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THE IMPACT OF RIVALRY AND EXCLUDABILITY ON TRANSPORT CHOICES: A PRELIMINARY RESEARCH

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ABSTRACT: Purpose: Many policies aimed at developing sustainable transport are based on a (partial) exclusion of car drivers and on a decrease in rivalry between different transport users. In this context, the primary purpose of this study is to assess the impact of changes in levels of rivalry and excludability resulting from infrastructural changes in the transport system providing enhanced sustainable transport choices. Methodology/approach: Rivalry and excludability determine patterns of consumption and are the basis of many aspects of sustainable transport policies. Therefore, the key issue for policy making is to determine the extent to which changes in these features support sustainable transport choices. To attempt to understand these features, preliminary survey research was conducted among users of the Wrocław (Poland) transport system to investigate; (i) which changes in the transport system are the most important for respondents, (ii) how these changes influence the intensity of rivalry and excludability, and (iii) whether these changes lead to a shift in transport mode choice. Findings: Changes in the transport system led to decreased or unchanged intensity of rivalry. There were few examples of exclusion, which affected primarily car users. Modifications in the levels of the two analysed features were not accompanied by a permanent shift towards more sustainable transport choices. Originality/value: While many studies investigate changes in transport behaviour resulting from particular solutions that promote sustainable transport, this study focuses on how transport users react when faced with many different changes in the transport system. The novelty of this approach sheds light on transport choices resulting from changes in rivalry and excludability and the results obtained may assist evidence-based policy recommendations.

KEY WORDS: transport behaviour, transport choices, rivalry, excludability, sustainable transport

Introduction

Rivalry and excludability are key features of goods which influence consumption patterns (Maunder et al., 1996, p. 125). Rivalry occurs when one consumer makes it impossible or harder for other consumers to use a good (Farley, 2012, p. 47). Exclusion means that it is possible to prevent someone from the consumption of a good (Farley, 2012, p. 49-50) or simply, that it is impossible for someone to consume a good. Important incentives to study these features emerged due to deliberations about taxation, imposing payments for consumption, and the dilemma of whether governments or markets should manage the provision and maintenance of certain types of goods (Samuelson, 1954; Musgrave, 1959; Buchanan, 1965). Another premise for research in this domain was the overuse of common-pool resources and the "Tragedy of the commons" (Hardin, 1968; Ostrom, 1990). In transport systems, rivalry and excludability can be analysed both in terms of accessibility and the interactions between transport users and selected aspects of sustainable transport (e.g. transport externalities). Transport studies refer mostly to the relations between different types of goods and the external effects of transport (Blum, 1998, pp. 83-86; OECD, 2002a, pp. 62-66), the complexity and management of urban transport systems (UN-Habitat, 2013, pp. 159-161; Platje, 2012, pp. 45-47) or, the development of successful financial models that would support sustainable urban mobility (UN-Habitat, 2013, pp. 159-161). These studies present little discussion of the relationship between the intensity of rivalry, the degree of excludability and transport behaviour. On the other hand, factors shaping transport choices are widely discussed in the literature (e.g. Grison et al., 2016, p. 288; Ramezani et al., 2018, pp. 1354-1356; Tyrinopoulos, Antoniou, 2013, p. 28-30; Paradowska, 2014, pp. 264-268). Similarly, there are many studies on instruments expected to promote sustainable transport mode choices (e.g. Verhoef et al., 2009; Yan et al., 2019; dell'Olio et al., 2018; Pucher et al., 2010, 2016; Cattaneo et al., 2018). Even though most of these instruments lead to changes in the levels of rivalry and excludability in transport systems, there are very few studies on the effects of these changes on behaviour. This paper aims to fill this gap by investigating the impact of changes in the levels of rivalry and excludability in transport systems on transport mode choices. The analysis is based on the results of empirical research conducted among transport users in the city of Wrocław (Poland). It is based on three research questions:

- What important changes took place in the transport system?
- What was the impact of these changes on the intensity of rivalry and the degree of excludability in transport system access for different transport users?

- Were there changes in transport choices as a result of modifications of the intensity of rivalry and excludability?

Literature overview

The discussion about classification of goods can be traced back to Samuelson (1954), Musgrave (1959, p. 162), Hardin (1968) and Ostrom (1990) where, depending on the intensity of rivalry and excludability, several basic types of goods can be distinguished. Ostrom (2010, p. 4) indicated that rivalry and excludability cannot be considered "present or absent", as they fundamentally indicate different levels (from low to high). This debate about rivalry and excludability has vital consequences for analysis of transport systems. Applying a complex approach, a transport system can be considered a club good, a congestion good (Platje, 2012, p. 46), or a public good (UN-Habitat, 2013, p. 162). In fact, different elements of transport systems have features of different types of goods and are characterised by different levels of rivalry and excludability (Blum, 1998; Platje, 2012). The degree of intensity of rivalry is moreover, strictly related to the capacity of transport systems and their number of users. Usually, the higher the number of transport users, the higher the intensity of rivalry and the greater probability of congestion (Platje, 2012; Blum, 1998, p. 83). Rivalry can take place between the same or different types of transport users and can lead to their (partial) exclusion. Moreover, exclusion can take place due to insufficient infrastructure or transport offers as the intensity of exclusion is strictly related to the accessibility of different transport modes, and as a consequence, available transport choices (e.g. Wulfhorst et al., 2017; Rode and Floater, 2014; Geurs et al., 2010). Levels of rivalry and excludability in transport systems are significant, among others in terms of the socio-economic role of transport (e.g. Blum, 1998; Platje, 2014; Platje. et al., 2017; Wang et al., 2018), the discussion about various tasks of private and public sectors in the provision and maintenance of elements of transport systems (e.g. Amos, 2004; Roumboutsos, 2015), and successful management of transport systems that would support sustainable development (e.g. Platje, 2014; Platje. et al., 2017; Paradowska, 2011; Richardson, 2005; OECD, 2002b). In this context, the overall demand for transport and transport mode choices play a fundamental role, because, due to negative transport externalities, the popularity and attractiveness of road transportation contributes to a large extent to unsustainable development (e.g. Geels et al., 2011; Trela, 2017, p. 157; Paradowska, 2017, p. 22). For this reason, factors influencing transport mode choices, especially a shift from cars towards sustainable means of transport, are widely discussed in

literature. Results of previous studies reveal that there are several groups of factors which are decisive for transport choices (Grison et al., 2016, p. 288; Ramezani et al., 2018, pp. 1354-1356; Paradowska, 2014, pp. 264-268; Schwanen, Lucas, 2011; Schneider, 2011):

- attributes of transport modes and personal criteria (e.g. Litman, 2008; Hess et al., 2005; Chee, Fernandez, 2013),
- the built environment and spatial planning (e.g. Ramezani et al., 2018; Scheepers et al., 2016; Ye, Titheridge, 2017; Christiansen et al., 2016),
- the situation-specific context (e.g. De Jong and Van de Riet, 2008; De Vos et al., 2016),
- psychological factors such as attitudes and habits (e.g. Setiawan et al., 2015; Outwater et al., 2003; Kuppam et al., 1999; Popuri et al., 2011; De Vos et al., 2013),
- demographic characteristics (e.g. De Vos J. et al., 2016; Chee, Fernandez, 2013).

Another direction of research focus on the examination of policy instruments and their impact on sustainable transport choices. These include road pricing (Cornagoi et al., 2019; Verhoef et al., 2009; Anas, Lindsey, 2011), or the use of parking policy (Yan et al., 2019; dell'Olio et al., 2018; Barata et al., 2011; Bos et al., 2004; Delmelle, Delmelle, 2012). Tools supporting cycling in cities were discussed by Winters et al. (2011), Pucher et al. (2010) and Pucher, Buehler (2016). Extensive research exists on the impact of many other sustainable transport instruments (e.g. Mayes et al., 1996; Bachand-Marleau et al., 2011; Standing, 2019; Meijer et al., 2017; Kopp et al., 2015; Cattaneo et al., 2018, pp. 960-962; Hiselius, Rosqvist, 2016; Stead, 2013; Ajanovic, Haas, 2016; Trela, 2017).

Instruments of transport policy are usually aimed at the reduction of rivalry between drivers and other transport users, with the ultimate goal of the purposeful exclusion of cars. Some tools are aimed at reducing exclusion as perceived by potential public transport passengers, cyclists and pedestrians. However, there are no direct studies on how changes in rivalry and excludability resulting from such instruments shape transport choices. Moreover, researchers mostly focus on the effects of particular solutions, whereas many transport systems, especially in urban areas, are constantly changing organisms. Thus, transport users face many transformations at the same time where reactions to some changes can be stronger than to others. In addition, different investments can have different effects on levels of rivalry and excludability which can then be analysed from the perspective of system dynamics in transportation (Sterman, 2000; Armah et al., 2010).

This paper aims therefore at filling this gap. The study presented has some limitations. Firstly, the focus is on improvements in different types of

transport infrastructure and in traffic organisation, because for most users these changes are easy to observe and to experience. Secondly, as the development of walking, cycling and public infrastructure is important for sustainable urban mobility (e.g. European Commission, 2017), the research does not take into consideration ("so called") soft measures or sophisticated technological changes. Thirdly, this is a case study based on just one city in Poland. Finally, due to sample size and respondents' characteristics, the findings cannot be generalised to the whole population and further research should be developed and conducted to study the reactions of transport users in different cities and under different circumstances.

Research methods

Preliminary survey research was conducted in May-July 2018 among transport users in Wrocław to ascertain changes in the transport systems that were considered most important for respondents, to investigate perceived intensity of rivalry and degree excludability and their transport behaviour resulting from these changes. The survey questionnaire consisted of three parts linked to the research questions presented above:

- changes in the transport system significant for transport users,
- impact of these changes on levels of rivalry and excludability,
- transport behaviour of respondents.

The transport system in Wrocław was selected for several reasons. Wrocław is a dynamically developing city (Książek, Suszczewicz, 2017) that is the fourth largest city in Poland. Moreover, despite a well organised public transport system and investments in solutions supporting sustainable transportation (Topolska, Topolski, 2015; Molecki, 2017; City Council of Wroclaw, 2015, 2016; Official website of Wrocław), the city is challenged by a high motorisation rate and high levels of congestion (Kamińska, Chalfen, 2017; Deloitte, Targeo, 2015). In Wrocław, there were 877 motorised vehicles registered per 1000 inhabitants and 551 738 registered vehicles in total. Based on these two indicators, Wrocław has the second largest vehicle usage in Poland, just after Warsaw, the capital of the country (Zespół Doradców Gospodarczych Tor, Polska Organizacja Branży Parkingowej, 2017, p. 11). High intensity of car usage is accompanied by negative transport externalities (Hołtra, Zamorska-Wojdyła, 2018; Koźlak, 2015).

The survey questionnaire was made available in printed and in online versions. and the participants were requested to forward the questionnaire to other respondents. The survey was distributed among groups with different characteristics in terms of gender and age. Despite the snowball-sam-

pling, 248 completed questionnaires were received. Thus, the sample can only be considered as an experimental group for preliminary research. The analysis was based on the comparison of shares of answers.

Results

There were 47.18% female and 52.82% male respondents in the sample with young transport users being more likely to complete the questionnaire. The 21-25 age-group accounted for 51.61% of responses, and the 26-30 age-group for 14.92%. There were only 2 questionnaires completed by respondents aged less than 21. The shares of other age groups were as follows: 31-35 – 6.8%, 36-40 – 9.7, 41-45 – 5.34%, 46-50 – 0.97%, 51-55 – 1.46%, 56-60 – 2.43%, 61-65 – 2.91%, 66-70 – 0.49% and 71-80 – 1.46%. About two-third of the questionnaires were completed by people living in Wrocław, and one third by people living outside of the city. 47.99% of respondents were students, 46.77% working people and only 4% were pensioners. This unrepresentative distribution of respondents' is another reason to consider the sample just as an experimental group.

The majority (76.2%) of all respondents experienced significant changes in the transport system, whereas, 6.85% indicated: "It's hard to say". Both these groups, however, were requested to indicate what changes were the most important for them. Multiple answers were possible as transport investments often embrace many simultaneous changes (e.g. in public transport and cycling infrastructure). Table 1 presents combinations of changes experienced by respondents and their impact on the use of different means of transport. The five main changes identified referred to (1) road and (2) public transport infrastructure, (3) traffic organisation, (4) walking and (5) cycling infrastructure. Almost two thirds (62.14%) of all respondents perceived and experienced at least one change in the transport system whereas, for 37.86% of respondents, the most important changes comprised combinations of different solutions. Basically, modifications in the transport system had a positive impact on the use of all means of transport (table 1). In particular, travelling by public transport and by car became more attractive. Levels of excludability did not change significantly. Nearly 17.5% respondents claimed that it was impossible to use some means of transport after the transport investments (table 2). Higher levels of exclusion were identified mainly in the use of cars (45.95% of all cases of exclusion).

Table 1. Impact of changes in the transport system on the use of different means of transport

The most important changes identified by respondents:						Answers		Impact on the use of cars [%]			
Road infrastructure	Public transport infrastructure	Cycling infrastructure	Walking infrastructure	Traffic lights	Traffic organisation	No.	%	Negative	Zero	Positive	No opinion
X						53	25.73	11.32	3.77	**79.25**	5.66
	X					26	12.62	19.23	**38.46**	30.77	11.54
					X	21	10.19	**52.38**	28.57	19.05	0
			X			15	7.28	13.33	**46.67**	33.33	6.67
		X				13	6.31	**30.77**	23.08	23.08	23.08
X		X	X			10	4.85	0	10	**90**	0
X					X	8	3.88	37.5	0	62.5	0
X	X					6	2.91	0	16.67	**83.33**	0
X		X				5	2.43	0	**40**	**40**	20
Other 28 combinations						49	23.79	**37.458**	11.7	44.36	6.48111
TOTAL						206	100	24.76	18.45	**50.49**	6.31

Source: author's own work based on the survey research.

Table 2. Impact of changes in the transport system on exclusion of means of transport

The most important changes identified by respondents:						Exclusion of some means of transport [%]			Excluded means of transport [%]	
Road infrastructure	Public transport infrastructure	Cycling infrastructure	Walking infrastructure	Traffic lights	Traffic organisation	No	Yes	Hard to say	Car	Others
X						**21.36**	1.46	2.91	8.11	**16.22**
	X					**12.62**	0.00	0.00	0.00	0.00
					X	**5.83**	3.40	0.97	**16.22**	8.11
			X			**6.80**	0.49	0.00	0.00	2.70
		X				**4.37**	0.97	0.97	**8.11**	2.70
X		X	X			4.85	0.00	0.00	0.00	0.00
X					X	2.91	0.49	0.49	2.70	2.70
X	X					2.91	0.00	0.00	0.00	0.00
X		X				1.94	0.49	0.00	0.00	2.70
Other 28 combinations						18.45	2.43	2.91	10.81	**18.92**
TOTAL						**82.04**	9.71	8.25	**45.95**	**54.05**

Source: author's own work based on the survey research.

Table 3. Levels of rivalry resulting from changes in the transport system

The most significant changes in the transport system identified by respondents:								Change in the intensity of rivalry caused by drivers (impact on other drivers) [%]				Change in the intensity of rivalry caused by drivers (average impact on cyclists, pedestrians and public transport vehicles) [%]				Change in the intensity of rivalry caused by cyclists, pedestrians and public transport vehicles (average impact on drivers) [%]			
Road infrastructure	Public transport infrastructure	Cycling infrastructure	Walking infrastructure	Traffic lights	Traffic organisation			Increased	No change	Decreased	No opinion	Increased	No change	Decreased	No opinion	Increased	No change	Decreased	No opinion
X								18.87	24.53	50.94	5.66	11.32	29.56	43.40	15.72	23.27	31.45	34.59	10.69
	X							30.77	53.85	11.54	3.85	16.67	55.13	23.08	5.13	24.36	57.69	17.95	0.00
					X			71.43	9.52	19.05	0.00	20.63	46.03	28.57	4.76	34.92	38.10	23.81	3.17
			X					33.33	46.67	6.67	13.33	17.78	37.78	42.22	2.22	24.44	31.11	40.00	4.44
		X						30.77	46.15	15.38	7.69	15.38	43.59	30.77	10.26	23.08	53.85	23.08	0.00
X		X	X					10.00	30.00	60.00	0.00	10.00	33.33	53.33	3.33	10.00	33.33	53.33	3.33
X					X			25.00	12.50	50.00	12.50	8.33	16.67	41.67	33.33	12.50	25.00	37.50	25.00
X	X							16.67	33.33	50.00	0.00	16.67	44.44	33.33	5.56	22.22	16.67	50.00	11.11
X		X						20.00	40.00	20.00	20.00	6.67	46.67	40.00	6.67	13.33	40.00	33.33	13.33
Other 28 combinations								34.60	28.37	33.75	3.28	11.22	36.00	46.32	6.45	27.24	28.59	37.32	6.85
TOTAL								29.61	31.55	33.50	5.34	38.35	13.59	38.19	9.87	24.27	36.57	32.36	6.80

Source: author's own work based on the survey research.

Table 3 presents changes in the intensity of rivalry caused by drivers and the users of means of transport other than cars. On average, transport investments did not impact nor lead to less difficulties for cyclists, pedestrians and public transport vehicles due to car drivers. However, the impact of drivers evolved in two opposite directions. Similar shares of respondents claimed there was a higher level (38.35%) and a lower level (38.15%) of rivalry by car drivers with regard to users of more sustainable transport. Moreover, while 31.55% of respondents did not observe any changes in the mutual impact of car users, 33.5% of changes resulted in a lower, and 29.61% in a higher intensity of rivalry between car drivers. What is important, is that different types of transport investments had different impact on levels of rivalry and excludability (tables 1, 2 and 3). Improvements in the road infrastructure devoted to cars led to lower intensity of rivalry between all transport users, but sometimes caused exclusion of more sustainable transport modes whereas changes in the public transport infrastructure had hardly any impact (either on car driver or on users of sustainable transport). Modifications in the organisation of traffic affected mostly drivers, in both rivalry and excludability. Development of walking and cycling infrastructure resulted in lower levels of rivalry between drivers, cyclists and pedestrians.

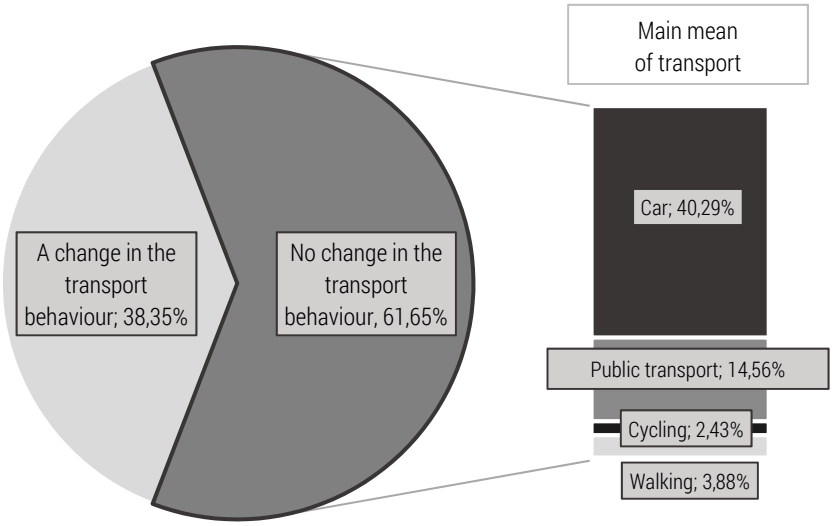

Figure 1. Changes in transport choices resulting from modifications in the transport system (shares of all respondents)

Source: author's own work based on the survey research.

Table 4. Changes in transport choices – frequency of use of different means of transport

The most important changes identified by respondents:							Change in transport choices (38.35% of all respondents)									
							Share of all respondents	Frequency of the use of new means of transport other than cars [% of respondents who changed their means of transport]					Frequency of resigning from a car [% of respondents who changed their means of transport]				
Road infrastructure	Public transport infrastructure	Cycling infrastructure	Walking infrastructure	Traffic lights	Traffic organisation			Never	Seldom	Sometimes	Often	Always	Never	Seldom	Sometimes	Often	Always
X							8.25	1.69	4.64	9.7	4.22	1.27	5.06	6.33	5.06	5.06	0
	X						6.8	5.49	3.38	2.53	4.64	1.69	3.8	2.53	3.8	3.8	3.8
					X		3.88	0.42	2.53	2.95	3.8	0.42	2.53	3.8	3.8	0	0
			X				2.43	0.42	1.27	2.11	2.11	0.42	3.8	1.27	1.27	0	0
		X					2.43	1.69	0.42	0.84	2.95	0.42	0	2.53	2.53	1.27	0
X		X	X				0.97	0.42	0.42	0.84	0.84	0	1.27	0	0	1.27	0
X					X		1.94	1.69	0.42	2.11	0.84	0	0	3.8	1.27	0	0
X	X						1.94	0.42	2.95	1.27	0	0.42	2.53	0	2.53	0	0
X		X					1.94	0	2.11	0.84	1.69	0.42	0	1.27	3.8	0	0
Other 28 combinations							7.78	2.52	2.95	7.17	6.32	1.26	2.54	8.87	6.34	2.54	0
TOTAL							38.35	14.77	21.1	30.38	27.43	6.33	21.52	30.38	30.38	13.92	3.8

Source: author's own work based on survey research.

In effect, changes in the levels of rivalry and excludability had a fairly weak impact on transport behaviour (figure 1) and the majority (61.65%) of respondents did not change their main means of transport. Among this group, more than 65.35% of respondents travelled mostly by car and 23.62% by public transport (40.9% and 14.56% of all respondents respectively).

Of all respondents, 26.21% claimed they had chosen new means of transport after a change in the transport system, whilst 12.14% were "not sure". Both these groups were asked to answer questions about the frequency of use of new means of transport (table 4). The results showed that among these group of respondents changes in the transport system turned out to provide incentives to use "sometimes" (30.38%), "often" (27.43%) or "always" (6.33%) a means of transport other than cars (11.6%, 10.6% and 2.4% of all respondents respectively). Only 3.8% of respondents who changed their transport behaviour definitively resigned from car use, 30.38% resigned "sometimes" and 30.38% "often" (1%, 12% and 12% of all respondents respectively). Lower intensity of rivalry caused by drivers did not cause a significant switch to sustainable means of transport. Similarly, increased exclusion of cars did not affect the overall use of cars. What is interesting is that women were more likely to switch transport mode than men. Compared to 35.45% of male respondents, 41.67% of female respondents agreed they chose a new transport mode due to the modification in the transport system. Similarly, respondents in the age groups 21-25 and 26-30, as well as respondents aged more than 50 were more prone to change their transport behaviour (36.63% and 40% of respondents in these age groups respectively decided to travel by a new mode of transport). This research did not focus on the impact of earnings on mode choices.

Discussion

It can be argued that respondents associated changes in the transport system based predominantly on their own experience. As most people surveyed travelled by car and public transport, almost half of respondents indicated that the most significant changes were related to road and public transport infrastructure, and to traffic organisation. In addition, less than 40% of respondents considered combined solutions as "important".

These results give an insight into two basic problems. First, respondents could neglect or be even unaware of changes significant for sustainable transport development. This could be for many reasons, e.g. due to attitudes and habits (such as car use habits), unwillingness to change transport behaviour (e.g. Setiawan et al., 2015; Thøgersen, Møller, 2008; Verplanken, Wood,

2006) or insufficient information about transformations in the transport system (de Abreu e Silva et al., 2018; Meng et al., 2017). Second, transport policy in Wrocław aims at many improvements in road transportation (City Council of Wroclaw, 2015, 2016). Thus, changes in public transport, walking and cycling infrastructure that led to less intense rivalry with car drivers turned out to be unsuccessful in terms of attracting new transport users. The reason is that changes in road infrastructure result in lower rivalry between drivers and increased attractiveness of travelling by car (e.g. Pfaffenbichler, 2011; Shepherd, 2014). On one hand, investments in road infrastructure can support many goals of sustainable transport, e.g. reduced congestion (e.g. Börjesson et al., 2015), improved safety (e.g. Paradowska, 2016) and accessibility (e.g. Ford et al., 2015) leading to an increase in positive transport externalities (e.g. Platje et al., 2017). On the other, improved road capacity and lower intensity of rivalry stimulate attractiveness of individual motorisation compared to more sustainable means of transport. Thus, in the longer run, cycling, walking and public transport may become less popular, and a higher number of car drivers can again result in an intensification of external costs and a reduction in external transport benefits (e.g. Sterman, 2000; Armah et al., 2010). For these reasons, decreased rivalry experienced by some respondents can be a reason for unsustainable transport choices and unsustainable transport development. Changes in the transport system should thus include both, restrictions and impediments for car users and improvements and facilitations for more sustainable transport users. These two directions of sustainable transport policy would be in accordance to what Tolley (1996, p. 213) calls the "simultaneous promotion of 'green' modes and the restraint of 'red' modes", due to the fact that people often prefer cars (e.g. Ellaway et al., 2003). What seems vital is to enhance the capacity of sustainable transport/infrastructure, while discouraging people from individual motorisation. Otherwise, the intensity of rivalry in using public transport or cycling can lead to congestion in these transport modes, making them less attractive.

Relatively weak reactions of respondents to changes in the levels of rivalry and excludability can be explained by the strong impact of other factors influencing transport behaviour, especially habits and preferences regarding use of cars (e.g. Setiawan et al., 2015; Schwanen et al., 2012; Bouscasse et al., 2018), and the accessibility offered by different transport modes (e.g. Ford et al., 2015; Wulfhorst et al., 2017; Rode, Floater, 2014). Therefore, complex and coherent solutions within a sustainable transport policy should be developed and introduced to cope with the problem of car domination in cities (e.g. Cirianni et al., 2018; Hickman et al., 2013; European Commission, 2017).

Conclusions

This study examines the impact on sustainable transport choices of changes in the levels of rivalry and excludability resulting from infrastructural changes in transport systems. The findings led to the following answers to the research questions:

- The most important changes in the transport system in Wrocław involved improvements in road infrastructure, public transport infrastructure and traffic organisation.
- In general, modifications in the transport system led to decreased or unchanged intensity of rivalry between transport users. However, the perceived rivalry between car drivers was considered to change in two contrary directions. There were few examples of exclusion, which affected mostly car drivers.
- Lower intensity of rivalry did not have a large impact on transport behaviour. Although 38.35% of respondents changed their transport choices, only 6.33% among this group always travelled by a sustainable mean of transport and 3.8% always resigned from cars. In addition, car drivers seemed to be more resistant to changes than other transport users.

The results have some implications for policy making that could lead to changes in transport choices supporting the development of sustainable urban transport. First, a complex assessment of all transport investments should be conducted on a regular basis to estimate the direct and indirect impact on levels of rivalry and excludability of various means of transport and to avoid an increase in the attractiveness of individual motorisation. Second, a de-intensification of rivalry and excludability experienced by users of sustainable transport modes should be accompanied by higher intensity of rivalry between car drivers with a (partial) exclusion of car users. Exclusion of inappropriate driving behaviour (e.g. speeding or disobeying traffic rules) should be better enforced to ensure improved road safety. Dissemination of information about improvements in public transport and improvements in walking and cycling infrastructure could assist public acceptance of car ban/restriction policies, support sustainable transport choices and help to mitigate a decrease in positive transport externalities. A systems approach should be developed and consequently applied to influence the multiple factors which determine transport choices.

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