



Functional disability and urbanism: definition of types in the metropolitan area of Lisbon and Porto

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ABSTRACT: This study focuses on a social, architectural and urban context, since nowadays the main functions of a civil engineer are considered to be more diverse from the ones assumed in the past, when the focus was mainly on construction. The key topic of this thesis is the people whose basic functional capabilities (e.g. walk, see and hear) are limited. These limitations causes disabled people to depend on third parties to do basic activities.

As such the applied methodology was divided into two parts, the first one where has been used different statistical techniques as the univariate, bivariate (correlation matrix) and factorial analysis that provided a global and useful information for better understanding the reality of all the suburban parishes of Lisbon and Porto. Also it was obtained a spacialization of the parishes in four groups according to the level of incapacity of occurrences. The second part consists in reducing the number of parishes for those where the number of incapacity occurrences per inhabitant were significant, and for this ones, it was applied the factorial and clusters analysis where it was obtained a typology of parishes that combines social demographic, architectonical and urban variables. The typology contains four groups of different parishes, which were represented spatially and it was done a description of the respective profiles.

The achieved results allowed to increase the knowledge about the inhabitants' life in the suburban zones of Lisbon and Porto.

1. Introduction

This work aim to study where the disable people are living in the metropolitan areas of Lisbon and Porto and understand how the urbanism and architecture components is affecting the sociability and environment of disable people such as social exclusion, functional autonomy and accessibility and mobility inside the cities.

For the purpose of this study a disabled person is a person who has difficulty or total inability to complete with independence three basic tasks: walking, seeing and hearing. In Portugal, the inability to achieve these three basic activities affects essentially the elder population, as shown by the Portuguese Census results of 2011, almost 50% of the elder population (1.005.032 people) are affected. This issue is becoming tangible issue with the passage of time, 30% of people between 65-69 years old are affected and 50% of people between 75-79 years old are affected as well. This is a growing concern due to the Portuguese population's aging evolution. According to the Portuguese Census of 2011, the activity that affects the most people 65 or more years old is walking (26,90%), then seeing (19,50%) and finally hearing (14,65%).

2. Study case

Thus, in order to obtain and analyse the results targeted by this study, three important basic points have to be set: variables, geographical units and statistical methods.

2.1 Variables

The variables can be divided into four groups: socio-geographic; inabilities; architectural and urbanistic.

The socio-demographic variables are used to trace the disabled person's profile. The specific variables in question are: age group, genre, academic level and professional career.

The second group, inabilities, is composed of four types of variables related to the three inabilities studied: walk, see and hear. The first type is the percentage of people with total inability to walk, see or hear. The second type is the percentage of population with partial inability to walk, see and hear. The third variable is the quotient between the number of people with total inability to walk, see and hear by the area of the parish. Finally, the fourth type is the quotient between the number of people with partial inability to walk, see and hear by the area of the parish. After the observation of the correlation matrix, it was possible to see that the difference between partial and total incapacity is very important and the number of people with total incapacity in proportion to total population is small, on the other hand the proportion of people with partial inability and total population proved to be more demonstrative and useful for the purpose of this research.

Thereafter, the work is going to shift its focus to the to the percentage of population with any partial inability, so for each geographical unit the key figure is the sum of all people with at least one type of partial inability hence resulting in the number of occurrences of partial disability (the number of people with a given partial incapacity is not very relevant, the relevant figure is in turn the global population with partial inability) divided by the resident population.

Although, it must be highlighted that this new variable contain simplification that arise from the fact that according to the data found in the 2011 Portuguese census a person with inability to walk, for example, can also be unable to hear so there is a risk that the variable total population with partial inability might be considering a given person more than once, nonetheless despite this potential distortion the variable still proves to be the most interesting and representative when depicting the reality of each geographical unit.

The third group, architectural, refers to the condition of the buildings, not only if they are degraded or not but also to which generation of construction they belong to and whether or not they have an elevator or ramp in the entrance.

The last group, urbanistic, explores the density of buildings and accommodations per parish and it also defines if the buildings are exclusive, primary or non-residential.

2.2 Geographical units

The implemented methodology of this study can be divided into two parts and the geographical units used in each part are different.

In the first part the parishes considered are those of the suburban areas of Lisbon and Porto, hence all parishes of Lisbon and Porto's metropolitan areas excluding the ones that belong to main central areas of each metropolitan area (the cities of Lisbon and Porto). The reason to not consider the parishes of the cities of Lisbon and Porto is because they have social, financial, architectural, urban and cultural characteristics substantially different from the other parishes.

In the second part, in order to simplify the study and to concentrate the work in the most disadvantageous parishes, it was decided that the parishes would be split into four groups according to the percentage of population with any partial incapacity. The first step consisted in calculating the average number and the respective standard deviation of the percentage of population with any incapacity for each suburban area (Lisbon and Porto) and as a result four groups were created. The first group contains those parishes with an average percentage of population with any incapacity lower than the total average minus its standard deviation. The second group includes those parishes with an average percentage of population with any incapacity that stands between the total average minus a standard deviation and the total average. The third group is composed of those parishes with an average percentage of population with any incapacity that stands between the total average and the total average plus one standard deviation. Lastly, the fourth set contains the parishes with an average percentage of population with any incapacity higher than the total average plus one standard deviation, this will in turn be considered the disadvantageous parishes.

The second part will be mostly focused in the disadvantageous parishes, which can be seen in figure 1 and 2.

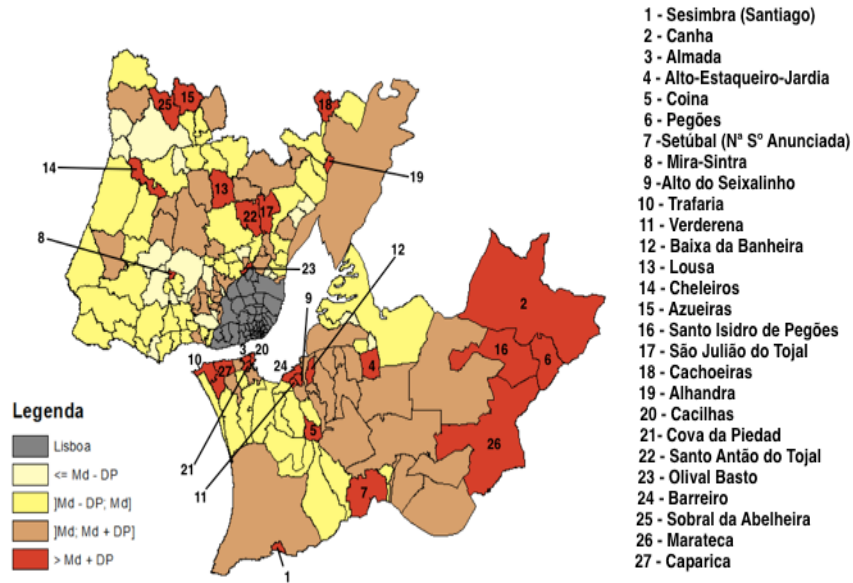


Figure 1 – Metropolitan area of Lisbon – Disadvantages parishes

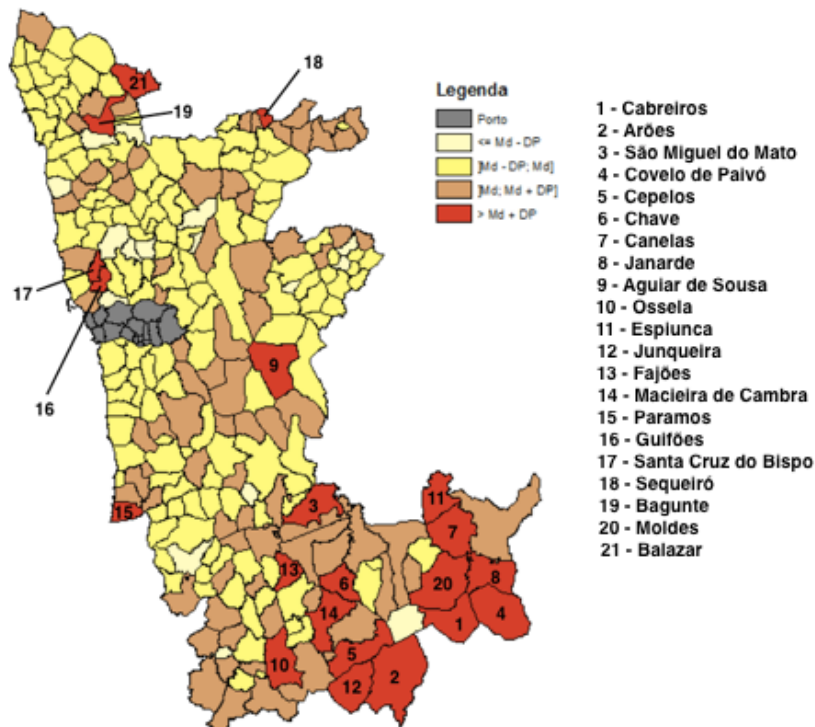


Figure 2 – Metropolitan area of Porto – Disadvantages parishes

2.3 Statistical methods

Firstly, in order to better understand the chosen variables and the scope of the problem being analysed in Portugal, a univariate analysis is done where for each variable the maximum,

minimum, average and standard deviation values are reached. Furthermore, a quick overview compares the results of the two metropolitan areas, Lisbon and Porto. Moreover, the study continues to compute the correlation matrix between the variables of the two metropolitan areas. The two types of variables within the correlation matrix in which the study will focus on are the disability variables and the social demographic variables with the intent of depicting the profile of a disabled person according to his/her age group, genre, academic and professional background. The analysis of the correlations amongst the different disability variables is interesting as to understand if a person who suffers from certain disability is more likely to suffer from one or more additional disabilities. Additionally, the correlations between disability and urbanistic or architectural variables are interesting in order to determine if the characteristics of buildings, like the absence of a lift in buildings with more than three floors or the lack of ramps in the entrances of buildings or the thermal, sound or illumination conditions of common areas within the buildings, affects in any way the independence levels and the social inclusion of disabled people. This study also tries to understand why certain correlations that were expected to be significant turned out not to be, a valid example is the variable total disabled people which showed some reduced correlations with others variables. This result changed the composition of the inability variable group, which was changed as to be composed solely by one variable, number of occurrences of inability per inhabitants.

The third step of the statistical analysis consists in a factorial analysis. The factorial analysis is relevant because by defining a number of factors, more specifically four factors in this case, it is possible to derive the weight of each variable per factor. For the purposes of this study the characteristics of each factor, which are determined by the variables that compose it, represent the four types of parishes present in each metropolitan area. The factorial analysis was then split into two parts. The first part consists in applying the factorial analysis to all the parishes of each metropolitan area, with the objective of gathering global information about the problem as well as grasping an overall understanding of the differences of both metropolitan areas. The second part consists in running the factorial analysis only on the most disadvantageous parishes of each metropolitan area, hence those whose total percentage of population with partial inability is higher than the average of the total population plus one standard deviation. This was useful in order to understand better the most disadvantageous parishes and to analyse if there was any geographical correlation present, as well as trying to conclude which were the variables with the highest degree of influence.

Finally, the clusters analysis was undertaken solely on the most disadvantageous parishes, the creation of four different groups composed by parishes with homogenous characteristics proved to be the greater advantage of conducting the cluster analysis.

3. Results and discussion

The application of statistical methods helped understand the profiles of disabled people. As it was seen before, as people get older they lose independence needing help from third parties to accomplish simple tasks as walking for example. So age group was the first detected relevant

variable in the study. Due in part to Portugal's historical background many of the now old people did not have access to a global and open educational system partially explaining the fact that old people tend to have a lower educational level. The lack of academic background ends up affecting in turn the the development of professional careers, the lack of a robust career path helps explain the financial constraints that some of these people in turn face which is translated in weak stability with a lot of them depending on Social Welfare subsidies or their friends and family. Finally, as people get older there is no clear trend showing them developing one specific inability, with a lot of cases of people suffering from the three inabilities. It is also worth mentioning the fact that the profile of disabled people across both suburban areas of Lisbon and Porto is the same. Using some of the correlation factors from the correlation matrix, Figure 3 shows the standard profile of a person who struggles to walk in the suburban areas of Lisbon.

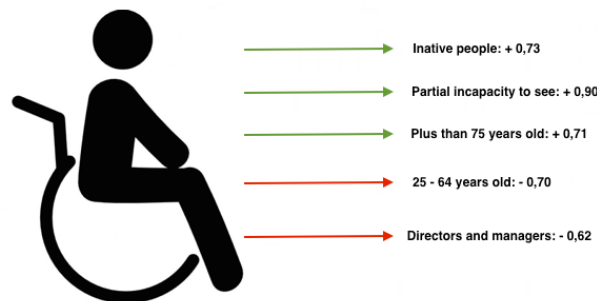


Figure 3 – Standard profile of a person with walking incapacity in Lisbon based on the correlation factor obtained on the correlation matrix

As can be seen in figure 1 and 2, suburbs of Lisbon has 27 out of 158 parishes in disadvantageous situation and suburbs of Porto has 21 out of 251 parishes. It is also observable that the majority of the disadvantageous parishes of each metropolitan area are located away from each capital (Lisbon city and Porto city).

In the metropolitan area of Lisbon, almost 63% of the problematic parishes are in the south riverside of which 14 parishes belong to the municipalities in the called Arco Ribeirinho (5 in Almada, 4 in Barreiro, 4 in Montijo and 1 in Moita) so it can be concluded that almost half of the disadvantageous parishes belong to just three municipalities. In the north riverside of the metropolitan area of Lisbon the disadvantageous parishes belong to Mafra + Sintra (4 parishes), Loures + Odivelas (4 parishes) and Vila Franca de Xira (2 parishes). It is also important to say that the axis formed by Cascais-Oeiras-Amadora does not contain any disadvantageous parishes.

In the metropolitan area of Porto, 14 out of 21 parishes (67%) belong to three municipalities, Arouca (8 parishes), Vale de Cambra (4 parishes) and Oliveira de Azeméis (2 parishes). So these three municipalities create a south core where is the most disadvantageous situation of percentage of population with any partial inability is concentrated. It is also relevant that 50% of the parishes of Arouca are identified as disadvantageous parishes. On the other hand, the

belt composed of Matosinhos, Gondomar, Maia and Vila Nova de Gaia contains 2 disadvantageous parishes which reinforces the argument that the disadvantageous parishes are located away from the main centres of each metropolitan area.



The location of the parishes is relevant because most basic services, for example hospitals or schools, are located in the capital city of each metropolitan area, so disabled people tend to face more obstacles when accessing them.

Applying the factorial analysis to the disadvantageous parishes of the suburban area of Lisbon four factors composed by the following variables were obtained, Table 1:

Variable category	Factor 1	Factor 2	Factor 3	Factor 4
Socio-demographic	Population without any educational level (%)	Age group +75 (%)	Age group 25-64 (%)	
	Population with 1 st basic level (%)	Population with 3 rd basic level (%)	Age group 65-74 (%)	
	Population with 2 nd basic level (%)		Inactive population (%)	
	Population with high school (%)			
	Population with higher education (%)			
	Directors and managers (%)			
	Architectural			
				Mainly residential buildings (%)

Table 1 – Distribution of the significant variables by the 4 factors

Legend:

-  Level of significance > 0,70
-  Level of significance < 0,70



The first factor could be related to parishes with wealthier population, due to the fact that their population has higher concentration of people with higher degree of education, therefore more directors and managers, hence higher concentration of people with stable jobs. The second is related to parishes with senior population and also old buildings in contrast with the third factor that denotes the parishes with young population and where the senior people (between 65 and 74 years old) and inactive population are not relevant. The last group refers to parishes composed mainly by residential buildings, where basic services as pharmacies, supermarkets or health centres are nearby.

A similar statistical analysis for the disadvantageous suburban areas of Porto can be found in Table 2:

Variable category	Factor 1	Factor 2	Factor 3	Factor 4
Socio-demographic				Age group 15-24 (%)
	Age group 0-14 (%)	Population without any educational level (%)		Age group +75 (%)
	Population with 1 st basic level (%)	Population with high school (%)		Male population (%)
	Population with 2 nd basic level (%)	Population with higher education (%)		Female population (%)
	Small employers (%)	Directors and managers (%)		Population with 3 rd basic level (%)
				Independent workers (%)
				Skilled workers (%)
Architectural		Buildings with more than 3 floors and no elevator (%)	Buildings < 1919 (%)	Exclusively residential buildings (%)
		Buildings without ramp in the entrance (%)	Buildings 1919-1945 (%)	Mainly residential buildings (%)
			Buildings 1971-1990 (%)	

Table 2 – Distribution of the significant variables by the 4 factors

Legend:

-  Level of significance > 0,70
-  Level of significance < 0,70

The first group is formed by young population with basic academic level with small employers so it can be defined as parishes with young population with economic potential. The second group could be regarded as parishes with high degrees of education and professional career paths but with poor buildings conditions. The third group refers to the age of the buildings where the featured edifications are the oldest. Finally, the last group is composed by young and financial active parishes.

The cluster analysis was also relevant to group the different parishes in four clusters according to their characteristics. Figure 4 and 5 shows the results of the metropolitan areas of Lisbon and Porto using a non-hierarchical k-means method with 4 clusters.

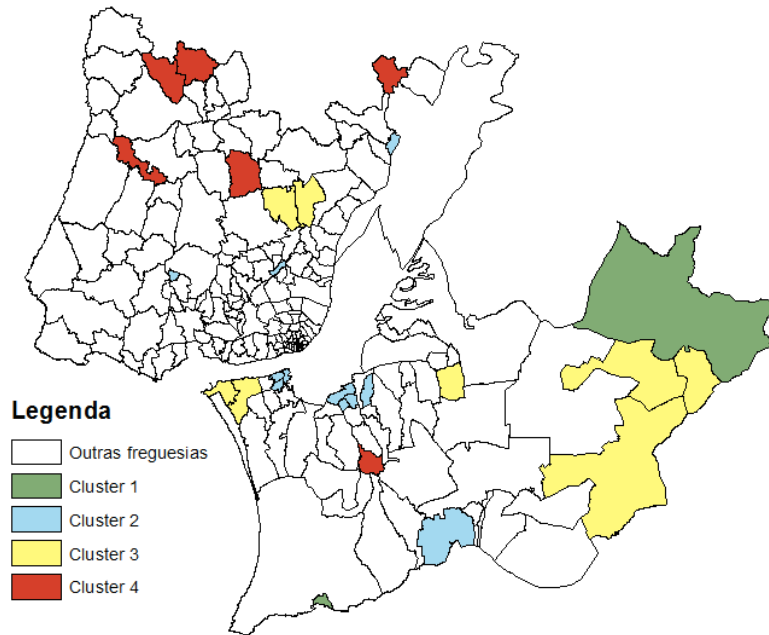


Figure 4 – Application of the not hierarchical method in the metropolitan area of Lisbon (4 clusters)

The first group, Canha and Sesimbra (Santiago), is composed by senior population (more than 75 years old) with low academic qualifications/level (basic education) and suffering of a high percentage of disability occurrences. The general conditions of the buildings are weak due to the advanced state of degradation arising from an old built environment (buildings built before 1920).

In the second cluster, formed by 11 parishes (8 from the south river side and 3 from the north river side), mostly composed by a senior population and presenting a high density of buildings and accommodations which do not feature independent living conditions for disabled people considering that the majority of the mentioned buildings have more than 3 floors, no elevator and no ramp at their entrance).

In the third group, the percentage of young people (between 0 to 24 years old) is high and the conditions of the buildings are integrative (buildings with more than three floors with elevator).

Finally, the last group, where the majority of the parishes are from the north river-side, shows an

active population (between 25 to 64 years old) with a stable professional career: independent workers, small employers and entrepreneurs. The buildings are modern thus the architectural conditions are favourable and integrative.

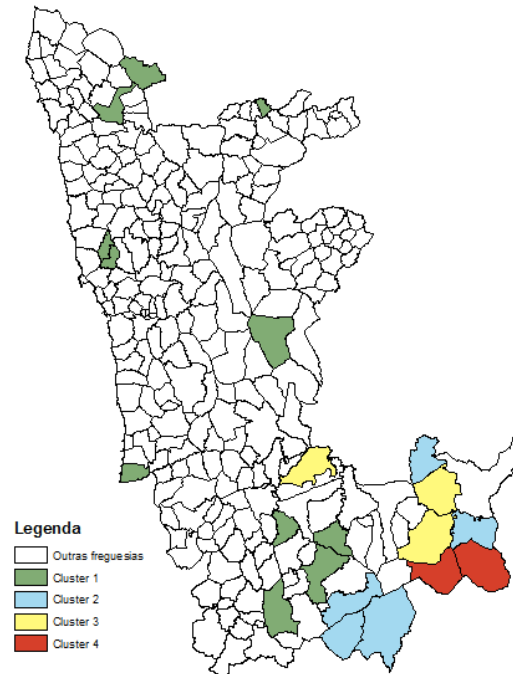


Figure 5 – Application of the not hierarchical method in the metropolitan area of Porto – 4 clusters

The first cluster is formed by a population in a working age (between 24 and 65 years old) with good professional career: directors or managers. However, the conditions of the buildings are not the best: buildings have more than 3 floors without elevator or they have no ramp in the entrance for the wheelchair. The second cluster is composed by a senior population (more than 64 years old) and high percentage of retired people. The architectural characteristics of the buildings are integrative: buildings with more than 3 floors with elevator or buildings with ramp in the entrance for the wheelchair. In the third group, it can be found buildings built before 1945 and with a high state of degradation. The fourth cluster, Cabreiros and Covelo de Paivó, displays the worst building conditions (old and with few living conditions for disabled people) for a mainly retired population and presenting high disability occurrences.

4. Conclusions

The main objective of this work was to study the integration of the disabled people in the metropolitan area of Lisbon and Porto, namely, to profile these people, identify the most unfavourable parishes and grouping them according to the social demographic, incapacity, architectural and urban characteristics.

An important factor in the beginning of the project was to change the focus of the studied population, that is, the totally disabled people over the partially disabled people because this group is not very representative in the global population of each parish. Despite this change, the obtained profile was the expected based on the bibliographic review, that is, an old group (more than 75 years old), with low academic level (basic education) and without any occupation. Also, this people are suffering progressively physical limitation, that is, inability to walk, see or hear.

Other important factor was to understand where this population is distributed in the two biggest metropolitan areas and focus the study in that parishes. From the 158 parishes of the metropolitan area of Lisbon, 27 of them have high number of disabilities occurrences and in the metropolitan area of Porto, from the 254 parishes, 21 have also high number of disabilities occurrences. An interesting aspect is that the unfavourable parishes are the farthest from the capital city of the metropolitan areas, Lisbon and Porto.

Comparing the worst group of parishes of each metropolitan area, in AML, formed by Canha and Sesimbra (Santiago), the architectural conditions of the buildings are not very integrative to the disabled people because they have been built before 1919 and right now they are in an advanced state of degradation, however, in AMP, formed by Cabreiros and Covelo de Paivó, the conditions of the buildings are appropriated to the disabled people.

In this study the analysis did not achieve the detail that shows the reality of the parishes of the two biggest metropolitan areas in Portugal. However, the methodology has been an asset during the thesis to trace the standard profile of a disabled person or to identify and characterize the most unfavourable parishes. The use of spatial cartograms was also important to have a global view of the situation in order to obtain results. However, the methodology suffered some simplifications. First of all, the creation of a new variable about disabled people and the number of disability occurrences made the study focus on all of the basic functional incapacities instead of concentrated in each one of the disabilities. Secondly, the reduction of studied parishes to the most unfavourable parishes (it could have been more useful to study all the parishes if the study presented a greater time span). The third simplification was the choice of 4 clusters to all clusters analysis which allowed the comparison of the results of the two metropolitan areas. Beyond the fact that this is an academic work, the simplification made in the present work are due to the circumstance of this being one of the first studies about functional disability and urbanism in Lisbon and Porto.

With the foregoing, this study may facilitate the implementation of new and more comprehensive projects reducing the simplifications in basic functional disability (not accumulating in one variable the functional disabilities) and a wider area (Portugal or Europe). In addition, to study the problem thoroughly and understand the reality of the studied geographical areas we can focus on the problem from three different points of view which are the architectural, the urbanistic or the economic. In the first two cases the objective is to understand more precisely how the buildings or infrastructure affect each disability. The third topic focuses on the study of how rehabilitating older buildings could boost the economy of Portugal as a senior tourism country or even the second

home of this population, calculating the costs that this would entail, the expectations of the number of tourists / residents that this measure could contribute and finally the profits in several sectors such as real estate, construction, state (taxes) and services.

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