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Bike-Sharing: Is Safety an Issue Adversely Affecting its Potential for Being Embraced by Urban Societies?

A. Nikitas¹, N. Michalakopoulos², P. Wallgren¹

¹ Division of Design and Human Factors,
Department of Product and Production
Chalmers University of Technology
Hörsalsvägen 5, 412 96 Göteborg, Sweden,
e-mail: alexandros.nikitas@chalmers.se
e-mail: pontus.wallgren@chalmers.se

² Nea Sevastia, 66100 Drama, Greece
e-mail: nikitasmic@googlemail.com

ABSTRACT

Using bicycles on an 'as-needed' basis, usually for a small rental fee and without the externalities and obligations linked to bicycle ownership, is what makes public bicycles a societally affordable medium to enhance the transition to a more sustainable urban transport paradigm. However, despite its distinctive character in terms of its potential to be a mechanism transforming in some degree urban mobility to a shared responsibility regime, bike-sharing still faces some of the same safety concerns associated with ordinary bicycle ridership. The most common problem for cyclists' wellbeing is that the traffic system is designed predominately from a car-user perspective. Even the cities that have recently implemented public bicycle programmes, and therefore showed some extra care to provide fitting urban conditions for them, have not yet achieved to fully eclipse car-orientation as the prime cornerstone of their development norms. This means that transport systems worldwide do not necessarily take fully into account the main characteristics of cyclists reflecting safety themes: a cyclist is vulnerable (in a crash), flexible (in behaviour), instable (may fall off the bike), inconspicuous (difficult to see), has differing abilities (due to a wide range of the population), is conscious of effort (i.e., highly motivated to minimize energy expenditure), and sometimes seen as intruders in the traffic systems, rather than as an integral part. This work refers to the results of a research scheme that meant to examine road users' attitudes directly reflecting public acceptability towards two bike-sharing schemes in Drama (Greece, 50.000 residents) and Gothenburg (Sweden, 500.000 residents). Although safety was not the principal initiative for doing this dual study, one key conclusion was that many people could not embrace bike-sharing due to their perceptions that bicycle represents in general an unsafe travel mode and that their cities provide only limited road safety for cyclists.

Keywords: bike-sharing, public bicycles, public acceptability, attitudes, safety.

1 INTRODUCTION

The last decade has seen a substantial increase in the perception of the bicycle as a realistic transport alternative to the car [1] meaning that cycling-related infrastructure and services are receiving more and more attention from urban policymakers. At the same time, the notion of a sharing economy (defined as the shared use of resources among individuals, including vehicles in a transportation network among others) has been rapidly embraced across the globe as a means of strengthening local economies and creative synergies within urban societies. The shared-use of mobility innovation mechanisms, in particular, offers the potential to lower a user's transportation costs; reduce the need for parking spaces in a community; improve overall air quality; and facilitate access to and encourage use of other transportation modes such as rail transit [2]. Bike-sharing therefore is a timely innovation that provides a realistic answer to both these contemporary urban development necessities; the necessity to invest on cycling and its significant pro-environmental value and the necessity to promote a culture of sharing for cities looking to craft resource-efficient pathways to prosperity.

Originally a concept from the revolutionary 1960s, bike-sharing's growth had been slow until the development of better methods of tracking bikes with improved technology [3]. Now, that with the intervention of GPS technology this is a non-issue, an excess of 500 public bicycle schemes of variable types and sizes operate in almost 50 countries worldwide [4]. Despite its vast potential as a medium designed to extend the reach of public transit services to final destinations in a way that prioritises people over cars, bike-sharing still faces some of the same safety concerns associated with ordinary bicycle ridership and then some more.

The principal safety problem for cyclists, and thus for the users of any public bicycle scheme, is that the traffic system is designed predominately from a car-user perspective giving little or no dedicated consideration to less popular or space-occupying modes. Even the cities that have recently implemented bike-sharing programmes, and therefore showed some extra care to provide fitting urban conditions for them, have not yet achieved to fully eclipse strong car-oriented urban development norms besides very few exceptions. This means that in general transport systems worldwide do not necessarily take fully into account the main characteristics of cyclists reflecting safety themes: a cyclist is vulnerable (in a crash), flexible (in behaviour), instable (may fall off the bike), inconspicuous (difficult to see), has differing abilities (due to a wide range of the population), is conscious of effort (i.e., highly motivated to minimize energy expenditure), and sometimes seen as intruders in the traffic systems, rather than as an integral part [5].

Nevertheless, even in the unlikely scenario that a transport system has catered for all these generic problems of cycling, both in real terms but also in terms of convincing road users psychologically and cognitively that there are no dangers related to cycling, bike-sharing could still have some mode-specific safety issues due to its distinctive public character; issues that can make people perceive bike-sharing as an unsafe activity. For example, the inability to provide bicycle helmets in conjunction with the rented vehicles in most bike-sharing schemes around the world is a serious drawback in any attempt to create the image (and thus the perception to potential users) that these schemes do satisfy in full safety requirements. Since there is concrete evidence that wearing a bicycle helmet significantly reduces the risk of head injury [6] people could be more likely to consider a public bicycle programme safe if helmet rentals were a fixed function of the overall scheme especially when considering that a lot of the programme users would not have a bicycle helmet of their own.

This paper is not aiming towards justifying the case for or against bike-sharing but instead means to pinpoint and put into context the importance of the attitude orientations that road users have regarding those safety issues that could be an obstacle for the success of an already operating (Gothenburg) or a future (Drama) scheme. Henceforth, the paper provides a presentation of the two case study examples, an analysis of the research methodology employed, the characteristics of the twin road user sample and the specific results of the questionnaire referring to safety. The paper as a whole is set to shed light on the safety-related attitudes of Gothenburg's and Drama's residents towards cycling in general and public bicycles in particular.

2 STUDYING THE CASES OF DRAMA AND GOTHENBURG

In order to be able to identify and subsequently discuss thoroughly public attitudes towards bike-sharing, the use of specific city scenarios that could give a pragmatic and meaningful attitude object to those perceptions, should be employed. The present study looked into the attitudes and system user experiences (the latter only when it was applicable) that could define the design (or re-design) criteria for two public bicycle schemes in two cities of different size, economies, topological and cultural characteristics. These cities are Drama (Greece) and Gothenburg (Sweden). The systems discussed are currently on very dissimilar operational phases; Drama is still in the process of bidding for funding and trying to decide on the precise requirements for the introduction of such a scheme while Gothenburg has already in place a successful system that has expanded massively in its four years of operation due to its popularity and the commitment of the city planners in making it a mainstream alternative to car.

2.1 Introducing the city of Drama and its ambition to introduce a bike-sharing scheme

Drama is a city situated in North East Greece next to the Greek-Bulgarian borders. Drama is 670 km away from Athens but it is relatively close to Greece's second largest metropolitan centre Thessaloniki (158 km). The closest seaport and airport are located in Kavala and Chrisoupolis 37 km and 68 km away from Drama respectively. Drama has a city-based population of 45,828 residents but the overall municipality population, which includes 14 suburban communities in close vicinity from the main city, is 58,944 inhabitants [7]. Until recently, the economy of Drama relied heavily on the local textile-clothing and paper production industries. However, these industrial production entities have either ceased their operations or moved across the border to Bulgaria being victims of the Greek financial crisis and the steep competition from antagonists from abroad. This is something that has affected adversely the local economy reducing significantly employment opportunities and making people more susceptible to poverty and social exclusion. More specifically, the Gross Domestic Product per person in Drama for 2009 was only 11,700 euros and was one of the lowest in Greece. Lately, there have been efforts to take advantage of the rich local natural environment and to develop an economy based on eco-tourism since the biggest forests and natural springs of the Balkans are situated in the wider area of Drama. This is something that in the longer term creates the need for commitment to a more sustainable resource management strategy with mobility being one of those resources.

Despite its manageable size Drama has been dealing with persistent traffic congestion problems. Currently bus services are the only means of public transport; however these are used almost exclusively by students and older people. Bicycle use has been growing slowly but steadily during the last few years. This is due to the realisation that more sustainable lifestyles should be adopted if environmental degradation is to be avoided and also due to financial reasons since it is considerably cheaper to run a bicycle than a car in the era of the Greek financial recession. Nonetheless, cycling is not yet established as a mainstream travel option for the city something that according to the results of this study is clearly associated with the lack of investment on bicycle infrastructure and the, thus far, very limited political support to promote cycling as a mode that is not only leisure-related [8].

Planning a bike-sharing scheme, referring to a system of 50 to 60 bicycles in three to five pick-up and drop-off stations, has been in the City's transport agenda for the last couple of years. This is a rather inexpensive investment programme that can be fully funded by EC resources and could offer to the citizens of Drama free or very affordable inner city transportation that could eventually replace a considerable load of short car trips. Identifying possible barriers that could reduce the public acceptability of a bike-sharing scheme (with issues regarding safety being a prime one) and understanding thoroughly its potential for generating modal shift, would enable the policy-makers to introduce a scheme with a user-centred focus. Examining the attitudes of Drama's road users and tax-payers on cycling, bike-sharing and its suitability for Drama was therefore a timely process for producing transport innovation reflecting the actual needs and plans of the city [8].

2.2 Introducing the city of Gothenburg and its popular Styr & Ställ

Gothenburg is the second largest city in Sweden and the fifth largest in the Nordic countries by population. More specifically, it has a city-based population of 519,400 citizens but the residents of Gothenburg's broader metropolitan area are almost one million. Gothenburg is situated on the Southwestern coast of Sweden and has a strategic geographical position in Scandinavia, being approximately half way between Copenhagen and Oslo. Due to the Gothenburg's advantageous positioning, trade and shipping have always played a major role in the city's economic history, and they continue to do so since Gothenburg's port is the largest harbour in Scandinavia. It should be noted however that due to antagonists from abroad shipping especially has regressed considerably over the last decades. Volvo was founded in Gothenburg in 1927 and is perhaps the most integral piece of the city's second pillar of economic prosperity, which is manufacturing, followed by other mega-companies like SKF and Ericsson. Gothenburg is also home to approximately 35,000 students, as the city hosts two higher education institutions; the University of Gothenburg and Chalmers University of Technology. The city is served by Göteborg Landvetter Airport, located 30 km southeast of the city centre, and by Göteborg City Airport, located 15 km from the city centre.

Gothenburg is a city providing a wide range of transport options to its residents and visitors. With over 80 km of double tracks, the blue iconic tram of the city is the largest light rail network in Scandinavia and together with the bus network form the basis of the public transport system. There are also daily boat and ferry services catering the needs of a city that is defined (even in terms of its own name) by river Göta. In early 2013, a road pricing scheme was introduced in the city centre to regulatory enforce, in some respect, modal change, while parking pricing is another measure that has been spread to all central and residential areas of Gothenburg for many years now [9].

With over 600 km cycling routes, Gothenburg provides an extensive bike road network that makes cycling a valid transport option for the city's road users. This is eased by the fact that because of the moderating influence of the warm Gulf Stream, Gothenburg enjoys milder weather conditions than most other cities with similar high northern latitude. Gothenburg has already in place Styr & Ställ, which is a self-service bike rental system, spread across 60 stations throughout the city centre with approximately 1000 bicycles. The system can be accessed 24 hours a day and seven days a week. It is available between 1st of March to 31st of October. Technical support is open at working hours every weekday. In order to access the system, customers have to subscribe to a 3-day pass (10 SEK), a season pass (75 SEK) or special business subscription. The usage is free for the first 30 minutes to allow people to pilot the system without any cost. The scheme is financed by the revenue generated from its users and from the commercial billboards placed throughout the city.

The scheme launched its operations in August 2010 consisting of 300 bicycles and 20 stations and by the end of its first season it expanded to 500 bicycles in 40 stations. In 2011 the number of bicycles increased to 700 and between the 1st of April and 30th of June there were 1087 season subscriptions and 6960 three-day passes issued. Around 70,000 movements took place on a weekly basis at that time; movement is any case a bike is rented, returned or moved by the service staff from one station to another [10]. In year 2012 this service was integrated to the services provided by the Västtrafik card, which is the equivalent of a one-for-all public transport pass for Gothenburg, eliminating the need for a separate card for Styr & Ställ. During 2012 there were over 202,000 rentals and 18,000 subscribers. In 2013 the number of rental stations increased to 57 and the number of bicycles to 1000 while in the 2014 season three more stations are in operation.

Safety is an issue that is important for Styr & Ställ providers since there is a dedicated page on the scheme's website set to make accessible road safety guidelines for the bike-sharing users. The safety recommendations span from information about how the user should start one's ride making appropriate adjustments to the rented bike and how one should avoid having a second person on the bike or an underage user to guidelines about one's list of responsibilities when renting a bike and about how one could comply with the highway code [11].

3 RESEARCH METHODOLOGY

A primarily quantitative survey was the methodological tool that was selected in order to identify attitudes towards bicycle use, bike-sharing and its potential (Drama) or actual (Gothenburg) usefulness and embracement from the public for both cities. A more qualitative research approach was deemed not to be applicable for the means of the study due to the researchers' strong focus on collecting data with a stronger generalization merit so that the results produced could be in some extent reflecting how favourably some people in Drama and Gothenburg view cycling in general and public bicycles in particular.

3.1 Questionnaire structure

The two questionnaires were designed to have a similar format and contained questions and sections easily comparable with each other. This was a conscious research strategy choice so that the overall study could be as homogeneous as it could have been. The questionnaire in Drama was administered containing 19 main questions organised in four parts referring to: the respondents' general travel behaviour choices; their views on bicycles and cycling; their attitudes towards public bicycles and their suitability for the city of Drama; and their demographic characteristics. The questionnaire in Gothenburg had very similar questions organized in the same order as the questionnaire in Drama with the addition of a question regarding general attitudes about Styr & Ställ looking into, for example, its popularity and attractiveness. The survey had also an additional thematic part regarding the respondents' actual public bicycle experience (something that could not have applied to Drama since an actual scheme has not been introduced yet). This theme contained a question with five sub-questions meaning to drive the respondents to evaluate some selected attributes of the scheme and was addressed only to those respondents that had actually used the public bicycles of Styr & Ställ at least once. There was one final open sum-up question in both questionnaires, where the respondents could write down in their own words any thoughts and remarks they wanted to share regarding bike-sharing. This was an intentional research design feature of the study meant to add a qualitative dimension to the work. Analysing this final part of the survey and questions that do not refer directly or indirectly to safety issues is not within the immediate focus of this paper however. Five-point Likert-scales were used to record responses varying from strongly agree to strongly disagree. The time needed for completing the survey was approximately 10 to 15 minutes.

Pre-notification [12, 13] and financial incentives [14, 15] have been reported to produce improvements in response rates, and therefore both were applied in this study. The incentive was an entry into a prize-draw, whilst the introduction of the questionnaire 'pre-notified' the research project and discussed why completing the survey could have been a meaningful and timely task for the respondent. In Drama, where the concept of bike-sharing could have been completely new to some of the respondents, there was obviously a need for defining the concept of bike-sharing so that its appreciation could be cohesive and consistent among the respondents. The pre-notification of the questionnaire described public bicycles as "those bicycles that one can access in many central points of a city in specially designed rental stations for short-term usually for a very small fare". For the means of Gothenburg's questionnaire the pre-notification referred directly to Styr & Ställ although a similar description of the term "public bicycles" was also provided in case there were respondents not knowing the local scheme. The pre-notification made it clear that the survey would be mainly for academic research and that the information given would be used in a confidential manner. It should be noted that a specific hypothetical scenario framing in detail the future bike-sharing scheme was not employed in the case of Drama, something that could have made even clearer the attitude object of the study. Nonetheless, this was a cautious decision in order to avoid i) biased answers depending on geographical considerations that might not apply at all when the real scheme would be launched and ii) thoughts that this was not a research study but rather an introduction-exercise for a specific scheme already planned from the local government.

3.2 Distribution and sampling

The questionnaire was available to the public of Drama in an online form and via one-page hard copies. This dual diffusion approach was decided since this research study was aiming to get a sample size that could be representative of Drama's population by maximising data collection opportunities and therefore improving the response rate. The empirical knowledge and prior experience of the first author about studying attitudes of Drama's population was suggesting that none of the two options (i.e. online survey and postal survey) could solely provide a sample size reflecting the needs of the study since: i) many people in Drama and especially people aged 50 and over are not particularly engaged with internet activities and ii) due to lack of Universities in the region there is not yet a research-friendly philosophy established to allow for an academic-driven postal survey to have response rates comparable to the likes of other countries or cities [8].

The online survey was accessible through the official webpage of the Municipality of Drama and was disseminated electronically through social media, while paper-based questionnaires were posted together with the City's water and sewage bill letters to an excess of 3000 households in Drama. The paper-based questionnaires were set to be returned to special collection boxes available in the City Hall's reception, the offices of the city-run company for the local 'water and sewage issues' (D.E.I.A.D.), the Citizens' Helping Desk of the City (K.E.P.) and the office of the Local Centre for Labouring Representation. The addresses for the postal survey were randomly chosen from D.E.I.A.D. administrators and were distributed evenly between the different parts of the city, so that the sample would be more representative in geographical terms.

The distribution of the questionnaire in Gothenburg was on the other hand a far more straightforward choice and was conducted solely via an online survey accessible from Chalmers University of Technology official webpage. Circulating the online questionnaire was amplified by using social media and e-mails. A hard-copy distribution was considered avoidable due to the considerably bigger size of the second study locality, the much bigger familiarity of the people in Gothenburg with online surveys and financial, time and management constraints.

The city of Drama generated 640 useable responses: 257 coming from the online survey and 383 that were reflecting the hard-copy questionnaire collection. There were also 31 partially completed online questionnaires and 40 non-usable postal questionnaires returned that were excluded from the analysis purposes, since a full completion of the questionnaire was set as a prerequisite for participation. The city of Gothenburg generated 535 useable responses and 23 partially completed questionnaires.

4 RESULTS AND DISCUSSION

The complete set of results of this dual study intends to enhance the development of a thorough theoretical and empirical understanding of the attitudes of the residents of Drama and Gothenburg reflecting directly or indirectly public acceptability towards cycling and bike-sharing. This paper nonetheless aims to focus solely to the attitudes that refer to safety issues and identify safety-related barriers that could be keeping road users away from embracing, not just these local public bicycle applications, but bike-sharing as a notion per se.

4.1 Identifying the Sample's Characteristics

Before proceeding with the identification and discussion of the safety-related findings of this dual survey, it is of significant importance to look into the profile of the two samples in terms of their demographic characteristics and in terms of their basic travel behaviour and transport attitude orientations. This would allow more meaningful comparisons to take place as part of the analytic process and could eventually allow the identification of particular groups (i.e. based on age, gender or frequency of driving or cycling) that could have specific group-related attitudinal issues towards bike-sharing safety issues.

Table 1 provides a synopsis of the demographic profiles of the two samples in terms of gender, age, type of household, education background and household income.

Table 1. Demographic characteristics of the two samples.

Demographic characteristics	DRAMA	GOTHENBURG
Gender	Male: 46.7% Female: 53.3%	Male: 56.1% Female: 43.9%
Age	< 20: 6.3% 20-29: 15% 30-39: 29.1% 40-49: 28.9% 50-59: 15.8% 60-69: 4.1% >70: 0.9%	< 20: 2.8% 20-29: 58.3% 30-39: 22.6% 40-49: 7.5% 50-59: 7.1% 60-69: 1.3% >70: 0.4%
Type of household	Single: 13.8% Couple: 11.4% Family (with child): 53.8% Family (parents): 18.9% Sharing flat with others: 2% Other: 0.2%	Single: 33.5% Couple: 35.5% Family (with child): 16.1% Family (parents): 6.7% Sharing flat with others: 6.0% Other: 2.2%
Educational background	Elementary school: 1.1% Junior high school: 2.8% High school: 26.1% Bachelor (Technical.): 18.0% Bachelor (University): 35.6% Master: 10.9% Doctorate: 2.2% Other: 3.3%	Elementary school: 0.6% High school: 18.5% Bachelor: 26.2% Master: 41.9% Doctorate: 6.0% Other: 6.9%
Income (household)	< 1,000€: 26.3% 1,001-2,000€: 37.8% 2,001-3,000€: 12.7% 3,001-5,000€: 1.9% >5,001€: 5.9% Do not want to say: 15.5%	< 20,000 SEK: 37.8% 20,001-30,000 SEK: 12.0% 30,001-50,000 SEK: 16.0% 50,001-70,000SEK: 12.8% 70,001-100,000 SEK: 8.3% >100,001 SEK: 2.4% Do not want to say: 10.7%

The comparison of the demographic profiles of the two samples indicate some basic differences between the two urban societies on focus but that was entirely anticipated. Actually, the authors make the case that this ‘versatility’ of the samples is adding to the value of the study enabling it eventually to look into bike-sharing dynamics as a concept that goes beyond specific local applications. People in Drama are far more likely when young to stay with their parents than people in Gothenburg and not as likely to stay in single households. The respondents from Gothenburg where in average significantly better off in terms of household income but this is evident when comparing income standards between Greece and Sweden. In terms of gender split Drama’s sample was closer to that of the general population in Greece (49.2% male, 50.8% female according to the 2011 Hellenic Census) but Gothenburg’s sample was not that far off either (49.9% male, 50.1% female according to the 2013 Swedish Census). The age split reflects the interest and potential usefulness that the attitude object could have on different ages; that is why people aged 60 and over who in general due to physical limitations are far less likely to cycle and therefore use bike-sharing did not participate in the survey in large numbers. This combined with the use of an online survey that was communicated a lot through social media applications explains the high number of respondents aged 20 to 29 (together with the ones aged 30-39 the people most likely to cycle) from Gothenburg. The results between age and frequency of cycling is statistically significant ($\chi^2 = 43.293$; $df = 30$; $p < 0.1$).

Table 2 provides a synopsis of the respondents' profiles in terms of some of their basic travel behaviour characteristics and attitudes towards transport and bike-sharing. Again the table refers separately to the samples of Drama and Gothenburg to allow for comparisons. It should be noted that the terms "regularly" and "sometimes" that are used to report frequencies correspond to the combination sets of responses of "daily" and "few times a week" the former and "once a week" and "at least once a month" the latter.

Table 2. Behavioural/Attitudinal characteristics of the two samples.

Behavioural /Attitudinal characteristics	DRAMA	GOTHENBURG
Frequency of driving a car	Regularly: 71.1% Sometimes: 6.6% Rarely/Never: 22.3%	Regularly: 19.4% Sometimes: 26.9% Rarely/Never: 53.7%
Frequency of cycling	Regularly: 19.2% Sometimes: 11.6% Rarely/Never: 69.2%	Regularly: 52.4% Sometimes: 19.9% Rarely/Never: 27.6%
Primary means of travelling to the most frequent destination	Car (driver): 48.8% Car (passenger): 5.6% Motorcycle: 6.6% Bus: 4.8% Cycling: 4.8% Walking: 29.4%	Car (driver): 5.8% Car (passenger): 0.9% Motorcycle: 0.0% Bus/Tram: 37.5% Train: 4% Cycling: 30.5% Walking: 21.4%
Primary factor for choosing transport mode	Cost: 9.2% Comfort: 41.4% Availability: 15.5% Time: 25.5% Environmental awareness: 8.4%	Cost: 14.5% Comfort: 22.6% Availability: 28.6% Time: 26.1% Environmental awareness: 7.2%
Bicycle ownership	Yes: 58.3% No: 41.7%	Yes: 78.8% No: 21.2%
Frequency of using bike-sharing*	Regularly: 46.9% Sometimes: 21.5% Rarely/Never: 31.6%	Regularly: 7.6% Sometimes: 5.6% Rarely/Never: 86.4%
Way of utilising a bike-sharing scheme*	Main travel mode: 15.6% Main travel alternative: 26.4% Secondary alternative: 27.7% Exercise and joy: 18.6% Do not use: 11.7%	Main travel mode: 2.8% Main travel alternative: 5.5% Secondary alternative: 21.6% Exercise and joy: 0.4% Do not use: 69.8%
Bike-sharing should be introduced in Drama / Bike-sharing is good for Gothenburg	Strongly agree: 56.7% Agree: 30.2% Neutral: 10.7% Disagree: 1.3% Strongly disagree: 1.3%	Strongly agree: 71.2% Agree: 21.2% Neutral: 6.2% Disagree: 0.7% Strongly disagree: 0.7%

*for Drama these are figures referring to the respondents' perceived usage of the scheme if this was introduced in the city; while for Gothenburg reflects usage during the 2014 bike-sharing season.

Again there are very intriguing differences between the two samples. The respondents in Drama are far more car reliant than the ones in Gothenburg. This is not simply a matter of travel behaviour philosophy but an indicator that in Drama alternative to car modal options are still not viable (e.g. there is not a good level of public transport services available). More importantly perhaps the respondents of Gothenburg cycle more frequently and are more likely to own their private bicycle. Interestingly enough cost is more important for the Gothenburg's respondents as a criterion for deciding on their main travel mode but this reflects in a degree the youth of this particular sample. In theory the respondents in Drama were very likely to embrace the new mode when in real terms the respondents of Gothenburg were rather unlikely

to use frequently Styr & Ställ or to utilise it as anything else than a secondary alternative. The most straightforward evaluation question of the questionnaire for Drama was referring to whether bike-sharing should be introduced in the city while for Gothenburg the question was framed to ask respondents if they consider the existing scheme to be good for the city. In both cases people were extremely sympathetic to the measure.

4.2 Safety as a criterion for embracing bike-sharing

Despite the fact that this study was not intended to be focusing extensively on the theme of road safety it was unavoidable to consider this when looking to develop an understanding of the attitudes reflecting the public acceptability of bike-sharing. This is because danger, or fear of involvement in an accident, remains the key reported deterrent to widespread cycle use [16] and therefore evidently to the success of bike-sharing schemes. Each of the two questionnaires therefore had two questions referring to road safety; one direct and one indirect.

The first set of questions for Drama and Gothenburg was part of the survey section themed as views on bicycles and cycling. It was asking respondents to choose an answer that best expressed their views on whether “bicycle is an unsafe mode” (Drama’s survey) or whether “cycling is safe” (Gothenburg’s survey) varying from strongly agree to strongly disagree (5-point Likert scale). The exact wording of the question was decided based on the less cognitively challenging way to express the statement in Greek and Swedish respectively and that is why there is a difference between the two. However, the attitude object of the question is arguably the same (there is almost no room for different interpretations of its meaning) and it was set to gather data on whether cycling is appreciated by the respondents of the surveys as a potentially dangerous travel mode or not. Figure 1 and Figure 2 illustrate the two sets of results.

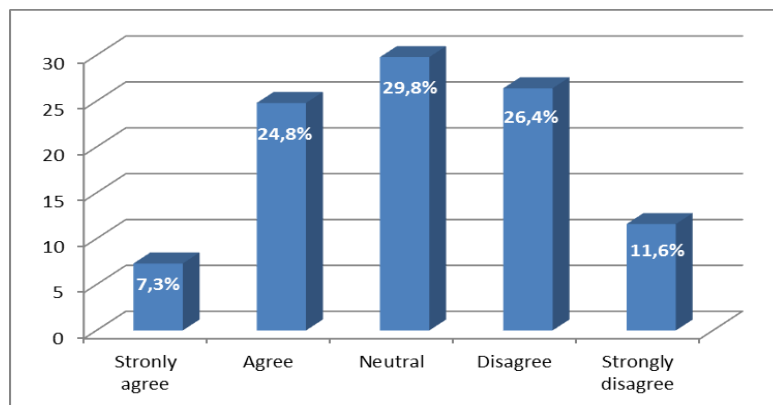


Figure 1. Bicycle is an unsafe mode (survey results from Drama).

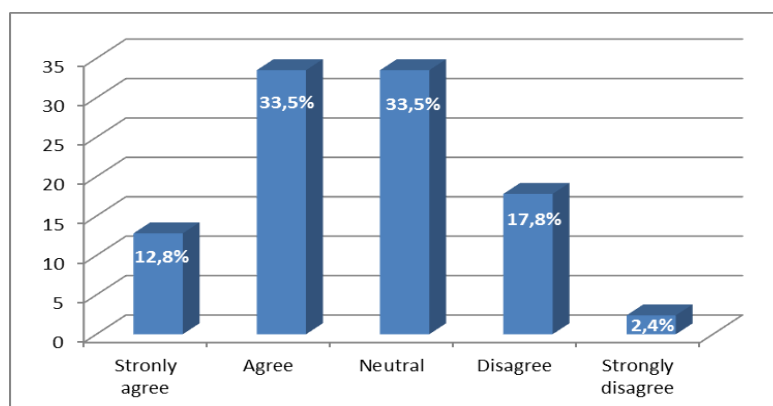


Figure 2. Cycling is safe (survey results from Gothenburg).

Both sets of results indicate that the respondents had no particularly strong views about whether bicycle/cycling is safe or not. All the responses containing the word “strong” used either in a positive or negative context gained small attention. On the contrary, in both cities approximately one third of the respondents provided a neutral reply possibly feeling that safety is something mostly depending on the individual cyclist and one’s overall ability to ride safely a bike within a city or perhaps being unable to decide if cycling is an activity so risky that could be classified as truly unsafe. In general, in both samples there were more respondents feeling that cycling is safe than those who thought that it is unsafe. The Swedish respondents were more likely than the Greek respondents to think that cycling is safe although this difference was not that significant (46.3% against 38%). This was something anticipated, nonetheless, in some degree since the Swedish respondents being more likely to own a bicycle and to cycle in a regular basis were more acclimatized to the dangers of bicycle use and could downplay them easier than others who did not have extensive daily cycling experiences (as most Greek respondents self-reported).

In the sample representing Gothenburg the younger an age group was the more likely the respondents consisting it were to believe that cycling was safe ($\chi^2 = 38.999$; $df = 24$; $p < 0.05$). There were no statistically significant gender differences ($\chi^2 = 5.999$; $df = 4$; $p = 0.199$) and no statistically significant differences referring to any of the other demographic or travel behaviour parameters listed in Table 1 and Table 2. The only other statistically significant finding that can be reported was the one about the correlation with the attitude referring to whether a particular respondent was likely to believe that Styr & Ställ was good for the city. Respondents that self-report compliance with this notion were more likely to believe that cycling was safe ($\chi^2 = 61.038$; $df = 16$; $p < 0.05$) although it should be noted that the sample groups against this notion were rather small.

In the sample representing the potential bike-sharing users from Drama there were no age-specific differences of statistical significance ($\chi^2 = 22.225$; $df = 24$; $p = 0.566$) nor gender-specific ones ($\chi^2 = 2.958$; $df = 4$; $p = 0.565$). Nonetheless, household income had a statistically significant correlation with the perception regarding cycling’s respective safety ($\chi^2 = 29.901$; $df = 20$; $p < 0.01$). People earning 5,001€ and more and the ones not wanting to disclose their household income were far more likely to agree or strongly agree than all others that bicycle was an unsafe mode. The frequency with which people self-declared that they will be using an eventual bike-sharing scheme was also strongly correlated with the perception regarding cycling’s respective safety ($\chi^2 = 44.956$; $df = 20$; $p < 0.05$). The respondents less likely to self-report an eventual use of the scheme were the ones most likely to believe that riding a bicycle is an unsafe travel option. The final statistically significant finding was the one referring to the correlation with the attitude set to frame whether a particular respondent was likely to believe that bike-sharing should be introduced in Drama ($\chi^2 = 35.808$; $df = 16$; $p < 0.05$). Respondents that self-reported compliance with this notion were more likely to believe that cycling was safe although it should be noted that the sample groups against this notion were rather small. This last finding combined with the correlation reported in Gothenburg’s sample relating the perceived goodness of bike-sharing for the city with the perceived safety of cycling means that people who tend to believe that bike-sharing is a needed function for the wellbeing of their urban society are more likely to consider cycling a less dangerous travel alternative.

The other important set of results that would be presented and discussed herein refer to the issues that respondents could actually (Gothenburg) or eventually (Drama) see as reasons for not using a bike-sharing scheme regularly or at all. For Drama’s case this question, in order to become more meaningful, was purposefully expanded into referring to cycling as a whole; the question actually started as such (i.e Are there any reasons for not cycling regularly and not being willing to eventually bike-share?). There was a number of set answers available to the participants of the study for responding to this question with “limited road safety” being among them in both surveys. The two predetermined sets of answers for the cities of Drama and Gothenburg were very similar but not identical since the very question was somewhat different in each city and the case of the already operating bike-sharing scheme of Gothenburg dictated the use of a few more answers context-dependent to its specific characteristics. The respondents were asked to choose not only one but up to two different factors that could make

them hesitant to adopt a more cycle-oriented travel behaviour. Figure 3 and Figure 4 illustrate the two sets of results referring to Drama and Gothenburg respectively.

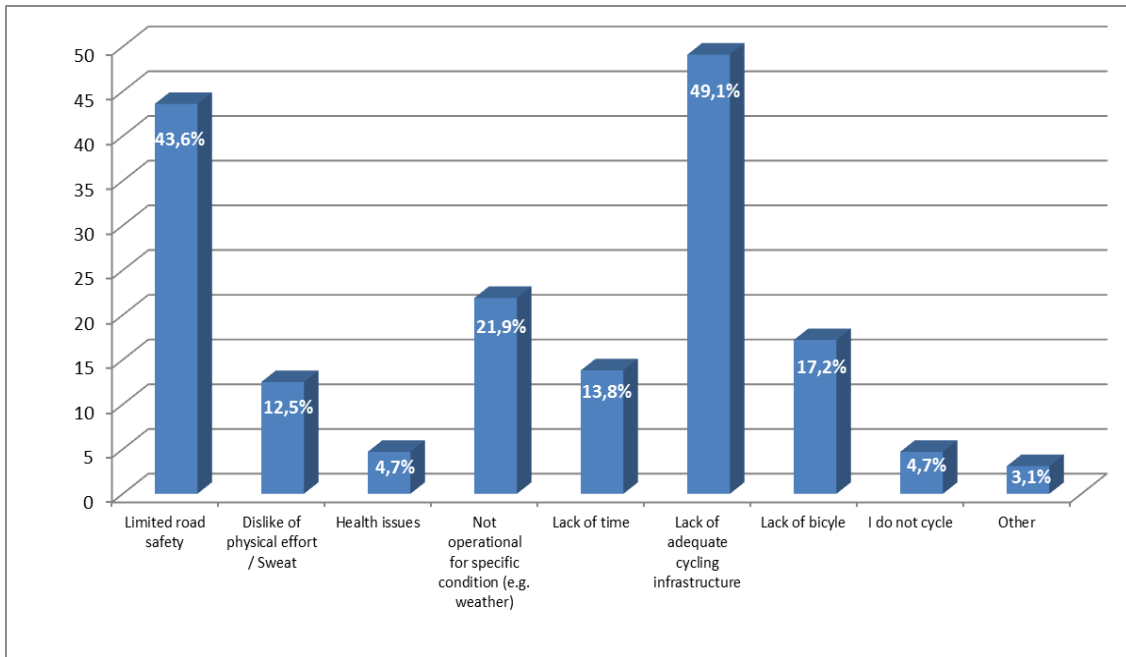


Figure 3. Reasons for not cycling regularly and not being willing to eventually bike-share (survey results from Drama).

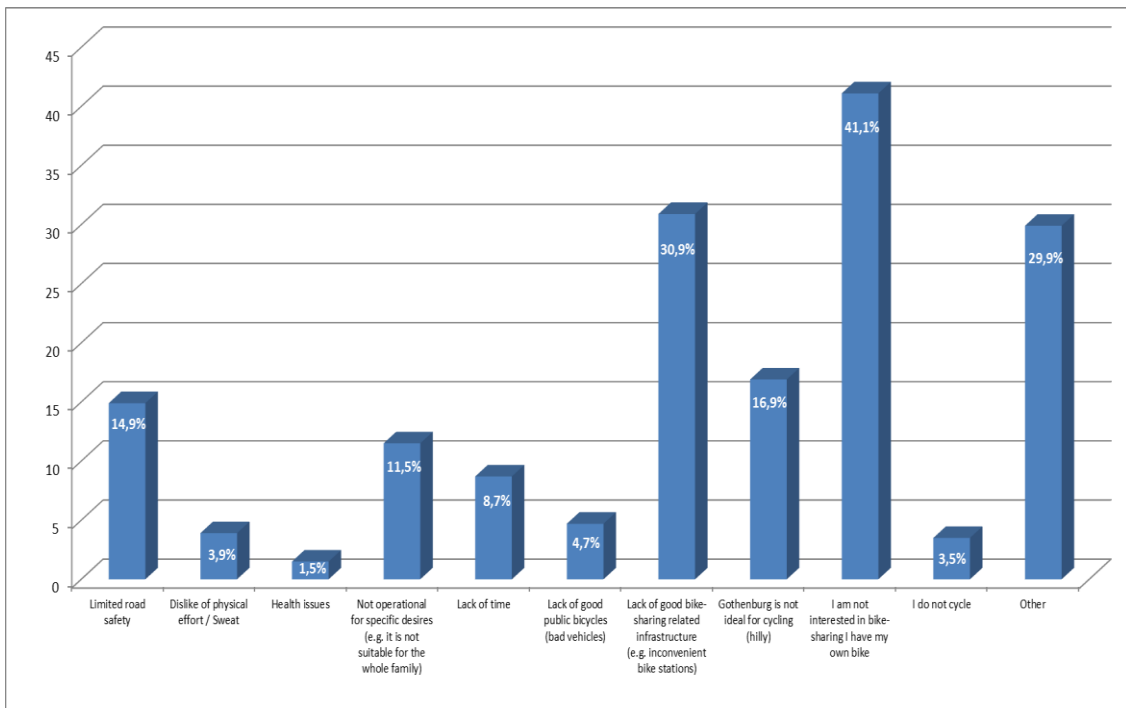


Figure 4. Reasons for not using bike-sharing more regularly or at all (survey results from Gothenburg).

The main reasons according to the respondents of Drama for being reluctant to cycle and potentially to use public bicycles are principally associated with the lack of cycling-oriented or bike-friendly urban infrastructure and the feeling that currently there is only limited road safety for cyclists. Almost one in every two respondents made the case for each of these two specific answers making clear that physical and cognitive barriers associated with the way a cyclist is hospitalized in one's respective urban environment constitute the key in giving up the ideas of cycling and bike-sharing. More specifically, and since this paper is set to embrace the theme of road safety, one could claim that the two factors, in which these two most popular responses refer to, are very much linked to each other. Better and more focused road infrastructure suiting the special needs of cyclists (or at least not fully disregarding them) could improve road safety conditions both in real terms but also in the way people perceive these safety-related conditions.

It is true that only recently the construction of bike lanes, bike roads and bicycle racks has been initiated in the city of Drama; therefore these specific attitudes are well justified [8]. The reality is that although cycling has been ignored almost entirely thus far from policymakers and has not as yet been classified as a truly mainstream travel mode that deserves investing on, bike-sharing was viewed very positively by the respondents of this work. This highlights the vast potential that this mode has if politicians decide to fund infrastructure that supports the needs of cyclists, and therefore improve road safety conditions both in real terms but also in the way people feel about them. If this important safety-enhancing precondition could be satisfied bike-sharing could in turn become a worthwhile investment for Drama capable of promoting a transition to an increased bicycle usage for the city.

The respondents of Gothenburg on the other hand, having a far superior city in terms of being able to access a number of well-developed alternatives to private car usage and a better overall road transport network already supporting cycling in multiple ways, were not that likely to choose "limited road safety" as one of their two answers. Only 14.9% of the respondents answered that limited road safety could act as an obstacle for them in using bike-sharing. Nevertheless one of the most frequent answers, which the respondents gave when asked about the reasons they could lead them to self-exclude themselves from using Styr & Ställ, was the one referring to the "lack of good bike-sharing related infrastructure (e.g. rental stations)". The term "good" in this specific context could well mean among other attributes (e.g. comfortable, conveniently located, aesthetically pleasing, accessible) that could contribute in defining the perceived goodness of the scheme "safe". "Lack of good public bicycles" was another reason for not employing the regular use of Styr & Ställ that could be again linked with road safety if "good" in a number of cases and for some respondents is partially equivalent to "safe" among other things. This means that even a rather advanced and rapidly expanding, due to its popularity, bike-sharing scheme could be perceived into some extent by more than a few people as an unsafe system or perhaps as part of an overall unsafe road transport system.

5 CONCLUSIONS

Change of road user attitudes is often advocated as a necessary condition for the improvement of road safety; some consider this as a panacea to the road accidents problem [17]. In this case the respondents' attitudes in both cities, were in aggregate level at least, already extremely sympathetic to public bicycles and thus do not need to be altered. Even these respondents (and there were many) that self-reported a small or no likelihood to actually (Gothenburg) or eventually (Drama) use in a systematic way bike-sharing tended to be positive towards a local scheme. Nevertheless, perceptions regarding cycling safety could constitute a significant barrier in allowing urban societies, like the ones in Drama and Gothenburg, to truly materialize the vast potential of bike-sharing by having more and more of their members using it. In particular, what could be listed as the main conclusion of this research study, when referring to the safety theme, was that many people could not embrace bike-sharing (or even cycling per se) based on two reasons; because they perceive riding a bicycle to be, in general, a rather unsafe travel alternative and because they believe that their cities provide only limited road safety for cyclists. Investments on more bike-friendly road transport infrastructure in general and better bike-sharing infrastructure in particular could mitigate these issues.

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