International Journal of Statistics and Economics;
[Formerly known as the "Bulletin of Statistics & Economics" (ISSN 0973-7022)];
ISSN 0975-556X; Year: 2020, Volume: 21, Issue Number: 1; Int. j. stat. econ.;

Pedestrians' Perception of Landscape Quality and Urban Liveability: A Field Survey in a Local Community of Tehran, Iran

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ABSTRACT

Sustainable urban planning promotes a mixed use of crossroads by pedestrians and vehicles, regulating traffic flow and improving street's liveability. Design of pedestrians' underpasses, reduction of street's width by physical barriers and, more generally, walkability limitations may reduce liveability of any urban place, stimulating wrong pedestrians' behaviours. The present study explores the linkage between urban design, micro-scale landscape quality and the underlying socioeconomic local context in Valie Asr crossroad, one of the most important cultural and commercial centres in Tehran, Iran. By investigating pedestrians' perceptions and public orientation toward urban liveability in Valie Asr, this contribution provides a reflection on urban planning, informing design of attractive and comfortable streets for pedestrians considering urban liveability. Results of a field survey assessing behaviours of the pedestrians and the overall landscape quality of the place provide practical indications to improve urban design based on sustainability principles, with the final objective to make public spaces more attractive for residents and visitors.

Keywords: public spaces, urban streets, design, Valie Asr crossroad.

Mathematics Subject Classification: 62J12, 62G99

Journal of Economic Literature Codes: Q56, R14, R52

ISSN 0975-556X
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1. INTRODUCTION

Urban spaces underwent significant transformations driven by social change as a result of globalization, demographic dynamics, and economic cycles (Carmona et al., 2003; Gehl, 2010; Carlucci et al., 2017; Pili et al., 2017). Large cities, especially under intense population growth, were increasingly subject to continuous transformations in urban landscapes, sometimes leading to reduced sustainability, lower liveability, greater social polarization, inequality and risk of poverty (Talen, 2002; Ceccarelli et al., 2014; Cuadrado-Ciuraneta et al., 2017). With these transformations, the evolution of public spaces has frequently reflected distinctive dynamics of (i) degradation and progressive abandonment, or (ii) modification toward more standardized and 'globalized' architectures (Soltani and Khodaparast, 2010; Memluk, 2013; Salvati et al., 2013). In these ways, public spaces were losing the link with local communities (Tibbalds, 1992). As opposed to homogeneous design and lack of historical reference typical of the Marc Auge's non-lieux, public spaces with a more traditional design may represent the necessary expression of urban landscapes for both residents and visitors – a sort of landmark for present and future generations (Montgomery, 1998).

Among public spaces in cities, urban streets are together a manifestation of the civil life of local communities and a place for social activities, improving overall sustainability and liveability of metropolitan regions (Moarrab and Ghorbannia, 2014). In this regard, streets are supposed to build the base for civilizing people's lives, satisfying citizens' needs (Montgomery, 2013). Appleyard and Lintell (1981) define streets as the most important part of urban landscapes and Jacobs (1961) states that "thinking of a city means imaging its streets". In these regards, urban streets provide all population segments and social classes with facilities for walking, sitting, biking and entertainment. However, such spaces, as Gehl and Genzoe (2004) and Gehl (2010) report, require dedicated policies involving the following objectives for public spaces' planning and design: (i) sustainability, (ii) security, (iii) health, and (iv) liveability. Since a large part of population lives in the streets for a long part of the day life, streets are regarded as social centres aggregating local communities (Denverigarta, 2012).

While providing connections serving automobile flows, streets are considered as public spaces where to improve social interactions together with active life (Jocobs, 1993). All these characteristics of urban streets contribute to liveability of a given landscape, maintaining a close link between cities and local communities, albeit under continuous architectural and social transformations. Tibbalds (1992) states that "the urban spaces belong to the people, not to the automobiles or huge building projects". In these regards, because of the increasing interest for vitality and sustainability of cities, a reduction of vehicles in urban spaces was recently proposed, promoting a new approach to the streetscape design (e.g. Clemente, 2017). On the one hand, contemporary cities are transforming toward a greater pedestrian accessibility, discouraging the use of private cars and encouraging the use of public transport, since "people are the main component of the city and without public spaces, the physical and spiritual connection between the people and the urban environment is not possible" (Memluk, 2013). On the other hand, urban traffic is particularly intense in contemporary metropolises and important conflicts between pedestrians and cars still exist, e.g. causing collisions in road

crossings with casualties (Hillier and Hanson, 1984). Consequently, the living situation in the streets of many cities across the world was reflected in a paradox of the 21st century as follows: “while we managed to travel to the moon, we are not able to conveniently pass the widths of the streets" (Soltani and Khodaparast, 2010).

One of the characteristics that define the quality of public spaces, both in research and common thought, is the ‘security’ issue, which can be divided in two basic dimensions: (i) security against criminal and antisocial behaviours, and (ii) pedestrian safety in relation to possible collisions with cars. The problem of man-car conflict has led urban planners and designers to develop different solutions, up to the physical separation of vehicle and pedestrian flows. Barriers separating pedestrian flow from the roadway, vehicular underpasses assuring continuity of pedestrian paths, and pedestrian overpasses, giving prevalence to the vehicular flow on the road, are possible solutions to this problem, although with a different contribution to urban sustainability and liveability (Alexander, 1987).

Various interpretations of the notion of ‘walkability’ put pedestrians (and the discourses that shape the development of pedestrian space) at the middle of any possible reflection on urban design and sustainable planning (Forsyth and Southworth, 2008; Ewing and Handy, 2009; Talen and Koschinsky, 2013). Concepts such as ‘sidewalk access’, ‘street connectivity’, as well as ‘land-use density’ and ‘diversification in urban functions’ are intimately connected with the ‘walkability’ issue (Montgomery, 1998; Porta and Renne, 2005; Forsyth, 2015). For instance, it was demonstrated how, in a predominantly single-family residential context, well-designed green street facilities - as well as other features such as parks, separation from vehicle traffic, and pedestrian networks - can significantly contribute to walking environment’s attractiveness (Handy, 1996; Hess et al., 1999; Lee and Talen, 2014). However, although the “walkable neighbourhood” is becoming a primary concern in sustainable urban design, claims about social impacts are the weakest in terms of research support (Litman, 2003; Lo, 2009; Adkins et al., 2012).

Based on these premises, the present study investigates a specific project separating pedestrian flows from car traffic flows with the aim to preserve pedestrians’ safety. The case study of the Valie Asr crossroad in Tehran, Iran, has been taken as a representative example of micro-scale architectonical transformations in a large city with the aim to elaborate a broader discussion on the role of public spaces – mainly urban streets – as liveable, multi-functional places in contemporary large cities. Providing an indirect exploration of how urban form fits into a more comprehensive model of choices about pedestrian trips (Leslie et al., 2005), Valie Asr crossroad represents one of the most attractive and lively spaces in Tehran. In recent years, implementation of a pedestrian underpass and iron rails closing the streets - in conflict with the principles of new and human-centred urbanism – have impacted negatively living standards, determining a progressive marginalization of pedestrians. The study assumes that urban design originally intended to preserve pedestrians’ safety may instead expose them to a higher collision risk by stimulating wrong behaviours and thus representing a sub-optimal response to urban change (Leslie et al., 2007). Basing on interviews, results of a field survey investigating perception of Valie Asr local community on urban liveability, allows a reflection on the relationship between societal needs and urban landscapes. A better comprehension of this linkage -

consolidated over time despite continuous transformations - can contribute to an effective and sustainable urban design (Manaugh and El-Geneidy, 2011).

2. PUBLIC SPACES AND URBAN DESIGN

The making of a liveable urban community is recognized as a complex endeavour. For much of the 20th Century planners and architects believed that modern (and rational) decision-making would create successful cities (Cerin et al., 2007). Increased car traffic in modern cities definitely stimulated a rethinking on the economic use and social role of public spaces (Pivo and Fisher, 2011). Jacobs (1961) proposed a novel vision in urban planning, focusing on 'social life' in the city and introducing a planning theory centred on the active involvement of people within urban spaces. By considering the gradual fall of socioeconomic opportunities in urban spaces, Jacobs (1993) mentioned various architectural solutions as a tool for reducing inter-urban trips together with restoration of the streets linked with residential places. Starting from a different point of view, Mumford (1961) proposed to reorganize inner cities for pedestrians. Assuming pedestrians as key elements of the urban transport system, a comprehensive analysis of urban design highlights the inefficiency of private vehicle transport in respect with public transport (Ledanterc, 2008).

The 'New Urbanism' is a kind of movement for urban planning developing first in the United States of America since the early 1980s (Jacobs and Appleyard, 1987). Today, the concepts of New Urbanism are considering ways to promote sustainable development in larger metropolitan areas (Cerin et al., 2007). With a progressive reduction of car dependence, creation of vital streets for walking and improvement of buildings' decoration and the aesthetic of business places, the logical framework underlying New Urbanism was recognized as one of the most recent thinking toward sustainability, liveability and walkability (Bianconi et al., 2018). In this perspective, Ledanterc (2008) stated that streets are the most wonderful things derived from human design. Alexander (2002) argued that urban streets are the scene of the social encounters; streets provide the ground for interaction between different groups, which contribute to a reinforced social order. According to Jacobs (1993), streets are the main elements of a city, contributing to social living and life functions.

The concept of 'urban street' underwent important transformations in more recent times. Gehl (2010) mentioned Venice as a pedestrian-oriented city, and Dubai as a car-oriented city. In fact, the extreme development of car traffic means a severe reduction of the satisfaction of large population groups. Therefore, streets are not only for the cars, but they should also provide pedestrians with opportunities of free walk, stop and enjoy while interacting with other people (Litman, 2003; Porta and Renne, 2005; Forsyth, 2015). Thus, putting aside pedestrians through over-paths and under-passes or, in other words, preventing them from entering streets or passing streets, could reduce the overall quality of urban landscapes (Talen, 2002).

According to Gehl (2010), the main issue of urban planning are people who live the public space. People share common aspects in terms of walking, sensing, movement options and basic behavioural patterns across the globe (Hillier and Hanson, 1984), while urban design actually takes into few accounts the city user's perspective (Carmona et al., 2003). According to a new urban vision, streets

and squares are increasingly required to be designed having in mind the close interest of the pedestrians (Clemente, 2015). Streets with a correct configuration may encourage walking, enabling neighbours to know each other more and protect themselves from collisions with cars (Clemente, 2017). Assuming that 'street life' in cities will be an increasingly crucial factor towards community success, supporters of the New Urbanism suggest that the right design will encourage walking, thereby stimulating interaction and a greater sense of community - discouraging automobile dependence (Montgomery, 1995). However, existing studies provide only partial support to this assumption, likely because of limitations in available data and methodologies (Mehta, 2008). More comprehensive and refined approaches are increasingly required to increase public support for walking and other non-motorized modes of travel (Lo, 2009).

3. STREETS, WALKABILITY AND SOCIAL PERCEPTION OF A LIVABLE LANDSCAPE

Walking and walkability provide a variety of benefits, including accessibility, consumer cost savings, public cost savings (e.g. reduced external costs), a more efficient use of land, community liveability, improved fitness and public health, economic development, and support for equity objectives (Munford, 1961). Walkability can be thus regarded as a complex theoretical issue implying better design whether composed of multiple, measurable dimensions, or providing a holistic solution to urban problems (Adkins et al., 2012). This definition problematizes the intuitive idea of walkability, since planning for walkable places varies substantially between definitions leading to different designs and potential conflicts between forms of walkability (Lee and Talen, 2014).

At the same time, the experience of walking in urban space provides diversified opportunities, distinct perceived gradients and the possibility to access services open to the public (Denverigarta, 2012). Earlier research investigated the relationship between site design and pedestrian travels in urban and suburban landscapes, considering predictors that include population density, land-use, income, neighbourhood site design (as measured by block size), and length (or completeness) of sidewalk systems (Mehta, 2008). Urban sites with small blocks and extensive sidewalk systems had, on average, higher pedestrian volumes than suburban sites with large blocks and short (or incomplete) sidewalk systems (Manaugh and El-Geneidy, 2011). However, suburban pedestrians are more likely to jaywalk and to use crosswalks than their urban counterparts (Talen and Koschinsky, 2013).

The attractiveness of a given street is intrinsically bonded in the relationship between pedestrian sidewalks and economic functions at the ground floor of buildings (Litman, 2003). The presence of activities and facilities in a street, together with the overall quality of the urban space, is a particularly attractive element and may influence pedestrian flows (Ewing and Handy, 2009). These issues are strongly connected to the visual perception of the urban environment, which can orient individual preferences and generate psychological comfort (Alexander, 1987). The road crossing nodes are regarded as sites interrupting the protected pedestrian flows and often lead to conflict between cars and pedestrians, often jeopardizing accessibility (especially to the most disadvantaged categories of users) and, ultimately, landscape quality (Hillier and Hanson, 1984).

Pedestrian overpasses, apart from being quite almost accessible only by stairs, may become a deterrent for some kinds of pedestrians (Forsyth and Southworth, 2008). Assuming that city size is an important factor influencing urban sustainability and affecting landscape quality at both micro- and local-scale (Moarrab and Ghorbannia, 2014), two examples were provided, the former from a large city, the latter from a small city, with the aim to illustrate successful (or unsuccessful) architectonical projects of pedestrian overpasses (Montgomery, 1995). In Hong Kong, a city with a very high population density, overpasses were often created and developed with the aim to regulate a double flow of pedestrians, the former at the street level, the latter at the first level – crossing roads and overpassing obstacles to walkability (Bianconi et al. 2018). The first level was organized to encourage walkability, since halls of hotels, shops and a large variety of activities and services were arranged at that level, where the pedestrian can walk safely (Figure 1). In Perugia, a small city in central Italy, overpasses that were made in the 1980s with the aim to connect two central districts in the compact city, remained unused for a long time and degraded rapidly, contributing to physical isolation, commercial desertification and the progressive abandonment of the district (Clemente, 2017). These two extreme examples may suggest that (i) a local context stimulating walkability and (ii) a multifunctional urban design linking different activities, human needs and societal experiences with a physical connection of distinctive use of land, are indispensable to plan a liveable urban landscape which is not abandoned and may develop attracting residents/visitors and creating value added (Clemente, 2015).

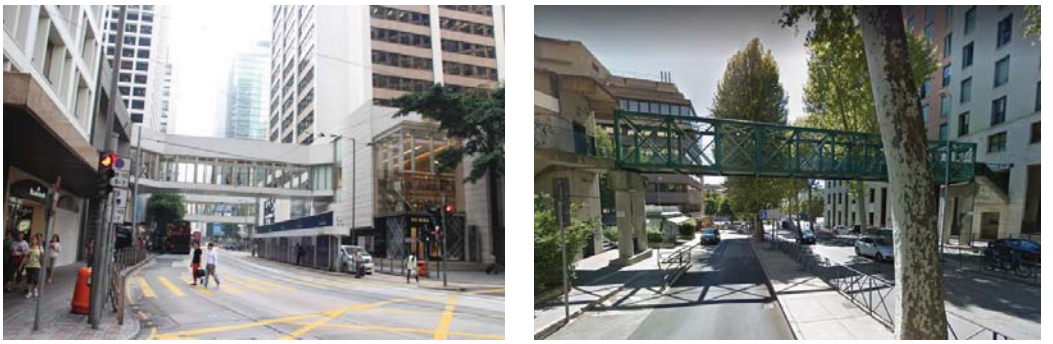

Figure 1. Examples of pedestrian overpasses in Hong Kong (left) and Perugia, Italy (right).

3. LOGICAL FRAMEWORK AND RESEARCH QUESTIONS

Assuming that a good spatial organization of pedestrian, cycle and vehicular traffic on both roads and sidewalks, may contribute to a more vital and usable urban environment, it was hypothesized that organizing pedestrian flows on two levels, especially in specific local conditions, is sometimes a suboptimal solution since one level could be less used and degraded (Clemente, 2015). As a matter of fact, only some of the locations where walking directed plans are implemented, were capable to attract pedestrians, depending on the design quality and the capacity to link engineering solutions, architectonical interventions and the intimate needs of the local community (Hess et al., 1999). Implementing car-oriented plans, restricting mobility of the pedestrians to underground ways and making the street traffic more flowing in order to remove any obstacle for cars, have affected urban liveability, impacting the overall landscape quality and district sustainability in Tehran. This study documents the development of an architectonical project creating a system of pedestrian underpasses and blocking traditional pedestrian paths by metal fences in Valie Asr crossroad (Ledanterc, 2008), and the specific impact of this intervention on the perception of landscape quality and urban liveability at the local community scale (Talen, 2002).

In the light of informing policies that improve urban liveability and walkability, the objective of this study is to understand if the physical separation of pedestrian and vehicular flows improves (i) safety, (ii) perception of pedestrian safety, and (iii) quality of public space. Based on (i) a systematic review of appropriate literature and (ii) a specific field survey carried out in Valie Asr, Tehran, the following research issues were investigated:

1. Are the people satisfied with pavements and pedestrians' spaces in Valie Asr crossroad in terms of the new forced mobility plan (underpass together with barriers for floor-level mobility through the widths of the street)?
2. Does multilevel mobility impact pedestrians' satisfaction with walking public spaces?
3. Does placing physical barriers to pedestrians' mobility along the widths of the street (floor-level) has impact on their satisfaction with walking in public spaces?
4. Which role has Tehran's Valie Asr crossroad played in satisfying peoples' needs? And, more specifically, what are the weaknesses and strengths of this public space for pedestrians' satisfaction and liveability of urban landscape?

4. STUDY AREA

Tehran is the capital city of Iran and the head town of the same province, hosting a population of around 8.694 million people in the central city and nearly 15 million in the larger metropolitan area of Greater Tehran. Tehran is the most populous city in Iran and Western Asia and the second-largest metropolitan area in the Middle East, ranking 29th by metropolitan population in the world. Thanks to theatres, student parks, pavements, the largest computer market in the country, subway and train lines, the Valie Asr crossroad is one of the most important cultural, institutional and commercial nodes with the highest traffic level in Tehran city (Figure 2). The crossroad connects the elder Valie Asr

street to the Islamic Revolution Street, with a total traffic volume (daily average) of 14,390 pedestrians, 5787 cars, and 257 buses (information collected from Tehran's municipality, 2014).

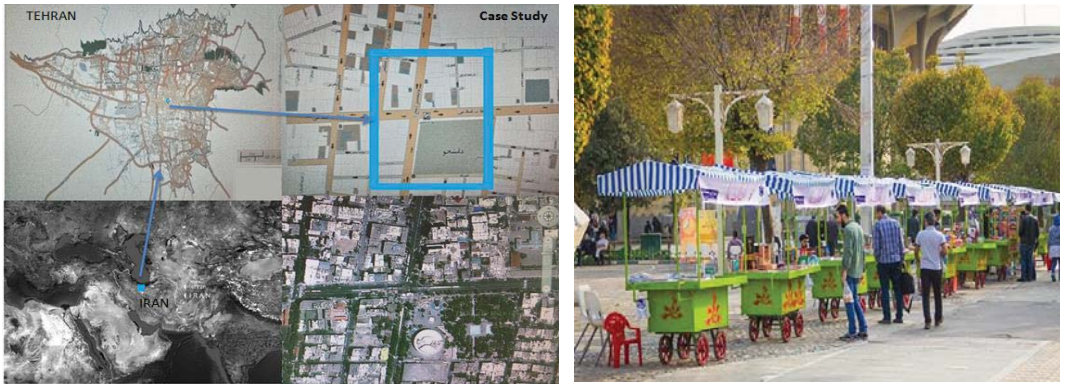

Figure 2. (Left) Valie Asr (Tehran, Iran) crossroad and its neighbouring spaces (source of basic maps: Tehran's municipality portals and Atlas of Tehran city, 2013); (right) space for walking at Valie Asr crossroad.

Since the crossroad has always been involved with the intertwining movement of pedestrians and cars, it was recently decided to realize an under pass regulating pedestrians' flows. This underpass project was Tehran's first under pass crossroad which was uniquely implemented and was ready to be operated by civilians (http://ccop.ir). The project was aimed at increasing landscape liveability and walkability, facilitating pedestrian's traffic through a physical separation of the sidewalk and the street, and providing quick access to the subway and suburban train stations (Figure 3). The project promoted easy movement of the (pollutant) motor vehicles while reducing interference for the pedestrians. After the under-pass plan was implemented, people have been banned from crossing the streets in this area, placing physical blocks limiting ground walkability, e.g. fences.

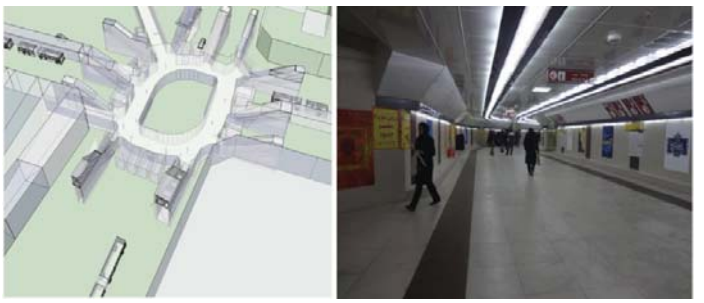

Figure 3. (Left) A new design plan for underpass improving pedestrian accessibility at Tehran's Valie Asr crossroad (based on the ccop.ir website, the comprehensive construction operation portal site).

5. METHODOLOGY

5.1. Field survey and questionnaire

To answer the four research questions mentioned above (see section 3), a field survey based on (i) direct observation, (ii) data recording through note taking and pictures, and (iii) a questionnaire was implemented (Hafeznia, 2016). Questionnaires with close questions investigating different research items (Table 1) were randomly submitted to 160 respondents (pedestrians in the study area) during afternoons in a week of Summer 2016. While sampling was not statistically representative, questionnaire's interviews were intended to provide a background information depicting the latent linkage between the local community and urban landscape (Salvati et al., 2013). Collected data were analysed using statistical approaches based on descriptive statistics and correlation analysis (Duvernoy et al., 2018) using Cronbach's Alpha coefficients with the aim to identify (apparent and latent) relationships among the studied variables. For all questionnaire items, Cronbach's alpha had a value of more than 80%, indicating a high reliability of the collected data.

Table 1. Reliability of data collected through questionnaires and the related item variables, estimated using Cronbach's Alpha coefficients.

Number	Items and variables	Scale	Number of items	Sample size	Alpha coefficient
1	Enough space for walking	Ordinal	1	160	0.809
2	Quality of spaces for walking	Ordinal	1	160	0.861
3	Feeling happy for walking	Ordinal	1	160	0.824
4	Possibility for taking seat and stop	Ordinal	1	160	0.828
5	Possibility of crossing the street level	Ordinal	1	160	0.828
6	Feeling no disturbance for cars' threat	Ordinal	1	160	0.838
7	Security for walking/crossing the street	Ordinal	1	160	0.807
8	Feeling satisfied when they are here	Ordinal	1	160	0.804
9	Desire for crossing at the same level	Nominal	1	160	0.842
10	Agree to the same level cross avoidance	Nominal	1	160	0.866
11	Satisfaction degree (mean, items 1- 8)	Ratio	8	160	0.847

5.2. Questionnaire validation

The questionnaire structure was verified through a technique of 'content validity' requiring the use of recognized (e.g. academic) subject matter experts to evaluate whether test items assess defined content. The Content Validity Ratio (CVR) approach, originally proposed by Lawshe (1975), was adopted to validate the questionnaire's structure. The CVR estimates agreement among judges regarding how 'essential', 'useful but not essential' or 'not necessary' to the performance of the construct a particular questionnaire's item is. If more than half the panellists indicate that an item is essential, that item has at least some content validity. In our case, close questions were submitted separately to 8 academic experts to evaluate the content validity of the questionnaire. Given that (i) a value of 0.75 was obtained for CVR and (ii) a threshold value of 0.75 was recommended when considering 8 experts (Lawshe, 1975), we conclude that the questionnaire has an acceptable content validity.

5.3. Statistical analysis

Data were analysed by way of (i) descriptive statistics performed using Statistical Package for Social Science (SPSS) software (Kaffashi, 2016) and (ii) inferential approaches testing hypotheses based on the main variables derived from questionnaires' analysis, as follows: (i) one-sample Kolmogorov-Smirnoff test: a non-parametric t-test assessing significance differences of the variables related with peoples' satisfaction of walking in Valie Asr crossroad. Variables include the following items (see Table 1): 'enough spaces for walking', 'quality of the walking spaces', 'satisfaction with walking', 'possibility of sitting and stopping', 'possibility of level movement from the widths of the streets', 'security in walking', 'satisfaction with being in the place'; (ii) independent samples test: this test is used to compare one feature among two independent groups. Assessment level was interval and ratio for dependent variables and two group (or nominal) for the independent variable (Kaffashi, 2016). In this study, 8 variables related to peoples' satisfaction with walking (items from 1 to 8, see Table 1) have been also calculated in terms of their means and it changed from ordinal scale to interval and ratio scales (dependent variable). This test analysed peoples' satisfaction between the two groups including those agreeing with passing the level streets and those against it. A specific analysis was also carried out on two groups including pedestrians agreeing (and disagreeing) with restrictions on passing the widths of the streets with fences (independent group).

5.4. Qualitative analysis

Qualitative data were collected through field observation realized by some of the authors visiting the location of the study (Valie Asr) and noting walking conditions and the barriers' impact on pedestrians along the day. Some pictures were taken with the aim to illustrate the most frequent conditions for pedestrians. Collected data were discussed in respect with the fourth research issue (see list at the end of section 3). Quality of urban spaces and settings were also documented through photographs.

6. RESULTS

To assess the basic characteristics of pedestrian's flow and their activities in Valie Asr crossroad, results of a survey of pedestrian's perceptions in terms of recent implementation at the crossroad (e.g. underpass construction), as described in section 5.3, were presented in this chapter. A specific analysis based on direct observation (section 5.4) was also illustrated with the aim to improve basic knowledge as far as the four research dimensions (section 3) are concerned. This chapter is organized in four subsections illustrating separately the empirical results dealing with each of the four dimensions mentioned above.

6.1. Are the people satisfied with walking and walking spaces of Tehran's Valie Asr crossroad with respect to the new project for underpass and with restricting passing width of the level streets? (Issue 1)

Analysis of responses to questionnaire's questions investigating satisfaction of the pedestrians for walking in Valie Asr crossroad indicated that respondents were highly satisfied with the following factors: (i) "enough space for walking", (ii) "quality of spaces for walking", (iii) "satisfaction with walking", (iv) "satisfaction with being in the place". Conversely, pedestrians were less satisfied with the following factors: (v) "possibility of stopping and sitting", (vi) "possibility of crossing the street through a level path", (vii) "being safe against the threats of the cars" and (viii) "safety of walking and

passing across the street". Results from the single sample Kolmogorov-Smirnoff test indicate that all the variables were significantly different ($p < 0.05$) and confirms patterns observed above for both items (i-iv) and (v-viii). These findings may contribute to better recognize strengths and weaknesses of the Valie Asr public space as perceived by local pedestrians.

6.2. Does individual's preference for multi-level passing affect satisfaction with walking in public spaces? (Issue 2)

Analysis of responses by pedestrians passing across the streets through ground-level or multilevel path indicated that 117 individuals (73.1%) were using ground-path ways while 43 individuals (26.9%) were used to walk through the under pass (Table 2), indicating the ground path as the preferred solution within the sample of respondents. Results of inferential statistics (independent t-test) showed a significant difference ($p < 0.05$) in the individual satisfaction with walking between the two respondent groups (Table 2). Satisfaction of pedestrians interested in using the under pass was higher than satisfaction of those who were interested in using the ground path. Most of the pedestrians who were interested in passing across the street through the ground-level path were dissatisfied with the iron fences.

Table 2. Results of the independent t test for question 2.

Hypothesis on variance	Lown test for variance equality							95% Confidence Interval of the Difference	
	F	Sign	T stat	df	Sign(2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Equal variance	0.285	0.594	-8.109	158	<0.001	-1.098	0.135	-1.366	-0.831
Unequal variance			-7.673	67.783	<0.001	-1.098	0.143	-1.383	-0.813

6.3. Did the positive (or negative) views of people on physical street barriers influence their satisfaction with walking in public spaces? (Issue 3)

Analysis of the pedestrians' perception on iron fences used as physical street barriers showed that 142 individuals (89%) did not accept the project while only 18 individuals (11.3%) declared to accept it. Many people were also dissatisfied with restrictions on crossing streets at the ground-level. A significant difference between the two groups (those who are satisfied and those who are dissatisfied) was observed as far as satisfaction with walking in the study area is concerned (Table 3). Satisfaction of individuals who agree with restricting pedestrians' passing by using physical barriers was higher than satisfaction of those who disagree with this path.

Table 3. Results of independent t test for question 3.

Hypothesis on variance	Lown test for variance equality							95% Confidence Interval of the Difference	
	F	Sign	T stat	df	Sign(2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Equal variance	7.011	0.01	4.090	158	0.000	0.879	0.215	0.455	1.304
Unequal variance			3.159	19.263	0.005	0.879	0.278	0.297	1.462

6.4. Which role did the Valie Asr crossroad play in satisfying the needs of the pedestrians and what are the weaknesses and strengths of the area in satisfying the needs of the pedestrians and liveability of the public spaces? (Issue 4)

Concentration of people who are enthusiastic for walking and living in public spaces, quality of the sidewalks, cultural uses, street shows, good access to the subway stations and buses, activity in the sidewalks and the spaces around the student's park indicate Valie Asr as an attractive place for both residents and visitors (Figure 4). Fences located at 150 m from the streets forced the pedestrian to move uniquely through the underpass, bringing them out of the vital urban space and ignoring the needs of elder and disabled individuals, despite the statutory regulations and the (only declared) efforts supporting this group of individuals (unpublished results based on authors' field observation).

Figure 4. Spaces for walking, sitting and socializing at Valie Asr crossroad.

Field observation showed that the main weakness at Valie Asr crossroad is multilevel crossing. Closing the width of the streets by iron fences with the aim to prevent ground-level pedestrians' crossing, makes the public space inacceptable in terms of human liveability for many residents and visitors. Other (minor) problems in terms of liveability of public spaces include lack of sanitary services, lack of secure biking roads, stores located at the sidewalks and salesmen which create informal barriers for walking, the motorcycles parking at the sidewalks, as well as beggary and noise pollution. The field investigation showed that while the crossroad is one of the most attractive places with providing good facilities for residents and visitors (Figure 5), the abovementioned barriers and problems are trouble for people living the public space (unpublished results derived from qualitative field observation). Removing (or, better, re-thinking and re-modulating) the physical barriers is as an appropriate action to improve liveability and walkability of Valie Asr public spaces.

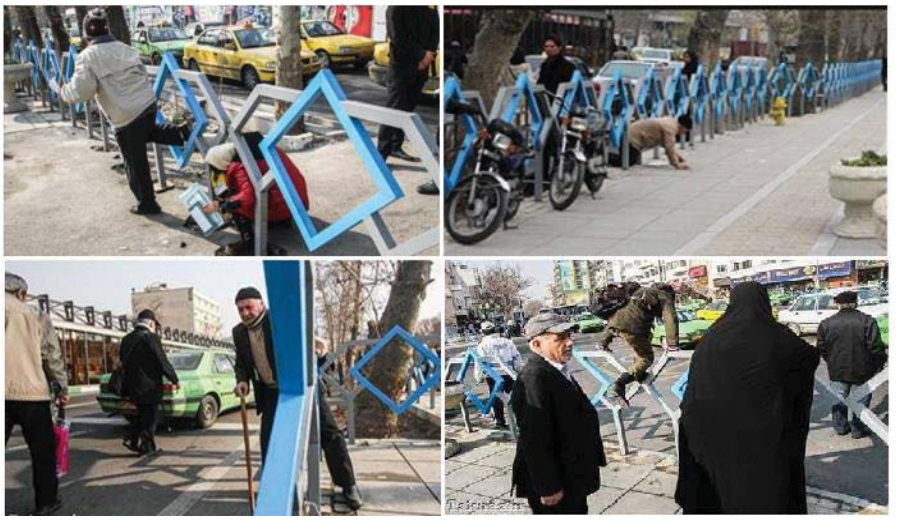

Figure 5. Pictures of physical barriers discouraging ground-level paths at Valie Asr crossroad and the reaction of some residents and visitors.

7. DISCUSSION

After decades of planning (more or less intentionally) resulting in urban decentralization and spillover of settlements over progressively larger metropolitan regions, relatively dense and fine-grained cities (possibly indicating the 'compact city' archetype) are increasingly seen as a more sustainable model than other morphologies oriented toward dispersion and spatial entropy (Pili et al., 2017). While cities' development is intrinsically considered a 'phenomenon of structured complexity', a number of engrained attitudes to city planning persist which together might undermine attempts to stimulate more active - and culturally confident - cities, reflecting together an improved design, development and management of urban landscapes and public spaces (Montgomery, 2013). The empirical analysis proposed in this paper – although limited to a case study investigating local dynamics in a Middle East large city such as Tehran, Iran – may contribute to a more comprehensive reflection of urban liveability and walkability under general principles of good city form, activity, street life, urban culture and social participation to design and planning decisions. Under the assumption that public spaces in Tehran have been constructed with implementing automobile-directed plans in a way that walking, stopping and public spaces' activities for pedestrians have been more and more difficult, results of the field survey demonstrate that mechanistic interventions, often imposed from outside, may create unexpected issues and do not solve the original problem to cope with, reducing the overall sustainability of human settlements (Montgomery, 1998).

Results showed that pedestrians at Valie Asr crossroad were satisfied with walking conditions. However, the place was suboptimal for the possibility of stopping and sitting, passing through the ground-level path across the street, and being safe against the threats of the cars. The overall satisfaction of people interested in using under pass was higher than those who were interested in using the ground-level path for crossing the street. Building infrastructures such as the underpass has contributed to the level of satisfaction of a specific group of people. However, several residents who

were interested in passing the ground-level path for crossing the street were particularly dissatisfied, since the tendency to cross the streets through ground-level (or multilevel) paths significantly influenced their satisfaction with walking at Valie Asr crossroad. Also, given the fact that many pedestrians were interested in using the ground-level path to cross the street indicates that urban planners and designers should prioritize this use, while providing further possibilities for the pedestrians in order to increase their level of satisfaction (Lo, 2009).

Empirical results of the field survey indicate that adopting methods for banning the pedestrians from crossing the streets, led to dissatisfaction of the people and inappropriate reaction, contributing to the reduced quality of the place. Considering that pedestrians move preferring the shortest route (Leslie et al., 2005), the behaviours of the people when crossing the physical barriers showed that most of them were interested in crossing the street through the ground-level path. Based on these results, our study confirms the assumption that certain aspects of urban form play a role in encouraging newly designed walking routes to a destination, although the savings in travel from the substitution of the 'designed' walking route with an 'informal' route – less safe but probably more traditional and lively – are important in the final pedestrians' choice (Leslie et al., 2007; Ewing and Handy, 2009; Forsyth, 2015).

In this regard, the uncertainty pedestrians' experience with the underpass was a problem per sè, influencing negatively the overall perception of the new architectonical intervention. This was especially problematic for different classes of people including children, elders, pregnant women and other weak individuals, since the perception of insecurity and the reduced accessibility are deterrent to the use of pedestrian underpasses (Cerin et al., 2007). Assuming the importance of Lynch's (1960) notion of 'urban spaces connectedness', pedestrians can have a biased perception of the city when they are forced to use underpass while being prevented from passing the ground-level streets. Moreover, pedestrians need to enjoy more convenient and comfortable street ways when they walk or stop (Montgomery, 1995). While traffic restrictions are not justified in economic and logical terms – being against the common humanity values and the right of individual choices – pedestrians' needs should be prioritized with design of appropriate public spaces. Since streets and squares must be attractive for convenient and secure walking (Jacobs, 1993), an appropriate spatial arrangement is definitely required to support planning and design that stimulate walkability as a direct contribution to urban sustainability (Pivo and Fischer, 2011).

Together with social aspects, urban designers are interested in the environmental quality of places that make them better for walking, considered not only as settings for physical activity, but also as sensorial and social settings. In these regards, research on walkability lacks qualitative studies that address the micro-scale analysis of urban environments. While concentrating on social interactions and individual perception of liveability of a public space, the present study provides indirect evidence of the latent relationship of (micro-scale) physical (e.g. land-use) and social characteristics of the landscape linking people's behaviour and perceptions toward walking (Handy, 1996). Using quantitative data from a field survey and open interviews, a full integration of user perceptions and subjective measures can be realized with the final objective to understand the impact of

environmental characteristics on walking attitudes and perceptions (Porta and Renne, 2005). This approach seems to be particularly appropriate when evaluating recent interventions on public spaces producing architectonical design and technical solutions sometimes decoupled with the local context, that can be regarded as 'sustainable' only from the engineering point of view (Hess et al., 1999). In line with earlier research, our study contributes to demonstrate "the significance of social qualities in supporting walking" (Mehta, 2008).

Based on earlier studies, completing sidewalk networks, creating walkways to connect all building entrances to public sidewalks, and increasing the opportunities for pedestrians to cross streets safely are key measures to improve walkability in urban areas (Adkins et al., 2012). At the same time, the empirical results of this study pointed out the importance of providing facilities to improve pedestrian safety for people who cannot (or do not want to) use underpasses in central areas. Our results and discussion finally provide further evidence on how urgent and important the claim is to think and realize public spaces specifically designed for all population segments and social classes, and definitely aimed at promoting life quality within urban landscapes.

8. CONCLUSIONS

According to Mehta (2008), "given a safe and comfortable setting, people look for usefulness, sense of belonging and pleasurably as additional and distinct needs to enhance their walking experience". With respect to the inappropriate condition of Valie Asr crossroad after the underpass plan was implemented, pedestrians' spaces were restricted to small sites with less accessibility. Many pedestrians declared to be dissatisfied with this condition and are more interested in passing across the street through the ground-level path. Some of the pedestrians express their dissatisfaction through jumping over the fences or passing through them, contributing to traffic congestion. This case study definitely outlines critical aspects of safety and liveability of the public space that derive from physical separation of pedestrian flows and vehicular traffic through elevated paths or subways. Especially for narrow road sections, pedestrians choose the easiest way to cross the road. What makes a pedestrian path attractive is the possibility to move from one activity to another in a simple way, i.e. without physical interruptions. What happens in the study area should be a clear warning to urban designers: when planning interventions for streets, direct observation of pedestrian flows and forecast of possible developments are particularly meaningful.

In this line of thinking, encouraging multidisciplinary and research-based development of quantitative approaches and indicators for walkability is necessary in a broader discourse of urban sustainability. Further research could specifically contribute to the literature on walkability design and measurement through hybrid and mixed (quali-quantitative) methodologies combining the opportunities given by Geographic Information Systems, Global Positioning Systems and suites such as Google Earth Engine and Google Street View with in-depth information from local surveys, interviews and other participatory approaches. Quali-quantitative approaches and especially mixed models assessing resident (and visitor) perception of walking environment attractiveness are appropriate to unpack a concept like walkability into multiple (e.g. individual) component characteristics. Operational

definitions to measure the street environment and test for significant associations with walking behaviour are finally considered a topical contribution to planning studies, with the ultimate purpose to inform urban design practice.

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