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Title

User Acceptance of Urban Cargo Bicycles

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Keywords

Cargo Bicycles, Urban Bicycle Infrastructure, User Acceptance, Bicycle Usage Evaluation, User Perspective

Challenge Addressed / Research Problem Investigated

Identify issues and needs for urban cargo bicycle riders

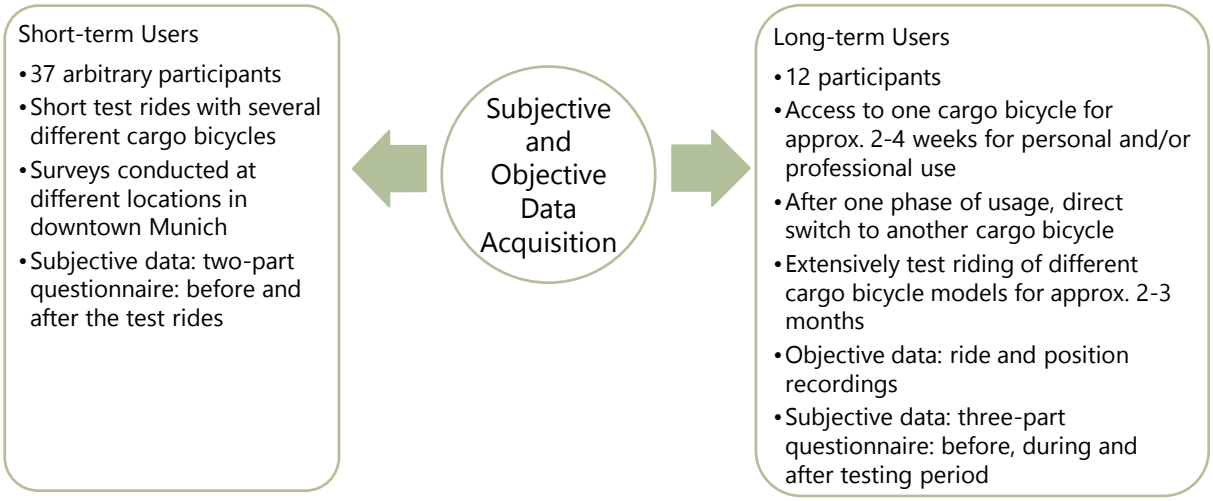
Abstract

The increasing need for sustainable and efficient urban transportation solutions has led to a growing interest in electric cargo bikes. These vehicles offer a promising alternative to traditional delivery methods, as they are environmentally friendly, cost-effective, and can navigate congested urban areas more easily. However, there are reservations regarding the use of electric cargo bikes. On the one hand, this is due to insufficiently planned infrastructure, e.g., bicycle lanes' width and turning radii have historically been designed and planned for conventional bicycles. On the other hand, this is also because cargo bikes are perceived as an evolution of existing conventional bicycles rather than a distinct and novel type of vehicle such as e-scooters (Keler, 2021). Our study aims to identify the advantages and disadvantages of electric cargo bicycles from the users' perspectives. It explores the requirements and potential of electric cargo bikes. The findings indicate clear recommendations for municipalities and cargo bicycle manufacturers to adapt to user acceptance and a more sustainable urban living. To this end, our study comprises two parts of surveys. Short- and long-term test subjects were provided with cargo bikes, and their subjective and objective data were collected. We first describe the methodology consisting of the selection of test subjects and the data collection. Then, we list first results of the subjective and objective data analyses. In the end, we summarize the findings and discuss future steps to increase the user acceptance of urban cargo bicycles.

A targeted scientific analysis was conducted to achieve the study's objectives. We employed a combination of qualitative and quantitative methods, including surveys, interviews, and field observations (Vogt (2022), Keler (2023), Lindner (2022)). Short-term users were provided with the opportunity to test multiple cargo bikes, after which they were interviewed to gather their initial impressions. Long-term users were equipped with multiple cargo bikes for several months and were surveyed at the beginning, during the testing phase, and at the end. Their position data were recorded and documented throughout the duration of the study. Both subjective and objective data were collected from the test riders. As a result, these surveys were not anonymous. The long-term data collection involved different individuals than those surveyed as short-term users.

Figure 1 shows the available four cargo bicycles by Riese&Müller, Urban Arrow, Butchers&Bicycles (all of which have their transport box in the front), and Cube (which has its transport box in the rear and two degrees of freedom).

Figure 1: Available cargo bicycles during the user study: (a) Riese&Müller Packster 70, (b) Urban Arrow Family, (c) Butchers&Bicycles MK1-E Touring, (d) Cube Dynamic Cargo (prototype)



The results of the short-term users' survey revealed that nearly 85% of respondents had never ridden a cargo bike before. However, 70% of them expressed willingness to consider using a cargo bike in the future. Both surveys revealed various requirements from both the municipalities responsible for public space and infrastructure, and manufacturers of electric cargo bicycles.

Infrastructure requirements: The most common conflict reported during the rides was the lack of or limited opportunities for overtaking due to narrow bicycle lanes. Furthermore, issues arose with non-lowered curbs when both ascending and descending. The long wheelbase of the cargo bikes made it challenging to maintain stability when going down a step. One drawback of longer bicycles is that demand-controlled traffic lights, which switch to green once a push button is activated, are often challenging to reach. A (long) bicycle needs to be pushed onto the road to activate the signal and then be pulled back, which is not acceptable from a traffic safety perspective. Further, participants often mentioned the challenge of crossing tram tracks. It is crucial to ensure that the front wheel does not slip into the tracks. Therefore,

in bicycle network planning, it is important to pay increased attention to ensuring that bike paths do not run parallel to tracks but rather intersect them perpendicularly.

Bicycle hardware requirements: Three of the bikes have their transport box in the front, while only the Cube bike has a rear cargo box. The survey revealed that approximately one-third of respondents preferred the cargo box in the front. The remaining participants preferred the cargo box in the rear to experience a more natural riding behavior. Additional features that were mentioned by the participants included luggage racks, a more practical kickstand, USB charging options for smartphones, and a phone holder. Furthermore, a turn signal was mentioned to facilitate turning, as the bikes with the front cargo box are difficult to steer with one hand (for hand signals). Under snowy and icy conditions, it was reported that the two-wheeled bikes were extremely difficult to steer on slippery surfaces due to their long length, and the bikes frequently slipped. The three-wheeled bikes were perceived as better and more stable in these conditions. However, once, a rain cover froze in the snow. As a result, the zippers became immovable and subsequently broke.

The objective data analysis mainly indicated that bicycle riders prefer appropriate infrastructure (lane width) and separate road networks for motorized vehicles and bicyclists. The research highlighted the positive user acceptance of electric cargo bikes in the urban public street space. Users appreciated the bikes' versatility, ease of use, and ability to navigate through traffic congestion. The study indicates through high user acceptance a predicted modal shift towards electric cargo bicycles. We can therefore expect a potential reduction of traffic congestion, air pollution, and noise levels in urban areas, all well-known objectives of municipalities and citizens. The agile and compact design of these vehicles allows for efficient maneuvering in narrow streets and crowded areas. Moreover, the electric propulsion system provides a sustainable and cost-effective alternative to traditional delivery vehicles, reducing carbon emissions and operating costs. However, challenges such as limited infrastructure, charging facilities, and regulatory frameworks need to be addressed to establish a widely accepted urban cargo bicycle usage. As most important and crucial, we see separate road networks for motorized traffic and cycling without shared spaces.

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