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geoinformation engineering
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Determining Usage Differences between Bikes and E-Bikes

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Master's Thesis HS 2012

Background

Shared Mobility

Areas not affected by traffic, air pollution or noise are becoming a scarce commodity, especially within densely populated areas such as the Swiss Plateau or in urban areas in general. Therefore, the awareness of the necessity for a sustainable way of mobility increases. The concepts of shared mobility, where vehicles are shared among several people, seem to be an appropriate approach to facing the upcoming traffic-related challenges. Probably the most well-known company in Switzerland within the field of shared mobility is the car-sharing operator *Mobility*.

Figure 1: *Mobility* car-sharing station at Berne's mainstation
Image: www.sbb.ch

Two-Wheeler Sharing

Bike-sharing systems are not only viable und sustainable modes of transportation for urban environments, but may also contribute to less crowded public transportation while improving public health. Whilst bike-sharing is a well proven concept with many successful examples all over the world, the integration of e-bikes in a sharing context is relatively new. In order to find out whether or not e-bike usage can increase the mobility utility as compared to conventional bike usage in a sharing context, one needs first of all to understand the major usage differences between e-bikers and cyclists from a general point of view as well as for a specific origin-destination relation.

Figure 2: Bike-sharing station of *velopass* at EPFL in Lausanne
Image: www.migrosmagazine.ch

Approach

Idea

General differences between bike and e-bike usage were analyzed based on GPS-tracking data recorded by bikes and e-bikes in the context of a combined bike and e-bike sharing pilot project operated by the ETH spin-off company *ElectricFeel* and taking place since June 2012 in the city of Winterthur. The study of usage differences for a specific origin-destination relation was based on a field study conducted in Zürich. The participants of the field study were tracked with a GPS-device while riding from the campus ETH Hönggerberg to ETH Zentrum and back with either a bike or an e-bike. After the test ride, the participants were asked to rate different route choice factors according to their importance and report how they perceived the ride in terms of physical activity, convenience and safety. In total 21 persons participated in the field study: 11 with an e-bike and 10 with a bike.

Tracking-Data Processing

The tracking data was filtered with a JAVA-routine. In order to evaluate the recorded tracks they were map-matched on a street-network using a geometrical approach designed with *ArcGIS ModelBuilder*.

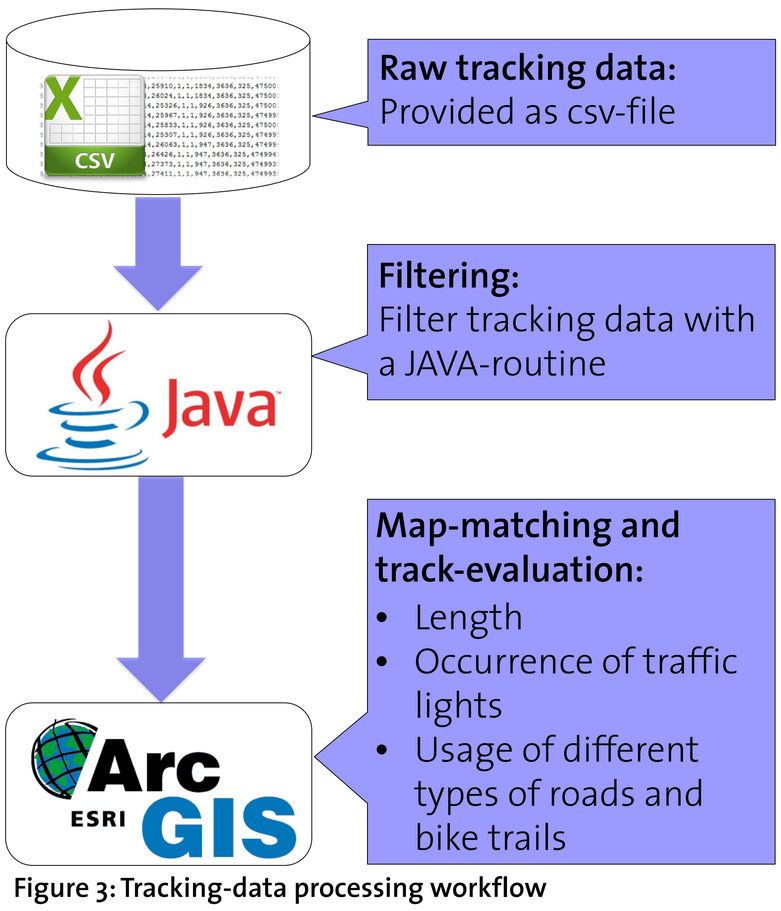

Figure 3: Tracking-data processing workflow

Results and Conclusion

General Trip Characteristics

In the open environment of Winterthur e-bike rides were found to be significantly longer with a significantly higher trip speed in comparison to the bike rides. For the field study in Zürich no differences were found between e-bikers and bikers regarding the trip length. However, bikers were found to ride significantly slower while riding uphill compared to the e-bikers. Regarding road types no preference differences between bikes and e-bikes were found. In Winterthur as well as in Zürich e-bikers rather rode along bike trails with a higher exposure to vehicular traffic such as visually separated bike lanes.

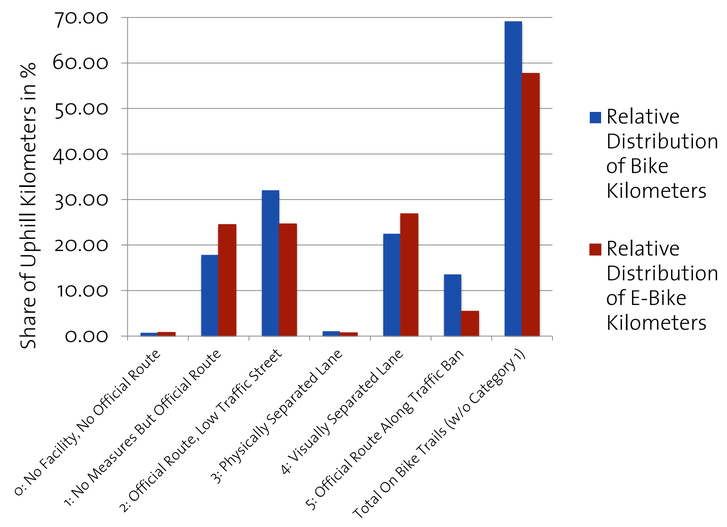

Figure 4: Distribution of recorded tracks over bike trail types for the rides from ETH Zentrum up to ETH Hönggerberg

Route Choice Factors and Trip Perception

Minimizing the distance was for e-bikers and bikers the most important route choice factor. However, due to the electric propulsion it was found to be significantly more important for cyclists than for e-bikers while riding uphill. The safety and the convenience of the trips was not perceived differently by bikers and e-bikers. However, the riders found the e-bike rides to be related with a significantly lower level of physical activity compared to the bike rides.

Conclusion

E-Bikes enable users of bike-sharing schemes to ride longer distances with a higher velocity at a lower level of physical effort. E-bikers seem to be less sensitive to riding among vehicular traffic than cyclists.