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European mobility cultures

A survey-based cluster analysis across 28 European countries

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European Mobility Cultures: A survey-based cluster analysis across 28 European countries

Abstract

More targeted European policies promoting green travel patterns require better knowledge on differing mobility cultures across European regions. As a basis for this, we clustered the EU population into eight mobility styles based on Eurobarometer data. The mobility styles – including, for example, “green cyclists” and “convenience drivers” – differed not only in their travel-related variables but also in their socio-economic background, IT-affinity, and life satisfaction, with green cyclist showing the highest life satisfaction and two car-oriented styles having the highest socio-economic resources. In a second step, the 28 EU member countries were clustered into six country clusters based on their representation of mobility styles. The country clusters indicate the existence of considerably different mobility cultures across the EU. Sub-regions can be identified that have highly different positions on the path towards sustainable mobility and therefore different requirements towards European platforms and support measures, e.g. for ‘Sustainable Urban Mobility Plans’. The country clusters can provide a starting point for future communication and targeting of European efforts in sustainable mobility.

Keywords: Mobility culture, mode choice, travel behaviour, Europe, environmental concern

Highlights:

- Based on Eurobarometer data, we clustered the EU population into eight mobility styles.
- Mobility styles differed in travel-related choices, socio-economics, IT-affinity, and life satisfaction.
- Based on their representation of mobility styles, EU countries were clustered into six country clusters.

- The country clusters form identifiable sub-regions or spatial clusters within the EU.
- Country clusters can be used for monitoring and targeting European transport policies.

1. Introduction

Despite a relatively high proportion of people walking and cycling in some European countries, the car generally remains the dominant mode of transport in Europe (EEA, 2015). Related problems, such as air pollution, noise, congestion, and reduced quality of life are far from being solved. To decrease car use and increase the amount of walking and cycling, it is crucial to develop targeted efforts within Europe. Promoting walking and cycling by targeted policies requires an understanding of individual travellers' motives and barriers as well as an explicit recognition of the diversity of European regions and their associated infrastructure, planning policies, politics, and mobility patterns. Comparing the European countries, reliance on car or motorcycles for everyday activities ranges from 91% of the population in Cyprus to 29% in Latvia. The reliance upon public transport ranges from 37% of the population in the Czech Republic to 10-11% in the Netherlands and Slovenia. For walking and cycling there are also substantial differences. In Romania 30% of the population report relying on walking to access everyday activities compared to the very low level of 3% in Cyprus and Denmark. The Netherlands holds the European record with respect to cycling with 31% of the population reporting that they rely on it for everyday activities. At the other end of the cycling 'scale' we find Malta with almost 0% of the population relying on it for everyday activities (EC, 2011a, see Figure 1). The implication of this diversity is that behavioural change and its promotion will have highly different starting points across different individual countries, or groups of countries, with comparable patterns. We argue that more knowledge of these differences and the associated European divides is required to develop European policies on sustainable urban mobility. Better knowledge may be especially helpful in structuring European resources to address the diversity of sustainable mobility challenges. EU policies in the field of mobility have included communication of best practices, campaigning and increasing awareness of sustainable mobility (CEC, 2009), as well as knowledge-support for the development of sustainable urban mobility plans, including ‘The Urban Mobility Observatory’ (European Commission, 2013). These efforts should benefit from more in-depth knowledge and validation of the European differences in mobility behaviours. Additionally, European projects in other fields than mobility (e.g. Nilsson et al., 2013; Helming et al., 2008) frequently apply regional typologies for communication as well as an approach to secure that the main European differences are represented in the selection of case studies and similar.

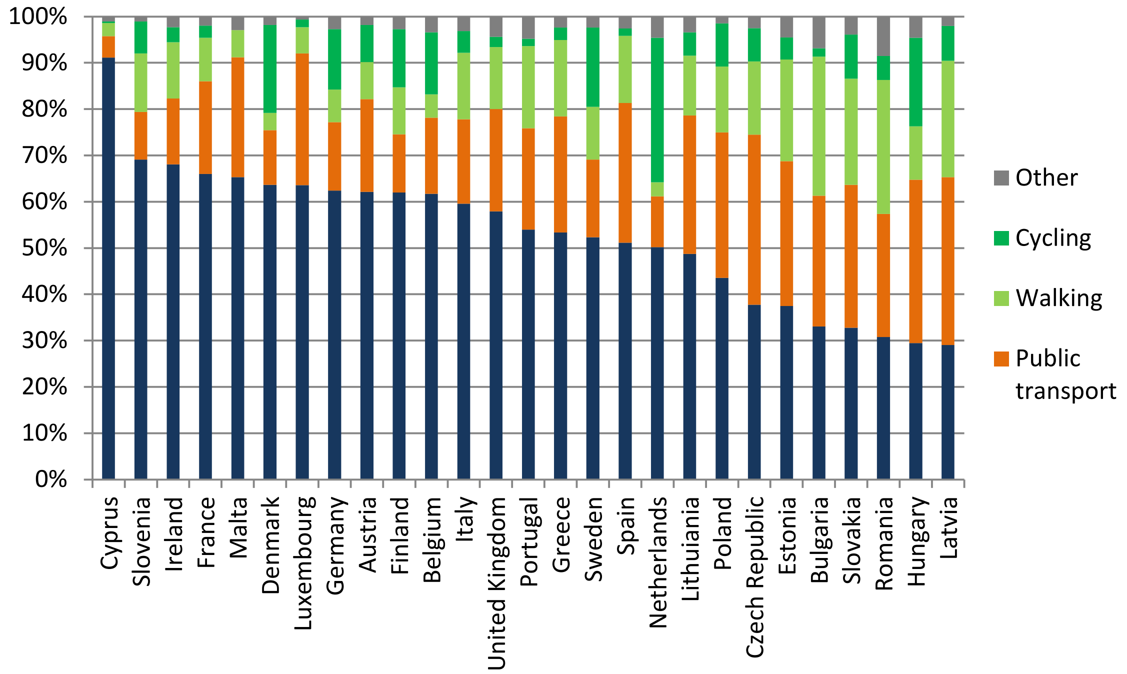

Figure 1: Mode distribution by country based on Flash Eurobarometer 312, question D7: What is the main mode of transport that you use for your daily activities? (EC, 2011a)

1.1. Market segmentation in the transport sector

The target-group or target-area specific planning and design of interventions is a measure that is often requested to increase the efficiency of environmental interventions (e.g., Geller, 1989; McKenzie-Mohr, 2000; Schahn, 1995) as interventions that are spread across the whole population according to the “shotgun approach” have only limited chances to achieve behavioural change and thus may be seen as ineffective or wasteful from a policy perspective. In market segmentation, target groups are identified by dividing the population into homogeneous segments with similar attributes that are considered *as* or related *to* the motivational basis for the targeted behaviour (e.g. age, attitude, place of residence), or by the behaviour itself. Several transport providers/associations and municipalities have used market segmentation as a basis for targeted interventions to increase the use of sustainable transport modes (e.g. Schubert & Kamphausen, 2006).

In the last decades, a variety of segmentation approaches have been suggested in transport research. These approaches can be divided by the factors that are used as a basis for segmentation: spatial factors (e.g., Hunecke et al., 2010; Scheiner, 2006), socio-economic factors (e.g., Ryley, 2006; Hildebrand, 2003), attitudinal factors (e.g., Anable, 2005; Pronello & Camusso, 2011) as well as the travel behaviour itself (e.g. Heinen et al., 2011; Prillwitz & Barr, 2011). All of these approaches have specific pros and cons depending on the area of application (cf. Haustein & Hunecke, 2013).

While the segments resulting from different studies may appear random on the first sight, it has been shown that segments identified based on different factors and regional samples can still include similar "core" segments, probably because of the interrelation of the different factors included (Haustein & Siren, 2015).

1.2. The mobility culture approach

"Mobility cultures" are defined as specific socio-cultural settings consisting of travel patterns, the built environment, and mobility-related discourses – i.e. they are defined by both the material and the socially-constructed dimensions of the transport system (cf. Deffner et al, 2006; Klinger et al., 2013). The concept of mobility cultures can be useful in trying to understand why specific mobility segments are well represented in one region but not in another. That we find more car dependent travellers in the US and less in Europe, may, for example, be explained by American settlement structures that provide fewer opportunities for the use of active transport modes and specific historically-embedded values and beliefs in relation to the private car, which can be regarded as key elements of the American car culture. In contrast, in the Netherlands cycling is not only facilitated by good cycling infrastructure (Pucher & Buehler, 2008), it is also linked to national Dutch identity, and both the material and the symbolic dimension are part of the Netherlands' cycling culture (Carstensen & Ebert, 2012; Pelzer, 2010). The EU project SEGMENT, in which eight attitude-based segments were identifies in seven European partner cities, provides another example: The segment of “practical travellers” were highly overrepresented in Utrecht and Munich, but (almost) non-existent in Athens and Sofia. The differences in the distribution were explained with differences in infrastructure provision and the existence or non-existence of a cycling culture and related social norms (Anable, 2013).

While mobility cultures are traditionally described qualitatively in a sociological and/or historical discourse (e.g. Carstensen & Ebert, 2012; Sheller & Urry, 2000), Klinger et al. (2013) have operationalized “urban mobility cultures” based on both subjective (e.g. cycling perceptions) and objective factors (e.g. transport infrastructure) and have assigned 44 German cities to six urban mobility cultures, e.g. “cycling cities” or “transit metropolises.” In a subsequent study, they examined how moving from one mobility culture to another changes mode choice and found car and rail use more affected by local infrastructural attributes and cycling stronger influenced by the overall mobility culture of a city (Klinger & Lanzendorf, 2015). That it matters for cycling perception and uptake how cycling is linked to local or national culture was also demonstrated by Pelzer (2010) and Aldred and Jungnickel (2014) by contrasting different local/national cycling cultures. Differences in cycling frequency can be explained by differences in cycling or mobility cultures that go beyond infrastructure provision and include a wider set of norms, beliefs, meanings, etc.

1.3. The present study

In this study, we aim to exploit existing Eurobarometer data with European coverage to analyse the differences in mobility in the EU. Based on segmentation of mode choice and travel motives, we first distinguish between different mobility styles within Europe and then cluster all EU member countries into country clusters based on the representation of the different mobility styles in each country. The study thus provides and overview of EU mobilities that to our knowledge is the first of its kind. Taking the relevant background variables of the countries – such as the socio-economic structure, urbanisation, and mobility policies – into account, we interpret the country clusters as indicators of different mobility cultures within Europe. The country clusters map general differences across Europe that we think can be of value in the context of organising and targeting European support for sustainable mobility; and when it comes to securing that the main European differences in mobility are considered in, for instance, European research and innovation projects.

2. Method

2.1. Procedure and participants

The data that formed the basis for this study came from the Eurobarometer 82.2 omnibus (EC, 2015a) that was conducted in all 28 EU member countries by the market research company TNS. The data was collected between 11 October 2014 and 20 October 2014 via face-to-face interviews in people's homes, in their national language. TNS applied a random, multi-stage sample design in all countries. In each country, a number of sampling points was drawn in each administrative regional unit with probabilities proportional to population size and density with the aim of representing the different NUTS2 regions and differences between metropolitan, urban and rural areas within each country. The total sample consists of 27868 persons aged 15 or older (EC, 2015a). Most countries are represented with approximately 1000 interviews. Exceptions to this are Malta, Cyprus and Luxembourg where approximately 500 interviews were held in each country; as well as Germany and UK (1532 and 1329 interviews respectively) where samples were larger to represent Northern Ireland and East-West German differences.

2.2. Measure

The questionnaire included 64 questions covering the topics “quality of transport,” “cybercrime,” the “public perception of VAT,” “patient rights,” and “blood, cell and tissue donation” (see EC, 2015b) for the full questionnaire). It further included questions regarding IT equipment and usage, socio-economic and political background as well as basic demographic data.

The selection of the variables that built the basis of our segmentation was determined by the limitations of the dataset. As an ideal basis for segmentation into mobility culture clusters, we consider the inclusion of the most relevant subjective and objective determinates of daily transport mode choice. As the best way of compromising with the given limitations, namely that several relevant determinants were not included in the dataset, we considered the direct inclusion of mode choice. As additional variables we included the reasons for mode choice to account for motivational differences in the behaviour, which are relevant when wanting to match interventions with user needs. Motives for mode choice were, however, only requested for the actually used mode, so that the preferences in relation to other modes remained unknown. We did not include all requested motives but only “convenience” (mentioned as a reason for the choice by 61.3%), “speed” (29.5%), and “price” (13.5%). “Environment” and “safety” were not included as they were mentioned only by around 5% of participants (4.5% and 5.9%, respectively). “Available facilities” (19.2%), and "there is no alternative" (5.7%) were not included as they did not express a specific preference or motive, but rather either a forced choice or something that may go along with convenience. We think that it is more relevant *why* people do or do not have the respective facilities, which should be related to one of the included motives (e.g. price, speed, convenience) or related to symbolic-affective motives, such as status, autonomy or privacy (cf. Anable & Gatersleben, 2005; Steg, 2005). The latter were, however, not included in the survey.

Finally, we included problem awareness with regard to different transport modes as there is no basis for transport users' voluntary behaviour change, when they are not aware of the problems their modal choices cause. The questions that built the basis for our segmentation are included in Table 1.

Table 1: Questions used as a basis for segmentation

Question	**Answer categories**
QA1: On a typical day, which mode of transport do you use most often?	*One answer:* Car Motorbike or Moped Train Ship or boat Urban public transport (bus, metro, tram, ferry, etc.) Bicycle Walking Other
QA2: What are the reasons for using this mode of transport?	*Max. 2 answers:* Convenience Price Speed Environmental reasons Safety Available facilities There is no alternative Other
QA9: Which of the following do you think are the most serious problems affecting rail transport in (COUNTRY)?	*Max. 3 answers:* Noise pollution Lack of high-speed lines Lack of reliable and punctual service Safety

	Lack of railway stations Missing railway links Quality of services and facilities on board, Ticket prices Accessibility Rail maintenance Other
QA10: Which of the following do you think are the most serious problems affecting air transport in (COUNTRY)?	*Max. 3 answers:* Noise pollution Air pollution Safety Lack of airports Ticket prices Accessibility of facilities at airports (parking, lifts, toilets etc.) Airport services (shops, restaurants, lounges) Lack of destinations from your closest airport Availability of public transport to or from your closest airport Other
QA12: Which of the following do you think are the most serious problems affecting sea or river transport in (OUR COUNTRY)?	*Max. 3 answers:* Noise pollution Water pollution Safety Reduced sea or river transport links Ticket prices Lack of frequent services Accessibility Other
QA13: Which of the following do you think are the most serious problems affecting roads in (OUR COUNTRY)?	*Max. 3 answers:* Road congestion Noise pollution Air pollution Safety Missing road links (between cities or across borders) Road maintenance The amount of freight being transported by road Other

2.3. Analysis

All answers to the question QA1 (typical mode of transport) were recoded into dummy variables. “Train” and “Urban public transport” were merged to the new dummy variable “public transport” (PT), and “Car” and “Motorbike or Moped” were merged to “Motorised Individual

Transport" (MIT). The answers to the questions, which allowed for multiple answers, were already coded as dummy variables in the dataset. Factor analysis was conducted to identify if single answers to QA9-QA12 could be merged into meaningful and reliable more general factors. This was, however, only the case for one factor, which we called "environmental concern traffic pollution." For this factor, air pollution from the road (QA13.3) and the air (QA10.2), water pollution (Q12.2), and noise pollution from the road (QA13.2) had higher loadings and were merged to a mean scale. Noise pollution from rail and water did not have substantial loadings and were thus not included.

As a basis for cluster analysis, we selected the dummy variables of the main transport modes (MIT, PT, cycling, walking), the main reasons for mode choice (convenience, price, speed) as well as the factor "environmental concern traffic pollution." A cluster analysis was conducted by SPSS 21 using the k-means algorithm. We conducted cluster analyses for solutions with four to nine clusters and compared the different solutions. As the main criterion we used the interpretability of the clusters, which lead to the choice of the 8-cluster solution. In Section 3.1, the cluster process and the resulting clusters are described by the cluster centres as well as by additional descriptive data. Differences between the clusters were tested with Chi^2-tests and ANOVAS (including post-hoc comparison, Bonferroni corrected).

Based on the weighted distribution of the eight mobility styles for each country, we did a second cluster analysis, with the countries as cluster members. We compared the cluster solutions for 3 to 6 country clusters and chose the 6-cluster solution, based on a careful comparison of the different solutions (see Section 3.2).

3. Results

3.1 European mobility styles: Cluster profiles

Comparing the cluster centres across the different cluster solutions, there were always 1–2 clusters per mode of transport with differing reasons for mode choice and/or differing environmental concerns; apart from the 7-cluster solution, where three types of car users were differentiated, and the 9-cluster solution, where three types of cyclists were distinguished. We chose the 8-cluster solution as it represented two types of each transport mode and most continuously represented the clusters of the other solution, and thus appeared to be the most stable solution.

Table 2 shows the cluster centres of the eight clusters based on their z-scores. The clusters were named according to their most striking characteristics based on the variables that were used for clustering.

Table 2: Cluster centres

		Convenience drivers	Busy green drivers	Price-oriented PT-users	Green PT-users	Practical cyclists	Green cyclists	Price-oriented pedestrians	Green pedestrian
Preferred mode	Walking	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	**2.38**	**2.38**
	Cycling	-0.31	-0.31	-0.31	-0.31	**3.21**	**3.21**	-0.31	-0.31
	Public transport	-0.52	-0.52	**1.93**	**1.93**	-0.52	-0.52	-0.52	-0.52
	Car	**0.89**	**0.90**	-1.09	-1.09	-1.09	-1.09	-1.09	-1.09
Reason	Speed	0.16	**0.84**	-0.33	-0.22	-0.11	-0.07	**-0.49**	-0.43
	Convenience	**0.36**	-0.22	-0.38	-0.27	-0.11	-0.23	**-0.48**	0.06
	Price	**-0.29**	-0.14	**0.57**	0.07	0.28	0.30	0.21	-0.21
Problem awareness		-0.38	1.61	-0.34	**1.87**	-0.36	1.85	**-0.48**	1.25

Note: Figures in bold indicate highest and lowest values

“Convenience drivers” constitute the by far biggest cluster (45.8% of the sample, 46.6% of the EU population). 95.7% of its members have chosen the car as their usual daily transport mode, 2.8% a motorcycle or moped and the remaining 1.5% a different mode of transport. Convenience drivers more often than the average chose convenience as the reason for this choice and less often price. Their environmental concern with regard to traffic noise and pollution was below average. The group probably represents something like the average European car users. By contrast, “Busy green drivers” (9.2% of the sample and 10.6% of the EU, of which 96.3% are car users, 2.9% moped/motorcycle users, and 0.8% others), stand out by putting more importance on speed than all other clusters and less on convenience than the average, which may indicate that they are rather captive drivers due to time pressure resulting from a busy daily life and/or their residential area/lack of accessibility. In addition, they show a high environmental concern with regard to traffic pollution.

“Price-oriented PT-users” (17.6% of the sample and 17.0% of the EU) mentioned with one single exception urban public transport or the train as their usual transport mode. Price was mentioned as a motive an above average number of times, and all the other included motives were mentioned a below average number of times. In contrast to Price-oriented PT-users, the comparable small group of “Green PT-users” (3.5% of the sample and 3.6% of the EU) showed a more or less average preference for price but mainly stand out by their higher environmental awareness. All Green PT-users named urban public transport or the train as their most often used daily mode of transport.

As the names already reveal, “Green cyclists” (2.7% of the sample and 2.6% of the EU) and “Practical cyclists” (6.2% of the sample and 5.4% of the EU) mainly differed in their degree of environmental concern with regard to traffic, while the other motives were mentioned a bit below (convenience, speed) or above (price) the average number of times. Both segments only consist of cyclists.

All “Price-oriented pedestrians” (11.3% of the sample and 10.5% of the EU) chose walking as their main daily mode of transport. They chose price a bit more often as a reason for that than others, while speed as well as environmental concern played a minor role in their decision. In contrast, “Green pedestrians” (3.7% of the sample and 3.6% of the EU) showed above average environment concern, though less than Green cyclists and Busy green drivers. While they also mentioned speed less often as a motive compared to the average, convenience played a higher role for them as compared to Price-oriented pedestrians and all other clusters apart from Convenient drivers. This indicates that Price-oriented pedestrians may rather be captive pedestrians while Green pedestrians may rather be pedestrians by choice.

In Table 3 the clusters are described based on socio-demographic variables and other selected variables that are considered to be relevant to supplementing the profile description of the clusters; namely, IT-related variables, travel activity, and life satisfaction. While differences between the clusters were statistically significant for all variables ($p > .001$), this also reflects that the sample size is very large and one should therefore also focus on the absolute size of the differences. As a general pattern, we can see that the two car-oriented segments appear more privileged in terms of resources, including IT-equipment and long distance trips, while pedestrians (and partly public transport users) are more disadvantaged, more often female and of higher age. Not surprisingly, PT users live more often in bigger cities and both types of drivers more often in rural areas. Within the transport modes, the environmental clusters appear better off as compared to the price-oriented clusters. The most disadvantaged segment – differing significantly ($p < .001$, Post-hoc tests, Bonferroni corrected) from all other segments in all IT-related aspects, number of trips, and life satisfaction – is the segment of price-oriented pedestrians. Finally, the Green cyclist strike out in several aspects with even better values than the Busy green drivers: they have the highest level of education, least problems in paying bills, most IT-activities and, most importantly, the highest life satisfaction. In the latter they differ significantly ($p < .001$) from all other segments, including busy environmental drivers (post-hoc test, Bonferroni corrected).

Table 3: Description of mobility styles by additional variables

	Mean/percentage within the cluster	Convenience drivers	Busy green drivers	Price-oriented PT-users	Green PT-users	Practical cyclists	Green cyclists	Price-oriented pedestrians	Green pedestrians	Total
Age	mean	47.1	45.0	45.0	42.3	47.5	44.6	52.7	50.6	47.0
Gender	% women	44.9	47.8	61.3	58.8	49.1	53.2	63.7	66.3	51.9
Living with partner	% with partner	72.5	71.5	50.2	51.7	57.6	61.6	52.5	55.9	63.8
Education	% only basic education (up to age 15)	12.5	9.2	14.9	9.9	16.2	8.7	27.7	22.8	14.6
Working status	% not working	39.2	34.6	59.8	53.2	57.8	49.5	73.9	68.8	49.2
Difficulties paying bills last year	% (almost) never	62.9	66.4	52.6	60.1	65.9	73.6	50.8	58.2	60.3
Type of community	% rural	36.0	38.8	21.1	17.9	30.9	26.0	30.8	28.2	31.5
	% middle	41.9	40.2	31.5	30.5	47.6	43.4	49.1	46.3	40.8
	% large town	22.0	21.1	47.5	51.6	21.5	30.5	20.1	25.6	27.7
IT	IT equipment [a]	2.0	2.3	1.6	2.0	1.7	2.2	1.1	1.4	1.8
	Online activities[b]	3.3	3.8	2.7	3.5	3.0	4.0	1.8	2.4	3.1
	Internet usage frequency (mean)	3.4	3.6	3.2	3.5	3.2	3.6	2.7	3.0	3.3
Journeys within EU last 12 month	mean	2.5	2.6	2.0	2.3	2.0	2.5	1.7	1.9	2.3
Life satisfaction	mean (1= very satisfied; 5= not at all)	1.9	1.8	2.1	1.9	2.0	1.7	2.2	2.0	2.0

Note: All results are statistically significant (Chi^2-test /ANOVA) on a 0.1% level.

[a] number of owned devices: desk computer, laptop, tablet, smartphone

[b] number of online activities: online banking, buying goods or services, selling goods or services, using online social networks, email, reading news online, palying games online, watching TV)

3.2 Country clusters

In a second set of cluster analyses, countries were segmented into country clusters based on their weighted distribution of the eight mobility styles. We compared the cluster solutions for 3 to 6 country clusters. In the 3-cluster solution countries in which price-oriented users were overrepresented were grouped together in one cluster (mainly East European countries); countries with an overrepresentation of green transport users were included in another cluster (mainly central and North European countries); and countries with a strong overrepresentation of car-oriented users were grouped in the third cluster (mainly island states, France and Italy). The main difference of the 4-cluster solution was that two car-oriented clusters were differentiated, one with more and one with less environmental concern. In the 5-cluster solution, the Netherlands and Denmark formed an additional separate cluster based on both countries' high share of (green) cyclists. In the 6-cluster solution three other countries joined this cluster, while Hungary now formed a cluster on its own. We used the 6-cluster solution as the final solution as it well represented the clusters of the 3-5-cluster solutions and thus indicated stability but at the same time was more differentiated with regard to green transport users, in particular cyclists of different motivations, which we regarded as useful additional information. By contrast, the merging of Denmark and the Netherlands into one cycling cluster (5-cluster solution) did not add much new information as it is well known these are the two leading European cycling countries (Nielsen et al., 2013).

Table 3 shows the weighted distribution of the mobility clusters separated for each country (or *country part* in case of Great Britain and Northern Ireland; East and West Germany) and which country cluster they belong to after k-means clustering with a 6-cluster solution. A mean distribution is provided for each country cluster to ease the comparison of the six country clusters. In country cluster 1, Convenience drivers are largely overrepresented while all the other mobility styles are underrepresented – cyclists especially are almost non-existent, and pollution is generally not considered to be a major problem with respect to transport since all the variants of green transport users, in particular, are underrepresented. The cluster members are Ireland, Northern Ireland and Cyprus – all islands on which the public transport networks are comparatively weak (EEA, 2013; 2015) and cycling is not very common. In country cluster 2, Convenience drivers are also overrepresented but only to a much lower extent. All the other mobility segments, apart from Green PT-users, are also underrepresented. In country cluster 3, both cycling segments are overrepresented as well as green users of other modes of transport. Apart from Europe's two leading cycling countries, the Netherlands and Denmark, the cluster includes Belgium, Finland, and Western Germany as members. Country cluster 4 is the cluster that contains the most countries, most of them placed in Southern and Eastern Europe. In this cluster price-oriented PT-users and pedestrians are overrepresented, possible reflecting the economic situation in these countries. Country cluster 5 is settled in Northern and Central Europe and consists of Sweden, East Germany and Austria. Characteristic for this cluster are a high amount of green travellers of all travel modes, and thus a high ecological awareness with regard to traffic. Finally, Hungary builds a cluster on its own with by far the highest amount – 19% – of cyclists and a high amount of price-oriented PT-users. The geographical distribution of the clusters is visualised in Figure 2 and reveals an interesting pattern, distinguishing a green central- and northern European spatial cluster where there are high shares of cyclists and green travellers; a periphery of the more recent EU member states in Eastern Europe, Spain and Portugal with high shares of price-oriented PT users and pedestrians. Hungary appears as an exception in this peripheral belt with its large share of non-environmental cyclists. The remaining European countries, including the UK, France and Italy, form a diagonal spatial cluster with a high share of convenience drivers, with some differences with respect to the role of public transport. Thus, the presence of mobility styles varies not only between the countries; it also forms identifiable sub-regions or spatial clusters within the EU.

Table 4: Description of the country clusters (corrected version)

		Convenience Drivers (%)	Busy green drivers (%)	Price-oriented PT-users (%)	Green PT-users (%)	Practical cyclists (%)	Green cyclists (%)	Price-oriented pedestrians (%)	Green pedestrians (%)
% sample (unweighted)		**45.8**	**9.2**	**17.6**	**3.5**	**6.2**	**2.7**	**11.3**	**3.7**
% sample (country weight)		**45.8**	**9.5**	**17.9**	**3.7**	**6.1**	**2.8**	**10.7**	**3.6**
% EU		**46.6**	**10.6**	**17.0**	**3.6**	**5.4**	**2.6**	**10.5**	**3.6**
Country clusters									
	Country								
(1)	Cyprus	83.0	3.4	3.6	1.0	0.6	0.6	5.8	2.0
	Northern Ireland	72.3	6.9	9.8	1.3	0.3	0.3	7.2	1.9
	Ireland	70.2	3.7	9.6	0.6	1.9	0.5	11.0	2.5
	mean	**75.2**	**4.7**	**7.7**	**1.0**	**0.9**	**0.5**	**8.0**	**2.1**
(2)	Italy	60.6	9.7	8.8	1.7	5.0	1.3	9.0	3.9
	Slovenia	59.4	12.4	7.7	1.4	6.6	2.4	6.5	3.7
	Malta	59.3	12.3	15.3	5.6	0.2	0.0	5.4	2.0
	Luxembourg	54.7	11.1	19.9	6.8	1.4	0.6	3.0	2.6
	France	54.6	15.0	13.0	4.2	2.1	1.5	6.0	3.7
	Great Britain	53.6	4.1	21.8	3.0	2.2	0.9	11.3	3.3
	mean	**57.0**	**10.8**	**14.4**	**3.8**	**2.9**	**1.1**	**6.9**	**3.2**
(3)	Belgium	46.5	14.6	13.1	4.9	7.4	5.6	5.5	2.5
	Finland	46.2	15.0	9.2	6.7	9.4	4.6	5.4	3.5
	Denmark	46.2	10.2	9.8	4.0	13.8	9.1	4.1	3.0
	Germany (West)	42.5	19.0	11.2	5.2	7.1	5.0	5.8	4.2
	Netherlands	33.7	15.0	7.1	4.2	19.4	16.5	2.3	1.8
	mean	**43.0**	**14.8**	**10.1**	**5.0**	**11.4**	**8.2**	**4.6**	**3.0**
(4)	Poland	41.4	6.6	28.6	2.3	5.9	0.7	12.2	2.3
	Spain	41.1	6.0	22.0	2.6	2.7	0.7	22.1	2.8
	Slovakia	40.3	6.0	24.2	1.7	5.9	1.3	18.2	2.5
	Lithuania	40.2	6.1	24.0	3.3	6.3	1.2	13.5	5.4
	Czech Republic	40.0	7.6	26.8	3.2	5.5	2.1	12.5	2.3
	Bulgaria	37.3	6.5	24.1	3.4	3.8	0.1	19.9	4.8
	Latvia	37.2	2.9	29.5	3.7	6.0	0.5	18.1	2.2
	Romania	36.5	4.7	27.4	2.0	6.1	0.8	18.3	4.2
	Portugal	44.8	4.0	24.6	2.3	0.8	0.1	19.5	4.0
	Greece	49.4	3.8	21.7	2.5	1.9	0.6	15.5	4.7
	Croatia	47.7	6.2	18.8	2.8	5.9	0.6	14.2	4.0
	Estonia	47.1	4.9	27.1	2.6	4.2	0.7	11.6	1.7
	mean	**41.9**	**5.4**	**24.9**	**2.7**	**4.6**	**0.8**	**16.3**	**3.4**

(5)	Sweden	35.5	15.8	10.3	9.8	7.9	8.8	3.3	8.5
	Germany (East)	34.0	19.1	14.2	7.7	9.4	4.5	6.8	4.3
	Austria	33.2	26.0	14.2	9.4	2.4	3.9	4.0	6.9
	mean	**34.2**	**20.3**	**12.9**	**9.0**	**6.6**	**5.8**	**4.7**	**6.6**
(6)	Hungary	**28.0**	**7.2**	**25.7**	**3.8**	**18.3**	**3.7**	**10.7**	**2.7**

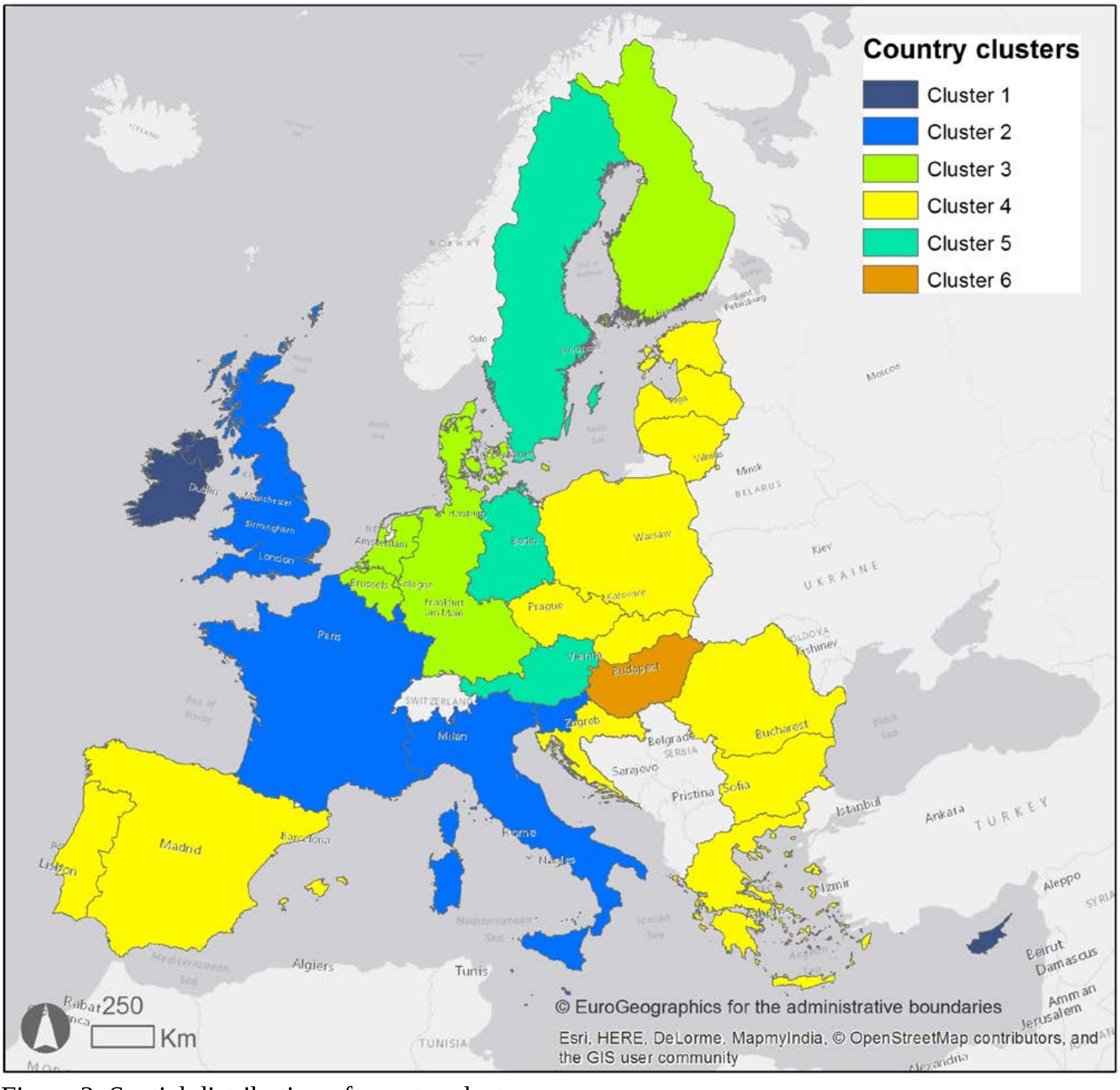

Figure 2: Spatial distribution of country clusters

4. Discussion and conclusions

Based on variables related to mode choice, travel preferences, and environmental concern as included in the Eurobarometer 82.2 omnibus, we divided the EU population into eight mobility styles by means of cluster analysis. Based on the frequency of mobility styles in each country, we clustered the EU countries into six distinct country clusters.

Being based on the Eurobarometer survey as a secondary dataset, the basis for the analysis and the clustering deviates from other approaches (e.g., Anable, 2005; Lanzendorf, 2002), in particular by limitations in the availability of relevant variables to be included in the segmentation. However, comparison of different clustering studies in the transport sector has shown that the results are generally robust and can withstand deviations with respect to the variables and the methodology (Haustein & Siren, 2015). Additionally, our study adds the value of comparison across countries and the identification of country clusters in the EU, which to the authors' knowledge has not been achieved in any previous study. Previous quantitative studies comparing regions with regard to predominant mobility patterns or cultures, either focussed on cities not countries (Klinger et al., 2013) or the country comparison was restricted to the description of mode-shares, travel distances or similar statistics (e.g. Armoogum et al., 2014). Developing clustering methodologies that combine transport choices with attitudes and values should be valuable in the context of monitoring the changes in transport patterns as well as whether progress is being made towards a greater openness towards more green travel patterns – as intended in the context of the EU's TERM indicators (European Environment Agency 2013). Finally, EU projects, studies, and policies may derive value from scientific evidence of the pan-European variation in mobility as prerequisite for the efficient implementation of policy actions and understanding of their effects.

Our analysis of the 27000 Eurobarometer respondents suggests that the EC population can be divided into eight mobility clusters: Convenience drivers (46.6% of the EC population), Busy green drivers (10.6%), Price-oriented PT-users (17.0%), Green PT-users (3.6%), Practical cyclists (5.4%), Green cyclists (2.6%), Price-oriented pedestrians (10.5%), and Green pedestrians (3.6%). The clusters differ with respect to everyday travel modes and with respect to the importance of speed, costs and environmental concerns – indicating different degrees of dependency and deliberateness. The mobility styles also differ in their socio-economic background; the two car-oriented styles have the highest level of socio-economic resources, and ‘green’ styles generally have higher socio-economic levels than non-greens. Against this background, it can be interpreted as a privilege to choose modes according to motives such as speed and convenience as compared to economic affordability, which is the predominant motive with respect to the price-oriented mobility styles. In terms of traffic problems, the “non-green” clusters may face basic problems other than pollution in their everyday lives, such as missing connections, which are probably better solved in the predominantly dense and economically advantaged countries that belong to, for instance, country cluster 3. Still, we think that it is more than the economic and infrastructural dimensions that shape the predominant mobility styles and related country clusters. In case of country cluster 3, the development of cycling in Northern Europe has been traced back historically and it has thereby been shown how political, social and cultural aspects were woven together to form distinct national cycling cultures, most predominant in the Netherland and Denmark (Carstensen & Ebert, 2012).

Together with country cluster 5, cluster 3 geographically forms a green central-and northern European zone with high shares of cyclists and green travellers. Cluster 4 forms a peripheral belt of the more recent EU member states in Eastern Europe, Spain and Portugal with high shares of price oriented PT-users and pedestrians, which may, apart from the historical importance of walking and public transport, reflect more recent economic developments and the severity of the economic crisis in these regions. Hungary appears as an exception in this peripheral belt with its large share of Practical cyclists. Factors that may contribute to this are the predominance of small settlements with calm traffic and flat landscapes – but also a tradition of cycling and a revitalization of this tradition in Budapest as part of a new identity as a (cycling) metropolis within the EU (Toth, 2014). In relation to that, Budapest put huge efforts into promoting cycling and making infrastructural improvements during the last decade (Kerényi & Bencze-Kovács, 2012), with the result that cycling flows in the central parts of the capital city increased by a factor of 10 between 1994 and 2014 (Bereczky & Varannai, 2015). The remaining European countries, including the UK, France, and Italy, form a zone with high shares of convenience drivers, but also some differences with respect to the role of public transport. Common to these countries is the absence of an everyday- or transport-cycling culture as witnessed in previous comparisons of policies and behaviours between countries (Osberg & Stiles, 1998; Wardlaw, 2014). Italy and France in particular are known to have strong cultures and identities in relation to bicycles in sport (Cardoza, 2010), but apparently this does not connect to everyday cycling. Differences in public transport between the countries seems to reflect the existence of strong metropolitan regions developed as transit cities (e.g. London and Paris) as well as general differences in urbanisation (e.g. Malta and Luxembourg that are highly urban and display high numbers of PT users within the cluster).

The country clusters and especially the spatial clusters that they form point to the existence of considerably different mobility cultures in the EU that are likely to require different policy approaches and to respond differently to policy actions or 'best practices' imported from other mobility cultures. The differences in responses to the promotion of cycling provide an example of the importance of cultures (cf. Aldred & Jungnickel, 2014) and we suggest that the mobility cultures classification could be used to increase awareness of these differences.

4.1. Limitations and future research perspective

The clusters developed and the clustering approach used may be a valuable tool to understanding the differences in the EU. Future replications of the study should be of high value for monitoring changes in travel patterns. Additionally, EU-wide data collections targeted more towards the needs of the analysis of mobility styles and cultures based on its choice and measurement of variables could also enhance the validity and policy value of the result. A clear limitation of the variables included in the Eurobarometer study is the focus on only the most frequently used mode of transport for each person, which makes it impossible to say anything about the clusters' level of multimodality. Also, the motives for mode choice were only assessed in relation to the dominant modes, while it would be highly relevant to know what the respective cluster members think about other modes, in order to learn more about possible barriers towards more environmentally-friendly modes in different European regions/country clusters. It is thus recommended that future studies also include the frequency of use for different modes as well as the relevant motives and attitudes in relation to all transport modes. Here, affective and symbolic motives should be considered in addition to the included instrumental motives, as they have been shown to be relevant determinants of mode choice (e.g., Anable & Gatersleben, 2005; Hunecke et al., 2007; Steg, 2005) and are also a part of the predominant mobility culture.

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