text, can be geolocated on a map (1-i.). Accordingly, the method can help produce geovisualizations of daily mobility that might be of value to policymakers and planners. However, it can be difficult to understand which places the participants are talking about when listening only to the sound recordings. For example, one participant in the e-bike study pointed to the map and said, “This hill is very steep.” Another did the same and said, “There is much traffic on this stretch.” When listening only to the recordings, it was difficult to locate these places, and such an awareness helped me devise strategies to avoid them. Such strategies included asking the participants to use place names, asking where it was after their explanation, stating where it was after the participants had explained it, and making notes or writing on the maps during the interview.

Some participants relied more on the maps than others, as they had different prerequisites and abilities to understand and read maps. For some, it was easy and intuitive to relate to and recognize the routes and patterns, while others found it more challenging or did not refer to it much. On the other hand, interviews can be advantageous for people who are eloquent in expressing themselves verbally. Arguably, it is valuable to use a mix-methods approach to bring together different ways of expressing knowledge and strengthening research findings (Elwood, 2010).

3.3. Analyzing data and disseminating findings after the interviews

Maps and geovisualizations can be powerful tools to convey and disseminate research findings to different audiences (Pavlovskaya, 2009), given that “different forms of data, representation and analysis are frequently afforded different levels of intellectual and political authority” (Cope and Elwood, 2009, p. 5). Maps, GIS, and quantitative measures are arguably the most authoritative approaches to spatial knowledge in sub|urban planning, and planners are familiar with using maps and GIS as planning support systems (Geertman and Stillwell, 2009). The use of maps as a tool in transport planning often represents a top-down view of material environments and urban form. The qulitative maps produced in the e-bike study present spatial patterns and mobile experiences by linking visualized GPS tracks to photos with captions based on quotes and stories from the interviewees (Fig. 1). Accordingly, the qualitative maps convey a mobilities-led perspective, thereby representing an alternative to instrumentalist and technical conceptualizations of transport. Even though such an approach arguably offers a different perspective on movement than the prevailing conceptualization in planning practice, disseminating research findings using visualizations and tools familiar to the audience can engage the stakeholders, ease knowledge transfer, and secure the perceived relevance and usefulness of the data.

The data produced through the proposed method can be used to create analytical representations of people's mobile and spatial experiences (Table 1-m), representing a form of experiential mapping. These analytical representations can be part of a discussion of mobility in a suburban context and the different scalar narratives of low-carbon mobility, contrasting the maps of daily and experienced mobility with the planned and mapped spatial patterns used in transport planning (Table 1-n). Maps that represent the daily mobile experiences of individuals have a more indistinct geographical expression compared to planning as a political-economic process with a clearer geographic expression—illustrating the different powers of maps. Contrasting these maps might help uncover connections and disconnections between daily mobility and the political economy of transport geographies and thus illuminate barriers and opportunities for low-carbon transitions.

After the e-bike study, the qualitative maps (Fig. 1) and a short written report summarizing the findings were presented to the e-bike scheme initiators. These outputs represent a form of evaluation of their intervention. In this way, the initiators obtained what they called a “qualified assessment,” expressing that the geovisual presentation of tracks and photos locating the mobile experiences of e-biking in a map was valuable to them, as it could be used as a reference when considering improvements (1-k.). Making geovisualizations based on the data produced and analyzed by the participants is an example of a bottom-up mapping tool. If implemented in transport planning it might change mapping in transport planning from a top-down to a bottom-up tool, thus highlighting the value of using GIS as a tool to bridge the gap between people and planners (Kahila and Kyttä, 2009). Moreover, there is a potential for planners to utilize this method themselves as a participatory planning support tool (Table 1-l.). Geovisualizations that locate and visualize infrastructural barriers, such as busy roads, places deemed unsafe to park an e-bike in, and places perceived as scary or challenging by e-bike users due to the lack of designated bike lanes, can be easily integrated into the existing maps used by planners in their daily work. Accordingly, this information can potentially induce changes and improve built environments and infrastructures, thus enhancing mobile experiences.

However, it is essential to note that there are different barriers to knowledge transfers. This is because knowledge can never be instrumentally transferred, as it is situated, inconclusive, can be interpreted differently, and needs backing to be turned into policies (Davoudi, 2006). For planners, the challenges of utilizing this method's findings include the fact that the data generated are qualitative with a small sample size, and is thus not representative or generalizable (1–6.). However, the approach suggested in this study can be used to identify places and sites of interest for transport planners, which can be further explored and analyzed. It would also be possible to include a larger sample size in future studies or in participatory planning using the same method. However, to produce generalisable knowledge about e-bikers or other sustainable travel modes, other methods might be more helpful. For example, Lock and Pettit (2022), have explored a co-designed bicycle planning support system using both active and passive data, which has the potential to generate data of larger sample sizes. However, it will not contribute to the same detailed knowledge of microgeographies of daily mobility and situational perspectives on transport. The method presented in the paper focuses on mobile experiences; such detailed

knowledge might be beyond the scope of strategic transport planners or policymakers. Furthermore, it must be highlighted that sustainable and smart mobility interventions, such as the e-bike trial scheme and spatial data on movement, can generate commercial values, particularly for strategic city marketing purposes (Table 1-7.) (Schwanen, 2015). Moreover, the focus on innovation and technology might overlook critical issues, such as social exclusion and mobility justice (Sheller, 2018).

4. Conclusion

This paper contributes to the methodological development of transport and mobilities studies by proposing a combination of qualitative GIS and map elicitation in studies of daily mobility. This paper discussed a range of practical considerations when combining these methods and highlighted the value of including study participants in both the production and analysis of spatial data. Doing so can empower the participants and generate knowledge of mobile experiences that, otherwise, cannot be generated based on spatial patterns alone. Bringing maps of the GPS tracks and particpant taken photos into the interviews helped foster rich narratives on mobile experiences and the microgeograhies of movement. Combining photo and map elicitation in the interviews also facilitated conversations on the im|material elements that constitute the mobility systems as well as on the barriers and enablers encountered by the e-bikers related to specific places and routes. This type of knowledge is more difficult to generate in a static-in room interview that does not include map elicitation. Accordingly, the maps helped facilitate another type of discussion in the interviews and enabled new forms of knowledge production (Elwood, 2010; Moore-Cherry et al., 2015). Furthermore, using an experiential map shapes different forms of conversations than using pre-made maps, such as Moore-Cherry et al. (2015) do in their paper. However, by accessing mobile experiences through technology and sedentary interviews, one may overlook some of the spontaneous, sensorial, and embodied *in situ* interactions that might be better grasped by travelling with the participants (Evans and Jones, 2011; Kusenbach, 2003). Nevertheless, tracking spatial travel patterns with GPS and participant-generated photos is not as resource-intensive as other approaches, as it allows researchers to follow the daily movements of a larger group of people without having to be present. However, compared to sedentary interviews or spatial tracking without interviewes, it is time consuming. Nevertheless, the method is beneficial for generating conversations of mobile experiences and spatial patterns – and it makes it possible to produce geovisualizations that can be used for dissemination.

There is also potential for using GPS data for additional, more sophisticated GIS analysis. This can contribute to greater information about the participants' travel practices prior to the interviews and prompt discussions during the interviews. First, there is the possibility of deriving more data (*e.g.*, the average speed of segments of the trips) from GPS tracking, which may inform the researcher on where and how often a participant stopped or slowed down. Second, network analysis can estimate alternative or faster routes, thus prompting discussions on avoided and untracked routes. Third, GPS data can be enriched by adding additional topography and urban morphology data, such as street width, building heights, and cycling infrastructures. Such improvements can prompt discussions about specific surroundings or the relevant contexts of each ride (*e.g.*, steep climb or a busy street), thus facilitating comparisons between route alternatives. This method can also be used in studies of other transport modes with different speeds and characteristics and the method could also be used in a comparative design. Moreover, the approach could also be used to identify themes and topics that could be used to inform a survey of e-bikers or other travellers in the area.

In terms of implications, the proposed combination of methods is relevant for policy and planning in four main ways. First, the geovisualizations of mobile experience can enable the transfer of knowledge and experiences from people travelling daily in urban and suburban areas to planners and policymakers. Second, the qualitative maps generated by this approach offer a mobilities-led perspective on movement and transport, which can potentially expand the conceived spaces of transport planners. Third, the method represents a form of participatory map-making and, therefore, may be used as a participatory planning support tool. The participatory aspects of the method can be enhanced by inviting users to discuss their mobile experiences with planners and to develop co-designing solutions. For this reason, the proposed method's effectiveness as a participatory planning support tool should be further developed and studied. Third, follow-up studies should be conducted to determine the impact of the proposed method on informing sustainable transport policy and planning. Finaly, the proposed method discussed in this paper is a way to counter-map the mainstream status quo in transport planning that can be used to explore connections and disconnections between daily mobility and the politics and structures guiding overall transport planning. This participatory knowledge production represents a shift towards more inclusive transport studies and planning, which is arguably crucial to enable a sustainable transport transition. This participatory knowledge production represents a shift towards more inclusive transport studies and planning, which is arguably crucial to enable a sustainable transport transition.

Funding

This research was funded by the Research Council of Norway, EnergiX Programme. Grant number 255189.

Author statement

It is a single-authored paper.

Conceptualization; RDW Data curation; RDW Formal analysis; RDW Funding acquisition; Lars Böcker Investigation; RDW Methodology; RDW Project administration; RDW Resources; RDW Software; RDW Supervision; Lars Böcker Validation; RDW Visualization; RDW and Lars Böcker Roles/Writing - original draft; RDW Writing - review & editing; RDW.

Declaration of Competing Interest

None.

Data availability

The data that has been used is confidential.

Acknowledgements

SmartCity Bærum.

References

Ajzen, I., 1991. The theory of planned behavior. Organ. Behav. Hum. Decis. Process. 50, 179–211.
Banister, D., 2011. Cities, mobility and climate change. J. Transp. Geogr. 19, 1538–1546.
Ben Akiva, M., McFadden, D., Train, K., Walker, J., Bhat, C., Bierlaire, M., Bolduc, D., Boersch Supan, A., Brownstone, D., Bunch, D., Daly, A., De Palma, A., Gopinath, D., Karlstrom, A., Munizaga, M., 2002. Hybrid Choice Models: Progress and Challenges, p. 13.
Büscher, M., 2018. Moving methods. In: Lury, C., Fensham, R., Heller-Nicholas, A., Lammes, S., Last, A., Michael, M., Uprichard, E. (Eds.), Routledge Handbook of Interdisciplinary Research Methods. Routledge, London.
Büscher, M., Urry, J., 2009. Mobile methods and the empirical. Eur. J. Soc. Theory 12, 99–116.
Cinderby, S., Cambridge, H., Attuyer, K., Bevan, M., Croucher, K., Gilroy, R., Swallow, D., 2018. Co-designing urban living solutions to improve older People's mobility and well-being. J. Urban Health 95, 409–422.
Clark, A., 2011. Multimodal map making with young children: exploring ethnographic and participatory methods. Qual. Res. 11, 311–330.

Cook, I., Harrison, M., 2007. Follow the thing: “west Indian hot pepper sauce”. Space Cult. 10, 40–63.
Cope, M., Elwood, S., 2009. Qualitative GIS. SAGE Publications Ltd.
Cresswell, T., 2010. Towards a politics of mobility. Environ. Plan. D: Soc. Space 28, 17–31.
D'Andrea, A., Ciolfi, L., Gray, B., 2011. Methodological challenges and innovations in Mobilities research. Mobilities 6, 149–160.
Davoudi, S., 2006. Evidence-based planning: rhetoric and reality. DISP 42, 14–24.
Delyser, D., Sui, D., 2013. Crossing the qualitative- quantitative divide II: inventive approaches to big data, mobile methods, and rhythmanalysis. Prog. Hum. Geogr. 37, 293–305.
Dennis, K., Urry, J., 2009. After the Car. Polity Press, Cambridge.
Edensor, T., Larsen, J., 2018. Rhythmanalysing marathon running: ‘a drama of rhythms’. Environ. Plan. A Econ. Space 50, 730–746.
Elwood, S., 2009. Multiple representations, significations, and epistemologies in community-based GIS. In: Cope, M., Elwood, S. (Eds.), Qualitative GIS - A Mixed Methods Approach, pp. 57–74.
Elwood, S., 2010. Mixed methods: Thinking, doing, and asking in multiple ways. In: Delyser, D.H., Aitken, S. (Eds.), The SAGE Handbook of Qualitative Geography. SAGE, London, pp. 94–113.
Epstein, I., Stevens, B., McKeever, P., Baruchel, S., 2006. Photo elicitation interview (PEI): using photos to elicit Children's perspectives. Int J Qual Methods 5, 1–11.
Evans, J., Jones, P., 2011. The walking interview: methodology, mobility and place. Appl. Geogr. 31, 849–858.
Evans, J., Jones, P., 2012. The Spatial Transcript: Analysing Mobilities Through Qualitative GIS: The Spatial Transcript. Area (London 1969) 44, 92–99.
Geertman, S., Stillwell, J., 2009. Planning Support Systems Best Practice and New Methods, the GeoJournal Library. Springer, Dordrecht.
Jung, H., 2014. Let their voices be seen: exploring mental mapping as a feminist visual methodology for the study of migrant women. Int. J. Urban Reg. Res. 38, 985–1002.
Kahila, M., Kyttä, M., 2009. SoftGIS as a bridge-builder in collaborative urban planning. In: Geertman, S., Stillwell, J. (Eds.), Planning Support Systems Best Practice and New Methods. Springer, Dordrecht, pp. 389–411.
Kim, J., Rasouli, S., Timmermans, H., 2014. Hybrid choice models : principles and recent progress incorporating social influence and nonlinear utility functions. Procedia Environ. Sci. 22, 20–34.
Kitchin, R., McArdle, G., 2017. Data-driven urbanism. In: Kitchin, R., Lauriault, T.P. (Eds.), Data and the City. Routledge, London, pp. 44–56.
Kusenbach, M., 2003. Street phenomenology: the go-along as ethnographic research tool. Ethnography 4, 455–485.
Kwan, M.-P., Knigge, L., 2006. Doing qualitative research using GIS: an oxymoronic endeavor? Environ. Plan. A 38, 1999–2002.
Kwan, M.-P., Schwanen, T., 2016. Geographies of mobility. Ann. Assoc. Am. Geogr. 106, 243–256.
Laurier, E., 2010. Being there/seeing there: recording and analysing life in the car. In: Fincham, B., McGuinness, M., Murray, L. (Eds.), Mobile Methodologies. Palgrave Macmillan UK, pp. 103–117.
Laurier, E., Lorimer, H., Brown, B., Jones, O., Juhlin, O., Noble, A., Perry, M., Pica, D., Sormani, P., Strebel, I., Swan, L., Taylor, A.S., Watts, L., Weilenmann, A., 2008. Driving and ‘Passengering’: notes on the ordinary Organization of Car Travel. Mobilities 3, 1–23.
Law, J., 2004. After Method: Mess in Social Science Reseach. Routledge, Oxon.
Lock, O., Pettit, C., 2022. Developing participatory analytics techniques to inform the prioritisation of cycling infrastructure. ISPRS Int. J. Geo-Inf. 11 (2), 78.
Merriman, P., 2014. Rethinking mobile methods. Mobilities 9, 167–187.
Middleton, J., 2018. The socialities of everyday urban walking and the ‘right to the city’. Urban Stud. 55, 296–315.
Moore-Cherry, N., Crossa, V., O'donnell, G., 2015. Investigating urban transformations: GIS, map-elicitation and the role of the state in regeneration. Urban Stud. 52, 2134–2150.
Nightingale, A., 2003. A feminist in the forest: situated knowledges and mixing methods in natural resource management. ACME 2, 77–90.
Pavlovskaya, M., 2009. Non-Qualitative GIS. In: Cope, M.E.S. (Ed.), Qualitative GIS. SAGE Publications Ltd, pp. 13–38.
Pavlovskaya, M., 2018. Critical GIS as a tool for social transformation. Canad. Geograph. Le Géographe Canadien 62, 40–54.
Pooley, C., Whyatt, D., Walker, M., Davies, G., Coulton, P., Bamford, W., 2010. Understanding the school journey: integrating data on travel and environment. Environ. Plan. A 42, 948–965.
Røe, P.G., 2000. Qualitative research on intra-urban travel: an alternative approach. J. Transp. Geogr. 8, 99–106.
Rose, G., 2016. Visual Methodologies: An Introduction to Researching with Visual Materials, 4th eidition. Sage Publications Ltd.
Schwanen, T., 2015. The bumpy road toward low-energy urban mobility: case studies from two UK cities. Sustainability 7, 7086–7111.
Shaw, J., Hesse, M., 2010. Transport, geography and the ‘new’ mobilities. Trans. Inst. Br. Geogr. 35, 305–312.
Sheller, M., 2018. Mobility Justice: The Politics of Movement in an Age of Extremes Verso.
Sheller, M., Urry, J., 2006. The new mobilities paradigm. Environ. Plan. A 38, 207–226.
Sheppard, E., 2005. Knowledge production through critical GIS: genealogy and prospects. Cartographica 40, 5–21.
Shove, E., 2010. Beyond the ABC: climate change policy and theories of social change. (attitude, behaviour, and choice). Environ. Plan. A 42, 1273–1285.
Southern, J., 2012. Comobility: how proximity and distance travel together in locative media. Can. J. Commun. 37, 75–91.
Spinney, J., 2006. A place of sense: a kinaesthetic ethnography of cyclists on Mont Ventoux. Environ. Plan. D: Soc. Space 24, 709–732.
Spinney, J., 2011. A chance to catch a breath: using mobile video ethnography in cycling research. Mobilities 6, 161–182.
Urry, J., 2007. Mobilities. Polity, Cambridge.
Vannini, P., 2017. Low and Slow: notes on the production and distribution of a mobile video ethnography. In: Mobilities: Curated Issue: Slow Mobilities, 12, pp. 155–166.
Vergunst, J., 2011. Technology and technique in a useful ethnography of movement. Mobilities 6, 203–219.
Walker, M., Whyatt, D., Pooley, C., Davies, G., Coulton, P., Bamford, W., 2009. Talk, technologies and teenagers: understanding the school journey using a mixed-methods approach. Children's Geograph. 7, 107–122.
Wikstrøm, R.D., Böcker, L., 2020. Changing suburban daily Mobilities in response to a mobility intervention: a qualitative investigation of an e-bike trial. Sustainability 12.