Mobility Design

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Mobility Design
Shaping Future Mobility

Volume 1: Practice
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Mobility Design: Shaping Future Mobility

↳ Kai Vöckler
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Mobility means the need—but also the ability—to accomplish physical movement in space.[01] To overcome space, to become mobile while at the same time determining the form mobility takes, is a fundamental need: mobility can be defined as individually achievable spatial movement. Accordingly, the term mobility refers to a qualitative experience, in contradistinction to the terms traffic/transport, which refer to a quantitative performance, to the conveying of people or goods from point A to point B (the overcoming of geographical distance). A primary focus of mobility design is the shaping of the mobility experience—how can transport infrastructure, including the means of transport, buildings, objects, and analog or virtual information, be configured in order to ensure a positive user experience? The quality of the interaction between users and the transport system is central to the acceptance of new forms of mobility. The following attempts to demonstrate the extraordinary importance of this set of design tasks in relation to climate change and the resultant need to developing an environmentally friendly mobility system.

The purpose of this introduction is first, to briefly outline the development of transport technologies up to the model of fossil-fueled individual automotive transport, still dominant worldwide today. We hope to show that this transport model results in enormous burdens on both mankind and the environment, and that climate change demands a reorientation. Decisive here, we argue, is not the means of transport itself, but rather the quality of movement. Enhanced quality becomes possible through new forms of networked, integrated, intermodal mobility. The development of an innovative, environmentally friendly, networked mobility system, however, is not solely a political, organizational, and planning task, but instead represents special challenges for the disciplines of architecture and design. This point is illustrated in this publication by more than sixty projects that are exemplary by virtue of their design qualities. There are already many groundbreaking, creative concepts and projects that illustrate how a climate-friendly mobility system can be configured. These are presented here, in the first volume of a publication series on mobility design. The focus is on design practice, on the interplay between architecture and the shaping of user-oriented spaces, processes, objects, and information.

Technologies for overcoming space In order to realize mobility, i.e., individualized movement, mankind has long sought for resources designed to improve the concrete possibilities of personal locomotion. With the domestication of riding and draft animals such as horses, donkeys, oxen, or camels, an organic symbiosis between human and animal augmented human muscle power. From the use of simple sleds for dragging loads to the invention of the wagon wheel, technical innovation led to the optimization of available options for overcoming space. Also important was the construction of rafts and boats. However, these were still dependent on muscle power and unpredictable natural forces such as water currents and wind power. Only the invention of the internal combustion engine, initially as a steam engine, facilitated greater independence from natural influences. With the development of railroads and steamships, worldwide networking was not only intensified but also synchronized using a uniform time scale.[02] It was the regularity and hence predictability of space utilization made possible by the new technologies that opened up new forms of space exploitation.[03] This access to global space via networked transport technology was portrayed vividly in Jules Verne's novel *Around the World in Eighty Days*, published in 1873, a narrative which retains its fascination even today—as numerous film versions testify. The sole reason for the journey was a bet among English gentlemen over whether a trip around the globe could be made in just eighty days. A feat that had only become conceivable through the opening of the Suez Canal, shortly before the novel appeared, and because the

01 The term mobility also encompasses intellectual and social mobility, which are, however, not addressed here.
02 Rammler 2014, pp. 19–38
03 Cf. Huber 2010

transcontinental railway in the United States had been completed. But necessary for the journey to become a reality was an indispensable tool: *Bradshaw's Continental Railway Steam Transit and General Guide*—a timetable containing all of the information necessary to travel planning, to which Phileas Fogg had recourse. Verne's novel rendered the introduction of universal time tangible (let us recall that the bet was ultimately won only because the travelers journeyed eastward, gaining an entire day crossing the international dateline). But the timetable was more than a mere auxiliary device: it was also a manifestation of the individualized spatiotemporal access to the world as a whole that had now become feasible.

Although the railway optimized the possibility of overcoming space, it nonetheless remained a means of mass transit. The loss of individual locomotion, formerly associated with the horse and carriage, was immediately decried. Drawbacks included the need to subordinate oneself to the regimentation of the timetable and the dependency of travel routes on the railway tracks, but also the distasteful experience of transportation as part of a larger mass. Better-off passengers deplored the minimal distinction gained through »first-class« status.[04] Only the invention of the internal combustion engine as Otto and diesel engines succeeded in linking the advantages of the horse-drawn carriage with the new railway, first through a motor that was independent of the muscle power of the horse, and moreover far more efficient, and secondly through the flexible usability of the new vehicle, as with a carriage. At first, it remained an open question which propulsion technology would prevail in individual vehicles, whether steam, electricity, or oil. Often omitted from the success story of the automobile is the fact that with the electric motor, a drive technology was available at the end of the 19th century that had already been used successfully in high-speed trains and streetcars and was technically far simpler. As early as 1899, Belgian racing car driver and engineer Camille Jenatzy drove a self-constructed electric automobile, *La Jamais Contente* (Eng.: The Never-contented), establishing a record of more than 105 kilometers per hour. It would take the automobile industry more than a century to rediscover this technology.[05] The storage battery and correspondingly limited range emerged as downsides to the electric engine—but even more so the price: in 1914, the »Detroit Electric« cost nearly ten times the price of a »Model-T Ford« with its combustion engine. In the United States, the leading nation in the mass fabrication of affordable autos in the early-twentieth century, meanwhile, focused lobbying by the oil industry in collaboration with manufacturers of automobiles (which used combustion engines) worked to establish motorized, oil-based transport. Between 1927 and 1955, in altogether forty-five US-American major cities, front companies purchased electrified streetcar companies and shut them down. Residents had no alternative but to purchase oil-based private automobiles.[06]

In architecture and urban planning as well, Modernism perceived individual auto mobility as progress and developed corresponding urban models in which automobile traffic could develop unhindered—despite the fact that in most countries in the nineteen-twenties, only a fraction of the population had access to this mode of transport. In his texts *Urbanisme*, architect Le Corbusier proclaimed an urban planning model that strictly segregated the functions of dwelling, industry, commercial activity, and recreational spaces from one another, as well as from transport systems.[07] He illustrated his concept in urban visions, among them the »Plan Voisin« of 1925 (named, characteristically, after a manufacturer of automobiles and aircraft): the old city center of Paris would be demolished and replaced by six-story, loosely positioned towers, around which individual transport could flow unhindered on broad boulevards. In 1932, at the 4th Congress of CIAM, the International Congress of Modern Architecture, an association of architects who regarded themselves as the avant-garde of a new, progressive urban development (at that time an exclusively male group), adopted the »Athens Charter,« which prescribed the segregation of functions and the dominance of mass motorized individual transport—with far-reaching consequences for urban planning during the postwar era, when their vision became a reality: now, cities became »car-friendly,« meaning: built around the automobile.[08] But this also required the necessary infrastructure: the automobile is inseparable from the street. Before the desired individual mass mobility could be achieved, the preconditions for it had to be created. That the putative individual freedom of movement was at the same time designed as mass mobilization was a conceptual contradiction that remained unnoticed at the time—only with increasing traffic density through the ongoing automobilization of the population after World War II and the size and prolongation of traffic congestion did this paradox become apparent. Symptomatically, road construction was pushed aggressively at a time when car owners were in the minority, and no one could possibly speak of necessity. Governments assumed key roles here.

This becomes especially clear with reference to Germany, one of the industrialized nations that remained somewhat backward after World War I when it came to automotive development: during the nineteen-twenties, Opel had just succeeded in bringing a plagiarized version of the French »Citroën 5 HP,« the so-called »Laubfrosch« (tree frog), onto the market as a »car for everyone.« The other small German autos, such as the der »Hanomag 2/10PS« (the »Army Bread«) or the »BMW Dixi« were objects of ridicule.[09] It is well-known that Adolf Hitler provided the decisive impetus for the development of a small, affordable car. In 1938, the town of Wolfsburg was established as the headquarters of VW, and the development of an inexpensive »Volkswagen« (Peoples' Car) was propagandized—as we know, it was only after the collapse of the Nazi regime that the car became available in significant numbers. The key investment of the National Socialist state was actually the construction of the Autobahn system, which was designed to stimulate the economy in conjunction with the promotion of automobile sales. The development of the German highway network was regarded as an undertaking that would weld together the »national community« into a unity—a myth that is still effective today, and one with great potential for simulating a sense of identity. It also compensated for feelings of inferiority in relation to the US, with its flood of automobiles (during the nineteen-thirties, more than 20% of the American population already owned cars), while it was deliberately overlooked that other European countries such as Italy had already constructed a highway network. But the German Autobahns did not remain empty solely due to wartime conditions: the proportion of automobile owners in the population as a whole was simply too small, even less than 1%. The significance of the highway system for military logistics became clear only in the course of the war. The example of Germany shows how state-directed infrastructural measures and the accompanying governmental systems of order and regulation gave rise to a developmental logic that facilitated the expansion and implementation of specific forms of mobility. During the nineteen-thirties, Germany had an excellent, well-developed rail network, which has, however, dwindled meanwhile to half its former size—also a consequence of transport policies oriented toward individual mass mobilization that were perpetuated without interruption after the end of World War II.[10]

04 Sachs 1990, pp. 110–116
05 In 1874, Jules Verne predicted the inception of hydrogen propulsion (using a fuel cell that obtained electrical current from hydrogen): »I believe that water […] decomposed […] by electricity […] will one day be employed as fuel, that hydrogen and oxygen which constitute it, used singly or together, will furnish an inexhaustible source of heat and light, of an intensity of which coal is not capable. […] Water will be the coal of the future.« Verne 2019, p. 288
06 Urry 2013, pp. 77–78
07 Cf. Le Corbusier 2015
08 Cf. Reichow 1959
09 Sachs 1990, pp. 57–58
10 Cf. Hruza 2020

Automobility: dreamlike velocity—slow-moving traffic But all of this alone fails to explain the success of automobilization. Alongside governmental measures in the area of traffic infrastructure and their accompanying financial, legal, and institutional safeguarding (coinciding with the disadvantaging or even repression of the competition, i.e. rail and streetcar travel), it also requires a subjective anchoring, an identification with the »mobility machines«—representative among them, of course, the automobile. The network consisting of supporting infrastructure, automotive transport, and regulative regional planning produces a subject-defining affectivity, an emotionally grounded self-affirmation that is based on the experience of overcoming space and is transferred to the auto as an object. It is the sensation of the self-determined and unrestricted overcoming of space, of allowing time to evaporate: the desire for velocity. Staged on the street, and through the automobile, is the utopia of an unlimited overcoming of space, through which the space-time relationship is accelerated—in a symbiosis of human and machine that endows the individual's powers with the necessary impetus.[11] There is no goal, just pure delight in speed for itself, in the negation of distances and divisions—a peculiar kind of spatial experience.[12] In his novel *On the Road*, written in 1955, Jack Kerouac captures this boundless energy: the trip from New York to California, and, after a Coca Cola, back again, across thousands of kilometers: »In no time at all we were back on the main highway and that night I saw the entire state of Nebraska unroll before my eyes. A hundred and ten miles an hour straight through, an arrow road, sleeping towns, no traffic, and the Union Pacific streamliner falling behind us in the moonlight. I wasn't frightened at all that night; it was perfectly legitimate to go 110 and talk and have all the Nebraska towns—Ogallala, Gothenburg, Kearney, Grand Island, Columbus—unreel with dreamlike rapidity as we roared ahead and talked (…).«[13] A drive that was as meaningless as crossing the street. A drive to nowhere: driving itself is the goal—the annihilation, the disappearance of space which, however, does not stand in contrast to the dimension of its emergence. When driving, space is generated continuously, and its passing by becomes a source of pleasure: the real space is transcended in an ecstatic spatial experience. The automotive conditions of velocity and movement have generated a space that negates the physical resistance of geographical space and seems to be without ground contact. This was immediately understood in the arts, as seen in the emergence of independent genres such as the »road novel« in literature and the »road movie« in film, which sublimate this experience artistically (it was, after all, a mobility experience that is rarely encountered in daily life). Popular films testify to this: in Monte Hellman's *Two-Lane Blacktop* of 1971, where a souped-up 1955 Chevrolet races across the US with a Pontiac GTO (whose driver is referred to in the film tellingly only as »GTO«).[14] It was followed in 1974 by *Gone in 60 Seconds*, whose star is a yellow 1973 Ford Mustang Mach 1. A film that has become imprinted in collective memory for its 40-minute car chase, in whose course more than one hundred autos are destroyed—on the canvas, it became possible to live out automobile-dependent masculine fantasies of omnipotence without inhibition.[15] In 1975, more sensitive souls preferred taking a drive with Rüdiger Vogler and Hanns Zischler in Wim Wenders' *Im Lauf der Zeit* (Kings of the Road) in a converted moving van in the »Zonenrandgebiete« (German-German border region) along the German-German boundary line. A road movie that rather illustrates the shaken character of German inwardness: at the start of the film, emblematically, Hanns Zischler attempts to commit suicide by plunging his VW Beetle into the Elbe.[16] People with a simpler mind preferred action comedies like *The Cannonball Run* with the unforgettable Burt Reynolds indulging in dubious stunts and crashes (one of which ends in a swimming pool).[17] This list of »car flicks« could be prolonged endlessly, and there is no end in sight. Then there are computer games such as »GTA—Grand Theft Auto,« whose sale of 300 million copies testifies to the undiminished delight in car chases. All of them make one thing quite clear: the question of how we move and with which vehicle is hardly incidental, instead it is part of practices of subjectification that are attached to emotionally-charged objects such as the automobile.

These are deeply embedded in everyday culture; combined here are lifestyles, consumer preferences, and modes of behavior that make possible individual self-experience and self-affirmation via the automobile. In the selected films, they are artistically exaggerated and coded in pop culture: as the automotive promise of unrestricted freedom of movement.

The automobile stands for the promise of individual autonomy, for the freedom of motorized travel—which however dissolves in the everyday reality of the anonymous mass of slow-moving traffic. The more people partake in individual automobility, the less they are able to live out this imagined freedom of movement—the mobility paradox. In large German cities, the average travel speed of a passenger car is reduced year by year, and on main roads, it is meanwhile lower than 20 kilometers per hour; it is now overtaken by bicyclists who swerve past, ostentatiously displaying their superior maneuverability.[18] This proves that the passenger car is not the only mode of transport that allows us to live out the sensation of freedom. What is, however, completely ignored is the fact that the putative freedom of individual automobility is dependent on a network of streets and parking spaces, fuel depots and service stations, traffic lights and lighting systems, on a complex supply network, without which automotive mobility would be virtually inconceivable (shame to him who thinks of *Mad Max*).[19] This putative autonomy is dependent upon an overarching infrastructure whose allocation and organization is part of public governmental service provision. Infrastructurally and institutionally, individual automobility is embedded in space, and it is here that the conversion of the all-dominant traffic model based on individual motorization must begin. Why is this necessary? Because of the climate crisis and resource shortages, but also because the substantial negative burdens on humans and the environment imposed by continuously increasing traffic heightens the urgency of arriving at fresh solutions for a sustainable mobility that respects both mankind and the environment.

The challenge of climate change—traffic/transport as the problem child Why take action on climate? Outlined once again in brief: the Earth is protected by a gaseous envelope, the atmosphere, which prevents heat from escaping into outer space. An important component of this atmosphere is formed by the greenhouse gases, which absorb heat energy. The proportion of greenhouse gases, in particular carbon dioxide (CO_2) is increasing continuously through the escalating use of fossil-based energy sources in industry, transport, and in households, as well as by environmentally harmful land-use and agriculture. The consequence is steadily increasing temperatures, with predictably catastrophic outcomes: rising sea levels, increasing droughts and spreading deserts, flooding, extreme weather events.[20] From a scientific perspective, there is no doubt about this development, nor is it attributable to natural climate fluctuations. Instead, it is well-documented that over the past two hundred years, and beginning with industrialization in the late-eighteenth century, the concentration of greenhouse gases in the atmosphere has increased, dramatically intensifying the greenhouse effect—with impacts that are tangible already today.[21] Which is why in 2015, through the Paris Climate Accord, 196 countries committed themselves to defining and implementing national climate protection goals

11 Cf. Dant 2004
12 Vöckler 2014, pp. 120–124
13 Kerouac 1968, p. 218
14 *Two-Lane Blacktop*, USA 1971, directed by Monte Hellman
15 *Gone in 60 Seconds*, USA 1974, directed by H. B. Halicki
16 *Kings of the Road*, BRD 1975, directed by Wim Wenders
17 *The Cannonball Run*, USA 1981, directed by Hal Needham
18 BVL.digital and HERE Technologies 2019
19 *Mad Max*, AUS 1979, directed by George Miller
20 BMU 2014
21 Deutsches Klima-Konsortium et al. 2020

designed to limit the warming of the Earth to less than two degrees centigrade, thereby at least mitigating this disastrous development. Among them was the Federal Republic of Germany, which set the goal of reducing national greenhouse gas emissions by 40% by 2020, and by 55% by 2030 in relation to 1990. Germany has met its climate protection target for 2020—but only as a result of the Covid-19 pandemic. If we take a closer look at the numbers, it becomes clear that Germany has a problem child: the transport sector. Over the past twenty years, this sector has contributed virtually nothing to reducing greenhouse gases—unlike every other sector.[22] But globally, too, the climate goal of keeping global warming below two degrees centigrade has been thwarted by traffic/transport. Even in an optimistic scenario, the strongly growing requirement for mobility, and the CO_2 emissions associated with it, in particular road and air traffic, means that the sector will make no significant reduction to CO_2 emissions as compared with current levels. Currently, the contribution of transport/traffic to global greenhouse gases is 14% and is expected to rise; here in particular, effective measures are therefore indispensable.[23] An index of the urgency of rethinking mobility is the number of private automobiles, which continues to rise worldwide: in 2015, this figure already amounted to around 947 million.[24]

Germany—car country Considering Germany, it immediately becomes clear that allegedly self-determined mobility via the private automobile is the main cause of the problem. Traffic volume in passenger traffic (the distance traveled multiplied by the number of people transported, calculated as passenger kilometers) increased between 1991 and 2019 by nearly 34%. Individual motorized transport occupied the dominant position. Its share of total passenger movement was approximately 75%.[25] One fifth of the total CO_2 emissions are attributable to traffic/transport. Fully 90% of that amount is associated with road traffic (cars and trucks). Unlike other sectors, CO_2 emissions caused by traffic/transport have seen virtually no decrease since 1990. Although innovations in propulsion and exhaust technology have been able to significantly reduce emissions, the relief has been neutralized by increased traffic intensity.[26] Exacerbating the situation are substantial increases in engine performance and vehicle weight, accompanied by a corresponding increase in fuel consumption. In short: traffic flows are increasing, as is the stress on people and the environment. Millions of people are on the road every day, many of them alone in private autos. This practice is associated with substantial psychological and physical strains on humans and the environment (stress, air pollution, noise, land consumption, contamination). Urban centers in particular are heavily burdened by the traffic volume: atmospheric and noise pollution are damaging to human health. Moreover, the climate crisis demands a fundamental reconceptualization of mobility behavior: as the case of Germany demonstrates, technical improvements alone are incapable of alleviating stresses on the environment and climate.

This applies to e-mobility as well. As long as electric autos are fueled with power from fossil energy, the switch to a different drive technology is irrelevant—only when the power is derived from renewable energy does the electric auto become environmentally friendly. Cautious optimism is warranted: the share of renewable energy in Germany's power mix is rising, and hence the climate footprint of the electric car is improving. But if we take into account production and disposal, service life and road performance, do electric autos really offer ecological advantages in comparison with vehicles using internal combustion engines? While the question is unresolved, it does appear that a switch to e-mobility is worthwhile in the long term. It is often forgotten that not just CO_2 emissions burden the environment, but particulate matter as well, a major source of which is road traffic. Particulate matter enters the atmosphere, not just through engines, but to a large extent through tire abrasion and braking—and this is the case with all vehicles types, including electric ones. With regard to noise pollution as well, electric vehicles offer little relief: for a vehicle with an internal combustion engine, the engine noise is dominant up to circa 25 kilometers per hour. At higher speeds, however, tire-roadway noise becomes predominate. Although electric cars are significantly quieter at very low speeds, they are as loud as conventional cars at high speeds.[27] However, the real problem lies elsewhere: it is the sheer mass of private vehicles, most transporting single passengers: German households own 43 million cars, and the number rises annually.[28] Whether they run on non-fossil or fossil energy, the result is virtually the same when we consider the gigantic utilization of land involved—land consumption through street traffic increases ceaselessly by a daily average of 17 hectares.[29] It is estimated that circa 50% of this is surfaced. And the greater part of this advancing environmental destruction caused by the need to provide infrastructure for continuously growing traffic streams is street traffic, which is dominated by individual automobility.

There are more and more autos—which are barely used and take up too much space A comprehensive study on mobility in Germany presented in 2017 highlighted the dominance of motorized individual transport, anchored in the privately owned automobile: in Germany, there are 527 automobiles owned by private households per thousand residents. And the number is growing: over the past two decades, the number of privately owned cars in Germany has risen continuously by circa 500,000 annually, and is for the most part attributable to the growing number of second and third cars in households. Nor is there any indication that the trend is weakening.[30] On an average day, a good 40% of private cars remain unused. The average operating time per vehicle per day is only 46 minutes, only 3% of the total duration of a day. Put differently: the private auto is more a stationary object than a moving vehicle: it remains parked for an average of 23 hours and 14 minutes daily—with over 20 of those hours outside the owner's front door.[31] Of the 30 kilometers covered on an average day, there is rarely more than a single passenger in the car (the average is 1.46 per vehicle).[32] Troubling here is not simply the astonishing inefficiency of this means of transport from a macrosocial perspective, but also the negative consequences of a form of mobility that is bound to the private automobile—we can hardly speak of an equality of the various means of transport. As a matter of course, the automobile is still accorded first priority when it comes to space and passage.

The inequitable utilization of (mostly public) land by the private auto in comparison to other means of transport is particularly flagrant in metropolises. An evaluation of stationary traffic in the Austrian city of Graz showed that bicycle parking spaces require 2%, public transport vehicles 3%, and stationary pedestrian traffic (street cafés, park benches, etc.) a similar 3%, while 92% of parking areas in public space were used by private autos. On average, each private auto requires 12 square meters of surface area. Moreover, as mobility researcher Stephan Rammler remarks so trenchantly, »Grass no longer grows there.«[33] Cities are well-acquainted with the consequences: sidewalks blocked by parked cars, circling automobiles searching endlessly for parking spaces. And these numbers are only the statistics for stationary traffic—the demands on space in city centers by individual transport modes is even more unequal when the street space required for moving traffic is taken into account. By a wide margin, private auto traffic uses the largest amount of surface area, pedestrian and cycle traffic the least. A private auto occupied by 1.4 people (on average) and traveling at 30 kilometers per hour requires 65.5 square meters, and at 50 kilometers per hour, a full 140 square meters—a streetcar with a utilization rate of

22 UBA 2020a
23 ITF 2017
24 Statista 2021
25 UBA 2021
26 UBA 2020a
27 UBA 2013
28 MiD 2017; Kuhnimhof and Liedtke 2019
29 UBA 2017
30 Kuhnimhof and Liedtke 2019
31 MiD 2017
32 Deutscher Bundestag, *Parlamentsnachrichten* 2018
33 Rammler 2017, p. 60

20% and traveling 30 kilometers per hour, in contrast, requires only 5.5 square meters, and traveling at 50 kilometers per hour, just 9 square meters.[34] Particularly noteworthy in this context is the fact that in German metropolises, the proportion of car-free households is 42%.[35] Put differently: with their cars, the other 58% of metropolitan households block off scarce public space for their neighbors (NB: we are talking about a method of transport that remains unused 97% of the time). A disproportionate demand on public space, which is moreover still virtually cost-free, or, more precisely: is used at the expense of car-free households, and diminishes the quality of life in cities to a considerable extent: it is completely taken for granted that children can no longer play on streets and must instead be restricted to security enclosures such as fenced playgrounds; sidewalks are blocked; cyclists can count themselves lucky if a minimum strip is designated as a cycle route, and they need not fight for their right to use the street; and everyone uncomplainingly endures noise and automobile emissions. Things cannot possibly continue like this. A central question is: how can we reduce traffic burdens without restricting mobility? How can we reclaim public, shared space in the process? How is quality of life to be restored?

Designing a new, environmentally friendly, networked mobility The restoration of quality of life, along with the reduction of environmental burdens, requires the reorganization of the now dominant automobile-based model of traffic/transport. Automobile-centered mobility is not a quasi-natural given and can be designed both politically and socially. But what is the alternative?[36] The continuing development of digital information systems has made innovative, smart, sustainable forms of mobility feasible. In the future, we will be able without difficulty to configure and use various modes of transport depending on our individual needs (networked, multimodal mobility), and without reliance on a private automobile. The technical preconditions already exist: mobile Internet via smart phones and tablets, which will be expanded in the future through additional forms of digitalized communication (keywords: smart devices / augmented reality). In the future, a flowing and reliable transition from one form of mobility to another, the use of diverse modes of transport on a single route, will be done intuitively and flexibly depending on individual requirements (intermodal mobility). This will simplify the use of both public and shared modes of transport (sharing offerings).

The new mobility is a powerful promise; required in order to redeem it, however, is the continuing expansion of both digital and traffic/transport infrastructures and the digital bundling of all mobility options in order to facilitate an unrestricted »flow« through the mobility system. Climate-friendly mobility does not mean traveling less, but in different and more intelligent ways.[37] Required here are not so much flying taxis and fully autonomous cars, but instead a functioning market, regulated by the public authorities, whose backbone—alongside rail-based long-distance, regional, and local transport—is the public local transport system, supplemented by on-demand services using autonomous/partially autonomous vehicles (small buses) and sharing options, operated with non-fossil energy.[38] A system that, in particular, encourages foot and bicycle traffic for local mobility. Taken together, all of this means a mobility system which can be used intermodally, and which is characterized by flexibility and adaptability to user requirements—even the absence of a private auto.

But changes of individual behavior alone are insufficient: the dominant automobile is supported by physical-material infrastructural elements, and in its socio-spatial organization by regulative and instrumental framework conditions that have interfered to date with the fundamental transformation of the auto-centered mobility system.[39] This means that the transition to an environmentally friendly mobility system is a macrosocial challenge that must be addressed politically. This also requires a social consensus that regards these measures as reasonable, but also as »functional« in relation to the everyday reality of the individual: they must be not just feasible, but must also correspond to the needs and desires of real people. This is where mobility design comes into play: it must mediate between the (environmentally friendly, multimodal) mobility system and the user. It must optimize access, influence experience positively, and facilitate identification. Individual adoption and evaluation are decisive factors for acceptance, which must be conceptualized as a specific function in relation to the reorganization of the mobility system. Moreover, acceptance is not achievable solely via communication about a new form of mobility, but primarily through the design of the physically experienced mobility system (together with its digital extensions) that is geared to human needs—a positive experience of mobility must emerge through actual use. This is not simply »nice to have,« but is instead a basic precondition for success.

From a macrosocial perspective, it is also evident that the CO_2 footprint—the environmental burden that results from individual behavior—is a question of milieu: the higher the household income, the greater the environmental contamination.[40] And for those with lower household incomes, who are largely dependent on public transport, and who may own one car but rarely two, a private automobile also ensures social participation—given the current condition of Germany's public transport, organizing the daily routine without a private automobile—including shift work, childcare arrangements, and daily errands—is a genuine challenge. Given its flexibility, moreover, a private auto allows owners a dwindling remnant of autonomy and serves as an emblem of one's ability to »keep up.« Beyond a straightforward means of transport, a tool for getting from A to B, an automobile represents the promise of self-determination and freedom, and it demonstrates social status. Moreover, automobile design conveys symbolic meanings that are associated by owners with specific values and desires that transcend the vehicle's practical purpose (transport and overcoming of distance).[41] In purchasing decisions, the required engine performance, fuel consumption, and other technical factors play a secondary role—a car must satisfy the demands of everyday life and run smoothly. However, functional aspects alone hardly account for the allure of the automobile (which takes nothing away from the engineering achievements involved). The automobile is more than that: an owner identifies with it and uses it to convey self-image. This leads to purchase prices that most car owners can only afford by taking out a loan. Automobile design and marketing provide purchasing incentives and stimulate a desire for ownership. From the earliest days of automobile production, well-known designers (virtually all of them men) endowed the symbolic and emotional needs of their (mostly male) customers with concrete form. In the US, for example, Raymond Loewy (»ugliness does not sell«) developed streamlined design, thereby giving the desire for speed a creative expression.[42] Or European designers of the postwar era, for example Ferdinand Alexander Porsche, who in the 1960s developed the Porsche design that has been continued to this day (and designed the legendary »Nine Eleven,« the Porsche 911, in 1963). Then there is Giorgio Giugiaro, author of the distinctive designs of the first VW Golf (1974) and the Fiat Panda (1980), or the Italian design studio Pininfarina, which shaped the designs of numerous vehicles for firms such as Alfa Romeo, Ferrari, Jaguar, Lancia, and Maserati. They made dreams come true, and the desire for self-realization or self-affirmation was cast into material form. The symbolic exaltation brought about by the design cannot be valued highly enough: in 1955, when the »Citroën DS« with its extraordinary design (along with its technical innovations, such as the hydropneumatic suspension, which seemingly made it

34 Randelhoff 2014
35 MiD 2017
36 Explored in detail in Eckart and Vöckler 2018, pp. 158–167
37 Cf. Canzler and Knie 2016
38 Cf. Mager 2017
39 Cf. Urry 2007
40 UBA 2020b
41 Cf. Geuenich 2020
42 Raymond Loewy, *Never Leave Well Enough Alone*, Baltimore 2002

float) was presented at the Paris Auto Salon, it provoked a surge of enthusiasm. In 1957, the French philosopher and author Roland Barthes wrote a famous essay that equates the »DS« (pronounced like the French word »Déesse,« Goddess) with the Gothic cathedrals—the latter a material expression of the love of God; the »DS« an expression of the love of velocity.[43] The automobile industry was aware of the impact of design and built up large internal design departments with support from psychologists, sociologists, as well as trend and market research firms. The design strategies of international automobile concerns tailored their models precisely to the desires and needs of customers: symbolic and emotional factors are decisive for purchasing decisions.

What is true for the automobile is true for all of the objects of utility that surround us: through them, we not only gain access to our world in practical terms, but aesthetically as well, all of it influenced and structured by design.[44] With and through them, we communicate with one another (and with ourselves as a society). And the impacts and significance of this communication—which takes place with and through the things we use and experience in everyday life, whether buildings, modes of transport, or utilitarian objects—are shaped by architecture and design.[45] These are the things that are familiar, taken for granted, everyday culture. All the more reason that an alternative, environmentally friendly, networked mobility system must not simply function smoothly (which also presupposes good planning and organization), but must also provide a positive mobility experience, and above all »speak« to people as a product, must express regard for them (in its design, its functioning, its »feel«), and moreover must emphasize outwardly that we are taking part in a progressive, appealing form of mobility.[46] It is the design that communicates values and conveys the meaning of the mobility system.[47] As explained above, mobility systems exist as material infrastructures and modes of transport, cultural notions and symbolic languages, social practices and the forms of subjectification associated with them.[48] In this framework, design makes understanding possible, conveys meaning, and generates identity (the »Offenbach model«).[49] Acceptance of and identification with a new, environmentally friendly, networked mobility system is inconceivable in the absence of high-quality design. If the new mobility is to become established, design plays an essential role, along the digital interface with the virtual information and communication space that accompanies us, but above all during the entire mobility process—formulated, once again, from the perspective of the user: How do I orientate myself? Is it straightforward and comprehensible? Does it inspire confidence, is it fun, am I motivated? How does it feel to be mobile together with others? How much proximity do I want, and how much distance? How do I experience the spaces through which I move, what do they tell me—am I valued? The task, then, is to shape and organize a highly complex process.

Mobility design Mobility design is oriented not toward the individual mode of transport, but instead toward the mobility needs of users. Mobility design shapes the interactions of users with the mobility system, which are constituted by time- and space-based user processes, by the physical configuration and organization of spaces and objects, by the digital interface, by the logic of information transfer, and by the underlying technical-infrastructural systems. This presupposes that mobility design is oriented systematically, and that it requires the bundling together of diverse mobility-related forms of expertise. Mobility design must hence be seen as an interdisciplinary task.[50] Design is the integrative element: through making design decisions, it mediates between humans and the mobility system and influences user experience.

Mobility design follows the guiding principle of a mobility system that is oriented toward user needs, is socially equitable, and is environmentally friendly. It considers mobility as a whole, as manifested in the need and the capacity to move through space. As an essential component of social participation, the implementation of mobility systems must ensure accessibility for as many segments of the population as possible. It is here, at the interface between human users and the mobility system, that mobility design makes a contribution. The design of mobility systems opens up new dimensions for the sustainable shaping of processes of social transformation. The design of new, sustainable, and networked mobility can be subdivided into two separate but interrelated areas of activity:

↳ First, there is the interdisciplinary, comprehensive design of the mobility system with consideration given to its organizational-institutional logic and political framework conditions, as well as to ecological, economic, and social aspects. Coming together here are various disciplinary approaches—from political and social sciences, urban and traffic planning, all the way to engineering disciplines, who work together with the design disciplines to develop a new understanding of the shaping and organization of mobility systems.
↳ Second, the design of the interaction between user and mobility system. Central here are the specialist competencies of design and architecture, which design spaces, objects, and information in a way that provides access, improves experience, and communicates meaning and quality (and hence displays respect and recognition for the user).

We believe that high-quality design is indispensable if people are to renounce the individual use of private autos. The transferral of personal feelings of freedom, status, value, and security currently associated with an object (the automobile) onto movement (mobility) means that this new form of individual locomotion must offer an experience that is persuasive, sustainable, and perceived positive. The technical and organizational determinants of automobile locomotion are by no means fixed for all eternity; they are alterable provided their functions—the guarantee of spatial and temporal autonomy, flexibility, and privacy—are preserved.[51] In short: as long as the »flow« is preserved. The task of mobility design is precisely to make this possible: to pave the way for an ecologically sustainable and socially equitable mobility by giving shape to a climate-friendly, networked, intermodal mobility. The good news: the work has already begun. The present publication showcases more than 60 outstanding examples of the design of mobility spaces, buildings, transport systems, objects of use, and information providers which, in their entirety, convey a forward-looking picture of innovative, climate-friendly mobility while testifying to the enormous importance of high-quality design.

43 »I think that cars today are almost the exact equivalent of the great Gothic cathedrals; I mean the supreme creation of an era, conceived with passion by unknown artists, and consumed an image if not in usage by a whole population which appropriates them as a purely magical object.« Barthes 1972, p. 169.

44 Cf. Gros 1983; Feige 2018

45 For the design-theoretical substantiation of the theory of product language, developed during the 1970s at the HfG Offenbach, cf. Schwer and Vöckler 2021

46 Cf. Eckart 2021

47 Cf. Vöckler 2021

48 Cf. Urry 2004

49 The »Offenbach model of human-centered mobility design« will be discussed in detail by the authors of the present volume on design research *Mobility Design: Shaping Future Mobility*, vol. 2, *Research*, eds. Peter Eckart, Martin Knöll, Martin Lanzendorf, Kai Vöckler).

50 This is the topic of the research cluster »Infrastructure-Design-Society« that is part of the »LandesOffensive zur Entwicklung Wissenschaftlich-ökonomischer Exzellenz« (LOEWE), supported by the German Federal State of Hessen in 2018–2021, headed by the Hochschule für Gestaltung Offenbach (design), and with the Frankfurt University of Applied Sciences (traffic planning), the Johann-Wolfgang-Goethe-Universität Frankfurt (social scientific mobility research), and the Technische Universität Darmstadt (media and communications technology | architecture) as project partners. www.project-mo.de

51 Cf. Rammler 2003

Literature

↳**Roland Barthes**, »The New Citroen« (Fr. 1957), in same author, *Mythologies*, New York 1972, p. 169.

↳**BMU—Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit**, »Wissenschaftliche Grundlagen«; status on 09 April 2014. https://www.bmu.de/themen/klima-energie/klimaschutz/wissenschaftliche-grundlagen/#c9380 [accessed on 7 April 2021]

↳**BVL.digital and HERE Technologies** »Analyse Verkehrsdaten,« 2019. https://go.engage.here.com/Accelerating-Urban-Logistics.html [accessed on 7 April 2021]

↳**Weert Canzler and Andreas Knie**, *Die digitale Mobilitätsrevolution. Vom Ende des Verkehrs wie wir ihn kannten*, Munich 2016.

↳**Tim Dant**, »The Driver-Car,« in *Theory, Culture & Society*, vol. 21 (4/5), pp. 61–79.

↳**Deutscher Bundestag, Parlamentsnachrichten**, »Verkehr und digitale Infrastruktur/Antwort,« 22 March 2018 (hib 182/2018). https://www.bundestag.de/presse/hib/2018_03/548536-548536 [accessed on 12 March 2021]

↳**Deutsches Klima-Konsortium, Deutsche Meteorologische Gesellschaft, Deutscher Wetterdienst, Extremwetterkongress Hamburg, Helmholtz-Klima-Initiative, klimafakten.de** (eds.), *Was wir heute übers Klima wissen. Basisfakten zum Klimawandel, die in der Wissenschaft unumstritten sind*, status on September 2020. https://www.deutsches-klima-konsortium.de/fileadmin/user_upload/pdfs/Publikationen_DKK/basisfakten-klimawandel.pdf [accessed on 7 April 2021]

↳**Peter Eckart**, »Schnee und öffentlicher Raum. Über das Verhältnis von Design und Sprache im öffentlichen Interesse,« in Thilo Schwer and Kai Vöckler (eds.), *Der Offenbacher Ansatz. Zur Theorie der Produktsprache*, Bielefeld 2021; pp. 351–361. doi.org/10.14361/9783839455692-026

↳**Peter Eckart and Kai Vöckler**, »Design your Mobility! Die zukünftige Mobilität gestalten / Shaping Future Mobility,« in Christian Holl, Felix Nowak, Kai Vöckler, Peter Cachola Schmal (eds.), *Rhein-Main—Die Region leben. Die Neugestaltung einer Metropolregion / Living the Region—Rhine-Main. The Redesign of a Metropolitan Region*, Tübingen/Berlin 2018, pp. 158–167.

↳**Daniel Martin Feige**, *Design. Eine philosophische Analyse*, Berlin 2018.

↳**Michael Geuenich**, »›...gibt es auch mal ein Küsschen auf das Lenkrad.‹ Anthropomorphisierungen von Technik und die fragile Black Box Automobil,« in Martina Heßler (ed.), *Technikemotionen. Geschichte der technischen Kultur*, vol. 9, Paderborn 2020, pp. 271–290.

↳**Jochen Gros**, »Grundlagen einer Theorie der Produktsprache. Einführung,« ed. Hochschule für Gestaltung Offenbach, Offenbach am Main 1983 [reprinted in Schwer and Vöckler 2021, pp. 88–122]

↳**Ludwig Hruza**, »Erinnerungen an das Eisenbahnzeitalter,« FAZ Net 10 January 2020. https://www.faz.net/-hfh-9umsm [accessed on 28 April 2021]

↳**Valeska Huber**, »Multiple Mobilities. Über den Umgang mit verschiedenen Mobilitätsformen um 1900,« in *Geschichte und Gesellschaft*, 36 (2), 2010, pp. 371–341.

↳**ITF – International Transport Forum**, *ITF Transport Outlook 2017*, Paris: OECD Publishing 2017. doi.org/10.1787/9789282108000-en

↳**Jack Kerouac**, *On the Road*, (Engl. 1955), Viking Press, 1957.

↳**Tobias Kuhnimhof and Gernot Liedtke**, »Geht das Zeitalter des Autos zu Ende? Über Gegenwart und Zukunft der Mobilität,« *Forschung und Lehre*, no. 6, 2019, pp. 514–517.

↳**Le Corbusier**, *The City of Tomorrow and Its Planning* (Fr. 1925), New York, 1987.

↳**Thomas J. Mager**, »Wie sieht die Zukunft der Mobilität aus. Stadt- und Verkehrsplanung für eine nachhaltige Verkehrswende,« in *Planerin* 5/17, 2017, pp. 30–32.

↳**MiD – Mobilität in Deutschland 2017.** »Ergebnisbericht,« written by Claudia Nobis and Tobias Kuhnimhof. Study by infas, DLR, IVT, and infas 360, commissioned by the German Federal Ministry of Transport and Digital Infrastructure (FE-np. 70.904/15). Bonn, Berlin 2018. Download: www.mobilitaet-in-deutschland.de (an abridged English version is available at https://www.bmvi.de/

SharedDocs/DE/Anlage/G/mid-2017-short-report.pdf?__blob=publicationFile)

↳**Stephan Rammler**, »Vom Think Tank zum Do Tank – und zurück.« Transportation Design als wissenschaftlich basierte Gestaltung zukunftsfähiger Verkehrssysteme, in W.-H. Arndt (ed.), *Beiträge aus Verkehrsplanungstheorie und -praxis* [presentations in the context of the colloquium »Verkehrsplanungsseminar 2002 und 2003« organized by the Chair of Integrated Transport Planning of the Institut für Land- und Seeverkehr of the Technische Universität Berlin]. TU, Univ.-Bibliothek, Abt. Publ. Berlin 2003, pp. 121–137.

↳**Stephan Rammler**, *Schubumkehr. Die Zukunft der Mobilität*, Frankfurt am Main 2014.

↳**Stephan Rammler**, *Volk ohne Wagen: Streitschrift für eine neue Mobilität*, Frankfurt am Main 2017.

↳**Martin Randelhoff**, »Vergleich unterschiedlicher Flächeninanspruchnahmen nach Verkehrsarten (pro Person),« status on 19 August 2014. https://www.zukunft-mobilitaet.net/78246/analyse/flaechenbedarf-pkw-fahrrad-bus-strassenbahn-stadtbahn-fussgaenger-metro-bremsverzoegerung-vergleich [accessed on 12 April 2021]

↳**Hans Bernhard Reichow**, *Die autogerechte Stadt. Ein Weg aus dem Verkehrs-Chaos*, Ravensburg 1959

↳**Wolfgang Sachs**, *Die Liebe zum Automobil. Ein Rückblick in die Geschichte unserer Wünsche*, Reinbek bei Hamburg 1990 [1984]

↳**Thilo Schwer and Kai Vöckler** (eds.), *Der Offenbacher Ansatz. Zur Theorie der Produktsprache*, Bielefeld 2021. doi.org/10.14361/9783839455692

↳**Statista Research Department**, 16 March 2021. www.statista.com/statistics/281134/number-of-vehicles-in-use-worldwide [accessed on 24 April 2021]

↳**UBA – Umweltbundesamt**, »Kurzfristig kaum Lärmminderung durch Elektroautos. Positionspapier,« 18 April 2013. https://www.umweltbundesamt.de/sites/default/files/medien/377/dokumente/position_kurzfristig_kaum_laermminderung_im_verkehr.pdf [accessed on 12 April 2021]

↳**UBA – Umweltbundesamt**, »Curbing Overdevelopment,« status on 14 October 2020. https://www.umweltbundesamt.de/en/topics/soil-agriculture/land-use-reduction/curbing-overdevelopment#land-use-in-germany [accessed on 12 April 2021]

↳**UBA – Umweltbundesamt** (2020a), »Emissionsquellen,« status on 30 July 2020. https://www.umweltbundesamt.de/themen/klima-energie/treibhausgas-emissionen/emissionsquellen#energie-stationar [accessed on 9 April 2021]

↳**UBA – Umweltbundesamt** (2020b) »Transforming the Transport Sector for EVERYONE,« position paper, August 2020, p. 9 [auto ownership, according to economic status and household in Germany in 2018] and p. 10 [CO_2 emissions per person and differentiated by transport mode and equivalent household income]. https://www.umweltbundesamt.de/sites/default/files/medien/1410/publikationen/pp_verkehrswende_fuer_alle_englisch_bf.pdf [accessed on 25 April 2021]

↳**UBA – Umweltbundesamt**, »Fahrleistungen, Verkehrsleistungen und ›Modal Split,‹« status on 22 February 2021. https://www.umweltbundesamt.de/daten/verkehr/fahrleistungen-verkehrsaufwand-modal-split#fahrleistung-im-personen-und-guterverkehr [accessed on 9 April 2021]

↳**John Urry**, »The ›System‹ of Automobility,« in Theory, *Culture & Society*, vol. 21 (4/5), pp. 25–39. doi: 10.1177/0263276404046059

↳**John Urry**, *Mobilities*, Cambridge (UK) 2007.

↳**John Urry**, *Societies Beyond Oil*, London, New York 2013.

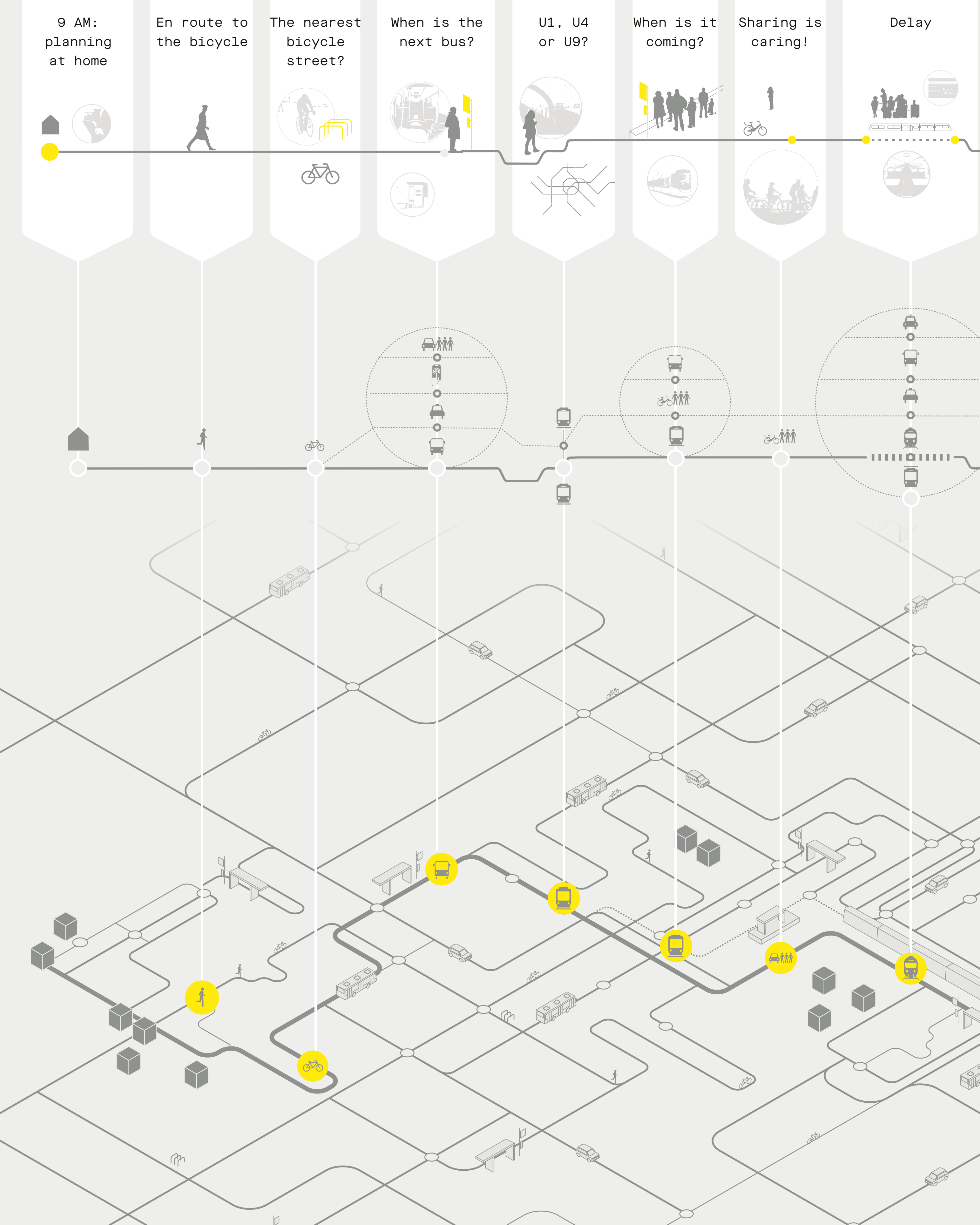
↳**Jules Verne**, *The Mysterious Island* (Fr. 1874). Orlando, California 2019.

↳**Kai Vöckler**, *Die Welt als Stadt. Ein Raumbild des 21. Jahrhunderts*, Berlin 2014.

↳**Kai Vöckler**, »In-Formation. Zur produktsprachlichen Analyse von Mobilitätsprozessen,« in Thilo Schwer, Kai Vöckler (eds.), *Der Offenbacher Ansatz. Zur Theorie der Produktsprache*, Bielefeld 2021, pp. 362–382. doi.org/10.14361/9783839455692-027

Designing Intermodal Mobility

The focus of mobility design is the space of action used by mobile users—beginning with the planning of individual mobility and extending to its practical implementation. Playing a decisive role in intermodal, environmentally friendly mobility, involving the use of a variety of mobility options along a given route—including, and not least of all, travel on foot—is *seamless mobility*. This means that from the very beginning, users need to have a clear understanding of the options offered by an intermodal mobility system: only this allows users to become properly oriented, to make good decisions, and to proceed toward their destinations with as few disturbances and complications as possible. Accessibility and the intelligibility of the mobility system are preconditions for uncomplicated mobility. But there is more: vitally important for physical movement through the mobility system are not just interfaces with digitally supported information systems, but in particular the touch points of the mobility system. This must be understood literally: among the essential prerequisites for the functioning of the system is the serviceability of objects, for example bicycle storage units, ticket vending machines, and the means of transport themselves, as well as the accessibility (absence of obstructions) of the spaces of mobility. Equally important is the experiential aspect: is the user's need for safety, privacy, and sociality adequately satisfied? Do the overall amenity and experiential qualities results in a sense of well-being? Does the mobility system, in all of its aspects, convey respect for me as a user? Do I perceive myself as participating in a shared, public mobility system that is viable for the future? The quality of user interaction with the mobility system is central to the acceptance of new forms of mobility and represents a genuine design task, for it mediates between user and system, striving to provide a positive experience via design decisions. The diagram below provides an overview of a prototypical multipart journey and exemplifies the way in which the user-oriented design of the spaces and processes, of objects and information, ensures the serviceability of the interfaces and touch points of the mobility system.


9 AM: planning at home
En route to the bicycle
The nearest bicycle street?
When is the next bus?
U1, U4 or U9?
When is it coming?
Sharing is caring!
Delay


Tuk-tuk
At work
Is there a shuttle service nearby?
Car sharing
Taxi
City train
Autonomous driving
6 PM: back home

Connective Mobility

Peter Eckart &
Kai Vöckler

Connective mobility refers to the interconnection of different transport systems through moving individuals. The connectivity of the system only comes about through mobile use: that is, intermodal mobility. It is crucial to understand intermodal mobility as a dynamic process through which networking is enacted in the first place. Mobility design is concerned with the interaction of users with a mobility system. Design shapes the access to the system. It creates recognizability, enables orientation, and ensures functionality and accessibility, making the mobility system as easy to use as possible for everyone, regardless of age, capabilities, or status. And not least, the value and significance of this form of mobility is communicated through the design.

In this section of the book, the shaping of the physical aspects of intermodal mobility systems is introduced. The digital expansion of mobility systems will be discussed in more detail in the section titled »Augmented Mobility.« With mobile access to the internet via smartphones and tablets (and via other technical interfaces in future), a substantial improvement in the planning and implementation of intermodal mobility has been achieved for users. This has opened the way to a revolution in mobility technology, based on the two principles of »networking« and »sharing.« Through the connection of digitally supported communication platforms with collaboratively shared and thus more efficiently utilized transport modes, environmentally friendly and intelligent mobility will be possible. However, smartphones (and other technical information and communication tools) do not transport people. For this, a transportation infrastructure is necessary to provide for physical mobility. As already mentioned in the introduction, this transportation infrastructure consists of pedestrian and cycle paths (see section: »Active Mobility«), and of public transport (bus, train), supplemented by different sharing services, from ride-sharing to jointly used vehicles. In addition, there are semi-autonomous (and soon fully autonomous) vehicles that are utilized as public vehicles on demand and as required. Test projects for this have already begun (see section: »Visionary Mobility«). However, from the perspective of users, all of these mobility services should be understood as an interconnected system that can flexibly adapt to mobility choices. In an intermodal mobility system, users interact with a highly complex system of different services that are physically embedded in space—such as mobile transport modes, along with essential and supportive stationary spaces and objects, which provide the relevant information in analog form. Accordingly, the section titled »Connective Mobility« is also organized under the subheadings of mobility hubs, information and wayfinding systems, climate-friendly transport modes, and architectural and urban design projects that cleverly integrate environmentally friendly mobility into planning and design.

The development of a well-functioning intermodal mobility system is not only a question of a political will to shape things, or of comprehensive organization and planning. Rather (as mentioned above), it is essentially a task for mobility design. Only through the design will users be made aware of the significance and value of this new, progressive mobility—in fact immediately during usage. For this reason, its design requires a systematic approach that considers all components of the mobility system at once: from bike stands, to transport vehicles, to station halls. Each of these individual elements facilitates user access to the entire mobility system: through the essential characteristics of comprehensibility and usability, its significance, and the emotional and symbolic impact of the designed mobility spaces. This fundamental problem for future mobility design, namely, taking a systematic approach to an intermodal mobility system, will be illustrated through the selected examples included here. The choice of projects include here was not only based on outstanding design quality, but also on how functional usability, emotional impact, or symbolic meaning were conveyed through design—as will be explained in the accompanying project texts. This book does not aim to offer a comprehensive overview, nor to provide assessments. Rather, the selection was based on insight gained from systematic observation, often of a special solution or a precisely worked-out detail. Therefore, it is also the reader's job to make the overarching connections, and at the same time to see and appreciate good design quality in the individual cases.

Here are a few introductory thoughts and examples. In order to enable access for all users, a mobility system must first be designed so that it is recognizable as a cohesive whole. This is a well-known fact that it was already necessary to achieve this during the development of the public inner-city transport systems with their interlinking of buses, streetcars, express trains and subways. A decisive factor for achieving this is the information and wayfinding system that provides the necessary orientation information, while symbolically expressing the meaning of the system as one of the most important elements of everyday urban life. In this context, good design is crucial, yet as is often overlooked, it is also important to sustainability. A pertinent example: in the nineteen-thirties, the draftsman Harry Beck created a map for the London Underground network that was no longer oriented according to geographic features. Instead, his new map represented the connections between stations and lines so that users would be clearly provided with the necessary information to orient themselves within the system. That is, he reconceived the map from the user's perspective. Today, his work remains a landmark design for underground maps, which has been refined in countless variants and further developed in digitally based dynamic versions. However, architecture and design do not only support the usability of the various elements (such as maps, ticket machines, benches, transport modes, train stations); they also influence user experience by responding to their need for spatial and experiential quality. An interesting example is how the train acted as the most important element of mobility development in the nineteenth century. Train station buildings of the time were designed to reflect their new social significance. They took on great importance as the critical starting, ending, and connecting points of a journey—both symbolically, as new »city gates,« and practically as functional complexes. The main train station buildings in the big cities adapted the architectural vocabulary of medieval cathedrals, an immediately recognizable symbolism for contemporaries. This was also expressed through the spatial configuration. The impressive train station halls, with their great height and width, symbolized the meaning of this transportation structure through their powerful spatial effects. This is still perceptible today. A good example is the Zurich train station hall, which fortunately was freed of all the later provisional additions in the late nineteen-eighties, following a citizens' initiative.

History can inform the design of a new, environmentally friendly intermodal mobility system, as demonstrated by the example of Pennsylvania Station in New York City. Along with Grand Central Station Terminal, it is one of the most important train stations in the metropolis, where up to 650,000 commuters arrive and depart every day. This is also thought to have been one of the most beautiful train stations in the US (in 1934, poet Langston Hughes dedicated a moving poem to it). In 1963, it was destroyed and literally forced underground to make way for the new Madison Square Garden. Consequently, the station became the symbol for a kind of transport planning that had completely lost touch with the needs of users, who from then on literally felt »like rats in a maze.« Many proposals were made before it was finally possible to give some of the deserved meaning back to this place. An adjacent 1912 post office building of the same era by the architects McKim, Mead & White (who also designed Penn Station) was redesigned as the entry hall and dedicated in 2021. The architects in charge of the redesign, SOM (Skidmore, Owings, & Merrill), created an imposing glass roof structure that emphasizes the expansiveness of the space and its lighting effects, resulting in an impressive experience. Here, a symbolic quality was recovered, which is immediately perceptible to users. To repeat this, it is a matter of how the mobility system »speaks« to me, how it imparts meaning—here through the entry and reception hall. That is the real task of the design disciplines, to bring this symbolism into everyday experience as well. This is already evident in the detail. Take the famous bullseye logo of the London Tube, which from the beginning accompanied the development of the oldest underground train system in the world, and eventually gained pop culture status in the nineteen-sixties. This logo has even been put on T-shirts. It continues to stand for the system as a whole, and with its high-quality materiality (signs are still porcelain enamel), it symbolizes what it stands for at every station of the underground network: the London Tube.

More such examples can be easily found. Most importantly, it is the people themselves who recognize whether they are being treated like »transportation cases,« or if they are being shown genuine respect in the designing of their everyday world, in this case transportation spaces. A new, collaborative, and intermodal mobility, based on the principle of sharing the use of transport modes and spaces with others, must develop a design vocabulary that reflects the needs and desires of users. And this design vocabulary must address everyone; it must be an expression of a communal mobility system for all of society. The design of public metro systems in the twentieth century demonstrates how they have become a central element of urban, and indeed national identity. Who could imagine Paris without its Métro? Just how deeply anchored the meaning of this public system is in the collective consciousness is revealed by the arts. Think for example of Raymond Queneau's novel *Zazie dans le metro* (Zazie in the metro), which was filmed by Louis Malle immediately after it was published (and which led to the naming of a Paris Métro station after Queneau). And if you look at New York City, it is not only the skyscraper silhouette of Manhattan, but also the New York City Subway information system designed by Unimark/Massimo Vignelli in 1970, which stands for the city itself and has embedded itself in the collective consciousness. Even a Stalin-era propaganda project such as the Moscow Metro, which was begun in the nineteen-thirties, still impresses us today with its luxurious stations designed to be like »palaces of the people:« nothing was too good or too costly. The sumptuous fittings recall the design vocabulary of feudalism, transformed to become the setting for a Communist utopia (which Bertolt Brecht celebrated in a 1935 poem as »The takeover of the great Metro by the Moscow working class«). Countless poems, novels, and theater pieces have been written and even films have been made about the Moscow Metro. Even if little has remained of the utopian vision, these underground stations are still today a part of Moscow's identity. Just how deeply this symbolism has shaped the consciousness of the residents is evident at the Revolution Square Metro Station, where thousands of Muscovites stroke the bronze statue of the Red Guard with his guard dog as a good luck charm every day as they pass it. As the Belarussian writer Viktor Martinowitsch fittingly wrote in his 2017 novel, *Revolution*: »A couple of stations, change, everything as in a dream. The Moscow Metro is like a dream that the tired big city dreams. And all of the people with their fates, their lives, and their burdens only appear as a fleeting dream narrative to this Moloch, until he rolls on his side and falls into an even deeper sleep. When you arrive underground, you don't need to think anymore, you can just shut your eyes, flow through his arteries, and let yourself dream of him.«

Mobility design is not just the »beautification« of technical transport systems, of structures and objects of use. Rather, it ensures usability, aids understanding, creates meaning, and thus persuades the people who use it to accept it. That is much more than just market-driven »differentiation,« that is, the target-group-specific design of means of transport, as is common in automotive design. Public mobility services in particular must appeal collectively to all people, symbolically expressing their importance to society as a whole. Developing a formulation for this is the job of future mobility design, as the projects introduced here clearly demonstrate.

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↳**p. 87** Courtesy of unit-design, Hongik University (Seoul); **pp. 88–90** Courtesy of unit-design, author unknown (photos)
↳**pp. 92, 93 top** BURRI public elements AG (photos); **p. 93 bottom** Kai Flender (Freier Architekt)
↳**pp. 95 (detail), 96** Cobe and Gottlieb Paludan Architects, Rasmus Hjortshøj—COAST (photos); **p. 98** Cobe and Gottlieb Paludan Architects
↳**p. 100** Ector Hoogstad Architecten; **pp. 101–103** Ector Hoogstad Architecten, Petra Appelhof (photos)
↳**pp. 105–108** unit-design and netzwerkarchitekten
↳**p. 109** Eibe Sönnecken (photos); **p. 110** Deutsche Bahn AG, Julie Wieland (graphic, content updated by HfG in consultation with Deutschen Bahn, as of: 05/2021);
p. 111 top Deutsche Bahn AG, Dominic Dupont (photo); **p. 111 bottom** Deutsch Bahn AG, Oliver Lang (photo)
↳**pp. 112, 113 top** Metroselskabet I/S (network plan and photo); **p. 113 bottom** Metroselskabet I/S, Søren Hytting (photo)
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↳**pp. 125, 126 top** RCP, Leonard de Serres (photos); **p. 126 bottom** DB/VG Bild-Kunst, Bonn 2021
↳**pp. 128, 129** Inga Masche (photos)
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↳**pp. 135–137** Irizar e-mobility
↳**pp. 139, 140** Kazuyo Sejima & Associates (photos)
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↳**p. 147** Press images Smovengo, Vankemmel-Thibaut (photos), https://www.smovengo.fr/medias/ [accessed on 29 March 2021];
p. 148 photo: Station Vélib' Métropole Gare RER—Vincennes (FR94) – 2020-10-04 – 3; author: Chabe01; license: CC BY-SA 4.0, https://creativecommons.org/licenses/by-sa/4.0/deed.en; source: https://commons.wikimedia.org/w/index.php?curid=94750370
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↳**p. 163** Wien 3420 aspern Development AG; **p. 164** Wien 3420 aspern Development AG, Daniel Hawelka (photos)
↳**pp. 166, 167, 168 top** BIG—Bjarke Ingels Group, Jens Lindhe (photos); **p. 168 bottom** BIG—Bjarke Ingels Group, Iwan Baan (photo); **p. 169** BIG—Bjarke Ingels Group
↳**p. 171** BIG—Bjarke Ingels Group, Jakob Bosserup (photo); **p. 172** BIG—Bjarke Ingels Group, Ulrik Jantzen (photos), **p. 173 top** BIG—Bjarke Ingels Group, Iwan Baan (photo); **pp. 173 bottom, 174** BIG—Bjarke Ingels Group
↳**pp. 176, 177, 178 top** Michael Egloff(photos); **p. 178 bottom** Martin Stollenwerk (photo); **p. 179** Müller Sigrist Architekten

WalkNYC: Standardized Wayfinding System

Exploring New York City is exciting. However, it's not only difficult for tourists to find their way around the city, even residents can quickly lose their bearings. To make getting around easier for everyone, and to encourage people to walk, cycle, and use public transport, the »WalkNYC« program was introduced.

Since 2013, this wayfinding system has provided residents and visitors with an internationally significant service that has already received numerous awards. The system, which consists of information kiosks on streets, at bus stops, subway stations, cycle rental stations, and ferry docks, helps pedestrians and cyclists to quickly orientate themselves by providing them with important information about available transport modes and links at their location.

This project was initiated at the behest of former mayor Michael Bloomberg and Janette Sadik-Khan, the Commissioner of the New York City Department of Transportation (NYC DOT). Following a public call for bids, in 2011 the PentaCityGroup was commissioned to develop the system. This group is supported by an interdisciplinary team with diverse areas of specialization: with City ID as the lead designers, the graphic designers of Pentagram, the industrial designers of Billings Jackson Design, the engineers and urban planners of the RBA group, and T-Kartor as the developers for the geoinformation system database.

The collaboration between the NYC DOT and the PentaCityGroup began with workshops aimed at precisely defining the goals of the project. The NYC DOT wanted to introduce a universal system that would be applicable to a wide variety of locations and situations, could be used by everyone, and would robustly support a cross-modal transit experience: the transfer between different transport modes was to be made as simple as possible. Facilitating car-free travel and promoting more sustainable forms of mobility are consistent with New York City's policy agenda. They took into account the overall travel experience of users, including their sense of well-being and their perception of the urban environment. The wayfinding system was to be integrated within the DNA of the city in order to build trust and allow people to quickly become familiar with it. Ultimately, the workshops concluded, WalkNYC should connect people with the entire city by inviting them to explore New York.

Following the first workshops, a design team swiftly began a series of tests and user analyses as a means of understanding how people orient themselves and move through the city. This research informed the overall design process. To this end, the team interviewed local people on location about their knowledge of the immediate vicinity and asked them to map it out.

In order to develop the visual identity of WalkNYC, in the preliminary phase the team took stock of the most common graphic signs in the city and how these were perceived. Based upon this research, the decision was made to use the signage designs of the New York City subway system. Bob Noorda and Massimo Vignelli of Unimark International designed this signage in 1970, which has since become iconic. Since the already familiar signage was used as the basis for the new system, users would only have to learn a few new symbols, with the added benefit that WalkNYC immediately gained the status of an official project. Existing subway signage provided the basis for the typography, layout, and colors, such as white writing on a dark background. The typeface used in subway signage was adapted: the new »Helvetica DOT« appropriated the existing style and expanded on it. In addition, new symbols were created for the most well-known buildings. Elements of the city inspired the limited color range: the yellow walk signals, green parks and cycle paths, white-striped crosswalks, and the gray streets and sidewalks. It was essential that the clear visual vocabulary stand out from the cluttered streetscape.

Another aspect that is special about WalkNYC is the use of head-up rather than north-oriented mapping. On each panel the map is oriented so that it corresponds to the viewing-direction of the person looking at it. In fact, a survey showed that 84% of those questioned preferred the head-up mapping over the traditional north-up or grid north formats. The head-up map focuses on the user's location within the immediate vicinity, while another map shows it in the larger context. This visual language was conceived so that it could be utilized in different media.

Different formats were intensively tested in order to ensure that the WalkNYC information panels would be placed in highly visible locations along pedestrian routes and in areas near subway stations and other transport hubs, in heavily frequented pedestrian zones and popular destinations. Information panels were to be slender, modern, and unobtrusive, and at the same time resistant to vandalism and weathering. For the protective covering, the team specified an assemblage of steel and glass—materials that also dominate the buildings of New York City. An entire family of products was developed that could be used in a wide variety of situations. The WalkNYC wayfinding system is a key component in the New York City Street Design Manual—an important resource for the further enhancement of the streetscape and infrastructure of the city. WalkNYC pedestrian signs are installed citywide on sidewalks and in plazas.

Location New York City, USA Introduction 2013–ongoing Client New York City Department of Transportation (DOT) Design PentaCityGroup – Design consortium of City ID (lead design, wayfinding specialist), Pentagram (graphic design), Billings Jackson Design (industrial design), RBA Group (engineering and urban planning), T-Kartor (GIS database development) In collaboration with Monotype (typography), Future Systems (fabrication)

Bus service totem with integrated real-time information