How urban green spaces relate to health and well-being

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Chapter 2

The Relational Dimension in Urban Green Places

Abstract[1]

Understanding of the merits of green spaces in cities has increased significantly. However, we seek to point out a systematic omission. The studies available take a predominantly positivistic stance, in that they relate positive effects on health, etc., to the mere physical presence of green spaces. We propose to infuse knowledge on the effects of green spaces with a more relational conception on places, common in geography, being laden with meaning to the people using and visiting them. We will review the current literature to substantiate this point and introduce a research agenda for establishing whether it is the sensory stimuli of green spaces that has positive effects or rather the psychological association with green places. This may help optimize the positive effects of green spaces and thus the livability of cities.

Key words: health; well-being; urban green space; place attachment

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2.1 Introduction

Urban areas have become home to half of the world's population. By 2050, the urban population will be up to 6.3 billion, accounting for 66% of the total population, and urban areas are expected to absorb the largest share of all population growth (United Nations, 2014). This urbanization process will present a challenge to the urban environment and its effect on many health-related issues (e.g., McMichael, 2000). The World Health Organization affirms that health is not only the absence of disease and infirmity but also a state of overall well-being (WHO, 1948). Therefore, how to create a livable environment that will support the health and well-being of the urban population has become of interest both to professionals and policymakers.

Physical, psychological, and social benefits can be linked to the presence of urban green spaces in the living environment. The notion of urban green space has been used as an umbrella term that refers to various types of nature in urban areas, for example, parks, urban forests, gardens, and green belts. Potential mechanisms of how green space in the living environment may contribute to health and well-being have been identified: improving urban environmental quality such as air quality, providing a restorative experience for users, stimulating physical activities, and promoting social interaction (see, for reviews, Hartig, Mitchell, De Vries, & Frumkin, 2014; Kou, 2015). Some refer to these positive contributions as ecosystem services (Jennings, Larson, & Yun, 2016). Even the mere looking at green environments is known to be restorative, for instance for stress reduction (Li & Sullivan 2016), but that is outside the scope of our argument. However valuable the insights from the current literature, researchers may not only need to provide theoretical knowledge that may explain why green space is beneficial, but also may need action-based knowledge that tells professionals and policymakers what they can do in practice, which might provide for the long-term benefits of green-space exposure.

There are several systematic reviews of the relationship between green space, and specific health and well-being benefits such as mental health (Gascon et al., 2015; Mantler & Logan, 2015), physical activity (Lee & Mahswaran, 2010), health in general (Shanahan et al., 2015; James, Banay, Hart, & Laden, 2015; Hartig et al., 2014) and mortality (Van den Berg et al., 2015, Gascon et al., 2016). This is important for the practical application of providing green space in cities. In order to optimize the health and well-being benefits of long-term exposure to

green space, there is a need to evaluate in what ways green space should be provided in the living environment.

To add to these reviews, our review has the specific purpose to support a critique on the positivistic dominance in health and green space research. The current article will set out to 1) critically review how green space in the living environment is referred to or examined in health-related research, and how consistent the health-related outcomes are; 2) discuss what the imbalance in the current way of examining the effects of green space is, and what perspective could be addressed to overcome it; and 3) provide future research opportunities aimed at supplementing the current research with a relational understanding of green space and its health-related benefits.

2.2 Methods

In order to examine how green space in the living environment was referred to or evaluated in previous health-related studies, we followed a systematic review method. We first took an inventory of the relevant literature. A systematic review approach was applied, which is used in the health sciences and social sciences, providing reliable assessments of the current research field (Petticrew, 2001; Roy, Byrne, & Pickering, 2012). Literature searches were conducted in the electronic database Web of Science, which has been shown to be very useful for review studies (Obokata, Veronis, & McLeman, 2014). Key words were used in a combination of "green space," with "health," "well-being," "stress," "obesity," and "mortality." The literature search was completed in June 2016. An additional search was conducted using the snowballing approach of reference checking and the authors' knowledge in this field, which may provide valuable supplementary information (Haaland & Van Den Bosch, 2015).

The studies included in this review had to meet the following criteria: 1) the study had to associate green space in the living environment to at least one type of health-related outcome; 2) the study had to be published in English and in a peer-reviewed journal, after 2000; and 3) conference articles, pure opinion, and descriptive papers were excluded. We have limited our focuses on green spaces as physical environment in everyday life, which are related to policy making, planning and design for promoting health of urban population. We hardly touched on the studies on neurosciences. Studies on broad predictors of general well-being such as neighborhood satisfaction were not included. In total, 2377 studies contained our key words. After checking duplicates, 1742 studies

published between January 2000 and June 2016 were reviewed. Through screening title and abstract, 126 studies were chosen as potential eligible studies for full-text evaluation, of which 82 studies were included in the review. Nine studies were included from snowballing approach and 4 studies were added by experts. Finally, 95 studies were identified as relevant for the review, which focused on green spaces in the living environment and in health outcomes. Six items of information have been derived from each paper, including author information, journal, study location, health outcomes measured, green space measurement, and findings.

2.3 Results

2.3.1 Descriptive analysis of the reviewed studies

Table 2.1 shows all of the 95 empirical studies included in the review. It indicates a trans-disciplinary interest in this field, covering the domains of "Environmental Sciences & Ecology," "Public, Environmental & Occupational Health," "General & Internal Medicine" "Geography," "Urban Studies," and "Psychology." Most of the studies were conducted in Europe (59.4%) and North America (24.0%). Other countries, including Australia (10), New Zealand (4), Japan (1), and Egypt (1), comprised 16.7% of studies. Various categories of health outcomes were explored, including self-reported health/general health (20 times), mental/psychological health and well-being (33), subjective well-being (9), mortality/risk of death (12), Body Mass Index and obesity (13), physical health/activity (24), sleep problems (3), stroke and cardiovascular disease (3), chronic illness and other diseases (4), screen watching time (3), and pregnancy-related health and pregnancy/birth outcomes (8), and behavior problems of children (1). The ways in which green space was referred to or examined in the reviewed studies were identified and characterized into categories. There are three main categories, including *proximity* with four sub-categories (P1, P2, P3, and P4), *abundance* with six sub-categories (A1, A2, A3, A4, A5, and A6), and the *quality* category (Q). In the following section, we will focus on the types of green space measurement.

Table 2.1

Authors, study locations, health outcomes measured, and green space measurement from 95 reviewed studies.

No.	Author (year)	Study Location	Health outcomes measured	Green space measurement
1	Adjei and Agyei (2015)	Wales, UK	Happiness	Q (+)
2	Aggio, Smith, Fisher, and Hamer (2015)	Scotland, UK	Children's screen time	P1 (+)
3	Agyemang et al. (2007)	Amsterdam, the Netherlands	Self-rated health	Q (+)
4	Alcock, White, Wheeler, Fleming, and Depledge (2014)	UK	Mental health	A3 (+)
5	Annerstedt et al. (2012)	Sweden	Mental health, physical activity	Q (+)
6	Astell-Burt, Feng, and Kolt (2013a)	Australia	Mental health	A2 (+)
7	Astell-Burt, Feng, and Kolt (2013b)	Australia	Short sleep	A2 (+)
8	Astell-Burt, Feng, and Kolt (2014a)	Australia	Skin cancer	A1 (-)
9	Astell-Burt, Feng, and Kolt (2014b)	Australia	BMI (Body Mass Index)	A1 (+)
10	Astell-Burt, Mitchell, and Hartig (2014)	UK	Mental health	A3 (+)
11	Bell, Wilson, and Liu (2008)	Indianapolis, USA	Children's BMI	A1 (+)
12	Bertram and Rehdanz (2015)	Berlin, Germany	Well-being	P3 (+) A1 (+)
13	Beyer et al. (2014)	Wisconsin, USA	Mental health	A3 (+)
14	Bixby, Hodgson, Fortunato, Hansell, and Fecht (2015)	UK	Risk of death	A3 (0)
15	Carter and Horwitz (2014)	Perth, Australia	Self-reported health	Q (+)
16	Chum, O'Campo, and Matheson (2015)	Toronto, Canada	Sleep duration and sleep problems	A1 (+)
17	Cohen-Cline, Turkheimer, and Duncan (2015)	USA	Mental health	A1 (+)
18	Coutts, Horner, and Chapin (2010)	Florida, USA	All caused mortality and cardiovascular mortality	P3 (0) A2 (+) A3 (0)

19	Cummins and Fagg (2012)	UK	BMI	A3 (-)
20	Dadvand et al. (2012)	Barcelona, Spain	Pregnancy outcomes	A1 (+) P4 (+)
21	Dadvand, De Nazelle, et al. (2014)	Sabadell, Spain	Children's sedentary behavior, obesity, asthma, and allergy	P4 (+) A1 (+)
22	Dadvand, Villanueva, et al. (2014)	Bradford, UK	Birth outcomes	P4 (0) A1 (+)
23	Dadvand et al. (2015)	Barcelona, Spain	Cognitive development in primary schoolchildren	A1 (+)
24	Dadvand et al. (2016)	Barcelona, Spain	General health, mental health status and physical activity	P2 (+) P4 (+) A1 (+)
25	De Jong, Albin , Skärbäck, Grahn, and Björk (2012)	Scania, Sweden	Physical activity and general health	Q (+)
26	De Vries, Verheij, Groenewegen, and Spreeuwenberg (2003)	Netherlands	Numbers of symptoms, general health	A2 (+)
27	Ebisu, Holford, and Bell (2016)	USA	Birth outcomes	A1 (+)
28	Fan, Das, and Chen (2011)	Chicago, USA	Stress and physical activity	P3 (0) A1 (+)
29	Feda et al. (2015)	New York, USA	Perceived stress of adolescents	A1 (+)
30	Gidlow, Randall, Gillman, Smith, and Jones (2016)	West Midlands region, UK	Chronic stress measured by hair cortisol	A2 (+)
31	Gong, Gallacher, Palmer, and Fone (2014)	Caerphilly County Borough, UK	Physical activities of elderly men	A1 (+)
32	Grahn and Stigsdotter (2003)	Sweden	Stress	P1 (+)
33	Grazuleviciene et al. (2014)	Kaunas, Lithuania	Blood pressure in early pregnancy	P3 (+)
34	Grazuleviciene et al. (2015)	Kaunas, Lithuania	Pregnancy outcomes	A1 (+) P3 (+)
35	Grigsby-Toussaint et al. (2015)	USA	Sleep insufficiency	A3 (+)
36	Guite, Clark, and Ackrill (2006)	London, UK	Self-reported mental well-being	Q (+)
37	Halonen et al. (2014)	Finland	BMI	P3 (+)

38	Hillsdon, Panter, and Foster (2006)	Norwich, UK	Physical activity	P3 (0) A1 (0) A4 (0) A6 (0) Q (0)
39	Hu, Liebens, and Rao (2008)	Escambia and Santa Rosa Counties, USA	Stroke mortality	A3 (+)
40	Hystad et al. (2014)	Vancouver, Canada	Birth outcomes	A1 (+)
41	Kihal-Talantikite et al. (2013)	France	Pregnancy outcomes	A3 (+)
42	Krekel, Kolbe, and Wüstemann (2016)	Germany	Life satisfaction	P3 (+) A1 (+)
43	Lachowycz and Jones (2014)	UK	Mortality	A2 (+) A3 (+)
44	Larson, Jennings, and Cloutier (2016)	USA	Subjective well-being	P4 (0) A3 (+)
45	Laurent, Wu, Li, and Milesi (2013)	California, USA	Pregnancy outcomes	A1 (+)
46	Lovasi et al. (2013)	New York, USA	Obesity of preschool children	A1 (+)
47	Maas, Verheij, Groenewegen, De Vries, and Spreeuwenberg (2006)	The Netherlands	General health	A1 (+)
48	Maas, Verheij, Spreeuwenberg, and Groenewegen (2008)	The Netherlands	Self-perceived health, physical activity	A1 (+)
49	Maas et al. (2009)	The Netherlands	Morbidity	A1 (+)
50	Markevych et al. (2014)	Munich, Germany	Behavioral problems in children	P3 (+)
51	Markevych et al. (2016)	Germany	Physical activity of adolescents	A1 (+) Q (+)
52	McEachan et al. (2015)	Bradford, UK	Depressive symptoms in pregnant women and physical activity	A1 (+) P4 (+)
53	McMorris, Villeneuve, Su, and Jerrett (2015)	Canada	Physical activity	A1 (+)
54	Mitchell and Popham (2007)	UK	General health	A3 (+)
55	Mitchell and Popham (2008)	UK	Mortality, circulatory disease, deaths from lung cancer, and	A3 (+)

			intentional self-harm	
56	Mowafi et al. (2012)	Cairo, Egypt	BMI	A5 (0) Q (0)
57	Ngom, Gosselin, Blais, and Rochette (2016)	Quebec, Canada	Cardiovascular morbidity and diabetes	P3 (+) Q (+)
58	Nielsen and Hansen (2007)	Denmark	Stress and obesity	P1 (+)
59	Nutsford, Pearson, and Kingham (2013)	Auckland City, New Zealand	Mental health	P3(+) A2 (+)
60	Pereira et al. (2012)	Perth, Western Australia	Cardiovascular disease	A1 (+)
61	Pereira et al. (2013)	Perth, Western Australia	BMI	A1 (+)
62	Pearson, Bentham, Day, and Kingham (2014)	New Zealand	Obesity and related behaviors	P1 (+)
63	Peschardt, Stigsdotter, and Schipperrijn (2016)	Copenhagen	Health-promoting use	Q (+)
64	Pietilä et al. (2015)	Finland	Physical activity and self-rated health	P1 (+) A1 (+)
65	Plane and Klodawsky (2013)	Ottawa, Canada	Health and quality of life	Q (+)
66	Potestio et al. (2009)	Calgary, Canada	Overweight/obesity of children	P3 (0) A3 (0) A4 (0)
67	Putrik et al. (2015)	Maastricht, the Netherlands	Self-rated health and depressive symptoms	Q (0)
68	Reklaitiene et al. (2014)	Kaunas, Lithuania	General health and depressive symptoms	P3 (+)
69	Richardson and Mitchell (2010)	UK	Cardiovascular disease mortality, respiratory disease mortality, limiting long-term illness	A3 (+)
70	Richardson, Pearce, Mitchell, Day, and Kingham (2010)	New Zealand	Mortality	A3 (+)
71	Richardson, Pearce, Mitchell, and Kingham (2013)	New Zealand	Physical activity, BMI, general health, mental health and cardiovascular diseases	A3 (+)
72	Richardson et al. (2012)	USA	Mortality	A2 (0)

73	Roe et al. (2013)	Dundee, UK	Stress measured by salivary cortisol concentrations	A3 (+)
74	Sanders, Feng, Fahey, Lonsdale, and Astell-Burt (2015a)	Australia	Child weight status	A3 (+)
75	Sanders, Feng, Fahey, Lonsdale, and Astell-Burt (2015b)	Australia	Children's physical activity and screen time	A3 (+)
76	Schipperijn, Bentsen, Troelsen, Toftager, and Stigsdotter (2013)	Denmark	Physical activity and physical activity in nearest urban green space	P3 (0) A1 (0) A5 (0) A6 (+) Q (+)
77	Stigsdotter et al. (2010)	Denmark	General health, quality of life and stress	P1 (+)
78	Sturm and Cohen (2014)	Los Angeles, USA	Mental health	P3 (+)
79	Sugiyama, Leslie, Giles-Corti, and Owen (2008)	Adelaide, Australia	Physical and mental health	Q (+)
80	Takano, Nakamura, and Watanabe (2002)	Tokyo	Longevity of senior citizens	P1 (+)
81	Tamosiunas et al. (2014)	Kaunas, Lithuania	Cardiovascular diseases and its risk factors	P3 (+)
82	Triguero-Mas et al. (2015)	Catalonia, Spain	General health, mental health, and physical activity	P4 (+) A1 (+)
83	Van den Berg, Maas, Verheij, and Groenewegen (2010)	The Netherlands	Stressful life events, numbers of health complaints, mental health, and general health	A1 (+)
84	Van den Bosch, Östergren, Grahn, Skärbäck, and Währborg (2015)	Sweden	Mental health	Q (+)
85	Van Dillen, De Vries, Groenewegen, and Spreeuwenberg (2012)	The Netherlands	General health, acute health-related complaints, and mental health	A1 (+) Q (+)
86	Van Herzele and De Vries (2012)	Ghent, Belgium	General health, bodily functioning, happiness, physical activity and perceived stress	Q (+)
87	Veitch et al. (2016)	Australia and USA	TV viewing time, overweight, physical activity	P3 (0) A1 (0) A5 (+)

			and obesity among women	
88	Vogt et al. (2015)	Augsburg, Germany	Older adults' physical constitution, disability, and quality of life	P3 (0)
89	Ward Thompson et al. (2012)	Dundee, UK	Stress (tested by salivary cortisol) and self-reported stress level	A3 (+)
90	Ward Thompson, Roe, Aspinall, Mitchell, Clow, and Miller (2016)	Scotland, UK	Stress and general health	A3 (+)
91	White, Alcock, Wheeler, and Depledge (2013)	UK	Mental health and well-being	A3 (+)
92	Wilker et al. (2014)	USA	Mortality following ischemic stroke	A3 (+)
93	Wolfe, Groenewegen, Rijken, and De Vries (2014)	The Netherlands	Chronic illness	A3 (0)
94	Wu et al. (2015)	UK	Mental disorders	A3 (+)
95	Zhang, Van Dijk, Tang, and Van den Berg (2015)	Groningen, The Netherlands	Mental health, physical health, and general health	Q (+)

Note: Self-reported distance/walking time/access to green spaces (P1); Self-reported appearance green spaces/parks within certain distance (P2); GIS-measured distance to green spaces (P3); GIS-measured appearance of green spaces/parks within certain distance (P4); GIS/Satellite image-measured the amount/percentage/NDVI of green space within pre-defined area around household/household postal code (A1); GIS/Satellite image-measured the amount/ percentage/NDVI of green space within pre-defined area around each neighborhood center/population weighted centroid (A2); GIS/Satellite image-measured the amount/percentage/NDVI of green spaces/green space service area within a geographic unit such as neighborhood/community/county/city (A3); Numbers of green spaces for certain population (A4); Numbers of green spaces within certain area (A5); The size of nearest green space (A6).
(+) refers to green space supporting one or more health-related benefits; (0) refers to null findings between green space and health-related benefits; (-) refers to green space hinders health-related benefits.

2.3.2 Green space measurement

As shown in Table 2.2, the term "Discussed" refers to a type of green space measurement that has been linked to one or more health outcomes in a reviewed

study. "Demonstrated" means that one or more of these positive relationships have been proven in this study. In total, green space measurements were discussed 128 times, which resulted in positive relationships between green spaces and health benefits being demonstrated 102 times (79.7%). Within all the types of green space measurements, we discerned two distinctive perspectives: positivistic and relational perspectives. The first considers the world to be one reality in which objective measurements are possible and fixed patterns can be identified. The latter acknowledges that multiple perceived realities exist in the minds of people, that are fluid and culturally based. For example, GIS analyses counting square meters of green on maps are typical for the positivistic perspective. In addition, topographical distances from people's homes to green space were taken as positivist. But where people were asked to express the availability of the green space they experienced, a study was considered as more relational. The positivist way of green space measurement accounts for 79% of the total of 128 discussions. This shows a positivistic trend in studying green space and health benefits. This is largely due to the application of GIS and remote-sensing techniques, in which green space is valued for its mere physical presence.

Table 2 .2

Green space measurement in the studies reviewed.

Category	**Green space measurement (positivistic or constructivist)**	**Discussed (times)**	**Demonstrated (times)**
Proximity	P1 (relational)	7	7
	P2 (relational)	1	1
	P3 (positivistic)	18	11
	P4 (positivistic)	7	5
Abundance	A1 (positivistic)	35	31
	A2 (positivistic)	8	7
	A3 (positivistic)	26	22
	A4 (positivistic)	2	0
	A5 (positivistic)	3	1
	A6 (positivistic)	2	1
Quality	Q (relational)	19	16
Total		128	102

Proximity: The distance to green spaces

The proximity to green space has been alleged to trigger residents' health benefits (De Vries and Goossen, 2002; Giles-Corti et al., 2005), since close distance can be assumed to result in a relatively strong effect on physical activity and frequency of green space use. Out of the 128 discussions of green space measurement, 8 discussions took *perceived* distance as a measurement for the availability of green space. In all 8 discussions, the respondents had to estimate the distance or appearance of green space within a certain distance (P1 and P2), all of which demonstrated a positive and significant relationship between green space and health benefits. For example, a study on elderly citizens in the Tokyo metropolitan area indicated that the survival rate of elderly citizens was associated with the self-rated availability of green space close to home (Takano et al., 2002). The shorter perceived distance to the urban open green space may also result in lower stress levels by increasing visiting times to green spaces. Another study also reported a positive relationship between a shorter distance to green spaces and less stress, as well as lower likelihood of obesity (Nielsen & Hansen, 2007).

A further 25 times, health outcomes were linked to GIS-measured distance to or appearance of green space, of which statistically significant positive relationships were demonstrated 16 times. Eleven out of 18 discussions reported that better health outcomes might be achieved by reducing the GIS-measured distance to green space from residential places. However, no such relationships were found in the other 7 discussions of GIS-measured distance to green spaces. In addition, 7 discussions applied GIS-measured appearance of green spaces/parks within a certain distance, of which 5 demonstrated significant positive relationships and 2 reported null findings. Therefore, we agree with Van den Berg et al. (2015) that the result is a mixed picture of the outcomes of empirical research related to proximity of green space and well-being. Not all studies confirm the positive effect of proximity. This variation in correlation begs for critically discussing the causal pathways assumed in the current academic discourse.

Abundance: The presence of green space within a pre-defined area

As with the proximity of green space to people's place of residence, it is logical to suspect that the greater the abundance of green spaces in the living environment, the healthier residents feel. This association has been tested in

dozens of empirical studies through precisely measuring the amount/percentage/NDVI/numbers/sizes of green spaces in residents' living environments.

Out of the 128 discussions of green space measurement, 66 discussions concern the abundance of green spaces in the living environment, 62 of which demonstrated a significant positive impact on health outcomes. There were three ways of measuring the living environment within these studies. First, 35 discussions used a GIS/Satellite image-measured abundance of green space within a pre-defined area around household/household postal code, followed by 8 discussions based on a pre-defined area around a neighborhood center/population-weighted centroid. Finally, 26 discussions concerned predefined territories such as neighborhood boundaries, census areas, wards, and cities. In addition, another three measures were also used to estimate the abundance of nearby green spaces, including numbers of green spaces per a certain population (2 discussions), numbers of green spaces within certain areas (3 discussions), and the size of the nearest green space (2 discussions).

One postulated benefit of increasing the ratio of green spaces in the living environment is to promote healthy lives by modifying the built environment in cities. Among the 95 studies we reviewed, the abundance of green spaces has been linked to various health and well-being indicators. A positive and significant relationship for green space health benefits was revealed in 93.9% of abundance discussions.

Quality and characteristics of green spaces

Only 19 discussions out of the 128 analyzed addressed the quality and characteristics of the green space by measuring its impact on health benefits, accounting for only 14.8% of the total discussions. Sixteen of these studies applied a quantitative research method, in which green space quality was reported by participants based on their perceptions (e.g., Adjei & Agyei, 2015; Sugiyama et al., 2008), objectively measured green space based on GIS maps (e.g., De Jong et al., 2012; Van den Bosch et al., 2015), or was examined according to other quality criteria (e.g., Van Herzele & De Vries, 2012; Van Dillen et al., 2012). Another two studies used a qualitative research method to let participants express the relationship between green space quality and health benefits (see Peschardt et al., 2016; Plane & Klodawsky, 2013). One study combined both quantitative and qualitative research methods (see Carter &

Horwitz, 2014). In total, 84.2% of these discussions demonstrated a positive relationship between green space quality and health benefits.

2.4 Discussion

2.4.1 Imbalance of green space measurement in these studies

Our review shows that the relationship between nearby green space and health outcomes in the existing literature is often, but not always, statistically evident. This may be due to a number of choices in these current studies, including 1) mainly focusing on the health outcomes from the physical presence of nearby green space without including the different environmental features of the green spaces; 2) lack of concern about the real-use experience of the physical and social environment of the nearby green spaces; and 3) not relating the subjective meaning of the nearby green space to health outcomes.

In the literature review, most studies appear to focus on the influence of the physical presence of green space on health outcomes. Both subjective and objective measurements were used to examine the presence of green space. However, the answers of residents might implicitly have included values they attached to them (the green spaces that they have in mind are the ones most appreciated by them), or might not (the green spaces that they have in mind are just spaces with vegetation, regardless of their attractiveness). The other studies applied objective measurements of green space such as the number of pixels on GIS maps or remote sensing pictures that are defined as *green space*. In this objective measurement, all green spaces are marked as *green* without differentiating the various environmental features. The results indicated that the relationship between green space and health was not always confirmative. The proximity to and abundance of nearby green space seemed only to explain a part of the relationship. This implies that physical presence might be not present all environmental features of green spaces.

Even if a positivistic stance is justified, there is a problem in defining the physical presence of nearby green spaces. In the studies reviewed, fewer studies were concerned with the use experience and perception of residents vis-à-vis their nearby green space. When using GIS maps or remote sensing data, the question is when to define a cell as having the value green. For example, a wide and tranquil residential street with lush overhanging trees and small but well-kept front gardens may be categorized as infrastructure and residential area on a GIS

map, because, strictly speaking, the surface has very little green. However, it may be experienced by residents as a very appealing green environment. On a remote sensing picture, the canopy of the street might actually cause it to be categorized as green. Therefore, the definition problem is profound: What is green space, and what is the minimum size it needs to have?

More importantly, the GIS- and remote sensing-based measurement ignores the issue of environmental features. Not every green space has the same environmental features. For example, some inaccessible left-over pieces of shrub land along a highway ramp, together with some overgrown light industrial sites, may lead to a higher calculated percentage of green space for a neighborhood than a compact affluent neighborhood centered on a popular well-kept park equipped with playgrounds, a running track, and restrooms. The first, technically, has much green, which, however, is inaccessible and may even be invisible; the second has little green space but with high recreational use. Therefore, the geographical information about green space could become more accurate by discerning a range of quality categories.

Whether the apparent positivistic prevalence is necessarily problematic depends on the question: Through what mechanisms are nearby green spaces actually beneficial to health and well-being? That is an important question, because when the nature of the relationship is not known, how can causality be assumed and policies designed that effectively improve well-being? In the examples above, the mechanisms behind green space and well-being were left implicit and not empirically tested. Therefore, we may question why green spaces closer to home result in more well-being. When benefits are expected to stem from green spaces' reduction of noise, cleaner air, and attraction of birds, it may not matter if the vegetation is inaccessible, invisible, or unattractive. However, when benefits come from more outdoor exercise, meeting people when walking the dog, recreational walking, feeling the sunshine, the currently prevailing approach might be limited.

Finally, few of these studies in our review have dealt with the subjective meaning of nearby green space for the health and well-being of residents. When people come in contact with nature, they may develop a sense of belonging to the broad nature community (Mayer & Frantz 2004). Nearby green spaces are valuable nature resources in the living environment and encompass residents' daily activities. However, a positivist approach treats nearby green space only as a *space* with vegetation cover. It may limit the understanding on the meanings of

green space and its impacts on health and well-being. Therefore, key questions remain. Is there any evidence implied in this that residents will develop an emotional attachment to the nearby green spaces? And will this emotional sense of belonging contribute to health and well-being?

2.4.2 Redressing the positivistic prevalence: from space-thinking to place-thinking

In the preceding section, we suggest that studies on the health benefits of parks and nature in and around cities apply a positivistic model of "green." Physical proximity and abundance are highly valued, thus revealing *space*-thinking. The phenomenon 'living environment' is strongly geographical in nature. Therefore, if we combine this observation with the trend from *space*-thinking with *place*-thinking in geographical research, it is surprising that the one underexposed role for urban green space in the studies reviewed is human place-bonding, that is, between people and the green environment. Within the field of geography, this factor has become a major subject, in which strands of theory have emerged that refute the idea of the world around us as being foremost a physical phenomenon. Rather, geographers now emphasize the fact that people attribute meaning to the parts of the world they experience.

Rise of the people and places perspective

Shifts within geographical disciplines reflect the thought changes of geographers vis-à-vis the best way of addressing problems. One of the most substantial changes is an attempt being made by geographers to distinguish the concept of *place* from that of *space*. The term *space* was defined as not embodied but an empty location for quantification and spatial analysis, appealing to the generalizing impulse of science (Cressell, 2004, p. 19). In the 1950s and 1960s, spatial science as an approach to human geography was dominated by the formulation of scientific law-like explanations of the distribution of phenomena (Holloway & Hubbard 2001, p. 9). By defining space as a mere container, this positivist approach helped researchers inculcate knowledge on aggregate spatial patterns. However, in such a positivistic approach, the unique characteristics of places and emotions of individuals are hard to deal with when searching for a generalized interpretation of human behavior, which may ignore the complex nature of phenomena.

The development of the notion of *place* emerged in the 1970s as a reaction to the previous positivist approach in spatial science. The place concept takes the element of subjectivity into account (e.g., emotions, experience, and meanings attached to places). It is also a complicated approach, because various geographers have explored the concept in different ways. However, the central argument about place seems related to individual places, including their locations, their boundaries, and their associated meanings and practices, as well as deeper discussion about place (Cresswell, 2004). For example, geographers such as Yi-Fu Tuan (1977; 1974) and Edward Relph (1976) made great strides in *place* research (Patterson & Williams, 2005). Tuan introduced the concept of place by comparing it with *space*. He defined *place* as *space* with meaning endowed or attached to it by people through their daily experience, and *space* as more abstract than *place* (Tuan 1977, p. 6). Meanwhile, Relph (1976, p. 20) proposed "authentic sense of place" to emphasize the importance of the living experience in a place, involving the "multifaceted phenomenon of experience".

In order to interpret the subjective meanings people attach to places, place attachment was developed to stress this emotional bonding between people and their places. Since place emphasizes the subjective meaning of place for individuals, place attachment has been used to describe the emotional bonds between people and their places. This meaningful relationship is supposed to emerge when individuals get to know a place and endow it with value (Kyle, Graefe, & Manning, 2005). The daily experience of a place may facilitate the process of place attachment, since the meaning attached to a place is the result of use and daily interactions. This attached meaning is considered important to people, since it is an extension of the self and an inseparable part of human existence. It resonates with previous existentialist thought. As for existentialist researchers, the relationships and interactions between people and their environment are essential for people; they contribute to "being in the world" and are an invariable attribute in a changing world (Lewicka, 2010).

The importance of places for health and well-being

Marmot (2010) suggests that there is a need to address the wider determinants of health and well-being. The physical and social environment of places, where people experience their daily lives, together with individually related health behaviors, are especially and decisively important (Learmonth & Curtis, 2013). Meanwhile, the subjective reflection of place – the meanings of place – also matters in terms of health and well-being. Together, the physical, social, and

subjectively symbolic environment contributes to a "therapeutic landscape," which refers to places that help people stay well by healing (Gelser, 2003).

The special physical and social environment of place is part of wider health determinants. The physical aspects of place, such as the preferred living conditions of a neighborhood, are important to health (e.g., Pearson et al., 2014). The physical design of a neighborhood has been proven to highly relate to the physical activities of neighborhood residents. A case study in Canada indicated that young people perceived safe, clean, green, and livable spaces as important features for health (Woodgate & Skarlato, 2015). The social environmental features of places are gradually being seen as important to health and well-being, for example, fair employment and decent work, social protection throughout one's life, and universal healthcare (Marmot et al., 2008). A case study in China, indicates that, in the daily experience of older people, the perceived social supports contribute to their life satisfaction (Yan et al., 2014).

The meaning of a place is acquired through the steady accretion of sentiment over the years, shaped by the daily intimate experiences of places by individuals (Tuan, 1977). The emotional attachment to a certain place will also be established through steady accretion. Place attachment gives people a sense of security, identity, and relaxation, and is assumed to be positively related to well-being (Lewicka, 2011). An empirical study shows that elderly people who have a sense of place attachment are able to establish both meaning for a place and the feeling of security, which contribute to the contingencies of aging and well-being of elderly people (Andrews & Phillips 2005). A case study in Aotearoa, New Zealand, revealed that the sense of attachment to the physical and social environment can promote well-being by using qualitative conversations with older people in 83 communities (Wiles et al., 2009). Moreover, Molcar (2008) found that place attachment generally related positively to all three subscales (existential, religious, and practice) of spiritual well-being. Therefore, spaces become relevant through people experiencing them as places. Using awareness of "place" and place attachment, green space researchers need to rethink the positivistic approach in studying green space and well-being. We therefore advocate the need to involve the perspective of the "place" concept that has appeared in geography when contributing to well-being studies.

Positive effects of urban green places

The insight that green *space*-thinking needs to supplemented with green *place*-thinking will invite researchers to expand the currently prevailing epistemological approach into the realm of a more relational perspective. The current epistemological approach links the physical provision of nearby green spaces to health and well-being outcomes. A more relational approach may contribute to the knowledge of how use perception and the qualities of nearby green space may contribute to health and well-being, how emotional attachment to nearby green space contributes to health and well-being, and in what ways people associate meaning to nearby green space. Two potential aspects of the relationship between nearby green space and health in terms of *place*-thinking are the use experience of physical and social environments, and the meaning of and emotional attachment to nearby green space.

The process of exposure to the environmental features (physical and social) of nearby green space may be more or less of value to health and well-being outcomes in different contexts and for different age groups; this factor has yet to be acknowledged sufficiently in existing green space and health research. Moreover, the physical presence of nearby green space, and its physical and social environmental features may be considered important. Depending on personal preferences, the design of green space, green elements, availability of activity facilities, and social interactions with other users matter. However, most studies (Arriaza, Canas-Ortega, Canas-Madueno, & Ruiz-Aviles, 2004; Hill & Daniel, 2007; Howley, 2011; Van Berkel & Verburg, 2014) are based on a visual research method that provides participants with photos so that they can estimate their preference by sorting and scoring, which may result in certain types of elements that are deemed important as use experiences. This inevitably entails that well-being benefits depend on the sensory stimuli of green spaces instead of real-use experiences. Moreover, the needs of residents may also be culturally determined and, therefore, change over time and space. A riverbank with trees and grass in a Chicago neighborhood may be appreciated by residents, while a similar situation in Mumbai may be detested. The needs of residents also change due to shifting life circumstances over time (Bell, Phoenix, Lovell, & Wheeler, 2014).

As discussed by Brown and Cummins (2013), studying the meanings that people attach to green spaces and the practices they perform within these green spaces constitute a vital perspective in terms of knowing the relationship between the urban green place and well-being. “Place” and “place attachment” bases are not well-acknowledged and even less often studied in green space literature. People

may bond to an urban green space through the positive engagement experience they attach to the green space. A comparative case study in Taiwan revealed that stronger attachment to green space was identified in those neighborhoods where residents were encouraged to participate in neighborhood park design than in unimproved neighborhoods (Huang, 2010). The engagement experiences, such as involvement intention, daily visiting, physical activities, and care-giving behavior, potentially elicited health and well-being benefits through emotional attachment. For example, care-giving behaviors enabled older widows to establish attachment to flowers, trees, and entire gardens, which had a strong relational value, helping the widows replace the emotional attachment that they had previously shared with their partners (Cristoforetti, Gennai, & Rodeschini, 2011).

2.5 Conclusions: proposals for future research to embrace urban green *place*-thinking

In recent years, researchers have shown a broader interest in health determinants, which has then focused on the modification of material and social settings where populations are living, as well as on health-related behaviors (Learmonth & Curtis, 2013). This challenges both policymakers and urban designers to create a livable environment in megacities in order to enhance the well-being of people. There has been concern in urban planning and design about urban green spaces that play a key role in providing a livable environment and in encouraging a healthy lifestyle. In order to provide urban green spaces that are adequate in terms of promoting health and well-being benefits, key questions still need to be answered, such as: Do we have an adequate theoretical basis for understanding the relationship between green space and health, and are we fully aware of the mechanisms behind this (Ward Thompson, 2011)?

In this paper, we aimed to establish whether the place and place-attachment approach gives more insight into the health impacts of urban green places, based on a critical overview of the prevailing approach in green space and health research. By emphasizing the difference between the concept of *space* and *place* in the field of geography, this paper argues that, instead of only studying urban green *space*, we should also pay attention to urban green *place*. This involves both the affective meanings that people attach to green spaces and the unique individual experiences and practices that they perform within green settings that are supported by the physical and social-environmental features. This awareness will contribute to understanding the mechanism of urban green space in terms of

how it is related to health variations and should help identify potential avenues for intervention to improve well-being. This more inclusive perspective is more in line with the dimensions of the WHO-definition of health, that extends toward spiritual, social, emotional and intellectual health, besides the physical perspective that is commonly used.

In regard to green *place*-thinking, we propose four recommendations for future green space and health research.

First, there could be more work done on examining the influence that emotional bonds with nearby green space have on health and well-being, which would fit in with a focus on broader understanding of the underlying mechanisms behind the relationship between green space and health. In addition to the physical presence of green space, the psychological association with nearby green *places* may be an important dimension in understanding their health effects, which involves how people subjectively perceive and become attached to the green places around them. For empirical research, quantitative measurement of attachment to nearby green space (e.g., Zhang et al., 2015) and in-depth interviews would be valuable in examining the health outcomes of attachment. Studying the combined influence of the physical availability (as a material prerequisite) and attachment (as the emotional transmitter) on well-being may lead to a more accurate description of beneficial mechanisms.

Second, should place attachment indeed be proven to matter, interesting insights would be gained by analyzing the process of how people construct green-place meaning and establish these emotional bonds. Attention might also be focused on what kind of use-experience stimulates the forming process in the use-experience of green space, both positively and negatively, and develops meanings that are individual, social, cultural, and political (Main, 2013). It may be helpful to conduct implicit association tests to measure the emotional attachment to green space in the living environment.

Third, research work is also needed in terms of exploring which environmental features of nearby green spaces facilitate or constrain the health-related attachment, in different contexts and age groups. The physical and social environmental features in real settings may be important for the use behaviors of residents. As we have mentioned before, social context and age-related capability are potential factors in actual use-behaviors. Creativity and ingenuity in the use of existing research methods, such as GPS and geo-narratives,

behavior mapping, field observation, and interviews, may be helpful in capturing the experience that people have in their real-life practices, and how people value and link these experiences to their health and well-being. In order to provide green places with the requisite qualities for different groups of users, comparing experiments and survey methods may help to understand why certain types of green places are used more, and are more easily related to well-being outcomes. In this way, a greater health impact with less physical presence might be achieved, adding to a sustainable policy for urban living.

Finally, further research is also needed to investigate why residents decide not to use nearby green space and what influences this decision. If exposure to green space is beneficial to health and well-being, how can we persuade people to visit nearby green spaces? Insight could be gained into real-life interventions, such as providing information on how visiting green spaces will be beneficial to health. Comparing green space use-behavior will be helpful for planners and policymakers in determining which intervention would have the most significant impact.

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