

PROCEEDINGS OF THE XXIV<sup>TH</sup> INTERNATIONAL CONFERENCE ON LIVING AND WALKING IN CITIES (LWC 2019), BRESCIA, ITALY, 12–13 SEPTEMBER 2019

# Pedestrians, Urban Spaces and Health

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**CRC Press**

Taylor & Francis Group

Boca Raton London New York

CRC Press is an imprint of the  
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A BALKEMA BOOK

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*Typeset by Integra Software Services Pvt. Ltd., Pondicherry, India*

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*Library of Congress Cataloging-in-Publication Data*

Applied for

Published by: CRC Press/Balkema  
Schipholweg 107C, 2316XC Leiden, The Netherlands  
e-mail: Pub.NL@taylorandfrancis.com  
www.routledge.com – www.taylorandfrancis.com

ISBN: 978-0-367-46171-3 (Hbk)  
ISBN: 978-1-003-02737-9 (eBook)  
DOI: 10.1201/9781003027379  
<https://doi.org/10.1201/9781003027379>

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## Increasing urban walkability: Evidences from a participatory process based on spatial configuration analysis

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**ABSTRACT:** The research analyses the theme of walkability in the western part of Potenza municipality. It combines spatial configuration analysis and evidence-based participatory process developed in the project “Active citizenship for Sustainable Development of the Territory” (CAST). The paper compares results of the public participation process concerning walkability and neighborhood accessibility with the results of the configurational analysis based on space syntax. During this research experience, a cognitive framework has been defined both adopting traditional approaches, and, in order to increase the participation, using new information technologies and social networks. The data that emerged were revised and evaluated for the definition of feasible strategies for the improvement of walkability, accessibility to the services and infrastructures and, more generally, the neighborhood liveability.

### 1 INTRODUCTION

Assuming the concept of walkability, as the possibility for citizens to move on foot is essential to provide them a modal choice in moving. In other words: choose whether to move on foot or not. Walking should be considered as a valid alternative to motor vehicles. In today's sense, however, walking is seen as a limitation and this is demonstrated by the fact that the possibility of moving on foot is often reserved for a few categories of users or, in the worst cases, a few areas.

The concept of walkability (Cervero and Duncan 2003, Ewing and Handy 2009, Carr *et al.* 2010, Blečić *et al.* 2015, Blečić, Canu, *et al.* 2016, Blečić *et al.* 2017) goes beyond accessibility to urban services, but implies a discussion on the quality of spaces and the ability to invest in pedestrian mobility in urban areas. Walkability should be understood as one of the main factors of urban capacity (Nussbaum *et al.* n.d., McCann 2002).

The quality of urban life does not represent the quality of life of individuals living in a certain geographical area, but the quality of the urban environment that influences development and the possibilities of choice and action, according to individual needs and wishes (Arras *et al.* 2014, Blečić, Cecchini, *et al.* 2016).

In this case, a participatory process was used (supported in the final phase by an analytical analysis (Ssx)) in which citizens were able to express strengths and weaknesses, opportunities and needs of their neighborhood in order to improve the level of viability of the neighborhood and thus improve the quality of life.

### 2 OBJECTIVE OF THE PAPER AND STUDY CASE

The paper's object is the application of the configurationally analysis theories or Space syntax analysis (Ssx) to the study case of Potenza municipality western zone, with the aim of assessing the pedestrian accessibility of the area.



As expressed in the theories of Bill Hillier (Hillier *et al.* 1976, Hillier and Tzortzi 2006), founder of Ssx, the movement within public space consists of a portion of movement attracted, influenced by the presence of activities and services, and a portion determined exclusively by the spatial configuration, the natural movement.

With reference to these theories, this work aims to study natural movement in a neighborhood by investigating how spatial configuration can affect pedestrian movement and accessibility within the neighborhood. The results of the SSX obtained on the state of fact with those obtained as a result of the insertion of new project arcs or the improvement of existing ones will be analyzed.

The study area includes the western part of the Potenza municipality, that is a mountain city situated in Basilicata region (southern Italy). Over the years, the city has welcomed several participatory activities, in most cases with a bottom-up approach (Lorusso *et al.* 2014, Amato *et al.* 2015, Rocha *et al.* 2015, 2016, Sassano *et al.* 2017), and in other cases promoted directly by local authorities (Murgante *et al.* 2011, Scorza and Pontrandolfi 2015).

The area investigated (Fig.), includes the districts of *Poggio Tre Galli*, the *G area* and the "study center" area.



Figure 1. Location of the study area: the neighbourhood of *Poggio Tre Galli*, the *G area* and the district called "Study-Centre".

*Poggio Tre Galli* and *G area* are predominantly residential neighborhoods with a high density building, while in the study center there are many higher education institutions and lower grade schools and many unpublished areas.

### 3 SPACE SYNTAX ANALYSIS

The SSX is characterized by the central role given to urban space in the face of settlement phenomena. It uses quantitative models to measure the effects of the spatial configuration on the physical properties of an urban aggregate and on its immaterial variables and recognizes in space the essential reasons for the phenomena that take place on it, so as to be able to interpret and understand them, but above all to be able to predict and simulate them. This approach allows to interpret and understand the internal geography of an urban aggregate; to suggest uses and destinations of the land congruent with the potential offered by the articulation of the urban space; to simulate the effects of the transformations in the project on the variables, material and immaterial, of the system, becoming a decision support system (DSS). The Space Syntax analysis is based on three assumptions: (i) the structure of the urban space influences the phenomena that take place within it; (ii) the perceptual appreciation of the space influences the behavioural choices within it; (iii) the grid of urban paths is considered as the constitutive structure of the urban space. Among the different methodologies for the configurational analysis



in this work, the axial analysis has been used. The Ssx was carried out on the road network of the vehicular and pedestrian area using the DepthMapXnet software.

The connectivity (Knight and Marshall 2015), integration and choice indices (Li *et al.* 2017) have been calculated and compared using the statistical indices of mean, standard deviation, variance; minimum and maximum values, Gini coefficient.

#### 4 RESULTS

Following numerous participatory meetings of the CAST project, it was possible to define the cognitive framework of the study area. Among the various themes analyzed, attention was focused on that of the liveability of the neighborhood and therefore also of the walkability. From the analysis of the problem tree, built with the citizens also with walks in the areas of interest, several problems emerged that denote a discontinuous pedestrian network and lacking both quantitatively and qualitatively. In particular, the presence of architectural barriers, discontinuity of sidewalks, restricted sections of routes, lack of safety measures, dangerous pedestrian crossings, poor maintenance and cleaning. All critical issues that negatively affect the accessibility of the area. On the basis of these critical points identified, the first Ssx analysis was carried out then, once the project interventions had been defined, the analysis was re-performed. The project interventions mainly concerned the improvement of existing arches with the enlargement of the section or the construction of new road arches (for a detailed description see (Carbone *et al.* 2018)). The results of the two analyses are summarised in Table 1 and discussed in the next paragraph.

Table 1. Statistical values obtained for the three indices calculated with the Ssx. PRE indicates the situation before the project and POST the situation after the project.

STATISTIC	Connettivity index		Integration index		Choice index	
	PRE	POST	PRE	POST	PRE	POST
Number of features	236	236	236	277	236	277
Mean	5.84	5.84	1.95	1.99	0.05	0.04
Standard deviation	3.96	3.96	0.67	0.61	0.08	0.07
Variance	15.69	15.69	0.45	0.38	0.01	0.00
Minimum	1.0	1.0	0.33	0.33	0.0	0.0
Maximum	21.0	21.0	3.54	3.57	0.39	0.41
Coeff. Gini	0.37	0.37	0.19	0.17	0.66	0.67

#### 5 DISCUSSIONS AND CONCLUSIONS

From the statistical analysis it is possible to quickly compare the PRE and POST situations: the connectivity index does not undergo changes with the addition of new pedestrian paths and is similar in both hypotheses; as regards the integration index increases the maximum value that means greater accessibility of the area (shorter distance of travel between the various arches) as evidence of this decreases the coefficient of gini (thus decreases the inhomogeneity of the area); in the index of choice slightly increases the maximum value after the insertion of new arcs as evidence of a greater alternative of routes.

In conclusion, the Ssx has been used to validate and deepen the results of a participatory process and has therefore allowed to explain in a scientific way when it emerged from the analysis carried out during the laboratory. It also made it possible to understand how to operate on the different parts that make up the study area and to evaluate the effects of the project hypothesis defined with the participatory activity.

To understand the spatial dynamics and have a complete framework of pedestrian mobility, it is necessary to integrate the more classical methodologies that are usually used and that



allow to analyze the attracted movement and the equipment and quality of the structures for pedestrian movements with analysis on the spatial configuration.

## REFERENCES

- Amato, F., Bellarosa, S., Biscaglia, G., Catalano, L., Graziadei, A., Metta, A., Murgante, B., Olivetti, M.L., Passannante, P., Percoco, A., Sassano, G., and Scaringi, F., 2015. "Serpentone Reload" an Experience of Citizens Involvement in Regeneration of Peripheral Urban Spaces. Springer, Cham, 698–713.
- Arras, F., Cecchini, A., Ghisu, E., Idini, P., and Talu, V., 2014. Perché e come promuovere la camminabilità urbana a partire dalle esigenze degli abitanti più svantaggiati: il progetto "Extrapedestri. Lasciati conquistare dalla mobilità aliena!" 9° Congresso Città e Territorio Virtuale, Roma, 2, 3 e 4 ottobre 2013, 185–196.
- Blečić, I., Canu, D., Cecchini, A., Congiu, T., and Fancello, G., 2016. Factors of Perceived Walkability: A Pilot Empirical Study. Springer, Cham, 125–137.
- Blečić, I., Canu, D., Cecchini, A., Congiu, T., and Fancello, G., 2017. Walkability and Street Intersections in Rural-Urban Fringes: A Decision Aiding Evaluation Procedure. Sustainability, 9 (6), 883.
- Blečić, I., Cecchini, A., Congiu, T., Fancello, G., and Trunfio, G.A., 2015. Evaluating walkability: a capability-wise planning and design support system. International Journal of Geographical Information Science, 29 (8), 1350–1374.
- Blečić, I., Cecchini, A., Fancello, G., Talu, V., and Trunfio, Giuseppe, A., 2016. Camminabilità e capacità urbane: valutazione e supporto alla decisione e alla pianificazione urbanistica. TERRITORIO ITALIA.
- Carbone, R., Saganeiti, L., Scorza, F., and Murgante, B., 2018. Increasing the Walkability Level Through a Participation Process. Springer, Cham, 113–124.
- Carr, L.J., Dunsiger, S.I., and Marcus, B.H., 2010. Walk Score™ As a Global Estimate of Neighborhood Walkability. American Journal of Preventive Medicine, 39 (5), 460–463.
- Cervero, R. and Duncan, M., 2003. Walking, bicycling, and urban landscapes: evidence from the San Francisco Bay Area. American journal of public health, 93 (9), 1478–83.
- Ewing, R. and Handy, S., 2009. Measuring the Unmeasurable: Urban Design Qualities Related to Walkability. Journal of Urban Design, 14 (1), 65–84.
- Hillier, B., Leaman, A., Stansall, P., and Bedford, M., 1976. Space syntax. Environment and Planning B: Planning and Design, 3 (2), 147–185.
- Hillier, B. and Tzortzi, K., 2006. Space Syntax: The Language of Museum Space. In: S. Macdonald, ed. A Companion to Museum Studies. Blackwell Science Ltd, 282–301.
- Knight, P.L. and Marshall, W.E., 2015. The metrics of street network connectivity: their inconsistencies. Journal of Urbanism: International Research on Placemaking and Urban Sustainability, 8 (3), 241–259.
- Li, X., Lv, Z., Zheng, Z., Zhong, C., Hijazi, I.H., and Cheng, S., 2017. Assessment of lively street network based on geographic information system and space syntax. Multimedia Tools and Applications, 76 (17), 17801–17819.
- Lorusso, S., Scioscia, M., Sassano, G., Graziadei, A., Passannante, P., Bellarosa, S., Scaringi, F., and Murgante, B., 2014. Involving Citizens in Public Space Regeneration: The Experience of "Garden in Motion". Springer, Cham, 723–737.
- McCann, E.J., 2002. Space, citizenship, and the right to the city: A brief overview. GeoJournal, 58 (2/3), 77–79.
- Murgante, B., Tilio, L., Lanza, V., and Scorza, F., 2011. Using participative GIS and e-tools for involving citizens of Marmo Platano–Melandro area in European programming activities. Journal of Balkan and Near Eastern Studies, 13 (1), 97–115.
- Nussbaum, M.C., Sen, A., and World Institute for Development Economics Research., n d. The quality of life.
- Rocha, M.C.F., Pereira, G.C., Loiola, E., and Murgante, B., 2016. Conversation About the City: Urban Commons and Connected Citizenship. Springer, Cham, 608–623.
- Rocha, M.C.F., Pereira, G.C., and Murgante, B., 2015. City Visions: Concepts, Conflicts and Participation Analysed from Digital Network Interactions. Springer, Cham, 714–730.
- Sassano, G., Graziadei, A., Amato, F., and Murgante, B., 2017. Involving Citizens in the Reuse and Regeneration of Urban Peripheral Spaces. Springer, Cham, 193–206.
- Scorza, F. and Pontrandolfi, P., 2015. Citizen Participation and Technologies: The C.A.S.T. Architecture. Springer, Cham, 747–755.