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Article

Maximising the Degree of User Choice: A Simple Tool to Measure Current Levels of Quality of Life in Urban Environments

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Abstract

In this article, we present a simple methodology based on Max-Neef, Elizalde and Hopenhayn (1991) “human scale development” paradigm to measure current levels of Quality of Life (QoL) for urban environments. In this procedure, fundamental human needs form the study domains. We assess their fulfilment with a set of questions reflecting the subjective dimension of QoL. We sort questions into needs after two consecutive processes: a qualitative one involving local communities and/or expert groups, and a quantitative one involving the definition of weights for each question and per need. Complementarily, we add objective indicators to reflect the objective dimension of QoL. This way, we make possible a comparison between the two dimensions and a definition and computation of an integrative QoL. We argue that this method can be used to define more holistic urban quality indexes to improve decision making processes, policies and plans. It can also be seen as a tool to enhance bottom-up approaches and processes of urban analysis to create more liveable places for the dwellers.

Keywords

human scale development; integration; need satisfaction; quality of life; urban environments

Issue

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1. Introduction

Urban environments have traditionally attracted people as they offer a wide choice of positive stimuli and opportunities for housing, work and leisure (Bonnes, Scopelliti, Fornara, & Carrus, 2013). This attraction has led to the creation of big urban settlements that accumulate today 55% of earth’s total population, a number that is expected to grow up to 68% in 2050 (United Nations, 2018). The present worldwide trend toward urbanisation is intimately related to economic development and to profound changes in social organisation, land use and patterns of human behaviour (Angel, Sheppard, & Civco, 2005). The demographic scale of these changes is unprecedented (Berry & Okulicz-

Kozaryn, 2009; D’Acci, Haas, & Bardhan, 2016) and will lead to important but still partially understood impacts on the global environment.

An increased number of negative—and potentially occurring—aspects of urban living can be identified. Examples are road traffic noise, poor air quality, high temperature and crowding, to name just a few. These sources of environmental stress have various physical and psychological consequences, including health-related problems, annoyance, negative emotions and diminished cognitive functioning (Bilotta & Evans, 2013; Bonnes et al., 2013). In addition, environmental stressors can negatively impact social behaviour (Moser, 1988; Page, 1977). For example, noise and crowding may increase avoidance reactions and aggression and

decrease prosocial behaviour (Regoeczi, 2003). It seems thus clear that the continuous accumulation of the population in cities worldwide, along with uncontrolled urban sprawl, is leading to degraded urban habitats, seriously affecting the emotional and physical state of city dwellers (Costanza et al., 2007; Kennedy & Adolphs, 2011; Lederbogen et al., 2011; Moro, Brereton, Ferreira, & Clinch, 2008; Veenhoven, 2007).

However, the last few decades have witnessed a tendency to consider the increasing complex spatialities of the globalising world, including spatialities of power and changing identities (Paasi, 2008). Both the perception of citizens and the conception of planners (Lefebvre, 1974) on space have been changing slowly, mainly due to the increasing aforementioned environmental, social and economic problems encountered in urban conurbations. Although places are being seen both as progressive (open to the wider world) and regressive (self-enclosing, defensive, inward-looking, and reactionary; Antonsich, 2011), urban environments are being re-evaluated and reconsidered as valuable for health, social integration and well-being of the individuals (Townsend, Maguire, Liebhold, & Crawford, 2010). At the same time urban space is being seen as a material, constitutive element of daily life, economy, and politics (Martin, McCann, & Purcell, 2003), an unavoidable social product created from a mix of legal, political, economic, and social practices and structures (Lefebvre, 1974). In this sense, Quality of Life (QoL) forms a subject of increasing interest and several empirical studies have been developed in order to characterise, either by means of subjective or objective indicators, the links between QoL and urban societies (see Berry & Okulicz-Kozaryn, 2009; Easterlin, Angelescu, & Zweig, 2011; Marans, 2012; Massam, 2002; O'Brien, 2005; van Kamp, Leidelmeijer, & Marsman, 2003; Wenz, 1977, and references therein). It is then important to examine the relationships between the characteristics of urban environments and the perceived QoL of the residents. Following this rationale, this article introduces a method of measurement of QoL for urban environments, based both on the perception of people using the urban space and data on existing objective spatial indicators. To check the levels of QoL per domain, Max-Neef et al.'s (1991) conceptual framework on "human scale development" (HSD) is used.

This article is organised as follows. Section 2 presents a literature review on human needs, the HSD paradigm and QoL. Section 3 includes the methodology proposed for the compilation of data and the comparison and measurement of subjective and objective dimensions of QoL in order to achieve an integrative result. Section 4 corresponds to the discussion section. The article ends with Section 5, conclusions.

2. Literature Review

The "human development" concept has its philosophical roots in Amartya's Sen capability approach (Alkire,

2002b; Nussbaum, 2000; Robeyns, 2005; Sen, 1999). The conceptual shift towards this type of development with a human face was embraced by the UNDP report of 1990 entitled *Concept and Measurement of Human Development* (UNDP, 1990). It was a breakthrough to the mainstream thinking of development solemnly as economic growth. Although the capability approach has since become the reference point to all practical approaches regarding human well-being evaluation, in this article we will focus on the HSD approach. Their main differences can be found on the way they define dimensions (Alkire, 2002a), their philosophical bases (Schumacher, 1973), the terminology and meaning of main concepts (i.e., needs and satisfiers versus functioning and capabilities) and the evaluation schemes (Cruz, Stahel, & Max-Neef, 2009).

The HSD notion appeared for the first time in an article published by the Dag Hammarskjöld Foundation in 1986 (Max-Neef, Elizalde, & Hopenhayn, 1986, 1989). It was then suggested that the best development process would be the one that enables improvement in people's QoL, allowing people and their communities to be self-coherent within themselves (Max-Neef, 1986). The axis of this central thought is that HSD concentrates on, and is sustained by, (1) the satisfaction of fundamental human needs and the generation of growing levels of self-reliance, and (2) the construction of "organic articulations of people with nature and technology, of global processes with local activity, of the personal with the social, of planning with autonomy, and of civil society with the State" (Max-Neef, 1992, p. 197).

The HSD approach differs from other need theories popular in previous decades such as Maslow's (1954), the International Labour Office's (1976) and Streeben's (1981), mostly because of the utilitarian view observed within them (Cruz et al., 2009). Utilitarianism is known to be looking only at the individual level, favouring whatever maximises individual happiness as the best choice, and misleading the evolution of the satisfaction of needs in time, implying that more is always better. It promotes selfish decisions rather than collective ones (von Borgstede, Johansson, & Nilsson, 2013) and when a large number of people makes selfish choices, negative outcomes accumulate, creating a situation in which everybody would have been better off if they had not acted in their own interests (Dawes, 1980). HSD takes a different appreciation acknowledging that because of our common human nature, we must satisfy a set of fundamental needs—common to all—to maintain a rich and meaningful life. These needs can indicate at the same time both "deprivations and individual and collective human potential" (Max-Neef et al., 1991, p. 30). They are seen as "finite, few and classifiable" (p. 18), changing in a slow pace along with the evolution of our kind (Elizalde, 2003; Max-Neef et al., 1989).

The fulfilment of all needs is considered equally important since any unsatisfied or not adequately satisfied human need reveals a form of human poverty, hindering

happiness and therefore developing potential pathologies (Cruz et al., 2009). What changes over time and between cultures are the satisfiers of these needs. There is no one-to-one correspondence between needs and satisfiers: one satisfier may contribute simultaneously to the satisfaction of different needs or, conversely, a need may require various satisfiers in order to be met, and these relations are not fixed, they vary according to time, place and circumstance (Max-Neef et al., 1991). Each economic, social and political system adopts different methods for the satisfaction of the same fundamental human needs. In every system, needs are satisfied (or not satisfied) through the generation (or destruction) of different types of satisfiers.

QoL is directly related to obtaining the necessary conditions for happiness throughout a society (McCall, 1975). These conditions can be identified with the availability of means for the satisfaction of human needs rather than human desires, and any lack of them may lead to unhappiness. QoL represents how well human needs are met or the extent to which individuals or groups perceive satisfaction or dissatisfaction in various life domains (Costanza et al., 2007). It forms a multi-scale, multi-dimensional concept that contains interactive objective and subjective elements. Recent research in QoL focuses on either of these two elements to construct quantitative indicators (Veenhoven, 2000). But, if QoL is to embrace the totality of human life, then both, objective and subjective dimensions should be considered (Cummins, 2000) as much as the cross-level interactions between them (Berry & Okulicz-Kozaryn, 2009).

Previous research demonstrated that the relationship between variables measured within each dimension is complex. Especially, for the urban contexts it is shown

that although relationships between objective and subjective indicators of QoL can be weak, care should be taken when making inferences about improvements in subjective QoL based on improvements in objective QoL (McCrea, Shyy, & Stimson, 2006). The combination of both objective and subjective measures towards an integrative QoL assessment enable the capture of a more holistic and effective image of the multiple social, special and temporal scales a place may have. QoL can then be related to the opportunities that are provided to meet human needs in the forms of built, human, social and natural capital (in addition to time) and the policy options that are available to enhance these opportunities (Mulder, Costanza, & Erickson, 2006; Vemuri & Costanza, 2006).

3. Research Methodology

We present the main steps of our methodology for the QoL assessment in Figure 1. The first four steps form the preparation process, the next two the classification and weighting process and the final three the final process toward an integrative QoL.

3.1. Preparation Process

We suggest starting from the definition of the place corresponding to the study case. Seeing this place as a system and defining its boundaries in terms of time, space, culture, history, etc., is essential for the second step of the methodology, the definition of the satisfiers. To do so, we should respond to the following question: what do we consider important to assess, focusing on the socioeconomic and geographical characteristics of our study case?

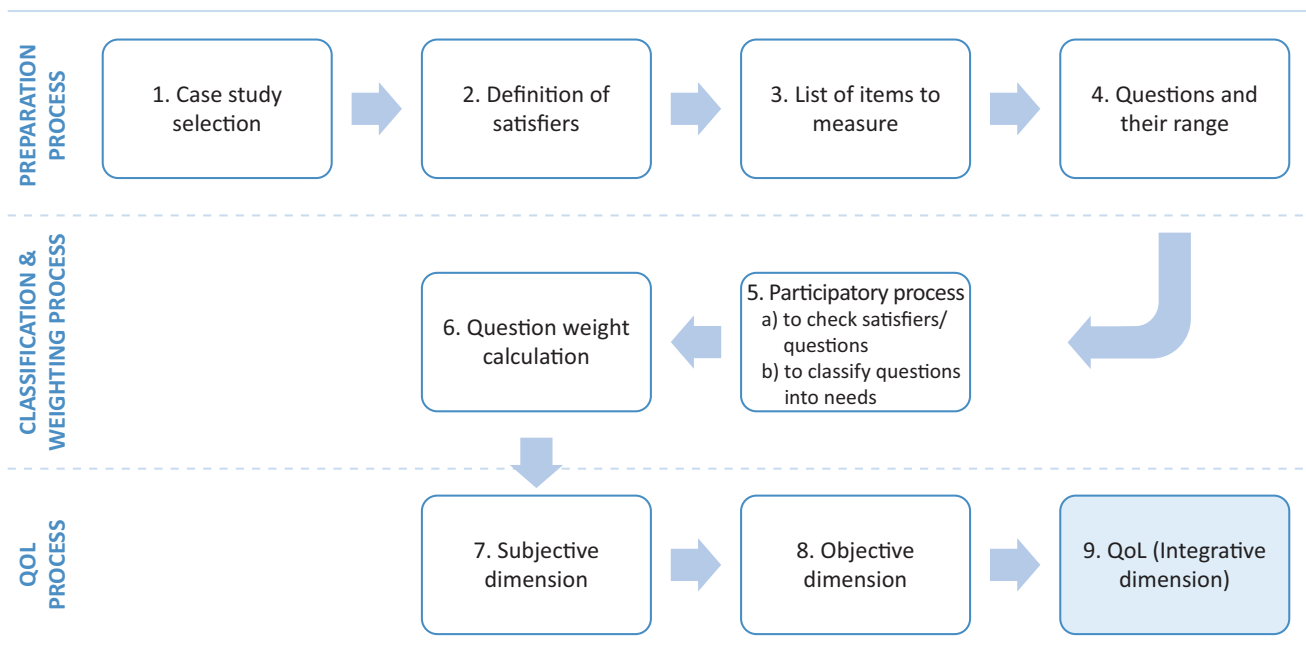


Figure 1. Methodology steps.

The satisfiers, whether of individual or collective nature, include all things that, by representing forms of being, having, doing and interacting, contribute to the realisation of human needs (Max-Neef et al., 1989). “Being” refers to personal or collective attributes (usually expressed as nouns related to the subject’s intrinsic attributes as our biological constitution, character and values); “having” registers institutions, norms, mechanisms, tools that can be expressed in one or more words (i.e., exosomatic tools, laws and information); “doing” is related with actions, personal or collective, that can be expressed as verbs. And “interacting” refers to locations and milieus (as times and spaces) and the way people relate to and articulate their environment (Max-Neef, 1992).

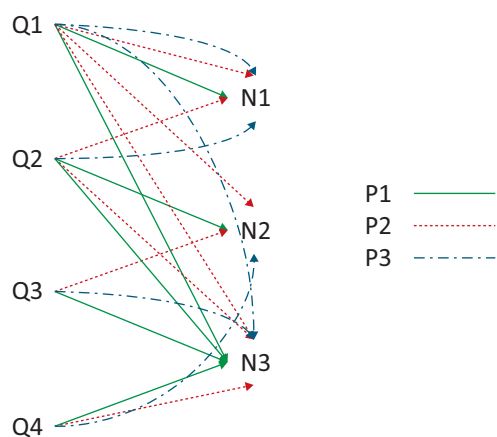
After completing the list of the satisfiers we should ask ourselves what we would like to measure related to them. This list of items corresponds to step 3. We should also think of how we want to do so. The second question will give us the questions and their thresholds we will later incorporate in our survey to complete the subjective dimension (step 4). In Table A1 of the Appendix we include an example of some satisfiers with their items and questions.

3.2. Classification and Weighting Process

Steps 5 and 6 suggest a participatory process to (1) check if the satisfiers, items and questions are corresponding to the place selected as our study case, and (2) to classify and weight the questions inside each need. The process should involve the local community and/or experts. We will call them our study group. Their engagement depends on the study case: it could be the neighbourhood committee of a neighbourhood we would like to study, an interdisciplinary group of experts with special interest to these subjects, an emerging social group wanting to give life to a public space, etc. They shouldn’t necessarily be the same participants of the survey, but people with knowledge of the needs of the place in question. We will focus here in point 2) which is more compli-

cated. The main function of the study group is to classify the survey questions into the human needs. We have already mentioned that in this study we are building on the HSD paradigm (Max-Neef et al., 1991), taking into consideration the suggestions made by Costanza et al. (2007) on measuring QoL. We suggest the use of the axiological needs, corresponding to subsistence, protection, affection, understanding, participation, leisure, creation, identity and freedom. Protection is changed to security, as suggested by Costanza et al. (2007), and subsistence is considered within reproduction, being the latter understood as a part of the former. Spirituality/ transcendence is also included because of its importance, both in QoL studies and in the assessment as a need (Moberg & Brusek, 1978; O’Brien, 2005; Peterson & Webb, 2006; Van Dierendonck, 2011).

The matching of the questions to one or more needs is a subjective choice related to personal understanding and interpretation. Consequently, we should ask the study group to individually classify the questions to each need. The easiest way to do so would be to match each question only to one need, but, as questions may be related to more than one need, it is recommended to give the freedom of selection to the participants. The categorisation of questions performed by the study group implies a subsequent process of weighting, where the importance of each question in the definition of a need will depend on the aggregated results of all members of the study group. To clarify this weighting process, a hypothetical example is given in Figure 2, where a study group composed by three people (P1, P2 and P3) is asked to classify four questions (Q1, Q2, Q3 and Q4) into three needs (N1, N2 and N3). Regarding need N1, all three members of the study group consider it is assessed by question Q1, while only two of them consider that it is also assessed by question Q2. The question weight is the ratio between the number of people who considered that question (Q1) related to that need (N1), and the total number of people who considered a question (Q1 and Q2) for that same need (N1). In this case, the weights



Need	Question	# People	Question weight
N1	Q1	3	3/5
	Q2	2	2/5
N2	Q1	1	1/4
	Q2	1	1/4
	Q3	1	1/4
N3	Q1	3	3/9
	Q2	2	2/9
	Q3	2	2/9
	Q4	2	2/9

Figure 2. Hypothetical example of correspondence of four questions (Q1, Q2, Q3 and Q4) into three needs (N1, N2 and N3) according to the perceptions of three individuals (P1, P2 and P3) belonging to the study group.

for questions Q1 and Q2 would be 3/5 and 2/5, respectively. In this sense, same questions may have different weights for different needs. For instance, bearing in mind the study group's classification of questions for need N2 in our example, all four questions would have the same weight corresponding to $\frac{1}{4}$, which is different from the weight assigned to them in assessing need N1 (i.e., 3/5 and 2/5 respectively).

If the number of questions is large, the study group may use the items (see Table A1 of the Appendix) for the classification or even work directly with the satisfiers.

3.3. Towards Integrative QoL

Step 6 points to the subjective dimension. To do so we start from the realisation of the survey, created using the corrected list of questions. It should be answered by a random and diverse sample of the target population related to the study case. It should be anonymous and may be completed both online and in person (Papachristou & Rosas-Casals, 2015b). The web survey mode is proposed because it has several advantages. It does not suffer from interviewer bias, and responders may feel more comfortable answering sensitive questions or moving through a survey at their own pace (Pearce & Ozdemiroglu, 2002). Moreover, a vast improvement in response speed over traditional mail surveys is widely reported and the financial expenditure (Wolfgang, 2002) and environmental impact of surveys on the Internet is smaller due to the elimination of postage, printing and data entry (Dillman & Bowker, 2002). The lack of any clarification of questions (MacKerron & Mourato, 2009) and the over-participation of responders with degrees in higher education, that tend to belong mainly to middle class and be more liberal (Brenner, 2002; Wolfgang, 2002) can be catalogued as some of the disadvantages of web surveys. Using only online surveys thus can cause some bias and may be considered as non-representative. Therefore, the use of in-person surveys is also suggested by the authors. To complete this dimension, we should calculate the statistics regarding each question's answers. A good interpretation of the accumulated data may lead to the creation of a visual representative image of the sample and foresee in it what is missing, what goes wrong and what is affecting personal well-being (Papachristou & Rosas-Casals, 2015b).

Once the subjective approach is completed, the objective one should be added (step 7). It consists of adding related objective indicators and their values for every question of our list. After doing so, thresholds should be also added for every objective indicator (see Table 1). Although it is sometimes difficult for the researcher to obtain data at a local scale, depending on the available data source, actual final considered threshold values should be obtained in decreasing order from the local to the regional scale. Objective thresholds come also in decreasing order from established local, regional or world legal limits and regulations.

Generalised thresholds and norms do not always work for all (urban) environments, and should be adjusted to our selected study case: space, place and its residents' culture, habits, customs and traditions. And even doing so, subjective perceptions and thresholds do not always coincide with the objective reality, where thresholds are usually quantified under unbiased assumptions. This fact might influence QoL and the perception that people obtain from their surrounding space and environment, curtailing initiatives that would be otherwise beneficial. Consequently, objective and subjective indicators and their thresholds should be considered altogether to detect possible deviations (step 9). This can be done with a matrix (see Table 2), where columns are identified in the following way:

1. Need.
2. Questions, related to each need. Each need is assessed by means of a number n of questions. Same questions can be used to assess different needs (i.e., question 2 is included to assess need A and need B).
3. Question weight, includes the partial weight w_n as % of each question, following the weighting process conducted by the group of experts and/or the community (see Section 3.2). Recall that a need is related to a particular group of questions, and weights for these questions must add up 100%.
4. Subjective dimension of QoL measurement, with:
 - a. Answer, expressed in terms of the highest satisfaction percentage (i.e., related to values 4 and 5 in the case of a 1 to 5 scale, or Yes in the binary case).
 - b. Threshold, normally when more than 50% of the sample answers positively to a question.
 - c. Satisfaction related to this threshold, identified with the binary variable b_n^S , showing whether the percentage of satisfied people is higher than the threshold (with a numerical value of 1) or not (with a numerical value of 0).
 - d. Subjective score (S_n^S), for each need, and as the summation of the product of each question weight (column 3) by its satisfaction (column 4c).
5. Objective dimension of QoL measurement, with:
 - a. Actual value of the item (i.e., current level of air quality, etc.).
 - b. Threshold, being it an upper or lower legally admitted limit for a particular dimension (i.e., maximum levels of NOx concentration in ppm, etc.)
 - c. Satisfaction related to this threshold, identified with the binary variable b_n^O , showing whether the current value of this dimension is lower/higher than the threshold (with a numerical value of 1) or not (with a numerical value of 0).

Table 1. Subjective, objective and integrative dimensions matrix.

(1) Need	(2) Question	(3) Weight	(4) Subjective				(5) Objective				(6) Integrative	
			(a) Answer	(b) Threshold	(c) Satisfaction	(d) Score	(a) Value	(b) Threshold	(c) Satisfaction	(d) Score	(a) Check	(b) Score
A	1	w_1			b_1^S	$S_A^S = \sum_n b_n^S w_n$			b_1^O	$S_A^O = \sum_n b_n^O w_n$	β_1	$S_A^I = \sum_n \beta_n w_n$
	2	w_2			b_2^S				b_2^O		β_2	
	
	n	w_n			b_n^S				b_n^O		β_n	
B	2	w_1			b_2^S	$S_B^S = \sum_n b_n^S w_n$			b_2^O	$S_B^O = \sum_n b_n^O w_n$	β_2	$S_B^I = \sum_n \beta_n w_n$
	3	w_2			b_3^S				b_3^O		β_3	
	
	n	w_3			b_n^S				b_n^O		β_n	
...
N	i	w_i			b_i^S	$S_N^S = \sum_n b_n^S w_n$			b_2^O	$S_N^O = \sum_n b_n^O w_n$	β_i	$S_N^I = \sum_n \beta_n w_n$
	j	w_j			b_j^S				b_3^O		β_j	
	
	n	w_n			b_n^S				b_n^O		β_n	
QoL					$\overline{S_N^S}$			$\overline{S_N^O}$		$\overline{S_N^I}$		

Table 2. Example of comparison between subjective and objective indicators of QoL. Results extracted from a study for a neighbourhood of Barcelona.

(1) Need	(2) Question	(3) Weight	(4) Subjective			(5) Objective			(6) Integrative	
			(a) Answer	(b) Threshold	(c) Satisfaction	(a) Value	(b) Threshold	(c) Satisfaction	(a) Check	(b) Score
Subsistence	How satisfied are you with the air quality in the neighbourhood?	1.65%	4–5: 9,20%	4–5 > 50%	No	ICQA average (2010) = 52 ¹	50<ICQA<75 ²	Yes	0.5	0.83%
Security	How satisfied are you with the air quality in the neighbourhood?	2.01%	4–5: 9,20%	4–5 > 50%	No	ICQA average (2010) = 52 ¹	50<ICQA<75 ²	Yes	0.5	1.01%
Subsistence	How satisfied are you with the green spaces in the neighbourhood?	1.65%	4–5: 8.62%	4–5 > 50%	No	Urban green: 6,55 m2/hab ³ 10–15 m2/hab ⁴	S. Europe cities average:	No	0	0%

Notes: ¹ Air quality index (ICQA) for Barcelona (Idescat, 2013); ² Generalitat de Catalunya (2019); ³ Ajuntament de Barcelona (2008); ⁴ Fuller & Gaston (2009).

- d. Objective score (S_N^O), for each need, as the summation of the product of each question weight (column 3) by its satisfaction (column 5c).
6. Integrative dimension of QoL measurement, with:
 - a. The integrative dimension of QoL includes a ternary variable β_n for each question in order to check whether the final value of the comparison between the two types of measurements for each question is positive, negative or neutral. When both, subjective and objective, indicators are satisfied, this result equals to 1 unit. When both are not satisfied, the result equals to 0 units. When only one of the two thresholds is satisfied, the result equals to 0.5 units.
 - b. Integrative score (S_N^I), for each need, as the summation of the product of each question weight (column 3) by its check variable (column 6a).

The score per need corresponds to the sum of all the total scores of the questions classified under that same need. Totals above and below 50% are considered as strong and weak satisfaction respectively. Final QoL scores for objective (S_N^O), subjective (S_N^S) and integrative (S_N^I) dimensions (Table 1, last row) correspond to the average of the individual objective, subjective and integrative scores per each need, respectively.

4. Discussion: Assessing QoL in a Neighbourhood of Barcelona (Spain)

We tested the methodology on Vila de Gràcia, a neighbourhood of Barcelona (Spain), with the aim of validating and discussing its steps and usefulness. We constructed the survey based on the satisfiers and questions listed in Table A1 of the Appendix. Our study group was formed by a group of experts of the Sustainability Measurement and Modelling Lab (summlab.upc.edu/en) and

the University Research Institute for Sustainability Science and Technology of the Universitat Politècnica de Catalunya (UPC)—BarcelonaTech (is.upc.edu/en). They were responsible for (1) the validation of the survey questions, and (2) the classification of the different questions into needs. Their work allowed us to compute the weight of each question per Need. We also established objective indicators and both objective and subjective thresholds related to each question.

A filled example of the matrix introduced in the previous section (Table 1) is shown in Table 2, where we omitted results for the objective and subjective scores to avoid overloading the table with excessive data. We observe that one same question (i.e., “How satisfied are you with the air quality in the neighbourhood?”) has a different weight for two different needs (i.e., subsistence and security). Experts have given to this question a higher importance inside the security need. Regarding the subjective thresholds, questions included answers in a scale range from 1 to 5 and, the thresholds in these cases are satisfied if more than 50% of the population sample rates them above 3. Objective values correspond to local (and in this example, environmental) indicators, and their thresholds correspond either to (a) limits pre-established by the indicators or (b) globally established limits.

The same process was followed for the rest of the questions to achieve the total score (i.e., satisfaction) per need and dimension, and the final QoL score for this study case. These values are shown in Table 3 and Figure 3(i). Results show a significant difference between total objective and subjective scores on average terms, with the objective score well below the subjective one, indicating that either people answered trying to appear more satisfied than they really are, or objectively established thresholds are rather strict related to the reality and they do not correspond to what people truly need or feel. Regarding the subjective dimension, all needs obtain a medium level of satisfaction (around 50%), exception made for two extremes: spirituality/transcendence, with the lowest one (46.1%), and participation and iden-

Table 3. Example of a QoL assessment for Vila de Gràcia (Barcelona, Spain).

Human needs (Domains)	Scores (%)		
	Subjective	Objective	Integrative
1. Subsistence	59.2	37.4	35.4
2. Security	58.3	29.1	34.6
3. Affection	57.3	12.3	29.8
4. Understanding	56.9	19.3	31.7
5. Participation	67.3	17.7	35.5
6. Leisure	50.0	13.0	27.9
7. Creativity	51.9	10.7	27.5
8. Identity	71.5	37.0	40.9
9. Freedom	58.6	25.8	32.9
10. Spirituality/ Transcendence	46.1	8.8	23.6
Total	57.7	21.1	32.0

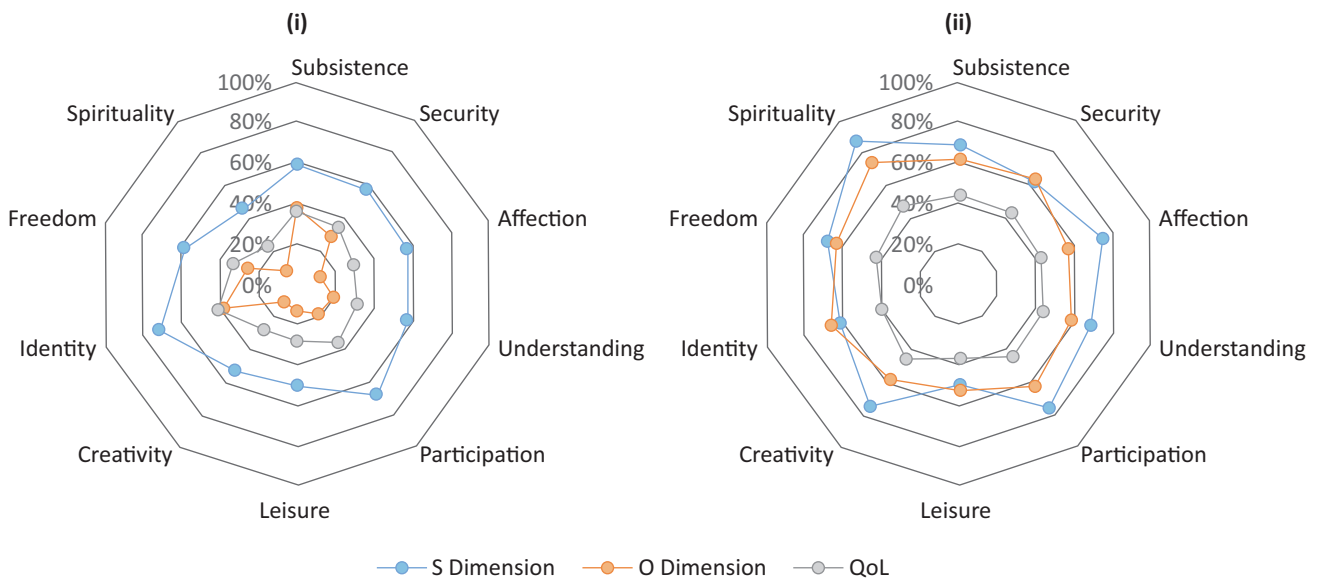


Figure 3. Graphic representation of the QoL assessment in Vila de Gràcia neighbourhood comparing subjective (s), objective (o) and integrative (QoL) results per need, (i) for the real case and (ii) for the hypothetical case that excludes questions without objective indicators.

tity, with the highest ones (67.3% and 71.6% correspondingly). In the objective dimension, needs obtain a much lower satisfaction than in the subjective one. The lowest satisfaction corresponds again to spirituality/transcendence (8.8%), followed by creativity (10.1%) and leisure (13.0%). Since the final integrative result depends on the value of β_n for each question, integrative results do not necessarily correspond to an average of both previous dimensions (i.e., objective and subjective). In our study case, integrative QoL stands between subjective and objective scores. At the need level, integrative satisfaction appears between subjective and objective dimensions, but with no need over 50%. Spirituality/transcendence reaches again the lowest satisfaction level (23.6%), indicating the poorest fulfilment of this need for the Vila de Gràcia neighbourhood.

As mentioned previously (see Section 2), in the HSD paradigm the fulfilment of all needs is considered as equally important and any unsatisfied or poorly satisfied need reveals a form of human poverty. The low satisfaction of spirituality in all dimensions, and creativity and leisure for the objective dimension, suggest the prioritisation of future policies and plans related to the fulfilment and satisfaction of these needs. The steps in which this methodology unfolds allow, at least, two different options to help defining future policies and plans. On the one hand, the identification of intervention axes and actions for each affected need and based on their satisfiers. The low representation of these needs in the objective dimension indicates that these domains are mainly connected to the individual and in these cases, literature indicates that linking objective and subjective measures of QoL may be relatively straightforward (McCrea et al., 2006). In other words, by making interventions in the

urban grid of the neighbourhood, like adding establishments and equipment or ameliorating the existing ones, a higher perceived satisfaction will also be obtained. In the specific case of spirituality/transcendence the example of satisfiers organised in forms of being, having, doing and interacting can be taken into consideration: actions such as facilitating access to nature and the creation of green spaces or the promotion of social centres and athenaeums would probably help in generating feelings such as calmness, compassion, peace, and understanding, directly connected to the need in question. Regarding leisure and creativity, these two spheres are considered as highly interrelated by the modern societies. In fact, Max-Neef et al. (1991, p. 17) state that “idleness” (leisure in our case) “and creation” (creativity in our case) “seem to be inseparable if the former is understood as the state of mind and spirit that is inviting to the muses”. It seems that our present-day extremely (pre)occupied and stressed way of life clearly affects the satisfaction of these needs. In the actual economic model, human creativity (i.e., thinking of novel and productive ways to do things) is generally declining and being replaced by high-tech apparels and gadgets (Csikszentmihalyi, 1996; Johnson, 2010). Hours spent on television, on the internet, using smart phones, video games along with the low participation to productive processes might be the possible answer to the low creativity and leisure scores. Actions such as the promotion of free time activities in the neighbourhood, or the forwarding of creative collaborative communities would probably lead to higher subjective scores in both needs. On the other hand, when the methodology is slightly extended to make use of weighted networks and dependence coefficients, it can be used to (1) reveal connectivity pat-

terns between needs and to (2) allow the identification and use of more strongly satisfied needs for the fulfilment of others less so favoured (Papachristou & Rosas-Casals, 2016).

The application of this methodology for Vila de Gràcia revealed one particularly difficult task related with the search of objective data and indicators. For this specific case study only 36% of the questions appears to have corresponding objective values public and openly accessible. If we excluded questions with no objective corresponding data, results would have been those shown in Figure 3(ii). All needs of the three categories in this case would have had higher scores. However, integrative results would not have been between the two dimensions as in the original case, but they would have had lower scores. This fact indicates that (1) most questions are satisfied either subjectively or objectively, and (2) that previous results were too low mainly because of the missing objective values (especially in the case of spirituality and creativity, that could be considered as more subjective needs). The fact that self-reported happiness is subjective, does not mean that it is unrelated to relatively objective variables (Lyubomirsky, Sheldon, & Schkade, 2005). In this sense, the scale of reference also affects the result and should be considered of great importance. It is true that researchers often encounter difficulties in finding legal limits and regulations or data at a local scale. However, it is recommended to always concentrate their inquest from the local to the regional and the global in order to maintain the same reference scale and to enable a comparison with the subjective data. At the same time, further caution should be taken both (1) during the selection of the objective indicators, as they cannot be based in subjective perceptions (Papachristou & Rosas-Casals, 2015a), and (2) while making inferences about improvements in subjective QoL based on improvements in objective QoL (McCrea et al., 2006).

Last but not least, it is important to recall that this type of measurement represents a snapshot in time. Urban environments are dynamic (Batty, 1971) and open systems (Sennett, 2006) and should be studied as such. From a social point of view, even though the methodology contains objective data, it depends mostly on the researchers' and/or study group's perception and criteria, both during the selection of satisfiers and the shaping of the survey question and the question classification process. Therefore, it is mandatory to try to incorporate all different options and aspects that may affect somebody's well-being and QoL, and the fulfilment of her needs (Papachristou & Rosas-Casals, 2015b). In terms of policies, any measurement data used for predictive purposes related to the QoL in our system would have to be repeatedly collected over sufficiently long time and samples, to successfully capture the co-evolution of humans with their environment, in order to develop an effective knowledge base and to be able to define improvement scenarios (Costanza et al., 2007).

5. Conclusions

Adding the possibility of expression of citizen voices to policy processes would deliver the much sought-after openness, transparency and inclusive dialogue missing in regular institutional and political practice. The subjective perception and feelings that a city dweller obtains from its surroundings is usually more than the mere sum of its isolated, and objectivised, forming parts. Thus, an integrative assessment is needed to conflate objective and subjective spheres to evaluate QoL in the particular case of the urban environment, keeping always in mind that, as society–nature relationships are characterised by complexity, uncertainty and political contentiousness, a complete and impartial view is rarely, if ever, possible. The methodology presented in this article allows the integrative approach considering both aspects and incorporating different questions into axiological domains and under the HSD frame of reference. By these means, it favours a small-scale, human-oriented, democratic approach, potentially leading to a more social design of urban space, while respecting the urban environment.

The use of human needs as domains of study aims at understanding the category in which a problem may be concentrated. Needs indicate deprivations and at the same time individual and collective human potential. Each economic, social and political system adopts different methods for the satisfaction of the same fundamental human needs. In every system, they are either satisfied or not through the generation or non-generation of different types of satisfiers. Therefore, the method here presented may also be of significant help when having to decide the focus of a decision-making process, concerning future policies, plans and measures of improvement. At the same time and keeping in mind that the fulfilment of all needs is considered equally important, this methodology can be considered as a useful tool both to evaluate and to improve the current urban environment, concentrating the efforts on the QoL of the dwellers.

Urban design and planning must be focused on the making of places for people and precisely on the process of making better places for people than would otherwise be produced. To achieve QoL, there is a need for a more democratic and enriching environment to maximise the degree of user choice, giving emphasis on the correlation between designed space, activities and use. We hope this methodology could help scholars, researchers, decision makers and citizens to finally understand that urban planning should be about planning for people who live in the city rather than planning for the city.

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Conflict of Interests

The authors declare no conflict of interests.

References

- Ajuntament de Barcelona. (2008). *Programa d'actuació municipal 2008–2011* [Municipal action program]. Barcelona: Ajuntament de Barcelona. Retrieved from <http://www.bcn.cat/publicacions/pdf/PAMdef.pdf>
- Alkire, S. (2002a). Dimensions of human development. *World Development*, 30(2), 181–205. [https://doi.org/10.1016/S0305-750X\(01\)00109-7](https://doi.org/10.1016/S0305-750X(01)00109-7)
- Alkire, S. (2002b). *Valuing freedoms: Sen's capability approach and poverty reduction*. Oxford: Oxford University Press.
- Angel, S., Sheppard, S., & Civco, D. (2005). *The dynamics of global urban expansion. Transport and urban development department*. Washington, DC: The World Bank. Retrieved from http://www.citiesalliance.org/sites/citiesalliance.org/files/CA_Docs/resources/upgrading/urban-expansion/1.pdf
- Antonsich, M. (2011). Grounding theories of place and globalisation. *Tijdschrift Voor Economische En Sociale Geografie*, 102(3), 331–345. <https://doi.org/10.1111/j.1467-9663.2010.00614.x>
- Batty, M. (1971). Modelling cities as dynamic systems. *Nature*, 231(5303), 425–428. <https://doi.org/10.1038/231425a0>
- Berry, B. J. L., & Okulicz-Kozaryn, A. (2009). Dissatisfaction with city life: A new look at some old questions. *Cities*, 26(3), 117–124. <https://doi.org/10.1016/j.cities.2009.01.005>
- Bilotta, E., & Evans, G. W. (2013). Environmental stress. In L. Steg, A. E. van den Berg, & J. I. M. de Groot (Eds.), *Environmental : An introduction* (pp. 27–35). Leicester: BPS Blackwell.
- Bonnes, M., Scopelliti, M., Fornara, F., & Carrus, G. (2013). Urban environmental quality. In L. Steg, A. E. Van den Berg, & J. I. M. De Groot (Eds.), *Environmental : An introduction* (pp. 113–1122). Leicester: BPS Blackwell.
- Brenner, V. (2002). Generalizability issues in internet-based survey research: Implications for the Internet Addiction Controversy. In B. Batinić, U.-D. Reips, M. Bosnjak, & A. Werner (Eds.), *Online social sciences* (pp. 117–139). Ashland, OH: Hogrefe & Huber Publishers. Retrieved from <http://psycnet.apa.org/psycinfo/2003-88135-000>
- Costanza, R., Fisher, B., Ali, S., Beer, C., Bond, L., Boumans, R., . . . Snapp, R. (2007). Quality of life: An approach integrating opportunities, human needs, and subjective well-being. *Ecological Economics*, 61(2/3), 267–276. <https://doi.org/10.1016/j.ecolecon.2006.02.023>
- Cruz, I., Stahel, A. W., & Max-Neef, M. A. (2009). Towards a systemic development approach: Building on the Human-Scale Development paradigm. *Ecological Economics*, 68(7), 2021–2030. <https://doi.org/10.1016/j.ecolecon.2009.02.004>
- Csikszentmihalyi, M. (1996). *Creativity flow and the psychology of discovery and invention*. New York, NY: HarperCollins.
- Cummins, R. A. (2000). Objective and subjective quality of life: An interactive model. *Social Indicators Research*, 52(1), 55–72. <https://doi.org/10.1023/A:1007027822521>
- D'Acci, L., Haas, T., & Bardhan, R. (2016). Inaugural editorial of Urban Planning. *Urban Planning*, 1(1), 1. <https://doi.org/10.17645/up.v1i1.586>
- Dawes, R. M. (1980). Social dilemmas. *Annual Review of Psychology*, 31(1), 169–193. <https://doi.org/10.1146/annurev.ps.31.020180.001125>
- Dillman, D. A., & Bowker, D. K. (2002). The web questionnaire challenge to survey methodologists. In B. Batinić, U.-D. Reips, M. Bosnjak, & A. Werner (Eds.), *Online social sciences* (pp. 53–71). Ashland, OH: Hogrefe & Huber Publishers. Retrieved from <http://psycnet.apa.org/psycinfo/2003-88135-000>
- Easterlin, R. A., Angelescu, L., & Zweig, J. S. (2011). The impact of modern economic growth on urban–rural differences in subjective well-being. *World Development*, 39(12), 2187–2198. <https://doi.org/10.1016/j.worlddev.2011.04.015>
- Elizalde, A. (2003). Desde el Desarrollo Sustentable hacia sociedades sustentables. *Polis*, 1(4). Retrieved from <http://red.pucp.edu.pe/ridei/wp-content/uploads/biblioteca/100403.pdf>
- Fuller, R. A., & Gaston, K. J. (2009). The scaling of green space coverage in European cities. *Biology Letters*, 5(3), 352–355. <https://doi.org/10.1098/rsbl.2009.0010>
- Generalitat de Catalunya. (2019). Air quality index (ICQA). Methodology. *Statistical Institute of Catalonia*. Retrieved from <https://tinyurl.com/y4ue2qtw>
- Idescat. (2013). Statistical yearbook of Catalonia. *Idescat*. Retrieved from <http://www.idescat.cat/pub/?id=aec&lang=es>
- International Labour Office. (1976). *Employment, growth and basic needs: One world problem*. Geneva: International Labour Office. Retrieved from http://www.ilo.org/public/libdoc/ilo/1976/76B09_199.pdf
- Johnson, S. (2010). *Where good ideas come from: The natural history of innovation*. New York, NY: Riverhead Books.
- Kennedy, D. P., & Adolphs, R. (2011). Social neuroscience: Stress and the city. *Nature*, 474(7352), 452–453. <https://doi.org/10.1038/474452a>
- Lederbogen, F., Kirsch, P., Haddad, L., Streit, F., Tost, H., Schuch, P., . . . Meyer-Lindenberg, A. (2011). City living and urban upbringing affect neural social stress processing in humans. *Nature*, 474(7352), 498–501. <https://doi.org/10.1038/nature10190>

- Lefebvre, H. (1974). *La production de l'espace* [The production of space]. Paris: Anthropos.
- Lyubomirsky, S., Sheldon, K. M., & Schkade, D. (2005). Pursuing happiness: The architecture of sustainable change. *Review of General Psychology*, 9(2), 111–131. <https://doi.org/10.1037/1089-2680.9.2.111>
- MacKerron, G., & Mourato, S. (2009). Life satisfaction and air quality in London. *Ecological Economics*, 68(5), 1441–1453. <https://doi.org/10.1016/j.ecolecon.2008.10.004>
- Marans, R. W. (2012). Quality of urban life studies: An overview and implications for environment-behaviour research. *Procedia—Social and Behavioral Sciences*, 35(2012), 9–22. <https://doi.org/10.1016/j.sbspro.2012.02.058>
- Martin, D., McCann, E., & Purcell, M. (2003). Space, scale, governance, and representation: Contemporary geographical perspectives on urban politics and policy. *Journal of Urban Affairs*, 25(2), 113–121. <https://doi.org/10.1111/1467-9906.t01-1-00001>
- Maslow, A. H. (1954). *Motivation and personality*. Manhattan, NY: Harper.
- Massam, B. H. (2002). Quality of life: Public planning and private living. *Progress in Planning*, 58(3), 141–227. [https://doi.org/10.1016/S0305-9006\(02\)00023-5](https://doi.org/10.1016/S0305-9006(02)00023-5)
- Max-Neef, M. A. (1986). *Desarrollo a escala humana: Conceptos, aplicaciones y algunas reflexiones*. Barcelona: Icaria Editorial.
- Max-Neef, M. A. (1992). Development and human needs. In M. A. Max-Neef & P. Ekins (Eds.), *Real life Economics: Understanding wealth creation* (pp. 197–213). London: Routledge. Retrieved from <http://atwww.alastairmcintosh.com/general/resources/2007-Manfred-Max-Neef-Fundamental-Human-Needs.pdf>
- Max-Neef, M. A., Elizalde, A., & Hopenhayn, M. (1986). Desarrollo a escala humana: Una opción para el futuro [Development on a human scale: An option for the future]. *Development Dialogue*. Retrieved from <http://habitat.aq.upm.es/deh/adeh.pdf>
- Max-Neef, M. A., Elizalde, A., & Hopenhayn, M. (1989). Human scale development: An option for the future. *Development Dialogue*, 1, 3–80. Retrieved from http://www.daghammarskjold.se/wp-content/uploads/1989/05/89_1.pdf
- Max-Neef, M. A., Elizalde, A., & Hopenhayn, M. (1991). *Human scale development. Conception, application and further reflections*. New York, NY: The Apex Press.
- McCall, S. (1975). Quality of life. *Social Indicators Research*, 2(2), 229–248. <https://doi.org/10.1007/BF00300538>
- McCrea, R., Shyy, T.-K., & Stimson, R. (2006). What is the strength of the link between objective and subjective indicators of urban quality of life? *Applied Research in Quality of Life*, 1(1), 79–96. <https://doi.org/10.1007/s11482-006-9002-2>
- Moberg, D. O., & Brusek, P. M. (1978). Spiritual well-being: A neglected subject in quality of life research. *Social Indicators Research*, 5(1/4), 303–323. <https://doi.org/10.1007/BF00352936>
- Moro, M., Brereton, F., Ferreira, S., & Clinch, J. P. (2008). Ranking quality of life using subjective well-being data. *Ecological Economics*, 65(3), 448–460. <https://doi.org/10.1016/j.ecolecon.2008.01.003>
- Moser, G. (1988). Urban stress and helping behavior: Effects of environmental overload and noise on behavior. *Journal of Environmental Psychology*, 8(4), 287–298. [https://doi.org/10.1016/S0272-4944\(88\)80035-5](https://doi.org/10.1016/S0272-4944(88)80035-5)
- Mulder, K., Costanza, R., & Erickson, J. (2006). The contribution of built, human, social and natural capital to quality of life in intentional and unintentional communities. *Ecological Economics*, 59, 13–23. <https://doi.org/10.1016/j.ecolecon.2005.09.021>
- Nussbaum, M. C. (2000). *Women and human development: The capabilities approach*. Cambridge: Cambridge University Press.
- O'Brien, C. (2005). Planning for sustainable happiness: Harmonizing our internal and external landscapes. In *Proceedings of Rethinking Development: 2nd International Conference on Gross National Happiness* (pp. 1–22). Antigonish: Centre for Bhutan Studies. Retrieved from <http://www.gpiatlantic.org/conference/papers/obrien.pdf>
- Paasi, A. (2008). Is the world more complex than our theories of it? TPSN and the perpetual challenge. *Environment and Planning D: Society and Space*, 26(3), 405–410. <https://doi.org/10.1068/d9107c>
- Page, R. A. (1977). Noise and helping behavior. *Environment and Behavior*, 9(3), 311–334. <https://doi.org/10.1177/001391657700900302>
- Papachristou, I. A., & Rosas-Casals, M. (2015a). *An integrative methodology for the quality of life measurement in urban places based on the accomplishment of human needs*. Paper presented at the UN-Habitat Future of Places III Conference, Stockholm. Retrieved from <http://hdl.handle.net/2117/83018>
- Papachristou, I. A., & Rosas-Casals, M. (2015b). Making the neighbourhood a better place to live. A SWB approach implementing fundamental human needs. *On the W@terfront*, 40(2), 31–50. Retrieved from <http://www.raco.cat/index.php/Waterfront/article/viewFile/300217/389681>
- Papachristou, I. A., & Rosas-Casals, M. (2016). Unveiling connectivity patterns of categories in complex systems: An application to human needs in urban places. *The Journal of Mathematical Sociology*, 40(4), 219–238. <https://doi.org/10.1080/0022250X.2016.1219855>
- Pearce, D., & Ozdemiroglu, E. (2002). *Economic valuation with stated preference techniques: Summary guide*. London: Edward Elgar Publishing Ltd. Retrieved from <https://webarchive.nationalarchives.gov.uk/20120919162306/http://www.communities.gov.uk/documents/corporate/pdf/146871.pdf>

- Peterson, M., & Webb, D. (2006). Religion and spirituality in quality of life studies. *Applied Research in Quality of Life*, 1(1), 107–116. <https://doi.org/10.1007/s11482-006-9006-y>
- Regoeczi, W. C. (2003). When context matters: A multilevel analysis of household and neighbourhood crowding on aggression and withdrawal. *Journal of Environmental Psychology*, 23(4), 457–470. [https://doi.org/10.1016/S0272-4944\(02\)00106-8](https://doi.org/10.1016/S0272-4944(02)00106-8)
- Robeyns, I. (2005). The capability approach: A theoretical survey. *Journal of Human Development*, 6(1), 93–117. <https://doi.org/10.1080/146498805200034266>
- Schumacher, E. F. (1973). *Small is beautiful: Economics as if people mattered*. New York, NY: Harper & Row.
- Sen, A. (1999). *Development as freedom*. Oxford: Oxford University Press.
- Sennett, R. (2006). The open city. *Urban Age*, 2006(November), 1–5. Retrieved from http://downloads.lsecities.net/0_downloads/Berlin_Richard_Sennett_2006-The_Open_City.pdf
- Streeten, P. (1981). *First things first: Meeting basic human needs in developing countries*. Oxford: Oxford University Press.
- Townsend, A., Maguire, R., Liebhold, M., & Crawford, M. (2010). *A planet of civic laboratories: The future of cities, information and inclusion*. Retrieved from http://www.iftf.org/fileadmin/user_upload/downloads/IFTF_Rockefeller_CivicLaboratoriesMap.pdf
- UNDP. (1990). *Human development report: Concept and measurement of human development*. Washington, DC: United Nations Development Programme. Retrieved from http://hdr.undp.org/sites/default/files/reports/219/hdr_1990_en_complete_nostats.pdf
- United Nations. (2018). World urbanization prospects: The 2018 revision. *United Nations*. Retrieved from <https://esa.un.org/unpd/wup/Publications>
- Van Dierendonck, D. (2011). Spirituality as an essential determinant for the good life, its importance relative to self-determinant psychological needs. *Journal of Happiness Studies*, 13(4), 685–700. <https://doi.org/10.1007/s10902-011-9286-2>
- Van Kamp, I., Leidelmeijer, K., & Marsman, G. (2003). Urban environmental quality and human well-being. Towards a conceptual framework and demarcation of concepts; a literature study. *Landscape and Urban Planning*, 65, 5–18.
- Veenhoven, R. (2000). The four qualities of life. *Journal of Happiness Studies*, 1(1), 1–39. <https://doi.org/10.1023/A:1010072010360>
- Veenhoven, R. (2007). Subjective measures of well-being. In mcgillivray (Ed.), *Human well-being, concept and measurement* (pp. 214–239). Houndmills, NH: Palgrave MacMillan.
- Vemuri, A. W., & Costanza, R. (2006). The role of human, social, built, and natural capital in explaining life satisfaction at the country level: Toward a National Well-Being Index (NWI). *Ecological Economics*, 58(1), 119–133. <https://doi.org/10.1016/j.ecolecon.2005.02.008>
- von Borgstede, C., Johansson, L.-O., & Nilsson, A. (2013). Social dilemmas: Motivational, individual and structural aspects influencing cooperation. In L. Steg, A. van den Berg, & J. I. M. de Groot (Eds.), *Environmental psychology: An introduction* (pp. 175–184). Leicester: BPS Blackwell.
- Wenz, F. V. (1977). Neighborhood type, social disequilibrium, and happiness. *Psychiatric Quarterly*, 49(3), 187–196. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/897027>
- Wolfgang, B. (2002). Web-surveys: An appropriate mode of data-collection for the social sciences? In B. Batinic, U.-D. Reips, M. Bosnjak, & A. Werner (Eds.), *Online social sciences* (pp. 1–6). Ashland, OH: Hogrefe & Huber Publishers.

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Appendix
Table A1. Example of questions (and groups of questions) associated to satisfiers before being weighted into needs. Source: Proper elaboration based on Costanza et al. (2007).

Satisfiers	Groups of questions	Questions	Response range
Food, shelter, vital ecological services, healthcare, rest	Caloric intake, access to clean air, water, facilities	Are you satisfied with the quality of water in your area?	1 (no)—5 (a lot)
		Are you satisfied with the quality of air in your area?	1 (no)—5 (a lot)
		How satisfied are you of the sanitation facilities in your area?	1 (no)—5 (a lot)
		How satisfied are you of the green spaces in your area?	1 (no)—5 (a lot)
		How satisfied are you of the pedestrian areas in your area?	1 (no)—5 (a lot)
		How satisfied are you of the noise in your area?	1 (no)—5 (a lot)
		How satisfied are you of the traffic in your area?	1 (no)—5 (a lot)
		How satisfied are you of the quality of food at your area (natural, biological, no-transgenic, etc.)?	1 (no)—5 (a lot)
		Are you satisfied of the house quality at your area (density, m2 by habitant, humidity, extreme conditions of temperature, etc)?	1 (no)—5 (a lot)
		Access to health care	
Do you have any long-term disabilities, health/mental problems?	Yes/No		
If yes does the long-term disability restrict your activities?	Yes/No		
Do you have access to public or private health care?	Yes/No		
If yes, how satisfied are you of your health care?	1 (no)—5 (a lot)		
Nurturing of children, pregnant women	Maternity leave/child care	Do you have in charge children from 0 to 14 years old?	Yes/No
Transmission of the culture	Family provision for care	Time dedicated to the education of children	1 (no)—5 (a lot)
		Do you think that the time you dedicate to your children's education is adequate?	Yes/No
Homemaking	Household and child care allocation within the household	Do you own your home?	Yes/No
		Do you believe that your living environment (house/apartment) favours the feeling of home?	Yes/No
		Do you feel "at home" when you go home?	Yes/No
Enforced predictable rules of conduct		Do you think that the existent rules and leys for your safety are sufficient?/Do you feel safe at your area?	1 (no)—5 (a lot)
Safety from violence at home and in public	Interpersonal violence experiences	Have you ever experienced violence in your familiar environment?	Yes/ No
Security of subsistence into the future		Do you think you can make plans for the future?	Yes/ No

Table A1. (Cont.) Example of questions (and groups of questions) associated to satisfiers before being weighted into needs. Source: Proper elaboration based on Costanza et al. (2007).

Satisfiers	Groups of questions	Questions	Response range
Maintain safe distance from crossing critical ecological thresholds	Environmental practices	Do you: recycle, save energy, don't spare water, share your car, share your apartment, use the bicycle, prefer walking to the destinations or use the public transportation?	Yes/ No
Stewardship of nature to ensure subsistence into the future			Yes/ No
Care for the sick and elderly	Who provides care for aged parents etc./in case of acute, chronic illness	Do you provide care for aged parents/ family or to somebody with a chronic illness?	Yes/ No
Being able to have attachments to things and persons outside ourselves	Level of attachment to significant others	Do you have or planning to form a family?	Yes/ No
		How much do you depend on your family?	1(no)—5 (a lot)
		Do you have friends?	Yes/ No
		How much do you depend on your friends?	1(no)—5 (a lot)
Solidarity, respect, tolerance, generosity, passion, receptiveness, ...		How often do you experience compassion, calmness, forgiveness, contentment, generosity, respect, passion, tolerance, solidarity, receptiveness?	1 (occasionally)—5 (really often)
		How often do you experience selfishness, jealousy, fear, worry, loneliness, anger, stress?	1 (occasionally)—5 (really often)
		Which of the above do you think that may change in a different urban environment?	
Access to information	Newspaper, radio, TV, internet, usage for news information	How often do you check the news on the newspaper, radio, television, and the internet?	1 (no access)—5 (continuously)
Intuition and rationality	Education	What is your education level?	no studies—doctoral
To act meaningfully in the world	Volunteering, association memberships	Do you or have you ever worked as a volunteer?	Yes/ No
		Do you participate to any association?	Yes/ No
		Are you a member in any social group?	Yes/ No
Contribute to and have some control over political, community and social life		Do you contribute to and have some control over political, community and social life in your area?	Yes/ No
Being heard		Do you express your opinion or speak publicly?	Yes/ No
Meaningful employment		Do you consider your job meaningful?	Yes/ No
Citizenship		Do you participate to the local assemblies of your neighbourhood?	Yes/ No
		Do you vote at the elections?	Yes/ No

Table A1. (Cont.) Example of questions (and groups of questions) associated to satisfiers before being weighted into needs. Source: Proper elaboration based on Costanza et al. (2007).

Satisfiers	Groups of questions	Questions	Response range
Recreation, relaxation, tranquillity, access to nature, travel	Time use, activities pursued, money spent	How satisfied are you of your free time?	1(no)—5 (a lot)
		How many hours do you work, spend with family/ friends, dedicate to yourself and dedicate to commuting?	0 → 8h
		How happy are you with your time distribution?	1(no)—5 (a lot)
Play, imagination, inventiveness, artistic expression	Free time use	With what frequency do you: go out, go to an excursion to the nature, go to spiritual or religious celebrations, watch TV, use internet/ computer at home, participate to an artistic activity, do sports, go to the cinema, see your friends, go to a museum, concert, play music, writing, drawing, sculpture?	1 (never)—5 (every day)
	Sense of play in work, etc.	Do you consider your time spent to work as creative?	Yes/ No
Status, recognition, sense of belonging, differentiation, sense of place	Major statuses, sense of “place”	Specify your relationship with the area	Live there, lived there, live close, work there, visit, etc.
		Specify your gender, age, type of occupation, salary per month.	
		How satisfied are you of your life, work, money, the place you live, family life, social life, social status?	1 (no)—5 (a lot)
		Do you feel like forming part of the place you live?	Yes/ No
		Do you think that with the money you earn you would live better in a different part of the city?	Yes/ No
Being able to live one’s own life and nobody else’s.	Personal freedoms in various social contexts (family, work, religion, etc.)	Do you feel free as a person?	Yes/ No
Mobility		Is the connection with work satisfying?	Yes/ No
Engaging in transcendent experiences	Spiritual/ transcendent experiences spiritual organization membership	How spiritual do you consider yourself?	1 (no)—5 (a lot)
		How often do you meditate/ pray?	1 (no)—5 (a lot)
Access to nature		Do you have access to the nature?	Yes/ No
		Do you feel the need to occasionally visit the nature?	1 (no)—5 (a lot)
Participation in a community of faith	Time spent on spiritual activities	How much time do you spend in spiritual activities?	1 (1-2 times per year)—5 (everyday)

Reference

Costanza, R., Fisher, B., Ali, S., Beer, C., Bond, L., Boumans, R., . . . Snapp, R. (2007). Quality of life: An approach integrating opportunities, human needs, and subjective well-being. *Ecological Economics*, 61(2/3), 267–276. <https://doi.org/10.1016/j.ecolecon.2006.02.023>