Bicycle success by social acceptance: the example of Japan

Léo MARTIAL
PhD student, Graduate School of Urban Innovation, Yokohama National University, Japan
79-5 Tokiwadai, Hodogaya-ku, Yokohama 240-8501, Japan; martial-leo-ud@ynu.jp

Fumihiko NAKAMURA
Professor, Graduate School of Urban Innovation, Yokohama National University, Japan

Shino MIURA
Assistant Professor, Graduate School of Urban Innovation, Yokohama National University, Japan

Adoption of non-motorized means of transport plays a key role towards sustainable cities while acknowledging major environmental challenges. Proposing bicycle-friendly infrastructure and policies is increasingly being prioritized in more and more cities. This article provides an overview of the bicycle in Japan. The current situation is analyzed based on national aggregate data and is linked to its history, policies and the emergence of a specific bicycle culture. A contrast between data and culture in bicycle use is highlighted, providing evidence about the specificity of the Japanese case. Previous studies on the bicycle focused on the importance of different aspects of bicycle infrastructure and policies. Through literature review based of the fourteen parameters of the Copenhagenize bicycle-friendly cities index, this study identifies the lack of studies about bicycle culture and social acceptance. It proposes an insight about the importance related to bicycle culture and social acceptance in bicycle success, using the example of Japan.

Keywords: *Bicycle Culture, Bicycle, Social Acceptance, Japan, Transportation*

1. Introduction

Urban mobility has been witnessing skyrocketing rates of motorization for decades, which has resulted in a significant number of negative impacts. (Castillo-Manzano et al., 2015). Cities all around the world are acknowledging major environmental challenges that are threatening human life (Stanley et al., 2011). In such a context, many countries are pursuing sustainable transport as a main goal of urban development plans. One of the recurring elements of sustainable transport systems is the promotion of non-motorized modes such as walking and cycling (Rietveld and Daniel, 2004). Due to the great benefits of cycling, the adoption of bicycles as a primary mean of transportation is also becoming recommended (Heinen et al.,2011). Building fast, safe and convenient cycle ways has become one of the main concerns in contemporary cities, such infrastructure being regarded as the key element to increase the bicycle modal share (Ebert, 2010). Indeed, exhaustive literature shows how the bicycle became successful in several countries such as the Netherlands, Denmark and Germany thanks to infrastructure and policies, making cycling a practical, convenient, fun, healthy and safe way to travel in their respective cities (Pucher et al., 2008). National aggregate data and many case studies in small and large cities in each country show that the key to reach high levels of bicycle use seems to be the supply of separate cycling facilities along well-travelled roads and at intersections, associated with traffic calming of most neighbourhoods. Wide-ranging cycling rights of way in those European countries are combined with large and secure bicycle parking facilities, good integration with public transport and a comprehensive approach about traffic education and training of both cyclists and motorists. Moreover, driving experience in the Netherlands, Denmark and Germany is made

more and more inconvenient and expensive in city centres with taxes and restrictions on car parking, use and ownership. The bicycle use in most western countries that do not provide such infrastructures and policies often peaks at only a few percent.

In terms of bicycle use and bicycle culture, Japan is ranking alongside successful European countries as one of the great bicycle nations of the world if we consider objectives data such as the number of bicycles owned per 100 people or usage of the bicycle for daily outings (Steele, 2012). Indeed, according to data compiled on contemporary social, political, and economic trends by the Honkawa Data Tribune [1], at 67 bicycles per 100 people, bicycle ownership in Japan ranks sixth in the world, following the Netherlands (111/100), Germany (83/100), Denmark (77/100), Sweden and Norway (71/100) and is tied with Finland. Data on usage places Japan third with 15 percent of all daily outings.

Despite this remarkable data, Japan is quite often disregarded in international debate concerning the bicycle. Japanese transportation is indeed well known for the speed and efficiency of its mass transit system, from local trains to the bullet train Shinkansen, as well as for its reliable, cheap and efficient automobiles. However, little attention is given to one of the Japanese most ubiquitous culture: the bicycle. Furthermore, unlike the popularity of the bicycle in Dutch, Danish and German societies raised throughout the twentieth century, becoming an important object in their national identification thanks to decades of bicycle promotion from their respective governments, the bicycle was disregarded and even discriminated against by the Japanese authorities for decades after World War II.

Such contempt marginalized the bicycle in other countries. On the one hand, some cities in western countries still tried to create exhaustive bicycle-friendly networks but remained often unsuccessful with low bicycle modal share. On the other hand, most Japanese cities are demonstrating bicycle success for decades without almost any consideration for this means of transportation from local and national authorities until very recently, not providing sufficient infrastructure and adequate policies. One of the reason is a general social acceptance of the bicycle by the Japanese population.

Despite much research and professional practice devoted to the evaluation of bicycle policies, physical environments and their relationship to bicycle use rates, only a limited number of them have focused on mobility culture. This study aims to differentiate itself by linking bicycle culture, social acceptance, lifestyle and overcoming a lack of knowledge and cultural barrier through efficient communication to a high bicycle use rate in contemporary cities through the example of Japan.

2. Methodology

The first part of the objective will be to identify a literature gap, using the Copenhagenize index of bicycle-friendly cities [2]. It is indeed the only index that ranks the most bicycle-friendly cities around the world, considering social aspects. The index is calculated according to fourteen parameters that we sort in four categories (Fig.1). A brief review of literature concerning physical environment and policies will help us to highlight the deficiencies regarding the category of mobility culture.

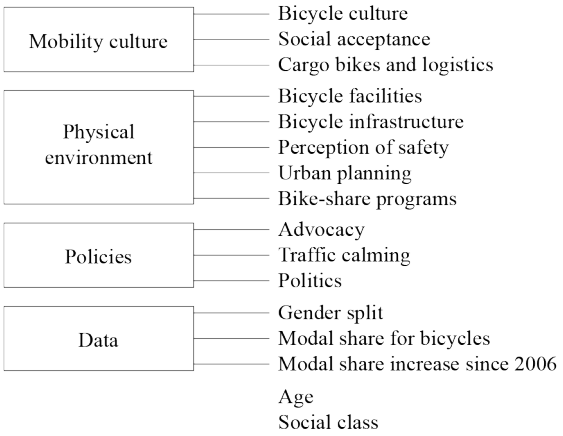

Fig.1 The fourteen parameters of the Copenhagenize index of bicycle-friendly cities

The second part of the objective will be to analyse the high rate of bicycle usage in Japan. Through history and the emergence of an underlying Japanese bicycle culture, this analysis will be chiefly concerned with the importance of the mobility culture category parameters and will link them to two parameters of data category: modal share and gender split, to which we add age and social class parameters.

These two parts of the objective will lead to concluding remarks about the consideration of bicycle culture in transportation planning and the importance of social aspect, informality and human behaviour in civil engineering.

3. Literature review

During the twentieth century, many theories of urban planning were encouraging heavy reforms to support better urban mobility, especially cycling. Nowadays, many cities, especially in developed western countries, are planning urban development infrastructures and policies to stimulate cycling as a primary transport mode once again (Buehler et al., 2012; Pucher et al., 1999). Bicycle infrastructure is an essential element in urban restructuring strategy (Lowry et al., 2016). Such plans are primarily designed to facilitate cycling in the city (Joo and Oh, 2013). We can consider two leading approaches to this end (Rietveld and Daniel, 2004).

The first approach is to dissuade the competing modes such as private automobile through taxes or physical constraints (Sterner, 2007). The second approach is to improve the appeal of cycling as a mode of sustainable transport by building safe, convenient and fast bikeways (Pucher et al., 2008).

Cycling represents an efficient transport mode at a relatively low cost in terms of both time and money. A bicycle is considered much more affordable than a car because of its purchase price, low maintenance and parking costs and does not require any fuel (Tiwari et al., 2015). In addition, considering that bicycles require a small amount of space for parking and moving, each lane on a standard road being able to accommodate up to seven times more bicycles per hour than cars, cyclists are not likely to be stuck in any kind of traffic congestion.

4. History and the current situation of bicycles in Japan

4.1. History

The Netherlands, Denmark and Germany are garnering much more attention than any other country about their bicycle infrastructure and policies, designed for decades to make cycling appealing (Pucher et al., 2008). They have spearheaded a whole range of activity geared toward the advancement of cycling, including trends in cycling safety, government roles in funding and planning cycling facilities and programmes, how to make cycling safe and convenient with bike paths, bike lanes, traffic calming, intersection modifications, bike parking, training and education, specific traffic laws and promotional events made appear associations such as Dutch cycling embassy [3] and Cycling embassy of Denmark [4] created to export their respective national knowledge about bicycle.

Japan's strengths with regard to the bicycle are mainly historic. The narrowness of most of the streets in big Japanese cities creates a natural traffic calming of most residential neighbourhoods (Sorensen, 2005), with a relatively low speed limit of 30 or even 20km/h, often hard to reach with many physical deterrents for cars such as electric poles or the absence of sidewalks that creates blind spots at almost every corner and allows pedestrians to roam freely onto the roadway itself. It should be further noted that motorists are assumed by authorities to be responsible for almost all collisions with cyclists and pedestrians. More recently, extensive bike parking at most railway stations, suburban, regional train and metro, as well as large supply of good bike parking throughout the city have been provided. It has not yet reached the massive amount of bicycle racks observable in some Dutch or Danish stations, but it has all but solved one of the

worst issues surrounding bicycles in Japan a few decades ago: wild parking (Koike, 1991; Morishige et al., 2014). The government is researching means to enhance this situation even further [5]. Most bicycle parkings in Japan offers improved lighting and security facilities often featuring guards and video-surveillance for a reasonable price, creating a good coordination with mass transit, either public or private. In addition, some bike paths turn into brightly coloured bike lanes when crossing intersections. Over the last few years, more and more schools are organizing comprehensive cycling training courses with tests by traffic police and bicycle accident demonstrations by stuntmen.

However, those strengths, both historic and recent, lie in stark contrast to the unfriendly or even hostile policies and infrastructure for bicycles in Japan. Indeed, there is almost no extensive system of separate cycling facilities with well-maintained discriminated paths, lanes and special bicycle streets. The Road Traffic Act of 1960 specified that cyclists must use the left part of the carriageway [6], the traffic in Japan being left-hand sided. As a result, bicycle accidents skyrocketed during the 1960s [7], triggering a quick change in regulation that allowed bicycle riding on designated sidewalks by the Road Structure Ordinance of 1970 (Kojima et al., 2012). Before 1971, there were strictly no bicycle roads or lanes in Japan, but the same ordinance introduced the necessary provision of bicycle roads where “automobile and bicycle traffic is high and it is necessary to segregate cyclists from the automobile traffic for traffic flow”. Today, these bicycle roads segregated from pedestrians represent only 3 000 kilometers and the roads not segregated from pedestrians 80 600 kilometers on the 1,2 million kilometers of roads in Japan, leaving 93% of Japanese roads without specific planning for bicycles. The majority of bicycle roads in Japan are then sidewalk bikeways, but the use of the sidewalk by cyclists presents several issues such as the conflicting relationship between cyclists and pedestrians (Koike, 2000), with bicycle-pedestrian accidents increased by 30% between 2002 and 2012 while the total number of traffic accidents decreased by 30% during the same period. With sidewalk bikeways being used bi-directionally most of time by high-speed heavy electric bicycles, the unpredictable movements of pedestrians generates serious accident potential. Children, the elderly and the physically impaired are particularly vulnerable. Not only dangerous for pedestrians, the sidewalk is not always a comfortable and safe path to ride for cyclists : electric poles, trees, road signs, street furniture, illegally parked bicycles all represent a threat, not to mention the narrowness, bumpiness and the quite poorly maintained pavement of some sidewalks. Some cyclists might ride on the road amongst automobiles, which is also permitted but with high risk of even more serious accidents.

Considering such major shortfalls in bicycle facilities leading to problems with using bicycles in Japan such as dangerous driving of automobiles, narrow roads, sidewalks and bicycle lanes, illegal street parking and many others [8], not to mention confusing traffic laws for cyclists, some impassable and hostiles intersections and companies that often prohibit their employees from commuting by bicycle for insurance reasons, how exactly did Japan become and remains one of the great bicycle nations of world, ranking alongside the Netherlands, Germany, and Denmark in terms of per capita bicycle ownership and use ? “The key to achieving high levels of cycling appears to be the provision of separate cycling facilities along heavily travelled roads and at intersections, combined with traffic calming of most residential neighbourhoods” (Pucher et al., 2008); some cities in western countries such as Stevenage in United-Kingdom have succeeded in building such facilities but bicycle modal share is now barely higher than English average with a modest 3%. Indeed, as early as the 1970s, the New Town of Stevenage had an excellent, inter-connected cycleway network designed after the Netherlands’ example, but cycle use did not skyrocket there, far from it. It is a good example that

infrastructure is not enough to make some people get (back) on their bicycles. Meanwhile, how does Japan, a country in which 86% of its 1 738 municipalities have not developed a bicycle network plan, even if more than half of them feel it is necessary to do so, show such a great bicycle ownership and bicycle usage for daily outings ?

4.2 Underlying Japanese bicycle culture

In most developed countries that have experienced motorization, cycling is not even considered as an option by many groups in society (Pooley et al., 2013). It is not re-establishing itself as a suitable means of transport among regular citizens, rather only as a subculture. For example, bicycle roads built to and from working and middle-class estates would not convince or even induce residents to ride bicycles, considered by most of them like toys, cycling being for children or low status adults. More than disregard, urban cycling tends to provoke a certain anger amongst other road users. On the one hand, aggressive behaviour among motorists has been a common research field for decades, examining several variables such as the presence of aggressive stimuli (Turner et al., 1975), social class (Deaux, 1971), ambient temperature (Kenrick et al., 1986) or anonymity (Ellison et al., 1995). The conflicting relationship between bicycles and cars on the other hand remains open to question but can be explained by several factors linked to the principle of altruistic punishment in humans, a study about cooperation among unrelated strangers in large groups (Fehr, 2002). Such a cooperation can be harder with individuals perceived as external to the group, meaning the cyclists amongst the automobile drivers. Cyclists must follow the rules of the road but they can do things that drivers are not allowed to: overtaking queues of cars, moving below the speed limit, getting off their bicycles to go on the sidewalk or cross the street through a pedestrian crossing. Such behaviour can be frustrating, even considered as cheating by some drivers, themselves staying in lane and following the rules.

Another major reason is a feeling of class struggle between cyclists and drivers due to rising real estate prices and increasing commuting distance and fuel costs, trapping working and middle-class individuals between unreachable real estate downtown and cheaper suburban properties but only accessible at significant cost (Grandjean et al., 2006). Cyclists can sometimes be then perceived by those long-distance commuting drivers as privileged people who can afford living downtown. Cyclists for their part often proclaim they are left with little option other than break rules that are not made for them, feeling vulnerable and discriminated against (Guilluy, 2014).

In Japan, the bicycle has not been necessarily more accepted as a legitimate mode of transport in the Japanese transport hierarchy (Koike, 2000) than other developed countries (apart the Netherlands, Denmark or Germany), still suffering from an ambivalence towards cyclists, categorized as a light vehicle rider or a pedestrian, the two modes being easily interchangeable depending on the cyclist's will. Such ambiguity makes traffic law enforcement sometimes difficult, especially in a country in which cyclists are encouraged to ride on sidewalks, creating a confusing situation when it comes to obeying the rules. However, a distinctive bicycle culture quickly emerged in the country and offered personal mobility to working and middle-class people in the early twentieth century (Steele, 2012). The bike was quickly perceived as a convenient, cheap and fast means of transportation, particularly for farmers and factory workers. During the famous Japanese economic miracle, Japan's record period of economic growth after World War II, the bicycle played a major role in the social and economic development of post-war Japan. It was the unsung hero of the first years of recovery and reconstruction, contributed to Japan's impressive economic growth, both challenged and complemented the endemic motorization and automobile culture. More recently, it has offered a credible alternative to the automobile for people seeking more sustainable urban transport. It has even provided an alternative means of transport in

case of natural disaster as seen after the Fukushima Daiichi nuclear disaster in 2011, helping some people of devastated area to rebuild their lives, just as it did following the havoc of World War II.

Daily commuting is a key component of urban transport (Stinson et al., 2004). Representing the second most important purpose of bicycle use in Japan after shopping [9], daily bicycle commuting is one reason why the bicycle has become a way of life and is deep-rooted in Japanese society as is in the Netherlands, where Europe's highest bicycle usage rates are observed (Pelzer 2010; Stoffers, 2012). In addition, aside from the city of Nagoya, few cities were able to take advantage of the opportunity for reconstruction after World War II (Steele, 2012). The reconstruction of most cities including Tokyo took place rapidly and quite randomly with little or no consideration to the dreams of the urban planners who wanted to introduce an American-style automobile culture into Japan (Hein, 2003). Many areas were slower to fundamentally transform the relationship between cars and bicycles (Oldenziel, 2011), retaining and expanding upon pre-war Japanese patterns advantageous for bicycle use (Sorensen, 2005). This land use has therefore a great influence on mobility policies and travel behaviour (De Vos, 2015), resulting in cycling being the fastest and most practical way to reach most destinations, the main reason for riding a bicycle on a daily basis in Japan [10].

4.3 The importance of bicycle social acceptance in Japan

How do drivers and the community at large consider urban cyclists? Bicycle culture and social acceptance are key elements necessary alongside material elements such as bicycle infrastructure and policies to come to a satisfactory bicycle system. Physical environment and mobility culture are two dimensions far from mutually exclusive which interact in a complex way. In addition, the function of this mutual causality also depends on historic aspects as well as urban and architectural particularities. As a result, it is hard to associate some empirical findings to other contexts or to extract some solutions and lessons proposed by some articles for other cities that would like to increase bicycle use, especially for the specific Japanese case.

Why has the bicycle thrived in Japan? Among all the developments and innovative transformations that have made the bicycle essential for Japanese mobility since the early twentieth century, the arrival of the electric bicycle is surely the latest important change. With the original model introduced in 1993 targeting women and the elderly, current e-bikes became lighter and more powerful. Made possible by revisions in 2008 to Japan's traffic law, these changes expanded usability, doubling the human pedal power without requiring a license, permitting up to three passengers -a parent and two children- on one bicycle, making heavy loads transportation or long distance commuting possible for more people, even the physically fragile. Although the revisions had been made to help parents of small children and the elderly, they made the e-bike more popular among working people, whether blue or white collar. It is perhaps a new bicycle culture under development.

Long before the arrival of e-bikes, the bicycle was already crucial for Japanese personal mobility since the early twentieth century. In the decades after World War II, contrary to most developed western countries, motorization did not end the necessity of bicycles in Japan. Bicycles have always complemented a powerful and efficient mass transit systems, especially railways, and continue to coexist with other means of private transportation such as motorcycles and automobiles, albeit with some unease. The bicycle in Japan started to thrive in the pre-war years when it was prized as a precious tool in rural areas and was adopted by suburban families after World War II for commuting, leisure and shopping. More and more urban professionals have also been rediscovering the bicycle over the last few decades. An inescapable bicycle in Japan is the *mamachari* ("mother's chariot"). First put on sale in 1956 by Yamaguchi Bicycle, this sturdy but light one-speed step-through

model with cargo basket in front was the easy-to-ride, inexpensive city bike that would transform Japan into a nation of cyclists (Steele, 2012). These bicycles became the centre of the suburban lifestyle that was developing in Tokyo and other major cities. Japanese women used their bicycles for shopping, taking small children to school and participating in community life. Japanese men biked to train stations on their way to work, teenagers used their bicycles to go to school and visit their friends. The *mamachari* is one of the main reason why the gender split is balanced in Japan today where 47% of cyclists are women (MLIT, 2015b), contrary to most developed countries witnessing three or four times more men than women on bikes except Denmark, Germany and the Netherlands (Pucher, 2008). Also important is the provision of various types of bicycles to accommodate different characteristics of users and activities. The cargo-bike, the cycle rickshaw and even the tandem are all well-known types of utilitarian cycling means in many cities across the world.

Convenience, economy, utility and land use are all reasons to choose the bicycle as a preferred mode of travel. In comparison with automobiles, bicycles are less expensive to own and maintain, they take up less space in a country where land is precious and sneaks in narrow and crowded street more efficiently. It is also far cheaper and easier to park a bicycle close to a shopping centre or a commuter station. We must also consider growing environmental concerns in Japan, especially after the Fukushima Daiichi nuclear disaster in 2011, also raising awareness of energy scarcity.

However, the fundamental reason why people in Japan never gave up the bicycle is perhaps the simple fact that they have been able to adapt their bicycle use to a wide range of lifestyles, notwithstanding their social class, age or gender. Contrary to the Netherlands or Denmark where the respective governments have been doing everything in their power to promote bicycle for decades, Japan's bicycle culture is not the result of government policies. Quite the contrary, most road structure ordinances and road traffic acts were rather punitive and even discriminating against the bicycle during the last few decades. The history of bicycles in Japan has been informal and private for more than a century and this surely is the main difference with European public mobility schemes. Bicycles were able to prosper outside public planning, having the capacity to transport people along minor routes other than those modern avenues established by the government. What was called the freedom machine by women's rights activist Susan B. Anthony at the end of the nineteenth century is offering for more than a century an unfettered mobility to everyone willing to use pedal power. The contemporary environmental concerns of the twenty-first century have brought some legitimacy to the culture of bicycle which was initially based on a relentless will of convenience, speed, autonomy and freedom.

5. Concluding remarks

Enhancing the attractiveness of cycling as a mode of sustainable transport can be achieved by both infrastructural development and strengthening of cycling culture (Lanzendorf and Busch-Geertsema, 2014). Research emphasizes the benefits of bicycle adoption as a primary transport means in urban areas. Cycling for daily outings is considered to be a sustainable and efficient mode of transport (Marshall and Garrick, 2011), especially for short-distance trips (Drumhell., 2001). The benefits of utilitarian cycling are manifest (Bauman et al., 2008). Replacing motor vehicles with bicycles results in environmental, health and social benefits (Lindsay et al., 2011). Such benefits can affect the community (Krizec, 2007). Some social benefits can also be highlighted, such as improved sense of community (Rissel et al., 2013) and advocacy of a healthier lifestyle (Owen et al., 2010). People from local communities have then the opportunity to reach their destination in a manner which is beneficial to their health with low environmental affects (Passafaro et al., 2014). There

is no universal approach to cycling revitalisation policies and infrastructure; it is intrinsically linked to the cultural context of a city. However, underlying schemes could be distinguished, such as the geography and land use of a city, generated with informal regulations, alternative routes chosen based on safety and speed, the process of mode choice or even how automobiles neutralize bicycle culture in some cities. Japan is a nation renowned throughout the world for its efficient, reliable and fast transport system, innovative technology and design, with the bullet train Shinkansen as a figurehead of Japanese expertise. Much less attention has been given to Japan's ubiquitous bicycle culture because of its informal aspect and the decades-long absence of public sector willingness to promote it. Despite a certain will to marginalize the bicycle after World War II, the bicycle never became a sub-culture in Japan nor a token of political advocacy or social and cultural identity as in most western countries. A lot of people in Japan just kept riding their bicycles regardless their age, social class or gender, notwithstanding the new way of life promised by automobile advertisements. Contrary to some western countries, riding a bicycle in Japan is not an ideology. Japan shows it is possible to be a developed country at the cutting edge of technology and at the same time retain a natural social acceptance for bicycles. Transportation planning sometimes reveals a wide gap between social sciences and civil engineering, but it is always necessary to consider informal aspects and human behaviour to design successful transportation systems and a sustainable, pleasant urban development (Antić, 2003). This article reviewed the importance of social acceptance for bicycle success, reminding us that positive communication is a keystone in mass deployment of bicycles.

Notes

1. https://honkawa2.sakura.ne.jp/6371.html *(in Japanese)*
2. http://copenhagenizeindex.eu
3. https://www.dutchcycling.nl
4. http://www.cycling-embassy.dk
5. http://www.japaneselawtranslation.go.jp/law/detail_main?re=&vm=2&id=2962
6. http://www.mlit.go.jp/kisha/kisha08/06/060117/03.pdf *(in Japanese)*
7. Traffic fatalities and injuries in Japan, Japanese national police agency
8. Japan Society results of an Internet questionnaire conducted in January 2012
9. Research report of safe use promotion of bicycles in Japan (2005)
10. Web survey carried out by National institute with residents in 27 cities across Japan.

References

Antić, M., & Haladin, S. (2003). *The importance of social sciences in the education of civil engineers.* In 6h International conference organization, technology and management in construction.

Bauman, A. E., & Rissel, C. (2009). *Cycling and health: an opportunity for positive change?.* Medical journal of Australia, **190**(7), 347.

Buehler, R., & Pucher, J. (2012). *Big city cycling in Europe, North America, and Australia.* City cycling, **287**-318.

Castillo-Manzano, J. I., Castro-Nuño, M., & López-Valpuesta, L. (2015). *Analyzing the transition from a public bicycle system to bicycle ownership: A complex relationship.* Transportation Research Part D: Transport and Environment, **38**, 15-26.

Deaux, K. K. (1971). *Honking at the intersection: A replication and extension*. The Journal of Social Psychology, **84**(1), 159-160.

De Vos, J. (2015). *The influence of land use and mobility policy on travel behaviour: A comparative case study of Flanders and the*

Netherlands. Journal of Transport and Land Use, **8**(1), 171-190.

Drumhell, B. (2001). *Sustainable Transportation Options for Protecting the Climate: A Local Government Guide.* ICLEI.

Ebert, A. K. (2004). *Cycling towards the nation: The use of the bicycle in Germany and the Netherlands, 1880 – 1940*. European Review of History, **11**(3), 347-364.

Ellison, P. A., Govern, J. M., Petri, H. L., & Figler, M.H. (1995). *Anonymity and aggressive driving behavior: A field study*. Journal of Social Behavior and Personality, **10**(1), 265.

Fehr, E., & Gächter, S. (2002). *Altruistic punishment in humans*. Nature, **415**(6868), 137.

Grandjean, A., & Jancovici, J. M. (2014). Le Plein s'il vous plaît. La solution au problème de l'énergie. *(in French)* Le Seuil.

Guilluy, C. (2016). *La France périphérique. Comment on a sacrifié les classes populaires*. *(in French)* Flammarion.

Hein, C., Diefendorf, J. M., & Ishida, Y. (Eds.). (2003). *Rebuilding urban Japan after 1945.* Basingstoke: Palgrave Macmillan.

Heinen, E., Maat, K., & Van Wee, B. (2011). The role of attitudes toward characteristics of bicycle commuting on the choice to cycle to work over various distances. Transportation research part D: transport and environment, **16**(2), 102-109.

Japan bicycle promotion institute (2018). *Statistics handbook.*

Kenrick, D. T., & MacFarlane, S. W. (1986). *Ambient temperature and horn honking: A field study of the heat/aggression relationship*. Environment and behavior, **18**(2), 179-191.

Joo, S., Oh, C., Jeong, E., & Lee, G. (2015). *Categorizing bicycling environments using GPS-based public bicycle speed data*. Transportation Research Part C: Emerging Technologies, **56**, 239-250.

Koike, H. (1991). *Current issues and problems of bicycle transport in Japan*. Transportation research record **1294**, 40-46.

Koike, H., Morimoto, A., & Itoh, K. (2000). *A study on measures to promote bicycle usage in Japan*.

Krizec, K. J. (2007). *Estimating the economic benefits of bicycling and bicycle facilities: An interpretive review and proposed methods.* In Essays on transport economics (pp. 219-248). Physica-Verlag HD.

Lanzendorf, M., & Busch-Geertsema, A. (2014). *The cycling boom in large German cities—empirical evidence for successful cycling campaigns*. Transport policy, **36**, 26-33.

Lindsay, G., Macmillan, A., & Woodward, A. (2011). *Moving urban trips from cars to bicycles: impact on health and emissions.* Australian and New Zealand journal of public health, **35**(1), 54-60.

Lowry, M. B., Furth, P., & Hadden-Loh, T. (2016). *Prioritizing new bicycle facilities to improve low-stress network connectivity.* Transportation Research Part A: Policy and Practice, **86**, 124-140.

Marshall, W. E., & Garrick, N. W. (2011). *Evidence on why bike-friendly cities are safer for all road users*. Environmental Practice, **13**(1), 16-27.

Ministry of internal affairs and communications, statistics bureau (2018).*Statistical handbook of Japan*.

Ministry of land, infrastructure, transport, and tourism (2004). *Traffic safety measures in Japan.*

Ministry of land, infrastructure, transport, and tourism (2005). *Research on how to use bicycles in urban transport. (in Japanese)*

Ministry of land, infrastructure, transport, and tourism (2005). *Bicycle traffic in Japan. (in Japanese)*

Ministry of land, infrastructure, transport, and tourism (2015a). *Creating safe and secure road spaces for cyclists.*

Ministry of land, infrastructure, transport, and tourism (2015b). *National city traffic characteristics.*

Ministry of land, infrastructure, transport, and tourism

(2016). *Guidelines for creating a safe and comfortable bicycle use environment. (in Japanese)*

Ministry of land, infrastructure, transport, and tourism (2016). *Recommendations for early development of bicycle network plan formulation and secure early securing of safe bicycle traffic space. (in Japanese)*

Morishige, S., Sano, K., & Nishiuchi, H. (2014). *Evaluation on bicycle removal policies by considering bicycle parking behavior and willingness pay by residents. (in Japanese)* Journal of Japan Society of Civil Engineers, Ser. D3 (Infrastructure Planning and Management), **70**.

Oldenziel, R., & de la Bruhèze, A. A. (2011). *Contested spaces: Bicycle lanes in urban Europe, 1900-1995.* Transfers, **1**(2), 29-49.

Owen, N., De De Bourdeaudhuij, I., Sugiyama, T., Leslie, E., Cerin, E., Van Van Dyck, D., & Bauman, A. (2010). *Bicycle use for transport in an Australian and a Belgian city: associations with built-environment attributes.* Journal of urban health, **87**(2), 189-198.

Passafaro, P., Rimano, A., Piccini, M., Metastasio, R., Gambardella, V., Gullace, G., et al, 2014. *The bicycle and the city: desires and emotions versus attitudes, habits and norms.* J. Environ. Psychol. **38**, 76–83.

Pooley, C. G., Horton, D., Scheldeman, G., Mullen, C., Jones, T., Tight, M., ... & Chisholm, A. (2013). *Policies for promoting walking and cycling in England: A view from the street*. Transport Policy, **27**, 66-72.

Pucher, J., Komanoff, C., & Schimek, P. (1999). Bicycling renaissance in North America?: Recent trends and alternative policies to promote bicycling. Transportation Research Part A: Policy and Practice, **33**(7-8), 625-654.

Pucher, J., & Buehler, R. (2008). *Making cycling irresistible: lessons from the Netherlands, Denmark and Germany*. Transport reviews, **28**(4), 495-528.

Rietveld, P., & Daniel, V. (2004). *Determinants of bicycle use: do municipal policies matter?*. Transportation Research Part A: Policy and Practice, **38**(7), 531-550.

Rissel, C., Greaves, S., Wen, L. M., Capon, A., Crane, M., & Standen, C. (2013). *Evaluating the transport, health and economic impacts of new urban cycling infrastructure in Sydney, Australia–protocol paper.* BMC public health, **13**(1), 963.

Rybarczyk, G., & Wu, C. (2010). *Bicycle facility planning using GIS and multi-criteria decision analysis*. Applied Geography, **30**(2), 282-293.

Sorensen, A. (2005). The making of urban Japan: cities and planning from Edo to the twenty first century. Routledge.

Steele, M. W. (2012). *The making of a bicycle nation*. Transfers, **2**(2), 70-94.

Sterner, T., 2007. Fuel taxes: an important instrument for climate policy. Energy Policy **35**, 3194–3202.

Stinson, M. A., & Bhat, C. (2004). *An analysis of the frequency of bicycle commuting using an Internet based survey.* Transportation research record: Journal of the transportation research board, **1493**, 122-130.

Stoffers, M. (2012). *Cycling as heritage: representing the history of cycling in the Netherlands*. The journal of transport history, **33**(1), 92-114.

Tiwari, G., Jain, D., & Rao, K. R. (2016). *Impact of public transport and non-motorized transport infrastructure on travel mode shares, energy, emissions and safety: Case of Indian cities.* Transportation research part D: transport and environment, **44**, 277-291.

Turner, C. W., Layton, J. F., & Simons, L. S. (1975). *Naturalistic studies of aggressive behavior: aggressive stimuli, victim visibility, and horn honking*. Journal of personality and social psychology, **31**(6), 1098.