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The Bicycle System

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Origin

During the 1990s, in developed countries, local authorities realized that creating cycling facilities alone was not enough to revive the practice of cycling. Many other factors were essential for supporting cyclists, securing their travel, encouraging the practice, and fostering their skills..

Components

The bicycle system is composed of:

- a continuous, connected, uniformly safe cycle network (CERTU, 2000, CROW, 2017) that aims to cover the entire road network, with facilities (tracks, lanes or shared bus cycle lanes[^1]) on roads limited to 50 km/h, reduced traffic areas (30 km/h zones, home zones and pedestrian zones) on all roads where local life dominates, contraflow bicycle lanes on one-way streets and overpasses or underpasses for crossing barriers in the urban landscape (large roads, railways, waterways, etc.);
- reliable bicycles with the necessary equipment at affordable prices to make frequent, comfortable and safe use possible;
- services such as parking facilities at home and at the destination (stations, workplaces, shopping areas, etc.), repair shops in every neighborhood, bicycle rental services (from half an hour to annual rentals), road signage, network maps, digital applications;

- obligation to make notably contraflow bicycle lanes on one-way streets, yield signs at red lights[^2] and parking facilities in buildings, factories and offices[^3];
- communication presenting the economic, environmental and health benefits of cycling to individuals and to the community, adapted to specific audiences;
- teaching children how to cycle, teaching adults who do not know how to ride a bicycle, and teaching all users rules for peaceful cohabitation on the road.

Systemic nature

All of these components complement and mutually reinforce one other, forming a system. However, the bicycle system cannot exist in isolation and forms part of the overall transport system.

The origin of the concept

As is the case for all simple concepts, several authors have developed the idea of a bicycle system simultaneously and independent of one another (Héran, 2001; BMVBW, 2002; De Wilde, 2002; see also Horton and Parkin, 2012; Ensink and Karsten, 2014 ; ; Luciano, 2017). Additionally, some cities understood much earlier than others the importance of introducing a bicycle system without necessarily stating this goal explicitly. In France, the Urban Community of Strasbourg launched a comprehensive scheme to develop urban cycling, elaborating a detailed plan in 1994 (Hauser, 1994). In Germany, the federal government decided to financially support ten pilot cities in becoming "bicycle-friendly cities" (*fahrradfreundliche Städte*) as early as 1979. It is therefore inaccurate to attribute the origin of the concept to any one individual or place, or to trace a clear historical trajectory.

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 Although the reference is rarely explicit, the concept of bicycle system was actually modeled on that of the automobile system. In 1988, town planner Peter Hall explained that car use requires not only a high-quality, extensive road network, but also mass production and mass consumption of cheap vehicles, sufficiently well-respected road rules, traffic information, international traffic rules, and a variety of services such as petrol stations, motels, fast food, shopping centers with large car

parks and garages, all of which make it possible to live, work and consume over large areas (Hall, 1988; Dupuy, 1995).

In fact, regular use of a mode of transportation constitutes a "modal system", whose basic structure is always comprised of four components: 1) an efficient, comfortable and safe transport mode[^4] 2) well-trained users 3) a continuous, connected, safe network and 4) a regulated, friendly environment.

In urban areas, the bicycle system, along with walking, public transportation and carpooling, can offer an "environmentally-friendly transportation system”[^5] capable of competing with the automobile system. Bike & ride is often faster than car travel.

The rise of the bicycle system

In order for a bicycle system to develop, all the components of the system need to progress simultaneously in order to avoid bottlenecks. For example, it is pointless to increase cycling amenities if cyclists cannot park their bicycles safely (or vice versa). Similarly, creating a large bikesharing services while the cycle network is still in its infancy makes little sense. It is likewise useless to encourage people to cycle if vast efforts are being made to prioritise car traffic. The authorities are becoming aware of these discrepancies and are trying to rectify the problems.

Four virtuous circles can therefore be activated within the four components of any modal system. 1) A park effect: the more bicycles there are available, the more the supply expands and diversifies to meet different tastes and needs (electrically assisted cycles, carrier cycles, cargobike, delivery tricycle, etc.), equipment (brake hubs, powerful lighting systems, puncture-proof tires, audible bells, comfortable saddles, etc.) and accessories (ponchos, gloves, helmets, bags, trailers, etc.). 2) A club effect: the more the cycling community grows, the more its members can help each other, and the more it increases its influence and imposes cycling as a new standard of behavior. 3) A network effect: the denser and more connected the network, the more attractive and efficient it becomes by making cycling more relevant (these three effects are inspired by Dupuy, 1999, chapter 3). 4) A safety in numbers effect: the more cyclists there are, the safer they are (Jacobsen, 2003), as they become more visible to other users, calm traffic by their slow speed, enjoy more amenities, and are often themselves drivers who become more aware of the presence of cyclists (Johnson, 2014).

These four virtuous circles mutually reinforce one other and make the upward dynamic of cycling irresistible – a veritable "cycling renaissance" (Pucher and Buhler, 2012). This can especially be seen today in the calm centers of big cities, but it is spreading to the close and outer suburbs, to medium and small towns, to less experienced cyclists, and among both middle and lower classes. According to existing data, at the height of this boom, the annual growth rate is 10 to 15% per year, or a doubling of the practice every 5 to 7 years Figures 1 and 2).

Figure 1. Change in bicycle use in Paris, Lyon, Bordeaux, Brussels, London and Geneva, from 2001 to 2017 (index 100 in 2001)[^6]

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Figure 2. Change in bicycle use in major U.S. cities, from 2005 to 2014, based on home-work commuting counts (rolling averages over three years)[^7]

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 The bicycle system can also collapse when motor vehicle traffic and speeds increase rapidly, which threaten cyclists directly. In the developed countries of Western Europe during the years of post-war growth, the motorization rate increased by about 10% per year. The four circles identified above began turning in the other direction, which explains the veritable collapse of cycling at that time, with a six-fold decline in countries that motorized the earliest (e.g. the United Kingdom and France) (Figure 3) over a period of 25 years. It then fell threefold in countries that motorized later, such as the Netherlands (Figure 4). The collapse was only halted by the energy crisis in 1974, and later by the traffic calming policies initiated in some countries, under pressure of populations overwhelmed by the nuisances linked to the automobile. Hence, the cycling modal share varied greatly according to the country in the early 2000s (Figures 5) (Héran, 2014).

Figure 3. Change in the number of cycling trips in the United Kingdom (in billions of passenger-kilometers)[^8]

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Figure 4. Change in the number of cycling trips in the Netherlands (in kilometers per year per inhabitant)[^9]

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Figure 5. Cycling modal share in European countries in the early 2000s (in %)[^10]

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The role of bikesharing systems

In Western countries, bikesharing services were in no way responsible for the revival of cycling. However, they have helped accelerate the renaissance that began several years ago. Data from cities where such a system is developed enough to influence practices (Lyon, Paris, London, Brussels, New York, Barcelona, etc.) clearly show this. More specifically, people are getting back on their bicycles first and foremost thanks to traffic calming policies in city centers. When bikesharing systems appear on the scene, they benefit from the windfall effect of a price that is three to seven times less (depending on the cost of the subscription) than owning a bicycle. But in the long term, the trend has hardly changed and is identical to that of cities without bikesharing (e.g. Grenoble and Ghent) or with a small bikesharing system (e.g. Strasbourg).

Public bicycles cannot replace a cyclable city policy, as they only help cyclists to get around the problems they encounter and do not solve them directly. Because of their high cost to the community (about 3,000€ per year per cycle) and the room they require in the public space (bicycles are spaced far apart, and stands must also have empty spaces), their potential is limited. Communities quickly run up against the classic economic problem of optimal allocation of scarce resources. If they are unable to find new funders, they generally reduce their bikesharing services to specific uses (notably tourism) and reallocate their budgets to dealing with the problems encountered by cyclists at their source: the purchase of quality bicycles, parking at

home and at the destination, breakdown repair, bicycle or accessory theft, the cyclability of the network, etc.

Bikesharing services without stands (known as free floating) are not a viable alternative to those with stands. Contrary to their promoters' assertions, they are not free for the community because they carry three hidden costs: 1) the cost of occupying the public space, for which municipalities justifiably want to charge a fee; 2) the cost of surveying the public space due to antisocial behavior that inevitably results from the illegal abandonment of bicycles everywhere[^11], and; 3) the cost of organizing the public space, as it is necessary, for safety reasons, to remove bicycles that clutter areas heavily used by pedestrians. In other words, to reduce these three costs and facilitate maintenance, free-floating bikesharing operators have come to realize that it is preferable to leave bicycles at specific places – i.e. stands[^12].

Perspectives

The current optimization of the bicycle system opens up amazing prospects. In Western Europe, it took nearly a century to create a remarkably efficient automobile system with reliable, comfortable, safe vehicles, a dense network of highways and expressways, abundant car parks, numerous services, suitable road rules, etc. In many countries, such as France, the United Kingdom and Spain, the bicycle system is still at the level of the automobile system in the 1930s. The potential for progress is therefore great and can already be seen in more advanced countries like the Netherlands, Scandinavian countries and Germany. All aspects of the system are concerned: bicycles, network, public, services, regulations, communication and training, and results could be obtained more quickly than for the automobile system, which is much more complex and costly to set up.

Human energy can be used more efficiently, with more aerodynamic recumbent bicycles or velomobiles (bicycle cars) (Van De Walle, 2004), whose spread has begun in pioneer countries such as the Netherlands and Denmark. Electric assistance (limited to 250 Watts by a European standard) can triple cyclists’ riding power while limiting speeds, as speed is a source of danger. In recent years, electric-assisted bicycle use has increased by approximately 30% per year (Fishman and Cherry, 2015)[^13].

Super cycle tracks networks can cross expressways, railways and waterways, and limit detours, stops and restarts, which are energy-intensive for cyclists, by ensuring an average speed of 20 km/h. Many places, including the Netherlands, Copenhagen, North Rhine-Westphalia, London, Paris, Strasbourg and Grenoble, have already started building them.

Cyclists are increasingly diverse. With the rise in motorization after the War, the utility cycling had become obsolete. It initially made its comeback in more peaceful city centers, among the health-conscious upper middle class. Today, bicycles and cycling are widespread among the lower middle class in suburbs and medium-sized towns. The working classes are also getting into it, as evidenced by the success of the bicycle-schools and bike workshops in areas with low-income housing. Cycling is also becoming more popular among women. While early on in its revival men represented 2/3 of cyclists, the across-the-board trend is towards equalization, as demonstrated by the success of city bicycles with a step-through frame, which are as practical and safe for women as for men, and the development of bicycle transportation solutions for children, which is still too often left to the mother (Dalouche, 2016).

The uses of the bicycle have also diversified, with each audience finding its own way of cycling. Parents are thrilled with using carrier cycles for transporting children or groceries. Artisans use delivery tricycles as an environmental argument, and to reduce costs. Board-sport lovers use fixies[^14]. Acrobats try unicycles. Peri-urban residents appreciate electrically assisted bicycles. Technophiles prefer velomobiles. The nostalgic resurrect old fashioned bicycles. Dandies distinguish themselves with trendy bikes. Older people enjoy more stable tricycles. Some disabled people are able to find autonomy thanks to the handicycles. There is something for everyone (see Figure 6).

Figure 6. The increasing diversity of cycling cultures.

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 Participative and solidarity workshops make up for a lack of bicycle sellers and repairers in neighborhoods and have spread across Europe in the past 10 years at a robust pace of 20 to 40% per year[^15]. Cycling schools, which are also booming, teach adults to ride and increase their autonomy[^16]. The media is finally becoming more receptive to various cycling cultures.

All of these developments, which can be observed in every developed country, should ultimately allow city dwellers to do most of their home-work commutes by bike[^17] using a hundred times less energy and materials than by car. Combined with fast, frequent, direct public transportation, an optimized bicycle system could be a realistic solution to the current challenges of everyday mobility.

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<!-- Notes -->
[^1]: Cycle tracks are separated from motor vehicle traffic by a physical barrier or, at the very least, a continuous white line. Bike lanes are separated only by a broken white line. Bus-bike lanes are bus lanes that are open to cyclists. [^2]: Cyclists may ignore red lights when making certain maneuvers, giving way to other road users. [^3]: Changing rooms and showers can be useful but are not essential, as cycling in the city does not require specific athletic physical abilities. [^4]: This is usually a vehicle, except for walking, for which merely a pair of shoes is necessary. [^5]: Translation of the German *Verkehrsmittel des Umweltverbundes*, a concept introduced in the 1980s (Monnheim and Monheim-Dandorfer, 1990). [^6]: Sources. For Brussels: Pro Vélo, *Comptages et analyse des données. 2017 Report*, Observatoire du vélo en Région de Bruxelles-Capitale, 2017, 22 p. For Lyon: Mathieu Meylan, Greater Lyon, Powerpoint document, Road services, urban mobility, 2017. For London: data available on the London City Hall website: https://data.london.gov.uk/dataset/cycle -flows-tfl-road-network and processed by us. For Bordeaux: Bicycle observatory for Greater Bordeaux. For Paris: *Le bilan des déplacements en 2016 à Paris* and those of previous years. For Geneva: City of Geneva, *Les comptages vélos 2015. Rapport technique*, Directorate-General for Mobility, 2016, 64 p. [^7]: Graph source: New York City Department of

Transportation, *Cycling in the City. Cycling Trends in NYC*, NYC-DOT, New York, 2016, p. 10. [^8]: Source: Department for Transport, National travel survey, 2017. No such statistics exist in France, but the situation in France is quite similar. [^9]: Source: Otto VAN BOGGELEN (dir.), *De invloed van het weer op het fietsgebruik en het aantal fietsslachtoffers*, Fietsberaad, Rotterdam, 2007, p. 25 and 28. [^10]: Source: European Commission, *EU Energy and Transport in Figures*, Statistical Pocketbook, 2000 et 2002. This first comparative exercise has not been repeated. [^11]: It is forbidden to park a vehicle on the sidewalk. Annoyed pedestrians dismiss these bicycles as unsightly wrecks. [^12]: Voir https://www.alternatives-economiques.fr/velos-responsables-velos-predateurs/00083550 [^13]: In France, purchase premiums for electric-assisted bicycles, introduced in February 2017 and greatly reduced a year later, helped double sales during that year. [^14]: Cycle with no freewheel. [^15]: Mi 2017, the federation of bicycle workshops, L'Heureux cyclage, had 50,000 members in 270 workshops in France. [^16]: All over Europe and in France in particular. We counted about 100 in the FUB network (French federation of bicycle users) and many others in cycling schools like the MCF (French cycling instructors), FFCT (French Federation cycle tourism), UFOLEP (the French Union of Secular Physical Education) and the *Petits Débrouillards* (Little "Do-it-yourselfers") as well as community centers. [^17]: In France, the average distance is 14.8 km, according to the 2008 national transportations and travel survey.

Mots clés
bike
bicyle
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Discipline
Sciences humaines
Sciences sociales
Urbanisme, architecture et paysagisme
Visuel
The Bicycle System
Activer
Activé
Niveau de profondeur
Balise H2 + H3
Ajouter le trianglesi ce contenu est affiché dans la quinzaine
Désactivé
Auteur lié

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Frédéric Héran (Transport economist and urban planner)

Thématique

Alternative mobilities

Ecological transition

Cycling & Walking

Cities & Territories

Concepts