Making shared rides more sustainable: Introducing dynamic stop pooling

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The transportation sector causes about one-fifth of all climate-damaging emissions in Germany. One promising approach to reduce the carbon footprint of the transport system is "shared mobility," i.e. sharing trips

with similar routes as in a flexibilized and widely available shared cab (ride sharing). Such a service requires fewer vehicles and reduces emissions. However, the complex collective dynamics pose a challenge when predicting the efficiency and sustainability of ride-sharing systems. Standard door-to-door ride sharing services trade reduced route length for increased user travel times and come with the burden of many stops and detours to pick up individual users. In general, the distance traveled per user decreases when more users share a bus, and the service becomes more sustainable. However, more users per bus yield more detours for each individual user. Ride sharing services trade increased sustainability for longer travel times.

In the new study, four scientists at the Center for Advancing Electronics Dresden (cfaed) at TU Dresden propose combining suitable nearby stops dynamically (dynamic stop pooling). Instead of serving all users exactly from their desired origin to their destination, users might walk a short distance to a nearby stop. In this way, one bus can collect multiple passengers at the very same stop. "Busses take more direct routes and stop less often. The special feature is that the stops are combined dynamically according to the current requests such that the bus routes remain flexible," explains Charlotte Lotze, the study's lead author.

The study shows that users wait and drive shorter if they only walk a short part of their trip. In this way, they travel faster on average with pooled stops than in a standard ride sharing service, despite the additional walking time. "As a result, fewer vehicles can serve the same users while maintaining the travel time if passengers are willing to walk a short distance to the pickup or from the drop-off to their destination," Lotze says. "Dynamic stop pooling therefore enables a more efficient and more sustainable service with fewer vehicles without requiring users to plan for longer travel times," adds Prof. Marc Timme, Head of the Chair of Network Dynamics.

The study has been published in the open-access journal *New Journal of Physics*

More information: Charlotte Lotze et al, Dynamic stop pooling for flexible and sustainable ride sharing, *New Journal of Physics* (2022). DOI: 10.1088/1367-2630/ac47c9