

Article

# Understanding Daily Mobility Strategies through Ethnographic, Time Use, and Social Network Lenses

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**Abstract:** The development of sustainable transport and mobility systems for the future will not only need more efficient, less contaminating, and technologically enhanced systems, information, and infrastructures; it will also require a transition to new forms of living and modification of contemporary forms of mobility and immobility. This challenge will undoubtedly require an understanding of past and present modes of living in order to disentangle the complexity of contemporary life and pinpoint the implications of new forms of sustainable mobility. Given that new systems, information, materialities, and infrastructures affect people differently, it is vital that preparations be made for the potentially uneven implications of introducing new mobility assemblages, particularly for countries in the global South where sustainability in transport and mobility systems are crucial to overcoming persistent inequalities. An important step in this direction is to understand the current mobility strategies that people employ on a daily basis. This paper addresses these mobility strategies through the lenses of ethnography, time use, and social networks. It does so by identifying new dimensions revealed by the different methods which together present the true diversity of mobility strategies. A case study based on research carried out in Concepción, Chile, illustrates how these tools are combined to reveal the complex decision-making involved in contemporary everyday life. The paper recognizes limitations in terms of data gathering tools, timings, epistemologies, languages, and forms of representation of our work, and challenging proposals for future research are put forward.

**Keywords:** mobility strategies; ethnographic approaches; mobile methods; time use; social networks; activity-travel

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## 1. Introduction

The principal consequences of an urban transport model based on car use are excessive energy consumption and negative impacts on health, air pollution, and congestion. More sustainable mobility systems that will deal with these impacts are a necessity. Sustainable transport and mobility systems for the future will involve more efficient, less contaminating, and technologically enhanced systems, infrastructure, information, and land use. However, as asserted by Banister [1], sustainable mobility also requires “understanding and acceptance by the people that it will succeed” (p. 80). This not only involves openness to new forms of mobility, but a transition to new forms of living involving modification of contemporary forms of mobility and immobility. This challenge will undoubtedly require an understanding of the ways we have lived in the past to disentangle the complexity of contemporary living and uncover the implications that any new form of sustainable transport systems may have. Given that new systems, information, materialities, and infrastructures affect people differently, preparations must be made for the possibly uneven implications of introducing new mobility assemblages, especially in cities in the global South, which tend to present strong socio-territorial inequalities. In fact, a serious transformation towards sustainable urban transport

systems not only needs to be environmentally efficient and innovative but should also consider the ways in which people deal with such transformations, the impact on their daily lives, and the fact that any intervention may exacerbate existing unevenness of mobility. An important step in this direction is to understand the diverse mobility strategies that people deploy on a daily basis.

In the context of uneven mobility practices, where diverse groups, including women, children, young people, the elderly, and the urban poor, experience extremely precarious forms of mobility, any sustainable mobility project would need to tackle this unevenness. For some, the “smart city” concept offers a possible way of tackling sustainable transport. Cities in the global South or, more specifically, private companies and policy makers (both local and national) operating in these cities have openly embraced the smart city concept, seeking to improve and generate innovation in areas of urban management such as transportation, waste disposal, public space, and systems of data gathering and processing. Chile’s capital, Santiago, is a good example of this. However, before incorporating new Smart City technologies into uneven cities, it is vital that we understand the potential implications that such interventions may have for mobility strategies.

Mobility strategies are defined as the everyday decisions and practices that people use to overcome their spatial constraints in order to perform their daily activities [2]. In transport studies, these strategies can be observed by means of activity-based approaches [3] which recognize travel as a “derived demand” motivated by the desire to perform activities. This perspective is more comprehensive than traditional approaches which focus primarily on trips themselves as the key unit of analysis. However, activity-based approaches are often applied on the assumption of individual strategies; this decision simplifies daily mobility analyses, whose major focus is on modeling travel outcomes, such as the number and efficiency of trips taken within a city [4]. That said, the complex strategies of individuals and households and their diverse range of contemporary living arrangements raise questions not only about outcomes, but also about behavioral processes [5,6].

This line of questioning requires mobility decision-making to go beyond individual perspectives and to acknowledge the relevance of social networks and the intricacies of everyday life. Activities and travel involve daily processes of interdependent coordination between diverse individuals and networks of people and things. These decisions also require an understanding of the practices and experiences that take place during travel and other activities. However, these perspectives are constrained by prevailing emphasis on quantitative approaches such as modelling and forecasting in transport research, techniques which overlook the complexity of people’s daily mobility. There is a clear need for alternative ways of observing mobility strategies and understanding complex issues through qualitative methods.

In fact, mobility studies [7–13] state that the static ways in which urban and transport analyses generally observe space are inadequate for addressing contemporary spatial complexities to do with the use of space, distances, inequalities, conflicts, and sustainability in the city. These complexities and challenges call, amongst other, for new methods of observing the intertwined ways in which people move about the city. Mobile methods [14,15] offer powerful insights for understanding these processes and are particularly relevant in the case of Chilean cities with their high levels of inequality in terms of access to transportation and the activity system [16,17]. A situated adaptation of methods is required in order to properly understand the unequal mobilities which characterize Latin American cities; in the case of Chile, it is precisely these inequalities that force us to look at other dimensions of sustainability as we explore the possibilities of sustainable transport.

This paper presents theoretical ways of observing and understanding mobility strategies. It basically proposes a means of understanding mobility strategies through combined quantitative and qualitative methods. It does so by identifying new dimensions and behavioral insights that may be gained from the different methods which, when put together, reveal the complex and entangled nature of mobility strategies. A case study based on research carried out in Concepción, Chile, illustrates how these tools may be combined to reveal complex decision-making in contemporary everyday life. The paper concludes by recognizing the limitations of the proposed framework in terms of data

gathering tools, timings, epistemologies, languages, and forms of representation, and by identifying the challenges that must be addressed by future research in terms of understanding sustainable mobilities.

## 2. Activity-Based Analysis, Time Use, and Social Networks

Our proposed interdisciplinary perspective constitutes a departure from the traditional transport research paradigm and may be understood in the context of the evolution of the field of travel behavior as covered by critical reviews by authors such as Pas [18] and Jones [19]. Pas, for example, identifies the advancement of the field through three approaches: social physics, econometrics and psychometrics, and human activity. Although progress through these approaches indicates a growing understanding of travel behavior, it does not necessarily imply sequential change, and all three concepts continue to be used in travel demand analysis today. The social physics approach, developed in the 1960s, focused on providing long-term forecasts for the implementation of large-scale infrastructure projects—particularly highways—post World War II. A paradigmatic example of the social physics model can be found in Howe [20] (p. 160):

*“Human beings may be considered to be electrons. Given the initial distribution of these unit negative charges, corresponding to centers of residence, and the distribution of centers of positive charge, representing places of employment, with magnitudes equaling the number of persons employed, the probability of movement between places of residence and places of employment can be predicted on the basis of electrostatic field theory.”*

Acknowledgment of the limitations of social physics models—especially in terms of aggregation—motivated the econometric and psychometric approaches. An example of the econometric approach is the set of discrete choice models developed by McFadden [21,22] and inspired by earlier concepts, particularly mathematical psychology [23]. The context in which these models were developed was very different from previous approaches, and they were applied as the basis of a variety of policies that involved assessment of specific groups in society, an emphasis on management over infrastructure, and greater interest in modal split than in the generation or distribution of trips [24]. Although the econometric, psychometric, and trip-based perspectives have been contested in recent academic literature [25], they remain the dominant paradigms applied by transport professionals and researchers [4].

Pas [18] defined a third perspective as the human activity approach, where travel demand is a derived demand motivated by the need or desire to perform activities, constrained by time and space, and influenced by the individual’s personal and social context. As a consequence, the main unit of analysis changes from trips to the activities that individuals perform (an “activity-based” perspective). Although not a total “revolution” in the Kuhnian sense [26]—these approaches still rely on some of the ideas of previous approaches—the activity-based perspective constitutes a major paradigm shift since it focuses not only on predicting travel but on explaining it. The approach involves a time use framework inspired by time geography [27], beginning with Jones’ pioneering application of HATS (Household Activity Travel Simulator) in the late 1970s [19] and evolving over subsequent decades [28,29].

As Jones [30] argues, previous paradigm changes involved a shift of the unit of analysis from vehicles to persons to activities and more recently, to attitudes and their dynamics. All of these approaches involve economics as the dominant discipline, but reference others such as psychology, although always from a quantitative perspective. However, as mentioned previously, mobility strategies involve embedded or interdependent practices that heavily contrast with the individualistic approach described above. For this reason, over the past ten years there has been a significant move towards analyzing and understanding travel behavior as an interactional phenomenon [28] not only among members of a household, but also within a person’s social network. This perspective acknowledges the “social” dimension of activities and travel and begins to gain momentum both as a tool to improve this quantitative modeling tradition, and as a means of understanding behavioral processes embedded in the action of traveling and performing activities [31–33]. Methods adapted from disciplines from de

social sciences such as social networks [34] are presented in the case study presented in Section 5 and are combined with time use data analysis to provide a richer perspective on people's mobility strategies.

This activity-centered perspective is also strongly linked with the territorial and land use context in which people's mobility behavior takes place. In fact, the development of ideas such as those of time geography has incorporated the spatial context within which people interact and perform their daily activities [27,35]. Similarly, the focus on activities involves an explicit recognition of the interplay between land use and transport, and of the direct links with discussions regarding sustainable transportation covering a wide range of issues, such as mode choice [36], commuting patterns [37], and mobility styles [38]. However, these perspectives are still framed by a quantitative approach which fails to capture the complex and relational context of people's daily mobility [39], which is crucial to developing an understanding of how future sustainable transport scenarios would affect people's mobility strategies. This challenge also links with the need of transport analysis not only on forecasting possible scenario outputs, but also understanding the crucial dimensions that influence the required behavioral changes. In this context, the mobility approach discussed in the next section offers a complementary perspective through which to capture these embedded, emplaced, and embodied mobility strategies.

### 3. Embedded, Emplaced, Embodied Mobility Strategies within a Continuum

As a relatively new field, mobility studies [7–13] have become relevant in broadening our understanding of the impact that movement has on contemporary modes of living, enhancing in particular ways of thinking about the future and sustainable forms of mobility, including transport. In the process, these studies reveal the complexity of contemporary decision-making with regard to mobility in a world of increasingly unfixed forms of living. Under this perspective, contemporary urban practices may be viewed as a continuum, making it difficult to separate out the individual activities, relations, and places in which people are involved on a daily basis.

Mobility studies have given rise to intense methodological debates in search of deeper perspectives on the specificities of living as phenomena of theoretical and empirical significance to present-day social reflection [40]. Daily urban mobility has become central to understanding modes of living in the contemporary metropolis. As explained before, traditional research methods for the study of transport-based primarily on transport engineering involving analysis of origin and destination, with a major emphasis on forecasting outputs-are insufficient for revealing the complexity of the mobility experience and contemporary living in general. How do we live in motion? How and why are journeys made? What happens during a journey? What are the effects of these journeys in cultural, economic, and social terms? What are the strategies people deploy on a daily basis in order to move? These are some of the questions which can only be explored through immersion in the experience of living in motion.

A variety of ethnographic strategies have been applied in recent years to describe and analyze mobility practices. Multi-sited ethnography-based on "following" the movement of people, objects, practices and discourses, allowing us to find the "thread of cultural processes" has received widespread coverage [41] (p. 97) and has been applied across a broad variety of research fields. In the case of spatial relations, multi-sited ethnography has been applied to the study of migration, social movements, cyberspace, and the economy. The use of ethnography in mobility studies, which involves looking into the relationships, experience and meaning of movement, is becoming increasingly common [12,14,15]. There is also growing experimentation in techniques for recording mobility practices using devices such as cameras, mobile telephones, GPS, and video recorders. Examples include Spinney [42] and Latham and Wood [43], whose use of film to record movement is a central element of their research, and studies such as that by Latham [44,45] make use of travel diaries complemented by interviews, focus groups, mind maps, and other elements [46–49]. Mobile methodologies have had a major impact on the way research is conducted in the social sciences in general. As a result of extensive experimentation and innovation, the range of methods employed continues to grow.

These methods have helped to reveal practices that had remained undetected by traditional research. For instance, when dissecting mobility practices, intricate strategies reveal the difficulties that urban travelers endure on a daily basis, particularly when modal change is involved or when resources are scarce [50]. Moreover, when individual daily activities are coordinated with those of household members, extreme difficulties may arise [51].

The intricate intersection, connection, and overall relation between activities indicate that mobility is not only related to transport, but that major daily living decisions are taken in accordance with mobility practices. Although many people undertake mono-functional journeys, most tend to combine multiple activities during a single journey and find ways of adapting to the city. What becomes clear is that current forms of urban living, the demands of economic growth, employment structure, cultural dynamics, and personal aspirations are not always adequately catered to by the city. The reasons for this inadequacy remain unclear. Some causes are structural, while others are related to today's new forms of city living. Observation, description, analysis and comprehension of these inadequacies are crucial to developing more sustainable mobilities.

In this context, Jiron [52] defines mobility strategies as those embedded, emplaced, and embodied decisions that people make on a daily basis as they conduct their mobility practices. According to the author, to be embedded means that these strategies are related not only to the need to reach certain destinations or carry out specific activities; rather, they are embedded in social structures that frame these practices. In fact, it is according to current structures of income, gender relations, age, and life cycle that they operate. Individual or household mobility decisions respond largely to their location within these social structures. These structures often generate uneven access to the city and, unless expressly modified or contested, they reproduce themselves perpetually. Hence, strategies are seldom individual; when they depend on other household members' as well as other members of social networks' mobilities—especially when children are involved—they are known as interdependent mobility strategies [53]. A daily mobility approach assists us in identifying the coping strategies that people develop and reveals the way in which society is changing as part of larger processes. Research into everyday life and work-life balance [54,55], as well as the complexities of gender, space, and mobility [56,57] help to cast light on this issue.

Mobility strategies are also emplaced in physical space, meaning that they are carried out in certain specific locations but also weave through spaces as they occur and provide meaning to people performing them. Place making, and mobile place making specifically, play an important role in the strategies people undertake. Some may sacrifice time, distance or even comfort for the sake of mobile place making [52].

By embodied mobility strategies, Jiron [52] refers to the way in which bodies become agents of mobility practices. Feminist geographers [56,58] have long explained how bodies have an impact on the way in which places are experienced. This experience is based both on gendered social relations and on biological differences between men and women. Through daily urban mobility practices, the pregnant, aging, colored, disabled, or young bodies perceive and are perceived, and this leads to significantly different mobility experiences of men and women, girls and boys. These embodied practices imply recognition of the uses of bodies while moving in order to avoid, minimize, or contest difficulties faced while traveling.

Through observation of mobility strategies, it is possible to distinguish the various barriers and enablers that people encounter as they move [59,60]. These are elements that help or hinder their performance of daily activities, and mobility strategies assist people in overcoming them or turning them to their advantage. They also vary according to travel mode and the individual characteristics of a traveler, such as socioeconomic level, gender, age, life course, level of mobility, and religion. Different types of barrier and enablers (as identified in Table 1), in the following case study using a variety of methods.

Broadening understanding of mobility strategies from the perspective of mobility itself seems pertinent, particularly in the context of cities in the global South, which tend to present unequal social



relations and uneven mobility infrastructures. As such, there is a need to broaden discussions and adapt methodologies which may help to comprehend such complexities in the context of feasibility studies for the implementation of sustainable transport systems.

#### 4. Mobile Methods

Observation of mobility strategies by focusing on activities, time use, social networks, and mobility enablers and barriers requires a set of methodological tools that combine a variety of scales and units. As mentioned above, mobile methods have been described as an important contribution of the new mobilities paradigm [8,14,15]. The possibilities presented by mobile methods are abundant as they question the traditional nature of research, and a number of authors have discussed their possibilities and drawbacks [14,15,40,61,62]. However, most commonly highlighted is the innovation of those research methods formulated with issues of mobility in mind. Such approaches are particularly advantageous when used to broaden traditional transport-based perspectives—particularly modelling—as other methods can provide denser descriptions of occurring situations that can both complement and raise new questions for contemporary research.

**Table 1.** Mobility barriers and enablers of mobility (adapted from [53,63] ).

Mobility Barrier/Enabler	Definition
Physical	Physical characteristics of the spaces people use and through which they move (e.g., streets, sidewalks, parks), as well as the location and availability of services, infrastructure, and way finding.
Financial	Monetary costs associated with the different transport modes available (e.g., bus fares, tolls, parking fees, vehicle maintenance).
Organizational	Diverse activities that people undertake regularly in order to configure daily life, generally involving coordination with others.
Temporal	The way in which time (e.g., time of day, seasons, days of the week, schedules, trip duration, rhythms) affect mobility decisions.
Traveling know-how	Cognitive capacity of individuals to move in specific ways, such as knowledge of how to purchase a ticket, how to wait in line, how to change a tire, or how to drive.
Technological	Availability of and individual capacity to use technology, and the latter's potential to diversify trips, enable trips, or even to remove the need to make a physical trip thanks to, for example, the internet or mobile phones.
Bodily and emotional	Embodied/affective attributes that people exhibit in specific situations; for example, fear to use certain spaces due to possible violence, or the way in which bodies are emplaced to avoid violence.
Institutional	The way in which formal institutions restrict or enable access to their premises, including opening hours, access demands, availability of service, and distance.

The case presented in the present paper comes from a study performed in the city of Concepción in the south of Chile, which employed a mixture of quantitative and qualitative methods. The quantitative section included a one-week time use survey which recorded for each activity its location, start and end time, out-of-pocket expenses incurred, and social interaction, as well as characteristics of each participant and their household. A personal network instrument [34] was also included to establish the social contacts that were closest emotionally to the respondent.

The qualitative section employed an ethnographic-inspired shadowing technique [64] which consisted of accompanying participants in their daily routines and observation of the way in which they organize and experience their journeys. The researcher takes notes and records images (film and stills) while sharing with the participant and collaboratively reflecting on the latter's experience. Reflection

takes place either during the trip or afterwards. This mobile method draws from anthropological techniques such as ‘deep hanging out’ during mobility or multi-sited ethnography, and from the various developments in mobile methodologies explained above. These include methods to capture multiple forms of mobility and methodologies that prioritize research of everyday landscapes, such as geo-logs, geographic mobile trajectories through diaries and photography, and video capture of trips.

Participants were interviewed prior to the shadowing process in order to gain an understanding of their potential journeys and their contexts in relation to household, social, economic, and cultural aspects. Although the interviews provide indications of what the journeys would be like, the actual journeys are often very different, particularly in terms of the precision of timings and coordination. Once their daily routines were complete, participants were accompanied and shadowed back to their homes, and the shadowing ended once they confirmed that they would not be making any further journeys that day. The technique required punctuality so as not to delay participants, as well as flexibility in adapting to their daily rhythms. In order to capture the various spatial and social interactions from the perspectives of different household members, different individuals from the same household were shadowed on different days. The process finished with post-fieldwork guided by elicitations from photos taken in the field, as well as contextual aspects from other participants gathered in the other modules of the data collection process.

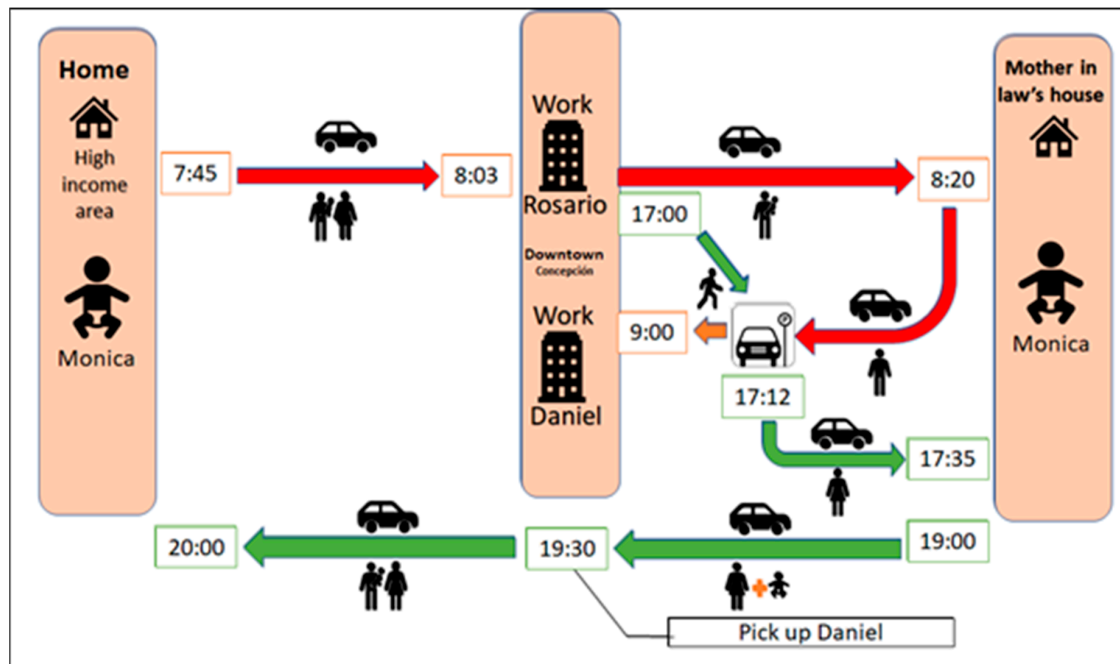
Analysis involved integration of the two datasets for each case study, identification of the key dimensions highlighted, and visualization of those dimensions in a schematic figure. The dimensions analyzed correspond to those discussed as part of the theoretical framework: financial, spatial, organizational, temporal, by transport mode, traveling know-how, technological, corporeal/emotional, interdependency, and social networks. Although the findings of this research are broad and are explained in greater detail elsewhere [6], the following case aims at presenting the various methods used in the production, description, and analysis of data. The case is not necessarily representative of the broader results of the complete research; however, the aim of the present paper is not to discuss the specific findings, but to provide an account of how three specific methods taken from different disciplines may be combined to provide a richer account of mobility strategies employed in the city of Concepción. An ethnographic account of the daily trips of a three-member household is complemented with survey results and social network analysis to provide a richer and more complex exploration of these patterns and, perhaps most importantly, reasons for “illogical trips” undertaken by the family. These “illogical” trips offer a broader understanding of mobility strategies based on reasons of care as opposed to efficiency or practicality.

## 5. Case Study: Rosario and Daniel

In this section, we present a case study conducted using mixed methods as a way of illustrating how combining methods can aid understanding of people’s mobility strategies. The case is part of a broader study on mobility strategies [6] and is based on a quantitative survey and an ethnographic-shadowing technique applied to people from three neighborhoods in the city of Concepción, Chile. The case involved a household of two adults, Rosario and Daniel (pseudonyms). Key mobility barriers and enablers were identified during this process.

Rosario is 43 years old and lives with her 45-year-old husband, Daniel, and their two-year-old daughter, Monica, in a high-income neighborhood. Both work in downtown Concepción and have a relatively high household income. The shadowing exercises for each were carried out on different dates, and observation of the complete household meant that daily trips were complex.

As shown in Figure 1, they travel together in their family car. Rosario starts work at 8 am and Daniel drops her off before beginning his own job at 9 am. An important part of their mobility strategy concerns their daughter, Monica. They prefer not to take her to daycare yet, so her grandmother (Rosario’s mother) takes care of her every day. This involves an additional stop on their commute.



**Figure 1.** Schematic of Rosario and Daniel's movements. Source: Adapted from [65].

In the mornings, once Daniel has dropped Rosario at work, he drives Monica to her grandmother's. In the afternoon, Rosario finishes work earlier than Daniel, and retrieves their car from their rented parking space, which is situated close to both of their places of work. She then collects her daughter from her mother's house in the nearby town of Chiguayante before returning to downtown Concepción to pick up her husband. The logistics involve long car journeys in the morning and afternoon and require coordination not only between Rosario and Daniel, but also with the grandmother. Public transport is simply not an option given the complex time-space pattern that their childcare decision generates.

Figure 2 offers a complementary perspective and shows the location of Rosario's weekly activities based on the time use survey. The dot sizes represent the number of episodes during the week. As expected, her home location is the center of the majority of episodes (mostly domestic), with work ranked as the second most important. However, another important spatial location is her mother's home given her role as childminder. Interestingly, from a spatial viewpoint, the trips to and from the grandmother's house are longer in distance than any other journey performed during the week, including the main commute. Furthermore, this place acts as an "anchor point" for the rest of the activities given its fixity: it cannot be replaced by any other location in the city. This characteristic is not only spatial, but also temporal, as it constrains and defines the other activities and trips performed during the day.

Although these ideas are not new, integration of the ethnographic approach and mapping of Rosario's weekly time use helps to construct a richer story of her daily mobility strategies, showing the reasons why she uses the car, the distances she travels, her schedule arrangements and more importantly, how the transportation system interacts with urban opportunities and her social networks. This more complex picture of Rosario's mobility contrasts with the traditional perspective that positions the commute as the most important portion of a person's spatiotemporal behavior, and sometimes even as the "only" portion to be considered by researchers and transport policymakers [66].



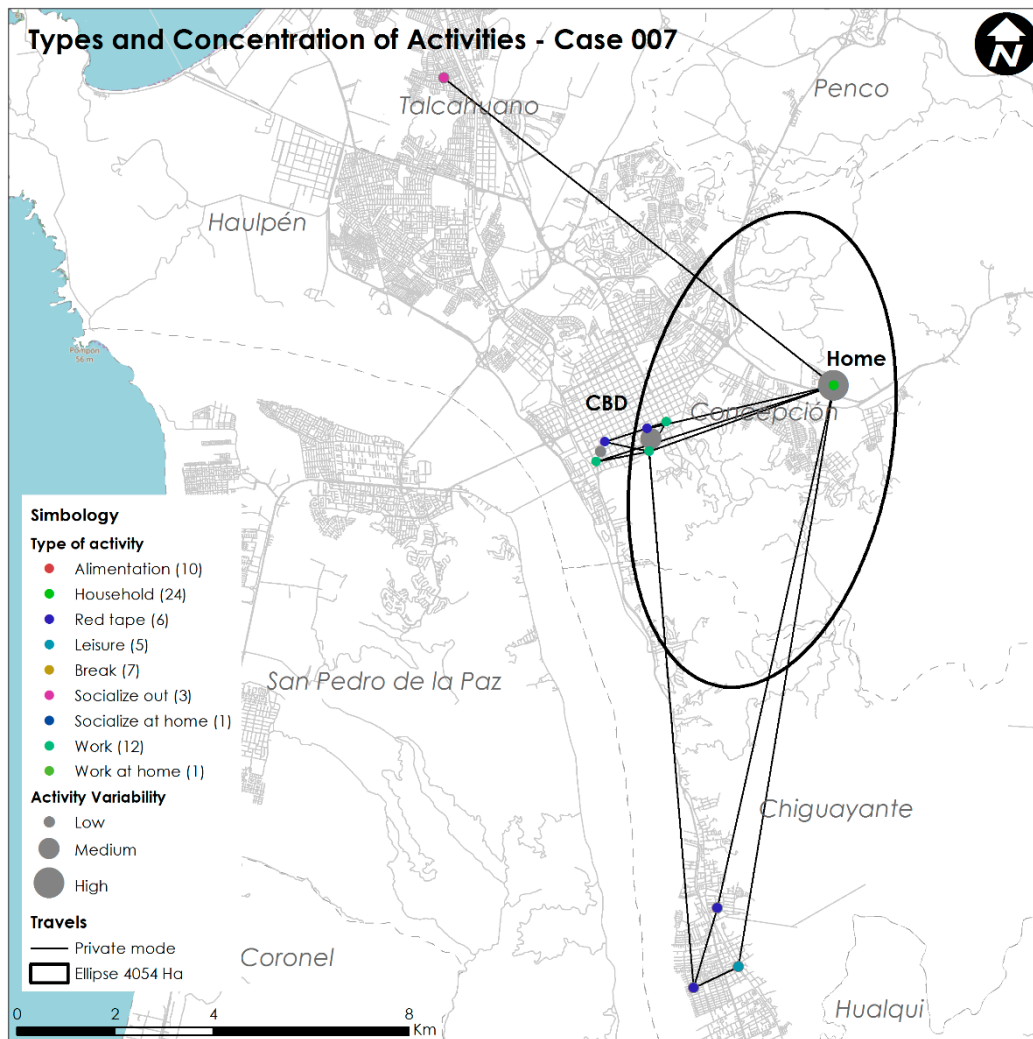
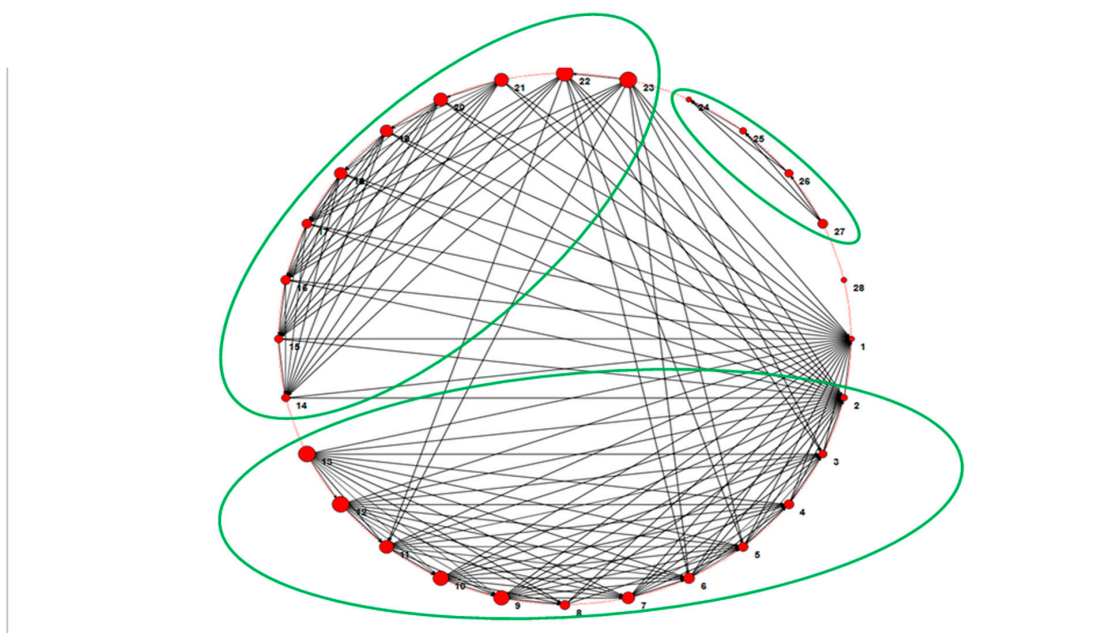


Figure 2. Rosario's activity locations. Source: Adapted from [67].

In addition, and as discussed in previous sections, the complementary insights provided by the ethnographic narratives and the time use survey clearly show that Rosario's spatio-temporal patterns are not isolated from other people. Both she and her husband are strongly interdependent, and their trips are defined by the care needs of their daughter. This illustrates how an individual-based approach using a trip diary or an individual time use survey would not account for the relevance of social interactions within her daily mobility strategies. For example, the relevance of Rosario's mother on Rosario's spatiotemporal patterns would not be clear without taking that interdependency into account.

The relevance of Rosario's personal networks to understanding her mobility is not restricted to her mother but includes the other people with whom she interacts on a daily basis. Figure 3 presents Rosario's personal networks using the instrument mentioned in Section 4 and reported in [34]. The social structure generated by the instrument shows three social subgroups within her personal network: one consisting of long-term friends (alters 2 to 13), another consisting of her family (alters 14 to 23), and a third consisting of friends from her neighborhood (alters 24 to 27). There is only one individual not related with anyone else (a colleague, alter 28). Finally, her mother (alter 1) is closely linked with her family and long-term friends, indicating her relevance in Rosario's social interactions.



**Figure 3.** Rosario's personal network.

The social space presented in Figure 3 is useful for understanding not only Rosario's social context (as traditional social network analysis allows), but also the spatiotemporal context of her mobility strategies.

Figure 4 shows the locations of Rosario's interactions with her personal network as part of her weekly routine, linking her social and physical spatial behavior. Four places stand out: her home and immediate neighborhood, her workplace, her mother's home, and the location of certain family members whom she visited on the weekend. The Figure is illustrative of the relevance-in terms of distance-of both the non-work-based trips and the temporal weekly rhythms of her mobility. However, analysis of Rosario's personal network also reveals links with longer-term temporal rhythms as identified by means of the frequency of her interaction with each alter. This is presented in Figure 5, which shows the frequency of face-to-face, social, and telephone-based interaction between Rosario and her personal networks. Face-to-face interactions encompass chance encounters, whereas social interactions constitute getting together with the express purpose of interacting. As discussed by other authors [33], visualization of these social interactions highlights the need to account for longer-term spatio-temporal strategies. However, links with weekly routines identified by the time use instrument and from the ethnographic narratives are also relevant here. In fact, Figure 5 also shows how Rosario's spatio-temporal constraints involve a pattern of frequent socializing with her mother (alter 1), with certain long-term friends (alters 14 to 18), and with close neighbors (alters 23 to 27). Interactions with the rest of her social ties are less frequent. Finally, the analysis provides a glimpse of the role of technology-in this case, the telephone-in social interaction as a complementary or substitute tool for face-to-face and social interaction, depending on the type of social contact [68]. Technology also plays a role in coordination of her daily mobility.

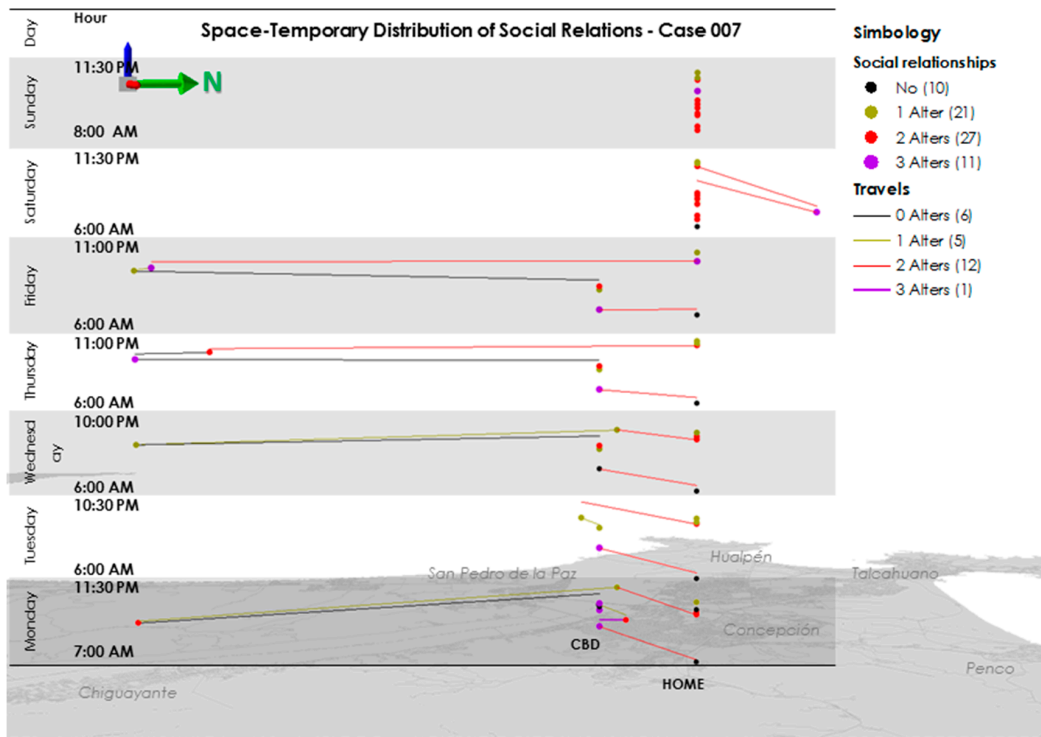


Figure 4. Places where Rosario interacts with her personal networks. Source: Adapted from [66].

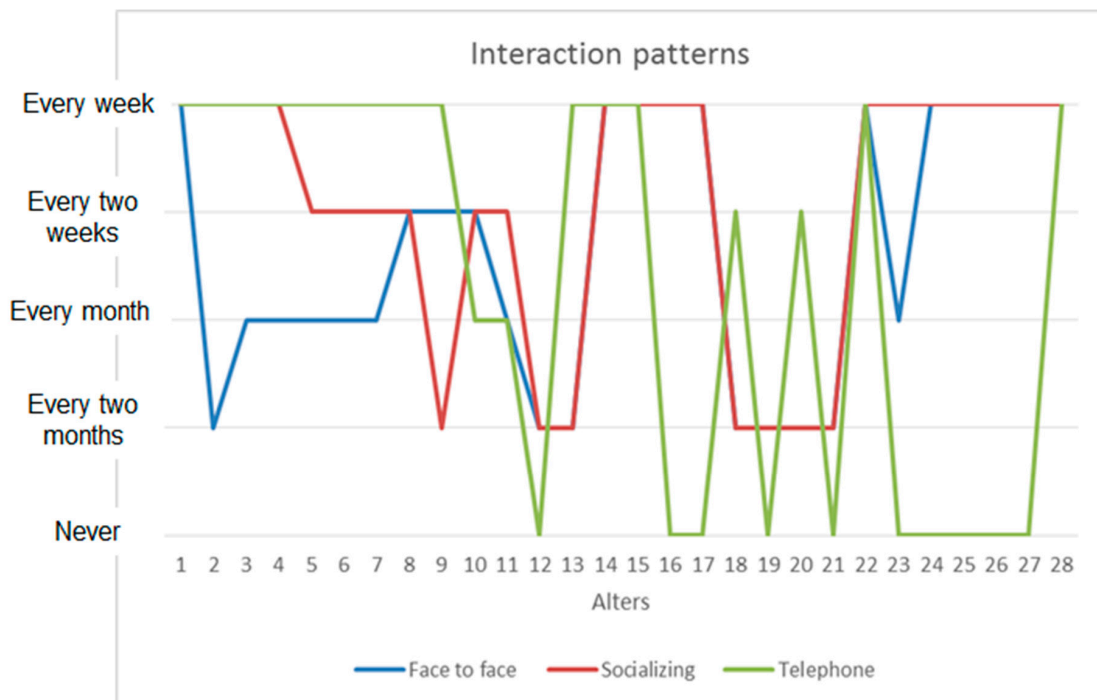


Figure 5. Frequency of interactions between Rosario and her personal network.

## 6. Conclusions: Integration of Methods in the Formulation of Sustainable Transport Policies

Devising sustainable transport systems will necessarily imply modifying current approaches to mainstream transport by, among other, incorporating forms of understand the intrinsic complexities of people’s mobility strategies. In this sense, mainstream transport analysis, in particular travel behavior

modeling and forecasting, require adapting to this urgent need, either by moderate changes or radical transformations to traditional ways of knowing upon which transport is based on up to now.

Moderate changes could involve incorporating more complex variables and new dimensions that could improve current travel behavior models. As the case presented illustrates, adding information about social interaction and support systems, as well as incorporating integrated perspectives on time use and spatial behavior can help to uncover aspects unavailable to transport models thus improving understanding people's mobility strategies. As presented in the theoretical section, current efforts placed on improving models have attempted to depart from a mechanistic towards a richer behavioral approach. However, such models are still deeply rooted on individual-based paradigms. As presented in the case, combining existing quantitative methods with qualitative approaches, particularly ethnographic ones, to elaborate more complex comprehension of mobility strategies, represents a step forward towards assessing these complexities. The methods presented in this paper constitutes a work in progress towards this direction.

However, combining methods may not be enough to deeply understand and change behavior towards more sustainable transport systems. A more radical approach in transport analysis would require questioning deeply rooted assumptions that would help to develop new types of methods that could truly integrate modeling perspectives and scientific evidence-based policies along with visioning, user's experiences, and collaborative knowledges mediation. This change will require a radical shift on current transport analysis gearing its major focus from forecasting scenarios towards becoming one of the several possible approaches to analyze urban travel behavior. This would not only involve combining qualitative and quantitative approaches to envision future transport futures but adapting to interdisciplinary ways of understanding mobility and designing mobility alternatives that are based on experience-based knowledge mediated with other forms of knowledge.

The paper aimed at contributing to this challenge by providing insights to the discussion of methods to study sustainable mobility strategies, particularly for cities in the global South, by means of a case study based in the city of Concepción, Chile. The research presented here combines ethnographic, time use and social network methods in an effort to understand mobility strategies. A conceptualization of mobility strategies and of barriers to and enablers of mobility sets the stage for a brief discussion of the theoretical traditions associated with the analysis of transport and relates traditional travel behavior research and more modern mobile methods. The case study then highlights how a combination of quantitative and qualitative methods has the potential to disentangle in novel ways the complex impact on mobility strategies of mobility barriers and enablers, offering new dimensions for analysis of transport and mobility practices.

The aim of this paper is not to discuss the results of the study as such, but to provide an example of the type of situation that may be identified through the use of combined methods, and which would otherwise be overlooked. A number of unexpected aspects are revealed by multi-method research. For instance, the relevance of interdependent mobility decisions made between Rosario, Daniel, their daughter, Rosario's mother, and other close members of their social networks highlights the need for a more explicit interactional approach to such analysis. Mobility decisions are seldom taken on an individual basis, even if mobility practices themselves are individual. Rather, a complex sequence of decisions takes place prior to, during and following mobility practices, thus making travel behavior much more complex than expected. A second aspect revealed by the approach adopted here is the importance of care—in this case, childcare—as a key aspect in mobility decision-making. Care has a strong influence on activities and trips observed in the case, including commuting, and defining spatial, temporal, and expenditure outcomes that can be better understood thanks to this integrated perspective. In fact, these two examples are also key to gaining a better understanding of the context of other longer-term decisions, such as residential location and car ownership and use, all of which are crucial considerations in the design of sustainable transportation systems [69]. These dimensions contribute to enriching potential quantitative models by facilitating a clearer understanding of some of the existing behavioral processes behind those activity and travel outcomes. Similarly, the case presented also

shows that, although the ethnographies offer a wealth of information on these dimensions, they are not on their own capable of capturing people's temporal and spatial behavior, and require the application of time-use monitoring and travel diaries to provide an adequate level of detail to account for people's complex mobility strategies.

In light of the moderate changes identified above, the application of combined methods can be identified as an essential issue from a policy point of view. In the case of both transportation and urban planning, the different approaches highlight the obvious but challenging need to integrate more explicitly different dimensions of daily life in order to generate improved sustainable outcomes. For instance, the case clearly illustrates the long-running issue of integrating decisions about the transportation system with daycare and work scheduling, a challenge which would affect other potential urban planning decisions. This means that swinging mobility patterns that dominate both transport planning and functional urban planning, separating work, residential, and commercial activities, are called into question when incorporating broader aspects of daily life. Questions are raised regarding the need to modify traditional planning practices based on the reproduction-production divide in order to accommodate the complexities faced on a daily basis by diverse urban dwellers. This is particularly relevant in cities in the global South which are considering serious long-term mobility decisions, often copying models from the global North without recognizing the specificity of local mobility strategies and their embedded, embodied, and emplaced dimensions.

The research approach presented in this paper has a number of limitations and presents some challenges, both theoretical and technical, in light with the more radical transformations required in the field of sustainable mobilities. Firstly, mobile methods and travel behavior approaches require further and more thoughtful integration considering their complementary capabilities for disentangling the complexities of mobility strategies. This integration constitutes not only an epistemological challenge given the different disciplines involved, but also highlights the need to acknowledge the intrinsic biases that hypotheses and research questions may exert on the final insights and results of an analysis. Interdisciplinary approaches require a shared understanding of the complexities at hand, as well as shared language that helps with understanding these complexities, and, most importantly, an effort to appreciate the value that different disciplines can contribute. Secondly, selection of a case study constitutes a challenge to represent "sensible" examples that will constructively represent the mobility strategies of interest. A proper recruitment process demands a balancing of adequate representation—necessary for proper quantitative methods—and information saturation, a requirement of credible qualitative approaches. However, attempts to achieve these objectives run the risk of developing methods that are excessively cumbersome and difficult to apply. In this regard, future work should explore the possibility of simplifying ethnographic and time use methods and reducing the resources involved in their application, all the while ensuring that their intrinsic advantages are in no way diminished.

Sustainable mobilities require us to go beyond increased technological complexity, consideration of the ecological dimensions of transport systems, or the search for new ways in which infrastructures can fit such systems into future strategies. An increasingly important aspect of sustainable transport policy involves understanding how change will be adapted by future users and, in that sense, it requires more thorough comprehension of the nature of mobility practices today. This is particularly relevant for cities in the global South, where urban living is fraught with inequality, pollution and congestion, and investment in infrastructure and new transport systems are hindered by limited resources. The analysis upon which responses to these challenges will be based therefore requires a more comprehensive understanding of everyday living and how this impacts mobility and transport decision-making.

From a policy perspective, future sustainable urban transport environments will require substantial changes to people's mobility strategies, and these complex processes will need to be disentangled by means of rich, mixed approaches. These more comprehensive perspectives will in turn inform new potentially relevant policies, such as improving the role of the travel experience in terms of people's



time use; assessing the role of the urban and transport context in interdependent, gendered decisions; or explicitly incorporating the role of transport in social support and social capital processes. However, removal of certain barriers will not guarantee the elimination of inequity, highlighting further the importance of intersectional perspectives that could take into account the interconnected influence of gender, socioeconomics, and other contextual dimensions on these mobility strategies. Although the integration of ethnographic, time use, and social network perspectives into transportation and urban analysis constitutes a useful step towards these goals, further experience and refinement of these exercises within different urban contexts is a crucial future requirement.

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