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Santiago de Chile through the Eyes of Jane Jacobs. Analysis of the Conditions for Urban Vitality in a Latin American Metropolis

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Abstract: The urban planning ideas proposed by Jane Jacobs in the 1960s remain relevant to this day, promoting a perspective on the relationship between urban morphology and the community that takes into consideration the experiences of the people themselves in the planning of cities. With Jacobs' ideas in mind, this article seeks to explore the urban territory of Santiago, Chile, and to assess the vitality of its neighborhoods with their diversity of morphological, architectural, and spatial characteristics. The results reveal a spatial reality that differs considerably from typical interpretations of this and other cities across Latin America, characterized by a strong radial center–periphery dynamic interspersed with sub-centers of high vitality, mainly in the form of rural towns and villages that, over time, became absorbed into the urban fabric of Santiago, along with social housing estates located on what used to be the urban periphery.

Keywords: Jane Jacobs; urban vitality; Santiago de Chile

1. Introduction

During the 1960s, renowned activist and journalist Jane Jacobs put forward a series of ideas relating to the design and planning of cities. These concepts rapidly gained momentum, offering an alternative to urbanism shaped by the modern movement that prevailed in the city of New York at the time, which was based on land use planning that differentiated between activities associated with the home, leisure, business, and work [1,2]. It had been developed as a means of organizing the urban fabric that would resolve the chaotic intermingling of uses, architectural styles, and high-density street life of pre-modern cities [2,3].

The paradigm was heavily criticized by Jacobs, who argued that problems derived from territorial dispersion, the rise of the private car, the demise of neighborhood life, and the lack of safety that results from segregated use zoning would become a serious hindrance to city life [3]. This ardent discussion of the future of cities involved a number of contrasting perspectives and led to the formulation of diverse approaches to planning and inhabiting the city that would influence planners for generations to come.

For Jacobs, cities are centers of human life and interaction [4]. Spaces for encounters and socialization are crucial to the formation of personal ties [5–12], contributing vitality and, ultimately,

the potential for the satisfaction of the desires and needs of inhabitants [13]. The latter is fundamental for Jacobs, who asserts that people need not only to live in and inhabit the city, but to "desire" the city in which they reside [3].

Her ideas provided the basis of a convincing response to the urban planning debate in the USA and later in Canada and remain relevant to this day. They constitute an approach to the city that considers, above all, the relationship between urban morphology, sociability, and community [13–17], and one that prioritizes the value of the personal experiences of residents in the planning of cities [18].

From the academic perspective, discussion of Jacobs' ideas tends to be limited to the Anglo-Saxon world, and publications that address Spanish-speaking contexts are scarce. The work of [1] concerning the city of Barcelona is an exception and constitutes a methodological point of reference for the present article in terms of measurement of the conditions for urban vitality. Its perspective draws on Jacobs' arguments and is of considerable value in relation to urban planning in Latin America, especially in light of the urban development processes that have dominated since the mid-twentieth century, in which urban expansion, construction of highways, suburbanization, and the eradication of peripheral informal settlements have featured strongly [19–21]. However, there has been a tendency in recent years to return to the centralized city concept, and this has created tension within the urban life debate [22] to a similar extent as the urban conflicts that occurred in Jacobs' New York.

In light of this, the present article asks a number of questions: How can Jacobs' concepts be applied to the spatial analysis of a Latin American metropolis? How can we apply Jacobs' perspective to Santiago, Chile, and what are the results? To what extent can Jacobs' arguments be directed towards the design and planning of Santiago? Thus, we seek to explore the urban territory of a Latin American city through Jacobs' eyes in order to assess the degree of vitality expressed by the city's various neighborhoods, considering the different morphological, architectural, and spatial characteristics of each.

Following this introductory section, we provide a brief review of Jacobs' concepts of urban vitality before embarking upon a description of the methodology used for the present study, along with data sources, processing, and scopes. In the fourth section, we present the results obtained for Santiago, which are structured according to Jacobs' concepts. The fifth section provides a discussion of the results and our conclusions, followed by recommendations for future research.

2. Jane Jacobs' Vision of the Conditions for Urban Vitality

The urban vitality conversation is multifaceted and involves a wide range of perspectives as to relevant conditions. The principle studies have focused on the influence of the morphology of the built environment on sociability and community, assessing how it affects the formation of neighborly connections [1,3,11–13,23–28]. Within this discussion, the concepts proposed by Jacobs as relevant to city planning are based not on science as such, but on observation of lived experiences. In her book entitled *The Death and Life of Great American Cities* (1961), Jacobs identifies four conditions as key to the generation of exuberant diversity in the streets and neighborhoods of a city.

The first condition is that of *concentration*. Jacobs asserts that there must be a sufficiently dense concentration of people present for different reasons, including for residential purposes [7,13,18,29]. Safety in the streets is achieved not by means of a police presence, but through a dense and unconscious network of voluntary surveillance provided by the people themselves [3]. Thus, a street that is busy with pedestrians [28] is much safer than a quiet street. This reflects a claim made by Jacobs that "there must be eyes upon the street" [3] (p. 35).

Another factor is housing density, regarding which Jacobs asserts that intensive use of urban land (i.e., a high housing density) is conducive to the vibrancy of an area. The authors of [30] found that, in Seoul, a higher density of buildings is associated with greater pedestrian footfall in the streets. However, intensive land occupation should not be confused with the construction of large apartment blocks [3] (p. 236), and it should not be assumed that a high housing density results in problem-free neighborhoods. Rather, Jacobs asserts that a higher density is only one of the factors that contribute to

the vibrancy of a neighborhood. Furthermore, she emphasizes that zones with a high housing density are often looked upon unfavorably, as this is often confused with high population density. As such, Jacobs distinguishes between low-density zones or neighborhoods [23]—those with a high population density that show signs of overcrowding [26]—and areas of high housing density, which are necessary for a city to flourish [3] (p. 240).

The second condition proposed by Jacobs is that of *diversity*, the central idea of which is that the neighborhood "must serve more than one primary function" [3] (p. 152), [13]. Mixed land use, which permits the intermingling or proximity of homes, workplaces, and services, is conducive to the vibrancy of urban spaces [13,31]. Furthermore, and closely linked to the previous condition, Jacobs maintains that the concentration of a population tends to become less beneficial if there is no diversity in terms of usage. As such, an abundance of businesses in a primarily residential area could attract people and thus improve the dynamism of the public space, which would, in turn, be reflected in street safety, where an individual can be heard and listened to [13,32].

The third condition is the *need for aged buildings*: "The district must mingle buildings that vary in age and condition" [3] (p. 187). This idea is based on Jacobs' comments concerning planning involving large-scale constructions which, according to her, fail to appreciate that healthy cities are organic, spontaneous, disorganizing, and complex systems that result from evolutionary processes [33]. The gradual rhythm of reurbanization, involving a mixture of buildings of all ages and types where the new eventually becomes the old, permits the persistence over time of connections that form between the inhabitants of a neighborhood. In short, Jacobs suggests that broad diversity in terms of building age and type is connected explicitly and directly with the diversity of the population, the diversity of businesses, and the diversity of scenarios [3] (p. 247).

The fourth condition is *contact opportunity*. "Most blocks must be short; that is, streets and opportunities to turn corners must be frequent" [3] (p. 178). This idea is based on the need for spaces in which to meet and socialize, which assists in the creation of connections between people from a given part of the city [3]. The opportunity for encounters between people has a positive effect on trust in a street and in the people that use it [5–10]. The temporal dimension plays a key role here, as this trust is formed through frequent light public contact, for example, when passing on the sidewalk [28]. The latter reflects an argument made by [34] concerning the importance of encounters between people and the role these play in the construction of a neighborhood community [18]. Social connections form on the streets of a neighborhood as people greet each other, walk in a particular manner, and get to know one another in a neighborly way that fosters a sense of trust and belonging [1,35].

In addition to these four conditions, and following proposals made by [1,30], we include two further conditions which are mentioned throughout Jacobs' book. The first of these is *accessibility*, which refers specifically to accessibility on foot [1] and via public transport as opposed to private vehicles. The second is *distance from border vacuums*. Large-scale infrastructures, termed "border vacuums" due to their tendency to absorb street life, have a negative effect on the vitality of neighborhoods, meaning that greater distance from them is preferable [36,37].

These six conditions, proposed by Jacobs as necessary for the generation of urban vitality, form the basis of our theoretical approach to the analysis of the city. Jacobs' influence on urban theory is most noticeable in the Anglo-Saxon world, particularly in Toronto, Canada, which provides perhaps the best example of the implementation of her ideas [4]. Her work has also inspired studies in Europe and Asia into how to address the challenges of the city and how to view urban space and its design and planning. The authors of [38] study a number of Italian cities and propose that walking is an element of urban vitality, while [30,39] assess the essential conditions of urban vitality in Seoul.

Particularly prominent in the Spanish-speaking world is the work of [1], which formulates a quantitative methodology for measurement of urban vitality based on Jacobs' theories, applying it to the city of Barcelona. In Latin America, proposals of this kind are of particular relevance considering the unequal patterns of urbanization that have characterized urban development across the continent [19,40–42].

There have been various different categorizations of Latin American cities based on certain specifics of urbanization in the region. Some of these have concluded that the main feature of the spatial structure of today's cities is fragmentation [43]. Some of the more recent contributions have placed the emphasis elsewhere, considering in particular the relationship between the functioning of the land market and the production and reproduction of land use patterns [42], which generates a particular urban structure typical of large Latin American cities, termed by [44] as the "com-fused" city. The latter is characterized by a land market that produces an urban structure that is both compact and diffuse. This pattern is different to the compact development found around the Mediterranean and to the diffuse nature of Anglo-Saxon developments, instead combining the two to form a new Latin American urban geography [19]. Here, the market and the state are not the only forces of urban production—the two are joined by the logic of need, manifested in a set of individual actions that include informal occupation of land, self-building, self-urbanization, and the formation of informal settlements [20,44–46].

In the case of Santiago, Chile, the authors of [47] reinforce this idea of diversity regarding urban growth trends, framing it within Schmid's proposal that the current urban phenomenon is characterized more by differences than by commonalities: there is no single style of urban life, as the growth of the city generates different habitats [48]. As such, we propose the need to study and understand the functioning of cities from this perspective with a view to formulating urban policies applicable to current patterns of urban growth in order to improve the quality of life for all inhabitants of the functional urban area.

As such, analysis of urbanization patterns from both new and old viewpoints is of particular value, and the application of Jacobs' perspectives presents an opportunity to study first Santiago and then other cities in the region.

3. Methodology

The methodology applied in the present work is based on the study by [1] of the conurbation of Barcelona, which involved the construction of the so-called Jane Index of urban vitality. An overview of the study area and a description of the methodology are given, specifying the way in which the dimensions of urban vitality were calculated and defining the sources of information for the construction of the indicators.

3.1. Study Area

The present study focuses on Santiago, Chile (Figure 1), a city of almost seven million inhabitants according to the country's 2017 census [49]. It is the seventh most populous city in Latin America after São Paulo, Brazil; Mexico City, Mexico; Buenos Aires, Argentina; Río de Janeiro, Brazil; Lima, Peru; and Bogotá, Colombia. The city has little in the way of colonial heritage due to the frequency of earthquakes and flooding, meaning that the majority of its built stock is relatively recent. Santiago has undergone considerable expansion since the 1980s, and over the past decade, this has featured other growth components, such as high-rise densification in central and pericentral areas [47]. This process of urban growth—involving both expansion and densification—has been shaped by pro-market urban policies and subsidization by the state, producing a pattern of urbanization with a strongly unequal social structure [50–54].

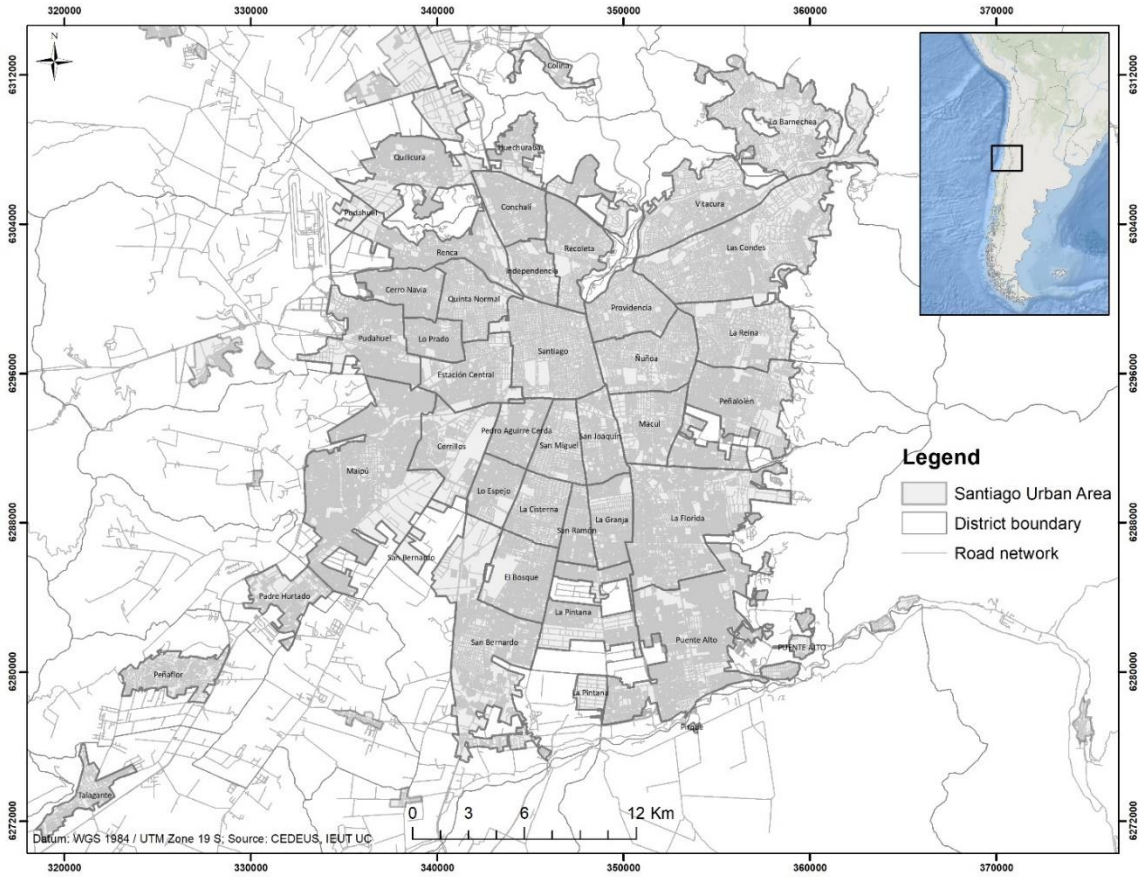


Figure 1. Santiago, Chile, and its districts. Source: compiled by the authors.

3.2. Calculation of the Dimensions of Urban Vitality

In the present work, we use the four dimensions identified by [3] as key to urban vitality, namely: (1) *concentration*, (2) *diversity of uses*, (3) *contact opportunity*, and (4) *need for aged buildings*. In addition, and following [30], we include two complementary variables: (5) *accessibility* and (6) *border vacuums*. Most of the indicators are based on the work carried out for Barcelona [1]. However, in some cases, there are differences due to the difficulties in collecting the same type of data.

Table 1 details the variables used to construct each of these six dimensions, along with their respective data sources. The majority of data are taken from official sources and the rest have been assembled by the research team from spatial analyses using geographical data systems.

As the study area, we selected the Consolidated Urban Area of Greater Santiago as defined in 2017 by the National Institute of Statistics. Following the methodology outlined by [1], we applied a 100 × 100 m fishnet grid to the area and designated each cell as an analysis unit. By extrapolation of the variables to cells, we were able to homogenize the various geographical units from the data obtained. Furthermore, given the diversity of units for each variable, the data were standardized prior to calculation of the indicators by dimension, using the difference from the average in units of standard deviation (z score).

Table 1. Analysis dimensions, variables, and data sources.

Dimension	Variable	Source
Concentration	Population density	2017 Census Tracts and Internal Tax Service (SII) Cadaster
	Housing density	
	Building density	
Diversity	Building use mix	Internal Tax Service (SII) Cadaster
	Residential–non-residential use	
Contact Opportunity	Block size	2017 Census Tracts
	Street width	Street plans and 2017 Census Tracts
Need for Aged Buildings	Average building age	Internal Tax Service (SII) Cadaster
	Standard deviation	
Accessibility	Distance from bus stops	Metropolitan Region Bus Stop Register
	Distance to Metro stations	Metropolitan Region Metro Station Register
Border vacuums	Distance (meters) from border vacuums	Various data sources explored by OCUC (Observatory of Cities UC)

Source: compiled by the authors.

In some units, there were variables with a positive effect on urban life, such as housing density, the presence of older buildings, and mixed activities, while in others, there were variables with a negative effect, such as large blocks and proximity to border vacuums. With this in mind, scores for each of the dimensions were calculated as follows:

3.2.1. Concentration Score (CS)

This dimension involves three variables: population density (PD), housing density (HD), and building density (BD). The final indicator was constructed as follows:

$$CS = zPD\left(\frac{1}{3}\right) + zHD\left(\frac{1}{3}\right) + zBD\left(\frac{1}{3}\right) \quad (1)$$

3.2.2. Diversity Score (DS)

This dimension involves two variables: building use mix (BUM), which is the proportion of each use type calculated at the building level; and residential–non-residential use (RNR), which is the proportion of residential versus non-residential use calculated at the block level. Both are calculated based on the five uses proposed by [1]: residential, commercial, work-related, recreational, and others. Unlike Barcelona, in Santiago, there are vast areas of predominantly residential land use, meaning that in many sectors, the proportion of non-residential use is zero. As these indicators are constructed on the basis of calculated logarithms and proportions, we avoided division by zero and logarithms of zero, replacing infinite or other invalid values with zero.

$$BUM = -1\ (\frac{\sum_{i=1}^{n} pi * ln(pi)}{ln(n)}) \quad (2)$$

$$RNR = 1 - \left(\frac{Res\ -\ NonRes}{Res\ +\ NonRes}\right) \quad (3)$$

The final indicator was constructed as follows:

$$DS = zBUM\left(\frac{1}{2}\right) + zRNR\left(\frac{1}{2}\right) \quad (4)$$

3.2.3. Contact Opportunity Score (COS)

This dimension involves two variables: block size (BS) and street width (SW). Block size was calculated at the block level and the mean block size was extrapolated to the grid. Street width was calculated according to the average grid-level distance from the central axis in order to avoid the bias produced by the Near tool in GIS when analyzing the block as a unit. In zones where the central axis was unavailable, data were complemented with the Near tool. The final indicator was constructed as follows:

$$COS = (-1)zBS\left(\frac{1}{2}\right) + (-1)zSW\left(\frac{1}{2}\right) \quad (5)$$

3.2.4. Need for Aged Buildings Score (NABS)

This dimension involves two variables: mean building age (MA) and the standard deviation of building age (SDA). These were calculated at the block level and extrapolated to the grid. It should be noted that values of zero for construction age were considered missing data. The final indicator was constructed as follows:

$$NABS = (-1)\, zMA\left(\frac{1}{2}\right) + zSDA\left(\frac{1}{2}\right) \quad (6)$$

3.2.5. Accessibility Score (AS)

This dimension involves two variables: distance from the Santiago Metro underground transport system (DM) and distance from bus stops (DB). Both variables were calculated in meters. Given that, in Santiago, access to the Metro is associated with a significantly reduced journey time/distance ratio compared to the public bus network, we gave greater weight to proximity to Metro stations than to bus stops. The final indicator was constructed as follows:

$$AS = zDB\left(\frac{1}{2}\right) + zDM\left(\frac{1}{2}\right) \quad (7)$$

3.2.6. Distance to Border Vacuums Score (DBVS)

This dimension is based on the variable of distance from large-scale infrastructure and other elements that interfere with urban vitality or hinder street life. In Santiago, elements identified as border vacuums included highways and railroads; structures such as malls and shopping centers, hospitals, stadia, prisons, and cemeteries; green areas larger that a hectare in area; wasteland; and the urban limit of Santiago. The distance in meters to such elements was calculated from each block and extrapolated to the grid. The final indicator was constructed as follows:

$$DBVS = zDBVS \quad (8)$$

3.2.7. Jane Index

Based on the six dimensions above and following [1], where the four base dimensions have a greater weight in the equation than the two annexed or "extra" dimensions, the Jane Index of urban vitality was constructed as follows:

$$JANE = CS\left(\frac{1}{5}\right) + DS\left(\frac{1}{5}\right) + COS\left(\frac{1}{5}\right) + NABS\left(\frac{1}{5}\right) + AS\left(\frac{1}{10}\right) + DBVS\left(\frac{1}{10}\right) \quad (9)$$

4. Results

The indicators calculated for each of the conditions of urban vitality are presented in map form in Figures 2–4. Each of the three maps shows a spatial reality that differs noticeably from traditional spatial interpretations of Santiago and other Latin American cities, which tend to portray an unequal structure and the concentration of assets in a certain sector of the city. The concepts evaluated according

to Jacobs' perspective show an alternative urban configuration and the results for each of the conditions are analyzed below.

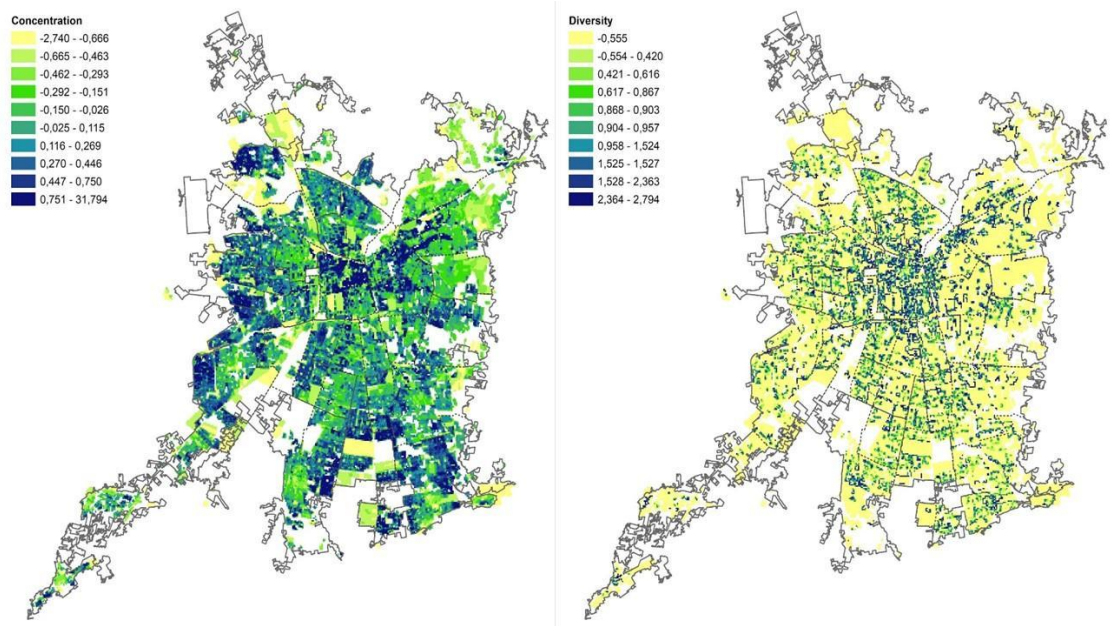


Figure 2. Concentration/Diversity indexes for Santiago. Source: compiled by the authors.

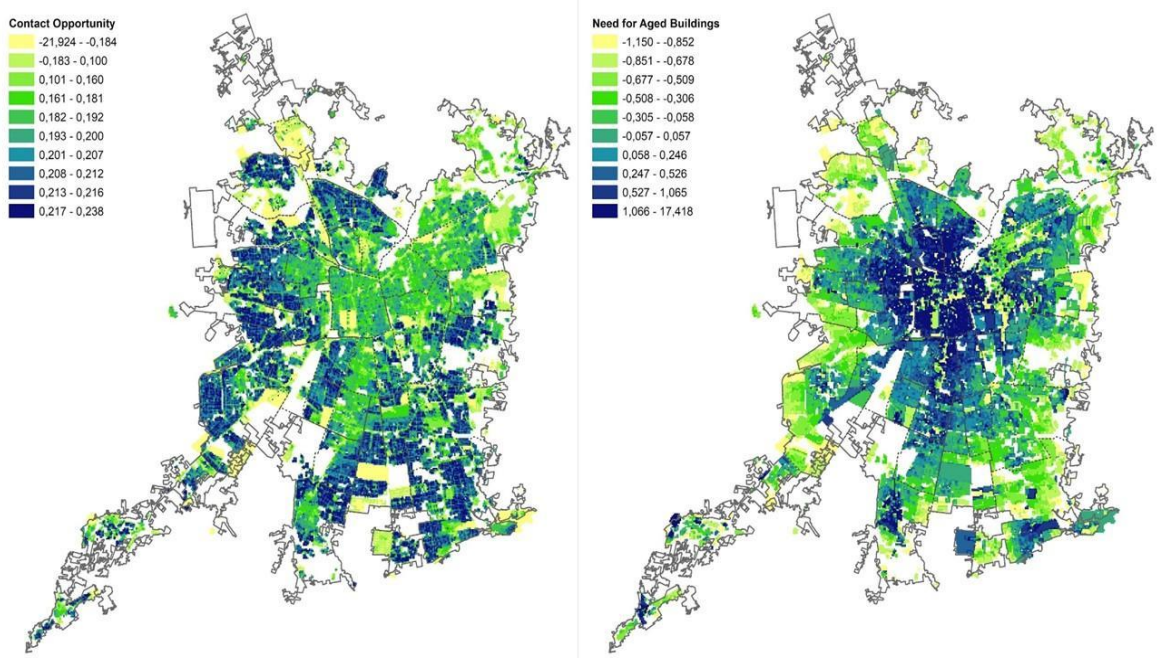


Figure 3. Contact Opportunity/Need for Aged Buildings indexes for Santiago. Source: compiled by the authors.

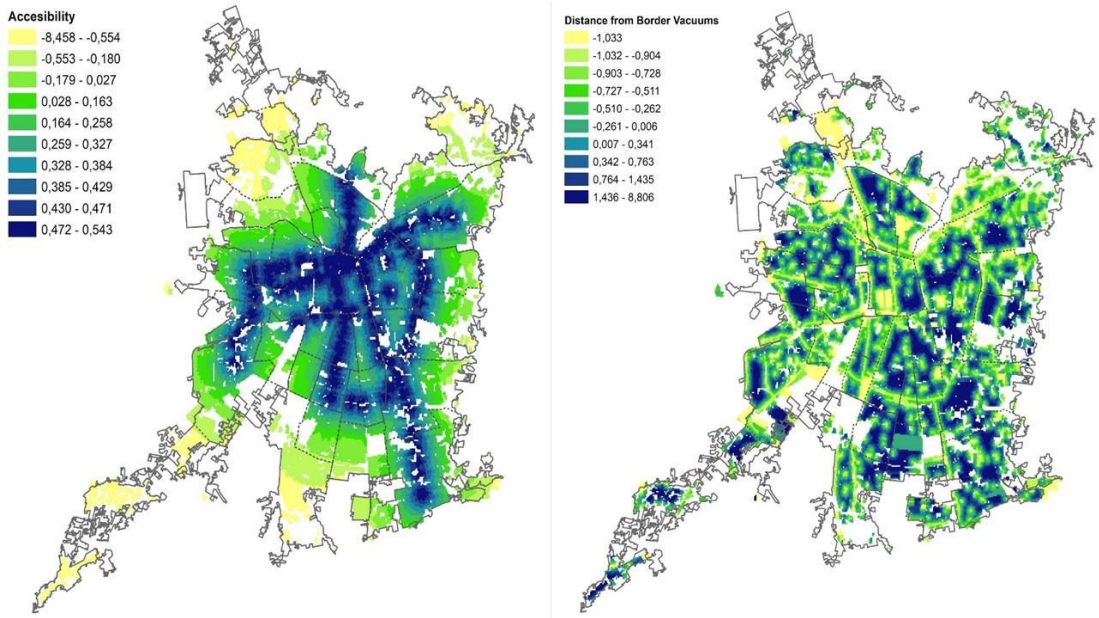


Figure 4. Accessibility/Distance to Border Vacuums indexes for Santiago. Source: compiled by the authors.

4.1. Concentration

The results for this index reveal particularly high values in Santiago's historic center and outwards towards the north-east, as well as in certain peripheral zones. As such, a view of the city according to Jacobs' condition of concentration enables us to identify two clear spatial patterns.

Closer inspection of the particularly high-scoring zones reveals that these correspond firstly to areas of high population and housing density in the historic center and the north-eastern high-income cone, the latter including the main arterial roads: Cristóbal Colón Avenue, Providencia-Apoquindo-Las Condes Avenue, and Kennedy Avenue. Although the low-scoring zones do not show any particular trend in terms of spatial distribution, they are generally located on the urban periphery (Figure 2).

However, the periphery can also be seen to contain a number of high-scoring zones. One explanation for this pattern is the strong presence of social housing estates in these zones, which are characterized by high population and housing density. These are found in particular in three zones: the north (district of Quilicura), the south-west (district of Maipú), and the south-east (district of Puente Alto) (Figure 2).

4.2. Diversity of Uses

The results for this index reveal a low overall level of land use diversity due to the predominance of housing across the city, coupled with a highly dispersed distribution of higher scores; however, the city center presents a generally higher score (Figure 2). The urban periphery is mostly characterized by a lower diversity of land uses, and once again it is residential use that dominates. However, certain pericentral and eastern zones break this mold, such as the district of San Miguel and the areas of commercial and office buildings along Providencia-Apoquindo-Las Condes-Vitacura Avenue.

4.3. Contact Opportunity

The results for this index reveal two clear spatial patterns. On one hand, the highest-scoring zones are those towards the periphery, where, according to Jacobs, smaller block sizes and narrower streets provide conditions more conducive to contact between people. On the other, those zones with medium and low scores are located within the historic center and out towards the north-east, as well as to the south of the district of Santiago Centro along Gran Avenida and Santa Rosa Avenues (Figure 3).

As with the dimension of *Concentration*, the presence of large areas of social housing explains the higher scores found in peripheral zones. These estates, built during the second half of the twentieth century, are characterized by high housing density and an urban fabric of narrow streets and alleyways and feature smaller blocks than those of the 100 × 100 m checkerboard found in central and pericentral Santiago.

4.4. Need for Aged Buildings

The results for this index reveal higher scores within the city's historic center, where a larger number of old buildings are intermingled with more recent structures built as part of the densification that has been occurring over the course of the past 30 years.

Two other trends can be identified in terms of high scores. The first concerns sub-centers that are of great importance within the local or district context, examples of which include Plaza de Maipú in the south-west and the La Florida commercial center in the south. The second refers to high-scoring zones on the urban periphery, which correspond to what were rural towns and villages which were enveloped by the expansion of Santiago to become urban sub-centers [55]. Examples include Puente Alto in the far south and San Bernardo to the east (Figure 3).

The urban periphery is generally comprised of low-scoring zones. With the exception of the aforementioned peripheral sub-centers, the rest of the city's outer ring presents greater homogeneity in terms of building age, a feature which constitutes a negative element in terms of urban vitality. Clear examples include highly homogeneous neighborhoods of social housing, along with the nucleus of Santiago's high-income cone, specifically along Apoquindo and Kennedy Avenues. The latter is explained by the large number of new buildings in the area, which again have negative implications in terms of urban vitality (Figure 3).

4.5. Accessibility

The results for this index reveal a spatial trend shaped primarily by the city's underground rail network, the Metro. Although the network does stretch as far as some zones on the urban periphery, the majority of stations are concentrated around the historic center, and it is here that the highest scores are found (Figure 4). By contrast, there are many peripheral zones with extremely low scores, such as Talagante, Colina, and San Bernardo. The bus network is also included in the construction of this index; however, the homogeneous distribution of bus stops across the city does not reveal any particular pattern.

4.6. Distance to Border Vacuums

The results for this index reveal that there is a generalized distribution of higher scores across the city, indicating zones which are relatively free from this type of infrastructure. By contrast, low-scoring zones indicate greater proximity to such structures, principally tolled highways such as the Américo Vespucio beltway, Santiago's urban limit, and large green areas such as O'Higgins Park and the Club Hípico. These infrastructural elements have a negative effect (associated primarily with safety) on contact between people and, as such, nearby areas present low urban vitality according to Jacobs' perspective (Figure 4).

4.7. Index of Urban Vitality for Santiago

We then constructed the Jane Index of urban vitality for Santiago based on all of the dimensions analyzed above. The highest scores indicate the zones with conditions for strong urban vitality thanks to greater possibility for personal interactions in public spaces and improved safety given the presence of "eyes upon the street" (Jacobs, 1961).

Figure 5 shows a higher Jane score within Santiago's historic center, including a large part of the district of Santiago Centro and the nearby districts of Recoleta, San Miguel, Estación Central, Providencia, and Ñuñoa. Higher scores can also be seen in parts of the district of Las Condes,

specifically along Apoquindo Avenue in the El Golf neighborhood. For the most part, these sectors are characterized by high scores in three of the four base variables analyzed (*Concentration*, *Diversity of Uses*, and *Need for Aged Buildings*), and also feature high *Accessibility* scores. It is also clear that some peripheral zones have a high vitality index (see Figure 5). Many of these correspond to social housing estates built during the second half of the twentieth century, mainly between 1959 and 1975 [56]. These zones have a more close-knit urban fabric with smaller blocks than those found within the traditional 100 × 100 m grid of Santiago's historic center. They are also characterized by a high housing and population density, meaning that their high level of vitality is explained primarily by the *Concentration* and *Contact Opportunity* indicators. By contrast, the suburban morphology of districts such as Lo Barnechea produces low scores associated with their relative isolation, large block size, and low density and diversity of uses.

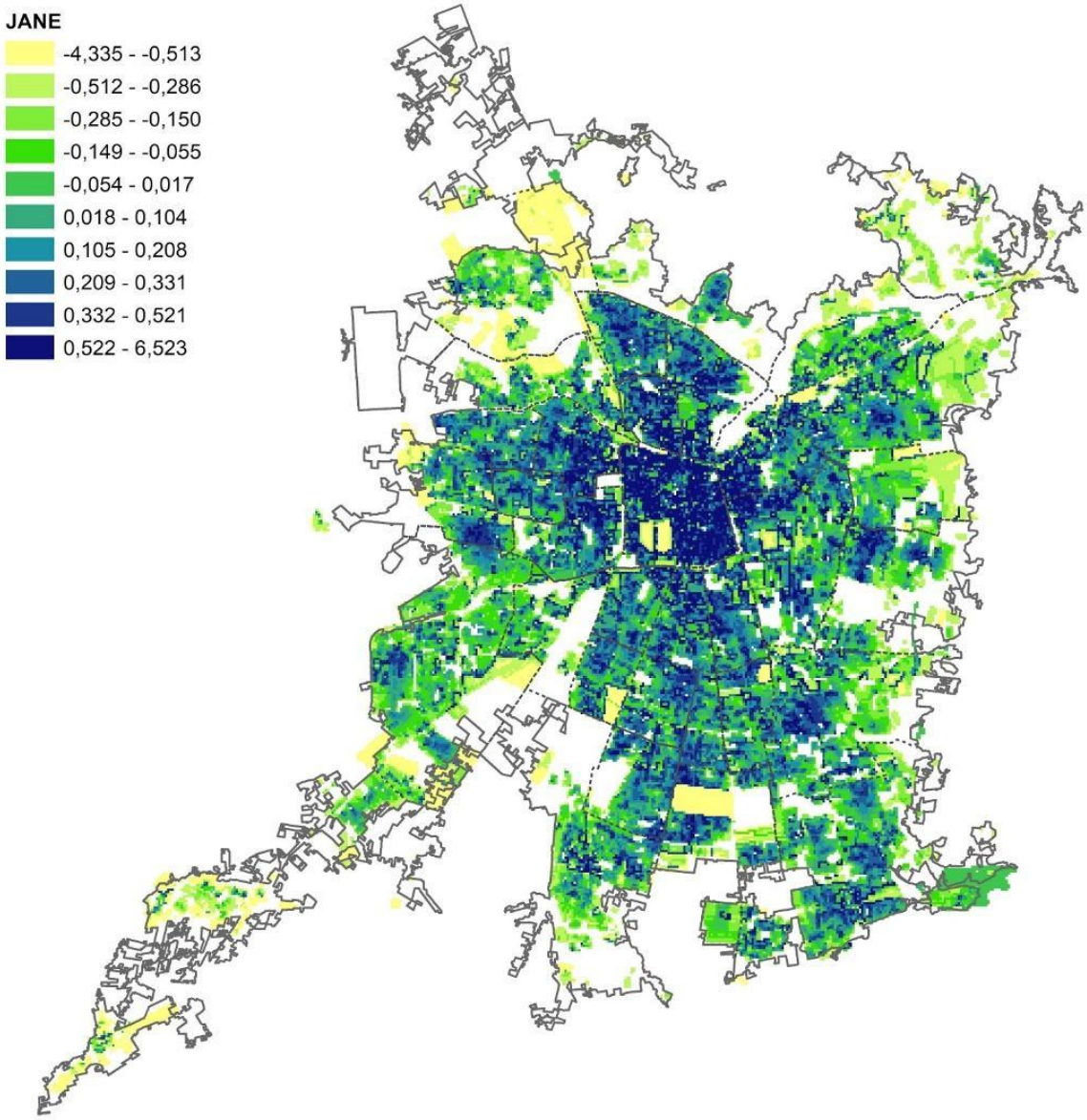
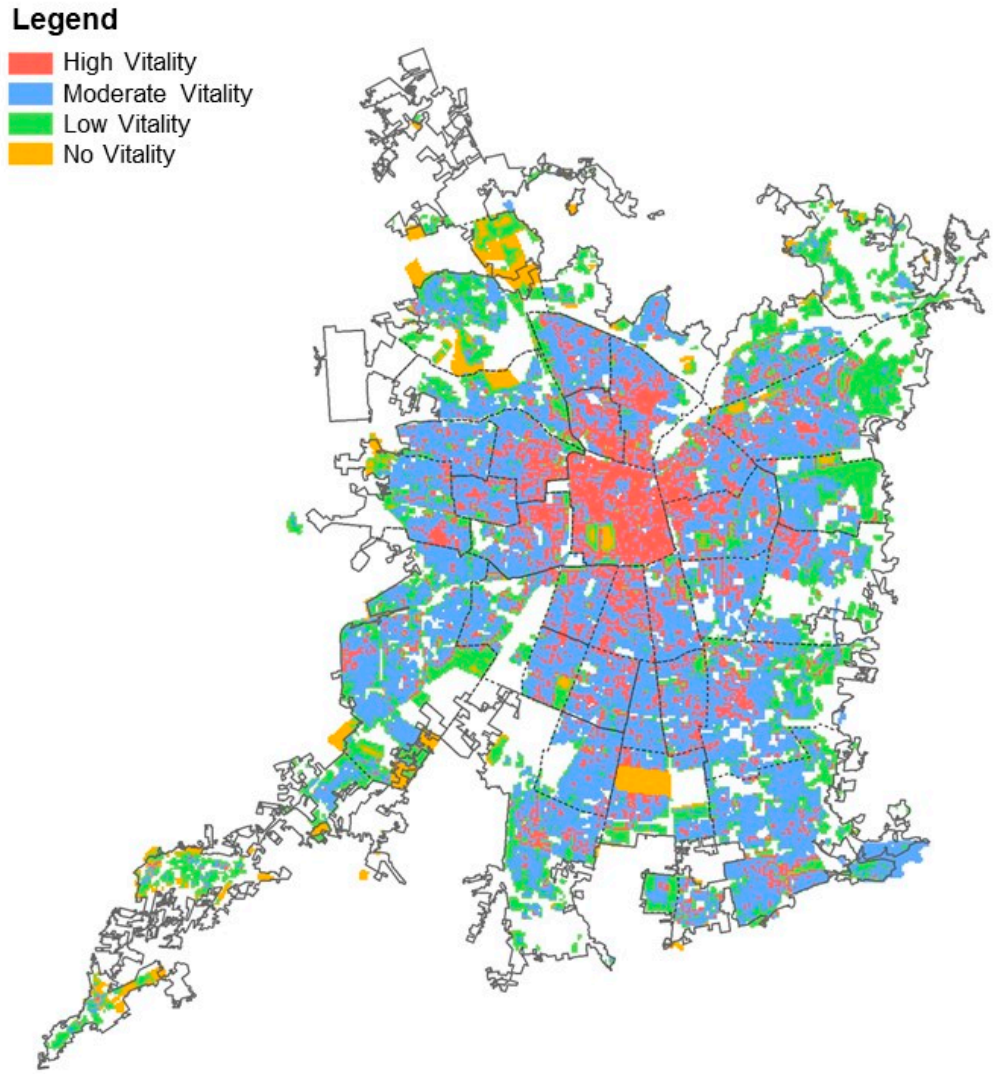


Figure 5. Jane Index of urban vitality for Santiago. Source: compiled by the authors.

Finally, following the method proposed by [1], we grouped the results of the Jane Index using the GIS Grouping Analysis tool. The results of this grouping are shown in Figure 6. The four resulting categories are titled *High Vitality*, *Moderate Vitality*, *Low Vitality*, and *No Vitality*.



Group	N	Average	Std. Deviation	Min.	Max.	Proportion
High Vitality	8972	0.638	0.280	0.363	6.519	16.8%
Moderate Vitality	27,747	0.088	0.130	−0.125	0.363	51.8%
Low Vitality	14,223	−0.339	0.156	−0.697	−0.125	26.6%
No Vitality	2612	−1.056	0.427	−4.329	−0.698	4.9%
Total	**53,554**	**0**	**1**	**−4.329**	**6.519**	**100.0%**

Figure 6. Jane Index of urban vitality (GIS Grouping Analysis). Source: compiled by the authors.

The analysis results show that areas of *High Vitality* account for around 17% of the Consolidated Urban Area of Santiago. Around 52% of Santiago is categorized as being of *Moderate Vitality*, reflecting strong homogeneity in terms of residential land use (see Figure 2) and peripheral zones developed since the 1990s featuring more recent buildings (see Figure 3). Finally, areas categorized as exhibiting *Low Vitality* and *No Vitality* account for 27% and 5% of Santiago, respectively, and are generally located on the periphery. These tend to be closed communities and sectors with little or no population located in close proximity to border vacuums.

A superficial glance at the results presented in Figures 5 and 6 reveals a marked radial dynamic in terms of urban vitality; however, upon closer inspection, it is possible to identify sub-centers with high urban vitality. These sub-centers correspond, for the most part, to rural towns and villages which gradually became absorbed into Santiago, such as San Bernardo and Puente Alto. However, as mentioned previously, we also find clusters of high vitality in the form of social housing estates

built on what used to be the urban periphery. These sectors share high scores for the *Concentration* and *Contact Opportunity* indicators, and the majority also score highly in terms of *Accessibility*. This can be explained by the fact that many of these estates located on the old periphery are now served by the Santiago Metro, extensions of which were completed during the 2000s. Examples include Población La Estrella in Pudahuel; Antigua La Florida, Lo Hermida, and La Faena in Peñalolén; the El Salto neighborhood in Recoleta; the El Parrón neighborhood in La Cisterna; and the Colón Oriente neighborhood in Las Condes (Metro line 5 was extended to Población La Estrella in Pudahuel in 2010; line 4 reached Antigua La Florida, Lo Hermida, and La Faena in Peñalolén in 2005; El Salto in Recoleta and El Parrón in La Cisterna were connected by an extension to line 2 in 2006 and 2004, respectively; and Colón Oriente was connected by an extension to line 1 in 2010).

5. Discussion and Conclusions

The present article reports an application to the city of Santiago, Chile, of the methodology proposed by [1] for the spatial analysis of conditions conducive to urban vitality according to the theorizations of Jane Jacobs. The results contribute to the wider discussion regarding the application of Jacobs' theory to the Latin American context, taking into consideration the specific characteristics of urbanization in the region and, in particular, in the Chilean capital. Unequal urbanization, processes of expansion and densification [42], and urban informality [46] are revisited and analyzed from the perspective of Jacobs, an author of considerable importance in the recent history of the field of urbanism. From a practical point of view, the present article will help planners to incorporate the morphological conditions conducive to vibrant streets, urban environments, and neighborhoods that foster community, local spatial practices, and neighborly ties.

The results are noticeably different to those we are accustomed to seeing for Latin American cities. The majority of maps of Santiago reveal an unequal urban pattern within which the eastern sector of the city is differentiated according to all of the indicators employed [40,41]. An analysis of the city according to Jacobs' perspective reveals a different Santiago: a city with an unfamiliar configuration and a radial pattern that favors the historic center above the low-density and highly uniform periphery. However, beyond this general pattern, there are a number of interesting features that stand out.

According to [3], the synergy of elements such as population concentration and a mixture of land uses [13] leads to greater proximity between places of residence and businesses, services, and places of work [31]. These aspects stimulate economic activity within neighborhoods, meaning a presence of abundant and diverse urban business [32], which, in turn, attracts a greater variety of people and users who, given the diversity of land uses present, find cultural opportunities and varied scenarios and environments. This is particularly apparent in the historic center of Santiago and its environs, where the majority of the city's areas of high urban vitality are concentrated. In sectors such as these, mixed land use and the constant presence of passers-by—referred to by [3] as "eyes upon the street"—contribute to greater safety in the form of people's passive vigilance of their surroundings [33] which, in turn, lowers crime and transforms these areas into vibrant spaces.

Although a high vitality index is to be expected in central urban sectors, what is interesting in the case of Santiago is the existence of conditions favorable to urban vitality in other parts of the city, for example, in sectors with large areas of social housing [20], specifically those built after the passing of Decree with Force of Law No. 2 in 1959 (Decree with Force of Law No. 2 of 1959 granted tax breaks for "affordable housing," that is, houses with a liveable area of less than 140 m^2. Vergara and Palmer (1990) consider the passing of this Decree to be the initial push towards the division of land and construction of affordable housing that took place during the 1960s, 1970s, and 1980s) and prior to the social housing policy that was implemented with the return to democracy in 1990. This vibrancy is explained to a great extent by the more compact morphology of these areas, whose blocks are shorter and streets are narrower than in the historic center, and by the high density that is characteristic of these estates, which in many cases is a product of multigenerational cohabitation and overcrowding.

These sectors were, for the most part, intended to accommodate Santiago's growing population, swelled by rural to urban migration and the eradication of encampments and informally occupied land [56]. The rise in the urban population was also driven by the urbanization of rural lands and the subsequent construction of precarious accommodation. An example of this was the so-called *Operación Sitio*, through which vulnerable families were granted plots of land that were connected to the utilities, but which did not include houses, leaving it up to each resident to build their own home. Despite their original peripheral location, many of these sectors—identified by [56] by their 9 × 18 m plot size—are now firmly integrated within the city and enjoy the accessibility provided by new and extended Metro lines, which contributes to their high scores according to the urban vitality index used here.

However, these sectors are almost exclusively residential, presenting little or no diversity in terms of land use. According to [3], the question of vitality is uncertain in "monotonous" districts where residential land use predominates over all others. However, there are other sources of vitality that are intangible or simply not captured in the data analyzed here, for example, the formation of social connections based on frequent contact in streets and neighborhoods [7], the sense of belonging felt by residents [14], the activities of small-scale or informal business, and the establishment of community organization at the neighborhood level [5,57], all of which influence patterns of urbanization in Latin America. The latter makes us believe that an urban vitality index for this context should consider a dimension focused on the sociability of people in the neighborhood. Such aspect refers to the neighborhood characteristics, neighborhood interactions, and the social links that are built at the local level [18]. In short, the activities of the people themselves are aspects that may or may not influence the degree of vitality of a neighborhood, as shown by other studies [39], where, based on the analysis of the walking activity of people, they conclude that this is associated with the six conditions of urban vitality raised by Jacobs.

Despite all of the above, these sectors are typically home to socio-economically vulnerable and residentially precarious populations and are often the subject of severe territorial stigmatization [20]. However, Jacobs' perspective allows us to appreciate morphological attributes which may be considered as positive and which contrast with more traditional interpretations. As such, in the event that the decision is taken to reform these neighborhoods, these conditions should be preserved and borne in mind for the creation of new neighborhoods developed with vulnerable populations in mind. An example of this is the case of the urban regeneration policies implemented in Chile by the Ministry of Housing and Urbanism (MINVU), in areas with a deficit in urban, physical, and social standards, although it remains to be seen if these consider a comprehensive perspective in their management.

Regarding the comparison with Barcelona, both methods show how the vision of the city under Jacobs' arguments explains similar elements from the perspective of concentration, where both cities have a center with high values and a periphery with low vitality. However, in Barcelona, it is also evident that there are sub-centralities of high urban vitality, corresponding to historical towns such as l'Hospitalet de Llobregat, Gràcia, Santa Coloma, and Badalona. However, there are other aspects that differ in both cities, such as the diversity of urban land uses. In this regard, in Barcelona, we observe a homogeneous spatial distribution, with high values distributed throughout almost the entire city. Meanwhile, in Santiago, a center–periphery relationship is observed, where the periphery shows extremely low values, due to the predominance of residential use with a lack of diversity of uses. This result represents the main aspect to consider regarding the methods. Since, in the case of Santiago and possibly in other Latin American cities, there are informal land uses not captured in the official datasets, especially among socially vulnerable neighborhoods, Jacobs' vision, represented through the index developed in this research, does not capture such informal uses that are typical of the context of Latin American cities.

Our findings raise a number of questions which should be addressed by future research. Although the index applied here offers evidence of conditions conducive to vitality in certain sectors thanks to their particular morphological variables, there is a need to analyze these zones at the

neighborhood level in order to assess whether the conditions associated by Jacobs with the presence of "eyes upon the street" are indeed effective, or whether they are hindered by social problems and vulnerability. Although more in-depth analysis of neighborhood-level social dynamics is needed in order to confirm their degree of urban vitality, we feel able to assert that, given their morphological characteristics and location, these sectors do at least have the potential for a strong degree of urban vitality.

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