Coming to grips with urban environmental quality in planning sustainable cities.

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Abstract

Based on a review of recent literature, this paper addresses the question of how urban planners can steer urban environmental quality, given the fact that it is multidimensional in character, is assessed largely in subjective terms and varies across time. The paper explores three questions that are at the core of planning and designing cities: 'quality of what?', 'quality for whom?' and 'quality at what time?' and illustrates the dilemmas that urban planners face in answering these questions. The three questions provide a novel framework that offers urban planners perspectives for action in finding their way out of the dilemmas identified. Rather than further detailing the exact nature of urban quality, these perspectives call for an approach to urban planning that is integrated, participative and adaptive.

Key words: urban environmental quality; urban quality of life; sustainable urban development; trade-offs; quality dimensions.

1. Introduction

Sustainable urban development is not a goal in itself; it is aimed at maintaining and increasing quality of life in a city, without compromising the conditions for this process to continue, here and elsewhere (Fischer and Amekudzi 2011). As any urban planner will recognise, the design and functioning of a city's physical environment are meant to contribute to this quality of life (Silva and Mendes 2012, Ogneva-Himmelberger *et al*. 2013, Velázquez and Celemín 2014). Yet, we cannot be sure about exactly *how* that contribution comes about. Reviewing recent scientific literature about 'quality of life' and 'urban environmental quality', this paper finds three main causes for this lack of understanding.

Firstly, it is well-established that quality can be conceptualised taking perspectives on different domains and sub-domains of life: e.g. life as-a-whole, city life, economic life, social life et cetera (Pacione 2003, Van Kamp *et al*. 2003). In each domain, multiple and only partly distinct dimensions can be distinguished; examples in the urban sub-domain are: the environmental quality; the availability of facilities; and the amount of green space (Moore *et al*. 2006, Silva 2015). Urban quality of life, as well as its sub-domain equivalent urban environmental quality – which is the focus of this paper – thus has a multidimensional character. Knowing this, though, does not help urban planners understand exactly *how* these multiple dimensions of urban quality influence one another, in order to make sensible trade-offs between them.

Secondly, it is also widely accepted that quality can only partly be gauged from objective conditions; it is the subjective perception and evaluation of these objective conditions that ultimately determines how the level of quality is perceived, whether in terms of quality of life (Felce and Perry 1995) or urban environmental quality (Moore *et al*. 2006). Although objective and subjective measures of quality differ fundamentally, they are generally considered to complement one another and, jointly, to well represent quality (Marans 2003, Pacione 2003, Santos and Martins 2007, Perlaviciute and Steg 2012, Marans 2015). The mere observation that 'quality' has different meanings for different people, however, does not help planners in optimally and equitably stimulating urban quality.

Thirdly, people's preferences vary over time, both within and across generations, and consequently, so does quality (Ruth and Franklin 2014). Pacione (2003) suggests that people accommodate to conditions over time. Furthermore, satisfying a specific set of needs in the short term may still compromise other needs on the long term (De Haan *et al*. 2014). Quality issues themselves also vary across time: there has been a tremendous increase in urban quality – as measured by objective indicators – in most Western countries (UNEP 2012). On the other hand, new quality issues arise, mirroring changing concerns in society (ibid.), e.g. climate change or endocrine-disrupting compounds (Rudel *et al*. 2003). Even knowing this, urban planners are often uncertain when, to what extent and at what cost such new issues must be addressed.

This paper reviews the relevant scientific literature about urban environmental quality and urban quality of life. What we found to be lacking is the implications of the accumulated knowledge for urban planners. We therefore suggest a novel perspective, which demonstrates that the multi-dimensional, partly subjective and time-dependent character of urban environmental quality confronts urban planners with serious dilemmas when trying to influence this quality. These dilemma's include: making trade-offs between incomparable quality dimensions; allocating urban quality equitably; and planning a sustainable level of urban environmental quality over time in the face of uncertainty. The perspective we take is created by answering three questions: 'quality of what?', 'quality for whom?' and 'quality at what time?' In our literature review, we explore these questions and subsequently illustrate the dilemmas – and some possible ways out of them – with examples derived from secondary material. In doing so, this paper contributes to urban planners' repertoire of actions in steering urban environmental quality.

The paper is structured as follows: The next section briefly describes our research strategy. In section 3, we seek to answer the question 'quality of what?' by identifying the multiple dimensions of urban environmental quality and reviewing distinct attempts to operationalise these dimensions and to make trade-offs between them. Section 4 addresses the question 'quality for whom?', delving deeper into the significance of objective and subjective indicators for urban quality and the relations between them. In section 5, the matter of 'quality at what time?' is further explored, analysing how the urban environmental quality agenda has changed over time and is likely to change in the future. From these questions, three dilemmas for urban planners arise that are empirically illustrated with, mostly Dutch, examples in section 6. In the last two sections, we offer perspectives that may help to solve these types of dilemmas and present our conclusion.

2. Method

We performed a literature search in Scopus, using three consecutive strategies. The first was a general search on 'quality of life' and 'urban environmental quality'. As evidenced by a special issue of Landscape and Urban Planning on urban environmental quality, the topic gained scholarly interest at the beginning of this century. We therefore limited our search to post-1999 articles. In June 2015, searching for ("quality of life" AND "environmental quality" AND urban) in title, abstract and key words, limited to social and environmental

sciences, yielded 70 papers; a search for "urban environmental quality" in title, abstract and key words yielded 52. The contributions found could largely be clustered into two main groups: one concerns dimensions of quality and indicators, the other has a focus on the perception of quality – both quality of life and urban environmental quality. The remainder deals with issues of policy, equity and demography in relation to environmental quality. We discarded articles that appeared to have no focus on urban environmental quality *per se*. The first two clusters gave rise to questions that help structure our research: 'quality of what?' and 'quality for whom?' The initial inventory was then followed by two more in-depth searches on the relations between urban environmental quality dimensions and on the relationship between objective and subjective indicators of quality. Searches were performed in all fields using strings like ("urban environmental quality" AND dimensions AND relations) and ("urban environmental quality" AND dimensions AND subjective AND objective) and variations of those. The third question, 'Quality at what time?', was inspired by Pacione (2003), who argues that people's perceptions and preferences change over time and by contributions relating quality to sustainability, particularly its temporal aspects (De Haan *et al*. 2014, Marans 2015).

In the assembled literature, we identified dilemmas that urban planners are confronted with when specifying quality in terms of 'what', 'for whom' and 'when'. Drawing on our previous research (Van Stigt, Driessen and Spit, 2013, 2015) and based on a wider internet search, we found practical examples illustrating those dilemmas. For analytic reasons, we treat the dilemmas separately, although in practice they often prove to be connected.

3. Quality of what? The multiple dimensions of urban environmental quality and their interactions

3.1. Urban environmental quality

There are many approaches to 'quality', differing in the domains or sub-domains of life they address and in the type of indicator – either objective or subjective (Pacione 2003) – they use. Common designations are 'quality of life', 'liveability', 'urban quality of life', 'environmental quality' and 'urban environmental quality'.

Building on earlier work by Van Kamp *et al*. (2003) and Opschoor and Reijnders (1991), we define urban environmental quality for the purpose of this paper as the ability of the physical environment to satisfy the needs of human beings, ecosystems and artefacts in cities. Urban environmental quality is regarded here as a sub-set of quality of life, pertaining to only those needs that are, directly or indirectly, related to the physical environment. It has many different dimensions, ranging from the concentration of pollutants in the atmosphere or the level of ambient noise to the presence of cultural amenities, the distance to the nearest form of public transport or the amount of green and open space.

3.2. Dimensions and indicators of urban environmental quality

In order to grasp urban environmental quality – and to steer it – scholars have suggested a wide range of indicators. Indicators may be based on objective as well as subjective data, and

either focus on one or two dimensions, or aim to be quite comprehensive. With respect to objective indicators, our literature search yielded various examples of one-dimensional quality assessments: ambient air quality (e.g. Mendes and Silva 2007, Braniš 2009), noise (e.g. Seidman and Standring 2010, Weber and Driessen 2010), metal concentrations in soil (e.g. Hamzeh *et al*. 2011) and abundance and quality of green space (e.g. Pereira *et al*. 2012). A two-dimensional assessment was found to combine e.g. air quality and noise (Silva and Mendes 2012). More comprehensive methods combine objective indicators of multiple dimensions into a single index (e.g. Wan *et al*. 2009, Silva 2015). Often, geographic information systems (e.g. Hamzeh *et al*. 2011, Joseph *et al*. 2014, Velázquez and Celemín 2014) and/or satellite data (Nichol and Wong 2009) are used to map quality aspects or indices.

Another line of inquiry uses statistical methods to find correlations between observed – usually self-reported – variables and latent variables that predict (urban) quality of life. Bonaiuto *et al*. (2003) used principle component analysis to find 19 perceived quality indices for residential environmental quality. Doi *et al*. (2008) studied infrastructure related elements of quality of life and Lee (2008) used structural equation modelling to find the principal dimensions of quality of life in Taipei. In the same city, Tu and Lin (2008) used principal component analysis to identify six dimensions of residential environment quality (Urban Planning and Design, Security and Social Relationship, Transportation and Commercial Services, Residential Atmosphere, Environmental Health, and Facility Management). All in all, there is a good deal of knowledge about which dimensions constitute urban environmental quality and related measures of quality, but there has been little research into how these dimensions interact.

3.3. Interrelationships between quality dimensions – empirical findings and theory

There is some recent research demonstrating that distinct dimensions of urban environmental quality influence one another. In a comparative study of three green spaces in Sheffield (United Kingdom), Irvine *et al*. (2009) demonstrate a relationship between the perception of sound and the attributes of the greenery. Park users expressed a hierarchy of preference for sound, valuing natural sounds over those of people or mechanical sounds. As the prevalence of these types of sound differ according to the ecological quality of the green space, it follows that these two aspects of urban environmental quality are related.

There is also some empirical evidence that quality dimensions interact in a hierarchic fashion. Johnston *et al*. (2002) elaborated an econometric model of a watershed management program consisting of several measures, as well as the financial cost of combinations of those measures. Each combination of measures led to certain environmental benefits, such as surface and ground water quality and public access to watershed recreation sites. Willingness to pay was derived from stated preferences for certain combinations of measures and cost contained in the plan. The model results show that the willingness to pay for surface water quality was dependent upon other qualities inherent in the plan in a rather counter-intuitive way. People were willing to pay more for one unit improvement of surface water quality if the plan also led to ground water quality deterioration. They were willing to pay less for

improving surface water quality if the plan also improved public access to recreation sites. This suggests that some dimensions of quality have a higher weight than others. The actual nature and shape of this relationship, however, remain obscure.

A model allowing for a trade-off between two distinct dimensions of urban environmental quality was proposed by Silva and Mendes (2012). They developed a composite index for city noise and air quality. This index combined normalised concentrations of five pollutants, each being given equal weight, and noise, which was, in turn, given equal weight compared to air quality. A later modification combined air pollutants using weights derived from their dose-response relationships: the more damaging to health, the higher the weight. Noise and air quality were still combined using equal weights for both (Silva 2015). The model illustrates the complexity of weighing quality dimensions and to make trade-offs between them.

From a theoretical viewpoint, dimensions of quality have, since Maslov (1954), been envisaged to have a hierarchical relationship: as acknowledged by Perlaviciute and Steg (2012), some quality aspects are likely to be found relatively more important than others, and this perception of importance may vary across different groups. Building on theories from social psychology, De Haan *et al*. (2014) suggested three hierarchically dependent levels of societal needs in a dynamic model explaining how needs that are met – or failed to be met – on one level influence expression of needs at other levels. In this model, basic societal needs such as sustenance, health, safety and shelter must be met before higher-level needs that include social cohesion, healthy ecosystems and convenience, are in order. Also Jacobs (2000) theoretically distinguished four different levels of urban quality – biological, social, psychical and metaphysical – that each are contingent upon satisfaction of the underlying levels.

At the basic level, phenomena and processes belong mainly to the domain of the natural sciences (Jacobs 2000). Once basic needs are met and other, higher-level quality aspects come into play, subjective judgments about that quality are introduced (Ruth and Franklin 2014). We will come back to this in the next section.

4. Quality for whom? Objective and subjective measures of urban quality and their relationship

It is widely acknowledged that quality indicators can be of a subjective as well as an objective nature (Marans 2003, Moore *et al*. 2006, Lee 2008, Howley *et al*. 2009, Fischer and Amekudzi 2011). Subjective indicators, such as citizens' complaints (for instance about noise nuisance), are used to assess urban environmental quality (Carvalho and Fidélis 2009). Felce and Perry (1995) argue that quality of life is determined by objective life conditions as well as an individual's satisfaction with these conditions. Furthermore, the individual's assessment of both *objective* conditions and *subjective* satisfaction with these conditions is influenced by personal values and aspirations, determining the relative importance of each of these conditions. These elements – conditions, satisfaction, values and aspirations – influence one

another. They may vary over time (see also section 5) and may be culturally determined (Felce and Perry 1995).

Recently, several scholars have looked into the *relationship* between objective quality determinants and their subjective evaluation. Over-all, there appears to be very little correlation between the two. Housing prices in the centre of Madrid, for instance, were found to negatively correlate with subjective measures of air quality and noise but – unexpectedly – positively with objective measures of air pollutants (Chasco and Le Gallo 2013). Likewise, McCrea (2006), found only weak correlation between objective measures of population density and subjective perception of overcrowding as well as between objectively assessed and subjectively perceived access to educational, commercial, medical and leisure facilities. Subjective urban quality of life could be predicted well from the subjective variables, but showed no significant correlation with the objective measures.

Von Wirth *et al*. (2014) also found that residents' satisfaction with the city correlated well with subjective measures of accessibility of city centre amenities and safety in public spaces. Contrary to McCrea (2006), they did find a strong link between objective and subjective access, the discrepancy being attributed to differences in spatial scale and typology of the areas under study. In another study, Lotfi and Koohsari (2009) found that the subjective assessment of accessibility of public spaces is dependant not only upon objectively measured distance, but also upon feelings of safety and perceived quality of the (pedestrian) route.

Surprisingly, Santos and Martins (2007) did find a fair correlation of objective conditions and their subjective evaluation by Porto's residents. Only with three out of fourteen indicators, the level of agreement found between objective and subjective measures was low.

Taking a somewhat different approach, Okulicz-Kuzaryn (2013) compared cities' Mercer[1] liveability index to residents' satisfaction with the city. Only moderate correlation was found. More specifically, the liveability index showed no correlation with residents' positive attitude towards foreigners, whereas satisfaction with the city did. Trust in fellow inhabitants was found to correlate well with both the liveability index and residents' satisfaction with the city.

In sum, people's experiences and values strongly influence their perceptions of quality. In other words, urban environmental quality is, to a large extent, 'in the eye of the beholder'. Relations between objective indicators and subjective perceptions of urban quality have been researched for only a few of a wide variety of indicators, and the evidence about these relations generally points towards a weak correlation between the two. Therefore, merely using objective indicators to assess urban environmental quality will result in a distorted image. Subjective evaluations of these objective attributes should complement the assessment.

5. Quality at what time? Urban planning in the face of uncertainty

As we saw, urban environmental quality is derived from notions about quality of life and liveability, which *per se* have no temporal dimension. However, as De Haan *et al*. (2014, p.

[1] http://www.imercer.com/content/quality-of-living.aspx; last accessed April 2015.

126) point out, '*increasing liveability is not necessarily healthy for society or the ecosystems associated with the societal system. (...) [A] liveable society is not necessarily a sustainable one, just as a happy life is not necessarily a long and healthy one*'. From the perspective of sustainable urban development, urban quality means meeting societal needs in a way that can be sustained over time, thus introducing a temporal dimension.

Urban environmental quality is not constant in time anyway. Along with changing patterns of social activity, objective conditions change and so do the perceptions of these conditions in society. In the 1960s, untreated industrial emissions to water and air were considered problematic because of locally elevated concentrations. During the 1980s, problems at higher spatial scale levels were recognised, such as 'acid rain', the wet and dry deposition of acid-forming sulphur and nitrogen compounds. Nowadays, urban environmental quality issues include reduction of vulnerability to climate change. In many societies, environmental problems have reached the political agenda, often resulting in effective pollution control. As a result, urban environmental quality has improved considerably since the beginning of the 20th century; health levels and life expectancy are higher than ever before (De Hollander and Staatsen 2003)[2]. However, new issues may influence the current quality level, either in a negative or a positive way. Climate change, for instance, is predicted to cause heat stress in cities as well as more frequent flooding, whereas technological developments in transport and industry are expected to lower emissions of environmental pollutants. The extent to which these developments will affect urban environmental quality is difficult to forecast.

People's preferences also change during the course of their lives – with respect to the specific needs of a certain life phase – and as a result of societal developments. Thus, definitions of liveability change not only across the life course but across generations (Ruth and Franklin 2014); the same holds for urban environmental quality. Therefore, demographic changes, such as an increasing fraction of elderly people, can be expected to change the perception of and demand for urban environmental quality. One example is the finding that some middle-class families with young children decide to stay in the city centre, rather than moving to the suburbs (Karsten 2003). Another is the contemporary scientific interest in the impact of climate change on the elderly (e.g. Carter *et al*. 2014). The fact that scientific literature on the latter topic before 2008 is scarce, indicates that new quality issues tend to 'pop up'. Therefore, we cannot be sure we are prepared for future challenges.

6. Implications: dilemmas in urban planners' practice

6.1. Making trade-offs between quality dimensions

Section 3 presented some evidence that distinct dimensions of environmental quality are interrelated. Theoretically, this relationship is hierarchical; in other words, loss of quality in one dimension that is at the bottom of the hierarchy is not automatically compensated by an excess of another quality aspect at a higher level. As a consequence, planners must first meet societal needs at the basic level; in terms of urban environmental quality this means assuring compliance with at least all legal environmental standards.

[2] Such is not the case in many newly industrializing countries (UNEP 2012).

In practice, however, urban planners may face a serious dilemma here. In pursuit of sustainable urban development, compact cities are *en vogue*, often at the expense of the quality of the urban environment (Howley, Scott and Redmond 2009), in terms of pollution and lack of green space. Manoeuvring space for making trade-offs is often limited by (supra-) national standards protecting residents' health and safety and the unimpeded functioning of ecosystems. It may be difficult for urban planners to comply with these standards. Protective measures, such as acoustic screens or remediation of polluted soils, are not always feasible: they are often costly and may create disadvantages that negatively impact other aspects of urban quality. In addition, a new development is planned precisely because it increases urban quality as a whole. Should one then abandon a plan just because it fails to meet legal requirements concerning only one aspect of urban quality?

An example of such a dilemma can be found in Roosendaal, a Dutch town where a partly derelict industrial estate near the train station was transformed into a high density mixed-function area (Gemeente Roosendaal 2008). From the start, the town's urban planners realized that the impact on environmental quality resulting from the remaining industry was severe. Even after optimally positioning the residential buildings, some of them could not be made to comply with regulations concerning industrial noise. Noise reduction at the source had been accomplished at an earlier stage of the development, and further reduction of source levels was deemed unrealistic. Under the circumstances, an obvious solution would have been to fit the buildings' design with a so-called 'deaf façade' (i.e. a façade that has no open windows or is equipped with an external transparent screen). For some of the buildings, however, the view of the surroundings was thought to contribute much to the area's quality, leading to the rejection of a deaf façade (Gemeente Roosendaal 2008). Instead, the – relatively small – excess of noise was compensated for by an increase in other qualities. Permitting higher noise levels as well as the compensatory measures were contested in court (Raad van State 2011). One point of disagreement was that the municipality had not sufficiently investigated means of reducing noise levels at the source. Another concerned the amount of compensation – in this case an extra insulation of three decibels. These objections neatly illustrate that compensation is complex, precisely because of the incommensurability of urban environmental quality dimensions and the unknown nature of the relations between them.

6.2. Uniform quality for all versus accommodating individual preferences

The second type of dilemma concerns the extent to which government needs to actively steer urban quality. It is the dilemma between a right-wing paradigm, relying on market forces, and a left-wing approach of high ambitions, full governmental responsibility with respect to sustainability and taking into account disadvantaged societal groups. The outcome, obviously, depends on the political agenda and on the distribution of political power within the City Council, which wields political power at this particular point. If the plan results in a level of urban quality that does not live up to the expectations of the constituency, local

politicians who commit themselves to a plan risk losing votes at the next elections[3]. An urban development project does not occur overnight, but takes place over a period of several years. Changes in the political (e.g. government elections) or economic (e.g. financial crisis) context may change the political agenda as well as the composition of the City Council.

This may be illustrated by the thwarted ambitions of the municipality of Woerden, the Netherlands (Van Stigt *et* al. 2013). Private parties took the initiative to convert an office building situated near the railway into apartments. However, the transformation did not meet municipal safety regulations regarding transport of dangerous substances. These regulations were based upon a previous high risk estimate, whereas the actual risk was assessed to be well below the national standard. The responsible alderman, of liberal signature, took the stance that he would have willingly allowed the initiative, provided the future residents would consciously agree to the – very low, but not zero – risks present. This illustrates that legal requirements often pertain to objective indicators of urban environmental quality that, as a rule, are bad predictors of subjectively perceived quality (see section 4).

More generally, proper planning involves informed decision-making, usually based upon expert knowledge. Expert judgement about urban quality, however, may differ from the quality as perceived by local stakeholders. Thus, planners cannot in advance determine whether the plan will offer the quality that is desired. Situations may then occur, in which planners, in order to comply with regulations, provide residents with solutions that they would rather not have, such as a sound barrier that blocks their view, whereas they are not bothered by the noise anyway.

This may be illustrated by two controversies surrounding noise barriers. The first is offered by a Dutch municipality that, in compliance with national railway noise standards, started a procedure for building a 2.7 m high noise barrier along the railway. A majority of residents, however, objected, as they would rather keep the view they have of the trains and the surroundings beyond and feared that the barrier wouldn't protect the higher stories of their homes anyway (Gemeente Zwolle 2011). The second example is the heavily opposed noise barrier around the Agricultural Business Centre in Bakewell, UK. The District council responded to complaints about noise from the cattle market and came up with plans for a barrier, which would be 180 metres long and rise to a height of 5.5 m. Residents claimed the barrier would ruin the historic character of the market town (Berardi 2012).

6.3. Prepare for long term environmental changes or not?

The third dilemma identified here is whether to take measures to improve urban environmental quality now, in the face of many uncertainties, or postpone action until more is known about the nature and seriousness of the problem at hand and about how it will evolve over time. As we argued in section 4, uncertainties stem from demographic changes, changes in people's preferences and from changes in the physical environment itself. We will

[3] Alternatively, residents vote with their feet and leave the area altogether, giving way to mostly lower-income groups; such dynamics could be detrimental to the original plan.

illustrate the latter with two practical examples: one in which urban environmental quality is expected to improve over time and one in which it is forecasted to decrease.

Our first example is found in Zutphen, a Dutch town where a newly built residential area was planned to be shielded from railway noise by a block of office buildings (Van Stigt *et al*. 2013). However, market conditions for offices are unfavourable and therefore the realisation of the buildings was postponed, leaving a large number of the houses in the area to be exposed to noise levels above national environmental quality standards. A recently passed law (Verschuuren 2010) was invoked allowing for a temporary exemption under the condition that, within a period of ten years, the original quality standards must still be complied with.

The Dutch town of Vlaardingen provides an example of the reverse dilemma: here the municipality wishes to restore the link between the old city centre and the nearby river Meuse by refurbishments of existing real estate and development of a new, mixed function area that is partly located between the old river dike and the river itself (Gemeente Vlaardingen 2003). To reduce flood risk, the ground level in parts of the area will be raised (Gemeente Vlaardingen 2004). The question is: by how much? It is difficult to answer because of the many uncertainties surrounding climate change and the concomitant changes in water level and flood risks. In answering this question, the municipality itself assumes a time frame of 50 years, whereas national authorities, urge them to adjust it to 100 years, which would amount to far higher investments and solutions that, from an architectural perspective, are less desirable.

7. Perspectives for action

7.1. Making trade-offs between quality dimensions: an integrated approach to urban planning

An integrated approach holds the promise of efficiency: leaving decisions about quality in separate silos – urban design, environmental policy, health care, social and economic policy – during the early stages of planning, will most probably end up with serious clashes between incompatible quality dimensions during the execution and management phases (Davidson and Venning 2011). That is why the European Commission embraces a thematic strategy on the urban environment, including a guidance on integrated environmental management (European Communities 2007), and why there is a continuous debate within the scientific community about strategies and instruments for environmental policy integration (e.g. Persson 2004, Jordan and Lenschow 2010). More recently, there have been calls for considering wellbeing, health and environment in an integrated, systemic and interdisciplinary way, creating a common knowledge base (Carmichael *et al*. 2012), and for aiming research towards emerging issues (European Environment Agency 2014). These calls suggest there may be gains in considering urban quality as an integrated whole. However, such consideration inherently brings about the question how individual standards for distinct quality aspects may be ‘merged’ into an integrated one that guarantees the same or higher level of quality than did the individual norms.

As a way out of this dilemma, exceeding environmental standards is, in practice, sometimes allowed (see 6.1), provided other dimensions of urban quality compensate for this loss of quality. As we argued, trade-offs among urban quality dimensions are problematic, due to the multidimensional character of urban quality. If indeed there is, as in some theoretical approaches to urban quality (e.g. Jacobs 2000), a hierarchy of quality dimensions, quality demands at a lower level must all be met before a quality dimension at a higher level can be considered. The literature does not provide any means of weighing one quality dimension to another, nor for balancing the distinct aspects within each dimension. The available empirical evidence indicates that the relationships among dimensions of urban quality are far from understood. Nevertheless, the mere existence of such relationships suggests difficulty in balancing the various aspects of quality. If other quality dimensions are conditional upon some basic dimension – that Jacobs (2000) terms 'biological' and Lynch (1984) 'vitality' – comprising adequate and safe food and water, absence of disease, pollution and hazard, as well as an adequate fit of noise levels to human requirements of sensory input, this would imply a crucial role for environmental quality aspects in the more strict sense.

Thus, aspects of urban quality that relate to these basic-level dimensions cannot be compensated for by qualities that are at higher levels in the hierarchy. In other words: compensating for inadequate urban environmental quality aspects – such as noise or pollution levels – by other aspects of urban quality (such as the view or the proximity of facilities) is not desirable. Rather, one should make optimal use of policies that may reduce the source of this quality loss. In fact, this is a process requirement in the Dutch compensation approach (Glasbergen 2005, Korthals Altes and Tambach 2008, Simeonova and Van der Valk 2010). Compliance with standards must be proven unfeasible with usual legal means, and even tailor-made solutions must be shown to provide inadequate solutions to the problem. Therefore, as a rule, reduction at the source must be exhaustively attempted, before taking recourse to compensation.

7.2. Quality for all or individual preferences? A bit of both, in a participative planning process

The dilemma between uniform quality and accommodating individual preferences might, at first sight, seem trivial, since Western states have public environmental policies in place that guarantee a certain level of urban environmental quality. In some cases, complying with environmental standards may turn out to be very costly. Offering compensation to those who experience a loss of quality if these standards are violated may be in order – notwithstanding the argument in section 7.1, that great care must be taken making trade-offs between one dimension of urban quality and another. Three important considerations apply for such trade-offs to be made in an informed and equitable way.

First, planners cannot know what constitutes sufficient compensation (Glasbergen 2005). If urban quality is to be understood as the extent to which the physical environment supports the needs of its residents and users and these needs are to a large extent subjective, then obviously trade-offs can be made only by the people concerned, rather than by professionals acting in the public interest. The qualities to be realised in an urban plan must, therefore, be

discussed in an open planning process. In such a participatory process, stakeholders learn from one another what the most relevant dimensions of urban quality are in any particular case (Golobic and Marusic 2007).

These discussions may be complicated by the fact that the professionals' objective variables sometimes collide with the participants' subjective assessments. This is not to say that there is no role for science at all. Precisely within a participative process, mutual learning must occur – the customer is not always right, but neither is the expert. Science may inform such a deliberative learning process. For this to happen, it is vital that all stakeholders trust the producers of scientific knowledge (Bickerstaff 2004). It should, however, be borne in mind that scientific knowledge is only one factor that determines people's stance towards environmental risks; many other psychological and socio-cultural factors play an important role as well (ibid.).

Second, when one resorts to compensation of quality aspects that do not meet a certain desired level, the question arises how to allocate the compensation costs. Sticking to the *polluter pays principle*, one could argue that the cost of compensatory measures should be borne by those who cause the deviation of the environmental standard in the first place. This is, however, not always feasible. In many cases, the loss of quality cannot be attributed to a single polluter (for instance traffic noise). In addition, in cases where a polluter has been given a permit, it would be unjust to present them with the costs of compensating for something that had previously been allowed, but that is now detrimental to the plan at hand. In such cases, the costs tend to be borne by the buyers of the real estate, which is more expensive because of the needed extra insulation or other building measures. In the Roosendaal case (see 6.1), this would – both literally and proverbially – amount to a *Dutch treat*. Another approach would be to allocate the remediation cost to the parties that are expected to gain from the plan. This could be either the municipality, whose assets rise in value, or the developer, who receives the proceeds of the real estate. It could even be all of the new users and residents, who benefit from the high overall urban quality and agree to bear the cost of the compensation for the few who suffer from an unacceptably low level of only one quality dimension.

Third, environmental problems manifest themselves at spatial scales that are much larger than the local scale on which an urban plan focuses, and human activities at this local scale are very much intertwined with socio-economic processes at a global scale. Approaching urban quality through a deliberative process in which only local stakeholders participate holds the risk of turning a blind eye to these larger scale social and environmental problems. To prevent this, the planning process can be designed to include individuals or groups representing social and environmental interests that transcend the local.

7.3. Take action now or later? Adaptive planning for sustainable urban development

As was argued in section 5, urban planning has to deal with a variety of changes in e.g. demographics, societal activities and preferences. We cannot be sure how quality will develop in the future – neither in terms of objective indicators nor in terms of people's

changing demands for and perceptions of quality. Furthermore, new quality issues may present themselves, and issues that *are* known today may gain weight on the political agenda. European air quality standards, for example, are well above WHO guidelines, and exposure levels below these standards have been reported to be associated with adverse outcomes, e.g. low birth weight (Pedersen *et al*. 2013), lung cancer and an increase in natural-cause mortality (Pope *et al*. 2002, Beelen *et al*. 2014). There is also firm evidence that environmental noise has impacts on health, notably ischemic heart disease, cognitive impairment of children, sleep disturbance, tinnitus and annoyance, even at sound levels that are common in busy cities and towns (World Health Organization 2011).

Furthermore, contemplating urban environmental quality from a sustainability perspective introduces even more time-dependency. Climate change may serve as a case in point: urban planners nowadays are involved in implementing policies to mitigate greenhouse gas emissions and to adapt to increasing incidences of heat waves and rain storms.

All these uncertainties call for adaptive planning. By taking an adaptive approach, planners acknowledge that sustainable urban development is not a static end-point, but a process of continuous prudent experimentation, monitoring the results and learning to make cities resilient to future changes (Ahern 2011). Lynch (1984) goes even further in arguing that with any intervention, planners should contemplate the possibility of 'undoing' it.

8. Conclusion and discussion

Urban quality is illusive in nature; it has multiple dimensions that can be assessed by objective as well as subjective measures, and it varies across time. We have shown that this particular character of the concept confronts planners with several dilemmas. By answering three questions – 'quality of what?', 'quality for whom?' and 'quality at what time?' – urban planners may find their way out of these dilemmas; however, additional research is needed to more completely understand how elements of quality interact and are perceived and how all of this changes over time. Nevertheless, recent literature on urban environmental quality already provides planners with useful perspectives for action. Rather than developing more urban quality indices, these perspectives call for an approach to urban planning that is integrated, participative and adaptive, meanwhile incorporating interests that are impacted at different spatial scales.

The three questions raised in our discussion have been treated separately for convenience, yet they are related in several ways. The question 'quality of what', for instance, relates to environmental standards that also reflect the issue of 'quality at what time?', because they were designed in the past and merely reflect the quality that was deemed acceptable at that time. Increasing knowledge may cause these norms to become more demanding in future.

'Quality of what', also relates to the question of 'quality for whom?'. In the first place, a conception of sustainable urban development – and, thus, of urban environmental quality – that favours high-density, mixed-use redevelopment of former industrial buildings in the proximity of public transport has been shown to exclude low-income tenants (Poitras 2009). Secondly, in cases where environmental quality standards are about to be exceeded, measures

taken to improve urban quality may not result in the same quality for all people who live in the area (e.g. Marshall *et* al. 2014). More particularly, lower-income groups may receive a relatively large share of the environmental burden, which, as we argue here, should preferably be mitigated by environmental standards. However, these groups have less access to those qualities that are distributed through market forces (Kruize *et al*. 2007). In compact cities – a type of sustainable urban development favoured in many Western countries – low-income groups benefit from public transport, better access to amenities and less social segregation, whereas housing that is available to them tends to be small and costly (Burton 2000). Conversely, the well-off have been found to favour residential areas that are highly burdened by noise and risk (Chasco and Le Gallo 2013), but have a nice view or a lively atmosphere; in addition, they can afford the cost of extra insulation (Kruize *et al*. 2007).

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