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Editorial

Shared Mobility: Evolving Practices for Sustainability

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Abstract: This introductory paper to the Special Issue "Shared Mobility" aims (1) to present and differentiate the diversity of practices and services that constitute the shared mobility sector; (2) to emphasize the contribution of each published article; and (3) to identify knowledge gaps of knowledge and provide further research avenues. With the contribution from 29 authors affiliated to social sciences and transportation research institutions in seven countries (Sweden, Germany, Netherlands, Greece, Belgium, Norway, and Australia), new understandings of the potential, drivers, barriers, and limitations of diverse shared mobility solutions for a more sustainable society are presented. The common message across the special issue is that the shared mobility sector is constantly evolving, while aiming to attain sustainability goals. Several papers have taken a psychological approach to explain the adoption of shared mobility practices (e.g., carsharing), yet these findings may be context-dependent, which future research should further investigate (e.g., differences between platform-based and self-service modes). We also call for researchers to pay attention to how traditional transit services can be combined with newer shared mobility services (e.g., micro-mobility), but also to informal public transport systems, as we identify these as important developing areas.

Keywords: shared mobility; carsharing; carpooling; ride-hailing; MaaS

Citation: Guyader, H.; Friman, M.; Olsson, L.E. Shared Mobility: Evolving Practices for Sustainability. *Sustainability* **2021**, *13*, 12148. https://doi.org/10.3390/su132112148

Received: 28 October 2021
Accepted: 30 October 2021
Published: 3 November 2021

1. Introduction

Shared mobility includes diverse forms of carsharing, bikesharing, and e-scooters services (i.e., "micro-mobility"), carpooling, taxi and on-demand ride services (e.g., ride-hailing), alternative transit (e.g., "paratransit", shuttle services), and private transit services (e.g., "micro-transit" services using vans and mini-buses) that supplement traditional public transit services [1,2]. These services enable people to access mobility on a "as needed basis" [3]. Shared mobility can be viewed as a tool to reduce congestion on the roads, reduce transportation infrastructure, reduce CO_2 emissions and the environmental impact of traveling, and reduce financial costs when compared with individual private ownership of vehicles. The shared use of transportation mode is possible on trips with a wide range of distance, and it varies in flexibility (see Figure 1). Nowadays, Mobility-as-a-Service (MaaS) operators leverage this large diversity of mobility services from different providers and combine them into a single digital platform (i.e., a mobile app) to address the transportation needs of people in a user-friendly manner and based on a pay-as-you-go subscription pricing model. Such innovations in the mobility sector are considered as a way to increase accessibility to daily activities, with the potential to increase people's wellbeing while reducing the environmental impact of daily travels.

The remainder of this paper is organized as follows. First, we take a step back and observe that current shared mobility practices are rooted in the past. As guest editors for this Special Issue, we aim to provide some background to the historical perspectives adopted by several published papers. In short, the following sections present the different modes of transportation that constitute shared mobility. Second, we present the Special Issue itself and highlight the contributions of the published papers following three topical

categories: (1) studies of simultaneous shared mobility; (2) studies of sequential shared mobility; and (3) studies combining multiple shared mobility services. Third, we conclude this introductory paper to the special issue by discussing further research avenues for shared mobility.

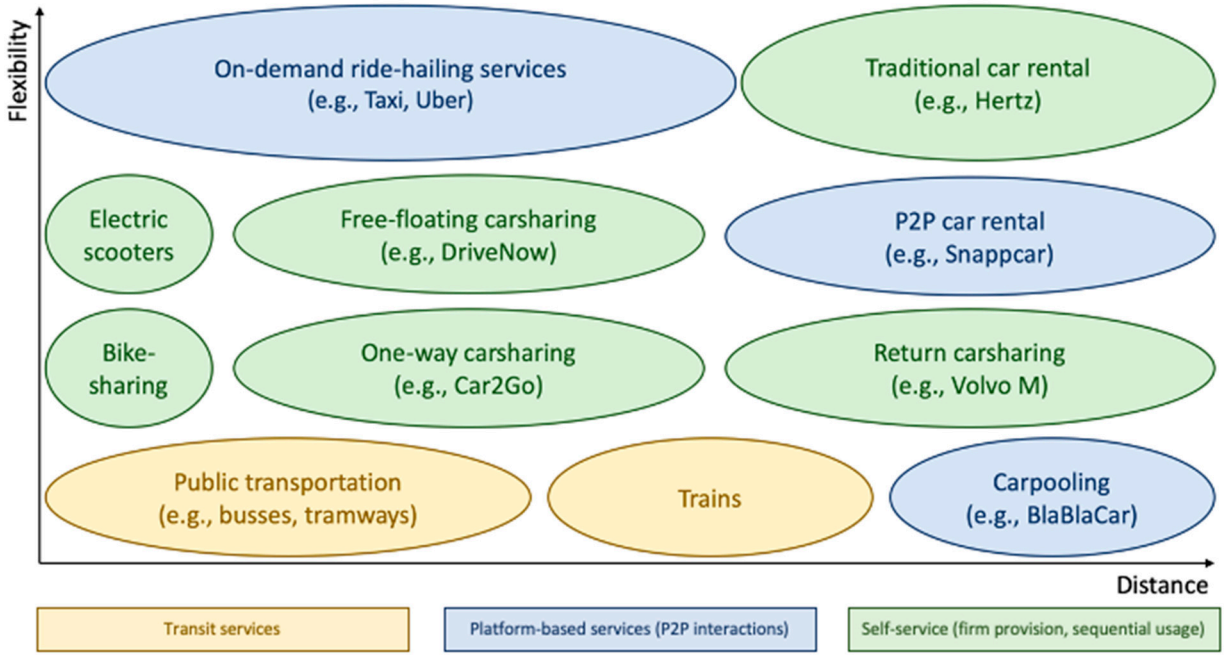

Figure 1. Shared mobility modes. Note: this representation excludes leasing (assimilated to permanent ownership), Mobility-as-a-Service (MaaS), or "Mobility-as-Network" systems and other "all-in-one" integrated combinations of various shared mobility modes and delivery services (i.e., P2P packages, crowd-logistics, and on-demand delivery) [4].

2. Shared Mobility Practices Rooted in the Past

Not only in the mobility sector have new technologies and innovations enabled a "sharing-economy" paradigm in society (e.g., the tourism sector too); however, it has been the most rapidly expanding sector. While "the automotive industry is just a slice of the pie" [5] (p. 60) of the estimated global revenues of the sharing economy—$335 billion by 2025, up from $15 billion in 2014—peer-to-peer (P2P) platforms (e.g., carpooling, car rental, ride-hailing) were generating the most revenues in Europe in 2015 [6]. In particular, the projected compound annual growth rate of the mobility sector of the sharing economy (2013–2025) is 23% [7]. Nevertheless, these shared mobility practices are deeply rooted in the past. Shared usage of vehicles, simultaneously or sequentially, is nothing new.

2.1. Carpooling Services

Today's digital platforms and mobile apps facilitating people to share rides (e.g., *BlaBlaCar*, *Uber*) can be traced back to hitchhiking. In practice, hitchhikers signal (i.e., the almost universal thumbs up) to drivers to stop, so they can inquire about their destination, and hop on to share a portion of their journey. From being a necessity for people with no access to transportation during the Great Depression and early 20th century, Kerouac's "On the Road" (1957) has popularized hitchhiking as a lifestyle. The practice progressively became organized (e.g., *AlloStop* was a call center created in 1958 as a non-profit organization in France to help hitchhikers find each other). This form of "organized hitchhiking" became popular. In France it was adopted by students during May 1968, and successively by the wider population during oil crises in the 70′s, and general strikes affecting public transportation in 1995. In the UK, a "share-a-car service" was launched in Ipswich in 1977 to redistribute the contact details of the inhabitants interested to share their journeys. In the

US, the reserved use of High-Occupancy Vehicle (HOV) "carpool" lanes was encouraged by the government post World War II in line with oil rationing. Moreover, "slugging lines" (i.e., people informally queueing at strategic positions to hitch a ride in a car with empty seats, and enabling drivers to use HOV lanes) or "casual carpooling" began to form in the late 70s [8,9]. In a nutshell, the few enthusiastic hitchhikers and city governments organizing this form of shared mobility emphasized the pro-active role of drivers in mitigating the impact of car travels on the environment by offering rides and increasing the utilization of empty seats.

As car ownership increased (as well as oil prices, traffic congestion, and environmental pollution and consciousness), the internet boom ("dot-com bubble") of the late 90s witnessed the creation of websites aimed at helping drivers and passengers to find each other—which is the beginning of organized carpooling [8]. These websites were online noticeboards where anybody could post and search trips, classified with keywords (e.g., cities), and contact each other to organize, ad hoc, a shared journey [10]. Carpooling (also known as "ridesharing" or "liftsharing") is adding additional passengers to a pre-existing car trips—such an arrangement allows drivers to fill otherwise empty seats in their vehicles. *BlaBlaCar*, which from 2004 to 2011 was simply called *covoiturage.fr* (carpooling in French), started as such a bulletin-board without interactive functions. It became a platform in 2006, making it possible for its users to communicate publicly on the ride descriptions and exchange private messages. Around the same time in the US, *Zimride* was launched in California (2007), it relied on Facebook's API to match drivers and passengers on long-distance journeys. *Zimride* was acquired by *Enterprise* in 2013. Since 2015, *Zimride* does not provide carpooling services to the public (anymore), but its algorithm and platform are provided (exclusively) to universities and corporate partners (i.e., white-label business model). Overtime, online websites and platforms progressively made it more efficient to organize carpooling [11]. In 2011, *BlaBlaCar* rebranded and deployed a new business model on its platform based on bookings (i.e., taking a commission on each seat) in order to reduce no-shows and last-minute cancellations—many associative websites with no commission were launched (i.e., *covoiturage-libre.fr, vadrouille-covoiturage.com, roulezmalin.com, laroueverte.com*) to replicate what *covoiturage.fr* used to be (i.e., free), but many, if not all, failed to reach and maintain a critical mass of users, and eventually shut down because of a decreasing level of activity.

From call centers, to online noticeboards, to matchmaking platforms, technology made it easier for drivers and passengers to find each other. Carpooling can now be organized automatically on commutes. This practice of short-carpooling ("court-voiturage" in French, as a semantic play on the word "covoiturage"), also called urban-carpooling, is when drivers offer their seats on their regular routes within cities/communes to be matched with other commuters—through mobile apps like *BlaBlaCar Daily* [12]. In the US, *Lyft* launched a carpooling service dedicated to commuters in 2016 by inviting drivers to register their recurring itinerary to be matched with passengers, especially from city suburbs into city centers and longer distances. However, *LyftCarpool* was closed due to lack of driver registration in 2016.

2.2. Taxi and Ride-Hailing Services

Ride-hailing (also known as "E-hail" and "ride-sourcing") are like taxi services provided by drivers for remuneration (e.g., professionally-trained and licensed drivers), but they are facilitated by mobile apps. *Uber* is a Transportation Network Company (TNC) founded in California in 2009 (originally as *UberCab*) that offers such ride-hailing services through *UberBLACK*. Noteworthy, carpooling (e.g., *BlaBlaCar*) is fundamentally different from ride-hailing services offered by TNCs, where drivers are professionals on-demand, paid for their time, and not just gas and mileage [1,13]. In other words, carpooling is an amateur and occasional activity, whereas ride-hailing involves partial or full employment and is tied to related (regulatory) issues of freelancing. For example, the mobile app *Zimride Instant* launched in 2012 in California (later renamed *Lyft* in 2013) aimed to enable ride

requests from passengers to be matched on-demand with drivers from *Zimride*'s carpooling community. *Zimride*'s founders dedicated full attention to turning their startup into a TNC in 2013, turning organized carpooling into ride-hailing by inviting individuals with their private vehicles (i.e., not licensed like taxis) to sign up as drivers on Lyft to compete with taxi companies (and *UberBlack*). Compared with *Uber*, *Lyft* did not determine its drivers' rate, but let passengers pay "a suggested donation" to drivers until 2013. *Lyft* also allowed tipping from its start (*Uber* did not).

TNCs have been accused of deliberately misusing the terms "community-based" and/or "ridesharing" in their communication to benefit from the associated positive ideas. This practice of "sharewashing" confuses the interpretation of on-demand ride-hailing services as true sharing [14,15]—e.g., *UberX*, (or *UberPop* in Europe) launched in 2012, but it was shut down by the European Union in Dec. 2017. The "suggested donation" argument was also a regulatory trick adopted by *Heetch* (TNC launched in France to replace *UberPop* that was shut down locally in 2015), which was also shut down in 2017. In practice, ride-hailing drivers are getting compensated for their labor (not only car ownership costs), so TNCs facilitate remunerated work.

Ride-splitting is when TNCs that facilitate ride-hailing further offer their customers to split their itinerary and fare with other passengers from the same sourced ride. Since 2014, *LyftLine*, *UberPool*, and *Uber Express Pool* offer such a ride-splitting service.

2.3. Carsharing Services

Similarly, ICT developments have enabled people to share ownership and usage of vehicles such as the benefits of owning a car (e.g., autonomy, independence, convenience) without the burdens (e.g., maintenance, parking, insurance), which can be accessed through rental services like *Zipcar*'s membership program. Still, the first carsharing initiative was a cooperative founded in 1948 in Switzerland (i.e., *Sefage*), where people with no car (but the need to use one) could find other people in their local community and borrow their car. In the 1950s, D'Welles [16] envisioned a new "Society of Shared Transportation" for Paris, where fleets of electric cars in parking lots around the city and close to residential neighborhoods would be available for citizens to use by clocking in and out their personal punch card. They would pay the transportation bill at the end of the month. *Procotip* (Montpellier, France) and *Witkar* (Amsterdam, Netherlands) in the 1970s constituted small-scale systems for one-way carsharing trips by local governments. In the 1990s, grassroots organizations became legitimized and carsharing systems started to spread worldwide [17,18]. From cooperative carsharing (e.g., *Vivalla bil* or *Majorna* in Sweden), in which a few households locally organized the shared ownership and utilization of vehicles, the carsharing sector emerged with non-profit and for-profit organizations taking on the fleet management responsibility. Like what D'Welles imagined, *Zipcar*'s membership program offers people access to a fleet of cars positioned at different city locations (i.e., usually parking lots), which can be unlocked with a smart keycard (since 2000) or from the app (since 2009). Customers pay a fixed price for the membership plan, and a flexible price based on usage. The fleet is monitored, maintained, and renewed to guarantee modern and eco-friendly cars. As vehicles are accessed and returned to the same location, this form of carsharing is called return carsharing. In essence, carsharing is a membership program intended to offer an alternative to car ownership under which persons or entities that become members are permitted to use vehicles from a fleet on an hourly basis [19]. Carsharing is different from traditional car rental or firms offering "car for hire" services (e.g., *Avis*, *Hertz*) due to the temporality of access (longer duration, rigid contract terms), price (more expensive), and convenience of services (airports mostly).

One-way carsharing (also known as "point-to-point") is enabled by GPS, network communication, and smartphone technologies, and cars (most often electric) can be picked-up and dropped-off at different parking locations or charging stations (e.g., similarly to bike-sharing docking stations) within city centers. For example, *Autolib* was a station-based electric carsharing service (2011–2018) in Paris. Free-floating carsharing is essentially the

same as one-way carsharing but without the dedicated parking spots. Instead, the fleet of vehicles is spread out within a predefined geographic region (i.e., city centers) and customers can geo-localize (and unlock) each car from a mobile app. *Car2Go (Daimler)* and *DriveNow (BMW)* respectively launched in 2008 and 2011 in Germany and expanded globally until the two auto-manufacturers announced the merger of their carsharing services into *ShareNow*, in 2018.

The sharing economy paradigm also made it easier for people to rent each other's private vehicles—although borrowing a friend's car is not a new practice. P2P car rental (or "personal carsharing") is a practice facilitated by online platforms where owners make their vehicle available to other members of a network or organization, in exchange for monetary compensation. Organizations facilitating P2P car rental provide insurance contracts, and customer support. The first services were launched by *eGO CarShare* (Boulder, Colorado) and *RentMyCar* (Germany) in 2001 [20,21]. P2P car rental enables owners to keep their car while reducing their ownership costs; and consumers get access to cars at proximity. It is cheaper than traditional rental agencies (e.g., *Hertz*), and vehicles can be booked for a flexible duration based on specific mobility needs. Technological developments such as smart-locks have facilitated a hybrid of P2P car rental and return carsharing—peer-to-business-to-peer (P2B2P) carsharing. For instance, *TravelCar* in Paris (launched in 2012) and *FlightCar* in the California, USA (2013) facilitate car rental between travelers leaving their vehicle unused for a while at the airport, and other travelers (e.g., tourists) in need of a vehicle for the corresponding period. In 2015, *Drivy* deployed the smart-lock technology so that customers unlock other people's cars (i.e., with their consent) from the mobile app, thereby removing the need to meet face-to-face.

The evolution of carpooling, ride-hailing, and carsharing practices happened as new technologies emerged, making it more efficient to organize mobility (see Figure 2).

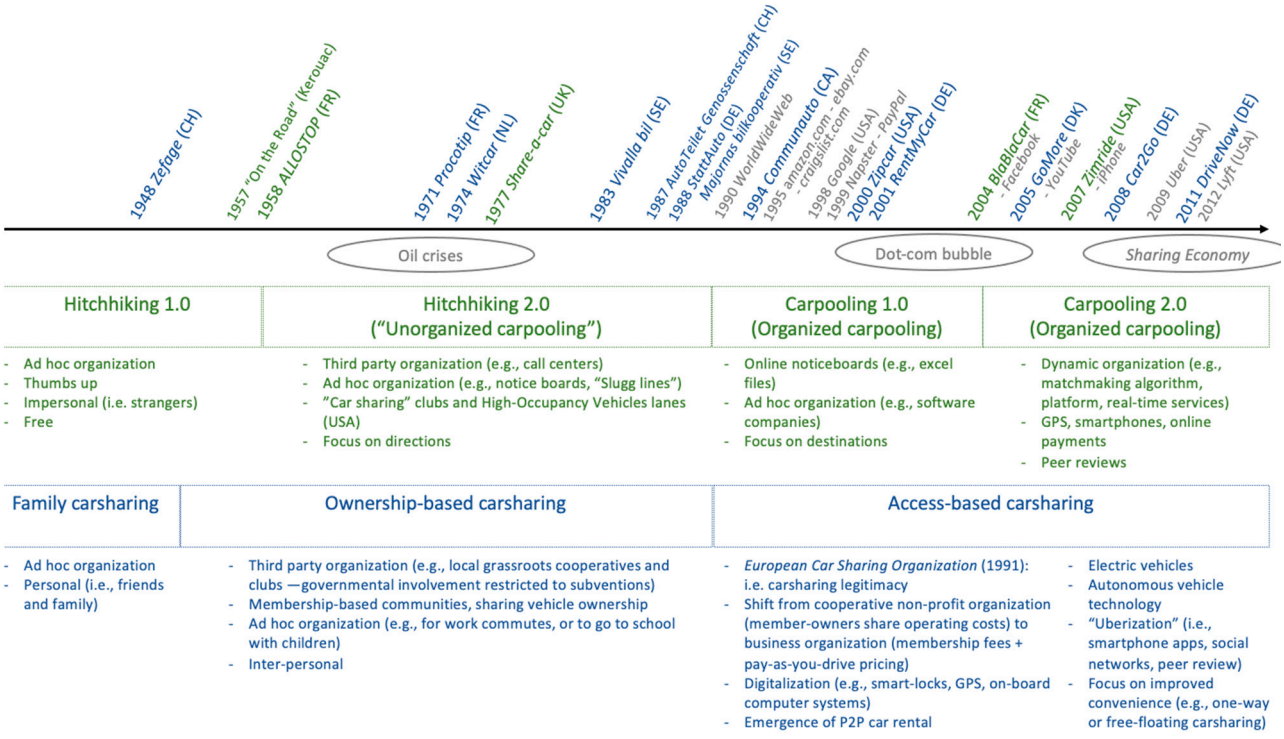

Figure 2. A brief history of carpooling and carsharing [22].

2.4. Micro-Mobility Services

Micro-mobility includes mobility services provided through a fleet of small, low-speed vehicles (primarily bikes and e-scooters) for personal transportation in urban areas, as an

alternative to ride-hailing, public transportation, or walking (e.g., trips of less than 30 min, like the First-Mile/Last-Mile), where vehicles can be accessed by one person at a time and paid at usage-rate (Frisbie et al. 2016; Shaheen et al. 2015b, 2016). Bikesharing systems are concentrated in urban areas, allowing users to access regular ("human-powered") or electric bicycles on-demand at all hours from a network of dock-based stations or free-floating based on GPS and mobile apps, for short trips in areas with good connectivity and a density of destinations [1,2,21]. Bikesharing service providers are responsible for the fleet's maintenance, storage and parking. In 2004, there were only 13 bikesharing systems [1], but they have burst in most metropolitan cities since, first at the initiative of governments (e.g., *Copenhagen City Bikes* accessible with a coin deposit like shopping carts were the first in 1995, *Nextbike*'s dock-based system was launched in Leipzig, Germany, in 2004, and *Vélib* in Paris, France, in 2007, prior to *Autolib*), and then with private companies (e.g., *Jump*'s dockless system was launched in 2010 in California). Nowadays, P2P platforms facilitate bikesharing between private individuals (e.g., *Spinlister* was founded in 2011 in California)—similar to P2P car rental.

E-scooter services constitute the other leg of micro-mobility, relying on a geo-fenced network of electric kick-bikes allowing users to unlock them on-demand in urban areas. In essence, it is the same as free-floating carsharing or bikesharing, but using e-scooters, which are more flexible but more limited in distance.

2.5. MaaS

Mobility-as-a-Service (MaaS) systems have traveler's transport needs in focus and aim to provide a mobility solution by integrating different mobility modes that are both public and private, such as to provide a "one-stop access to all services through a common interface" (Mukhtar-Landgren et al. 2016). The first MaaS company, *MaaS Global*, was founded in 2015. It operates the *Whim* app in Finland, Austria, Belgium, Japan, and the UK. *Go:Smart*, a government pilot project of MaaS (later renamed *UbiGo*), was trialed out in Sweden in 2013. Based on ICT developments (e.g., mobile networks, GPS technology, integrated payment services), the promises of MaaS include the provision of a more convenient and more sustainable solution than owning and driving private cars, and subsequently the reduction of congestion in city centers and suburbs, of traffic accidents, and of the space needed allocated for parking. Thus, MaaS is anchored in the shared mobility paradigm promoting access and shared usage over private ownership of vehicles, through the assumption that a smooth integration of a large variety of mobility services, like combining bike sharing with public transport services, is more appealing than owning, parking, maintaining, and driving a car (e.g., [23,24]). There are different levels of integration of MaaS [25]: level one integrates information for multi-modal travel planning (e.g., *Google Maps*); level two integrates booking and payment (e.g., *Uber*); while level three integrates the service offers through bundling/subscription contacts (e.g., *Whim*); and level four extends to goal integration amongst all stakeholders through policies and incentives (e.g., *UbiGo*).

3. This Special Issue

The overall purpose of this Special Issue is to better understand the potential, drivers, barriers, and limitations of diverse shared mobility solutions to contribute to a more sustainable society. As academic guest editors for *Sustainability*, we received 19 manuscripts, out of which 12 were sent out to reviewers that we suggested for their expertise on shared mobility to *Sustainability*'s managing editors, and were ultimately published after the review process. The 29 authors of the published manuscripts are affiliated to social sciences and transportation research institutions in seven countries (Sweden, Germany, Netherlands, Greece, Belgium, Norway, and Australia). All manuscripts are based on empirical research, with a dominance of quantitative (8) over qualitative (3) research design, except for one review. The European dominance of authors is reflected in the origins of the datasets: three studies took place in Sweden, three studies in Germany, and one study each in Belgium,

Italy, Norway, Netherlands, and Australia. Overall, there is a dominance of studies based on practices that involve using cars—carsharing, carpooling, ride-hailing (see Figure 3).

Figure 3. Wordcloud based on the abstracts of the 12 published papers of the special issue.

We have organized these manuscripts according to: (1) whether the vehicle is shared simultaneously by several persons (i.e., carpooling, ride-hailing, on-demand transport services); (2) whether the vehicle is shared sequentially (i.e., carsharing services); and (3) manuscripts covering multiple shared mobility services.

3.1. Shared Mobility Modes in Which the Vehicle Is Shared Simultaneously by Several Persons

Shared mobility services are often numerous in large metropolitan areas and city centers. However, there remains an issue of first-mile/last-mile transportation, in that even though there are public transport services available, they are not close enough to the departure or destination of people for them to hop onboard. There needs more research on how to overcome this barrier to access. One solution could lie in MaaS ecosystems that combine transportation services from different providers to suit particular mobility needs, such as riding an e-scooter to the train station. In line with such combination of transportation services, Mitropoulos, Kortsari, and Ayfantopoulou [26] aimed to study the potential of carpooling as a solution to increase usage of rail, tram or metropolitan services. Based on a survey of 327 European participants in the *Ride2Rail*'s study measuring willingness to drive their car to/from public transport stations while offering the ride on a carpooling app, the researchers found that convenience of pick-ups/drop-offs, area of residence (urban vs. rural), delay/detour from the journey, security (i.e., ability to check

passenger profiles), and the number of passengers influence their decision. Their results indicate that a single pick-up/drop-off point was clearly preferred by potential drivers. The majority was ready to accept an overall delay to their journey of 5 min, but they were reluctant to offer carpooling services at night. Drivers preferred to travel with friends (30%), family (29%), and co-workers (28%), compared to strangers (13%). People who live in rural or sub-urban areas were more likely to offer carpooling rides than those with urban residence. The majority of drivers preferred to check the passenger's profile using a carpooling application and Facebook. Eventually, Mitropoulos et al. argue that the cost reduction should be at least 2–3 € to engage more drivers.

Using carpooling as a mobility solution means that potential participants need to perceive that this practice can make daily activities possible (make it easy to do go to the office, grocery shopping, or hobbies for example), in a satisfactory way. This perceived accessibility to life's activities is not only necessary to make carpooling attractive, but it is also key to well-being and social inclusion. However, Friman, Lättman, and Olsson [27] found that perceived accessibility scores low (mean = 2.8/7) among carpooling participants. For their study of the determinants of perceived accessibility, they surveyed 122 Swedes who have shared rides, and they found that simplicity of travel (i.e., how reliable carpooling is perceived to be), living in densely populated areas, years of education, and trips purpose (i.e., school and work) have a positive influence—whereas shorter travel time, reduced travel cost, environmental concern, and socializing motives (and other socio-demographics variables) are non-statistically significant. The researchers highlight that their study assessed perceived accessibility when carpooling was the only mobility option available to do daily activities, whereas in reality carpooling is considered among other mobility solutions, such as perceived accessibility offered by a combination of shared solutions (e.g., MaaS in which carpooling offers a solution to the first-mile/last-mile problem) deserves further research.

The role of Autonomous Vehicles (AV) for the shared mobility sector deserved to be investigated since the development of such driverless technologies can have tremendous impacts on ride-hailing and carsharing services, but also public transport services and MaaS ecosystems. Dolins, Strömberg, Wong, and Karlsson [28] set out to investigate the factors influencing AV adoption when it comes to public transportation. They were particularly interested in unveiling the socio-economic motives and emotional experience that AV evoke. Precisely, the qualitative study is based on focus groups (19 participants) in New South Wales, Australia—where public transport authorities demonstrated high levels of innovation for both on-demand public transit and AV pilots and deployments. Users of on-demand transport services offered by a public provider (i.e., *Keoride*'s vans and busses) or commercial providers (i.e., *UberPool* or *Ola*'s ride-hailing services) were asked about their current shared mobility experience and their willingness to participate as passengers in future on-demand public transport services using AV. The researchers confirmed known factors influencing the travelers' willingness to use on-demand transport services: cost, comfort, convenience, and safety. What is particularly interesting is the new findings: the study participants' deeper concerns and intentions related to the concept of community (or common culture) and the importance of the driver as an authority figure (or the fear provoked by the absence of driver in AV), which Dolins et al. call "sharing anxiety". This demotivating factor leading to unwillingness-to-share AV is the result of a complex relationship between concerns for the overall impact on the journey time and quality; safety; personal space within the shared vehicle (sharing a public space with strangers); and trust in authority (public or private service provider).

While carpooling enables drivers and passengers to organize shared journeys by cars and split the travel costs, it is effortful. Ride-hailing services are more convenient since these journeys by cars are offered by professional drivers, and they can be ordered in advance or even on-demand. *Uber* is the infamous unicorn of the sharing economy for having changed the mobility sector by disrupting incumbent players, which led to a diversity of regulatory responses at the local or national government level and Euro-

pean level. There has been extensive media coverage witnessing *Uber*'s efforts of digital companies to influence regulations. Did they succeed? Distelmans and Scheerlinck's [29] qualitative research analyzed *Uber*'s quest for legitimacy in Brussels, Belgium, based on 483 press articles from 2014 to 2020. They found that the company's extensively used tactics of framing (e.g., arguing that the law is outdated, that Uber is not a taxi service) and lobbying (e.g., about the need for adapted rules) in its first years of operation (i.e., launch of *UberPop*, *UberX*), but *Uber*'s institutional work (including attempt at theorizing a new ecosystem around innovation, collaborating and partnering with other organizations, and negotiating with regulators) decreased overtime. The study concludes that *Uber* failed in its legitimization process (e.g., *UberPop* was considered illegal and shut down) due to conflictive chain reactions between stakeholders and the diverging interests of corporations and governments that complicates the shared mobility sector. It would be interesting to compare these findings to e-scooter service providers, who often appear in the debate for greenwashing, encumbering sidewalks, and cluttering bike-racks and thus face diverse regulatory measures, and whether they apply similar institutional strategies and how these can explain success or failure.

3.2. Shared Mobility Modes in Which the Vehicle Is Shared Sequentially

Carsharing has increased its popularity, but is it really a solution to increase sustainability in mobility? Kolleck [30] highlighted that one key aspect in assessing sustainability is better knowledge on how carsharing relates to car ownership. He argued that earlier research has primarily relied on survey studies and resulted in non-conclusive findings; some suggest very strong substitution rates between shared and private cars. By analyzing the number of cars available through free-floating and station-based carsharing services, as well as the number of private cars registered by individuals between 2012 and 2017 across 35 large German cities, Kolleck found that one additional station-based car is associated with a reduction of about nine private cars—but free-floating carsharing had statistically significant relationship with a reduction in car ownership. Neither type of carsharing had a significant impact on the markets for used and new cars. Although somewhat surprising, Kolleck concluded that these results are in line with some conservative survey findings showing that different forms of carsharing might have weaker or stronger effects in relation to sustainability.

In line with the Special Issue's call for papers on shared mobility and sustainability, Arbeláez Vélez and Plepys [31] focus on improving our knowledge of how carsharing relates to greenhouse gas emissions (GHG) at both individual and city levels. Their study is based on quantifying emissions of travel habits before and after engaging with carsharing. They employed a well-to-wheel approach to compare self-service business to consumers (B2C) and platform-based (P2P) carsharing in Amsterdam, Netherlands. In line with what one would expect, their results indicated that changes in GHG emissions after engaging in carsharing vary among individuals, where previously car-free individuals' emissions tend to increase, while previous car owners' emissions reduce. Importantly though, the savings in emissions from individuals who change from car-dependent to carsharing are substantially higher than the increase in emissions from individuals who change from car-free to carsharing. Also, depending on the characteristics of the shared fleets, GHG emissions vary, with B2C fleets tending to have lower emissions per passenger-km than P2P. When looking at sharing at the city level, it is suggested that a greater reduction in emissions can be achieved if green technology adoption is combined with behavioral changes, rather than implementing one of them separately. Such strategies can be enabled through appropriate policies supporting shared mobility solutions integrated in city transport systems.

While carsharing consumers are assumed to be environmentally conscious, some also suggest that consumers prefer mobility providers who show responsibility and trustworthiness. In light of current market developments, Kuhn, Marquardt, and Selinka [32] questioned whether environmental concerns and trust have similar effects on the intention

to use carsharing. Based on a research framework adapted from the Theory of Planned Behavior (TPB) and two survey datasets based on the cases of *Share Now* (free-floating) and *Stadtmobil* (station-based), which are the largest providers in Germany, the researchers found that perceived behavioral control is strongly related to the intention to use carsharing. This relationship was stronger for station-based carsharing. In addition, positive attitudes toward free-floating carsharing were related to behavioral intentions, but not for station-based carsharing. As regards to social and personal norms, not significant effects were observed. Kuhn et al. concluded that more research is needed to disentangle these nuanced findings. Based on their survey results, they argued that different business models may need to apply different priorities.

Silva Ramos and Jakobsson Bergstad [33] also applied the TPB to investigate the determinants of intention to use carsharing services. They tested a model of carsharing usage intention based on habits, climate morality (personal norms and environmental concern), subjective norms, control (perceived behavior control, ease of use, and perceived usefulness), and trust. Survey data were collected from 6072 Italian and Swedish users and non-users of carsharing. Similar to Kuhn et al. [32], Silva Ramos and Jakobsson Bergstad's results showed that measures of control were the strongest factors related to behavioral intention. Subjective norms were also positively related to the intention to use carsharing—a finding not observed by Kuhn et al. Comparing the two nationalities and groups of users/non-users, trust was related to usage intention only in the Italian groups, and climate morality had a small negative effect only in the Swedish groups. The researchers concluded that their findings increase knowledge about carsharing adoption and help to identify the behavioral and psychological factors that primarily influence behavioral intention.

Julsrud and Uteng [34] also investigated the potential importance of trust for carsharing by exploring if and how different forms of trust varied between users of different business models. Surveys were collected from 3070 users of the three largest carsharing providers in Norway—*Bilkollektivet* (Cooperative), *Hertz* (B2C), and *Nabobil* (P2P). The analyses indicate that high levels of in- and outgroup trust are strong predictors for cooperative carsharing. In contrast, the P2P business model was preferred by drivers with lower levels of trust towards both people within the closer social circles of friends and family (in-group), as well as towards strangers in the wider social circles (out-group). Julsrud and Uteng elaborated that this latter finding suggests that there are other mechanisms at play when social interaction and sharing of cars is undertaken in a network- and technology-based sharing format. B2C carsharing seems to situate somewhere in the middle with in-group trust being important, but out-group and technology-based trust are not. In line with previous research, they concluded that a different set of institutional logics is at play in the emerging P2P platforms (i.e., the sharing economy paradigm) compared to older, more traditional, cooperative and non-profit carsharing communities.

Previous research on carsharing has revealed that users tend to be young, are highly educated, have high incomes, and live in densely populated neighborhoods. Yet, Derikx and van Lierop [35] argued that this does not explain why people with similar socio-economic characteristics in comparable urban contexts do not all adopt carsharing—why only some do? In line with others [32,33], Derikx and van Lierop applied the TPB as a theoretical framework and they added aspects of social- and self-identity to the equation. Based on survey data from two neighborhoods in Berlin, Germany, their comparative analysis of users and non-users of carsharing showed that having a pro-technology self-identity and negative pro-car identity were significantly associated with behavioral intention to participate. A negative relationship was also observed between individuals' environmental self-identity and the degree of their pro-car identity. Furthermore, those with prior carsharing experience are much more likely to use carsharing again than individuals with no experience. Therefore, Derikx and van Lierop suggested that even a single use could increase the long-term uptake of carsharing, which shows the importance of recruiting new carsharing users among people who are currently consumers of mobility technology,

primarily the segment of early adopters of new technologies, since they already have the matching self-identity.

3.3. Multiple Shared Mobility Services

Roukouni and Homem de Almeida Correia [36] concentrate on methods to evaluate possible impacts of shared mobility. They ask whether it is possible to value possible environmental, economic, and societal impacts. In order to answer this question, they review different types of impact methods presented in research by discussing their pros and cons. A general observation from this study is that there is a large pool of different methods, but a considerable amount is still case-specific and exploratory. A classification shows that there are methods focusing on ex-ante evaluations as well as ex-post evaluations. Methods focusing on environmental and economic impacts of shared mobility seems to be more common than methods focusing on societal impacts. The authors warn against scaling up some of the methods too quickly or uncritically transferring their results. Roukouni and Homem de Almeida Correia conclude that the results could guide policymakers to obtain a better understanding of available methods, what they can offer regarding output, and how it can support decision-making.

Based on a longitudinal case study of a regional Mobility-as-a-Service, Guyader, Nansubuga, and Skill [37] follow the collaboration between governmental authorities, mobility service providers, and other stakeholders from the public and private sectors. Previous research highlighted many challenges in the development of MaaS, including issues of technological integration, but also issues of collaboration between the diverse stakeholders involved, and trade-offs between expectations for MaaS and the actual user experience. Understanding possible tensions between stakeholders' different institutional logics within a cohesive ecosystem is important in order to understand how to best promote collaboration between different actors. Five dominant logics were identified by Guyader et al. (state, market, sustainability, experimental, and service logics), resulting in tensions within organizations or between the MaaS ecosystem stakeholders that relate to finding a common vision/scope, establishing the business model, triggering behavioral change in travel, defining roles within the development project, and learning through experimenting with innovative solutions. Guyader et al. reasons that enthusiasm, involvement, and clear leadership play a key role in managing and resolving tensions in MaaS ecosystems.

4. Further Research Avenues

The common message across the Special Issue is that the evolving shared mobility sector has promises for sustainability. The research papers published herein offer a diversity of research approaches (e.g., survey-based, literature review, focus groups, case studies) on carpooling, ride-hailing, carsharing, and MaaS from which we can conclude that the adoption of shared mobility practices will continue to rise. While there are studies that are focused on sustainability aspects of shared mobility, such as the influence of environmental concerns influence on carsharing uptake [32], the effects of carsharing on GHG emissions [31], a classification of various impacts of shared mobility modes [36], we believe there needs to be further research based on metrics capturing the benefits of shared mobility for sustainability (e.g., GHG emissions, socio-economic benefits). Such metrics could help us to better understand who benefits from shared mobility systems and who does not. Proper metrics may also be useful if decision-makers want to support the development of systems that tackle specific social impacts or that contribute towards some societal goals.

Overall, we also denote that much research findings are context-dependent, for example, based on a limited geographical region that may differ in culture, norms, or regulations [33] or based on a particular business model (e.g., P2P platforms vs. self-service) [32,34]. Consequently, research on the influence of context would be valuable. For example, future studies could investigate and explain the differences between North-American and European contexts (e.g., carpooling uptake). The terms paratransit or

informal transport systems were not addressed in this Special Issue, although it is a shared mobility service common in low- and middle-income countries. There seems to be a lack of research in this area. With the aim of learning from different parts of the world, we therefore call for research and knowledge sharing activities between various actors involved in informal public transport systems and new shared mobility services.

Several research papers have taken a psychological approach to analyze the influence of diverse constructs such as of psychological ownership and status seeking motives [30], social and self-identity [35], perceptions of trust, safety, and community culture [28] on shared mobility adoption. In light of the disruptive COVID-19 pandemic, the mobility service providers reacted with new practices and users adopted new habits. Researchers should continue to study the evolution of socio-psychological attitudes (e.g., contamination concerns) on the willingness to use shared mobility services.

Although shared mobility includes micro-mobility services (e.g., e-scooters, bikesharing), public transportation services (bus, tram, train, cable car, etc.), or shuttle services for example, neither submissions nor publications in this Special Issue specifically focused on them. Nevertheless, we can denote that several papers investigated the relationships between traditional public transportation services and carpooling [26] or on-demand ride-hailing [28], or a combination of them all in a MaaS ecosystem [37]. Considering for example the recently proposed pathways to overcome the challenges of wide-scale deployment of micro-mobility for sustainability [38], we believe that empirical research on the integration (e.g., packaging, bundling) of different mobility services, including carsharing, public transportation, and micro-mobility, is urgently needed.

Author Contributions: Conceptualization, H.G., M.F., L.E.O.; writing—original draft preparation, H.G.; writing—review and editing, M.F., L.E.O.; visualization, H.G.; project administration, M.F., L.E.O.; funding acquisition, M.F., L.E.O. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Acknowledgments: We are thankful to Alexandros Nikitas, Nathan McNeil, Radka Nacheva, Karin Skill, Grzegorz Karoń, Joanna Moody, Borna Abramović, Aleksandar Erceg, Tadeusz A. Grzeszczyk, Joerg Schweizer, Alessandra Rossi, Ali Enes Dingil, Maria Urbaniec, Brenda Nan-subuga, Matthew Conway, Luca Mantecchini, Pia Albinsson, Katarzyna Hebel, Antonio Menor-Campos, Alexandre Repkine, Marcin Połom, Magdalena Dobrzanska, Juraj Grencik, Katarzyna Turoń, Elena Alyavina, and Mario Binetti for accepting to review manuscripts submit-ted to the Special Issue. We are also thankful to Marc A. Rosen, Editor-in-Chief of Sustainability and Stacey Zhai, Associate Publisher at MDPI for inviting us as guest editors.

Conflicts of Interest: The authors declare no conflict of interest.

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