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URBAN LIVEABILITY AS RESULT OF DIFFERENT ASPECTS

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ABSTRACT

Nowadays it is possible to identify a series of parameters that contribute to defining the liveability characteristics of a public space. It is important that all the parameters are satisfied because they are elements that interfere with each other. Morphological characteristics, which partly contribute to defining the environmental performance of the space, together with the functional characteristics of the area, determined by the presence of activities, must be assessed together; however, evaluating them not only in qualitative but also in quantitative terms is not always easy to do. The paper presents a way to evaluate this characteristic of urban space through examples.

Key words: urban liveability, morphology, environmental sustainability, attractiveness, qualitative-quantitative evaluation.

1. INTRODUCTION

One of the objectives that local administrations are aiming for, is linked to the improvement of the environmental sustainability and urban liveability, even if the strategies for achieving the objective are often not clear. It can be stated, at the institutional and Community level, and in particular starting from the 1990 with the green book on the urban environment "Towards a thematic strategy on the urban environment", that the model of a compact city, i.e. a city that offers the mix of functions, and favors a pedestrian and slow mobility, is considered the most sustainable reference model from all points of view.

However, we note that many people leave the city to live in smaller villages and cities not far from the town, looking for better quality of life linked to the size of the house (which generally outside the cities costs less), and the presence of green areas, both private and public. Without going into the reasons that push people to leave the city, we must focus at least on some crucial aspect, which represents a real paradox (as reported by Neuman, 2005, 15; Dessì, 2015, 77): what is considered environmentally sustainable by local and regional policies is not always perceived as a liveability process by the inhabitants of a city. On the contrary, the risk that the compact city attracts people who have moved out of the city, and who move by private cars increases the risk of congestion, pollution, noise, etc.

Can we affirm that environmental sustainability and urban liveability must start from the quality of public spaces? How can we improve and evaluate the quality of urban space?

It is difficult to explain why public spaces with similar morphological characteristics and similar localization have very different attractive capacities, and it is equally complicated to demonstrate how very different spaces can trigger similar livability and vitality dynamics.

In reality, it is becoming increasingly clear that liveability is the result of a mix of elements that affects people's perception of space. The problem persists when we decide to measure the level of liveability, because the elements are not always quantitative, but often psychological, qualitative.

The paper proposes an evaluation of the livability of a kind of urban space, the urban street, using an indicator developed by the Barcelona urban ecology agency and adapted for the Italian context in some passages. The objective of this index is to establish the necessary indicators to evaluate each of these effects according to the answer in a human scale.

2. HOW TO ASSESS THE URBAN SPACE LIVEABILITY

The urban livability index of the Barcelona urban ecology agency is a number, the result of the sum of the contributions belonging to three categories of different variables, i.e. morphological, psychological (related to attractiveness) and environmental. It's interesting to mention that all the variables are comparable because a numerical value from 1 to 5 is associated (1 is the lowest value and 5 the highest one) not only to the quantitative variables (for example the values of air quality, or accessibility), but also to the psychological ones, linked to the capacity of activities and the perception of greenery to attract a mix of people and other functions that allow the urban space to be recognized as livable and vital.

The first category includes geometric variables concerning the relationship between the dimensions of urban space (measured with the sky view factor, that is, the portion of the sky visible from a point of the space), the accessibility (measured in terms of slope and width of the pavement) and the percentage of the whole space reserved for the pedestrian.

The second category includes the psychological variables, i.e. the ones able to activate mechanisms of space attractiveness, such as the functional mix (measured in "bit" with the Shannon formula), the type of activity, and the presence of green as a catalyst element. Compared to the original model, a weight (in negative) is given to closed shops. The negative value is very low (-0.2), as in fact the presence of a closed shutter is not very decisive; the weight is relevant, instead, in the case of many closed shop shutter. Another important category includes the environmental variables that determine the thermal, acoustic and air quality comfort.

The paper aims to verify with this index the liveability level of two types of streets, but also to verify the variation due to the modification of some variables on one of the two streets. The potentiality of the indicators is not only in the verification of a number, but also in the possibility of considering the indications on where to focus the interventions deriving from a low score, in particular if concentrated on a category of variables. It is also true that the modification of one or a group of variables also has repercussions on the other variables.

Each of the variables has been calculated for the entire street as a single stretch or as average of small stretches with the value between 1 and 5. It is clear that a subsequent intervention will focus mainly on the specific points with the most criticalities that in the average value often disappear.

Tab. 1. Fundamental elements that identify the livability index of the urban space and the area around. Source: Agencia Ecologia urbana de Barcelona

LIVABILITY OF THE URBAN SPACE			**LIVABILITY OF THE AREA**
MORPHOLOGY **Ergonomic**	ATTRACTION **Psychological**	WELL-BEING **Physiological**	ACCESS **Proximity**
Distribution of the street space	Degree of urban diversity	Thermal comfort	Accessibility to public transportation, stops, bicycle nets and urban paths
Degree of accessibility	Percentage of attractive activities	Pollution level	Proximity to daily activities
Sky view factor	Perception of green volume	Daily sonorous level	Accessibility to equipment

3. ANALYSIS AND PROPOSALS: COMPARISON BETWEEN REAL CASES

The first comparison refers to two streets in Milan, via Pirelli and via Sammartini both near the Central Station, the most important train station in the city.

Via Pirelli is a street on the East-West axis, on which buildings of variable heights, between 6 and 20 floors face. If we consider the first stretch about 500 meters long, even where the multi-storey tower-type buildings are at a certain distance from each other, the continuity of the street is guaranteed by a basement, that is a continuous commercial front about 10 meters high on which buildings arise. It is a two carriageways street, one in each direction, and with the possibility of parking on the sides. At the ground floor there are commercial activities, entrances of residences, offices or hotels. The section is on average 18-20 meters (including sidewalks), although in some sections the section widens up to 30 meters.

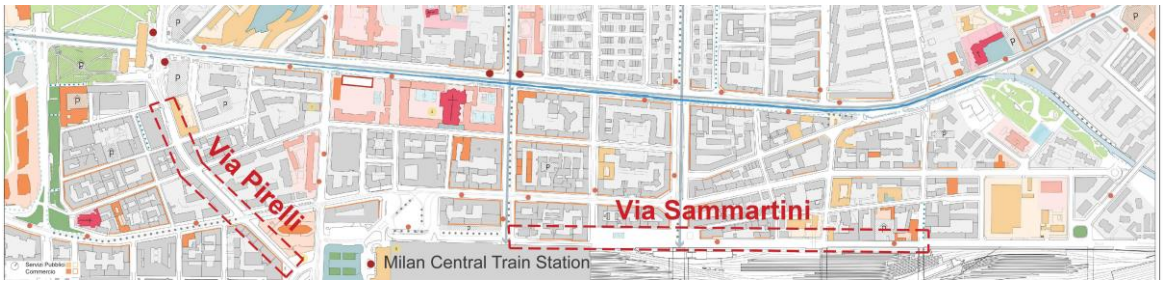

Fig. 1. Map of part of Milan in which are visible the 2 streets and the train station. Source: Elaboration at the Design Studio at AUIC School at the Politecnico di Milano (2016-2017)

Via Sammartini is located along the elevated railway line about 10 meters above street level; the side of the street under the railway is occupied by warehouses (now mostly closed or not open to the public). Residences or buildings with specific non-residential functions occupy the other side. The street is on the North/East-South/West axis, and is wider and less congested than via Pirelli; the section is approximately 26 meters wide.

The flat sidewalks of via Pirelli are around 3 meters wide, including parking space in line. The assessment of accessibility according to the approach of the urban ecology agency of Barcelona, assigns a score equal to 3. In via Sammartini the sidewalks are wide on average 3 meters (in some places less) therefore the score is 4.Due to the distribution of the pedestrian area in via Pirelli, largely dedicated to the carriageways and car parks in the street, and then quite scarce compared to the total of the space (about 100,000 m^2, up to the clearing that joins viale Melchiorre Gioia on the north), the score is equal to 2.5, while in via Sammartini it is equal to 1.

For via Pirelli, dimensional ratios are assessed at different points on the street and at the clearing, while in via Sammartini the central sections are taken into account, thus excluding the two parts at the beginning and the end of the street. This last variable is evaluated in a slightly different way from the original method, because it is expected that over a certain amplitude the street may be perceived as an extra-urban road, therefore opening values over 90° are considered with a score lower than 5.

Tab 2. Table with correspondence of dimensional ratio and sky view factor of a street and score associated to different values

Dimensional ratio (H/D)	**Sky view factor**	**mark**
0,5<H/D<1	53°<SVF<90°	5
1<H/D<2	28°<SVF<53°	4
0.35<H/D< 0.5	100°<SVF<90°	3
2<H/D<3.5	18°<SVF<28°	2
H/D>3.5; H/D<0.35	SVF< 18° SVF> 100°	1

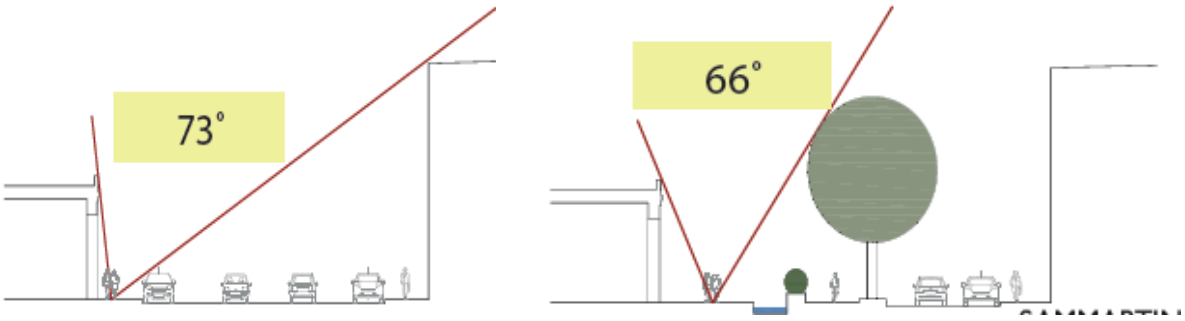

Fig. 2. Example of different sky view factor values of the same street before and after a design proposal. Source: Elaboration at the Design Studio at the AUIC School, Politecnico di Milano (2016-2017)

The second category corresponds to the variables that define the attractive quality of the space, therefore the functional mix, the type of activity and the volume of greenery. The first variable, called urban diversity, has been calculated considering a range of about 60 possible commercial activities that may be present in the urban space. For via Pirelli what emerges is that the evaluation is at the current state medium-high, equal to 3; in fact, the street is dense of offices and residences, connecting via M. Gioia with the central station, both for those who travel on foot or by car. In this case, with respect to the original evaluation model, the highest score is expected to be associated to a value, in terms of bit, equal and greater than 4 (the original model considers the score of 5 for 6 bits and more). The quality of the activities is also high: are present retail businesses or bars that make the street vibrant and “hospitable” during the whole day. The evaluation of this parameter is 3.7.

Via Sammartini has a low value, equal to 1.9, due to the dispersed and in any case limited presence of activities. In addition, the quality of the activities is not high because services with a strong attraction are not easily found, but rather warehouses, nightclubs and parking lots; in fact the score is equal to 1.2. The warehouses closed in this street offer a scenario of abandonment that discourages the presence of people. For each "closed shutter" a slightly negative value has been assigned, which affects only when the closed warehouses, which represent a potentiality for the project, are very numerous. With this consideration, the score would go down to 0.6.

The volume of greenery is significant only for a small stretch of via Pirelli, as the other part is without green. For this reason, the positive contribution is strongly attenuated when considering the average of the whole street. The overall score is equal to 1. In via Sammartini, the presence of greenery is related only to the equipped garden, partly vegetated, beside a basketball court above an underground parking lot, therefore the value is equal to 1.

The third category corresponds to the environmental variables, linked to the assessment of the environmental comfort of the person who carries out activities in the urban space, and in particular thermal and acoustic comfort and air quality. Regarding thermal comfort, it is advisable to evaluate it at least in three moments of a summer day and in different points of the space. The average will provide a unique value, but in subsequent considerations related to a project intervention, it will be necessary to focus on areas that are far from thermal comfort conditions. In the case presented in the paper, spot environmental measurements were made. Actually, the measurements should be taken at different times of the day and for several days at the same time. The measures are also useful for calibrating a simulation model. Simulations can be used in the design phase to evaluate the proposals and make comparison with the status.

The thermal comfort evaluation of the current state, under the sun, and in the central hours of a hot summer day, in via Pirelli is equal to 2, while in via Sammartini it is equal to 1.

The evaluation of the acoustic conditions is based on the measurement of the decibel (which can now be detected through telephone applications) to be referred to the normative indications that come across the EU from directives translated into national law). In via Pirelli the value is equal to 2, while in via Sammartini, less congested, the value is 3. The presence of trains, in spite of what we might think, does not increase the noise in the street, because they are at a higher level than the street, and for the presence of a massive railing.

In both the streets, the air quality value is low, according to the entire area of Milan (homogeneous area), and with the morphology of the street, as well as with the absence of vegetation that can help in this concern.

An important aspect emerges and refers to the functional mix and the presence of retail and food commercial activities, that have a very high attractiveness and represents an important key to improve the liveability of urban places. Via Pirelli is a welcoming street during the day and in the evening, via Sammartini no, and the score proves it. Furthermore, the environmental conditions are favored in via Pirelli because the higher buildings cast shadows even during the day. Via Sammartini, especially in the first part of the day and in summer is much more exposed to critical conditions of overheating and therefore of discomfort.

Considering the results, both partial and general of the two urban spaces, we can wonder how it is possible to improve liveability conditions in particular in the street with the most critical issues, via Sammartini. About what and how should action be taken? Which are the elements that most of all bring positive effects also on the other aspects? A significant response concerns the proposal (among those developed in the final Design Studio on open spaces within the AUIC school of the Politecnico di Milano) which starts from the analysis of the elements that determine urban liveability and show a critical condition, however, evident at a glance. The evaluation of the nine parameters defines a base also for the design proposals. In general, the proposals focused on the possibility of increasing the attractors, on how to improve the slow mobility and the use and perceptive quality of the public space. These proposals also led to the improvement of the environmental conditions, for which it was still proposed some complementary interventions.

Going further into a particularly effective proposal, slightly different interventions are envisaged on the street, which have in common the rebuilding of the pavement in pedestrian areas, far increased, the use of trees and shading systems and water along the paths, seats. The asphalt therefore remains in the carriageways for car traffic while in the pavement areas there is a light stone, stoneware in the seating areas and then teak wood inserts, grassy spots, and shallow water basins and stretched to follow the courses or the seats.

The two carriageways develop at the sides (taking up the space previously left for car parking), while the pedestrian area develops mainly in the middle; for this reason there are two rows of trees in the center, or alternatively a light cover that protects and makes the central path recognizable. The sidewalk on the west side remains practically the same, around 3 meters, and in some cases over 4, while on the east side 2-3 meters increases up to 5.5 meters.

By looking at the results of the current state and the project proposal on via Sammartini, it can be seen that a general improvement has taken place in all aspects. Although it is an existing and apparently not modifiable fabric, a strategy has been proposed which allows to associate this new space with the shape and size of a city street in the compact and traditional fabric of the city of Milan. As mentioned above, the aim to increase the cycle-pedestrian space by reducing the space reserved for the machines is the base of the proposal. On one side the sidewalks have been extended (improving the aspect of accessibility), a central area has been left for pedestrian moving and sited activities, bringing the ratio between pedestrian space and the whole area from 17% to 76%, and therefore to an improvement in the index score linked to pedestrian space from 1 to 4. The aspect linked to the dimensional ratio, in terms of sky view factor, especially in certain points of the street, has been improved. The presence of rows of trees has in fact reduced the sky opening, and allowed to bring the score from 4 to 5.

Fig 3. View of the status of via Sammartini. Source Google Maps

Fig 4. Plan of a design proposal of via Sammartini. Source: proposal elaborated during the Design Studio of urban spaces at the AUIC School at the Politecnico di Milano (2016-2017)

Fig 5. View of the status of via Sammartini. Source Google Maps

Fig 6. Section of a design proposal of via Sammartini. Source: proposal elaborated during the Design Studio of urban spaces at the AUIC School at the Politecnico di Milano (2016-2017)

The attractiveness has been improved first due to the presence of more vegetation, especially row trees, or in groups in the wider areas, and secondly by encouraging the presence of commercial activities. The aim is to encourage the presence of different type of activity instead of only one type, such as bars and restaurants. This strategy can contribute to attracting a mix of different people throughout the day and evening. However, the types of activities have also been identified among those that have greater attractiveness, in particular, in addition to some other bars and restaurants, also retail stores for food, self-care, clothing, etc., which can be placed in the warehouses, now closed, under the railways, which should be taken into consideration in a regeneration process of the entire area.

Strategies related to the reduction of car traffic and the increase in green areas are expected to lead to a reduction in noise pollution levels and to an improvement in air quality. The expectation is legitimized by the comparison with streets similar to the proposal with acceptable acoustic conditions. These strategies certainly lead to an improvement in the thermal comfort conditions, further improved thanks to the use of lighter materials compared to the asphalt of the roadways and pavements, to the increase of permeable areas and to the presence of water near the seats and paths.

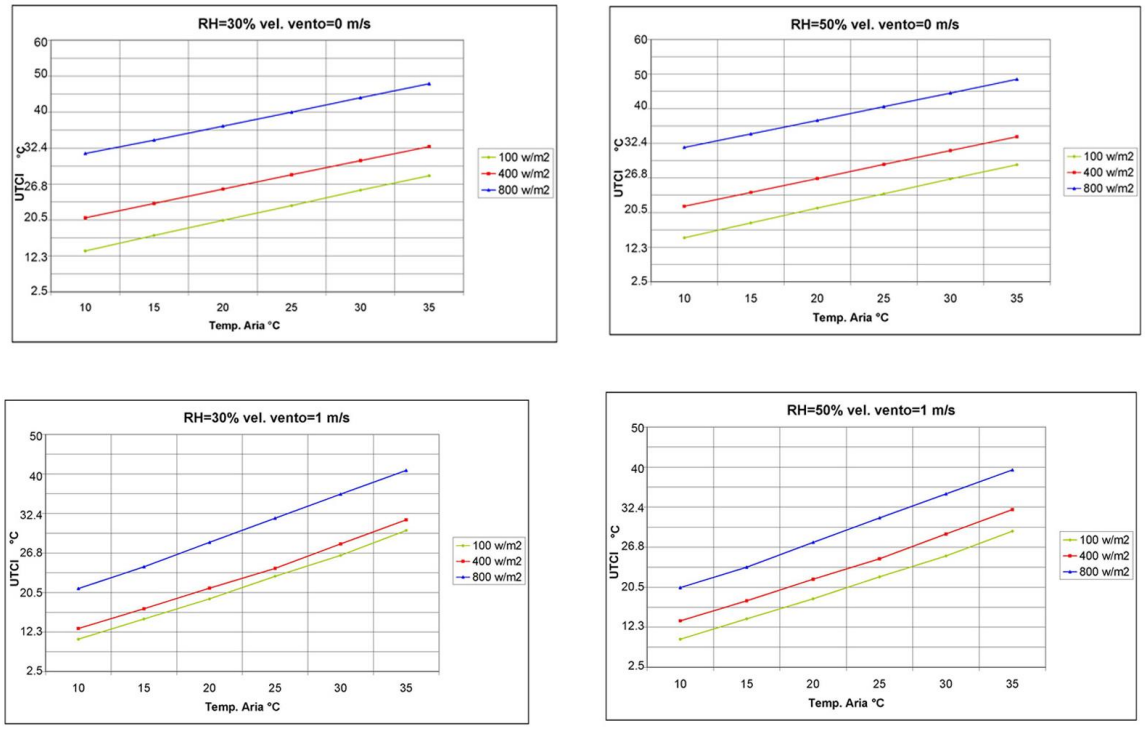

Fig. 7. Four of the nine nomograms representing thermal comfort conditions (UTC) varying solar radiation and air temperature. Each nomogram represents one specific condition as combination of relative humidity (30, 50 and 80%) and wind velocity (0,1 2 m/s).

In particular, thermal comfort, as already mentioned, is the result of a series of strategies. For example, the presence of trees, which currently corresponds to 2% of the area's volume, with the project passes to much more interesting percentages, between 40 and 50% depending on the area. Presence of trees means reduction of the incident radiation component on the people, on the horizontal and vertical surfaces that do not overheat, and MRT values that contribute to reducing the heat balance on the person and therefore to improve the comfort conditions.

To evaluate the comfort conditions of the existing situation, measurement tools can be used, while for the project it would be opportune to perform simulations of thermal behavior in dynamic regime. A simplified alternative is represented by the use of nomograms that evaluate the variation of UTCI (the comfort indicator linked to the energy balance of a person outside) when the parameters of air temperature, solar radiation, wind speed, relative humidity, obviously for locations characterized by specific latitude and altitude.

Using the same nomograms, both for the current situation and for the project, the contribution of the strategies is clearer and it is possible to think about further improvement with the strengthening of strategies already proposed or defining the implementation of others. In this case, for example, in the current state at 3 p.m. (2 p.m. solar time) on a very hot and sunny day in May (solar radiation 665 w/m2, air temperature 26.61°C relative humidity 35%), the values of UTCI were around 37° C (the comfort threshold is around 27° C), while in the shade with the implementation of the design strategies, the UTCI is expected to be around a value of 24 °C, i.e. within the range of acceptable thermal comfort conditions.

4. CONCLUSIONS

The study involved the analysis of two types of streets in Milan, different for configuration and presence of functions. Both are located in strategic areas of Milan, being very close to the central station, but in fact very different in physical characteristics and liveability levels. The analysis and therefore the comparison achieved through the Barcelona liveability indicators, slightly modified in some aspects (in particular for the calculation of urban diversity and morphology) showed some differences above all in terms of the amount of space dedicated to people compared to cars, and to attractiveness, i.e. the presence of people and the functional mix. Even the thermal comfort conditions are more acceptable in via Pirelli than in via Sammartini. Due to its structure and functions, the possibility of improvement of via Pirelli is much lower than in via Sammartini, which has important potentials that could improve liveability in many aspects and completely transform the face of the street.

Tab. 3. Livability condition of the current status of via Pirelli and via Sammartini, and about the design proposal of via Sammartini. The reported scores are related to each parameter, each category and the general livability condition.

Categories	**Variables**	**Score** (Current state)		**Score** (design proposal)
		Via Pirelli	**Via Sammartini**	**Via Sammartini**
Ergonomics		**3.2**	**3**	**4.7**
	Pedestrian space	2.5	1	4
	Accessibility	3	4	5
	SVF(Sky View Factor)	4	4	5
Attractiveness		**2.6**	**1.2**	**4.8**
	Urban diversity	3	1.9	5
	Quality of the activities	3.7	0.6 (1.2 if closed shop shutter are not taken into account)	4.3
	Green volume	1	1	5
Environmental		**2**	**1.6**	**3.7**
	Thermal comfort	3	1	5
	Acoustic comfort	2	3	4
	Air quality	1	1	2
Total		**2.6**	**1.9**	**4.4**

The presented proposal is very focused on the activation of strategies that can incentivize the presence of people (residents and occasional one), both because the pedestrian area is expanded, by improving the fruitful and environmental characteristics, and because the increase of the presence of commercial and receptive activities that can bring people all day long. For this reason, it is expected that the improvement can be quantified from a score 1.9 to 4.4.

It must be said that the project itself is not sufficient to guarantee the urban regeneration of a place but it is fundamental to support and guarantee over time a mechanism, which must however be part of a broader strategy triggered by the policies of the municipality, and which involves the stakeholders and the resident community.

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