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Cargo bikes for personal transport: A user segmentation based on motivations for use

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ABSTRACT

Building on the success of e-bikes, sales of e-cargo bikes are rapidly increasing in several countries. Cargo bikes fill an important gap in the urban transport market by combining the advantages of cycling with the greater transport capacity of a family car. Whereas most research on cargo bikes has focused on logistics, this paper addresses their use for personal transport. It is based on a large-scale survey in Switzerland among both proprietary cargo bike owners (CBO) and users of cargo bike sharing (CBS) ($N = 955$). A principal component analysis finds 3 families of motivations for using cargo bikes: transporting children, staying active, and reducing car use. Based on these 3 components, we use hierarchical clustering to identify 4 user segments: cargo transporters, enthusiasts, multimodals, and sustainable parents. Our results suggest that owned and shared cargo bikes are complementary and have the potential to attract new audiences to cycling and reduce car use. They could become a central component in a low-carbon/post-car urban mobility strategy. However, user experiences indicate that lacking safety, road infrastructure and parking provisions remain barriers to wider cargo bike use. We conclude by proposing a future research agenda for cargo bike research.

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Cargo bike; cargo bike sharing; cycling; e-bike; segmentation

Introduction

In the context of a transition toward sustainable mobility, cities are witnessing important changes related to the decreasing dominance of automobility (Gerike et al., 2019). One of the most visible changes has been a renaissance of cycling (Buehler & Pucher, 2021), which is accompanied by newfound developments in technology (electrical assistance, bikesharing) and a diversity of bicycle shapes, from e-bikes to folding bikes to bike-sharing. A recent trend in the bicycle scene are cargo bikes, also known as freight bicycles or "bakfiets" in dutch ("box bikes"), bicycles with an additional loading capacity enabling the transport of heavy goods or people. There are a variety of cargo bike shapes and sizes, from two- to three-wheelers, including delivery bikes, longtails, long johns, front-load tricycles, and heavy-load tricycles (Narayanan & Antoniou, 2022). An alternative to cargo bikes are trailers which can be attached or detached from a bicycle (or e-bike), offering more flexibility. While cargo bicycles have existed since the start of the twentieth century as freight transport vehicles (Narayanan & Antoniou, 2022), their use was until recently limited to high-cycling locations, such as the Netherlands or Copenhagen, where an estimated 25% of families with two or more children own cargo bikes (City of Copenhagen, 2017). The appeal of cargo bikes has increased strongly with the addition of electrical assistance, which reduces required effort when carrying heavy loads or cycling uphill (Marincek & Rérat, 2021).

Cargo bikes could fill an important void in the sustainable transport market. In congested cities with increasing limitations on car traffic, they could represent an efficient alternative to the family car and its negative environmental impacts. Their transport capacity of over 100 kg (depending on the model) enables them to carry children, groceries, or bulky objects, extending cycling for non-work trips, which are often overlooked in research and cycling policies (Ravensbergen et al., 2020).

The growth in cargo bike uses is not only due to cargo bike owners (hereafter CBO) but also to various services of cargo bike sharing (hereafter CBS). Sales of cargo bikes have increased across all major European markets, with some claiming that they could be the cycling industry's next main market (Schaik, 2022). In Switzerland, the country in which this study is based, sales have increased by 184% between 2019 and 2021, reaching 4218 units (Velosuisse, 2022), while in Germany, they have increased by 62% in 2020-2021, reaching 167,000 units (ZIV, 2022). Meanwhile, CBS services have enabled access to cargo bikes on a per-trip basis, opening up a potential for new users and trips. Unlike bike-sharing, which is either free-floating or relies on a dense net of stations, CBS services mostly work like traditional bike rentals, requiring users to return vehicles to a

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single, initial station (Becker & Rudolf, 2018b). CBS ranges from large-scale fleets managed by public entities or private operators (Becker & Rudolf, 2018b) to small-scale nonprofit sharing within associations or housing cooperatives (Börjesson Rivera & Henriksson, 2014).

To date, most research on cargo bikes has focused on their potential for urban last-mile delivery (see review by Narayanan & Antoniou, 2022). By contrast, relatively little is known about the use of proprietary cargo bikes for personal transport. When viewed through the lens of the diffusion of innovation (Rogers, 2010), current cargo bike users in Switzerland can be regarded as "pioneers" and part of the "early adopters". Cargo bikes are still an emerging trend and represent a "niche" in the urban transport market (Sherriff et al., 2023). Understanding by whom, why and how they are used is necessary from a political perspective, in order to scale up their diffusion and reach a wider audience to create change (Huguenin & Jeannerat, 2017). User segmentations or typologies can help to differentiate between different types of cyclists and "inform the different stages of planning for cycling infrastructure development by targeting more accurately the needs and requirements of different types of users." (Félix et al., 2017, p. 125).

Our goal is to better understand the drivers of cargo bike uses, and the main barriers to their wider adoption by offering a first segmentation of cargo bike users. We ask ourselves the following research questions. Firstly, who are cargo bike users, and how do they have access to cargo bikes (ownership, sharing or a combination)? Secondly, what are their motivations for adopting or using them? Thirdly, what are their experiences of cargo bike use and the barriers that prevent them from cycling more?

To this end, we developed a nationwide survey to collect data on cargo bike users, as no census data is currently available. In contrast to emerging literature on cargo bikes which mostly relies on small or convenience samples, this is the first large-scale study ($N = 955$) to include both CBO and CBS, and to differentiate between models of cargo bikes with different characteristics and potentials of use. Based on the motivations for adopting a cargo bikes, we conducted principal component analysis followed by hierarchical clustering to identify four main groups of users.

The remaining of this paper is structured as follows. We start by reviewing the literature on cargo bikes in section 'Literature review'. Our data and methods are then presented in section 'Method'. The section 'Results' is separated into the following points. First, we present the profile of cargo bike users. Then, we address the motivations for using cargo bikes and propose a segmentation of users into four groups. Thereafter, we focus on the experiences and barriers related to cargo bike use. In section 'Discussion', we discuss the implications of these results. Finally, in section 'Conclusion', we reflect on the limitations of our study and provide future directions for cargo bike research.

Literature review

Cargo bikes are a new topic in transportation and mobility literature. Most of the available research on cargo bikes focuses on logistics, or the commercial transport of goods (Narayanan & Antoniou, 2022). Research on cargo bikes for personal transport remains limited to a few exploratory studies with small sample sizes (see review by Carracedo & Mostofi, 2022). This section aims to provide an overview of cargo bike research, the profile of users, their motivations for adopting cargo bikes, and the barriers related to using them. Given that our study includes both CBO and CBS, this section addresses findings for both and highlights the differences between these two groups when needed.

Cargo bike sharing users (CBS)

A few studies on CBS have been conducted in Germany. Becker and Rudolf (2018b, 2018a) surveyed users of over 30 free CBS operators ($N = 931$), which included 31% e-cargo bikes, and 69% unassisted models. Bissel and Becker (2024) also conducted a large-scale survey of 2590 CBS users throughout the country. In Basel, Switzerland, Hess and Schubert (2019) conducted a survey among users of a fully electrically assisted CBS platform ($N = 301$). In North American cities, one study considered the potential of electric three-wheelers as part of an adaptive bikeshare program for older adults or people with disabilities (MacArthur et al., 2020). In Sweden, residents of a housing association ($N = 12$) were given access to shared cargo bikes (both e-cargo and unassisted) during an experimental trial (Börjesson Rivera & Henriksson, 2014).

Cargo bike owners (CBO)

To the best of our knowledge, CBO have been the subject of only one quantitative survey, conducted in the United States among 194 participants with both electric and unassisted models (Riggs, 2016; Riggs & Schwartz, 2018; Schwartz, 2016). Qualitative interviews were also conducted in the United States with parents using cargo bikes for transporting children by Riggs and Schwartz (2018) ($N = 9$), Thomas (2021) ($N = 20$), and Masterson (2017) ($N = 15$), as well as in Amsterdam by Boterman (2020) ($N = 53$). In Norway, a randomized control trial included 36 parents who were loaned cargo bikes (Bjørnarå et al., 2017, 2019). A further source of information on CBO are larger e-bike user surveys conducted in Great Britain ($N = 2092$, of which 6% cargo bikes and 3% tricycles) (Melia & Bartle, 2021) and the United States ($N = 1796$, of which 12% cargo bikes) (MacArthur et al., 2018).

User profile

Cargo bike users appear to be primarily men, both among CBO in the United States (Riggs, 2016), and CBS in Germany, Austria, and Basel (Switzerland) (Becker & Rudolf, 2018b; Hess & Schubert, 2019). Their age is relatively low, around 38-39 years on average for CBS (Becker & Rudolf, 2018b; Hess & Schubert, 2019), while for CBO, age data is unavailable. Families with young children are the prime user group among CBO, representing 95% of

respondents in an American study (Riggs, 2016). Conversely, they only account for 31% of CBS users Germany and Austria (Becker & Rudolf, 2018b) and 51% in Basel, Switzerland (Hess & Schubert, 2019). The socioeconomic status of CBO is higher than the average population, with two thirds of CBO in the US having bachelors' degrees and half having annual household incomes over 100'000 USD, a "middle to upper class income" (Riggs, 2016). This is not the case of CBS, who in Switzerland had only average household incomes (6'000-8'000 CHF[1] monthly compared to a national gross income of 7938 CHF), despite higher education levels (77% tertiary degree) (Hess & Schubert, 2019).

Within households, owned cargo bikes fill a space previously occupied by the dominant mode of transport. Among CBO in the United States, 60% previously used a car (alone or carpooling) as their main mode of transport (Riggs, 2016). Meanwhile, in European contexts, CBS are often car-free households accustomed to using other shared mobility services like car-sharing. In Basel (Switzerland), 81% of CBS users lived in car-free households and up to 51% owned car-sharing memberships (Hess & Schubert, 2019), while in Germany, 35% of CBS users had carsharing memberships and 25% would use carsharing if cargo bikes were unavailable (Becker & Rudolf, 2018b). Collective CBS services also replace the need for car-sharing trips in car-free (or car-reduced) neighborhoods in Sweden (Börjesson Rivera & Henriksson, 2014), Germany and Switzerland (Baehler & Rérat, 2022). Bissel and Becker (2024) suggest that CBS reduced car ownership (either through abolishing or avoiding purchase) between 7.4% and 18.1% of their sample.

Most cargo bike users were already cycling regularly before using a cargo bike. In Germany and Austria, 71% of CBS named cycling (including e-bikes) as their main daily mode of transport, followed by public transport (13%), the car (6%), multiple modes (flexible users who alternate between different main transport modes) (6%), and walking (3%) (Becker & Rudolf, 2018b). Even in the United States, 30% of CBO previously used a bicycle as their main mode of transport (Riggs, 2016).

Motivations for using cargo bikes

While no study thus far has systematically investigated the motivations for adopting cargo bikes, the literature points to several benefits which apply to both CBS and CBO. The main benefit of cargo bikes is their greater carrying capacity compared to a bicycle, which can substitute car trips (Masterson, 2017).

A specific motivation for parents and caregivers is the flexibility to transport young children to activities or school, and to perform trip-chaining with other activities. CBS services may also be used for specific trips with children, but not as regularly. This "station wagon effect" (Riggs, 2016) is especially mentioned by women, who are often responsible for mobilities of care (Riggs & Schwartz, 2018; Ravensbergen et al., 2020; Thomas, 2021). Beyond this purpose, another motivation is the pleasure of transporting children and spending "quality time" with them (Eyer & Ferreira, 2015; Masterson, 2017). Unlike trailers which are located behind the rider, cargo bikes allow for interaction with children during trips. Cargo bikes can also be used specifically for recreational trips with children (Thomas, 2021). Staying active while traveling can also be an important motivation, offering young parents who do not have much free time available the possibility to engage in physical activity with their family (Thomas, 2021). When transporting children, another benefit of cargo bikes is the sense of safety they provide in traffic because of their larger size, making people feel more visible to other road users (Thomas, 2021).

Using a cargo bike, whether owned or shared, is often motivated by the wish to reduce car dependence, and find an alternative way to transport children (Bissel & Becker, 2024; Riggs, 2016; Thomas, 2021). In car-centric communities, switching to cargo bikes as a daily vehicle provides the freedom to avoid searching for parking, to bypass traffic and make unplanned trips (Masterson, 2017; Thomas, 2021). Cargo bikes also allow to travel faster and estimate trip duration more predictably than with a car (Masterson, 2017). In addition to these practical benefits, adopting a cargo bike often represents a way to be coherent with ones' environmental values or to purse a car-free lifestyle (Baehler & Rérat, 2022). Many users see their cargo bike as "an extension of their environmental, social, and health values" and a way to be able to live car-free (Masterson, 2017, p. 54). Among CBS as well, almost all (92%) report high sensibility for climate change issues (Becker & Rudolf, 2018a).

The specific motivations for CBS are slightly different to those for CBO. CBS services are viewed as a cheaper, more flexible alternative to ownership for people who lack the need for cargo trips on a daily basis (Hess & Schubert, 2019). Like car-sharing, CBS services appeal to those who occasionally need to accomplish large-capacity trips (Hess & Schubert, 2019). Beyond capacity, CBS functions as a "sphere of experimentation" for people to try cargo bikes out before purchasing one (Becker & Rudolf, 2018a).

Barriers

The main barrier to the wider adoption and use of cargo bikes, both for CBS and CBO, are unwelcoming cycling conditions. Cycling infrastructure is still underdeveloped in most cities and when it exists it is usually not adapted to cargo bikes, which are longer and wider than traditional bicycles, and take up more space by usually traveling at a slower speed (Greibe & Buch, 2016). Many segregated bike paths are too narrow to safely accommodate cargo bikes and oncoming or overtaking cyclists (Melia & Bartle, 2021), as the recommended minimum width for a unidirectional two-lane cycle track is 2.35 meters (2.25 without parked cars) (Greibe & Buch, 2016). Obstructions such as poles or barriers on bicycle paths require sharp turns which can be difficult for cargo bikes. At intersections, left turn boxes are often too short for cargo bikes (Masterson, 2017). Without

[1]CHF stands for Swiss Franc. The value of 1 CHF is roughly equivalent to 1 EURO at the time of writing.

dedicated cycling infrastructure, some roads can be too narrow for cargo bikes to safely bypass a line of standing cars (Liu et al., 2020). Perceived safety is a major barrier for parents when carrying children in fast-moving or congested traffic (Riggs & Schwartz, 2018). Unsuitable cycling infrastructure forces some cargo bike users to use less safe routes than they would with a regular bicycle (Melia & Bartle, 2021). External conditions such as unfavorable weather (rain, ice, snow) can also be barriers, due to a fear of slipping and falling, or not being seen in darkness by motorists (Thomas, 2021).

Owned cargo bikes, but also CBS services, require specific end-of-trip facilities (Heinen & Buehler, 2019) at destinations and at home. Most bicycle parking racks are not wide or long enough for cargo bikes (Riggs, 2016). As a result, users park on the sidewalk, where they may block pedestrian passage (Masterson, 2017; Thomas, 2021). Cargo bikes' weight (over 40 kg) makes it difficult to carry them up or down stairs or hang them up, for example in a train carriage. Therefore, storing a cargo bike at home requires more space than a conventional bicycle. For CBO, having access to a ground-level bike storage room or a secured garage is necessary (Thomas, 2021).

In addition to cycling conditions, social stigma can represent a barrier to cargo bike use (both for CBO or CBS). In places where cycling is not the norm, carrying young children by cargo bike may be seen as reckless and dangerous (Riggs & Schwartz, 2018; Thomas, 2021). Conversely, in the Netherlands, where cycling is much more accepted, cargo bikes are a symbol of gentrification associated with progressive parenthood and gender roles (Boterman, 2020).

For CBO, the perceived cost of purchasing cargo bikes (over 3'000 Euros) can be a barrier to their adoption. Maintenance costs are also higher than conventional bikes due to increased wear and tear on components[2] such as brakes and tyres, and the need for specialized technicians due to the electrical motor (Masterson, 2017; Thomas, 2021). Despite this, many users see economic benefits to using a cargo bike compared to the combined cost of car ownership, gas and parking (Masterson, 2017; Thomas, 2021). With technological improvements, barriers related to battery range only affect some heavier three-wheeled models which drain their battery more quickly and are less suited for long distances or hilly routes (Masterson, 2017).

Among CBS, the most frequent barriers to use are a lack of need for carrying heavy goods, and competition from having other transport options available (Hess & Schubert, 2019). CBS also requires planning trips in advance, making spontaneous trips difficult (Hess & Schubert, 2019). The complexity of the reservation process and its cost can also deter users (Hess & Schubert, 2019). Lastly, people with little experience of cargo bikes can feel uncomfortable handling a larger vehicle, or be afraid of carrying objects or children by bicycle (Hess & Schubert, 2019).

[2]These costs depend on the type of trips undertaken and the climate, topography, and street surface.

Summary and research gaps

Cargo bikes are a new mode of transport and research on their users is still scarce. We can identify several gaps in the literature. Firstly, there have been no comparisons between the two types of access to cargo bikes, namely CBO and CBS. This limits our understanding of the differences between "owners" and "sharers" and their patterns of use. Secondly, little is known about the diffusion of cargo bikes within the population, cargo bike users' position in the life course, socio-economic situation, vehicle ownership, and how these characteristics vary between contexts and over time. Furthermore, no research has considered differences in the motivations for cargo bike use between CBO and CBS users, or between models of cargo bikes. Lastly, the everyday experiences of cargo bike users remain largely unexplored, including the learning process, interactions with other road users, and perceived safety in different situations. To fill these gaps, we now present our method and data.

Method

Cargo bike survey

A nationwide online survey in Switzerland was used to target both CBO as well as CBS. In 2021 (the latest available figures), 7.9% of all journeys in Switzerland were made by bicycle, which is higher than in English-speaking and Latin countries but lower than in Northern European countries. Large differences are found between German-speaking (9.6%) and French-/Italian-speaking cantons (4.2%/2.7%), indicating varying levels of cycling infrastructure (Rérat, 2021).

About 4200 electrically-assisted cargo bikes were sold in Switzerland in 2023 and roughly 18,000 since 2016 (Velosuisse, 2024). The number of cargo bikes without electric assistance sold are not reported in statistics (they are encompassed in an "other" category) but as our survey shows they are much less frequent (12%) than electrically-assisted models. The amount of shared cargo bike users is difficult to estimate, with the main CBS operator, "Carvelo2go", claiming to have 30'000 total users since its creation in 2015 (carvelo2go, 2022). Registering as a Carvelo2go user is free but trips are paid (5 CHF + 2.50 CHF per hour), with a half-fare rate for subscribers to a yearly pass (90 CHF) and members of the Touring Club Switzerland. Carvelo2go operates 360 electrically-assisted cargo bikes in 90 (mainly urban) municipalities across the country which were used for 21,230 trips in 2021. The cargo bikes are hosted by shops and can be rented and returned during open hours. A smaller number of shared cargo bikes are not for rental and shared within companies or housing cooperatives or even informally between acquaintances.

Cargo bike users were contacted through the following means. The survey was available in French and German and hosted on the website of our research institute (OUVEMA). The link to the survey was shared on social networks (Twitter and LinkedIn) as well as in the newsletters of the research group and in a national cycling journal

(Velojournal). Associative actors including local cycling advocacy groups (PRO VELO[3]) and sustainable transport groups (ATE/VCS[4]) were contacted to distribute the survey in their respective newsletter and among their members. Leaflets containing a QR code linking to the survey were distributed onto cargo bikes in several cities of the country. Additionally, two bicycle shops specializing in cargo bikes passed on the survey to their clients *via* their mailing lists (in Basel and Lausanne).

The survey was launched in June 2022 and open until September 20th, 2022. A total of 955 valid responses were obtained, with 87% of respondents completing the survey until the last page. Our sample may not be statistically representative, given that the profile of CBO is currently not recorded in any official statistics. Relative to the population, French-language respondents are strongly overrepresented (60.5% of respondents vs. 25% of the population), whereas German-speakers are underrepresented (39.5% of respondents vs. 71% of the population) and the survey was not translated in Italian (4% of the population) given its smaller demographic weight (FSO, 2022). This unequal diffusion of the survey across regions of Switzerland can be explained by the researchers' location in the French-speaking part of the country and stronger collaboration from French-language local cycling groups.

Survey questions

The survey included 42 questions (for an overview see Table A1, appendix) which were inspired by the literature review. Participants were asked how they had access to cargo bikes (ownership; cargo bike sharing services; borrowing from friends/relatives; sharing at work, sharing within a housing cooperative). This allowed us to categorize respondents into either owners or users only. CBO were asked about their cargo bike (model, electrical assistance, price, etc.) and purchase information.

In addition to participants' socio-demographic characteristics, people living in family households were asked how many children they carried by cargo bike, and all multi-person households were asked how often other people used their cargo bike (recoded into a binary variable). The frequency of cargo bike use was measured overall as well as for six trip purposes (recoded into a binary variable). We asked for the number of vehicles owned in the household as well as cargo bikes, cars, motor two-wheelers, pedelecs (e-bikes with an assistance until 25 km/h), speed-pedelecs (e-bikes with an assistance until 45 km/h), and conventional bicycles. We also asked participants if they owned a drivers' license, a car-sharing pass, or a public transport pass (binary categorical).

The motivations for cargo bike use were assessed through nine statements derived from the literature and a five-point Likert scale (disagree; rather disagree; neutral; rather agree; agree). Motivations for cargo bike sharing were assessed by a separate list of six statements based on CBS literature (Becker & Rudolf, 2018b, 2018a; Hess & Schubert, 2019). The experiences of cargo bike were measured using the same scale.

Analysis

In a first step, descriptive analyses were conducted to understand CBO and CBS profiles, vehicle equipment, frequency of use, motivations for using a cargo bike, and experiences and barriers. We used crosstabs and Pearson's chi-square to test for differences in terms of access to cargo bikes (CBO vs. CBS) and cargo bike models. In a second step, we created a typology based on the motivations for cargo bike use. Using principal component analysis, nine motivations were reduced to three components. Based on the z-standardized component loadings, hierarchical clustering (Ward method) was used to group participants based on their patterns of response (Everitt et al., 2011). By observing the agglomeration schedule (dendrogram), we identified three and four-group solutions. The four-group solution was retained due to its greater potential for interpretation.

Results

The profile and characteristics of cargo bike users

Access to a cargo bike

Three quarters (72.9%, $N = 696$) of participants are cargo bike owners (CBO), although they may also access cargo bikes in other ways. The rest (27.1%, $N = 259$) only have access to cargo bike sharing (CBS). This includes CBS[5] services (18.5%, $N = 177$), as well as sharing through other means (8.6%, $N = 82$) such as at the workplace (3.7%), with friends or relatives (3.6%), or within a housing cooperative (0.5%). Interestingly, around one in five participants (21.3%) have access to cargo bikes in several ways. The most common combinations are ownership and CBS services (5.8%), CBS services and sharing at work (1.9%), CBS services and sharing with friends/relatives (1.8%), and ownership and sharing in a cooperative (1.3%).

Model and purchase information

As shown in Table 1, the most frequently owned cargo bike model is the front-loader (66.9%), the classic version of the "bakfiets" with a loading box in the front. The second type is the longtail (23%), a more classic bicycle shape with a longer rear rack. Three-wheelers (tricycles) are less common (10.1%), which could be due to handling and parking difficulties related to their dimensions and their reduced relevance in hilly contexts. Though most were bought new, a few cargo bikes were used (15.6%), signaling the emergence

[3]PRO VELO is a cycling advocacy association representing the interests of cyclists. It has 39'000 members in 2021.

[4]"Association transports et environnement" or "Verkehrsclub der Schweiz" is an association which supports environmentally sustainable transport. It has 100'000 members according to its website.

[5]The total proportion of people with access to CBS services is N = 238 or 24.9% of respondents, but this also includes owners who have access to them besides their personal cargo bike.

Table 1. Access to a cargo bike and model information (CBO only).

Variable	Category	N	Percent
Type of cargo bike	Front-loader	424	66.9
	Longtail	146	23
	Three-wheeler	64	10.1
Purchase	New	570	84.4
	Used	105	15.6
Date of purchase	2016 and before	100	16.2
	2017-2018	113	18.3
	2019-2020	210	34
	2021-summer 2022	194	31.4
Electrical assistance	None (unassisted)	82	12.1
	25 km/h	526	77.6
	45 km/h	70	10.3
Purchase subsidy	Yes	229	34.5
	No	434	65.5

of a secondhand market. Electrical assistance is the norm with 77.6% of cargo bikes being assisted until 25 km/h, and 10.3% until 45 km/h, whereas only 12.1% are unassisted. The diffusion of cargo bikes over time is still a recent phenomenon, with 65.4% of cargo bikes bought in the last 3 years. Longtails have diffused more recently than other models, with 58% bought in the last year and a half (since 2021). The median price of a cargo bike is around 5500 CHF (3000 CHF for unassisted models) and has increased over time. One third (34.5%) of CBO benefited from a subsidy for purchasing a cargo bike. Unlike other countries, Switzerland has no national subsidy program (ECF, 2016) but some cities, cantons and private firms offer subsidies for the purchase of cargo bikes.

Sociodemographic profile

Table 2 presents cargo bike users' profile. People aged between 30 and 49 years make up the majority of users (average: 42 years). CBS are significantly younger than CBO, with 13.9% aged under 30, compared to 2.5% for owners. Both younger and older people may be deterred from buying cargo bikes by a lack of need to transport children, or insufficient parking space in apartments.

Around two thirds of cargo bike users live in families with children (68.2%). CBO are more often young parents (77.4%) than CBS (39.1%). Among family households, almost all (89.1%) carry their children by cargo bike, and 57.6% carry two children or more. This suggests that families with young children and gear to transport, which would traditionally use a car, are the prime audience for cargo bikes.

The gender makeup suggests that two thirds of respondents (66.4%) are male (71.2% of CBS, 64.9% of CBO). However, this proportion only reflects the gender of the person "responsible" for the cargo bike and who filled in the questionnaire, which might explain the overrepresentation of men. Indeed, cargo bikes seem to be "family bikes" as 79.3% of CBO agree to sharing them with another member of their household. Unlike conventional bikes, only the saddle needs adjusting, so they can be used by different people in the household.

Cargo bike users have a high socio-economic position. Almost all are employed (93.3%) with very few retirees, students, unemployed or housekeepers. Compared to CBO, CBS include significantly more students (7.4% vs. 0.5%) and retirees (3.7% vs. 1.3%). Education levels are high, with 80.2% of users holding a tertiary (university) degree. Net household income is also high, with half earning over 9'000 CHF per month compared to a national average of 6'600 CHF (Household budget survey 2019, FSO, 2022a). This is due to the household structure of owners, which are mostly dual-career couples. Compared to CBO, CBS include more lower income groups earning below 3'000 CHF per month (11.4% vs. 4.3%), reflecting a higher share of young adults in single-person households, students, and retirees. The place of residence of 88.7% cargo bike users is an urban or suburban municipality (compared to 63% of the national population), with only 6.9% living in peri-urban (vs. 32%) and 4.4.% in rural areas (vs. 16%) (FSO, 2017). Cargo bike use is currently mostly a suburban and urban practice and even more so for CBS (92.6%) than CBO (87.5%). This can be explained by the greater availability of CBS services in dense areas where the potential demand is higher.

Vehicle ownership and transport passes

Cargo bike users are a population of cyclists. Almost all own conventional bicycles (88.3%) or e-bikes (30% pedelecs and 10.5% speed-pedelecs) (Table 2). They have a low reliance on motorized modes, with only 47.6% owning a car, while 42.9% have a carsharing pass to use a car when needed. Moreover, one quarter own a public transport pass (27.1%). CBO have access to more vehicles than CBS, including cars (54.4% vs. 28.4%), pedelecs (33.3% vs. 21.1%), speed-pedelecs (11.7% vs. 6.9%), and conventional bicycles (89.7% vs. 84.4%). This is likely due to living in families (bigger households, childcare), with higher incomes and vehicle equipment rates. Meanwhile, more CBS have access to alternatives to the car like carsharing (54% vs. 39.6%) and public transport passes (33.5% vs. 25.2%).

Frequency of use

Frequency of use strongly differs between CBO who can access it directly, and CBS, which need to plan their use in advance and "book" (and pay) their desired trip. On the one hand, around nine in ten (91.3%) CBO reportedly use their cargo bike several times per week, of which over half every day or almost (54.8%). On the other hand, most CBS only use a cargo bike a few times per year (70.5%) or per month (20.7%), with only 8.8% using them every week. Different models of cargo bikes also have significant differences in their frequency of use, with more longtail users cycling every day (59%) than three-wheelers (37%), suggesting the former are more suited to daily trips, while the latter have a narrower range of uses. Moreover, e-cargo bikes with an electric assistance are also used more often every day (61%) than unassisted models (42%).

Motivations for owning and sharing cargo bikes

The most agreed upon motivations for adopting a cargo bike (Table 3) are, in descending order, adopting a

Table 2. User profile by access (CBO vs. CBS).

Variables	Categories	N	% All	% Owners (CBO)	% Sharers (CBS)	Statistical test (Chi2)
Age	20-29	41	5.2	2.5	13.9	$p < .001$
	30-39	280	35.5	36.9	31.0	
	40-49	324	41.1	44.1	31.6	
	50-59	113	14.3	13.8	16.0	
	60 and over	30	3.8	2.7	7.5	
Gender	Male	527	66.4	64.9	71.2	$p < .01$
	Female	267	33.6	35.1	28.8	
Household composition	Other household	255	31.8	22.6	60.9	$p < .001$
	Family with children	548	68.2	77.4	39.1	
Employment situation	Student	17	2.2	0.5	7.4	$p < .001$
	Employed full-time	404	51.1	52.2	47.9	
	Employed part-time ($< 90\%$)	333	42.2	43.5	37.8	
	Unemployed or homemaker	21	2.7	2.5	3.2	
	Retired	15	1.9	1.3	3.7	
Educational background	Other (apprenticeship, vocational school)	158	19.8	19.2	21.6	non-significant
	University, Polytechnic University of Applied Sciences or Pedagogy	638	80.2	80.7	78.4	
Monthly net household income	>3′000 CHF	42	6.2	4.3	11.4	$p < .001$
	3′000 to 6′000 CHF	106	15.5	13.4	21.7	
	6′000 to 9′000 CHF	197	28.9	30.6	24.0	
	9′000 to 12′000 CHF	207	30.4	32.0	25.7	
	12′000 to 15′000 CHF	130	19.1	19.7	17.1	
Number of children transported by cargo bike	None	64	10.8	6.1	38.8	$p < .001$
	1	186	31.5	32.3	27.1	
	2 or more	340	57.6	61.6	34.1	
Cargo bike used by other members of household	Yes	505	69.5	79.3	30.1	$p < .001$
	No	222	30.5	20.7	69.9	
Place of residence	Urban (city and suburban area)	668	88.7	87.5	92.6	$p < .01$
	Intermediary (Peri-urban and rural centre)	52	6.9	8.3	2.3	
	Rural	33	4.4	4.2	5.1	
Car ownership	No	436	52.4	45.6	71.6	$p < .001$
	Yes	396	47.6	54.4	28.4	
Motor two-wheeler	No	770	92.5	92.0	94.0	non-significant
	Yes	62	7.5	8.0	6.0	
Bicycle (unassisted)	No	97	11.7	10.3	15.6	$p < .05$
	Yes	735	88.3	89.7	84.4	
Other e-bike (25 km/h) (not cargo bike)	No	582	70	66.8	78.9	$p < .01$
	Yes	250	30	33.2	21.1	
Other speed-pedelec (45 km/h) (not cargo bike)	No	745	89.5	88.3	93.1	$p < .05$
	Yes	87	10.5	11.7	6.9	
Carsharing pass	No	412	57.1	60.4	46.0	$p < .01$
	Yes	309	42.9	39.6	54.0	
Public transport pass	No	580	72.9	74.8	66.5	$p < .05$
	Yes	216	27.1	25.2	33.5	
Frequency of cargo bike use	Every day or almost every day	385	40.8	54.8	2.0	$p < .001$
	Several times a week	270	28.6	36.5	6.8	
	A few times a month	104	11	7.5	20.7	
	A few times a year or less	185	19.6	1.2	70.5	

sustainable form of mobility (93% agree or rather agree), moving independently and efficiently (91.2%), reducing the use of the car (or giving it up) (88.9%), carrying heavy loads (85.9%), having an alternative to public transport (76.3%), and transporting children to school or activities (74.5%). Less important motivations are going on bike rides (63.2%), cycling more (52.4%), and exercising while traveling (47.3%).

Differences in motivations for cargo bike use between CBO and CBS are statistically significant. CBO are especially motivated by reducing car use and sustainable mobility, conducting child-related trips such as transporting children to school or activities or going on bike rides, and the ability to move independently and have an alternative to public transport or the car. This suggests they need the cargo bike for frequent trips to transport children. Meanwhile, CBS are less motivated by the proposed reasons, except for the ability to carry bulky items, suggesting a more occasional need.

Using CBS rather than purchasing a cargo bike is motivated mainly by a lack of need (88.4% agree) and a lower price (85.1% agree). Further reasons include preferring to share (68.8%), already having other transport alternatives (58.2%), not having parking available (52.4%) and the ability to test a cargo bike (50.3%).

To summarize these motivations (excluding those for CBS only), we used principal component analysis (PCA). As shown in Table 4, we found three components with eigenvalues over 1 which together explained 63% of the variance. The first component labeled as “Carrying children” loads onto the motivations of transporting children to activities, going on bike rides, having an alternative to public transport. The second component, labeled as “Staying active”

Table 3. Motivations for cargo bike use by access (CBO vs. CBS).

		% Agree or rather agree			
		All	Owners (CBO)	Sharers (CBS)	Statistical Test (Chi2)
Motivations for using cargo bikes	Adopting sustainable mobility	93	93.8	90.5	$p < .05$
	Moving independently and efficiently	91.2	94.3	81.5	$p < .001$
	Reducing or giving up the car	88.9	90.5	83.6	$p < .001$
	Carrying heavy loads	85.9	85	88.4	$p < .01$
	Having an alternative to public transport	76.3	81	61.8	$p < .001$
	Transporting children to school or activities	74.5	84.8	42.1	$p < .001$
	Going on recreational bike trips	63.2	72.5	34.4	$p < .001$
	Cycling more	52.4	56.6	39.6	$p < .001$
	Exercising while traveling	47.3	51.2	35.2	$p < .001$
Motivations for sharing rather than buying	It is sufficient for my occasional transport needs	–	–	88.4	–
	It's cheaper than buying	–	–	85.1	–
	I prefer to share rather than own	–	–	68.8	–
	I already have other transport alternatives	–	–	58.2	–
	I don't have parking space available	–	–	52.4	–
	It allows me to test whether I like the cargo bike	–	–	50.3	–

Table 4. Components loadings for motivations for cargo bike use (note: bold values are over 0.4).

	Component		
	Carrying children *(34.9% of variance)*	Staying Active *(17.2% of variance)*	Reducing car use *(11.1% of variance)*
Transporting children to school or activities	**0.897**	0.089	−0.019
Going on bike rides	**0.835**	0.196	−0.04
Having an alternative to public transport	**0.464**	0.399	0.279
Cycling more	0.146	**0.869**	0.105
Exercising while traveling	0.195	**0.863**	0.099
Moving independently and efficiently	0.442	0.182	**0.499**
Carrying heavy loads	−0.149	−0.138	**0.668**
Reducing or giving up the car	0.108	0.267	**0.658**
Adopting sustainable mobility	0.066	0.168	**0.771**
Rotation Method: Varimax with Kaiser Normalization.			

loads onto the motivations to cycle more, and to exercise while traveling. The third component, labeled as "Reducing car use" loads onto the ability to move independently and efficiently, to carry heavy loads (without a car), to reduce or give up the car, and to adopt a sustainable form of mobility.

Four types of cargo bike users

Based on the three components identified above, we used hierarchical cluster analysis (Ward method) to create four groups of cargo bike users, including both CBO and CBS. Figure 1 represents each group's average score for the three components, compared to the average of all respondents. A negative value indicates a lower-than average motivation, while a positive value suggests a stronger motivation. Because agreement to motivations was very high, a negative value does not indicate a disagreement but only a lower rate of agreement compared to other groups. The proportion of each group is specific to our sample and not representative of their weight in the population. Further characteristics and travel patterns for each group are shown in Table 5, along with Pearson's Chi2 tests for inter-group differences. Only significant differences are reported.

"Cargo transporters" ($N = 199$, 24%) are, on average, more motivated than other groups by using a cargo bike to reduce or avoid car trips. Conversely, they are less motivated by the ability to carry children or be physically active. Over half of the members of this group are CBS (51.3%). They include significantly more non-family households (72.7%), men (76.4%), and people aged 20-29 (15%) or over 50 years (31.1%). In terms of vehicle equipment, they have a low rate of car ownership (35.5%). Their frequency of cargo bike use is low compared to other groups, with the majority (58.3%) using it only few times per month or year. Most of them use a cargo bike for trips which require carrying capacity such as bulky items (95.6%) or groceries (86%). Nonetheless, some use one to go to work (49.4%), carry kids to school (28%) go on bike rides (46.9%) or social outings (44.3%).

"Enthusiasts" ($N = 291$, 35%) have positive scores for all three components, suggesting they are more motivated than average to use a cargo bike to be physically active, to carry children, and to reduce car use. People in this group are mostly CBO (89.3%), live in familial households (83%) and are professionally active (95%). Compared to other groups, a higher proportion uses a longtail cargo bike model (26.8%) and many additionally also own a pedelec (35%). They ride cargo bikes frequently, with 59.7% being daily users. Almost all use their cargo bikes for a wide range of purposes: to shop (98.9%), carry children to school (98%), go on recreational trips (97.7%), to do social activities (90.7%), carry bulky items (92.5%) or to go to work (86.3%).

"Multimodals" ($N = 154$, 19%) live in households which rely on several means of transport and where cargo biking is an additional option. They are much less motivated than other groups by using a cargo bike to reduce car trips or give up driving, but are equally motivated by staying active and carrying children. More people in this group own cars

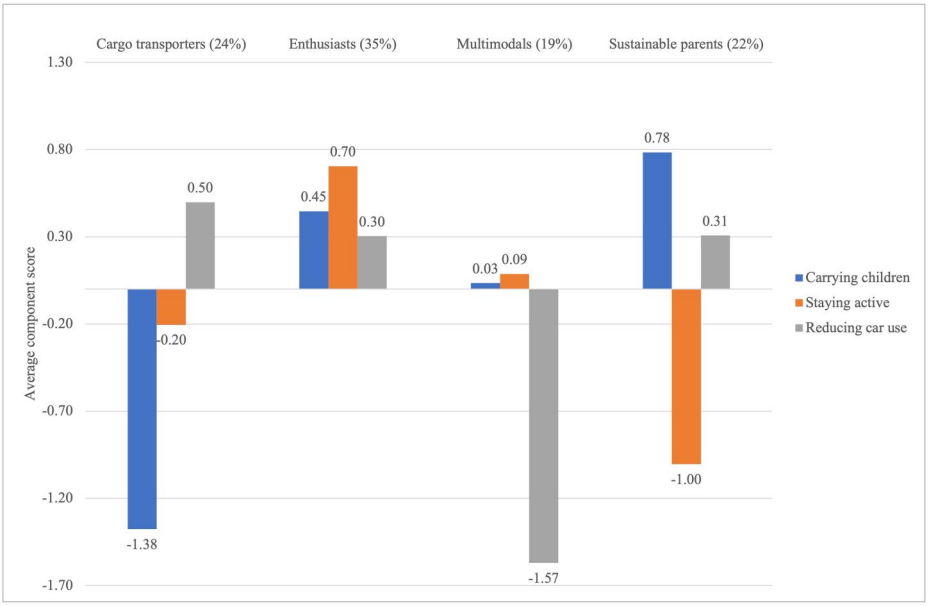

Figure 1. Groups of cargo bike users and average scores by component ($N = 821$).

(62.4%), pedelecs (36.1%) and motor two-wheelers (11.3%) than among other groups. One in three of its members are CBS (29.9%), the second-highest rate after "cargo transporters". They use cargo bikes more often than "cargo transporters" but still less than the other two groups, although they are composed of a majority of families (around 80%).

"*Sustainable parents*" ($N = 177$, 22%) are more motivated than average by adopting a cargo bike to carry children and reduce car use, but less motivated by being physically active or cycling more. Among members of this group, 87.6% are CBO. Compared to other groups, they include more family households (86.6%), people aged between 40 and 49 years (50.9%), part-time workers (64.6%), and German-speakers (51.4%). People in this group have the highest rate of conventional bicycle ownership (94.5%, with 64% owning 3 or more) and the second-lowest rate of car ownership (43.3%). They are the second-most frequent cargo bike users, with 84.7% cycling at least every week. Almost all of them use the cargo bike for household trips such as carrying children to school (95%) or groceries (96.9%), but fewer (77.3%) use it to cycle to work.

Experiences and barriers

Table 6 depicts the experiences and barriers related to cargo bike use. A first range of variables refer to the learning process, which does not appear problematic to most. Almost all CBO (94.7% agree) find it fast to learn how to use a cargo bike, but slightly fewer (87.6%) CBS think so. This might be due to CBO being able to ride more often, whereas CBS need more time to gain experience, and may have to switch between models. A further difference is observed between cargo bike models, with two-wheeler and e-cargo bikes considered as faster to learn than three-wheelers (due to their weight, size, and different handling) and unassisted models (requiring more effort to balance and ride uphill). The perceived difficulty of using a cargo bike over a regular bicycle also differs between CBS (68.5% agree) and CBO (41.9%). Cargo bikes in CBS fleets are larger models than many of those privately owned, and do not include longtails, which resemble regular bicycles and are easier to handle. Battery range is considered as a problem only by a minority (16.8%), with no difference between CBS (who are not responsible for charging) and CBO. Only owners of three-wheelers have slightly more issues with range than those of other models, likely due to their greater weight draining the battery more quickly.

A second range of variables highlight the lack of safety. Overall, two thirds (67.3%) of cargo bike users disagree that current cycling infrastructure is suitable for cargo bikes. Dissatisfaction is higher still among CBS (77.7%) than CBO (64.7%). Shared users may be more critical of infrastructure due to less experience of handling cargo bikes and using larger models. It is also possible that current infrastructure conditions deter them from purchasing a cargo bike. Having to carry children affects perceived safety and 62.4% of cargo bike users say they adapt their route when carrying children. Significantly more CBO (66.7%), who are more often parents, do so, than CBS (47.7%). Overall, only 57.4% of cargo bike users feel respected by other road users, and 68.4% feel safe riding in traffic[6]. The lack of a difference between CBO and CBS suggests that perceived safety depends on infrastructure, rather than users' handling skills.

A third range of barriers in terms of cargo bike experience is parking. While two thirds of CBO have enough space to park at home (67.9%), only a quarter of CBS do (27.4%). This major difference suggests that shared cargo bike use may partly be due to a lack of parking space at home. Outside of the home, availability of parking at destinations is considered as lacking for most cargo bikes users

[6]Interestingly, users of three-wheelers feel more respected by other traffic users than longtails, suggesting their bigger size helps in this respect.

Table 5. Characteristics of the four groups.

Variables	Category	% Cargo transporters	% Enthusiasts	% Multimodals	% Sustainable parents	Statistical test (Chi2)
Language	German	48.7	25.1	35.1	51.4	$p < .001$
	French	51.3	74.9	64.9	48.6	
Cargo bike access	Cargo bike owners (CBO)	48.7	89.3	70.1	87.6	$p < .001$
	Cargo bike sharers (CBS)	51.3	10.7	29.9	12.4	
Age	0-29	15.0	2.7	3.9	0.6	$p < .001$
	30-39	32.2	40.2	35.2	34.8	
	40-49	21.7	45.6	47.7	50.9	
	50-59	22.8	9.6	10.2	11.8	
	60 and over	8.3	1.9	3.1	1.9	
Gender	Male	76.4	62.9	64.9	64.8	$p < .05$
	Female	23.6	37.1	35.1	35.2	
Household	Other households	72.7	17.0	22.0	13.4	$p < .001$
	Family with children	27.3	83.0	78.0	86.6	
Employment	Student	6.7	1.2	1.6	0.0	$p < .001$
	Part-time work (80% or less)	42.8	51.5	47.3	64.6	
	Full-time work (90-100%)	47.2	43.5	44.2	31.7	
	Unemployed or homemaker	0.6	0.8	0.8	0.6	
	Retired	2.2	1.2	2.3	1.8	
Bicycle ownership	No	8.2	10.9	9.8	5.5	non-significant
	Yes	91.8	89.1	90.2	94.5	
Car ownership	No	64.5	44.7	37.6	56.7	$p < .001$
	Yes	35.5	55.3	62.4	43.3	
Motor two-wheeler ownership	No	91.3	92.9	88.7	95.7	non-significant
	Yes	8.7	7.1	11.3	4.3	
Pedelec ownership	No	74.3	65.0	63.9	72.6	$p < .1$
	Yes	25.7	35.0	36.1	27.4	
Public transport pass	Yes	29.4	23.5	27.8	28.2	non-significant
	No	70.6	76.5	72.2	71.8	
Cargo bike model (only CBO)	Longtail	18.1	26.8	29.4	16.8	$p < .1$
	Front-loader	73.5	64.2	57.8	72.5	
	Three-wheeler	8.4	8.9	12.7	10.7	
Frequency of cargo bike use	Every day or almost every day	17.6	59.7	35.7	48.0	$p < .001$
	Several times a week	24.1	27.9	30.5	36.7	
	A few times a month	21.1	8.6	9.1	7.9	
	A few times a year or less	37.2	3.8	24.7	7.3	
Going to work / study by cargo bike	No, never	50.6	13.7	26.9	22.7	$p < .001$
	Yes	49.4	86.3	73.1	77.3	
Carrying children to school with cargo bike	No, never	72.0	2.0	15.3	5.0	$p < .001$
	Yes	28.0	98.0	84.7	95.0	
Going on recreational trips by cargo bike	No, never	53.1	2.3	12.5	4.4	$p < .001$
	Yes	46.9	97.7	87.5	95.6	
Carrying bulky items by cargo bike	No, never	4.4	7.5	21.9	3.7	$p < .001$
	Yes	95.6	92.5	78.1	96.3	
Shopping/groceries with cargo bike	No, never	14.0	1.1	12.6	3.1	$p < .001$
	Yes	86.0	98.9	87.4	96.9	
Doing social activities with cargo bike	No, never	55.7	9.3	27.6	15.2	$p < .001$
	Yes	44.3	90.7	72.4	84.8	

Table 6. Experiences of cargo bike use by access (CBO vs. CBS).

		% Agree or rather agree			
		All	Owners (CBO)	Sharers (CBS)	Statistical Test (Chi2)
Experiences of cargo bike use	Learning to use a cargo bike is fast	92.9	94.7	87.6	$p < .001$
	I feel safe on a cargo bike in traffic	68.4	70	63.4	non-significant
	I adapt my route when carrying children	62.4	66.7	47.7	$p < .001$
	I have enough space to park a cargo bike at home	58.4	67.9	27.4	$p < .001$
	I feel respected by other road users when using a cargo bike	57.4	57.7	56.7	non-significant
	It is more difficult to ride a cargo bike than a normal bicycle	48.3	41.9	68.5	$p < .001$
	Bicycle facilities (lanes, paths) are suitable for cargo bikes	32.3	35.3	22.3	$p < .05$
	Parking is suitable for cargo bikes at my destinations	30.9	30.7	31.6	non-significant
	Battery range is sometimes insufficient	16.8	16.7	16.9	non-significant
Experiences of cargo bike sharing	The booking procedure is easy	–	–	94.1	–
	I have a cargo bike rental point nearby	–	–	83.8	–
	The rental price is correct	–	–	82.2	–
	The opening hours are sufficiently long	–	–	55.2	–

(69.1% disagree), both CBO and CBS, with no significant difference.

Regarding the specific experiences of cargo bike sharing, the main barrier appears to be the short opening hours of the sharing locations, which only 55.2% of CBS find to be sufficient. This is specific to the Carvelo2go host service described in section 'Method'. Having to adapt to a shop's opening hours might severely limit the use of shared cargo bikes for daily commuting trips, or for social activities in the evening. Conversely, neither the proximity to cargo bike rental points, the complexity of the booking procedure, or the rental price are considered as barriers by most users.

Discussion

There are two ways to access cargo bikes: ownership (CBO) and shared use (CBS), which mainly includes CBS services, but also sharing at the workplace, between friends or relatives, or in housing cooperatives. Both systems of use are complementary rather than in competition. CBO are mostly parents with children, confirming previous studies (e.g. Riggs, 2016), for whom the cargo bike is the main family vehicle used for transporting children (care mobility) by both adults in the household. Meanwhile, CBS tend to be younger and live more often in non-family households. They mainly consider cargo bikes as a transport option for occasional trips to carry heavy or bulky objects while avoiding the use of a car (or car-sharing). Using CBS rather than CBO is motivated by price, a lack of need for owning a cargo bike, a preference for sharing, and a lack of adequate parking space. While not used as frequently, CBS has the potential to appeal to a broader population of people who do not have frequent bulk transport needs, for whom purchase cost or parking space is an obstacle, or who want to familiarize themselves with this type of bicycle before purchasing it.

We found that cargo bike use was motivated by three main dimensions: carrying children, staying active, and reducing car use. Based on these motivations, four groups of cargo bike users can be distinguished. "*Cargo transporters*" are young car-free adults who are keen to use shared cargo bikes in order to avoid driving for transporting bulky items. "*Enthusiasts*" are motivated to own a cargo bike as their main vehicle to stay active, transport children and replace car trips. "*Multimodals*" are a mix of CBO and CBS for whom cargo bikes are an additional option for specific trips, but who aren't willing to give up the car altogether. Lastly, "*Sustainable parents*" acquired a cargo bike to transport children but were already actively cycling on a regular basis for other trips, and have low rates of car ownership.

Our study highlights the potential of the cargo bike as an attractive transport option for households wishing to replace car trips. It provides a cargo function - for goods or children- which other alternatives to the car (public transport, "individual" bikes, etc.) only partially fulfill. One of the main motivations for using cargo bikes is having an alternative to the car (in terms of use and/or ownership). Almost half of cargo bike owning households are car-free (45.6%) compared to 22% at the national scale and 7% for couples with children (OFS & ARE, 2023). While owning a cargo bike is not the only factor in reducing the role of the car (e.g. other transport alternatives, an urban residential location) it may be an important resource to avoid motorization and a parenting tool for families (Thomas, 2021). Meanwhile, using CBS does not necessarily reduce many car trips, but may facilitate living without owning a car and thus avoid future motorization.

At present, the experience of cargo bike users remains hampered by barriers which limit their potential adoption and use. The main barrier limiting the use of cargo bikes is perceived safety and the lack of dedicated infrastructure, like for conventional cycling in Switzerland (Rérat, 2021). Most users consider cycling infrastructure to be insufficient for cargo bikes, which have broader dimensions, as previous studies have suggested (Greibe & Buch, 2016; Liu et al., 2020; Masterson, 2017; Thomas, 2021). This dissatisfaction is stronger among users of larger shared cargo-bikes and three-wheelers, which are more difficult to maneuver, highlighting the lack of space dedicated to cycling in the current roadscape. Lacking or inadequate parking facilities also represent a barrier to cargo bike use, as other studies have found (Masterson, 2017; Thomas, 2021). In particular, we found CBS to lack bicycle parking space at home, which could represent a major obstacle to buying a cargo bike in the future.

Conclusions

This study represents the first large-scale survey combining CBO and CBS thus far, filling an important gap in the literature. It provides a first understanding of users' profiles, the motivations for using cargo bikes and the experiences and barriers which limit this practice. Building on the success of e-bikes, cargo bikes represent a further extension of the practice of cycling in terms of uses (child-serve trips and goods transport) and profiles. They provide an additional transport capacity which fills an important gap in the landscape of urban active transport modes. Both owned or shared cargo bikes could replace many trips which were previously made by car, or support car-free lifestyles. From a policy standpoint, cargo bikes' potential to attract new audiences to cycling and reduce car use should make them a central component in a low-carbon/post-car urban mobility strategy.

While cargo bike sales are increasing, the practice is still recent - over 80% of cargo bikes were purchased less than four years before the survey - and evolving rapidly, as evidenced by the emergence of longtails. The diffusion of cargo bikes is in its early stages and current users are mostly "early adopters" within a niche (Rogers, 2010). Scaling-up to a mass market will require a range of policies including the development of both CBS and CBO, incentives to foster use, the provision of suitable, safe and convenient infrastructure, awareness campaigns to "normalize" cargo bikes as a legitimate transport mode, and integration of cargo bikes with other components of the transport system.

Of course, there are a few limitations to our study. While it enabled us to reach a wide audience, our recruitment strategy does not guarantee a representative sample of cargo bike users. Moreover, when compared to CBO, our sample of CBS is rather small. Furthermore, our survey is based on self-reported behavior which cannot be verified and represents only a "snapshot" of cargo bike users at a given time. Our study context, Switzerland, is a European country with "average" cycling levels but has enjoyed a rise of cycling in cities in recent years. Its predominantly urban population and high purchasing power may contribute to the success of cargo bikes. The hilly topography of its cities explains why electrical assistance was a key factor in the diffusion of cargo bikes, unlike in flatter contexts like the Netherlands or Copenhagen. Lastly, a highly efficient public transport system at the national and regional level, combined with cycling, allows some urban households to give up motorization.

From a research standpoint, the rise of cargo bikes calls for a new research agenda to address both their macro and micro effects. At the country level, researchers could study cargo bikes' diffusion and use across spaces, populations, as well as their effects on travel habits, especially their modal shift potential for reducing car trips or car ownership. From an individual perspective, future research could aim to understand how cargo bike adoption fits within users' existing cycling careers. To this end, qualitative methods and longitudinal or biographical research could be especially useful to unpack the multiple factors that trigger the adoption of cargo bikes (e.g. for young parents), their varying uses over the life course, the potential shift from sharing to owning and back again, and the role of cargo bikes after children grow up.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Appendix

Table A1. List of survey questions.

Category	Survey questions	Response Categories
Access to a cargo bike and model information (owners only)	Type of cargo bike	Front-loader; Longtail ; Three-wheeler
	Purchase	New; Used
	Date of purchase	2016 and before; 2017-2018; 2019-2020; 2021-summer 2022
	Electrical assistance	None (unassisted); 25 km/h; 45 km/h
	Purchase subsidy	Yes; No
User profile	Age	20-29; 30-39; 40-49; 50-59; 60 and over
	Gender	Male; Female
	Household composition	Other household; Family with children
	Employment situation	Student; Employed full-time; Employed part-time (<90%); Unemployed or homemaker; Retired
	Educational background	Other (apprenticeship, vocational school); University, Polytechnic University of Applied Sciences or Pedagogy
	Monthly net household income	>3′000 CHF; 3′000 to 6′000 CHF; 6′000 to 9′000 CHF; 9′000 to 12′000 CHF; 12′000 to 15′000 CHF
	Number of children transported by cargo bike	None; 1; 2 or more
	Cargo bike used by other members of household	Yes; No
	Place of residence	

(*continued*)

Table A1. Continued.

Category	Survey questions	Response Categories
		Urban (city and suburban area); Intermediary (Peri-urban and rural centre); Rural
	Car ownership	Yes; No
	Motor two-wheeler	Yes; No
	Bicycle (unassisted)	Yes; No
	Other e-bike (25 km/h) (not cargo bike)	Yes; No
	Other speed-pedelec (45 km/h) (not cargo bike)	Yes; No
	Carsharing pass	Yes; No
	Public transport pass	Yes; No
	Frequency of cargo bike use	Every day or almost every day; Several times a week; A few times a month; A few times a year or less
Motivations for using cargo bikes	Adopting sustainable mobility	Disagree; Rather disagree; Neutral; Rather agree; Agree
	Moving independently and efficiently	
	Reducing or giving up the car	
	Carrying heavy loads	
	Having an alternative to public transport	
	Transporting children to school or activities	
	Going on recreational bike trips	
	Cycling more	
	Exercising while traveling	
Motivations for sharing rather than buying	It is sufficient for my occasional transport needs	Disagree; Rather disagree; Neutral; Rather agree; Agree
	It's cheaper than buying	
	I prefer to share rather than own	
	I already have other transport alternatives	
	I don't have parking space available	
	It allows me to test whether I like the cargo bike	
Experiences of cargo bike use	Learning to use a cargo bike is fast	Disagree; Rather disagree; Neutral; Rather agree; Agree
	I feel safe on a cargo bike in traffic	
	I adapt my route when carrying children	
	I have enough space to park a cargo bike at home	
	I feel respected by other road users when using a cargo bike	
	It is more difficult to ride a cargo bike than a normal bicycle	
	Bicycle facilities (lanes, paths) are suitable for cargo bikes	
	Parking is suitable for cargo bikes at my destinations	
Experiences of cargo bike sharing	Battery range is sometimes insufficient	Disagree; Rather disagree; Neutral; Rather agree; Agree
	The booking procedure is easy	
	I have a cargo bike rental point nearby	
	The rental price is correct	
	The opening hours are sufficiently long	