Bike-sharing: Its History, Models of Provision, and Future

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Abstract

This paper briefly discusses the history of bike-sharing from the early 1st generation program to present day 3rd generation programs. There is a detailed examination of models of provision and the state of the art outside of the European Union. The paper concludes with looking into the future of bike-sharing, with a discussion about what a 4th generation program could be.

Introduction

Bike-sharing, or public bicycle, programs have received increasing attention in recent years with initiatives to increase bike usage, better meet the demand of a more mobile public, and lessen the environmental impacts of our transport activities. Originally a concept from the revolutionary 1960s, bike-sharing's growth had been slow until the development of better methods of tracking the bikes with improved technology. This development gave birth to the rapid expansion of bike-sharing programs throughout Europe and now most other continents.

History of Bike-sharing

There have been three generations of bike-sharing systems over the past 45 years (DeMaio 2003, 2004). The 1st generation of bike-sharing programs began on July 28, 1965 in Amsterdam with the *Witte Fietsen* or White Bikes (Schimmelpennick 2009). Ordinary bikes, painted white, were provided for public use. Anyone could find a bike, ride it to his or her destination, and leave it for the next user. Things didn't go as planned as bikes were thrown into the canals or appropriated for private use. The program collapsed within days.

Then in 1991, a 2nd generation of bike-sharing program was born in Farsø and Grenå, Denmark, and in 1993 in Nakskov, Denmark (Nielse 1993). These programs were small, with Nakskov's having 26 bikes at four stations. It wasn't until 1995, nearly thirty years after bike-sharing was invented that the first large-scale 2nd generation bike-sharing program was launched in Copenhagen as Bycyklen, or City Bikes, with many improvements over the previous generation. The Copenhagen bikes were specially designed for intense utilitarian use with solid rubber tires, wheels with advertising plates, and could be picked up and returned at specific locations throughout the central city with a coin deposit. While more formalized than the previous generation with stations and a non-profit organization to operate the program, the bikes still experienced theft due to the anonymity of the customer. This gave rise to 3rd generation bike-sharing with improved customer tracking.

The very first of this new breed of bike-sharing programs was Bikeabout in 1996 at Portsmouth University in England (Black and Potter undated). Students could use a magnetic stripe card to rent a bike. This and the following 3rd generation systems were smartened with a variety of technological improvements, including electronically locking racks or bike locks, telecommunication systems, smartcards and fobs, mobile phone access, and on-board computers.

Bike-sharing grew slowly in the following years with one or two new programs launching annually, such as Rennes, France's, Vélo à la Carte in 1998, but it wasn't until 2005 when 3rd generation bike-sharing took hold with the launch of Velo'v with 1,500 bikes in Lyon, France by JCDecaux. This was the largest 3rd generation bike-sharing program to date and its impact was noticeable. With 15,000 members and bikes being used an average of 6.5 times each day by late 2005, Lyon's big sister, Paris noticed (Henley 2005).

Two years later Paris launched its own bike-sharing program, Vélib', with about 7,000 bikes and has expanded to 20,600 bikes since. This massive undertaking and its better-than-expected success changed the course of bike-sharing history and generated enormous interest in this transit mode from around the world. By the end of 2007, the year Vélib' launched, there were about 60 2nd and 3rd generation programs globally. By the end of 2008, there were about 90 programs.

Outside of Europe, bike-sharing finally began to take hold in 2008. The year was busy with new programs in the following cities (in alphabetical order by country and then city):

- Brazil: Rio de Janiero - Samba, São Paolo - UseBike;
- Chile: Santiago - b'easy;
- China: Beijing - Beijing Bicycle Rental, Hangzhou - Hangzhou Public Bike, and
    Shanghai;
- New Zealand: Auckland - nextbike;
- South Korea: Changwon - Nubija;
- Taiwan: Kaohsiung City - Kaohsiung Public Bicycle Rental; and
- U.S.A.: Washington, D.C. - SmartBike D.C.

Slightly more than every other month a new program launches (DeMaio 2007 and 2008a).
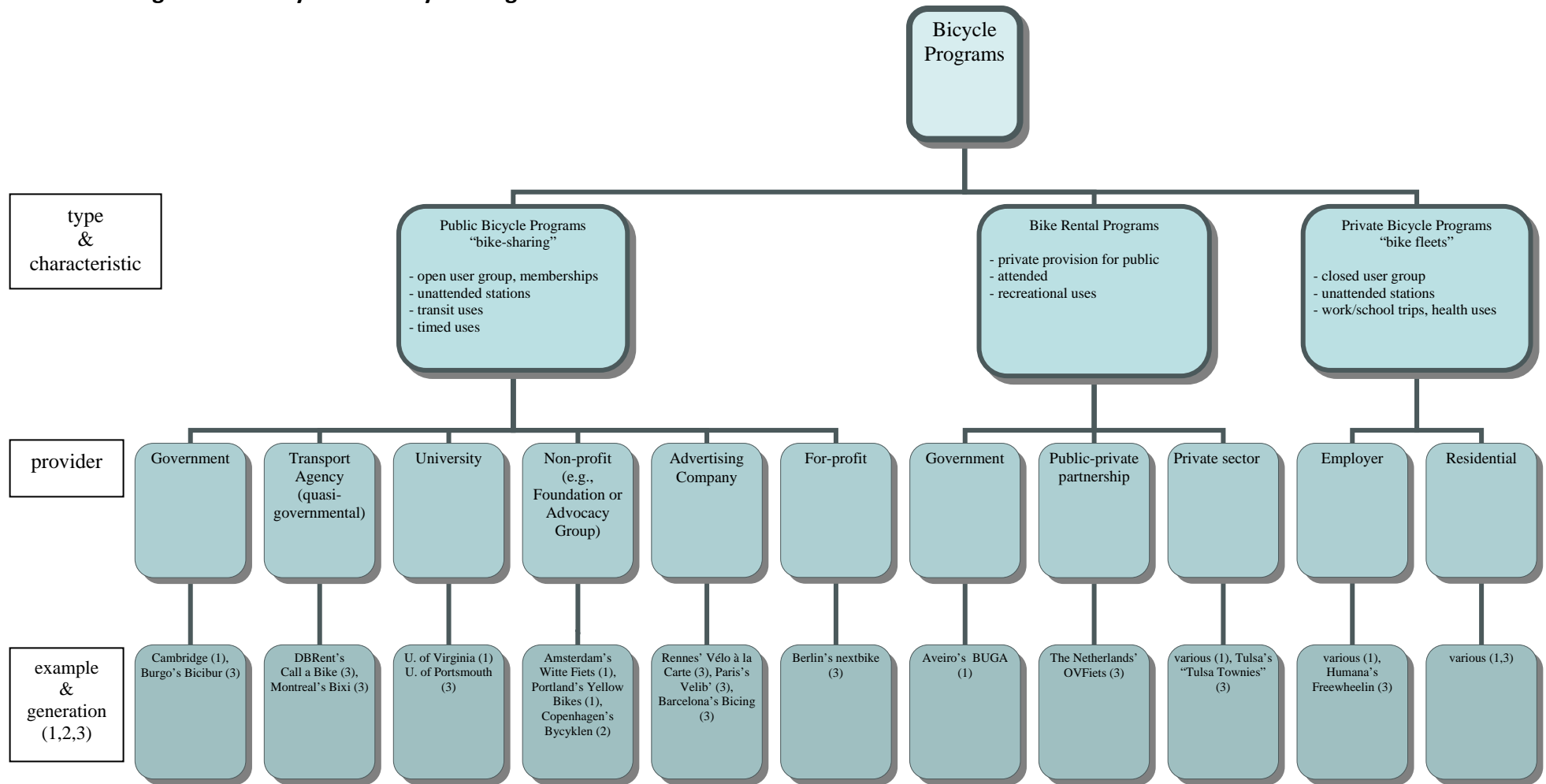
Models of Provision

Since bike-sharing's inception, various models of provision have existed. As illustrated in Figure 1 - Family Tree of Bicycle Programs, bike-sharing providers have included governments, quasi-governmental transport agencies, universities, non-profits, advertising companies, and for-profits. This section discusses the benefits and detriments of each model.

In the government model, the locality operates the bike-sharing service as it would any other transit service. In some cases, the government gives new life to abandoned bikes which it has collected on the streets, by refurbishing them and replacing them on the streets with a public purpose, as was done with Cambridge, England's 1st generation Green Bike program (Jonas et al. 2003). Additionally, the government can operate an off-the-shelf bike-sharing system as was done in Burgos, Spain with Bicibur (Civitas 2009). With this model, the government has greater control over the program as the operator. On the other hand, it may not have the experience that existing bike-sharing operators have in managing a program. Also, the government maintains the liability for the program.

The transport agency model has a quasi-governmental organization providing the service. The transport agency's customer is a jurisdiction, region, or nation. Transport agencies, such as Deutsche Bahn of Germany and Stationnement de Montréal are prime examples. Deutsche Bahn is the national railway provider of Germany and has a car-sharing and its Call a Bike bike-sharing service, to name a few of its offerings. Stationnement de Montréal, the parking authority of Montréal, provides "management of municipal paid on-street and off-street parking" and, as of this month, its Bixi bike-sharing service. Both organizations have gotten into bike-sharing as an extension of their other transport offerings to be a well-rounded mobility provider (Deutsche Bahn 2009, Stationnement de Montréal 2009).

The benefit of the quasi-government transport agency model is that the jurisdiction benefits from plugging into the experience and innovation of the bike-sharing service provider, especially in the case of national Deutsche Bahn, without needing to develop the capabilities internally. Additionally, both the jurisdiction and transport agency's top priority is to provide a successful public transport service, rather than generating revenues, which is discussed in more detail below as a detriment in the advertising company model. A detriment of this model is that without the locality releasing a tender for the service, a more qualified operator may exist than the transport agency operator.

Figure 1 - Family Tree of Bicycle Programs

Bicycle Programs

type & characteristic

Public Bicycle Programs "bike-sharing" - open user group, memberships - unattended stations - transit uses - timed uses	Bike Rental Programs - private provision for public - attended - recreational uses	Private Bicycle Programs "bike fleets" - closed user group - unattended stations - work/school trips, health uses

provider

Government	Transport Agency (quasi-governmental)	University	Non-profit (e.g., Foundation or Advocacy Group)	Advertising Company	For-profit	Government	Public-private partnership	Private sector	Employer	Residential

example & generation (1,2,3)

| Cambridge (1), Burgo's Bicibur (3) | DBRent's Call a Bike (3), Montreal's Bixi (3) | U. of Virginia (1) U. of Portsmouth (3) | Amsterdam's Witte Fiets (1), Portland's Yellow Bikes (1), Copenhagen's Bycyklen (2) | Rennes' Vélo à la Carte (3), Paris's Velib' (3), Barcelona's Bicing (3) | Berlin's nextbike (3) | Aveiro's BUGA (1) | The Netherlands' OVFiets (3) | various (1), Tulsa's "Tulsa Townies" (3) | various (1), Humana's Freewheelin (3) | various (1,3) |

example & generation (1,2,3)

5

The university model has the educational institution providing the service, most likely in a campus setting. Examples are the former program at the University of Portsmouth, England and newer incarnations such as that of St. Xavier University in Chicago, U.S.A. (Black and Potter undated, DeMaio 2008b). The benefit of this model is the university can expand its intra-campus transit service without relying on the jurisdiction to offer sufficient bike-sharing service on campus. A detriment is the surrounding jurisdiction potentially would not benefit from the service, unless it was opened to the adjacent neighborhoods. Also, if the locality were to use another system, there could be compatibility issues with the university's system.

The non-profit model has an organization which was either expressly created for the operation of the service or one that folds the bike-sharing service into its existing mandate. Examples of non-profit programs include the City Bike Foundation of Copenhagen in Denmark which operates Bycyklen and the City of Lakes Nordic Ski Foundation which will operate the future Nice Ride program in Minneapolis, U.S.A. (City Bike Foundation of Copenhagen undated, City of Lakes Nordic Ski Foundation 2009). While the non-profit operates the program, they usually receive funding from the jurisdiction for the service they provide to the public in addition to collecting the revenues generated by membership and usage fees, and sponsorships (City of Lakes Nordic Ski Foundation 2008). The non-profit model benefits the locality as it removes liability from them and places it on the non-profit which has limited funding and is less likely to have a lawsuit filed against it. A detriment of this model is the non-profit can be reliant on the public sector for a majority of its funding (City of Lakes Nordic Ski Foundation 2009).

With the advertising company model, companies such as JCDecaux, Clear Channel Outdoor, and Cemusa offer a bike-sharing program to a jurisdiction, usually in exchange for the right to use public space to display revenue-generating advertisements on billboards, bus shelters, and kiosks. The benefit of this model is it can be a convenient and cost-effective way for local governments, who couldn't afford to provide the bike-sharing service otherwise, to be able to do so. To date, this model has been the most prolific.

A detriment with the advertising company model is the problem with moral hazard. The advertising company usually does not benefit from revenues generated by the system as the jurisdiction does, so the advertising company does not have the same incentive to keep the bikes maintained as the jurisdiction would if it were operating the system. In fact, the better the advertising company has the bikes maintained, the more it would cost them, and the less profit they would keep from the advertising contract.

Another concern with this model is revenue generation. The BBC reported JCDecaux's unhappiness with its once thought lucrative contract with the city of Paris, quoting Remi Pheulpin, JCDecaux's Director General, stating, "All the receipts go to the city. All the expenses are ours," (BBC 2009). A report in Streetsblog quotes Paris' Deputy

Mayor for Transportation, Denis Baupin, saying, "[JC]Decaux is using media sensationalism in order to obtain more money from the city of Paris," (Fried 2009).

One case in particular, the advertising company provides the bike-sharing service for a fee and not for an advertising contract. In Barcelona, B:SM, or Barcelona de Serveis Municipals, a company owned by the city, has contracted with Clear Channel to operate the service (Barcelona de Serveis Municipals undated). This model is more similar to the transport provider model as the contractor happens to be an advertising company but its advertising services are not used.

The for-profit model has a private sector company providing the service with limited or no government involvement. Nextbike is a prime example of this model with a local business running the service in a locality with the off-the-shelf flexible station bike-sharing system offered by nextbike. While similar to the advertising company model, this model differs as there is no on-street advertising contract with the locality and the for-profit keeps revenues generated. A benefit of this model is that the private sector can start a service as an entrepreneurial activity rather than wait for the public sector to do so. A detriment is that the for-profit may not receive funding assistance for the service as programs offered under other models do. Additionally, if the for-profit uses a fixed, versus flexible, system, they would need to have the locality's support to use public space, unless all stations are on private property.

There is no ideal model at the present. Each has its specific niche which works in the various local environments where bike-sharing systems are active. The remaining bike rental and private bike programs classified in Figure 1 are for clarification purposes as the concept of bike-sharing is defined by the industry.

State of the Art Outside the European Union

Development of bike-sharing systems by non-European Union countries has been increasing as the market for the service grows. Focusing on one company in particular, Public Bike System was developed by Stationnement de Montréal and designed based on the best European practices for its own use. Public Bike System has introduced many innovations with its system that is set to launch this month in Montréal. These improvements over existing systems include the bike, station, and business model.

Powering stations has generally been with underground wiring to the nearest electrical source. This is expensive, time consuming, and affects where stations may be located. It also prohibits the easy relocation of the station due to the cost. Public Bike System has incorporated solar panels into their system to remove the need for underground electrification, as have Bicincitta' and B-cycle (Bicincitta' 2009, B-cycle 2009, Public Bike System 2009a). Public Bike System also incorporates rechargeable

batteries to provide assistance should there not be enough solar energy for days at a time.

The cost and time of installing stations is great. To remove these barriers, Public Bike System has developed a "Drop and Go" portable unit which requires no construction in its installation. The weight of the station is sufficient to keep it in place. Additionally, the kiosks can be used to pay for adjacent multi-space motor vehicle parking (Public Bike System 2009a).

The bikes have some improvements over other systems' bikes. The seat post has single-digit numbers printed on its side to represent seat heights. These numbers allow customers to remember easily their preferred seat height rather than needing to readjust seat posts multiple times to ensure they have the best height. Rear lights are built into the frame of the bike, thereby decreasing wear and tear and potential vandalism and theft. The chain is built into the structure of the bike, better protecting it and lessening wear and tear (Public Bike System 2009b).

Future of Bike-sharing

What will the 4th generation of bike-sharing look like? It could be difficult to say until the leap from 3rd to 4th generation is made and we're looking back in hindsight. Some systems may already be moving in this direction. Advances will likely be more incremental than before as there are more competitors in the marketplace than a few years ago, so a good idea from one will quickly spread to the others to remain competitive. Improvements could, and likely will, be made in every aspect of bike-sharing, including the methods of check-out and return, ease of use, fixed and flexible stations, tracking of the bikes and mileage, bike and station design, powering stations, incorporation into other modes of transport, distribution, business models, and theft deterrence.

Distribution of bikes must improve to make the bike-sharing service more efficient. Staff moving bikes from areas of high supply/low demand to areas of low supply/high demand is time consuming, expensive, and polluting. Luud Schimmelpennick, a co-inventor of the bike-sharing concept, reports the operational cost of JCDecaux's distribution of bikes is about $3 per bike (Schimmelpennick 2009).

Vélib' has made an improvement in this area with the launch of its "V+" concept, reports Velib et Moi - Le Blog. As it requires more physical effort and time for customers to reach uphill stations, V+ gives an extra 15 minutes to access about 100 of these designated uphill stations. The extra time given has encouraged greater use of these stations. Within the first three months of V+ being offered in Summer 2008, 314,443 instances of 15-minute credits were given. These extra 15-minute bonuses also may be saved up when not used during the trip to the V+ station (Vélib' 2008).

Schimmelpennick wants to take this concept one step further by paying customers for distribution to stations which need more bikes. In addition to the customer receiving credit which can be used towards more use of the program, like described above, Schimmelpennick proposes allowing customers to exchange credit for money to be paid by the program operator, at about a sixth of the distribution cost (Schimmelpennick 2009).

The advertising company model has been the predominant model of provision. This model of provision will continue to be popular and likely evolve. There is a finite number of cities with populations large enough to support outdoor advertising programs, so the advertising companies will eventually reach the natural limit of this model. This is, of course, unless they have more programs not needing advertising contracts, like that of Bicing (described above).

As the demand for bike-sharing increases, the other models of provision will continue to experience growth as bike-sharing system vendors have sprung up in the industry and created their own systems, such as nextbike, Public Bike System, Intrago, Veloway, and Smoove. Many of these systems have no outdoor advertising component, but rather can be purchased by the local operator. These systems are allowing jurisdictions and universities either with populations too small to make outdoor advertising profitable or where advertising on public space is simply prohibited, to consider launching their own bike-sharing services.

Today we're approaching 100 programs globally with many being planned as governments rush to implement bike transit (DeMaio 2009). This year could see another 40 launches based on the number of jurisdictions that are planning systems. New 2009 launches could include the following (in alphabetical order by country and then city):

- Argentina: Buenos Aires;
- Australia: Brisbane and Melbourne;
- Canada: Montréal and Toronto;
- Columbia: Bogota';
- England: Blackpool, Bristol, and London;
- France: Nice and Vannes;
- Ireland: Dublin;
- Israel: Tel Aviv;
- Taiwan: Taipei;
- Turkey: Konya; and
- U.S.A.: Arlington (Virginia), Denver, Honolulu, Miami Beach, Saint Xavier
        University (Chicago), and San Francisco.

Conclusion

The future of bike-sharing is clear - there will be a lot more of it. Gilles Vesco, Vice President of Greater Lyon, France, quotes his mayor when saying, "There are two types of mayors in the world: those who have bike-sharing and those who want bike-sharing." This certainly seems to be the case as each bike-sharing program creates more interest in this form of transit - call it a *virtuous cycle.*

As the price of fuel rises, traffic congestion worsens, populations grow, and a greater world-wide consciousness arises around climate change, it will be necessary for leaders around the world to find modes of transportation to move people in environmentally sound, efficient, and economically feasible way. Fortunately, bike-sharing fits these needs and not a moment too soon. Not a panacea, as bike-sharing's detractors point out, bike-sharing is a complementary mode of transport and another tool in the toolbox of public transport.

When the world comes out of the present global economic downturn, hopefully we won't be back to exactly where we left off before it began, but rather a new world order - one in which environmental and social issues take the forefront, and where bicycling and bike-sharing play a strong role in transport.

References:

Barcelona de Serveis Municipals. undated. BSM Organización.
    http://www.bsmsa.es/index.php?id=10&L=1/.

BBC. 2009. Thefts Puncture Paris Bike Scheme. February 10.
    http://news.bbc.co.uk/2/hi/europe/7881079.stm/.

Bicincitta'. 2009. Gallery. http://bicincitta.com/gallery.asp/.

Black, Colin, and Stephen Potter. undated. Portsmouth Bikeabout: A Smart-Card Bike
    Club Scheme. http://www.metrobike.net/index.php?s=file_download&id=11/.

B-cycle. 2009. What is B-cycle? http://www.bcycle.com/.

City Bike Foundation of Copenhagen. undated. Bycyklen København.
    http://www.bycyklen.dk/.

City of Lakes Nordic Ski Foundation. 2008. Twin Cities Bike Share Project Business Plan.
    pp 38-9. http://twincitiesbikeshare.com/downloads/doc_plan.php/.

City of Lakes Nordic Ski Foundation. 2009. Nice Ride Minnesota.
    http://twincitiesbikeshare.com/.

Civitas. 2009. City Bike Scheme in Burgos. http://www.civitas-
    initiative.org/measure_sheet.phtml?lan=en&id=302/.

DeMaio, Paul. 2003. Smart bikes: Public transportation for the 21st century.
    Transportation Quarterly 57(1): 9–11.

DeMaio, Paul. 2004. Will Smart Bikes Succeed as Public Transportation in the United
    States? *Journal of Public Transportation* 7(2): 1-15.
    http://www.nctr.usf.edu/jpt/pdf/JPT%207-2%20DeMaio.pdf/.

DeMaio, Paul. 2007. What a Year for Bike-sharing. The Bike-sharing Blog. December 30.
    http://bike-sharing.blogspot.com/2007/12/what-year-for-bike-sharing.html/.

DeMaio, Paul. 2008a. Bike-sharing Wrap-up for 2008. The Bike-sharing Blog. December
    31. http://bike-sharing.blogspot.com/2008/12/bike-sharing-wrap-up-for-
    2008.html/.

DeMaio, Paul. 2008b. University Bike-sharing's Time has Come. *The Bike-sharing Blog*.
    October 26. http://bike-sharing.blogspot.com/2008/10/university-bike-sharings-
    time-has-come.html/.

DeMaio, Paul. 2009. The Bike-sharing World Map.
    http://maps.google.com/maps/ms?ie=UTF8&hl=en&om=1&msa=0&msid=10422
    7318304000014160.00043d80f9456b3416ced&ll=43.580391,-
    42.890625&spn=143.80149,154.6875&z=1&source=embed/.

Deutsche Bahn. 2009. DB Fuhrpark.
    http://www.dbfuhrparkservice.de/site/dbfuhrpark/de/anschlussmobilitaet/ansc
    hlussmobilitaet.html/.

Fried, Ben. 2009. Reports of Vélib's Demise Greatly Exaggerated. *Streetsblog*. February
    12. http://www.streetsblog.org/2009/02/12/reports-of-velibs-demise-greatly-
    exaggerated/.

Henley, Jon. 2005. Rentabike Moves Up a Gear from Curiosity to Runaway Success.
    The Guardian. August 12.
    http://www.guardian.co.uk/world/2005/aug/12/france.jonhenley/.

Jonas, Andrew et al. 2003. Environment, Sustainability, and the Cambridge
    Phenomenon. October. http://www.hull.ac.uk/geog/PDF/ESRCwp6.pdf/.

Nielse, Brigitte Høj. 1993. *The Bicycle in Denmark: Present Use and Future Potential.*
    Danish Ministry of Transport. 52.

Public Bike System. 2009a. The Station. http://www.bixisystem.com/the_station/.

Public Bike System. 2009b. The Bike. http://www.bixisystem.com/the_bike/.

Schimmelpennick. 2009. Conversation. March 5.

Stationnement de Montréal. 2009. Stationnement de Montréal.
    http://www.statdemtl.qc.ca/index.php?page_id=42&lang=en/.

Vélib'. 2008. Velib et Moi - Le Blog. October 2.
    http://blog.velib.paris.fr/blog/reportages/triomphe-des-bonus-v-vous-
    ameliorez-tous-les-jours-le-service-velib/.