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How did bicycle share increase in Vitoria-Gasteiz?

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Abstract

Cycling mobility has often been neglected in transport planning. Nevertheless, the potential benefits of increasing the bicycle share make cycling promotion a key element for transforming cities toward sustainability. This research addresses the case study of Vitoria-Gasteiz, a city where the bicycle share has almost quadrupled in eight years. Through an exploratory analysis of the city´s last mobility surveys we find some insights into the bicycle user profile and the cycling trip. The results show differences between cyclist and non-cyclist groups especially by gender and age. On this account, target groups for addressing *probike* transport policies can be better identified.
Keywords: cycling; uban mobility; bicycle user profile; cycling trip;

1. Introduction

Different countries and cities in Europe have been promoting cycling during the last decades due to the several advantages at both personal and social level that involves a modal shift to the so-called *soft modes* (i.e. walking and cycling) (Harms et al. 2015; Dufour 2010; PROBICI 2010). Some of these advantages of cycling affect the individual directly like health benefits from physical activity performed when taking an *active mode* (Pucher and Buehler 2010). Improvements for the society as a whole stem are mainly related to car use lessening (e.g. cleaner atmosphere, reduced noise, less congestion, enhanced spaces liveability) (Tight et al. 2011). And the positive impact of modal shift on the reduction of greenhouse gas emissions stands out at global level. Therefore, moving toward sustainability goes through a change in the mobility daily paradigm and this involves attracting motorised vehicle users to public transport and soft modes.

Looking for promoting cycling in the best possible way, it is essential to understand the factors influencing bicycle use as a mode of transport (Handy et al. 2014). And logically, there is a particular interest in monitoring the use of certain modes when assessing the effectiveness of policies to encourage cycling (Bonnel et al. 2009; Handy et al. 2014). Even when the number of cycling studies has been rising considerably, reviews on cycling for commuting like Heinen et al. (2010) and Handy et al. (2014) highlight the need of further research on the factors relating to cycling. Some of these gaps are: gathering a wide range of factors in the same urban scale study; conducting research at different locations due to transferring difficulties; and studying in-depth cities that stand out in terms of bicycle-friendly policies and modal split evolution toward sustainable modes to shed light on the conditions that lead them there.

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This paper aims to contribute to this knowledge by examining the case of Vitoria-Gasteiz, a Spanish city with a transport policy founded on promoting cycling mobility as one of its main pillars and where the bicycle share has risen substantially. Based on survey data analysis, the research seeks to identify the bicycle user profile and type of trip in Vitoria-Gasteiz´s context.

The paper is structured as follows. Literature review on factors related to bicycle use is presented in the next section. The case study context is depicted in section number three, where the city and the urban mobility measures adopted in Vitoria-Gasteiz are described. The methodology used for the study is included in the fourth section. In the fifth section the results of the analysis are exposed and discussed. Last section includes the main conclusions and proposes further research.

2. Factors influence on bicycle use

Interest on sustainable mobility in general and on cycling in particular has grown quickly in a few years, and so did the number of studies on factors associated with bicycle use. It should be warned that several studies prevent policy-makers from transferring results between different locations. Some studies evidenced that policy measures for encouraging bicycle use are not directly transferable from one place to another (Heinen and Handy 2012; Marsden and Stead 2011). The cycling context has been particularly studied as a segmentation criterion among cities (Dufour 2010; Cervero et al. 2009).

Starting with the factors that involve the whole city, they can come from natural conditions or from the built environment. Regarding the weather, unusual weather conditions can decrease notably bicycle use (Dill and Voros 2007). The topography of the city –especially slopes maximum gradients– has an influence on cycling as well (Menghini et al. 2010). Yet, some towns with steep slopes meet considerable cycling mode shares (Cervero and Duncan 2003). Cities with dense urban development where different activities and uses meet seem to be more appropriated for cycling (Kemperman and Timmermans 2009). The existing bicycle network has been repeatedly been positively associated with cycle use (e.g. Hunt and Abraham 2007; Titze et al. 2008), but citizens with more cycling experience give less importance to such infrastructure (Broach et al. 2012). The cost of alternative modes –more expensive than cycling– seem to be important when considering cycling (Handy and Xing 2011).

Some factors are inherent to the journey –although they derive from the city´s urban design, way of life and transport policy–. Many studies pointed out the distance as one of the key factors when considering cycling (Handy et al. 2010). Below certain distances, cycling becomes very competitive (Hunt and Abraham, 2007). On the other hand, people who move by bicycle do not seem to concern as much as other modes users about minimising travel time (Paez and Whalen 2010). The purpose of the trip is also consistently mentioned as a relevant factor in the literature (e.g. Wardman et al. 2007) so it is suggested to distinguish commuting trips from sport, recreational and leisure bicycle use.

Socio-demographic characteristics have been identified as strongly associated to cycling, especially gender and age. Nevertheless, the studies show different conclusions about some of such factors (Dill and Voros 2007; Moudon et al. 2005; Pucher and Buehler 2008). Anyways, in many low-cycling contexts cycling users tend to be associated to young people and men (Garrard et al. 2008; Heinen et al. 2010; Garrard et al. 2012; Garrard et al. 2008; Dill and Voros 2007; Asperges 2008). The household income influence is not clear and seems to be also strongly related to the context. The income ranges of bicycle users seem to be higher in places where cycling is more usual and on the contrary, lower in low-cycling contexts (Rondinella 2015). The number of family members and bicycle availability are associated positively with cycle users, as opposed to car availability (Pinjari et al. 2008). Moreover, it seems appears that higher level of motorisation in a city implies less commuting trips by bicycle. Bike-sharing systems make bicycles available without ownership (Shaheen et al. 2012).

Besides studying the actual use of the bicycle as a mode of transport, several studies highlight the importance of analysing how cycling is viewed in the society, considering the values associated to cycling, the image, and the aspects perceived as requirements for being able to cycle properly (Aldred and Jungnickel 2014). People attitude towards cycling is usually worse than their attitude towards driving a car. On the other hand, people with a negative perception of car use consequences is more likely to cycle (Dill and Voros 2007). The larger community may also influence individual behaviour, as stated by multiple researches based on the Theory of Planned Behaviour (Ajzen 1991). Travel habits and cycling experience appear also as key elements in cycling consideration. Research results have been significant when using cycling familiarity — and motivation (i.e. commute to work or study place versus other purposes bicycle use) of the cycling previous experiences —as a segmentation criteria (Kroesen and Handy 2014; Rondinella 2015). The attitudinal indicators towards cycling may include other attributes such as fun, relax, image, clothing, comfort, fitness requirement, exercise opportunity, pedestrian nuisance, accident risk, pollution breathing, vandalism, environmental benefits, health, quickness, flexibility or reliability, among others. Some authors tried to group them and find the underlying latent variables that could measure such attitudinal factors (Fernandez-Heredia 2012; Muñoz et al. 2016).

After the literature review, the need of further research on the factors related to bicycle use as a mode of transport in different contexts and using wide samples remains important. Thus, we addressed such kind of research framed within the case study of Vitoria-Gasteiz, introduced in the following section.

3. Case study: Vitoria-Gasteiz

The case study of this research is placed in Vitoria-Gasteiz, a medium-sized city with over 240,000 inhabitants in northern Spain. It has a mild humid moderately cold climate. Its flat topography –excluding the historical core town set on a hill– favours bicycle use. Another key feature of the city that is on the side of bicycle use is its compact urban development. The vast majority of the

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population live in an area of about 6 km in diameter, nearby basic services access –education, health and cultural facilities within 300 m distance–. The city has one of the highest incomes per capita in Spain and its rate of unemployment is lower than the national average.

Vitoria-Gasteiz has enjoyed general consensus for decades in implementing urban environmental strategies and has been a pioneering city in sustainability commitment (Andrés Orive and Dios Lema 2012). Its actions on urban transport are some of the main reasons to make Vitoria-Gasteiz recognized internationally and win awards such as the European Green Capital in 2012. The main planning document on this field is the Sustainable Mobility and Public Space Plan (SM&PSP) (City of Vitoria-Gasteiz 2008) initiated in 2006. It aimed to reverse the use of the private car – by limitations to car use and primacy to other modes of transport, particularly active ones– and to improve the public space liveability. The public transport network consists of ten bus lines and two tram lines. Regarding bicycle use, Vitoria-Gasteiz has been traditionally a leading city for decades. The SM&PSP was supplemented in 2009 with a Bicycle Mobility Master Plan (City of Vitoria-Gasteiz 2009). Some actions that were carried out based on the SM&PSP included the spread of the bicycle lanes network, bicycle parking facilities, bike-traffic safety courses and new cycling regulations. In sum, transport policies and the built environment of Vitoria-Gasteiz make commuting by bicycle potentially feasible for the vast majority of its citizens.

The City of Vitoria-Gasteiz has carried out urban mobility surveys periodically; last ones were conducted in 2006, 2011 and 2014. According to the Mobility Survey that was conducted in 2014, there are over 911,000 trips in Vitoria-Gasteiz during a working day, mainly within the city (96.1%) and an average of 4.3 daily journeys per person. Practically the entire population (96.7%) travelled the day before the survey. Vitoria-Gasteiz has the highest confirmed rate of cycling in Spain. Among people commuting to their work or study centre from their residence, 6.3% go by bicycle in Vitoria-Gasteiz; in contrast, the average in Spain is only 2.4% (INE 2011). The modal split is dominated by trips on foot (54.3%), followed by private vehicles (24.7%), bicycles (12.3%), and public transport – bus and tram – (7.6%) according to the Mobility Survey 2014. Hence, the modal split is clearly inclined toward non-motorized modes. The cycling share in the city has rocketed lately, especially in the last data period from 2011 to 2014 – from 6.8% to 12.3% in 3 years– (see Fig.1), shaping the context of a “climber cycling city” (Dufour 2010). Considering such significant change in the cycling share over just three-years-time and recalling the identified research gap on understanding the factors related to the modal shift towards cycling, it appears that Vitoria-Gasteiz is an appropriate case study for this research.

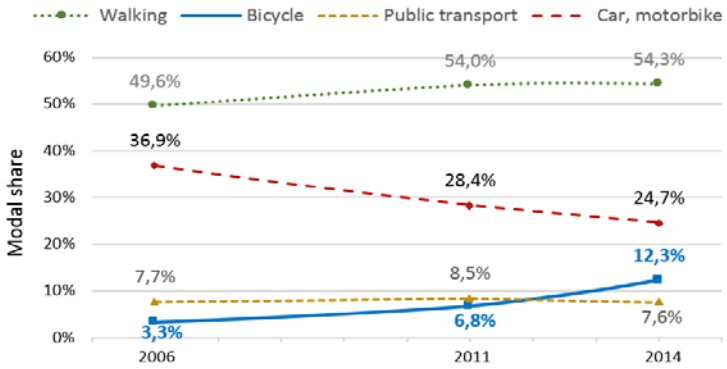

Fig. 1. Modal share evolution in Vitoria-Gasteiz (percentage over total of trips). Source: Mobility Surveys 2006, 2011 and 2014.

4. Data collection and analysis methodology

This paper research is primarily based on the Mobility Survey 2014 data collected for TRANSBICI project. This research project selected the city of Vitoria-Gasteiz to analyse travel behaviour, mode choice and bicycle use in urban areas throughout a multidisciplinary approach. Additionally, we used data from the Mobility Surveys 2006 and 2011 for comparison over time.

We carried out an explanatory analysis of the city´s modal share by trip purpose and distance covered, and the sociodemographic profile of the citizens, comparing people who go on bike and the rest of the population. In parallel, data from some of these profile factors that were available both in 2006, 2011 and 2014 was included in order to gain insight into the evolution and tendency.

Some of the variables analysed are sociodemographic such as the gender, the age, the professional occupation, the household status, having children under six at home, the number of household members, and the household income range. Other selected variables have to do with the trip itself, besides the mode of transport chosen: motivation of the journey and distance covered.

On the account of this research, the following considerations were made. The results are provided for the universe applying the factor of expansion for each of the individuals with the same gender and age range at the different zones of the city. Several comparisons are made between the cyclist and the non-cyclist group. The cyclist group is defined as the set of people who cycled at least for one of their trips the day before the survey. As the estimation of the self-reported travel time could be easily underestimated or overestimated, the travel distance was calculated by entering the origin and destination with Google Maps API (Application Programming Interface). Minimum network distances covered on foot were obtained. Analyses focused on distances

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do not include trips with the origin or the destination located out of the municipality of Vitoria-Gasteiz. Trips with no specific destination (e.g. an outing) were separated from the rest of the sample because their distance is irrelevant for this study as it does not determine the mode choice in the same way as for other trips. When origin and destination were reported as coinciding, distance travelled data is missing. Nevertheless, for reported trips below five minutes walking trips, less than 500 m range was adopted.

5. Analysis of cycling profiles

This section gathers the results found after conducting the exploratory analyses introduced above. It delves into the features of the cycling trip and the bicycle user profile.

5.1. Characteristic cycling trip

A previous comment within the case study´s section introduced the powerful increase of the bicycle share within Vitoria-Gasteiz over the last years (see Fig. 1). Looking at the modal split in percentage, it is remarkable that while the bicycle rocketed – quadrupled from 3 to 12% in 8 years–, the car declined – decreased from 37% to 28% between 2006 and 2011 and fell 3 percentage points more in 3 years–. Transferring car trips to bicycle trips –toward a more sustainable mobility– still entails a huge potential in Vitoria-Gasteiz. The cycling average annual growth rate between years within the 2006 to 2011 period is estimated at 15.6% and it is even higher –21.8% year-on-year increase– for the period from 2011 to 2014. Regarding this comparison it should be noticed that 2006 data was collected during winter period (December 2006), as opposed to the other surveys (April–May 2011 and mainly May–June 2014); thus, concerning its collecting season, 2006 data was more likely to have a lower representation of outdoors modes such as cycling. On the other hand, it should also be born in mind that the 2011 survey included children from six to ten years old (2006 and 2014 samples included people from ten) who are more likely to travel on foot or as passengers in cars. A priori, the main alternative modes of transport which come into play when facing the modal choice are walking, public transport (bus and tram) and car, apart from the bicycle. It was analysed if the trip purpose and distance would help to delimit particular competition areas.

Looking at the purpose of the trips made within Vitoria-Gasteiz, although the predominant share is the walking one used for more than half of the total number of trips, it appears that people go more on foot for not commuting trips but prefer car driving for commutes to work and almost equally go on foot and ride their bicycle for commutes to their study place. Fig. 2 shows how these modal split differ depending on the purpose of the journey. It should be considered that commuting trips to work and to the study centre represent only the 18.8% and 7.4% of the total number of trips, respectively. Nevertheless, it should be taken into account the correlation between the occupation and the age for understanding also the high rate of the bicycle for attending to the study centre.

Regarding the distance, it was observed that the majority of cycling trips have a distance travelled between 1 and 2.5 km and still competitive for journeys until 5 km –more than half and almost one third of the trips by bicycle, respectively– (see Fig. 3). The competitiveness with the bicycle mode against the motor vehicles until certain distances was also pointed out by Hunt and Abraham (2007). Yet, until 1 km trips are clearly dominated by walking mode and from 5 km on by the car.

In sum, the major competitors of the bicycle are the walking mode for shorter trips and non-commuting purposes, and the car for journeys from 2.5 km and commuting to work. On the other hand, trips between 1 and 5 km seem to be the most appropriate niche for the bicycle. There was not found clear evidence for relating cycling avoidance for particular purposes due to the purpose itself.

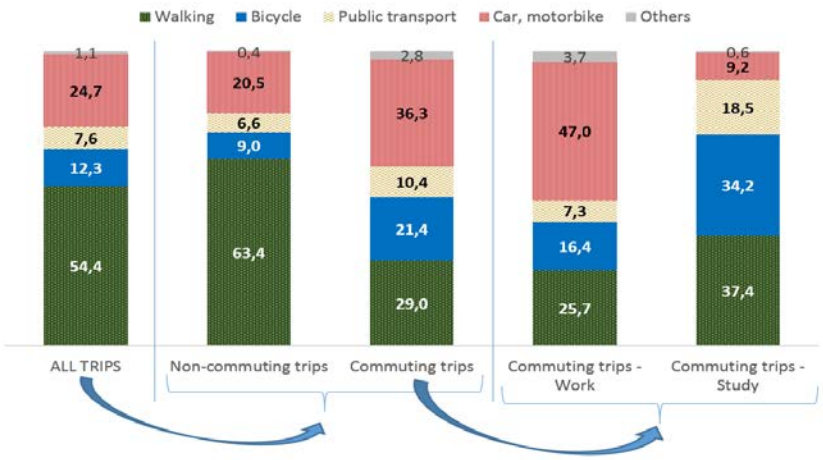

Fig. 2. Modal share by trip purpose in Vitoria-Gasteiz. Source: Mobility Survey 2014.

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Fig. 3. Number of trips by mode and distance in Vitoria-Gasteiz. Source: Mobility Survey 2014.

5.2. Bicycle user profile

Apart from the given conditions of the trip, there are other personal factors that could affect the choice of cycling whether they are inherent of that individual or circumstantial. The sociodemographic variables measured in the Mobility Survey of Vitoria-Gasteiz that bring insights into the bicycle user profile and its comparison with the rest of the citizens of Vitoria-Gasteiz are recorded in the following Table 1.

Table 1. Sociodemographic distribution in Vitoria-Gasteiz compared between cyclists and non-cyclists. Source: Mobility Survey 2014.

Factor	Category	Absolute value			Share of the category over the group			Share of the group over the category		
		Total	Non-cyclists	Cyclists	Total	Non-cyclists	Cyclists	Total	Non-cyclists	Cyclists
Gender	Male	106,500	80,705	25,796	49	45	65	100	76	24
	Female	112,010	98,380	13,630	51	55	35	100	88	12
	Total	218,510	179,084	39,425	100	100	100	100	82	18
Age	10-19	21,636	10,370	11,265	10	6	29	100	48	52
	20-29	24,319	16,364	7,956	11	9	20	100	67	33
	30-39	29,407	24,643	4,763	13	14	12	100	84	16
	40-49	50,799	41,968	8,831	23	23	22	100	83	17
	50-64	46,557	41,697	4,860	21	23	12	100	90	10
	≥65	45,792	44,042	1,750	21	25	4	100	96	4
	Total	218,510	179,084	39,425	100	100	100	100	82	18
Occupation	Student	30,666	15,953	14,713	14	9	37	100	52	48
	Employed	92,103	76,335	15,768	42	43	40	100	83	17
	Unemployed	29,693	24,286	5,407	14	14	14	100	82	18
	Retired	48,759	46,025	2,734	22	26	7	100	94	6
	Domestic work	17,288	16,485	803	8	9	2	100	95	5
	Total	218,510	179,084	39,425	100	100	100	100	82	18
Household status	Father or mother	80,861	69,102	11,759	37	39	30	100	85	15
	Son or daughter	51,034	31,827	19,207	23	18	49	100	62	38
	Couple without children at home	59,523	53,984	5,539	27	30	14	100	91	9
	Other relatives	2,498	2,235	263	1	1	1	100	89	11
	Without family ties	24,594	21,938	2,656	11	12	7	100	89	11
	Total	218,510	179,084	39,425	100	100	100	100	82	18
Parents with children under six at home*	Yes	21,022	17,862	3,160	26	26	27	100	85	15
	No	59,839	51,240	8,599	74	74	73	100	86	14
	Total	80,861	69,102	11,759	37	39	30	100	85	15
Household members	1	22,784	20,446	2,338	10	11	6	100	90	10
	2	70,567	63,715	6,852	32	36	17	100	90	10

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	3	55,705	44,916	10,789	25	25	27	100	81	19
	4	57,524	42,039	15,485	26	23	39	100	73	27
	≥5	11,931	7,970	3,961	5	4	10	100	67	33
	Total	218,510	179,084	39,425	100	100	100	100	82	18
Household income	< 1,000 €	18,666	16,178	2,488	9	9	6	100	87	13
	1,000-2,000 €	74,481	63,655	10,826	34	36	27	100	85	15
	2,000-3,000 €	50,832	41,622	9,210	23	23	23	100	82	18
	>3,000 €	28,049	21,637	6,412	13	12	16	100	77	23
	Not available	46,482	35,993	10,489	21	20	27	-	-	-
	Total	218,510	179,084	39,425	100	100	100	100	82	18

*Only if the respondent holds the status of father or mother at their residence.

Table 2. Trips by bicycle comparison of gender and age between 2006, 2011 and 2014. Source: Mobility Surveys 2006, 2011 and 2014.

Factor	Category	2006		2011		2014	
Gender	Male	4,340	69%	12,833	67%	25,796	65%
	Female	1,950	31%	6,320	33%	13,630	35%
	Total	6,290	100%	19,153	100%	39,425	100%
Age	10-19	1,092	17%	3,288	17%	11,265	29%
	20-29	2,534	40%	4,614	24%	7,956	20%
	30-49	2,164	34%	8,523	45%	13,594	34%
	50-64	315	5%	2,218	12%	4,860	12%
	≥65	185	3%	510	3%	1,750	4%
	Total	6,290	100%	19,153	100%	39,425	100%

In the light of these results, we can observe that the current cyclist group is dominated by men (65% males vs. 35% females). Looking beyond, it appears that this majority is less marked for younger ranges –men share over cyclists are 59%, 62% and 60% for 10-19, 20-29, 30-39 ranges, respectively– than for older ones –70%, 82% and 73% for 40-49, 50-64 and over 65 ranges, respectively– (see Fig. 4). Global gender comparison has become slightly more balanced over the last years (see Table 2) –the difference between shares has decreased approximately 4 percentage points between 2006 and 2011 and almost 2.5 over the period 2011-2014–. This could be a sign of increasing youth cycling culture, as Garrard et al. (2008) and Heinen et al. (2010) associate the men-women balance at going on bike with consolidated cycling contexts. Trips by bicycle have also increased in older age ranges, which is also an indicator of bicycle-friendly contexts. Another interesting aspect observed is that cycle share decrease significantly with the age for both men and women from 10 to 39. From this age on, the percentage of women on bikes keep steadily declining while for male-cyclists there is an upturn at the 40-49 years range and then a fall again. Therefore, the highest proportion of cyclists over an age range corresponds to the teenagers (more than half), followed by people in their twenties (one third of them). Nevertheless, considering that the 40-49 interval is the most populated in Vitoria-Gasteiz, bike riders of this age are second most numerous (8,831), below 10-19 years (11,265) and over 20-29 (7,956) (see also Fig. 4).

The vast majority of the cyclists are students and workers – 77% of the people on bike, almost half each–. On the other hand, as the number of employed people triples the number of students, it appears that the rate of cyclists over the students is almost half of them (48%) conversely to the value of 17% bicycle users over the workers. Nevertheless, the occupation factor appears to be strongly associated with the age. Something similar regarding the association with the age occurs to the household status factor. Thus, it would be preferable to maintain the focus on the age.

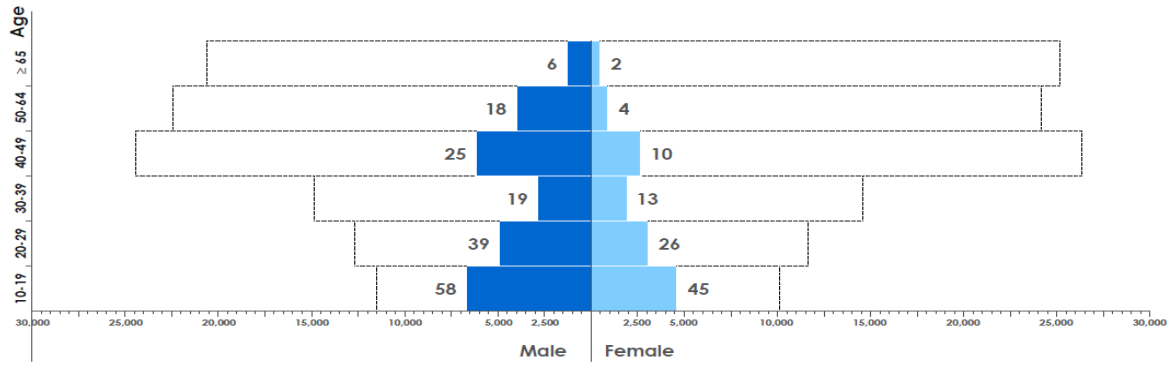

Fig. 4. Population pyramid with cyclist distribution (in %) by gender and age in Vitoria-Gasteiz according to 2014 Mobility Survey.

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Table 3. Comparison of parents with children under six at home by their gender and occupation. Source: Mobility Survey 2014. Source: Mobility Survey 2014.

Conditions			Absolute value			Share of the group over the category (%)		
30-39 years old*			Total	Non-cyclists	Cyclists	Total	Non-cyclists	Cyclists
Female	Employed	Mother with children under 6 at home	6,402	5,885	517	100	92	8
		Rest	19,644	17,469	2,175	100	89	11
	Rest	Mother with children under 6 at home	3,103	2,846	257	100	92	8
		Rest	11,280	9,665	1,615	100	86	14
Male	Employed	Father with children under 6 at home	9,025	6,804	2,221	100	75	25
		Rest	22,311	17,672	4,639	100	79	21
	Rest	Father with children under 6 at home	1,007	843	164	100	84	16
		Rest	6,755	4,789	1,966	100	71	29

*The frequency of parents with children under six at home is not representative other age ranges apart from 30-39.

However, if looking particularly at the fact of being a father or mother with children under six years old at home, the use of the bicycle appears to be almost equal between the ones who satisfy the condition and the ones who do not. Nevertheless it does exist difference on cycle use between mothers and fathers with children under six at home and it also provides interesting information observing the occupation at the same time (see Table 3). The only representative age group that meets being a parent and living with children under six requirements is the 30-39 years old range. Within that group, the students are not representative either. It appears that mothers with children under 6 at home use less the bike as women within the same age range and occupation, especially the ones who are not employed – 8% vs. 11% for employed ones and 8% vs. 14% for unemployed, retired or domestic work–. The case of the men is different: cyclist rate over not employed males is also lower for fathers with children under 6 at home; conversely, the proportion of cyclists over employed fathers with children under 6 at home is higher compared with the rest of employed men in their thirties.

The rate of cyclists increases both with the number of household members and the household income (see Table 1). It could also be observed that it increases with the number of household members within each home income range. Nevertheless, the information is not the best. On the one hand, almost one quarter of the respondents did not provide information. On the other hand, a deeper analysis would involve the income per person. Such value can only be roughly estimated with the ranges available. Such rough results imply a less use of the bicycle when increasing the income till one turning point approximated around 2,500 euros per person where the rate of the bicycle jumps to the highest values. That could be in keeping with Rondinella (2015) findings if thinking of Vitoria-Gasteiz of a transition in between of a low-cycling context – looking at the higher use of the bicycle in parallel with lower incomes– and a high-cycling context – looking at the bigger rates of use for wealthier people.

To this end, the research analysis suggests the distance, the gender and the age as the key determinant factors for choosing the bicycle. The next section will contribute with the comparison of the perceptions on cycling aspects for groups distinguished but the selected factors within this section related to the person –not to the trip– (i.e. gender and age range).

6. Conclusions

We analysed the mobility surveys collected in Vitoria-Gasteiz, a city with a steadily climbing bicycle share, from a very low rate to a considerable one. The modal share evolution show active modes as predominant in the city and how motorised modes decreased while cycling increased.

The distance, the gender and the age were identified as the main factors related to bicycle use, which are some of the highlighted factors in the review carried out by Handy et al. (2014). Notable differences appeared by trip purpose, with more cycling use for work and study purposes. Nevertheless, the occupation appeared to be correlated to the age, already identified as a key factor.

There is not a single average cyclist as the rates are distributed among different groups and it tends to a more spread profile – with a more balanced rate of men and women and higher percentages of bicycle users among older age ranges. Therefore, future policy measures should focus on these groups were the cycling share is still potentially feasible to be strongly increased. Nevertheless, according to the most recent data, the bicycle user and his trip profile is better defined by a young man, riding within a distance of 1 to 2.5 km or even until 5 km journey.

Once we pictured this characterisation on objective variables it would be interesting to understand the psychosocial foundations of such profile as suggested the review by Handy et al. (2014). These insights can guide further analyses focused on cycling perceptions using panel models with a smaller sample. When applying temporal statistical analysis, one of the main problems could be the small variation between each year data. The stead and rapid increase of bicycle use in Vitoria-Gasteiz since the beginning of the century supports the choice of this city as a case study also from this point of view. Panel analysis would help to understand modal shifts in a more precise way and avoiding variables that were not observable. Familiarity with cycling is an interesting factor to be included in future analysis, as introduced by Rondinella (2015); the way of asking about such experience in the surveys should

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be taken into account. Further understanding of the role of the subjective perceptions on cycling as proposed by Willis et al. (2015) and the different views of motivators and barriers towards cycling compared by gender and age – the most determinant sociodemographic factors identified in this research– could help to understand the basis of such differentiations. It would be also interesting to compare several "climber cycling cities".

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References

Ajzen, I., 1991. The theory of planned behavior. Organizational Behavior and Human Decision Processes 50, 179–211.
Aldred, R., Jungnickel, K., 2014. Why culture matters for transport policy: the case of cycling in the UK. Journal of Transport Geography 34, 78–87.
Andrés Orive, L. Dios Lema, R., 2012. Vitoria-Gasteiz, Spain: From Urban Greenbelt to Regional Green Infrastructure. In: T. Beatley (Ed.), Green Cities of Europe: Global Lessons on Green Urbanism. Washington DC: Island Press/Center for Resource Economics.
Asperges, T., 2008. Cycling, the European approach: Total quality management in cycling policy and lessons learned of the BYPAD-project. Intelligen Energy-Europe.
Bonnel, P., Lee-Gosselin, M., Zmud, J., Madre, J.L., 2009. Transport Survey Methods: Keeping Up with a Changing World. Emerald Group Publishing Limited.
Broach, J., Dill, J., Gliebe, J., 2012. Where do cyclists ride? A route choice model developed with revealed preference GPS data. Transportation Research Part A 46, 1730–1740.
Cervero, R., Duncan, M., 2003. Walking, bicycling, and urban landscapes: evidence from the San Francisco Bay Area. American Journal of Public Health 93, 1478–1483.
Cervero, R., Sarmiento, O., Jacoby, E., Fomez, L.F., Neiman, A., 2009. Influences of Built Environments on Walking and Cycling: Lessons from Bogotá. International Journal of Sustainable Transportation 3(4), 203–226.
City of Vitoria-Gasteiz, 2008. Plan de Movilidad Sostenible y Espacio Público de Vitoria-Gasteiz
City of Vitoria-Gasteiz, 2009. Plan Director de Movilidad Ciclista.
Dill, J., Voros, K., 2007. Factors Affecting Bicycling Demand: Initial Survey Findings from the Portland Region. Transportation Research Board, Washington DC.
Dufour, D, 2010. Cycling Policy Guide: General Framework. PRESTO project: Promoting Cycling for Everyone as a Daily Transport Mode.
Fernandez-Heredia, A, 2012. El potencial de las variables latentes en modelos explicativos del uso de la bicicleta. PhD Thesis. UPM, España.
Garrard, J., Handy, S., Dill, J., 2012. Women and cycling. In: J. Pucher and R. Buehler (Eds.), City Cycling, 211–233. Cambridge: The MIT Press.
Garrard, J., Rose, G., Lo, S.K., 2008. Promoting transportation cycling for women: the role of bicycle infrastructure. Preventive medicine 46(1), 55–9.
Gatersleben, B., Appleton, K.M., 2007. Contemplating cycling to work: Attitudes and perceptions in different stages of change. Transportation Research Part A 41(4), 302–312.
Handy, S., van Wee, B., Kroesen, M., 2014. Promoting Cycling for Transport: Research Needs and Challenges. Transport Reviews 34(1), 4–24.
Handy, S., Xing, Y., 2011. Factors Correlated with Bicycle Commuting: A Study in Six Small U.S. Cities. International Journal of Sustainable Transportation 5(2) 9, 1–110.
Harms, L., Bertolini, L., Brömmelstroet, M.T, 2015. Performance of Municipal Cycling Policies in Medium-Sized Cities in the Netherlands since 2000. Transport Reviews, 36(1), 1–29.
Heinen, E., van Wee, B., Maat, K., 2010. Commuting by Bicycle: An Overview of the Literature. Transport Reviews 30(1), 59–96.
Heinen, E., Handy, S., 2012. Similarities in Attitudes and Norms and the Effect on Bicycle Commuting: Evidence from the Bicycle Cities Davis and Delft. International Journal of Sustainable Transportation, 6(5), 257–281.
Hunt, J., Abraham, J., 2007. Influences on bicycle use. Transportation 34, 453–470.
Instituto Nacional de Estadística (INE), 2011. Population and Housing Censuses 2011.
Kemperman, A., Timmermans, H., 2009. Influences of the built environment on walking and cycling of latent segments of the aging population. Proceedings of Transport Research Board Annual Meeting 2009, Washington, DC.
Kroesen, M., Handy, S., 2014. The Relation between Bicycle Commuting and Non-Work Cycling: Results from a Mobility Panel. Transportation 41(3), 507–27.
Marsden, G., Stead, D., 2011. Policy transfer and learning in the field of transport: A review of concepts and evidence. Transport Policy 18(3), 492–500.
Menghini, G., Carrasco, N., Shussler, N., Axhausen, K.W., 2010. Route choice of cyclists in Zurich. Transportation Research Part A 44, 754-765.
Moudon, A.V., Lee, C., Cheadle, A.D., Collier, C.W., Johnson, D., Schmid, T.L., Weather, R.D., 2005. Cycling and the built environment, a US perspective. Transportation Research Part D 10, 245–261.
Nankervis, Muñoz, B., Monzon, A., Lopez, E., 2016. Transition to a cyclable city: latent variables affecting bicycle commuting. Transportation Research Part A 84(2016), 4–17.
Paez, A., Whalen, K., 2010. Enjoyment of commute: a comparison of different transportation modes. Transportation Research Part A 44(7), 537–549.
Pinjari, A., Eluru, N., Bhat, C., Pendyala, R., Spissu, E., 2008. Joint model of choice of residential neighborhood and bicycle ownership: accounting for self-selection and unobserved heterogeneity. Transportation Research Record: Journal of the Transportation Research Board 2082, 17–26.
PROBICI, 2010. Guía de la movilidad ciclista. métodos y técnicas para el fomento de la bicicleta en áreas urbanas.
Pucher, J., Buehler, R., 2008. Making Cycling Irresistible: Lessons from The Netherlands, Denmark and Germany. Transport Reviews 28(4), 495–528.
Pucher, J., Buehler, R., 2010. Walking and Cycling for Healthy Cities. Built Environment 36(4), 391–414.
Rondinella, G., 2015. Considering Cycling for Commuting: The Role of Mode Familiarity. PhD Thesis. Universidad Politecnica de Madrid, Madrid, España.
Shaheen, S., Guzman, S., Zhang, H., 2012. Bikesharing across the globe. In: J. Pucher and R. Buehler (Eds.), City cycling, 183-210. Cambridge: MIT Press.
Tight, M., Timms, P., Banister, D., Bowmaker, J., Copas, J., Day, A., Drinkwater, D., 2011. Visions for a Walking and Cycling Focussed Urban Transport System. Journal of Transport Geography 19(6), 1580–89.
Titze, S., Stronegger, W.J., Janschitz, S., Oja, P., 2008. Association of built-environment, social-environment and personal factors with bicycling as a mode of transportation among Austrian city dwellers. Preventive medicine, 47(3), 252–9.
Wardman, M., Tight, M., Page, M., 2007. Factors influencing the propensity to cycle to work. Transportation Research Part A 41, 339–350