DigiEduHack Solution
ECF Hackathon - Building the cycling city of the future
Challenge: ECF Hackathon - Building the cycling city of the future Challenge 2020

Berlin Bicycling Digital Traces

Open Data Road Crashes and Traffic Data Online Visualization

Bicycle mode share recently expanded (from 8% to 13%), and the private motorized trips share shrink (from 38% to 30%), the total number of urban road crashes, fatalities, and injury dropped along the last 2 decades, it did not affect the number of a specific road users group: bicyclists.

Team: Building a fact-oriented Bicycle network

Team members

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Solution Details

Solution description

Countless urban transport systems in history have arrived at one of the following stages: stasis, stabilization, and then a period of decline. Up to 1930, the bicycle was predominantly used in Berlin over other transport technologies and then was gradually considered among the majority of social groups to be an inferior and outdated technology in comparison to motorized vehicles. This meaning gradually permeated the social group of policymakers, who in turn ignored bicyclists in travel

surveys, traffic regulations, and urban road infrastructure. The use of bicycles declined sharply until the late 1990s and then increased slightly alongside infrastructure measures. In the framework of socio-technical changes, society shapes technology by attributing meanings that become quite fixed throughout time and will constitute how it works. In the social construction of large technological systems, such as urban mobility in Berlin, human and nonhuman components interact and mutually influence each other until controversies are settled, transport technologies gain momentum together, and interventions became more difficult. Decades of laissez-faire attitudes produced a vacuum in the data, planning, design, and policymaking practices focused on urban bicycling in Berlin, as well as an assessment of measures affecting urban bicycle use and bicycling road safety; this was also seen in many other cities around the world. Although sustainable urban transport has been the increasingly predominant meaning attributed to the bicycle starting in the early 2000s, social groups within Berlin's bicycle sociotechnical ensemble dispute with different problem definition and solving strategies to expand urban bicycling and make it safer. In this paper, I explore the potential of planning, design, and participation driven by analysis of an unprecedented spatiotemporal scale of digital data collection in Berlin's bicycling system. The hypothesis is that ICTs as a source of spatiotemporal data constitute an unprecedented opportunity to overcome the quality and quantity of data problems found in the urban bicycling behavior and safety literature, and that is possible to shape an ICT-based tool with limited human, financial, and technical resources to produce online analysis and visualizations to inform and settle disputes between multiple actors and social groups in urban bicycling policymaking. The goal is to combine diverse material collections sourced via ICTs in one analytical frame, contributing to fact-oriented planning, design, and participation in policy-making for the Berlin bicycling system. First, I simultaneously analyzed large sets of digital data collected on the spatiotemporal variation of bicycle use, bicycling road crashes, and bicycling road infrastructure on the city scale. Next, I experimentally developed an ICT artifact to visualize and inform participation in urban bicycling policymaking. I concluded by reporting on bicycle road safety within five different infrastructure typologies, creating prioritization criteria for bicycle road system expenditures, and debating the unsuitability of specific bicycle road designs in Berlin. Despite the limited human and technical resources, the experimental tool I developed appears to optimize the time between policy-making and implementation of measures since it allows actors to participate in policymaking with a more detailed understanding of bicycle use and road safety in Berlin.

Solution context

Berlin, 2011: Urban road crashes began to be registered by the police on the spot, using a hand-sized ICT device. This provided not only the precise geolocation data for the crash, but a variety of other data variables such as the direction of the parties involved, the inferred cause of the crash, injury severity, the road users involved, vehicle types and maintenance conditions – all of which are indispensable for studies on urban road crashes, safety, and injuries. All records began to be transmitted to the police data centers and could be remotely accessed via network, where variables could be edited by hospital staff accordingly to the victims' clinical changes. Digitalization of this process provided unprecedented quality and quantity of data on crashes in the city which were ready to be used in research. Previously, this data was collected and stored in a pile of more than 30,000 paper forms each year, filled out manually when each crash was reported. A large part of this data had been used in the courtroom but not in research, due to the difficulties imposed by analog records being transformed into large-scale data sets and therefore permitting statistical analysis. In 2012, the Berlin Senate installed digital sensors in some locations along the city's bicycle infrastructure to measure and transmit bicycle use volumes in the city via internet. This data was incorporated into the records after decades of manual counting at some of the city's road intersections. Today, any citizen, planner, policy maker, or researcher can access a public website

displaying bicycle traffic volumes in real time, along with basic statistics and graphs selected according to the user's preferred time frame and location. This data shows how bicycle volumes in the city rose, stalled, or decreased in different seasons, along with temperatures. After fifteen years, an innovative bicycle sharing scheme (which was the first to operate in the city, developed and implemented with indirect subsidies from federal funds) became entirely funded by private sources in 2016. A year earlier, system owners outbid their competitors in the public request for bids held by the Berlin Senate to choose a company to supply and operate a fleet of 7,000 bicycles and docking stations which would be added to the existing scheme with 2,000 bicycles. Local subsidies estimated at € 10,000 rapidly spread the system to all corners of the city by 2017. That same year, more than ten different companies in the urban mobility service sector were tracking urban bicycle activity in Berlin through either GPS devices installed on the bicycles in the city's two sharing schemes or the GPS onboard smartphones. Apps for routing, navigating, tracking, and measuring physical activity during rides along the city's 1,500 kilometers of bikeways were provided free of charge to the estimated 500,000 user who rode their bicycles every day in Berlin. In this way, ICTs mixed with urban bicycling and triggered diversification of services and products associated with a hundred-year-old technology: the bicycle. By 2018, four new dockless (or stationless) schemes provided by foreign companies added about 2000 more bicycles to the sharing systems, all launched legally but without any regulation by local transport authorities. Some residents see the city as currently flooded with bicycles, while others say that for decades it has been aflood with cars.

Solution target group

Policymakers, researchers, bicycle advocacy groups, and companies in the MaaS sector.

Solution impact

After the bicycle's wide adoption in German cities up to the 1940s, it was gradually considered an inferior and outdated technology in that society in comparison with motorized vehicles. When its predominant social meaning was no longer transport, bicycle traffic was no longer surveyed by authorities, and traffic regulations considerably restricted its circulation; urban bicycling was excluded from Berlin's travel surveys until the 1990s. Information in urban transport systems and variations in mode use have a significant impact (both positive and negative) on the economy, society, and the environment. Like many other cities, Berlin systematized procedures for traffic counting and urban travel surveys (UTS), and since 2003 the city participates in the nationwide System of Representative Travel Surveys (SRV) every five years. Throughout an entire year, data is collected using a paper-based questionnaire sent primarily by mail (or if an individual prefers email), or a telephone or face-to-face interview is conducted with about 15,000 inhabitants. For Berlin, the data digitization, processing, analysis, and reporting may take an additional year after the year-long survey. Recently, ICTs have pervaded mobility systems, boosting digital sensing of individual dynamics, and producing an unprecedented amount of spatiotemporal data. Did ICTs, which can arguably be called disruptive, reach, and alter ends of urban mobility sociotechnical ensembles, for example, urban mobility research controlled by the public sector? Can digital data collection cope with adopted and accepted practices and methods? To answer these questions, this paper has three goals: (i) to discover which actors and social groups are currently interacting and shaping a specific mobility artifact (bicycles with ICTs) and how they are doing so, thereby assessing the pervasiveness of ICTs in the bicycle-related sociotechnical ensemble in Berlin; (ii) to discuss the use of eventual bicycling spatiotemporal data each actor may hold, for bicycling UTS purposes, thereby describing the commercial model for UTS products or services using ICTs as a data source and requiring pro bono access to data sourced through ICTs for use in this paper; and (iii) to conduct a full digital bicycling UTS and statistical validation of data sourced through ICTs, discussing its use as material

in bicycling UTS and comparing results with those in SRV Berlin. The method is qualitative for accomplishing goals (i) and (ii) and quantitative for goal (iii). The materials derived from 16 actors who were identified, contacted, interviewed, and/or investigated via the internet, testing and description of the features of 13 apps and online data visualization systems commissioned by actors, data on 76,292 bicycle trips commissioned by BikeCitizens, data from the Berlin Senate on bicycling traffic volumes and SRV Berlin 2008 and 2013 reports. I concluded by arguing for a complete shift to digital materials and methods because of the lower surveying costs involved, the statistical significance of my results, higher level of details, the feasibility of more frequent travel surveys, and effects assessment through sharper control in before-after bicycling system infrastructure implementation.

Solution tweet text

Berlin Bicycling Digital Traces: Open and integrated datasets for building a fact-oriented bicycling road infrastructure and bicyclists awareness.

Solution innovativeness

The system makes available online datasets and visualizations that are key for better road infrastructure quality, citizens participation and optimization of public expenditures.

Solution transferability

To all cities where quality and quantity of data is available, such as in the pilot case and prototype, Berlin.

Solution sustainability

Solution team work