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Micromobility – More than Just Toys

Micromobility is about to change what our cities look like. For some years now, particularly the appearance of electrically powered scooters, so-called “e-scooters” has been causing quite a stir – and their impact has been both positive and negative. As they move around, they compete with pedestrians and traditional bicycles, as well as with the equally new cargo bikes.

■ The image on this page has been generated using artificial intelligence. It visualizes a futuristic city landscape in which e-scooters have replaced traditional cars. Is this what mobility will look like in the cities of the future? Probably not. After all, even the most powerful AI tool must be based on commands that are input by the user before it can project the technical possibilities of today onto the future. And when we imagine the technical possibilities of future mobility, we quickly run the risk of ignoring the possible interactions between different parallel approaches to development, ones that are perhaps still emerging or which already exist. This is impressively demonstrated by the influence of aerodynamics on vehicle development, which played a key role in the success of the car at the beginning of the 20th century.

Our visions of the future are shaped by the present. For example, the very first cars resembled their predecessors, the horse-drawn carriages, in almost every detail. The new feature was that they were powered by an internal combustion engine. But what was missing was the carriage shaft for harnessing the horses, which meant that these

apparently dysfunctional carriages must have looked pretty grotesque to people at the time.

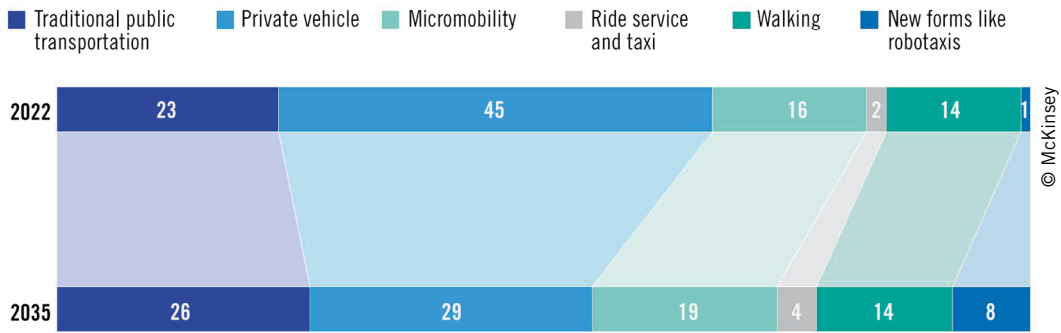
THE CAR – BENCHMARK FOR ALL MOBILE DREAMS

Over the course of the 20th century, the car became the ultimate means of individual mobility. In fact, the transportation infrastructure was designed around it to a certain extent. “The Car-Friendly City – A Way Out of the Traffic Chaos” was the title of a seminal book by Hans Bernhard Reichow, which was published in 1959 [1]. Even if this traffic concept no longer seems appropriate today, it is still being pursued in large parts of the world, particularly in rapidly growing metropolitan areas.

Currently, there are around 1.6 billion vehicles on the roads worldwide [2]. This roughly corresponds to the number of people living on earth at the beginning of the automobile age around the year 1900. In the meantime, the global population has increased to more than 8 billion people, combined with a trend towards urbanization. For example, the municipality of Chongqing on the upper and lower reaches of the Yangtze River

IN THE SPOTLIGHT

Breakdown of mobility by mode of transport, worldwide [%]



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Although the car will remain the most popular transport option, its share of overall mobility will decline

Note: Figures may not add up to 100 % due to rounding. Source: McKinsey Center for Future Mobility

in China now has more than 30 million inhabitants. In 1950, only less than a third of the world’s population lived in cities (29.6 %), while in 2015 this figure had already increased to more than half (54.0 %). In these megacities, cars travel on broad, multi-lane roads. According to calculations by the United Nations, two thirds of the world’s population (66.4 %) are expected to live in cities by 2050 [3].

However, this type of mobility is still unevenly distributed. According to a study by the management consulting company McKinsey, there are 868 vehicles per 1000 capita in the United States, 635 in Norway, and 391 in Mexico. Compared to this, the figure of just 219 per 1000 capita in China may come as a surprise. But in absolute figures, that still accounts for more than 300 million vehicles on the road in the world’s most populous country.

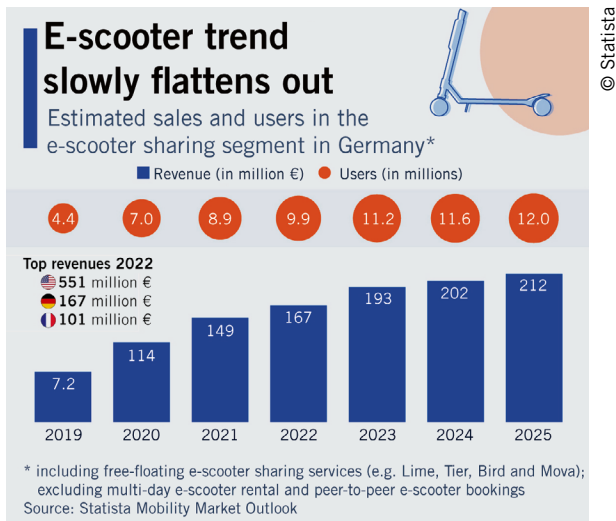
The car-friendly city is bursting at the seams — mobility is coming to a standstill. Drivers in Munich, for instance, spend an average of 87 hours in traffic jams every year, according to the authors of the McKinsey study [4]. Kersten Heineke, Nicholas Laverty, Timo Möller, and Felix Ziegler predict that, within the next decade, the mobility ecosystem in our cities is likely to undergo a transformation not seen since the early days of the automobile.

In 2022, private cars were used for 45 % of all trips for individual mobility throughout the world, but this proportion could dramatically fall to 29 % by the year 2035, the study predicts. The findings from the 2022 study carried out by McKinsey Center for Future Mobility show that people are now more open to changing their transportation habits. According to the study, almost one-third of respondents (30 %) plan to increase

their use of micromobility (e-bikes and e-scooters) or other forms of shared mobility such as ride sharing or ride hailing (calling a taxi or other mobility service) over the next decade. Nearly one-half of respondents (46 %) are open to replacing their private vehicles with other modes of transportation in the coming decade.

MOBILITY IS BECOMING SMART

The decrease in car usage will become apparent in the cities. In return, the authors of the McKinsey study expect to see a multitude of experiments with new mobility technologies in the next ten years, including autonomous vehicles, roboshuttles, or urban air taxis. At the center of these changes will be a rise in micromobility, the authors predict. The global micromobility market is worth about 180 billion US dollars today. The authors’ analysis shows that the value could more than double by 2030 to reach about 440 billion US dollars. The main aspect of this trend is the individually noticeable benefit of intermodal journeys. There are already platforms that integrate all possible mobility combinations for a particular route. Intelligent traffic, optimized commuter flows, fewer traffic jams – that is what the future of mobility should look like. To turn this vision into reality, the German Federal Ministry of Education and Research (BMBF) and the NextGenerationEU recovery plan of the European Union, for example, are funding the Competence Cluster Intelligent Intermodal Commuter Traffic, in which Osnabrück University of Applied Sciences and other institutes are involved [5]. Another example from



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Estimated sales and number of users in the e-scooter segment in Germany

research is the project Mobility Intelligence as a Service (MIAAS) at Bonn-Rhein-Sieg University of Applied Sciences [6].

Around ten million people in Germany will use e-scooter sharing services this year, according to an estimate by Matthias Janson, a data journalist at Statista, on the basis of the Statista Mobility Market Outlook. A turnover of around 167 million euros in the e-scooter segment in 2022 means that Germany is the world's second biggest market for e-scooter rentals – ahead of France and the USA. Nevertheless, the sales curve is slowly flattening, Janson says. In 2022, sales are estimated to have grown by 12.2 % compared to the year before. But in 2025, growth compared to the previous year will be just 4.7 % [7].

The affinity towards the use of micromobility varies from country to country. In a survey published by Statista in 2021, 42 % of the respondents from Germany said that they would prefer to use a bicycle for their everyday journeys, while the figure in China and Italy was much higher at 49 %, and consider-

ably lower in the UK and the USA at 32 %, respectively. 13 % of people in Germany would like to use an e-scooter, thus putting them in the middle of the statistical range. In France, the percentage of people who prefer this vehicle category is 18 %, compared to just 6 % in China [8].

The mobility transition from cars to various forms of micromobility is full of contradictions, as the figures from surveys and forecasts suggest. And it also has a polarizing effect. Often, scooters are parked incorrectly or, what is even more annoying, are simply left lying on the sidewalk with no consideration for others. On September 1, 2023, Paris became the first European city to impose a total ban on e-scooter rentals. Only privately registered e-scooters are now permitted [9].

The German Institute of Urban Affairs (Difu) and the German Aerospace Center (DLR) have examined how scooters have typically been used to date and what conflicts arise between pedestrians and bicycle traffic on the one hand and e-scooters on the other. The study, which was carried out on behalf of the

Federal Ministry for Digital and Transport (BMDV) and was funded by the National Cycling Plan, also focused on the possibilities of municipalities to design and control the traffic situation. The result is a set of practical guidelines which can be used by municipalities as a tool to help them integrate e-scooter rental systems into the existing traffic system [10].

According to the authors of the study, the impact of e-scooters on the traffic situation is currently being underestimated. The findings showed that e-scooters are used not only for leisure trips, but also for going to work or for shopping. It also became clear that, for almost a quarter of trips, e-scooters in rental systems are used in combination with public transportation. At the same time, there is a great potential for conflict between e-scooters and other road users. Particularly when it comes to being obstructed by parked e-scooters, pedestrians are more affected than cyclists. One in six pedestrians said they had tripped or fallen over a parked e-scooter. Cyclists, on the other hand, tend to experience less serious conflicts,



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2 QUESTIONS FOR...

Do e-scooters or electric bikes have a chance of reducing car traffic in inner-city areas?

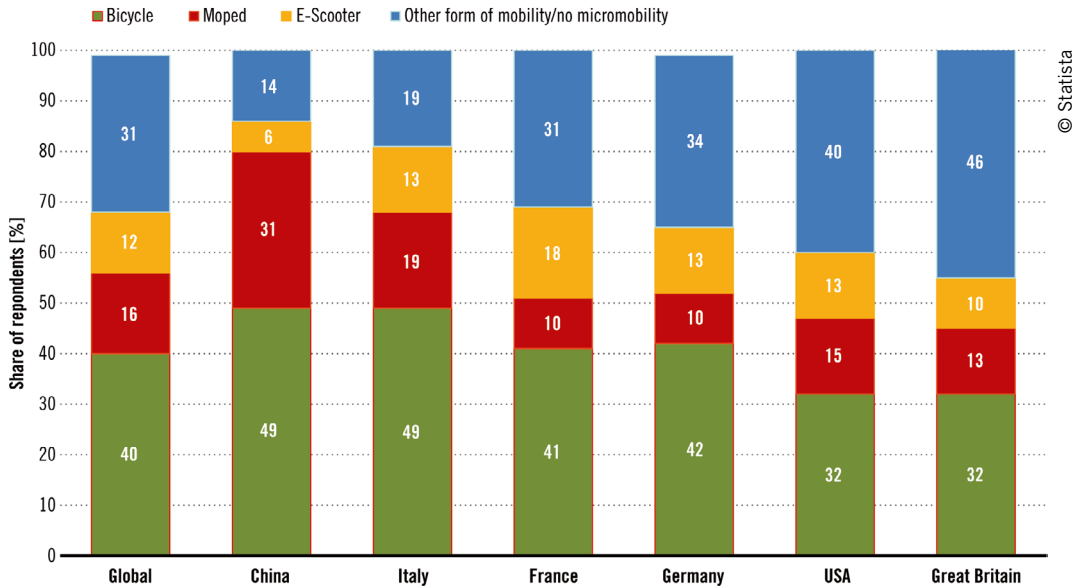
HABLA _ It's true that micromobility has a certain potential to reduce car traffic, but this is still likely to be very limited at the moment. One reason is that it is not only cars that are being replaced by micromobility. Some journeys that are made on e-scooters are more likely to be instead of walking or taking a short trip on public transportation. All of these cases have no effect on reducing car traffic. Secondly, we know from research that it is currently mostly males and tech-savvy people who use micromobility services. This usually requires them to use an app on their smartphone. In addition, travelers with luggage or with children will use micromobility much less than other travelers. So, there are individual factors that limit its use. However, if access to micromobility is generally improved, for example through better booking options in an

intermodal transport app, micromobility can potentially have a greater impact on reducing car traffic.

As a co-author, how do you assess the results of the ZAW study on future transportation use [11]?

HABLA _ What surprised me most was that a targeted moral appeal combined with a social comparison – our “nudge” – reduced car usage so significantly during the field test. The use of car-based means of transport such as rental cars, ride sharing, and ride hailing or even taxis fell by 10 % among participants based on their mobility budget. That doesn't sound like much, but it is a lot when you consider that the price of driving a car would have to rise significantly to achieve a similar reduction. And obviously, in our field trial there was actually a substitution between the use of car-based means of transportation and micromobility.

IN THE SPOTLIGHT



Note(s): Worldwide; July 2021; 18-65 years; 6000 respondents. Further information on these statistics, as well as explanations of footnotes, can be found on page 8.
Source: McKinsey & Company; ID 1280714

Survey findings: What type of micromobility vehicle would you prefer for your everyday journeys?

for example when they have to swerve or slow down to avoid an e-scooter.

NEW RISK POTENTIAL IN TRAFFIC

The car-road system has been successfully optimized over many decades. The number of fatalities in road traffic in Germany fell from its peak of 19,193 in 1970 to 2,776 in 2022 [12]. However, the increasing complexity of traffic and the heterogeneity of vehicles that now share our roads and paths pose new potential for danger.

As part of the Smart Urban Road Safety (SURF) project, a team from the Vehicle Safety Institute at TU Graz has used virtual human body models

to investigate accidents involving electric scooters and to identify the most important factors for preventing serious injuries [13]. As is the case with other two-wheeled vehicles, the study found that wearing a helmet can significantly reduce the risk of head injuries not only when riding a bicycle but also when using an e-scooter – in this case by up to 44 %. The study also found that it makes sense to ban the use of e-scooters on sidewalks and footpaths. The simulations showed that collisions with pedestrians often result in serious injuries.

“In addition to a ban, a speed limit would also bring more safety in this regard,” said project leader Christoph

Leo. For example, if the collision speed is reduced from 25 to 15 km/h, the risk of head injuries to pedestrians is reduced by up to 49 %. In contrast, in collisions with passenger cars, it is mainly the speed of the car that plays a major role in the level of injury risk. Collisions with cars traveling at 40 km/h can cause severe or even fatal head injuries to e-scooter riders. “In general, the risks of this form of mobility seem to be underestimated, which is why we expect to see an increasing number of injuries in the coming years. You are safer in road traffic on foot or by bike,” said Leo, summarizing the results of the project.

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Simulation of a collision between an e-scooter and a car

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Micromobility



Professional article: Anke, J.; Ringhand, M.; Petzoldt, T.; Gehlert, T.: Micro-mobility and road safety: why do e-scooter riders use the sidewalk? Evidence from a German field study www.springerprofessional.de/en/link/26013882

Professional article: Schleich, M.; Valtingoier, I.; Heichele, A.: Drive Systems for Micromobility from E-bikes to Light Electric Vehicles www.springerprofessional.de/en/link/25961870

Book chapter: Karlı, R.G.Ö.; Çelikyay, S.: Current Trends in Smart Cities: Shared Micromobility www.springerprofessional.de/en/link/20189696

Book chapter: Tan, S.; Tamminga, K.: A Vision for Urban Micromobility From Current Streetscape to City of the Future www.springerprofessional.de/en/link/18551900

How Sustainable is Micromobility?

E-bikes, e-scooters and the like are becoming increasingly common, especially in cities. But what about their environmental footprint? www.springerprofessional.de/en/link/26947248



OPINION

“Cars and roads – over many decades we have developed a transportation system in which we have gradually optimized the interactions to enable all sides to benefit: car makers, road builders, town planners, and, not least, the individual car user. Car driving has not only become more and more comfortable, it has also continued to become safer, after reaching a peak in the number of road accident fatalities in the 1970s. But micromobility is now reshuffling the cards. New forms of interaction are developing in the transportation system, the consequences of which – like the disruptive invention of the automobile more than 100 years ago – are not yet fully apparent.”



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