

Indicator system to measure the qualities of urban space affecting urban safety and coexistence

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Abstract. Urban space design directly influences its own safety. Sometimes this security is given by urban furniture, lighting or urban facilities, among other aspects. This paper presents a methodology based on the development of a system of indicators that provides the opportunity to assess what qualities of urban space influence street safety. It is important to know what aspects of public space make the citizen consider it a safe place and at the same time, to contrast these data with scientific documents. The first results are shown after applying this methodology to the case study of the city of Malaga, and specifically, to a sample of streets selected based on objective criteria crime rate. For research and obtaining indicators, digital surveys have been carried out on a group of 300 people, using Google Forms and social networks. Likewise, to obtain samples of the streets with the highest and lowest crime rates, registration data has been geolocated by the tolls of the Geographic Information Systems (GIS). The main contribution of this document is focused on defining indicators to characterize and quantify the safety in the streets of the urban public space. These are contrasted with objective data and records of insecurity and crime, and can be applicable to any street in any city. Finally, through these indicators, it is intended to know what are the parameters that influence urban safety for future designs of public spaces, or their renovation, achieving in the future, the existence of streets with a higher level of safety.

1. Introduction

Safety is a key issue for the proper functioning of the city, and the development of a sustainable city. But we can hardly speak of sustainability, if city does not meet basic conditions such as urban security. Security is an indispensable condition and a right of citizens to be able to develop a comfortable, safe and fearless community life in public spaces.

Many researchers agree that urban and environmental design plays a fundamental role in the quality of public space, and specifically, in the safety of the streets of our cities. A good design of the urban space contributes to making public space a safe space for its users, even being able to prevent situations of insecurity and reduce the number of crimes [1]. The relationship between architectural and urban design and the safety of cities has been a recurring theme since the 1960s and 1970s. Already in these years, architects and urban planners such as Oscar Newman announced the influence of architectural and environmental design on crime, as a result of the high crime rates produced in the residential settings of many American cities [2]. Newman developed a "Defensible Space Theory" that has been widely discussed, used, and criticized by criminologists, lawyers, sociologists, urban planners, and architects. Through this theory, the architect argues that it is possible to design urban environments that reduce crime rates in the residential neighborhoods, affecting the behavior of both residents and criminals [2].

Jane Jacobs, in one of her most outstanding books, "Death and Life of the Great American Cities", also vindicates the importance of people feeling safe and protected in the public space of cities. For the American activist, the presence of people, community life and activity on the streets promote safety on them. Hence, she claims the design of open, permeable urban spaces in which different types of activities coexist; where residents and other users are part of a natural mechanism of surveillance that she calls "eyes on the streets" [3].

Based on these theories by both authors, a large number of investigations have been developed. They directly relate urban design, street safety and crime. However, many of these approaches to crime through situational prevention measures have been widely criticized. In some cases, they have neglected the causes of crime, or they have solely focused on architectural aspects and neglected social conditions. In some other cases, these theories have given rise to results of designs of very closed communities [4]. Laura Vozmediano stresses the importance of working on the social cohesion of the communities, in order to achieve good crime prevention [4]. In this sense, prevention strategies must attend to, not only physical aspects, but also social parameters, that reinforce the identity of the community with public space and social control [5].

Despite all these criticisms, there are numerous experiences in England, the Netherlands, South Africa, Canada, Chile and other countries where crime prevention methodologies have been developed through environmental design, with successful results [6]. In the cases of Dutch and English cities, situational crime prevention has significantly reduced the rate of certain types of crime, such as home burglary [4]. However, it is not an issue that is normally taken into account in the conventional practice of urban planning [7]. In Spain, there is no tradition of incorporating these criteria in Urban Planning or Urban Design.

The main objective of the research is to develop a system of indicators as a tool to measure safety in urban spaces, and to identify the physical parameters that favor street safety - whether objective or subjective. The concept of objective security is related to crime rates and crime prevention, although it is a broader concept linked to social, economic and political factors [5]. Subjective security corresponds to the security perceived by users of public space. This system of indicators is not proposed as a single tool but rather complementary to others that incorporate other social aspects such as citizen participation processes and cooperation with local communities.

This research develops a methodology for obtaining these indicators, based on a bibliographic review of previous research on urban design and safety, in the use of citizen surveys about the aspects that influence urban safety, and in the use of criminal maps. Also, the testing of this system of indicators is carried out in different streets and urban spaces in the city of Malaga.

2. State of play

A review of some of the urban investigations framed in the prevention of situational crime is carried out, and they are analyzed from the point of view of the aspects that influence the security of the urban space. Jane Jacobs, one of the forerunners in claiming safe urban spaces, directly addresses the issue of city safety. In her words: “*a busy street has possibilities of being a safe street. A little crowded street is probably an unsafe street*” [8]. For Jacobs, a safe street must have three qualities. Firstly, there must be a clear demarcation between public and private space. Secondly, the presence of “eyes that look at the street” is necessary. She talks about natural street owners. For the journalist, residential buildings must face the street to provide security for neighbors and strangers. Thirdly, a safe street must have users almost constantly, in order to increase the number of eyes that watch and monitor the streets, as well as to induce those who live in houses to observe the street [8]. In this sense, she establishes that one of the basic requirements of this surveillance is the presence of shops and public facilities with different opening hours on the sidewalks of the neighborhoods. Transit of people, diversity of uses and users, and sufficient supply of shops and public services on ground floors are fundamental aspects to be taken into account in the design of urban spaces.

Newman agrees with Jacobs on the idea that regular observation and surveillance of public space by residents is an important factor in reducing the number of crimes and reducing users' perception of insecurity. He also agrees on the importance of involving the residents in this surveillance task. Increasing natural surveillance, territoriality, and reducing accesses help prevent crime. In his urban design recommendations, he highlights the convenience of locating public areas such as parks and play areas that are clearly visible from the streets and surroundings, or the importance of adequate lighting in order to facilitate such surveillance at night, among other factors [9]. Newman's ideas have been implemented in several American residential projects, and yet they have also many criticisms that argue for an excessive influence of physical form on human behavior, without adequately addressing other social aspects [2].

These ideas of natural surveillance, territoriality and access control are also incorporated in the formulation of theories of opportunity, specifically in the theory of Routine Activities [10] which establishes a greater probability that a crime occurs if any of these three causes converge: presence of a motivated aggressor, an attainable objective and the absence of guardians capable of avoiding crime, that is, the absence of social control. Many of the urban design - security tools are based on these premises, such as Crime Prevention Through Environmental Design (CPTED) tools. The CTPED strategies try to discourage the offender's decisions before committing a crime, and build a sense of community among inhabitants to favor territorial control of their environment [11].

Among the different CTPED strategies, different studies [12]; [13]; [5] point out the following important aspects: natural surveillance- by increasing the risk perceived by the offender-, natural access control –to limit the opportunities for crime-, the natural reinforcement of the territory-promoting social cohesion and sense of belonging in local communities-, the image (good care or neglect) of the environment, and support for the development of activities and complication of possible objectives.

These principles can be translated into design strategies according to the following classification [14]: spaces with good visibility (clear sight lines), adequate lighting, minimizing isolated routes, avoiding entrapment, promoting the mix of uses, using activity generators, promoting sense of identity through maintenance and management, signs and information, and general improvement of urban design (avoiding residual spaces for example).

The research carried out “Madrid Security Atlas” [6] is interesting. Criminal maps are used and design measures are outlined in different urban spaces. In this work the analysis and re-design of some

urban spaces has been carried out attending to different aspects: spaces and types of uses, natural surveillance, visibility, lighting, access control, identity of public space, participation and sense of belonging of the public space, and maintenance.

The research “System of indicators and conditioning factors for large and medium-sized cities” [15] establishes that the degree of urban habitability of public space depends on the physiological, physical and psychological well-being of people. The feeling of insecurity reduces this well-being. In Rueda's words: *"the feeling of security must take into account the physical and social environments together"* [16]. In this work, the importance of guaranteeing adequate light levels, and guaranteeing the continuity of activity on the ground floor as commercial and tertiary uses, is established as it inhibits desertification of the streets. Another aspect that is considered is the mix of population, arguing that the separation of groups for reasons of income, age, culture or others, generates mutual ignorance and fosters feelings of insecurity. Social cohesion and diversity is essential for the balance between different actors in the city [17].

Colectivo.6 [18] carries out an interesting study on gender urban planning, which allows measuring, through a system of indicators, autonomy in urban space. It analyses whether urban space generates a perception of safety and can be used autonomously. The following aspects for a safe (perceived) place are included: visibility, alternative routes, accessible spaces, continuous pedestrian lighting, perimeters and open limits to the street, facades of buildings that allow informal surveillance, streets with pedestrian priority, presence of furniture, and cleaning and maintenance from the environment. In relation with this gender perspective in public space, the study “Security and Public Space: Mapping of metropolitan policies with a gender perspective” is very interesting [19]. Among the methods used to address violence against women and girls in cities, preventive policies through urban design are precisely highlighted. Specific experiences in different countries can be consulted. The Seoul experience is highlighted, where some urban improvement measures have been implemented: glass-walled elevators, cameras, greater street lighting, and mirrors to avoid blind spots in parks, parking lots, residential areas, and school grounds.

The research made by Minguez, Martí and Vera [20] on “Keys for projecting comfortable public spaces” also exhaustively develops the concept of perception of security through indicators. In the words of the authors: *"in order to achieve an environment free of threats, there must be social cohesion as well as designing the city so as to enhance the visibility of the space and its transparency, using architectural elements that promote natural vigilance among fellow citizens."* One of the most important aspects that the authors highlight is achieving the diversity of uses to guarantee variable flows throughout the day, a fundamental aspect included by most of the analyzed research [21]. Visibility and transparency are achieved through the following physical aspects: proportion between the road section and height of buildings, the building typology (without residual spaces), the use of vegetation as a protection element, or the pedestrianization of public space.

The work of Páramo and Burbano [22] adds a new attribute with respect to previous investigations: surveillance through mechanical means. This work makes a documentary exploration on the indicators that measure the quality of life in cities, particularly in their public spaces. In relation to security, different types of crimes, vandalism and damage to public space are addressed, and the presence of the police, security personnel and the presence of cameras are indicators to be taken into account in situational crime prevention.

From all these investigations the most repeated design factors and indicators are compiled, and it is highlighted the consensus from the different disciplines - from Law, Sociology and Psychology, or from Urban Planning - regarding the need to complement aspects of architectural design with other social cohesion measures and policies for good crime prevention.

3. Methodology

The following methodology is developed based on a bibliographic review of previous research on urban design and safety, the development of citizen surveys on aspects that influence street safety, and the use of criminal maps.

3.1 – Phase 1: Preparation of a system of indicators based on a bibliographic review and the preparation of citizen surveys.

The selection of indicators on security in urban space is made from a bibliographic review of previous research that relates urban design and security. To do this, these investigations are analyzed and the aspects that influence street safety according to them are extracted. Also, some tools and experiences carried out in some cities in the international context are analyzed in order to incorporate specific parameters into the indicator system.

Results from surveys carried out on citizens about aspects that influence street safety are added to the list of indicators. The people surveyed have quantitatively and qualitatively assessed the most influential aspects for safety in the urban space. They have selected three aspects of public space, which in their opinion make it a safer place and three other aspects that produce the opposite effect: generating insecurity. The survey leaves open the possibility of adding new indicators that have not been considered in the initial database. In this way, a list of parameters previously established from this research work, has been expanded by citizens based on their own experience.

The results of this survey are also used to weigh the greater or lesser influence of each of the aspects considered. Each indicator is evaluated on a scale of 1 to 5 and, multiplied by a weighting factor, based on survey results. The measurement of all the indicators in the same urban space, allows to quantitatively assess the security in this space, as well as to know what aspects could be improved for greater security. GoogleForm forms have been used to carry out digital surveys (up to 300 responses).

3.2 _ Phase 2: Application of the indicator system to a selection of street samples through the use of criminal maps.

In this phase, a sample of streets in the city of Malaga has been chosen, and the indicators have been applied to the different urban spaces selected, evaluating their safety in a comparative way. For the selection of streets, a criminal map of the city of Malaga has been used. This map has been built from the information of criminal data provided by the Police, and its geolocation in the city of Malaga through the use of the QGIS georeferencing program. For the selection of streets, two types of crimes have been considered: those that require crowding, such as thefts by distraction; and those that occur more frequently due to the lack of traffic and people in the urban space.

The objective of this phase is to test, from the official crime data, whether the established indicators efficiently measure street safety. Once the measurement of all the indicators in the different selected streets has been evaluated, a number from 1 to 5 is obtained, which allows knowing the degree of security of each one. Beyond this quantitative assessment, the indicators allow to know which aspects of urban space can be improved to be considered safe spaces.

3.3 _ Case study: city of Malaga

The research work, and specifically, the selection of street samples for the application of the indicator system, focuses on the area of the historic center of the city of Malaga, in which there has been an intense tourist development in the last ten years especially. The criminal map of the city (built from confidential crime data provided by the Police, 2018-2019) clearly shows a higher concentration of crimes - attending to those that occur in public space - in the historic center than in other Malaga neighborhoods.

This urban area supports a very strong load pressure as it is a central space for the entire population of the city, and for a high number of tourists. The high concentration of people in a relatively small

urban space (compared to other Spanish cities) has been favored by a process of pedestrianization of streets that began in the early 2000s. These crowding conditions can favor, in some cases, certain types of crimes such as theft in public spaces. Hence, the selection of streets also meets agglomeration criteria as indicated in the results section.

4. Results and discussions

Phase 1: Development of the system of indicators

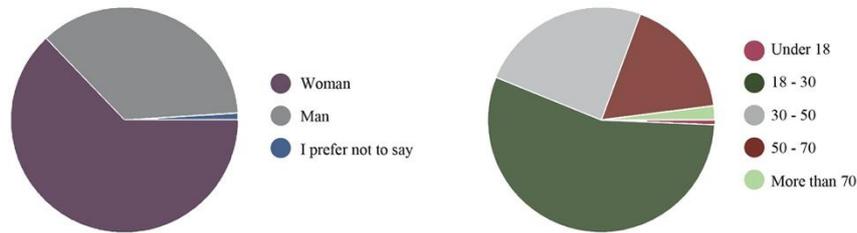
From the analysis of previous research – check the state of the question- and the obtaining of specific parameters derived from these investigations, the aspects to consider in the preparation of the system of indicators are listed (see also Table 1):

Table 1. Preparation of indicators based on previous research and description. Own elaboration.

INDICATORS	DESCRIPTION	REFERENCES
1. Lighting	Amount of street lighting and intensity	- [5], [6], [9], [15],[21]
2. Furniture of stay in the street	Presence of furniture that invites you to stay	- [18]
3. Presence of pedestrian streets	Type of traffic: existence of pedestrian roads on the street	- [17], [18], [20] ,[21]
4. Presence of roads	Type of transit: existence of roads	- [9], [15]
5. Existence of public parks or large areas of free areas near	Existence of large green areas	- [9], [20]
6. Urban elements that impede visual control	Existence of any element that impedes vision and therefore does not let behind it	- [6], [14], [18] , [20]
7. Transit of people	Flow of people	- [6], [8], [14], [18], [20]
8. Police presence and surveillance with other security measures	Existence of surveillance personnel or street cameras	- [22]
9. Spaces that favor the concentration of people	Streets that invites the crowds	- [8], [14], [20]
10. Urban deterioration (lack of cleaning, deterioration of buildings and other elements of public space)	Neglected streets or empty lots. More deteriorated 0 -less 5	- [5], [6], [14], [18]
11. Main commerce use	Existence of shops in the area. Proportion of street bass occupied by open premises	- [5],[8],[15]
12. Main home use	Buildings from B to B+10	- [5],[8]
13. Main tourist use	Buildings from B to B+10	- [5],[8]
14. Diversity of uses	Mixture of uses (residential, industrial, tertiary and tourist)	- [6], [8], [14], [15], [16], [20]

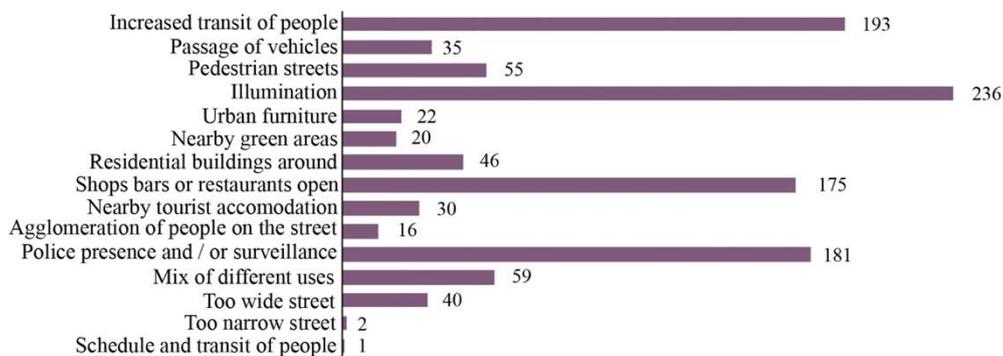
Based on this developed database, it is considered that not all indicators are of equal importance when measuring and perceiving street safety. For this reason, a survey model has been developed with the objective of obtaining data on the perception of citizens. The most remarkable results of the surveys have allowed, on the one hand, to weigh the influence of each one of the proposed indicators, and on the other hand, include new aspects or indicators that had not been previously considered. The age and sex of the interviewees are considered as important data, since this can influence the perception of spaces.

Figure 1. Results of the survey carried out on 300 people through GoogleForm. Data on age and sex.



The survey has more answers made by women than by men. This can contribute the fact that the issue of security in public worries women more than men. On the other hand, the age of the respondents is mostly between 18 and 30 years old.

Figure 2. Results of the survey carried out on 300 people through GoogleForm. The indicators that provide more security to the street according to the opinion of citizens.



Therefore, as a result of the surveys, the three parameters or indicators, which according to the citizen perception, provide more security to the street are: [1] lighting, [2] greater traffic of people and [3] police presence. On the other hand, the indicators that make streets be more unsafe are: [1] little or no lighting, [2] little traffic and [3] the existence of neglected streets or empty lots.

This choice can be different when analyzing the responses of women and men. The responses of women are usually based, for the most part, on crimes such as sexual assault, intimidation and violence. In the case of men, their responses are usually derived from another type of origin, such as the crimes of physical violence and robbery, or theft.

With the results of the surveys, the indicators of the initial database have been weighted and the aspects suggested by the respondents have been added. Oversizing of the streets was one of the aspects that have been provided by respondents (2 replies). Other interviewees (2 replies) have included the social aspect as determinant of street safety (they have mentioned the presence of people of social exclusion on the streets). This "social" indicator has not been included in the list of indicators for the reason that this study aims to focus on urban design attributes. However, it considers that social aspect is a determining factor influencing the safety of the streets. In some way, social diversity is incorporated through the diversity of uses, traffic and natural surveillance of the streets. In any case, this indicator system is not regarded as a single tool but it should be completed with other methods based on promoting social cohesion. See the conclusions section.

Table 2. Preparation of indicators based on the results of the surveys. Own elaboration.

INDICATORS	DESCRIPTION	REFERENCES
15. <i>Good proportionate dimension of the street</i>	Streets too wide or too narrow	- [5], [8] ,[20]

Indicators values have been weighted with the results of surveys based on the number of respondents who selected each of the indicators. The evaluation is set from 0 to 5 points (less security 0 - 5 extra security) and then multiplied by the weighting factor set. Each of the streets to be evaluated in two different time periods: a period of day (8:00 to 20:00) and another period at night (20: 00-8: 00). It has been considered a spring schedule in Spain (Length: O 4 ° 0'0 "Latitude: N 40 ° 0'0")

Figure 3. Final indicators of qualities of urban space that influence safety. Measurements and weighting. Source: self made.

QUALITIES OF URBAN SPACE								
	0 - None	1- every 100m	2- every 70 m	3- every 50 m	4 - every 30 m	5 - every 10 m	Survey score (300 people)	WEIGHT FACTOR
1. LIGHTING							236	0,2
2. FURNITURE OF STAY IN THE STREET							22	0,01
3. PEDERASTIANS STREETS	0-0 pedestrian routes	1-1 or more pedestrian routes (total size 2m)	2-1 or more pedestrian routes (total size 5m)	3-1 or more pedestrian routes (total size 10m)	4-1 or more pedestrian routes (total size 20m)	5-1 or more pedestrian routes (total size 25m or more)	55	0,03
4. ROADS	0 - None	-	-	-	4 - 1 lane	5 - 2 lanes	35	0,02
5. EXISTENCE OF PUBLIC PARKS OR LARGE AREAS OF FREE AREAS	0 - It does not exist	1 - zone 100 m2	2 - zone 200 m2	3 - zone 300 m2	4 - zone 400 m2	5 - zone 500 m2 or more	20	0,01
6. URBAN ELEMENTS THAT IMPEDE VISUAL CONTROL	0- more than 15 elements	1- 12 elements	2 - 9 elements	3 - 6 elements	4 - 3 elements	5 - 0 elements	55	0,03
7. TRANSIT	0- 0 people per 5 min or more than 60 people	1 - 10 people per 5 min	2 - 20 people per 5 min	3 - 30 people per 5 min	4 - 40 people per 5 min	5 - 50 people per 5 min	193	0,1
8. POLICE OR SECURITY PRESENCE	0 - no police presence /no security or presence of cameras	2 - presence of surveillance cameras	2- presence of several surveillance cameras	3 - police presence/security (low)	4 - police presence/security (high)	5 - police presence/constant follow-on and cameras	181	0,1
9. EXISTENCE OF CROWDS	0- None	1- 5 people	2- 10 people	3 - 20 people	4 - 50 people	5 - more than 50 people	16	0,01
10. STATE OF DETERIORATION OF URBAN SPACE	0	1	2	3	4	5	102	0,08
15. GOOD PROPORCIONATE DIMENSION OF THE STREET	0	1	2	3	4	5	40	0,03
OTHER								0,08
TYPOLOGIES AND INFRASTRUCTURES								
	0 -0%	1 - 10 %	2 -25 %	3 - 50%	4 -75%	5 -100 %	Survey score (300 people)	WEIGHT FACTOR
11. COMMERCE							175	0,14
12. MAIN HOME USE	0 - 0	1 - GROUND FLOOR	2 - B+1	3 - B+2	4 - B+3	5 - B+4 or more	46	0,03
13. MAIN TOURIST USE	0 - 0	1 - GROUND FLOOR	2 - B+1	3 - B+2	4 - B+3	5 - B+4 or more	30	0,01
14. DIVERSITY OF USES	0 - 0 uses	-	2 - 1 use	3 - 2 uses	4 - 3 uses	5 - 4 uses	59	0,04
OTHER	0	1	2	3	4	5		0,08

Phase 2: Application of the indicator system to a selection of street samples through the use of criminal maps

At the same time, the research project deals with confidential data (which cannot be published) provided by the national police on crimes that occurred in 2018-2019 in the city of Malaga. These data include information about the time of occurrence, location, and victim information for each of the registered crimes. Only crimes occurred in public spaces have been considered for the research.

In order to obtain the samples, the analysis has been based on two groups of crimes: those favored by the existence of crowds [x] and those that occur due to the lack of presence of people [y]. That is to say, the agglomerations are going to incite specific kind of crimes such as the theft of personal elements, by absent-mindedness and distraction, while the scarce presence of people invites other types of crimes where generally, greater violence is implied, such as sexual assault, theft with force or robbery of vehicles. In the latter case, the existence or presence of people is not considered only in public space, but also the lack of natural vigilance in the environment adjacent to the street due to its main use (theory of eyes on the street).

Two streets in the busiest area of the city center -with high concentration of people- have been chosen [23]; they may encourage crimes of the first type [x]. Two other streets in not so busy areas have also been chosen which may arise crimes of the second type [y]. The street names cannot be revealed. The two busy streets are identified: [a] and [b] and those two less busy ones: [c] and [d]. They have a similar length. Selected samples have the following offenses in public space:

Table 3. Crimes occurred in the urban space. 2018-2019. Source: national police

STREETS [X]	STREETS [Y]
Street [a]: - 0 crimes.	Street [c]: - 1 theft crimes. Modus operandi: robbery with force. - 1 crimes of motor vehicle theft. Modus operandi: unknown. - 1 crime: theft. Modus operandi: unknown. - 1 crime: robbery with violence and intimidation. Modus operandi: ph violence; - 1 crime: robbery with force in things (fracture of a bowler hat on a construction site)
Street [b]: - 1 crime: theft. Modus operandi: carelessness. - 1 crime: theft. Modus operandi: pickpocketing.	Street [d]: - 1 crime: robbery with violence and intimidation. Modus operandi: ph violence. - 1 crime: vehicle damage, modus operandi: Vandalism. - 1 crime: theft. Unknown modus operandi. - 1 crime: theft inside the vehicle. Modus operandi: unknown

Table 4. Result of the application of indicators to the samples of chosen streets. Rating from less security (0) to more security (5).

Indicator	Street[a] day	Street[a] nigth	Street[b] day	Street[b] nigth	Street[c] day	Street[c] nigth	Street[d] day	Street[d] nigth
1	5	5	5	5	5	4	5	4
2	3	3	1	1	3	3	0	0
3	3	3	3	3	2	2	3	3
4	0	0	4	4	5	5	0	0
5	0	0	5	5	0	0	3	3
6	5	5	0	0	1	1	1	1
7	5	5	4	4	5	0	0	0
8	5	5	5	5	0	0	0	0
9	5	3	5	0	0	0	0	0
10	0	0	5	5	3	3	1	1
11	5	0	5	0	5	0	5	0
12	0	0	4	4	5	5	5	5
13	5	5	4	4	2	2	0	0
14	4	4	5	5	5	5	2	2
15	5	5	5	5	3	3	5	5
Total score	3,38	2,66	3,65	3,33	3,04	1,64	2,85	1,45

As a result of the evaluation of the samples (Table 4) it can be concluded that those streets that invite crimes of type [x] have a higher score based on the safety of urban elements, compared to the sample streets for the crime [y]. In the case of the street [a] it is a street in the busy historic center which presents a good score during the day due to its good lighting characteristics and frequency of pedestrian next step with the police presence. However, at night, the score decreases considerably, among other things, limited presence of uses night as locals are closed and there is no residential use. Street [b] is a busy street for tourists and with similar characteristics to the previous one. Instead, at night, there is a mixture of active uses, the existing homes, premises and restaurants open. For this reason, it is the street with the best score. However, in this street two counts of larceny that is associated with crowds and high traffic of tourists occur. On the other hand, the streets [c] and [d] are characterized by a considerable influx of people during the day, but very little at night. Lighting quality is lower than in the samples [a] and [b]. Police and surveillance presence is also null, although they are areas with residential use. The results show, based on the values obtained from the indicators, that security at night is low in these two streets.

5. Conclusions

The main contribution of this work is the preparation of a specific system of urban design and street safety indicators based on the combination of different methodologies: a review of previous research, the use of citizen surveys and their perception of security, and the use of criminal maps in the city of Malaga. The results obtained when checking the efficiency of the indicators show consistency with the data from official crime records, inviting an increase in the number of streets analyzed and extending the study to other areas of the city, including other cities. The proposed system of indicators allows to quantitatively assess the safety of the streets, and in a qualitative way, to know the architectural and urban aspects that can be improved to increase their safety or perception of safety. This aspect may be of interest in order to implement measures in the design or renovation of urban spaces. However, its application is not presented as a unique tool, but must be complemented by other social strategies and policies that promote social cohesion and the sense of identity of local communities.

Regarding the methodological approach, it is necessary to expand the research in relation to various aspects. The perception of insecurity is not the same for men as for women, and possibly, the weighting of the indicators differs if it is done independently, distinguishing between sexes. Likewise, the distinction of the type of crimes has been incorporated between those that require the presence of overcrowding, or those that, on the contrary, occur in the absence of traffic and people in the urban space. In relation to the former, the weighting of certain indices such as the overcrowding in the streets could be adjusted, to the detriment of others. On the other hand, the high impact of some of the indices, such as the lighting index, is identified, which suggests that they should achieve a minimum score, and if not, establish a weighting system that penalizes the rest of the attributes. In any case, the indicator system is a base tool of scientific interest that invites to expand research at a methodological level, and in relation to the field of study in other cities.

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