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Developing and testing a framework for the assessment of neighbourhood liveability in two contrasting countries: Iran and Estonia

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Abstract

A growing body of evidence indicates that the environmental quality of residential neighbourhoods has an impact on their liveability. It can be a contributory factor to the prosperity and development of cities because it reflects the real-life experiences of residents and can also affect the attractiveness of a city for well-qualified workers. A liveable neighbourhood can help to improve the quality of life of residents, which is one of the determining factors in creating a socially sustainable urban environment. This research aimed to develop a practical method for assessing the liveability of a residential neighbourhood, tested in two contrasting countries, Iran and Estonia. We developed and tested a set of criteria based on the principles and attributes of liveability obtained from the literature and we used a Delphi survey of Iranian and Estonian urban planning and design experts to identify which of the candidate criteria were most appropriate to each country together with their priority weighting. The results showed that while many of the same criteria applied to both countries, the importance of them varied, in part reflecting environmental and social differences such as climate. The method has potential for use in the development of indicators of liveability as part of urban sustainability assessment.

Keywords: Liveability; residential neighbourhood; Delphi technique;

1. Introduction

1.1. Liveability

A growing body of evidence indicates that a range of aspects associated with built environments have an impact on liveability (Appleyard, 1981; Capon, 2005; Golkar, 2007; Jacobs, 1961; Khastou & Saeidi Rezvani, 2010; Morais & Camanho, 2011; Paumier, 2004; Wells et al., 2007). Liveability can be defined as the quality of life as experienced by the residents of a neighbourhood within an urban area (Bray, 2010; Evans, 2002; Higgins & Campanera, 2011; Mulligan & Carruthers, 2011; Omuta, 1988; van Kamp et al., 2003). Some authors consider the concept of liveability to be difficult to define and measure (Wheeler, 2001; Balsas, 2004). Existing descriptionsof what constitutes liveability may include a range of different issues underpinned by a common set of guiding principles such as accessibility, inclusiveness (Oberlink, 2006), equity, safety, continuity (Lynch, 1998), and participation. The design, maintenance and use of built environments, the availability and proximity of public spaces, effects of the urban microclimate, aesthetic qualities of the landscape, presence of vegetation and greenery (Li et al., 2006; Niemelä et al., 2010; Rotem-Mindali, 2012; Tian et al., 2014; Viegas et al., 2013), the accessibility of parks and other public open spaces and the perceived safety of an area (Leby & Hashim, 2010; HNEPH, 2012) have all been advanced as important environmental influences on liveability.

Many of the above factors can also be linked to the concept of ecosystem services (Millennium Ecosytem Assessment 2005). These services may be obtained from either natural or cultural elements of ecosystems (including urban ecosystems), or some combination of both. The kind of services can be categorised as some regulating services, such as purification of water and air by urban green elements but those connected to liveability are mainly cultural ecosystem services such as aesthetic and recreational benefits. The relevance of considering human-social values when studying urban ecosystem services has been highlighted by several authors (Grimm et al., 2000; Zipperer et al., 2000; Kinzig and Grove, 2001; Li & Wang, 2002; Yli-Pelkonen and Niemelä, 2005; Tzoulas et al., 2007; de Groot et al., 2010) and when planning urban systems with relatively few natural elements the broader meaning remains valid (Wallace, 2007).

Liveability is thus a broad term encompassing a number of characteristics of urban environments affecting their attractiveness as places to live. Indicators of liveability may have a potentially more important role in assessing urban sustainability and can be used in checking the effects of changes to the urban environment.

Potential measurement criteria for any criterion or indicator used in the assessment of environmental conditions can be classified as either "objective" or "subjective". Objective criteria generally refer to quantitative data and the majority can be described using various statistics (e.g. percent of homes vacant in a neighbourhood, the average distance from home to a green space, amount of green area per inhabitant) (Angur et al., 2004; Islam et al., 2009; Mearns, 2012). These types of criteria have been widely used because they are seen as being more rigorous (e.g. traffic volume and noise) (Riedel et al., 2013). Subjective criteria are based more on personal feelings, perceptions and attitude, and are usually qualitative in nature (Tsaur et al., 2006). They rely more on factors perceived to be important by residents themselves. They may also incorporate factors which are not directly affected by the built environment and which may be outside the control of planners, for instance, such as the "neighbourliness" of the people living there. Experts in urban planning and design may provide a middle way of identifying factors as a result of their training in objective factors combined with their experience of working with urban communities and therefore familiarity with more subjective factors.

Among urban design and planning agencies where the strategic focus is on the creation and development of "liveable" neighbourhoods the opinions and perceptions of local residents are increasingly being used to identify factors affecting the liveability of a particular place. However, more objective criteria might be more important where public participation is poorly developed or when it is necessary to link the perceptual aspects expressed by the local people to more measurable factors which can be manipulated through planning instruments and design guidance. While experts are trained in theoretical and legal aspects about landscape and urban planning, if they are also practitioners then they normally develop a wealth of experience on the ground and can effectively work using a blend of knowledge and experience. However, this practice-based experience (Atchison et al., 2006) is rarely recorded or accumulated, so that it is largely invisible to policy makers or researchers, becoming a kind of tacit knowledge which if captured more formally can be of real benefit. Thus, surveying and collecting the opinions of experts on a range of topics and calling on their experience to validate or reject theoretically-developed criteria in order to make them more directly useable in real life can be a very valuable reality check. Megill (1992) stated that reality checks enable us to check experience against assumptions for logical fits.

The objective of the research presented here was to test candidate criteria for measuring neighbourhood liveability obtained from the research and theory literature among experts from two countries. The research question asked: is it possible to identify common criteria which apply regardless of the location and context of an urban neighbourhood, or are there aspects which are location specific? In this study we sought to identify key criteria for building liveable urban neighbourhoods in two very different countries, Iran and Estonia. These were chosen for their contrasts in climate, degree of urbanisation, traditional and recent urban forms and quantity of green areas as well as their socio/cultural conditions. Table 1 summarises the contrasts between the two countries.

Table 1: The differences between Iranian and Estonian urban setting and lifestyle

Iran	Estonia
A dry desert climate with hot summers and cool or mild winters, most rain in winter (Four different climate zones: BWh, BSh, Csa and Dsa climate) (Nasrollahi, 2009)	A cool temperate climate with warm summers and very cold, snowy winters, precipitation distributed all year round (Jaagus, 2013)
Moderate difference between day length in summer and winter	Long summer days and short winter days (Jaagus, 2013)
8 very large cities with population over 1 million (SCI, 2012)	Two main cities, both small in world terms: 450,000 and 100,000 population respectively (Jauhianen & Kährik, 2005).
Housing in small dense courtyard developments or larger blocks of flats	Many people live in Soviet era blocks of flats or in single family houses with gardens in low density suburbs (PHC, 2011)
Moderate proportion of private open spaces such as yards or gardens	Single family houses usually have gardens
Moderate proportion of public green spaces within the city centres (Laghai & Bahmanpour, 2012)	Large amounts of public green spaces at all scales within the cities
Moderate proportion of vacant building and land	High proportion of vacant buildings and land in some areas
Strong family-orientated living structures (Dastmalchian et al., 2001)	Strong degree of individuality and small nuclear family structure
Moderate to high numbers of car ownership	High proportion of car ownership
Moderate to high proportion of privately-owned houses (IBP, 2006)	High proportion of owner-occupation of houses and flats (PHC, 2011)
Homogeneous cultural composition and religion	Distinct cultural groups of Estonians and Russians often in distinct residential regions, low degree of religious observance (PHC, 2011).
Moderate availability of the internet and public Wi-Fi	Very high proportion of access to internet and public Wi-Fi
Sport and exercise of moderate use in public spaces (Mozaffari et al., 2013)	Sport and exercise important uses of public space, with seasonal differences between winter and summer

The Delphi method was adopted as being the most suitable approach to meeting the research objective (Manoliadis et al., 2006; Ng et al., 2013). It should enable candidate criteria to be identified and tested for their suitability for coping with locational differences while enabling local expert input to the formation of a standardized set. Determination of the liveability attributes could also provide the content for indicator development by breaking them down into measurable factors. This study used subjective measures to explore experts' opinions directly, thus making the basis for assessing liveability more operational when assessing it together with residents of neighbourhoods such as via a questionnaire or when comparing objectively measurable criteria with the results of a questionnaire.

1.2. The Delphi method: theory and general characteristics

The Delphi method is widely used for gathering data from limited numbers of respondents from a specific domain of expertise and is designed as a group communication process aiming to achieve a convergence of opinion on a specific real-world issue (Dalkey, 1972; Hsu and Sandford, 2007; Linstone and Turoff, 1975; Lindeman, 1981; Ludwig, 1994; Young and Jamieson, 2001). As stated by Miller (2006), surveys usually try to identify "what is," whereas the Delphi technique attempts to address "what could/should be".

The Delphi technique can be applied in the following areas (Linstone & Turoff, 1975; Yousuf, 2007):

- Exploring urban and regional planning options.
- Distinguishing and clarifying real and perceived human motivations.
- Exploring priorities of personal values, social goals, etc.

The feedback process is an integral part of the Delphi method. The results of the first iterations are re-evaluated and modified by respondents in later stages after reviewing and assessing the comments and feedback provided by the other Delphi experts (Dalkey, 1967). The method is also set up to ensure anonymity to respondents. The feedback process is controlled by the administrator and a number of statistical techniques can be used to interpret the data (Dalkey, 1972; Ludlow, 1975; Douglas, 1983; Hsu and Sandford, 2007).

As iterations proceed, respondents or panel members usually offer their opinions with more insight. Several studies have shown that the practical number of rounds or iterations usually needed is between two and three (Mitchell, 1991; Gallego et al., 2008) in order to reach consensus. The rounds generally proceed as follows:

Round 1: The Delphi method traditionally begins with an open-ended questionnaire which is used to obtain specific information about a content area from the experts (Custer et al., 1999) the responses to which are converted into a structured questionnaire for the second round. It is a common modification however, to use a structured questionnaire based upon an extensive review of the literature in Round 1 instead and this is what was used in the present study (Kerlinger, 1973).

Round 2: Each participant receives a second questionnaire (or the first questionnaire derived from the literature review) and is asked to review the items, to rate them or to put them in rank order so as to establish provisional priorities among them. As a result of this round, areas of disagreement and agreement are usually identified (Ludwig, 1994; Jacobs, 1996).

Round 3: Each participant receives a further questionnaire that includes the items and ratings summarized from the previous round and is asked to revise their judgments or "to specify the reasons for remaining outside the consensus" (Hsu and Sandford, 2007, p. 3). This gives the panel members the chance to clarify further both the information and their particular judgments. However, only a slight increase in the degree of consensus can be expected compared to the previous round, (Weaver, 1971; Dalkey & Rourke, 1972; Anglin, 1991; Jacobs, 1996).

Round 4: In this often final round, the list of remaining items, their ratings, minority opinions, and items achieving consensus are distributed to the panel members. It provides them with a final chance to revise their judgments (Pfeiffer 1968; Delbecq et al., 1975; Ludwig, 1994).

1.3. Subject Selection

The selection of subjects is a vital aspect of any Delphi survey. Usually people are considered eligible to participate if they have backgrounds, expertise or experience related to the target issue, are capable of contributing helpful inputs, and are willing to revise their initial or previous judgments for the purpose of reaching or attaining consensus (Pill, 1971; Oh, 1974). Jones and Twiss (1978) consider that the most appropriate individuals should be selected through a nomination process. Delbecq et al. (1975) recommend as small a number of experts as necessary for the panel, with verification of the results through follow-up explorations. The number of experts is "generally determined by the number required to constitute a representative pooling of judgments and the information processing capability of the research team" (Ludwig, 1994, p. 52). One of the most recent studies suggests a panel of between ten and eighteen experts for each homogeneous sub-group (Okoli & Pawlowski, 2004). By contrast, if a range of reference groups are involved in a Delphi study more experts are usually needed. For qualitative research in social studies, the usual number is between fifteen and thirty (Peffers & Tuunanen, 2005) while Ludwig (1997) found that between 15 and 20 respondents is common. In this study 12 and 13 experts formed the initial panel in each case study (see below).

1.4. Data Analysis

Dalkey (1972) claims that the use of statistical analysis techniques helps to reduce the potential of group pressure for conformity and here consensus can be defined as a certain percentage of the votes falling within a prescribed range (Miller, 2006), for example having 80 percent of experts' votes fall within two categories on a seven-point scale (Ulschak, 1983). Hsu and Sandford (2007) suggest consensus being where at least 70 percent of panel members rate three or higher on a four point Likert-type scale with a median at 3.25 or more. Scheibe et al. (1975) consider, however, that the use of percentage measures is inadequate and go on to suggest measuring the stability of experts' responses over successive iterations. The main statistics used are generally measures of central tendency (means, median, and mode) and level of dispersion (standard deviation and interquartile range) (Murray & Jarman 1987; Hasson et al., 2000). In studies with closed answers, such as a Likert-scale, the mean, the median and interquartile range for each variable is usually provided for feedback to the next iteration (Hill & Fowles, 1975; Eckman, 1983; Witkin 1984; Jacobs, 1996; Hayne & Pollard, 2000; Akkermans et al., 2003; Gallego et al., 2008).

2. Methods

According to one of the established approaches a preliminary set of items for evaluation may be obtained from the literature as opposed to a first round questionnaire. In developing any assessment the establishment of priorities is also important (Coccossis & Mexa, 2004; Tsaur et al., 2006). In order to source the criteria for use in the first round an exhaustive literature search was undertaken using the Iran University of Science and Technology (IUST)'s comprehensive database and a range of search engines such as Web of Knowledge, Science Direct and Springer. Through examining a broad range of references obtained from the results of the search, 32 key candidate variables influencing liveability which appeared most frequently in the literature were identified and classified into three main categories: built-form, spatial quality and social/community factors.

Following the identification of the candidate criteria, the Delphi study was set up to identify which of them were most important and suitable and to derive the priority weightings for each. The study presented here comprised two questionnaire rounds that were sent to two different sets of panel members, one in Estonia and one in Iran, between October 2012 and February 2013. Two weeks were given for the experts to complete the questionnaire in each round, as recommended by Delbecq et al. (1975).

A pilot study was carried out first, using five experts, in order to test the understanding of the questions and the usability of the system. The structure and design were also validated by two experts in Delphi methodology. The feedback produced during the pilot study was included in the final design of the Delphi questionnaire. Some criteria were removed at this stage to reduce the final list for the questionnaire to 25 items.

In this study, the target was to obtain twenty participants (ten Estonian experts and ten Iranian experts) in the panel in order to fulfil the recommendations noted above. With this aim in mind, forty-two invitations were sent out (to twenty Estonian experts and twenty-two Iranian experts). A letter by email introducing the study and the Delphi process was sent as part of the invitation. Twenty-five experts (twelve Estonian and thirteen Iranian) agreed to participate and completed the first round, while ten Estonian and ten Iranian experts participated in both rounds, meeting the target. Figure 1 presents the process used in the study.

The experts were selected from people with substantial knowledge in the field of residential neighbourhood planning and design. They were from a pool of academics and practitioners in environmental design, landscape architecture and housing and residential design. In Estonia the experts were invited from among staff members of the Department of Landscape Architecture at the Estonian University of Life Science and from the Estonian Landscape Architects' Union (in Estonia most planning of residential areas is carried out by landscape architects in association with architects (who focus on the buildings); there is no specific profession of urban planning). In Iran, the experts were invited from staff members of the Tehran College of Fine Arts, Shahid Beheshti University Faculty of Architecture and Urban Planning, and IUST's School of Architecture and Environmental Design. This included a broader range of expertise than was available in Estonia, which is a small country with a small pool of professionals.

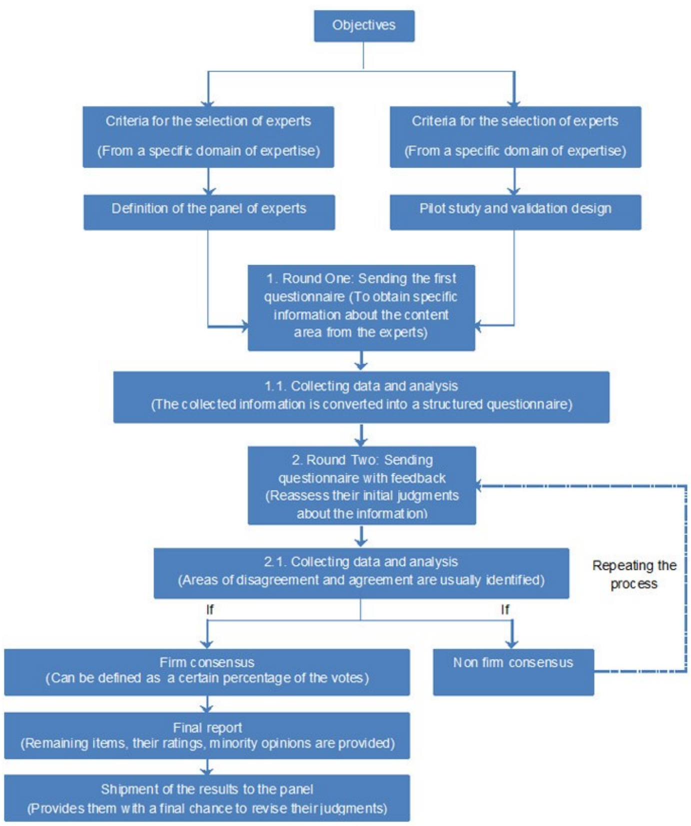

Fig. 1. Process of the Delphi technique.

Data from the questionnaire were entered into a database and analysed using the Statistical Package for Social Sciences (SPSS) version 19.0 for Windows. The main focus was on the descriptive analysis of the participants' responses, especially the central tendencies of data (means and median) and the level of dispersion (standard deviation). Anchors of the 5-point Likert scale ranging from 1: "Not at all Important" or "Not at all suitable" to 5: "Extremely

Important" or "Extremely suitable" were used to explore the "importance", and "suitability" of each attribute. "Importance" indicates whether such attributes were deemed important by the expert for assessing neighbourhood's liveability assessment; "suitability" indicates whether such attributes, while important, were suitable tools to evaluate the liveability of a residential neighbourhood. Based on the recommendation by Taylor and Judd (1989), open-ended questions were added in order to collect more information deemed beneficial to clarifying the problems at hand. The experts were also asked to provide suggestions on how to improve the framework and to suggest criteria not listed. Following revisions as a result of the comments received from the first round, the participants were asked to repeat the assessment in the second round. The two-round Delphi survey proved adequate for achieving consensus using the statistical approach, so a further round was not needed.

3. Delphi survey results

3.1 General success of the survey and modification to criteria

In the first round, the panel members suggested several additional variables for inclusion in the framework, alterations to the wording of several attributes and amalgamation of others. In addition, criteria considered incomprehensible and repetitive or irrelevant were eliminated, the resulting set of criteria of 25 items being used in the next round.

The questionnaire contents in the second round were the same except for three attributes (number of storeys, disused buildings, and territorial functioning). The statistical analysis showed that the experts did not reach a consensus on these attributes. A *t*-test was used to determine whether or not the experts' opinions on the first and second round were similar. The results demonstrated that a significance level of α=0.05 was reached, and the *p*-value of all criteria exceeded 0.05. The results showed a very slight increase in the convergence in round two from round one although no significant movement in the mean scores was found. Thus it was felt that continuing the research for further rounds would not produce any extra convergence of opinions. "Importance" was adopted as the basis for attribute selection. Seven attributes in total were eliminated, resulting in a final set of 18 attributes included in the final questionnaire grouped into three categories: (1) built-form factors; (2) spatial quality factors; and (3) social and community factors. Table 2 also shows the variables which were finally used in each category.

Table 2: The preliminary and proposed list of the attributes of a Liveable Residential Neighbourhood by three categories

Category	Variable	Description	Preliminary	Proposed
Built-Form Factors	1-AF	An alternative appearance to the facades	✓	✓
	1-HF	Housing form	✓	
	1- PSS	The proportion and scale of the spaces enclosed by buildings	✓	✓
	1-CM	The existence of colour and material harmony	✓	
	1- MUB	The provision of mixed-use buildings	✓	✓
	1- NS	Number of storeys	✓	
	1- BDP	Contribution of buildings of different periods	✓	✓
	1-DB	Disused buildings	✓	
Spatial Quality Factors	2- AGS	Amount of green space (Private and public green space)	✓	✓
	2- PTN	Presence of trees and natural elements	✓	✓
	2- PWF	Presence of water features	✓	✓
	2- MS	Management of the spaces	✓	✓
	2- SH	The sense of hierarchy between public and private spaces	✓	✓
	2- QA	Quality of access to the residential public spaces	✓	✓
	2- EWF	Easy way-finding in the neighbourhood spaces	✓	✓
	2- VPS	Visibility of public spaces	✓	✓
Social + Community Factors	3- UR	Usability of routes	✓	✓
	3- QPF	Quality of pavements and footpath surfaces	✓	✓
	3- VSV	Volume and speed of vehicles	✓	✓
	3-SP	Separation of pedestrian and road traffic	✓	
	3- LN	Lighting during the night-time	✓	✓
	3-TF	Territorial functioning	✓	
	3- PVP	Presence of a variety of people in neighbourhood public spaces	✓	✓

3- JAP	Joint activities opportunities	✓	✓
3-SI	The sense of intimacy	✓	

The next step was to calculate ranks based on the importance of each attribute. The following sections present the results of the ranking and weighting of the factors by the experts according to the groups of factors. What immediately emerges in each case is the difference in importance ranking given by each group of respondents.

3.2. Built-form factor ranking and weightings

The results for the built form factors are presented in Table 3; the values denote the degree of importance of the various built-form factors. According to the Estonian experts, "the proportion and scale of the spaces" was the most important factor. The mean of 3.93 fell within the "somewhat important" interval. "The alternative appearance to the facades" was then ranked second, "The provision of mixed-use buildings" third and "The contribution of buildings of different periods" fourth. However, for the Iranian experts, "The alternative appearance to the facades" was ranked first followed by "The proportion and scale of the spaces", "The provision of mixed-use buildings" and "The contribution of buildings of different periods".

Table 3: The importance of Built-Form factors

	Built-Form Factors										
	Estonian Experts				Iranian Experts				Mann-Whitney U	Z	Sig.
	N	Mean	Median	Std. Deviation	N	Mean	Median	Std. Deviation			
1-AF	10	3.43	3.33	.80	10	4.47	5.00	.72	18.00	-2.51	.012
1-PSS	10	3.93	4.00	.72	10	4.03	4.00	.78	47.00	-.24	.810
1-MUB	10	3.36	3.33	1.15	10	3.80	4.00	.57	36.00	-1.09	.272
1-BDP	10	2.03	2.33	.96	10	3.13	3.16	.42	12.50	-2.90	.004

The weightings show that "The alternative appearance of the facades" and "The proportion and scale of the spaces" are generally the most important to both groups of experts respectively. A Mann–Whitney U test was applied, which compared the results for the two samples and also permitted a comparison between the importance of the various variables.

The results show statistically significant differences between the Estonian and Iranian experts and their opinions to the variables: "The alternative appearance of the facades" (U = 18.00, Z = -

2.51, p = .012) and “Contribution of buildings of different periods”.(U = 12.50, Z = -2.90, p = .004).

The reason for the differences is difficult to account for as respondents were not asked to state why they ranked factors as they did. It can be speculated on the basis of the differences between the two countries noted in the introduction that traditions and cultural differences in architecture and streetscape may account for them.

3.2. Spatial quality criteria ranking and weightings

The results for the spatial quality factors (Table 4) show that the for the Estonian experts, the most important attribute with a mean importance rating of 4.43 was “Quality of access to residential public spaces”, and the least important one, with a mean importance rating of 2.20, was “The presence of water features”. According to the Iranian experts “Amount of green space” scored the highest (mean of 4.53) followed by “Presence of trees and natural elements” and “Quality of access to the residential public spaces” (mean value of 4.33). The lowest mean rating for this category is 3.36, which is the “The presence of water features” in the neighbourhood.

The results of the Mann-Whitney U test show statistically significant differences between the Estonian and Iranian experts and their ratings (the Iranians ranking them higher) to several variables: “Amount of green space” (U = 23.00, Z = -2.19, p = .028), “The presence of water features”, (U = 9.50, Z = -3.11, p = .002), “The sense of hierarchy between public and private spaces” (U = 17.50, Z = -2.51, p = .012), “Easy way-finding in the neighbourhood spaces” (U = 22.00, Z = -2.17, p = .030) and “Visibility of public spaces”(U = 6.00, Z = -3.42, p = .001).

These results are interesting because they suggests that in Estonia there is plenty of green space in urban areas but it is access to it which is important, while in Iran there is not so much to start with so having enough is more important, as well as having more vegetation in general. The issue of the hierarchy of public to private spaces may also reflect cultural differences and patterns of, for example, private gardens around houses in Estonia being more common but also communal spaces in residential areas being characteristic of Soviet Era housing estates. Water might have been expected to be more important in Iran, a hot and dry country where water has been a design feature in parks and gardens for millennia.

Table 4: The importance of Spatial Quality factors

	Spatial Quality Factors										
	Estonian Experts				Iranian Experts				Mann-Whitney U	Z	Sig.
	N	Mean	Median	Std. Deviation	N	Mean	Median	Std. Deviation			
2-AGS	10	3.83	4.00	.61	10	4.53	5.00	.63	23.00	-2.19	.028
2-PTN	10	3.66	3.66	.89	10	4.33	4.00	.61	27.50	-1.79	.074
2-PWF	10	2.20	2.00	.77	10	3.36	3.33	.48	9.50	-3.11	.002
2-MS	10	3.50	3.33	1.08	10	3.70	4.00	.69	45.00	-.390	.696
2-SH	10	2.86	2.83	.93	10	4.10	4.00	.89	17.50	-2.51	.012
2-QA	10	4.43	4.50	.63	10	4.33	4.00	.61	45.50	-.38	.707
2-EWF	10	3.10	3.00	.96	10	3.80	4.00	.57	22.00	-2.17	.030
2-VPS	10	2.53	2.66	.74	10	3.90	4.00	.50	6.00	-3.42	.001

3.3. Social and community criteria ranking and weightings

The results for the set of social and community factors (Table 5) show that Estonian experts were generally reliable in their responses. The mean value for "Volume and speed of vehicles" is 4.27, which indicates that experts perceived this attribute the most influential determinant. Another important attribute with a mean value of 3.86 is "Joint activities opportunities". "Lighting during the night-time" is deemed to be the least important attribute for experts, with a mean value of 3.43.

The Iranian experts perceive "Lighting during the night-time" to be the most important factor (mean value of 4.60) followed by "Presence of a variety of people in neighbourhood public spaces" and "Volume and speed of vehicles" with mean values of 4.23 and 4.17, respectively. On the other end of the range, "Quality of pavements and footpath surfaces" and "Usability of routes" were identified as the two least important attributes. The relevant mean importance ratings were 3.86 and 3.76 out of a possible 5, respectively (Table 5). The results of the Mann-Whitney U Test show statistically significant differences for the variable "Lighting during the night-time" ($U = 16.00$, $Z = -2.69$, $p = .007$), the Iranian experts being more likely to assess this variable as important.

The distinct differences between Estonian and Iranian experts might be accounted for in several ways. The importance of the presence and variety of people may be something which makes places more rich and lively for Estonia, while traffic volume and speed may reflect the fact that many housing areas were not built for cars originally but that they now have to cope with many of them. The issue of lighting at night being the most important in Iran and the least important in Estonia is intriguing. In Iran, being further south, it is darker earlier in the evenings in general all year round while in Estonia, in the north, it is very light until late in the evening in the summer, when of course most parks are used, while it is dark early in the evenings in winter, when parks are not used for informal uses so much (ski tracks excepted).

Table 6 shows the complete comparison of rankings between each country.

Table 5: The importance of Social + Community factors

	Social + Community Factors										
	Estonian Experts				Iranian Experts				Mann-Whitney U	Z	Sig.
	N	Mean	Median	Std. Deviation	N	Mean	Median	Std. Deviation			
3-UR	10	3.50	3.33	1.00	10	3.76	3.66	.55	38.00	-.94	.346
3-QPF	10	3.60	3.66	.73	10	3.86	4.00	.74	40.00	-.79	.430
3-VSV	10	4.27	4.00	.68	10	4.17	4.00	.63	46.00	-.33	.744
3-LN	10	3.43	3.16	.93	10	4.60	5.00	.52	16.00	-2.69	.007
3-PVP	10	3.70	3.66	.64	10	4.23	4.00	.74	30.00	-1.59	.112
3-JAP	10	3.86	4.00	.93	10	3.97	4.00	.46	46.00	-.32	.745

Table 6: The final ranking of the key criteria within the thematic groupings for a liveable neighbourhood in Estonia and Iran, most important at the top to least important at the bottom

Estonia	**Iran**
Built-Form Factors	
The proportion and scale of the spaces enclosed by buildings	An alternative appearance to the facades
An alternative appearance to the facades	The proportion and scale of the spaces enclosed by buildings
The provision of mixed-use buildings	The provision of mixed-use buildings
Contribution of buildings of different periods	Contribution of buildings of different periods
Spatial Quality Factors	

Quality of access to the residential public spaces	Amount of green space (Private and public green space)
Amount of green space (Private and public green space)	Presence of trees and natural elements
Presence of trees and natural elements	Quality of access to the residential public spaces
Management of the spaces	The sense of hierarchy between public and private spaces
Easy way-finding in the neighbourhood spaces	Visibility of public spaces
The sense of hierarchy between public and private spaces	Easy way-finding in the neighbourhood spaces
Visibility of public spaces	Management of the spaces
Presence of water features	Presence of water features
Social + Community Factors	
Volume and speed of vehicles	Lighting during the night-time
Joint activities opportunities	Presence of a variety of people in neighbourhood public spaces
Presence of a variety of people in neighbourhood public spaces	Volume and speed of vehicles
Quality of pavements and footpath surfaces	Joint activities opportunities
Usability of routes	Quality of pavements and footpath surfaces
Lighting during the night-time	Usability of routes

4. Discussion

The study findings have provided quite a clear understanding of the different opinions of experts from two contrasting countries of the importance of environmental attributes for evaluating the liveability of residential areas. In previous investigations (Ballas, 2013; Golkar, 2007; HNEPH, 2012; van Kamp et al., 2003; Wells et al., 2007) the relative importance of environmental attributes and how they influence neighbourhood liveability had not been specifically determined. Thus, we attempted to define carefully and to assign weights to the attributes used in the study and the results appear to be quite significant and potentially useful.

There is a tension between developing a tool to measure physical environments that is robust because it contains only items that can be measured readily and reliably, and one that is sufficiently flexible to have wide applicability over time. This affects the utility of an environmental indicator to municipality planners and policy-maker, for example. Taking two different environments in Iran and Estonia and through this demonstrating that there are differences in ranking and weighting within a commonly agreed set of criteria suggests that the approach is quite sensitive. The contrasting rankings may in part be due to the different environmental conditions but may also be due to differences in education and experience of the experts in the two countries, so that further work might be useful to test this. The fact that the criteria extracted from the literature are generally universal and that they were only challenged by the experts in limited cases also suggests that they are quite robust and that the variations in ranking and weighting are indeed due to environmental and cultural differences.

According to Estonian experts' opinions, the least important social and community factor was "Lighting during the night-time" while being most important to the Iranians. This is the most significant difference between the two groups and some reasons for this were offered in the results section. Other research suggests that lighting has lost much of its potency to produce affective atmospheres, deliver aesthetically pleasing environments (Edensor, 2013) and create a liveable environment. From the results of these studies (Falchi et al., 2011; Marchant, 2005), it can be noted that lighting levels in public spaces are often set high as a deterrent against crime, even though studies have not proven this to have any effect on crime rates. Moreover, several ecologists and medical researchers are worried about the potentially harmful effects of light at night on human health (Chepesiuk, 2009; Lyytimäki & Rinne, 2013). The reasons why night time lighting is ranked so highly by the Iranian experts needs further exploration.

Some of the other differences might be accounted for by the characteristics of urban density, built form and general proportions of green areas within cities in each country. Estonia is a country with a temperate climate and Estonian cities are generally very well endowed with green spaces while Iran is in an arid region and the cities are more densely built up (see Table 1). Even in the densest Soviet era housing areas with highest residential buildings there is a lot of green space. The climate may also have more of an effect. With long light summer days and short dark winter days, Estonia has a more extreme climate in some ways and life tends to be distinctly different between summer and winter, which often includes some intensely cold weather. In Iran, at a more southerly latitude, this difference is not so strong; summers are hotter while winters are milder. Thus, the experts trained for the most part in the respective countries seem more likely to rank importances which reflect the social and environmental conditions as well as other aspects. The fact that the experts from the two countries viewed several factors differently in ranking and weighting can be seen as an indicator of the robustness of the system and its sensitivity to different cultural and environmental conditions, necessary if it is to be used operationally.

This study produced the categories to assess liveability in local neighbourhoods and permitted the allocation of weights, based on the level of importance, within each category. Ultimately the outcome of this research is a resource which should enable architects and urban planners to ensure that the work they undertake contributes to the building of liveable neighbourhoods, as well as generating an environmental audit tool that can be used to assess neighbourhood liveability. However, researchers must carefully consider the problems associated with a Delphi study. Some disadvantages of the technique are: a) the expert's cultural bias can lead to similar answers to some questions which in fact are poorly understood in terms of the cause-effect relationships; b) judgments are those of a select group of people and may not be representative of the respective professions as a whole and c) the results should not be viewed as a final solution (Powell, 2003; Yousuf, 2007). Conversely, the positive aspects of a Dephi study are a) initial ideas presented by experts can be tested for consensus or criteria derived from the literature; b) there is an opportunity for candidate criteria to be added or rejected and c) the technique of achieving consensus and the statistical tools as well as the way the study is administered enable an open and transparent result to be achieved. By using a Delphi study as a first step in a wider approach to testing potential indicators with the public it enables a potentially huge list of criteria to be reduced in scope and also enables the views of experts to be compared with that of residents through a further survey. It would have been possible to use a public survey based on the results of a literature search without a Delhi survey of the experts. However, since the point of the work is to develop a set of reliable indicators, the intermediate use of the Delphi establishes a stronger link between those who have to use the indicators and the public as those who experience the liveability or lack thereof in a specific neighbourhood.

5. Conclusions

The objective of this study was to test candidate criteria obtained from the research and theory literature among experts from two countries with widely contrasting environmental and cultural conditions. The research question asked: is it possible to identify common criteria which apply regardless of the location and context of an urban neighbourhood, or are there aspects which are location specific? The answer to this is that it was possible to find such criteria and that the location specificity is more to do with the relative importance of each rather than having separate criteria as such. The results showed that most of the initially suggested criteria were appropriate but that some were not considered practical or meaningful by the experts and so were excluded, while others were added. This shows the robustness and value of using experts with practical experience to ensure that criteria are more likely to be successful in providing indicators of neighbourhood liveability, even when derived from academic research of high quality.

While there were differences between the experts from the two countries, there were also broad agreements as to which criteria were useful and which least useful as well as showing how a set of criteria could be given different weights for different circumstances while also remaining broadly comparable. The use of the test in two contrasting countries also adds to the confidence that the criteria are likely to be reliable elsewhere, albeit with different weighting, and that these different weightings are to be expected and not to be considered flaws in the system. The developing of a valid and reliable tool for assessing neighbourhood liveability has some implications for improving overall quality of life.

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