# Practice-Led Design Research (III)

## Reconfiguring Bicycle Mobility and Integrating It into the Transport System

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From the perspective of sustainability, environmental protection, and health, cycling is a form of active mobility that outranks motorized personal transport (BMVI 2021: 11). In urban areas in particular, the advantages of cycling are immediately evident: space requirements, for example, are far lower, while cycling produces virtually no noise and has practically no environmental impact (regarding the space requirements of the various modes of transport in moving traffic per person, see Randelhoff 2014). But how can bicycle mobility be promoted using new design concepts? How are new incentives encouraging bicycle mobility to be generated? A systematic approach that regards the bicycle not merely as a product, but instead as an element within a larger intermodal (and environmentally friendly) mobility system is essential. From the user's perspective, moreover, the bicycle should be considered as a mode of mobility in conjunction with transport infrastructure that is operated by other mobility providers.

## Promoting Bicycle Mobility

Bicycle design addresses all variants of this mode of transport, including cargo bikes, recumbent bicycles, and children's bicycles, but also accessories, including trailers for children or cargo, transport baskets or bags, locking devices, along with ergonomic attachments. Here, the selection and combination of elements is determined primarily by the requirements of the individual user as they relate to the specific (mobility) situation. The bicycle infrastructure, in turn, facilitates movement and orientation for cyclists while guiding traffic flows. A systemically designed bicycle infrastructure incorporates aspects of road safety, for example, specially installed cycle lanes that provide separation from both car traffic and pedestrians. But it also integrates aspects of comfort and serviceability, such as footrests at stopping places and service stations with bicycle pumps, which provide infrastructural support to bicycle mobility in ways that resemble service stations for automobiles. Similarly, the creation of access points and transitions to and within the overall transport system via bridges or elevated bike lanes may form parts of a (new) bicycle infrastructure in ways that facilitate new forms of use of the mobility system. Safe parking facilities for cyclists, in bicycle parking garages, on cycle racks, or at specially secured locking stations make demands on the planning, design, and implementation of a well-equipped infrastructure that is oriented toward the user's needs. With the bicycle infrastructure, differently than with the bicycle itself, it is less the individual's needs that stand in the foreground; given primary consideration instead are the collective needs of all bicycle users. The interests of society as a whole too must be taken into account if the relevance of structural changes to the respective mobility element is to be evaluated and shaped accordingly.

But how can people be motivated to regard bicycle mobility not solely as a leisure activity, instead integrating cycling into everyday mobility as a self-evident element? How can design contribute to enhancing acceptance of bicycle transport as a sustainable, cost-effective, environmentally friendly, and efficient form of mobility that is used on a regular basis? Design and design research strive to develop new, innovative mobility concepts or optimize existing ones and conveying their findings to current or future users of the mobility system. Design measures make it possible not only to arrive at solutions to existing problems, but also to generate possibilities for reconceiving bicycle transport, in terms of both the bicycle as a product and the cycling system as a whole. In order to raise awareness of the functionality and attractiveness of cycling, design incorporates these factors into product development, linking individual and social needs conceptually. Design therefore takes into account individual needs as they relate to the bicycle as an object, but also conceive of these needs as an aspect of an overarching, intermodal mobility system. The questions raised above will now be explored and illustrated through three projects.

## The Reconfiguration of the Bicycle as a Product

How can loads be transported conveniently and comfortably using bicycles? In cities, combining travel via bicycle with the transport of loads or large purchases is generally achieved only with


**Figs. 1+2** Through a simple motion, the bicycle becomes a cargo bike. (Source: David Maurer-Laube/Convercycle)

a special cargo bike, and hence confronts many cyclists with difficulties. Also, a cargo bike is not particularly practicable when no loads are to be transported. They are unwieldy, require considerable parking space, and cannot simply be carried onto suburban trains, for example. The »Convercycle« (design: David Maurer-Laube) addresses this problem head on.[01] It combines comfort, experiential quality, and function, and encourages people to use the bicycle more frequently, even when transporting loads. By reconfiguring the bicycle based on user needs, it generates a new mobility option: the two-wheeler is an ordinary bicycle and a cargo bike at the same time. Depending upon which type of bike is required, it is adaptable to everyday needs through a clever folding mechanism that is operated by means of a handle on the rear wheel (↳Figs. 1+2). The bike unites the advantages of a short, easily storable, lightweight, maneuverable city bike with the transport options of

a cargo bike that accommodates purchases, sports bags, beverage crates, or baby seats. The success of this reconfigured bicycle is clearly evident: David Maurer-Laube has been pursuing development, marketing, production, and sales through his own extracurricular startup, and has already sold more than a thousand units since 2019, with sales now averaging around fifty monthly.[02]

How can active mobility become a sustainable and individual experience? Another possibility for reconceiving the bicycle and better adapting it to individual needs is through ergonomic optimization, so that each bicycle becomes distinctive and personal while at the same time optimizing the mobility experience. This becomes possible through the digitally supported data capturing of the bodily dimensions of the individual user and the corresponding adaptation of the bicycle frame through the insertion of individually manufactured frame parts through 3D printing. Through this concept, »Frame One« offers a customized bicycle (design: Felix Pape and Mervyn Bienek).[03] To begin with, the dimensions of the projected customized bicycle are determined by measuring the user and taking into account his or her personal riding habits. An individualized frame that conforms to the individual's physical needs is created on the basis of a frame algorithm. Finally, the frame is manufactured locally on-site using 3-D printed sleeves and readily available, cost-effective, semi-finished products, and outfitted with the appropriate accessories. The personalization of the bicycle not only allows functional and aesthetic adaptations, but also reduces health problems by significantly improving cycling posture (↳Figs. 3+4). The bicycle's design and the manufacturing process facilitate a local, intelligent, cost-effective production approach that counters the pull of mass production. Felix Pape and Mervyn Bienek are developing and marketing »Frame One« through an independent, extracurricular startup, and have already realized a functional prototype.

## The Adaptation of Bicycle Infrastructure to the Experience of Mobility

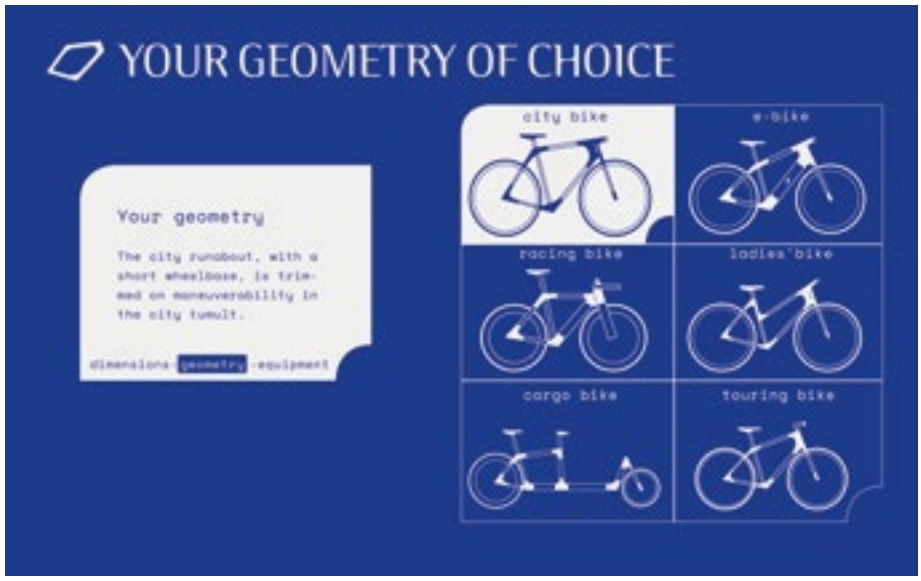
As a rule, transport infrastructures are planned from a purely functional perspective: how can people or goods be transported from point A to point B with maximum efficiency? This seems reasonable enough, but that approach often neglects the user's needs, resulting in a less satisfactory mobility experience. In the end, the experiential quality and comfort of the mobility experience call for something more than a seamless, functionally conceived process. It is at this point that design comes into play: how can a networked transport infrastructure—in this case for bicycle traffic—be adapted to individual needs? How can the larger social significance of an environmentally friendly mode of mobility be communicated, with the aim of promoting identification with and acceptance of it?

One example is the design project »Green Line« (design: Andreas Grzesiek), which emerged from a student ideas competition organized by the Regionalverband Rhein-Main and the Fraport AG, and which expands the existing transport infrastructure at Frankfurt Airport's Terminal 2 to include a bicycle bridge.[04] As the region's largest employer, the airport represents considerable potential for influencing the mobility habits of its employees in a positive way through special options. Moreover, the adjacent municipal forest, with its bike routes in green surroundings, encourages active mobility as a link between the airport and downtown Frankfurt or with neighboring residential areas. Up to now, the transport infrastructure at the airport itself, however, was almost

**01** The »Convercycle« originated in the winter semester 2017–2018 at HfG Offenbach University of Art and Design, which was devoted to the topic »The Bicycle in the City,« in the course »wheel2wheel« (supervisors: Peter Eckart with Anna-Lena Moeckl and Julian Schwarze).

**02** According to Convercycle Bikes GmbH, these numbers reflect sales as of January 2022 since market launch in June 2021 and from an earlier Indiegogo campaign.

**03** »Frame One« emerged in the University of Art and Design (HfG) Offenbach summer semester of 2016, which addressed the topic »The Bicycle and Urban Production,« in the course »bike.0« (supervisors: Peter Eckart with Julian Schwarze).




**Figs. 3+4** Configuration and finished customized bicycle with individual connecting elements (source: Felix Pape, Mervyn Bienek/Frame One)

hostile to bicycles, especially at an intersection and feeder road that were to be integrated into the network of cycle routes around the airport by the ideas competition. The design was developed from the perspective of bicyclists: to a great extent, the cycling route leads through the municipal forest, and is confronted with a challenging traffic situation only in the area of the crossing. The design, which takes the form of a forest aisle, cites the airport's wooded surroundings, continuing the positive experience of nature through the intertwining of landscape and bridge elements. The resultant wave form offers cyclists view and noise protection while serving as an icon of environmentally friendly mobility (↳Fig. 5). The design offers a positive mobility experience, generates visibility for this mode of transport, while at the same time achieving a powerful symbolic impact.

The projects presented here demonstrate how design can promote active mobility and encourage people to switch from other forms of mobility. First, there is the design of products that are oriented toward the needs of users, reconfiguring them by regarding them as systemic elements and conceiving them from the perspective of the mobility experience. Secondly, design is used consequentially to adapt elements of the transportation infrastructure that support cycling in

**Fig. 5** Positioned between Autobahn A3 and Terminal 2, the bicycle bridge becomes an iconic symbol of the new mobility. (Source: Andreas Grzesiek/DML, HfG Offenbach am Main)

ways that improve the mobility experience. Not only can design be used to optimize the mobility system through product innovations, but it can be used to convey the importance of innovative and environmentally friendly mobility along the interface between the mobility system and users. This means using design in order to arouse curiosity while promoting acceptance of different or new modes of mobility and their use in everyday life. In this way, design can contribute to the emergence of new habits and routines, hence advancing the larger aim of promoting sustainable mobility.

**Literature**

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**04** The project is a concept of the BikeBridge seminar at the University of Art and Design (HfG) Offenbach (supervision: Peter Eckart with Julian Schwarze) from the summer semester 2017. BikeBridge emerged from a student competition for a bicycle bridge in the framework of the sponsorship project Fahrradmobilität in großen Gewerbe- und Industriestandorten am Beispiel des Frankfurter Flughafens (Bicycle mobility in large commercial and industrial locations using the example of Frankfurt Airport), organized by the NRVP (National Cycling Plan). Partners in the project were the mobility department of the Regional Authority FrankfurtRheinMain and Fraport AG.