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Travel patterns, regarding different activities: work, studies, household responsibilities and leisure

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Abstract

This study provides a descriptive analysis of the relationship between mobility and gender through unravel the complex relationships between gender roles at home (household responsibilities), leisure and the labor market (employment status). Specifically we study both the average number of journeys by different daily activities and the distances and average time spent on them. Thus, the spatio-temporal patterns of these activities allow us to identify different socio demographic variables that may help explain the relative differences in the behavior of journeys to different activities.

The results highlight that, women perform more trips than men regardless of the reason. Moreover, the difference between the number of trips by gender is greater when the reason for the trip is about household responsibility. Regarding the influence of socio-demographic variables the study reveals that in general, the reason why men and women travel greater distances is due to work. One interesting result is that employed women travel considerably shorter distances to work than do men even though they spend similar commute time. This suggests that, the journey to work may reflect the magnitude of immobility that women face in their everyday lives.

On the other hand, the socio-demographic characteristics analyzed (size and population density, household income, etc...) condition mainly women's travel patterns..

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1. Introduction

The Time-Use Studies provide information on what people have done and how to divide their time, demonstrating that patterns of structuring daily time vary in relation to variables such as social group membership, age, gender, employment status or household income. It is definitely the gender variable that prints the major differences. In fact, Time Use Survey 2009-2010 of the Spanish National Institute of Statistics INE (2010) reveals significant gender inequalities in the use of time, mainly manifested in activities such as "Work" and "Home and Family ". This fact is discussed extensively in papers on Time Use as Carrasco and Dominguez (2003) and Rivas (2013).

Just as men and women make a different use of their time in activities such as "Work" and "Home & Family", we can see there are different travel patterns in which gender is one of the variables that major differences prints. Indeed, authors such as Hanson and Hanson (1980) and Niemeier and Morita (1996) state that women tend to spend more time involved in family and domestic obligations, so despite finding work, they have to reconcile their work and family life, which may result in women in general will perform shorter trips. Thus, authors like Madden (1981), Hanson and Johnston (1985), Wachs (1987), Gordon, Kumar, and Richardson (1989), Hanson and Pratt (1990), Rosenbloom and Burns (1993), Blumen (1994), Hjorthol (1998), McGuckin and Nakamoto (2005) suggest that women who work have shorter trips, opting to work near their homes, even if it means sacrificing their own career and their opportunities for occupational advancement.

The main aim in this research is to verify the existence of gender differences in daily mobility and the influence of their socio-demographic circumstances in choosing destinations, by analyzing distances and time spent on trips. Thus, the most knowledge of travel patterns in our current society will assist us to improve more efficient mobility and also more sustainable.

2. Methodology

This study is part of a larger research project focused on exploring ideas, attitudes and motivations of women and men around different aspects of mobility (travel purposes, travel times, distances and modal choice, ...).

The methodology of this paper, is based on an essentially descriptive approach, and is aimed at collecting data on the different travel patterns that are useful for implantation of sustainable transport policies based on adequate knowledge of reality, for it, we have analyzed .micro-data from the Social Survey 2011: mobility in the urban regions of Andalusia by the Institute of Statistics and Cartography of Andalusia IECA (2013).

This survey took place in November 2011 although the micro-data were not published until March 2013. The target population of this survey is the family houses in urban regions of Andalusia and people aged over 16 residing in them. Finally the sample size was over 5,767 households and 17190 displacements.

The sample design was made by a three-stage cluster model. The expected relative error for all urban areas was 1.5% for a confidence level of 95.5%, under the assumption of maximum indetermination ($p = q = 50\%$) and a design effect 2.

The micro-data analysis has been performed using the SPSS statistical package (V15.0) to identify the main socio-demographic variables which can affect the different male and female mobility.

3. Mobility and gender

The average number of trips per person performed on a weekday is 3.57 IECA (2013), being 3.66 for women and 3.48 for men. We can see that the difference in the ratio of trips / person by gender is 4.97%, reflecting a greater number of journeys by women.

Table 1 - Average number of trips per person by gender

	Total	Male	%	Female	%	Difference in Ratio trips / person
People commuting	4.151.839	2.077.769	50.04	2.074.070	49.96	
Trips/day	14.820.071	7.232.345	48.80	7.587.726	51.20	
Trips/person	3.57	3.48		3.66		4.97

By taking age into account, we can see that although women generally make a greater number of trips, this is not, after 50, where the trend is reversed. In addition, women aged 30 to 39, are who perform the most number of journeys, being in this age where major gender differences in the number of trips occur. This greater volume of trips performed by women indicates a more complex life full of activities, further corroborated by the reduced mobility of them from age 50 (Table 2).

Table 2 - Average number of trips per person by gender and age

	Average trips/person	Average trips/person Male	Average trips/person Female	Difference in Ratio trips / person
16-29	3.62	3.46	3.78	8.76
30-39	4.03	3.69	4.34	15.96
40-49	3.85	3.74	3.96	5.83
50-64	3.35	3.53	3.16	-11.16
>65	2.75	2.76	2.73	-1.25
Total	3.57	3.48	3.66	4.97

3.1. Number of trips by gender and trip purpose

The analysis of the mobility patterns by gender requires the study of their different trip purposes. In general, household responsibility trips (shopping, picking up children, medical issues, visits to friends and family etc…) represent over 27% of trips (Table 3).

Table 3 – Concentration index of trips by gender and trip purpose

	Concentration Index (%)	Concentration Index (%)	Concentration Index (%)	Gender Gap
Going home	40.71	40.95%	40.49%	1.84
Work	14.18	17.35%	11.16%	-19.41
Study	2.94	2.81%	3.07%	6.72
Household Resp.	27.63	21.74%	33.24%	23.21
Leisure	10.94	13.29%	8.71%	-18.51
Other	3.59	3.86%	3.33%	-5.04
Total	**100.00**	**100.00%**	**100.00%**	**2.40**

As shown in the table above, the reasons "Going home" (similar for both sexes) and "others" do not contribute to the research we are developing, so we will focus on the analysis of the journeys to work, household responsibility, study and leisure.

The Concentration Index of trips by gender and trip purpose analysis shows how the reasons related to work and household responsibilities are the major differences that show gender. These differences, however, are not produced on the basis of mobility studies, very similar for both genders.

If we include in our analysis the age variable (Table 4), we can observe how gender differences in the mobility of people aged between 16 and 29, in working trips or household responsibility trips are not very high. However, gender differences in mobility, are increased strikingly large between 30 and 49 years, where household

responsibilities generate over 60% of the female trips and the Gender Gap reaches a maximum of 32.38% in women aged between 30 and 39 years old.

Table 4 - Concentration Index of trips by gender, age and trip purpose

Age		Concentration Index (%)	Male Concentration Index (%)	Female Concentration Index (%)	Gender Gap
16-29	Work	17.67	20.00	15.59	-7.02
	Study	18.90	19.62	18.24	1.78
	Household Resp.	39.23	31.51	46.15	24.01
	Leisure	24.20	28.87	20.02	-12.82
	Total	**100**	**100**	**100**	**5.41**
30-39	Work	29.12	38.36	22.09	-13.89
	Study	1.85	1.80	1.90	16.12
	Household Resp.	56.91	44.51	66.36	32.38
	Leisure	12.11	15.33	9.66	-9.45
	Total	**100**	**100**	**100**	**13.54**
40-49	Work	35.55	45.02	26.85	-21.23
	Study	1.64	0.78	2.43	54.72
	Household Resp.	51.42	39.85	62.03	25.80
	Leisure	11.39	14.35	8.68	-20.58
	Total	**100**	**100**	**100**	**4.27**
50-64	Work	30.81	37.23	23.17	-31.27
	Study	0.64	0.62	0.66	-5.19
	Household Resp.	48.10	38.68	59.31	12.65
	Leisure	20.45	23.48	16.85	-24.71
	Total	**100**	**100**	**100**	**-8.63**
>65	Work	0.39	0.37	0.40	-5.54
	Study	0.32	0.26	0.40	11.50
	Household Resp.	27.39	22.07	33.71	12.46
	Leisure	22.31	25.52	18.48	-24.31
	Total	**50**	**48**	**53**	**-3.95**

The analysis of working trips, inform us that although the number of trips is increasing for both men and women up to 49, from which, the number of trips descend for both. Men always make more trips. In fact, the gender gap in these increases with age.

It is also curious to see how the gender gap in leisure trips, moves towards men regardless of age, as it is the case with trips to work, confirming the pendularity of male trips "leisure - work" as is identified by authors like Sánchez de Madariaga (2004) and García and Rodríguez (2008).

3.2. Analysis of the duration and average distance traveled on trips by gender

3.2.1. Average distance

Mobility studies consulted agree that women's trips are usually shorter in distance and time than men´s, and this fact is increased when it comes to commuting to work, Madden (1981), Hanson and Johnston (1985), Wachs (1987), Gordon, Kumar, and Richardson (1989), Hanson and Pratt (1990), Rosenbloom and Burns (1993), Blumen (1994), Hjorthol (1998), McGuckin and Nakamoto (2005), Olmo and Maeso (2013).

Table 5 shows the average of the distances covered in daily travel by gender, regardless of trip purpose. It also shows the average distances in trips for work, household responsibility or leisure, considering variables as gender, age, size and density of the town, number of household members, educational level, employment status and household income. We have also reflected the percentage difference between the distances traveled by men and women in all categories. It also shows, that the majority of analyzed categories, men travel longer distances than women. In fact, male trips are 37.54% longer than the female´s. Furthermore, this difference increases when the reason to the trip is work (38.11%). Exceptionally, although, men perform more leisure trips, women average more distances.

As we can see, the average distances traveled by women and men in daily trips, depending on age. Between 30 to 49 years old, men perform much longer distances. Moreover, when we analyzed separately the reasons that generate trips where we can see women with the highest levels of domestic responsibilities (30-49 years old) with major time constraints perform working and household responsibility trips at distances considerably less than those by men. Also noteworthy is the fact that the reasons for which women and men perform longer trips are laboral reasons, performing domestic and leisure trips a lot closer to home.

As for gender differences in the distances traveled by size and density of the town, table 5 indicates longer distance journeys for both women and men are made in small and/or dispersed cities, as was wait, holding constant gender differences around 35%.

Furthermore, Table 5 indicates that when trips are for work, gender differences in the distances are increased considerably in big and/or compact cities. It is also found, that in dispersed cities and/or small towns, working trips are longer for both men and women, while household responsibility trips and especially leisure trips are made closer to home, regardless of size and type of town.

We have also studied other socio-demographic characteristics, such as the number of household members, educational level, employment status and household income. In general by increasing the number of household members, gender differences increase.

The education level has a significant influence, so that the higher the educational level, the greater the average distance traveled. Furthermore, when we only consider commuting to work, the distances traveled are significantly longer and the gender differences are less, when educational level is higher. As for the employment status, we can see how the distances traveled by busy men are longer. This situation is repeated even among the unemployed, with the exception of the categories "Students" and "At home", in which women travel longer distances.

Finally, the average distance traveled, also depends on the economic level, in fact, the average distance covered by women and men, increase as the household income increases, but this growth is not similar for both, being much higher for men, so we can see how gender differences increase with the household's economic level.

Table 5 – Gender differences in average distances traveled (km) by trip purpose and socioeconomic characteristics.

	All reasons			Working Trips			Household Resp. Trips			Leisure Trips		
Gender	Male	Female	% Diff.	Male	Female	% Diff.	Male	Female	% Diff.	Male	Female	% Diff.
Male	6.42	-		10.26	-		4.86	-		2.91	-	
Female	-	4.01	37.54	-	6.35	38.11	-	4.01	17.49	-	3.13	-7.56
Age												
16-29	5.66	4.89	13.60	7.90	5.56	29.62	3.66	4.89	-33.61	3.48	4.24	-21.84
30-39	8.68	4.15	52.19	13.71	7.93	42.16	5.54	4.15	25.09	3.61	4.96	-37.40
40- 49	7.39	3.98	46.14	10.38	6.34	38.92	4.88	3.98	18.44	3.89	2.53	34.96
50-64	5.64	3.54	37.23	8.11	4.94	39.09	5.55	3.54	36.22	2.58	1.86	27.91
>65	3.36	2.65	21.13	1.03	0.39	62.14	4.00	2.65	33.75	1.64	1.71	-4.27
Size of town												
Big cities	5.55	3.42	38.38	9.58	5.49	42.69	3.85	2.29	40.52	2.50	2.83	-13.20
Medium cities	6.66	4.33	34.98	9.66	6.39	33.85	6.05	3.36	44.46	3.10	4.00	-29.03
Small cities	7.82	4.80	38.62	11.95	8.22	31.21	5.68	3.67	35.39	3.46	2.86	17.34
density of the town												
Dispersed	7.88	4.96	37.06	11.09	9.42	15.06	6.35	3.90	38.58	3.87	4.08	-5.43
Intermediate	7.58	4.92	35.09	11.06	8.43	23.78	6.33	3.56	43.76	5.39	2.57	52.32
Compact	6.02	3.75	37.71	9.99	5.60	43.94	4.39	2.72	38.04	2.44	3.04	-24.59
Number of household members												
1 or 2	6.29	4.34	31.00	10.39	6.89	33.69	5.28	3.00	43.18	2.48	2.51	-1.21
3 or 4	6.47	3.88	40.03	10.25	6.23	39.22	4.27	2.99	29.98	2.99	3.01	-0.67
5 or 6	6.66	3.88	41.74	10.79	5.74	46.80	5.36	2.59	51.68	3.70	3.45	6.76
> 6 members	4.83	5.03	-4.14	2.99	9.58	-220.40	9.18	4.31	53.05	2.70	11.40	-322.22
Educational level												
Primary	4.95	3.17	35.96	10.84	3.84	64.58	5.33	3.18	40.34	2.21	2.56	-15.84
Secundary	5.99	3.68	38.56	9.28	5.28	43.10	4.03	2.53	37.22	2.91	3.46	-18.90
University	9.72	5.59	42.49	12.66	8.42	33.49	7.29	4.08	44.03	4.70	2.94	37.45
Employment status												
Full-Time job	8.95	5.46	38.99	10.62	7.15	32.67	6.01	3.75	37.60	5.05	3.04	39.80
Part-Time job	5.71	3.64	36.25	5.37	4.41	17.88	6.01	3.61	39.93	2.09	1.91	8.61
unemployed	3.79	2.73	27.97	-	-	-	3.83	2.40	37.34	2.14	3.76	-75.70
Student	3.88	5.51	-42.01	2.80	1.59	43.21	2.46	2.60	-5.69	2.54	5.29	-108.27
At home	0.00	3.14	-	-	-	-		2.89	-	-	2.90	-
Inactive	3.86	3.02	21.76	-	-	-	4.71	2.74	41.83	1.85	1.95	-5.41
Household income												
< 1100 €	4.37	3.23	26.09	7.36	4.80	34.78	4.60	2.93	36.30	1.80	2.85	-58.33
1101 - 1800 €	6.05	3.79	37.36	8.94	5.46	38.93	4.16	2.68	35.58	3.38	3.89	-15.09
1801 - 2700 €	6.89	4.38	36.43	11.31	7.44	34.22	4.16	3.12	25.00	2.70	2.97	-10.00
> 2700 €	10.84	4.91	54.70	12.91	8.05	37.65	8.03	3.62	54.92	5.28	2.31	56.25
No answer	6.25	4.68	25.12	10.01	6.10	39.06	5.12	3.16	38.28	3.00	2.89	3.67

3.2.2. Commute time

We have seen that regardless of the reasons, female trips are considerably shorter in distance than male´s. In fact, female trips are 62.46% shorter. However, even when female trips are equally shorter in time, gender differences between times spent in commuting are smaller than those derived from the analysis of the distances.

Table 6 shows the average time spent on commuting. We also consider the variables gender, age, size and density of the town, number of household members, education level, employment status and household income. We also have reflected the percentage difference between times spent by men and women. As we can see, it also happens that in the vast majority of analyzed categories, men spend greater commute time. But unlike the previous case, where we saw that male travel a 37.54% longer distance, the time spent by men is 10.59% higher than those invested by women. Therefore gender differences in time spent in commuting are lower than those produced when we measure distances.

In the case of journeys to work, where distances covered by men become 38.11% longer, we find that gender differences in the time invested decreases to be almost the same order. Thus, time spent by men is 23.68 minutes, while women spend 23.14 minutes, so the difference is only 2.28%.

Table 6 also analyses the average time spent by men and women in daily trips, depending on age. In this case, even though women spend less commute time than men, gender differences are slight.

When we analyzed the reasons for travel, we observed that 30 to 49 years old women performed working and household responsibility trips shorter than men´s. However, commute time spent on these trips is quite similar for both. Indeed, gender differences in time invested do not reach 11%, while in distances were around 40%. Which is consistent with the use of different transport modes as indicated by numerous authors Hanson and Johnston (1985) Diaz, (1989), Hjorthol (1998), Diaz and Jiménez (2002), Valdés (2008), Monzon, Valdes, y Xue (2008), Vega and Roman (2011), Olmo and Maeso (2013).

Therefore and despite this, as we have seen, a number of mobility studies suggest that women tend to make shorter trips, both in distance and time, than men. In our case, this statement is true regarding distances, since the analyzed data indicates that female trips are considerably shorter in distance than men´s, regardless of the reason they are generated. However, if we consider the average time spent on them, as we have shown, there are no significant differences between both sexes.

When we consider the different trip purposes, we can see that although working is the reason that generates longer trips in time and distance, time spent on household responsibility and leisure trips, is much smaller, so it could show a different modal choice, because as discussed earlier, that trips are performed closer to home . We can also observe how gender differences in time invested are much lower.

Table 6 indicates longer trips in time for both women and men in big and/or compact cities where distances covered were smaller, which confirms the different modal choice depending on the size and density of the town. As for gender differences, as we can see, they are increased in small and/or dispersed towns.

Considering other socio economic characteristics, shown in that table, we observed that the number of household members does not influence much as the level of education or employment status. So, the trips involve greater commute time are made by people with university degrees, who covered greater trip distances. Special case is that involving people with lower level of education, who invest longer commute times, even if the distances traveled are lower, showing a different modal choice. In this case, gender differences remain constant. Regarding employment status, we can see that men spend greater trips times, less in the categories "student" and "at home".

Table 6 – Gender differences in commute time (min) by trip purpose and socioeconomic characteristics.

	All reasons			Working Trips			Household Resp. Trips			Leisure Trips		
Gender	Male	Female	% Diff.	Male	Female	% Diff.	Male	Female	% Diff.	Male	Female	% Diff.
Male	21.24	-		23.68	-		17.84			20.75	-	
Female	-	18.99	10.59	-	23.14	2.28		15.85	11.15	-	20.01	3.57
Age												
16-29	19.75	19.83	-0.41	18.71	20.70	-10.64	14.89	15.32	-2.89	19.49	18.60	4.57
30-39	21.28	17.21	19.13	26.25	23.64	9.94	16.44	14.72	10.42	15.68	18.03	-14.99
40- 49	20.77	18.08	12.94	23.96	23.31	2.71	17.17	14.66	14.64	18.85	16.96	10.03
50-64	21.81	20.49	6.06	23.53	24.50	-4.12	20.62	17.62	14.54	21.39	23.96	-12.01
>65	23.78	20.93	11.98	16.41	10.31	37.17	20.90	19.79	5.30	25.46	21.73	14.65
Size of town												
Big cities	21.50	20.01	6.93	23.93	24.48	-2.30	17.36	16.16	6.91	21.43	21.14	1.35
Medium cities	21.26	18.62	12.42	22.76	21.13	7.16	19.43	16.29	16.16	20.76	20.29	2.26
Small cities	20.72	17.44	15.83	24.03	22.12	7.95	17.01	14.95	12.11	19.57	16.89	13.69
density of the town												
Dispersed	21.03	17.52	16.69	21.39	19.92	6.87	17.77	14.95	15.87	21.82	18.62	14.67
Intermediate	21.72	19.82	8.75	25.21	26.22	-4.01	17.94	16.80	6.35	23.09	19.27	16.54
Compact	21.21	19.13	9.81	23.88	23.12	3.18	17.83	15.91	10.77	20.28	20.27	0.05
Number of household members												
1 or 2	22.91	20.84	9.04	25.74	24.25	5.79	19.79	17.74	10.36	21.18	21.65	-2.22
3 or 4	20.47	18.45	9.87	23.35	22.70	2.78	16.23	15.26	5.95	19.95	19.73	1.10
5 or 6	21.66	18.11	16.39	22.17	23.04	-3.92	19.14	15.06	21.27	23.76	17.12	27.95
> 6 members	19.65	19.87	-1.12	21.56	30.00	-39.15	23.51	19.85	15.56	14.25	18.38	-28.98
Educational level												
Primary	21.44	19.49	9.07	23.83	21.62	9.27	19.41	17.99	7.35	22.15	20.16	8.98
Secundary	20.75	18.34	11.58	23.37	22.05	5.65	16.93	14.88	12.11	20.11	20.14	-0.15
University	22.69	20.21	10.95	24.46	25.01	-2.25	19.13	16.35	14.52	19.52	19.48	0.20
Employment status												
Full-Time job	21.83	20.18	7.57	23.91	24.23	-1.34	17.43	15.49	11.14	18.18	18.14	0.22
Part-Time job	20.42	17.24	15.59	20.68	20.00	3.29	17.44	14.64	16.03	17.85	14.84	16.86
unemployed	18.79	16.98	9.61	-	-	-	17.34	14.66	15.44	16.10	19.30	-19.88
Student	20.04	21.56	-7.59	14.47	30.29	-109.33	14.17	14.62	-3.21	21.46	18.75	12.63
At home	0.00	18.14	-	-	-	-	-	16.98	-	-	21.83	-
Inactive	22.96	20.98	8.64	-	-	-	20.36	18.79	7.70	20.75	23.57	-13.59
Household income												
< 1100 €	20.40	19.13	6.21	24.04	24.90	-3.58	17.56	16.79	4.40	21.28	21.80	-2.44
1101 - 1800 €	21.81	18.21	16.50	23.40	23.69	-1.24	18.62	14.72	20.91	22.60	18.93	16.24
1801 - 2700 €	20.26	18.19	10.21	23.19	21.84	5.82	15.78	14.71	6.74	18.77	20.37	-8.52
> 2700 €	23.57	19.25	18.33	25.34	23.65	6.67	19.92	16.40	17.66	18.64	17.41	6.60
No answer	20.98	20.67	1.47	22.83	21.96	3.81	18.27	17.12	6.30	19.85	20.46	-3.07

4. Conclusions

Emphasizing the importance of knowledge of travel patterns, this study provides a descriptive way to examine the relationship between mobility and gender through unravel the complex relationships between gender roles of women at home (household responsibilities), leisure and the labor market (employment status) through the study of the different distances traveled and time invested. Therefore, the importance of the study of these variables is confirmed as an analysis factor of the complex interrelationships between these three areas of daily life for women.

The results of our study reveal that different travel patterns depend more on variables such as trip purpose, gender or age than of some conventional variables of household responsibilities such as the number of household members.

Regarding the influence of socio demographic variables the study reveals that in general, the reason why men and women travel greater distances is due to work, performing their household responsibilities, study or leisure activities closer to home. On the other hand, the employment status and other socioeconomic characteristics analyzed (size and population density, household income, etc...) condition significantly the number of trips and distance and time spent.

One interesting result is that employed women travel considerably shorter distances to work than do men even though they spend similar commute time.

This suggests that, the journey to work may reflect the magnitude of immobility women face in their everyday lives.

Furthermore, the distances traveled and the time spent on them, are confirmed, as key variables in the study of the relationships between the women´s household responsibilities and their employment status; having a significant impact on the latter. In fact, women with the highest levels of domestic responsibilities (30-49 years old) with major time constraints are more likely to work close to home, even if it means sacrificing their own career and occupational advancement.

Therefore, the spatial planning of land use is essential for organizing the mobility, especially feminine mobility, because of the complexity of it, motivated by their multiple responsibilities. These policies affect less to male mobility, as we have seen, is longer than women´s and focuses mainly on two activities (work and leisure)

On the other hand, the findings could help to formulate public transport policies, since the correct planning of transport systems is important to ensure that women have access to goods and services, with the same conditions as men. Thus the knowledge of the different travel patterns of women and men will be useful to plan effective measures that reach a sustainable mobility.

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