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THE INFLUENCE OF THE PLACE OF RESIDENCE ON THE BEHAVIOR AND TRANSPORT PREFERENCES OF THE INHABITANTS OF THE AGGLOMERATION

Abstract

Transport behaviors and preferences have an impact on modal split, which is why they should form the basis for shaping the public transport offer. Achieving the goals of sustainable mobility requires taking into account differences in transport behavior and preferences characterizing residents from different areas of the agglomeration. Analyzing differences in behaviors and preferences, the possibilities and limitations resulting from the mass character of public transport services and the fact that the main determinant of the offer is the space determined by displacements in the source-target relation should be taken into account. This article identifies differences in transport behavior and preferences of residents based on the center and suburbs of the Gdańsk agglomeration. At the same time, a preliminary attempt was made to explain the causes of specific differences in residents' behavior and transport preferences, taking into account the limited volume of publication. The share of public transport in the implementation of travel decreases with the distance of the area of residence from the center of the agglomeration. The increase in the share of rail transport in travel affects the increase in the importance of waiting time and the lack of change as a decisive factor in the selection of cars in trips. Transport preferences are strongly diversified in individual areas. Differences are noticeable even in the center areas constituting separate administrative units.

Keywords: transport preferences, transport behavior, travel attitudes, built environment, public transport

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Introduction

In the technical sense, public transport is a branch of transport distinguished on the basis of the so-called vertical transport classification, based on the road criterion. However, the separation of the term "urban transport" in the functional sense is achieved by the so-called horizontal classification of transport, taking the division of territorial units within which particular transport operations are carried out as a criterion of division (Rydzkowski, Wojewódzka-Król, 1997).

The basis for qualifying certain agglomeration areas for service by urban transport should be the nature of traffic in these areas, determined by the implemented functions. The formation of specific settlement complexes depends on the level of socio-economic development of individual regions and the advancement of urbanization processes. These factors has a fundamental influence on the formation of urban complexes, as well as on the changing nature of the agglomerations themselves and their internal structures undergoing constant transformation. A specific type of agglomeration is a conurbation, a polycentric agglomeration whose development is a result of the proximity of cities of all sizes (Parr, 2004). The functioning of the conurbation is based on a common settlement, transport network or other urban facilities. The spread of cities influenced the distance and speed of travel (Banister, 2008), which decide on the choice of means of transport.

In order to ensure an efficient course of socio-economic processes, the transport network in agglomeration areas should be shaped in accordance with the principles of sustainable mobility. The goals of sustainable mobility relate to the economy (accessibility, productivity, costs), society (affordability, livability, equity) and the environment (pollution, noise, resource use) (Rahman, van Grol, 2005). "The goal of sustainable transport is to ensure that the environment is protected by the "affection transport activity" (Litman, Burwell, 2006). Sustainable mobility strategies may include improving conditions for walking and cycling, more support for public transport and activities to reduce car travel in areas exposed to congestion. The goals are also to improve travel comfort and safety and to reduce transport needs (Litman, Burwell, 2006). Achieving the policy goals of sustainable mobility requires undertaking actions that encourage residents to change transport behavior, while changing transport behavior is possible provided that the travel options offered as an alternative to car travel will be tailored to transport preferences and residents' expectations for the quality of services. For this purpose, entities offering alternative services- modes (public transport, car-sharing, bike-sharing) and public transport authorities must conduct or outsource research into the demand, behavior and transport preferences of residents.

Analyzing the demand in public transport, it is necessary to differentiate effective demand (registered on the market) from potential demand, which can be transformed into effective demand while meeting certain expectations of potential passengers. The factors affecting the demand are:

– number of services offered;
– quality of service (determined by the ranking of service attributes such as punctuality, directness, frequency, reliability, convenience and others);

- prices and characteristics of price elasticity, including for different types of services of this transport, service areas and travel distances, time period, destinations, price structure (Paulley et al., 2006);
- price structure;
- revenues;
- competitive offer of alternative (sustainable) modes compared to private cars;
- travel quality;
- active replacing commuter trips by car and public transport called Park & Ride (Olsson, 2003).

The economic situation of households influences transport behavior of residents. The increase in income leads to modal shift in passenger transport – the share of car trips increases. The results of research in the Greek cities indicate that the effects of the economic crisis have a strong impact on limiting the use of the car, compared to the transport means classified as sustainable (Papagiannakis, Baraklianos, Spyridonidou, 2018). One of the goals of sustainable mobility policy is to counteract the increase in the share of cars in travel. However, some researchers assume that the structure of demand for travel in cities will not change radically in the future. More hybridization of means of transport is being predicted, depending on local conditions. Some researchers predict that the car's share in trips will drastically decrease, while there will be significant changes related to the use of energy (Aguiléra, Grébert, 2014). The increase in the share of car-sharing will improve the efficiency of car use, although it does not necessarily lead to a reduction in greenhouse gas emissions (Jung, Koo, 2018).

Researching and analyzing the factors influencing the travel behavior on transport mode choice may be used not only to adapt the offer of services to the preferences of residents, but also in the construction of vehicles, in order to adapt their construction to the expectations of potential passengers (Madhuwanthi et al., 2016). As the goal of sustainable mobility is to encourage passenger car users to change their transport behavior, their preferences should also be examined and analyzed. It is worth noticing that the expectations of this group of residents regarding the quantity and quality of public transport services offered are usually higher than passengers of this transport. However, meeting the expectations of this group of potential public transport passengers is a marketing and financial challenge. Moreover, if it was possible for car users to establish emotional and symbolic connections with public transport, they might be more likely to shift away from regularly opting to use their private cars (Redman et al., 2013). It is justifiable to analyze transport behavior of residents in relation to different areas of cities and agglomerations. Residents from households in central locations tend to travel less than others and walk more often. It is important to study the desired quality, knowledge of which gives local authorities the background information for personalized marketing policies based on the user's requirements rather than their daily perceptions. Knowledge about the desired quality of services provides operators with answers to their questions regarding investment efficiency and should be the basis for developing a strategy encouraging the use of public transport based on the needs and expectations of current and potential customers (Dell'Olio, Ibeas, Cecin, 2011). Research results can also be used to improve the perception

of services on the one hand and to take specific corrective actions by operators on the other (Tyrinopoulos, Antoniou, 2008).

Differences in the importance of preferences and transport behaviors are characteristic of European cities (Pawlasova, 2015). The importance of attributes for passengers can be analyzed in the form of ranking, conjoin analyzes, or the inclination to incur additional costs for passengers to increase their attractiveness (Björklund, Swärdh, 2017).

In the search for regularities in transport behavior and preferences, residents are segmented according to specific criteria. The a priori segmentation criteria are commonly adopted by including information on the characteristics of residents in the research instrument sheet. The criteria for distinguishing segments are then such parameters of residents as gender, age, socio-occupational status, place of residence, automotive status, income, number of people in households, marital status. In order to better understand the reasons why residents choose different modes on their daily trips, an approach that analyzes the complex attitudes that determine the mode selection is also used (Shiftan, Outwater, Zhou, 2008). These analysis approach employs factor and cluster analysis to shed light on preference and other characteristics (Krizek, El-Geneidy, 2007). Segmentation proves that choice of transport modes is influenced by several factors, such as individual characteristics and lifestyle, the type of journey, the perceived service performance of each transport mode and situational variables (Beirão, Sarsfield Cabral, 2007).

Explanations of regularities regarding preferences and transport behaviors, including the main determinant – space, take into account the criterion of distance and travel time (Salonen, Toivonen, 2013; Kujala et al., 2018; Nurdden, Rahmat, Ismail, 2007). Research and strategists responsible for transport policy often treat complex urban areas, but also agglomerations as a whole, in the sense that they postulate the implementation of uniform transport strategies for the entire area. Ignoring the specificity of the needs, behaviors and transport preferences of the residents of peripheral areas within the agglomeration, as well as the seemingly homogenous areas of their center, may lead to ineffective actions in the field of sustainable mobility. Based on the results of research in three cities of the Gdańsk agglomeration, located in northern Poland, transport behavior was identified and an attempt was made to explain them.

1. Purpose and structure of the article

Article concerns the occurrence of relationships between the place of residence and transport behavior and preferences. It's assumed that there are differences in the preferences and transport behavior of residents depending on the place of residence in the agglomeration and length of travel measured by distance and time. The purpose of the article is to demonstrate the need to take into account differences in the transport preferences and behavior of residents in mobility plans and the offer of public transport services. Changes in the meaning of individual attributes of transport services have to be regarded in timetables and tariffs.

Decisions in this regard are often made on an intuiting basis and take into account the political interest, not the real expectations of the residents.

The title of the presented article contains the main hypothesis about the existence of relationships between the place of residence and behavior and preferences. Additional hypotheses assume that there are differences in the preferences and transport behavior of residents depending on the place of residence in the agglomeration and length of travel measured by distance and time. The purpose of the article is to demonstrate the need to take into account differences in the preferences and behavior of residents in mobility plans and the offer of public transport services. Changes in the meaning of individual attributes of transport services have to regard in timetables and tariffs. Decisions in this regard are often made on intuiting basis and take into account the political interest, not the real expectations of the residents.

The article represents the stages of the research and is organised as follows:

Section two presents the main research hypothesis about the existence of relationships between the place of residence and behavior and preferences.

Section three describes research methods such as Comprehensive Traffic Surveys and Comprehensive Research on Transport Needs, Demand, Transport Behaviors, and Preferences. The section also explains the test site.

Section four gives the results of surveys grouped into areas related to basic characteristics and transport behaviors of the inhabitants of the analyzed communes, factors determining the choice of the car, and the preferences and expectations for public transport.

Section six summarises the study and the arguments confirming the thesis stated in the introduction. Finally, the paper indicates topics further research is needed.

2. Methodology and theory

Wide range passenger transport demand surveys are carried out in Poland as Comprehensive Traffic Surveys (CTS) and Comprehensive Research on Transport Needs, Demand, Transport Behaviors and Preferences – Comprehensive Transport Surveys of Residents (CTSR).

The CTS scope covers not only the research of passenger travel, but also other vehicle traffic. Its main purpose is to create traffic models for the area covered by the research. The four-stage models enable the diagnosis of the transport system and the propagation of changes in traffic, as well as the variation of the transport service of specific areas, assuming the variability of specific parameters. The modern platform for modelling and simulating traffic relations are used. (Hildebrand, Hörtin, 2014). The scope of passenger transport research is most often limited to demand research (directions and intensity of displacement of inhabitants, motivation, travel destinations, means of transport used, and hours of individual journeys). The CTS is more often included in transport preferences (*Kompleksowe badania ruchu we Wrocławiu i otoczeniu*, 2018) and subjected to assessment of individual attributes of public transport services.

The CTSR covers a wide range of issues related to transport needs, demand, transport behavior and preferences, assessment of public transport services

and assessment of realized and potential transport policy goals. In Poland, such research is carried out to the widest extent by the Public Transport Authority (PTA) in Gdynia. The company is the only organizer of public transport in Poland conducting such tests on a regular basis every 2–3 years. Since 2010, irregular research in a similar to PTA scope has been conducted by the Metropolitan Union of Communication of the Gulf of Gdansk (GBMA). PTA conducts research in Gdynia, GBMA conducts research in municipalities located on the suburbs of the Gdańsk agglomeration, which creates 14 municipal and rural municipalities.

CTSR implemented by PTA and GBMA are conducted using the standardized direct interview method and the questionnaire as a measurement instrument. In the PTA study, the sample was selected using a stratified random method – 1% of Gdynia residents aged 16–75, drawn randomly from the list of residents, in proportion to the number of residents in individual districts of the city. The sample of GBMA research in one of the analyzed communes – the Commune of Żukowo – was selected in the same way, while the research covered 2.9% of residents aged 16–75, in proportion to the number of residents of village councils. In the second of the presented studies, GBMA carried out the Random Route trial, including 3.1% of residents in the same age bracket. The lower age limit was set for 16 years of age due to the relatively low share of people under 16 in urban travels. Analogical reasons caused the limitation of the upper age limit.

In surveys carried out on the basis of a random drawing of residents registered at a given address, there was a problem with the interview with residents who do not live at a given address (people working abroad, people renting their own flat). Regardless of the method of selection of the sample, all the tests showed specific difficulties resulting from the interview with some of the main users of cars in the household. Due to the fact that they are the most professionally active people, in some cases the substitute addresses (reserve list) were used, conducting the study with persons of the same gender and age, living closest to the person from the basic list. It should therefore be assumed that the actual share of the main users of passenger cars in households and the share of passenger car journeys is higher than the examined one.

The article is based on a comparative analysis of transport behavior and preferences of residents of two cities from the agglomeration center: Gdynia and Sopot, and the area of the urban-rural commune Żukowo, located on the outskirts of the agglomeration. The research in Gdynia was carried out in 2015, in Sopot in 2018 and in the municipality of Żukowo in 2017. In the largest city of the agglomeration – Gdańsk, in 2016 CTS tests were carried out. Their scope, however, makes it impossible to compare results with other tests.

3. Results

Gdynia, Sopot and Żukowo are cities located in northern Poland. All three cities are part of the Gdańsk agglomeration. There are 248,000 inhabitants in Gdynia, 38,000 in Sopot, 29,000 in Żukowo in the town and the area of the commune (GUS, 2018). Gdynia and Sopot form the core of the agglomeration. The town of Żukowo,

together with the surrounding rural area, is about 20 km away from the largest city of the agglomeration's core. In Gdynia and Sopot there is well-developed public transport (buses, trolleybuses, metropolitan and regional metropolitan rail). The Żukowo commune serves 4 bus lines, metropolitan and regional railways. The rates of public transport service measured by the annual number of vehicle kilometers of public municipal transport per capita in Gdynia, Sopot and Żukowo are 65, 29 and 8 respectively. In the agglomeration area, an integrated public transport tariff has not been implemented so far. In 2008, GBMA introduced an additional tariff – metropolitan, whose offer in 2015 was modified to the detriment of passengers (the GBMA uniformed scope of entitlements has been diversified into concessions applicable to rail and other public transport).

Table 1 presents the basic characteristics of the residents of the three communes.

Table 1. Characteristics of the residents of the analyzed areas

Parameters	[%]		
	Gdynia	Sopot	Żukowo Commune
Men	47.0	54.4	51.3
Women	53.0	45.6	48.7
Age: 16–20	5.0	4.9	7.7
21–30	15.3	13.6	19.4
31–40	21.6	19.2	22.3
41–50	16.3	17.3	20.1
51–60	17.9	16.0	15.8
61–70	19.0	21.8	12.4
>70	4.9	7.2	2.3
Households with cars	72.2	65.1	86.0
Socio-professional status			
Employed	55.8	53.5	62.4
Unemployed	9.4	6.8	10.1
Students	7.9	6.6	8.8
Working students	2.7	1.8	1.2
Retirees / pensioners	23.3	25.2	17.0
Working retirees / pensioners	0.9	0.9	0.5

Source: (own study based on *Preferencje i zachowania komunikacyjne mieszkańców Gdyni Raport z badań marketingowych 2015*, 2016; *Preferencje i zachowania komunikacyjne mieszkańców Sopotu w 2018 r.*, 2018; *Preferencje i zachowania komunikacyjne mieszkańców Żukowa*, 2018)

There are no statistically significant differences in the gender and age cross-section in the analyzed agglomeration areas. The share of households with a car(s) differs sharply. It is the highest in the urban-rural commune of Żukowo. This is understandable in a situation in which the range of public transport services in this commune is definitely the lowest. Car ownership depends on many factors. These include: place of residence, age, education and marital status of the head of the household, use of public transport, number of employees, number of non-employees and the number of children in the household and total household expenses (Eakins, 2015). The factors that determine the car ownership

the most are revenue and the fact of having a car before. The probability of buying a car increases with regular incomes (Nolan, 2010).

Differences in the socio-professional status are important. The participation of retirees and pensioners is clearly lower in the urban-rural commune. This can be explained by the lower share of people in the retirement age in this municipality (*Bank Danych Lokalnych*, 2018), smaller share of persons entitled to pension benefits in the countryside (this applies mainly to women whose professional activity in these areas is definitely lower than cities (*Bank Danych Lokalnych*, 2018) and also a partially higher share of working people. The analysis of data in the cross-section of age groups and socio-professional status confirms this last thesis. Table 2 shows modal split.

Table 2. Modal split in the analyzed communities

Modes	Gdynia	Sopot	Żukowo Commune
cars	51.5	57.3	65.3
public transport	35.6	30.5	23.8
bikes*	1.6	3.6	1.8
walks	10.9	7.6	8.3
others	0.4	1.0	0.8

*no recreation motivations

Source: (own study based on *Preferencje i zachowania komunikacyjne mieszkańców Gdyni Raport z badań marketingowych 2015*, 2016; *Preferencje i zachowania komunikacyjne mieszkańców Sopotu w 2018 r.*, 2018; *Preferencje i zachowania komunikacyjne mieszkańców Żukowa*, 2018)

The larger share of passenger cars in the modal split in the municipality of Żukowo is clearly visible and, at the same time, the smallest share of public transport. This is a logical consequence of the clearly larger share of households with passenger cars in this municipality. In order to examine the impact of travel distance on the selection of a car in dominant journeys related to work and study, the averages of travel times declared by all respondents were calculated using this mode of transport and the differences between the time of travel by public transport and car were calculated – Table 3.

Table 3. Average declared travel time to work and study [minutes]

Modes in motivation and Ratio of pt travel time to car travel	Gdynia	Sopot	Żukowo Commune
car to work	20	22	27
pt to work	39	36	52
car to school	20	20	39
pt to school	36	26	51
ratio travel time: pt/car to work	1.80	1.63	1.92
ratio travel time: pt/car to school	1.75	1.30	1.54

Source: (own study based on *Preferencje i zachowania komunikacyjne mieszkańców Gdyni Raport z badań marketingowych 2015*, 2016; *Preferencje i zachowania komunikacyjne mieszkańców Sopotu w 2018 r.*, 2018; *Preferencje i zachowania komunikacyjne mieszkańców Żukowa*, 2018)

The data presented in Table 3 allow to specify a clear relation between the length of travel and the choice of means of transport. The increase in the length of travel induces residents to choose a car in travel to work and study. Also, the increase in the difference in travel time between car and public transport encourages the use of a car, although in the case of Sopot residents this relation is clearly smaller. Due to the declarative nature of travel time (for example, people who do not use public transport defined approximate, estimated time of travel with this type of transport), the statistical relations between data from tables 2 and 3 were abandoned.

Table 4 summarizes the main reasons for using the car in travels.

Table 4. Reasons for using the car on trips

Gdynia	Sopot	Żukowo Commune
convenience	convenience	convenience
shorter travel time by car	shorter travel time by car	shorter travel time by car
transport of things, shopping	no need to wait	no need to wait
no need to wait	no interchanges	no interchanges
no interchanges	no uncomfortable company of other people	no need to access to the bus stop
no need to access to the bus stop	transport of things, shopping	transport of things, shopping
the car is a working tool	low cost	transport of children
transport of children	no need to access to the bus stop	no uncomfortable company of other people
low cost	transport of children	lower cost of car travel
no uncomfortable company of other people	the car is a working tool	own safety
own safety	own safety	the car is a working tool
bad health condition	bad health condition	bad health condition

Source: (own study based on *Preferencje i zachowania komunikacyjne mieszkańców Gdyni Raport z badań marketingowych 2015*, 2016; *Preferencje i zachowania komunikacyjne mieszkańców Sopotu w 2018 r.*, 2018; *Preferencje i zachowania komunikacyjne mieszkańców Żukowa*, 2018)

The most important factor determining the choice of a car, regardless of the place of residence in the agglomeration is the convenience and shorter time of car travel. Convenience as the determinant of vehicle selection is also indicated by other research results (Wang et al., 2013). For those who travel by car in Sopot (the agglomeration core), compared to the same segment in Gdynia (also the agglomeration core), the choice of car is more dependent on the lack of waiting and interchanges. An analysis of the current offer of public transport and traffic trusses (traffic distribution graph) of car users showed that in a situation where car users would change their car for public transport, the railway's share in this group's travels would be much higher in Sopot than in Gdynia. The necessity to use railways, anticipated by users of passenger cars in Sopot, is affected by a higher potential nuisance of interchanges and expectations. It is significant that the average rate of interchanges in Sopot is lower than in Gdynia (1.09 to 1.32 respectively). This means that the nuisance of interchanges and expectations for car users in the core increases not so much as the number of interchanges increases, as long

as depending on the type of transport – in this case the railways. In the Żukowo commune, located on the suburbs of the agglomeration, the greater impact of waiting and interchanges on the choice of a car can in turn be explained by the distance to the center (the main purpose of daily travel) and the public transport offer limited to 4 bus lines and relatively low frequency train connections. In the urban-rural commune, the importance of choosing a car in travels is more necessary to reach the bus stop. The time to access to the bus stop of around 95% of inhabitants in the agglomeration core (Gdynia, Sopot) does not exceed 10 min, whereas in the Żukowo commune it concerns 76% of the residents. The inconvenience of the access increases for car users along with the distance; access to the nuisance was considered by every 8 users of the car reaching the stop for 10 minutes and every 3 coming 10 or more minutes. It also draws attention to the greater importance in Żukowo of transporting children for the choice of a car in travels, which is associated with the greater distance of schools from households.

Undertaking activities aiming at changing the transport behavior of residents in accordance with the objectives of sustainable mobility requires identification of the main attributes of public transport and the degree of their fulfillment by the current public transport offer. Table 5 summarizes the most important attributes in the opinion of residents.

Table 5. The importance of passenger transport attributes in the analyzed municipalities (in order)

Gdynia	Sopot	Żukowo Commune
directness	punctuality	frequency
punctuality	availability	availability
frequency	low cost	punctuality
availability	reliability	directness
low cost	speed	speed
reliability	frequency	reliability
speed	directness	low cost
convenience	rhythmicity	rhythmicity
rhythmicity	information	convenience
information	convenience	information

Source: (own study based on *Preferencje i zachowania komunikacyjne mieszkańców Gdyni Raport z badań marketingowych 2015*, 2016; *Preferencje i zachowania komunikacyjne mieszkańców Sopotu w 2018 r.*, 2018; *Preferencje i zachowania komunikacyjne mieszkańców Żukowa*, 2018)

Table 6. The worst fulfilled attributes by public transport (in order)

Gdynia	Sopot	Żukowo Commune
directness	punctuality	low cost
frequency	convenience	convenience
punctuality	low cost	directness

Source: (own study based on *Preferencje i zachowania komunikacyjne mieszkańców Gdyni Raport z badań marketingowych 2015*, 2016; *Preferencje i zachowania komunikacyjne mieszkańców Sopotu w 2018 r.*, 2018; *Preferencje i zachowania komunikacyjne mieszkańców Żukowa*, 2018)

Ranking of attributes indicates significant differences in the cross-section of the place of residence in the agglomeration. A certain impact on the significance of a given attribute may have the degree of their fulfillment by public transport (Table 6). In Gdynia, the three attributes fulfilled to the smallest degree are: directness, frequency and punctuality. The relation between the meaning of attributes is not so obvious. In Sopot, the three worst performing attributes are: punctuality, convenience and low cost. The high significance of the low cost for the residents of Sopot coincides with the degree of non-fulfillment (the third unfulfilled attribute). This can be explained by the relatively high number of interchanges, including using one of the means of transport as part of the journey, which significantly increases their cost to passengers. At the same time, this is a signal for public transport organizers that the level of tariff integration, and especially the travel costs with changes in the core of the agglomeration are not satisfactory for passengers who frequently use rail transport. However, it is hard to explain the last place of convenience in the Sopot ranking, when it was listed as the second unfulfilled attribute. In the urban-rural commune of Żukowo, located on the edge of the agglomeration, the most important attribute is the frequency, which seems obvious (assuming the relation between the place in the ranking and the fulfillment of the attribute) in the light of the parameters of public transport services in this commune. Low cost as an attribute was listed only in the 7th place in the ranking and at the same time as the worst satisfied attribute by public transport. Its relatively small significance can be explained by the awareness that the place of residence at the edge of the agglomeration generates high travel costs. The unattractive travel costs of public transport in the assessment of the residents of the Żukowo commune do not affect the general meaning of this attribute.

It can be stated that the ranking of attributes is not shaped in a completely objective way. The quality of the current public transport offer and the quality obtained through the implementation of the journey by own personal car have an impact on the importance of the attribute. Passengers make, sometimes subconsciously, a comparison of the public transport offer – as the quality offered and the benefits provided by car travel – as the expected quality. The homogeneity of the transport offer may influence the ranking of attributes in a given area – the larger the analyzed area, the greater the probability that individual regions will have different quality offered and delivered (due to the simultaneous implementation and consumption of transport services, the quality gap occurs relatively often in passenger road transport most exposed to congestion). The stated thesis requires further analysis of statistical relations between variables, which goes beyond the scope of this article.

The attribute of travel convenience was also analyzed, examining the relation between the place of residence (determining the length of travel in the agglomeration) and the expected level of convenience in public transport vehicles – Table 7.

Table 7. Expected by the residents level of travel comfort in public transport [%]

Expected level of convenience	Gdynia	Sopot	Żukowo Commune
always or mostly sitting place	65.8	57.5	63.7
a standing place in uncomfortable conditions	24.0	25.7	10.1
acceptable journey in conditions of congestion	3.1	4.3	3.7
no opinion	7.1	12.5	22.5

Source: (own study based on *Preferencje i zachowania komunikacyjne mieszkańców Gdyni Raport z badań marketingowych 2015*, 2016; *Preferencje i zachowania komunikacyjne mieszkańców Sopotu w 2018 r.*, 2018; *Preferencje i zachowania komunikacyjne mieszkańców Żukowa*, 2018)

The level of expected travel convenience varies depending on the place of residence in the agglomeration. It is worth noting, however, that the participation of the residents of Gdynia, forming the core of the agglomeration, always or mostly sitting place, is higher than among the residents of the peripheral commune of Żukowo, despite the fact that residents of the urban-rural commune declare longer declared travel times by transport, as well as Sopot, located in the agglomeration core. This phenomenon can be explained by other perceptions of the travel time of Gdynia residents who use 94% of road transport in the core and are therefore most likely to be exposed to congestion. The subjective time in congestion conditions is longer (Meng, Rau, Mahardhika, 2018), so a greater percentage of Gdynia residents expect a sitting place. Passengers who are residents of the other city in the core of the agglomeration – Sopot are four times more likely to use the fast means of transport of the city railway, hence the share of people waiting for a sitting place among them is lower. On the other hand, residents of the urban-rural commune perform part of the journey only within the area of their commune, not exposed to congestion, occurring in the core. However, the presented dependencies should not significantly affect the shape of the transport offer, because the convenience of traveling in a public transport vehicle was not considered an important attribute (Table 8).

Most of the residents of the examined cities, regardless of their location in the agglomeration, expect direct connections, even at the lower frequency. There is no relation between preferences and current transport behaviors, i.e. the share of travel with interchanges in a given commune. Interestingly, the share of people who are in favor of direct connections increases with the intensity of service per 1 inhabitant and 1 km^2 of the area served. However, there are not enough prerequisites to claim that the increase in the number of services offered in public transport results in an increase in expectations regarding the activation of direct connections. This thesis requires the analysis of compounds and statistical hypotheses, which goes beyond the scope of this article and will be the subject of further research. Moreover, it should be stated that the tendency to change depends on many factors, including those related to the transfer conditions (Grzelec, Miloch, 2017).

Table 8. Preferences regarding the nature of connections [%]

Connection type	Gdynia	Sopot	Żukowo Commune
direct, frequency > 15 minutes	66.0	55.0	48.0
with interchanges, frequency < 10 minutes	20.9	25.0	26.0
undecided	13.1	20.0	26.0
interchange ratio = (number of trips) / (number of transports)	1.3	1.1	1.2
service intensity ratio = (number of vehicle kilometers) / (annual population)	1.3	1.1	1.2
service intensity ratio = (annual number of vehicle kilometers) / (population	65	29	8
service intensity ratio = (annual number of vehicle kilometers) / (area of the commune)	142,000	46,000	1,707

Source: (own study based on *Preferencje i zachowania komunikacyjne mieszkańców Gdyni Raport z badań marketingowych 2015*, 2016; *Preferencje i zachowania komunikacyjne mieszkańców Sopotu w 2018 r.*, 2018; *Preferencje i zachowania komunikacyjne mieszkańców Żukowa*, 2018)

4. Disscussion and conclussion

The thesis on the existence of relations between the place of residence and the behavior and transport preferences presented in the title of the paper should be considered as proven. The location of the given area in the agglomeration affects the modal split of the journey. An increase in the distance from the core of the agglomeration increases the propensity to use passenger cars. Also, the increase in the difference in travel time between car and public transport encourages the use of a car, but these dependencies require more detailed analysis. The most important reasons for choosing a car when traveling, regardless of the place of living in the agglomeration, are convenience and shorter travel times. The increase in the share of rail transport in travel affects the increase in the importance of waiting time and the lack of interchanges as a factor determining the choice of cars on travel. This relation, however, should be treated as characteristic of the Gdańsk agglomeration, in which the process of integrating public transport began in 1991 and has not ended until now.

The significance of attributes in the cross-section of individual areas is much different. Ranking of attributes is not shaped in a completely objective manner – the specific impact on the place of a given attribute is influenced by the degree of its fulfillment by the current public transport offer and subconscious assessment of the quality offered by the current public transport offer and the benefits of car travel and certain relations.

Travel distance and at the same time other factors, such as access to fast transport means (urban and metropolitan rail) have the impact on expectations regarding the possibility of occupying a sitting place. The relation between the intensity of service and the preference for direct travel requires further statistical analysis.

The presented results provide an incentive for discussion and the discussed issues will be continued through subsequent analyzes and the use of other research results. The authors point out the following issues that may be discussed:

1. The presented research results confirm the authors' thesis (Okraszewska et al., 2019), who used the results of other studies showing that documents constituting political declarations regarding sustainable mobility such as New Urban Agenda, focusing on cities, omit some features of the agglomeration. As a consequence, although NUA's goals can be successfully implemented in the agglomeration cores, suburbs, due to their specificity, "escape / flee" from its provisions.
2. The authors would like to draw attention to the importance of low cost as a travel attribute. The results of the research may be another prerequisite in the discussion on the effectiveness of not only the introduction of free public transport, but also the extension of entitlements to free travel in the light of the objectives of sustainable mobility.
3. According to the authors, in subsequent research it is necessary to distinguish more clearly the concept of convenience in research into the causes of car use in travel and attribute research. Because the first – as interviewers signal – include not only the comfort of travel, but also the flexibility of using the means of transport in a specific place and time. In attributes research, convenience is associated only with the comfort of travel.
4. The regularities discussed in the article are based on the analysis of behaviors and preferences by place of residence. This is the main criterion used in shaping the transport offer, the basic determinants of which are space (relation: travel source – destination) and time. The question arises as to the scope of practical application of the identified segments according to other criteria adopted a priori (gender, age, socio-professional status) and on the basis of cluster analysis. The necessity of distinguishing other segments should be justified by the possibility of transforming them by the organizer of public transport into target markets. The justification for separating segments is, among others their measurability, extent (capacity of a given segment justifying directing to them a separate offer of services) and availability (possibility of referring to a given segment of the offer of services, in other words the possibility of arriving with a separate offer to a given segment). The practice of public transport organization and its mass character prove that the target markets can be people working (line operation parameters can be adjusted to specific expectations of professional groups or even workplaces), pupils and students (synchronization of departures with classes' time) and even people older (midibus lines penetrating housing estates, ensuring shortening the distance and time of reaching stops). The gender criterion and degree of disability are widely used to overcome barriers to availability of services in relation to the "un bloc" transport offer, and not through the creation of target markets (change of bus and stop construction, handrails, lifts, etc.). In subsequent research, this issue will be developed.

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