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Barros, P., Mehta, V., Brindley, P. orcid.org/0000-0001-9989-9789 et al. (1 more author) (2021) The restorative potential of commercial streets. *Landscape Research*, 46 (7). pp. 1017-1037. ISSN 0142-6397

<https://doi.org/10.1080/01426397.2021.1938983>

This is an Accepted Manuscript of an article published by Taylor & Francis in *Landscape Research* on 5 July 2021, available online:

<http://www.tandfonline.com/10.1080/01426397.2021.1938983>.

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The restorative potential of commercial streets

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With cities continuing to grow at rapid rates across the globe, daily exposure to traffic, noise, crowding, information overload and other stressors have exacerbated urban dwellers' need for restoration. Yet, how to enhance the restorative potential of urban environments remains a vastly understudied research topic. This article explores the perceived restorative potential of commercial streets in the Boston metropolitan area (US) and Belo Horizonte (Brazil). Triangulation of data (derived from face-to-face interviews, unstructured observations, and social media) and cross-cultural analysis indicate that commercial streets can be planned, designed and managed as destinations for restoration. This study shows that immediate social context, urban design qualities, land use, managerial strategies, meaningful aspects, built and natural elements, in certain combinations, tend to enhance the perceived restorative potential of the commercial streets. While there were numerous similarities in output from the two countries, there were also significant differences.

Keywords: urban design; health and well-being; restorative environment; restorative perceptions; streetscape; psychological restoration; built environment; urban planning; stress recovery; place attachment.

Introduction

There is an increasing acknowledgement of the relationship between urban design, health and well-being (e.g., Barton, 2016; Carmona, 2019; Clark et al., 2006; Corburn,

2004; Jackson, 2003; Leyden et al., 2011). Researchers have examined numerous aspects of urban environments, including transportation, infrastructure, and housing, for their link to health and well-being (e.g., Amerio et al., 2020; Barros et al., 2019; Iravani & Rao, 2020; Saelens et al., 2003; Tilley et al., 2017). However, the evidence available is not consistent, and a comprehensive overview of the positive and negative links between urban design, health, and well-being remains under-researched.

Given that rapid urbanisation and contemporary modes of city living worldwide have increased stress-related exposures and mental fatigue, opportunities to routinely experience restorative urban environments have been acknowledged as highly important (Hartig, 2004). Restoration refers “to the experience of psychological and/or physiological recovery process that is triggered by particular environments and environmental configurations, i.e. restorative environments” (Joye & van den Berg, 2019, p.66).

Even though the study of the restorative properties of urban environments has experienced a relative increase in recent years (for review, see Weber & Trojan, 2018), the analysis of the restorativeness of urban green spaces (e.g., parks) has attracted most of the attention. Recognising that it is not always possible to insert large urban green areas into the urban fabric, researchers have stressed the need of directing efforts towards the investigation of the restorative potential of other types of urban environments (Subiza-Pérez et al., 2020; Weber & Trojan, 2018). While evidence shows urban streets to be less restorative than urban green spaces (Johansson et al., 2011; Kinnafick & Thøgersen-Ntoumani, 2014; Stigsdotter et al., 2017), most of these previous comparative investigations examined the restorative potential of “busy urban streets” for walks. Therefore, it is certainly not evident that urban streets other than busy ones are not suited for restoration.

Scholars have studied commercial streets as important urban assets for exchange of service and goods, social encounters, leisure activities and active modes of transportation (Ewing & Cervero, 2010; Mehta, 2013; Talen & Jeong, 2019). These linear spaces are in a range of neighbourhoods from downtowns and centre city neighbourhoods to peripheral urban areas. They are characterized by a mix of uses, with most blocks containing retail at the ground floor level and office and/or residential space, usually on upper floors. Although no study has been conducted to explore lively commercial streets as restorative destinations, there are three key motives to explore them as such.

First, people tend to rate spaces for leisure and socialising as the most restorative in urban settings (Galindo & Hidalgo, 2005; Hidalgo et al., 2006). Second, several microscale aspects potentially related to the experience of restoration tend to feature lively commercial streets, including seating, natural elements, cafés, flowers and people (Abdulkarim & Nasar, 2014; Kaplan & Kaplan, 1989; Nordh et al., 2011; Rosenbaum et al., 2009). Lastly, lively commercial streets tend to attract and retain people for a range of purposes, and attractive urban spaces were proven to have high restorative value (Hidalgo et al., 2006).

Since local culture may influence how commercial streets are used daily by city dwellers (Rapoport, 1990), ideally, researchers should conduct studies in multiple contexts (Altman et al., 1980). Brislin (1980) argues that “cross-cultural studies are necessary for the complete development of theories in environmental research since no one culture contains all environmental conditions that can affect human behaviour” (p.47). Cross-cultural studies on the restorative potential of urban environments are also critical from a practical point of view because they can guide the development of global and local evidence-based recommendations to plan, design and manage urban options

for restoration as part of a larger strategy to promote public health and well-being. Another limitation of the past research on restorative urban environments is that the majority has been developed in the Global North (for review, see Weber & Trojan, 2018). To date, there is only one cross-cultural study on restorative urban environments (Staats et al., 2016), which found cultural differences in restoration likelihood in urban environments studied in the US, Netherlands and Sweden, all relatively affluent countries.

Given these gaps, this study explores how people in cities within the US and Brazil routinely experience the lively commercial streets selected as study areas. The research questions that guided this enquiry were: Do lively commercial streets have the potential to function as restorative destinations for carrying out stationary and sustained social activities? If so, what microscale aspects of commercial streets are associated with restorative properties by their users? How do restorative experiences differ across countries?

Restorative environments

Stress Recovery Theory (SRT) (Ulrich, 1983; Ulrich et al., 1991) and Attention Restoration Theory (ART) (Kaplan, 1995; Kaplan & Kaplan, 1989) are the main (and easily reconcilable) theories to restoration. SRT postulates that safe and non-demanding settings (characterised by openness, natural elements and moderate levels of complexity) are likely to evoke immediate affective responses, which, in turn, enables the individual to recover from emotional distress and fatigue. A central concept of ART is directed attention, a limited resource that allows people to focus on a task at hand, situation or behaviour even when intrusive sensory information competes for attention. Efforts to inhibit distractions diminish our capacity to direct attention. Signs of attentional fatigue include irritability, impulsivity, and less sensitivity to others.

ART posits that environments with four specific attributes - being away, fascination, extent and compatibility - fulfil the conditions needed to arouse people's involuntary attention, potentially reducing stress and restoring mental capacity. Being away involves experiencing a sense of psychological distance from daily obligations, worries and unwanted distractions. Physical distance from everyday environments can help people engage in thoughts and activities that afford psychological escape from daily sources of mental fatigue. It is not a necessary condition to experience a sense of being away. Fascination is an automatic, pleasant and effortless mode of attending that allows directed attention to rest. Extent refers to an ordered environment of substantial scope for physical or mental exploration. Compatibility is the capacity of the environment to fulfil individual needs and preferences. It follows that lively commercial streets can be referred to as restorative destinations to the extent their regular users perceive them as non-demanding and aesthetically pleasing urban settings likely to improve their emotional, physiological and attentional states (Kaplan & Kaplan, 1989; Ulrich, 1993).

Methods

To broaden our understanding of what can constitute restorative urban environments, we selected as study sites commercial streets that corresponded well with the definitions of restorative environments. More specifically, the commercial streets investigated in the US and Brazil, countries at different stages of development, were considered relatively undemanding, safe and pleasing destinations for shopping, dining and entertainment within their specific cultural contexts. The methods used across cases were as similar as possible.

The second author investigated three commercial streets located in the metropolitan area of Boston following a PhD trajectory on what aspects make

neighbourhood commercial streets lively (Mehta, 2013). The current study, which is part of a larger mixed methods research, extends this earlier study conducted in 2005 by exploring the restorative potential of those lively commercial streets. The available interview data on people's feelings, perceptions, and attitudes toward those settings suited the purposes of this research because they did not impose any ideas about restoration on the participants and the photos taken during the direct observation sessions provided further information on the transactions between people and those commercial streets. We adapted the interview and behavioural protocols applied in the US context through a pilot study in the streets selected as study areas in Belo Horizonte (Brazil). The fieldwork activities took place from August 2017 until October 2018 in Brazil. We applied thematic analysis (Braun & Clarke, 2006) and visual analysis (Creswell & Creswell, 2018) to examine the interview and photos gathered during the fieldwork activities, respectively.

We also used Flickr data (a renown photograph sharing website) to collect information about how people perceive and interact with the commercial streets selected as study areas in the US and Brazil. Social media data are increasingly perceived as alternative sources to public surveys (Tsakalidi et al., 2015). Wilkie et al. (2020) found them to be an effective approach in collecting information concerning attention restoration from Twitter Tweets. Despite the advantages associated with using social media data (e.g., the opportunity to gather information generated by their users in a timely and cost-effective manner), there is, however, little research on the potential of collecting information about restorative experiences from social media, specifically through Flickr. One benefit of Flickr over many alternative social media platforms is that contents must relate to a specific place on the ground at a particular time. Tweets, for example, may not necessarily mention a place name (and therefore may not be

geographically located) or might be georeferenced to a location but may not necessarily include content relevant about that location. Specifically, within the context of our study, the use of Flickr data is part of an attempt to generate more convincing and accurate findings through data triangulation. The Flickr data used in this study covers the period 2003-2018. The methods section details how we gathered and analysed the Flickr data.

We triangulated data to add to the internal validity and described the procedures adopted so that others can replicate them (Creswell & Creswell, 2018). We, as researchers, acknowledge that we played an active role in defining the methods, collecting data, identifying which themes were of interest and reporting them to sustain our arguments.

The settings

In the US, the second author gathered data in three commercial streets in the metropolitan region of Boston: Massachusetts Avenue in Central Square in the city of Cambridge (population: 101,355) (US Census Bureau, 2000); Harvard Street in Coolidge Corner in the town of Brookline (population: 57, 107) (US Census Bureau, 2000); and Elm Street in Davis Square in the city of Somerville (population: 77, 778) (US Census Bureau, 2000).

In Brazil, the first author collected data in Alagoas, Fernandes Tourinho, Paraíba and Tomé de Souza streets. These commercial streets intersect to form an outer ring around the popularly known Savassi Square, located in Savassi borough, Belo Horizonte (population: 2,501,576) (Census IBGE, 2010). After undergoing major construction, including the pedestrianisation of Pernambuco and Antônio de Albuquerque streets, Savassi Square was reopened in May 2012. Featured with many

amenities, Savassi Square is a valuable people-friendly urban open space in Belo Horizonte.

While the three streets studied in the US are the commercial streets in their respective neighbourhoods, those four in Brazil are typical commercial streets in sophisticated mixed-used areas in large cities. The large majority of the buildings in the streets examined in the US range from one to four stories in height and comprise mostly older buildings from the late nineteenth and early to mid-twentieth century. In contrast, the streets studied in Brazil were typified by modern mid- or high-rise buildings with one to twenty-four stories.

A mix of uses that fulfil routine needs occur at ground floor level, including restaurants, coffee shops, bars, fast-food restaurants, bookshops, offices, bank, barbershops, for example. A variety of materials (e.g., glass, brick walls), entrances of different types and sizes as well as a range of small-scale objects, including those found to enhance the restorative potential of urban streets (i.e., trees, planters, seats), characterise the street level. Although the streets studied in Brazil are relatively more polluted, crowded, dangerous and dirtier than those investigated in the US, people tend to perceive them as generally safe and pleasant for carrying out optional social activities (e.g., rest, shop, dine) within Belo Horizonte.

Interviews

We adopted convenience sampling strategies in both countries to recruit interviewees (for detailed information on the interview protocol applied in the prior study conducted in the US, see Mehta, 2013). In Brazil, after testing the questions used in the US through a pilot study, the first author conducted 101 face-to-face structured interviews (Appendix A of Supplementary material). The researcher walked through the selected commercial streets and approached all individuals seated alone outdoors, except those

talking on mobile phones, showing signs of drunkenness or under 18 years old. Those who accepted the invitation read the information sheet and signed the consent form. Interviewees received no remuneration for their participation. The second author asked the same questions in the same set order and manner for all participants. To obtain more detailed descriptions, we employed standardised probes (e.g., Anything else?). The answers were handwritten and read afterwards by the interviewer to cross-check the accuracy of the information recorded. In Brazil, the interviews lasted 10 to 50 minutes. A total of 51 people, 24 (47 %) female and 27(53%) male, were interviewed in the US. The majority of participants, 19 (37%), were in the 25- to 44-year age group, and the minority 4 (8%) were 65 years or older, 15 (29%), 13 (26%) were in the 45- to 64-year and 18- to 24-year age groups, respectively. A total of 101 people, 51 (50.49%) female and 50 (49.50%) male, were interviewed in Brazil. The majority of participants, 63 (62.37%), were in the 25- to 44-year age group, and the minority 6 (5.94%) were in the 65- to 84-year age group. None of the respondents were 85 years or older, 21 (20.79%) and 11 (10.89%) were in the 45- to 64-year and 18- to 24-year age groups, respectively.

Photos from unstructured direct observations

During the fieldwork activities in the US (2005) and Brazil (2017-18), unstructured observations were carried out on weekdays and weekends throughout the day and evening. The researchers often acted as participant observers, watching and taking notes while spending time in seating areas. Photos used to record activities as they occurred in the commercial streets studied in the US (N 71) and Brazil (N 67) were randomly selected for visual analysis.

Data based on Flickr

Photos (2003- 2018) were extracted in August 2019 from Flickr using the Flickr API.

Each photograph contains georeferenced coordinates – making it possible to extract those taken within the study areas. Accompanying each photo is a mandatory user-generated title and description. These textual data were combined to return 6,361 photographs and associated captions: 905 for Central Square; 727 for Coolidge Corner; 1,900 for Davis Square, Boston metropolitan area, and 2,829 for Belo Horizonte. Data from the three study areas in the US were aggregated.

Additionally, 2,000 Flickr photos were randomly selected for visual analysis: 1,000 from Boston (28%) and 1,000 from Belo Horizonte (35%). Many Flickr photos depicted scenes from carnivals/festivals, running and cycling or music events. Whilst at times such photos included interesting insights into the spaces, they were excluded from analysis, as well as photos of inside spaces (e.g., inside marquees) and those photos not of the streetscape (e.g., buildings). This was because this research focuses on the daily restorative value of commercial streets. The Flickr photos from the US (N 64) and Brazil (N 88) included in this study account for 8.8% and 6.4 %, respectively, of all photos. The process was implemented through computer programming using Python 2.7.10, a commonly used and open-source programming language – <https://www.python.org>.

Analyses

To answer the research questions, we triangulated different sources of evidence and analysed if similar results were obtained across the commercial streets studied in the US and Brazil. The different sources of evidence - interviews, photographs taken during the field observations and Flickr photos - were integrated into a convergent line of enquiry.

The data from the interviews were analysed using thematic analysis (Braun & Clarke, 2006). After the data were organised for analysis, the responses were read and reread to identify relevant topics; the researchers identified those accounts interpreted as

important to answer the research questions and grouped those dealing with the same issue in specific categories and broader themes. The identification of repeated patterns that fitted well with the ART framework led us to proceed with a theoretically driven thematic analysis. As previously undertaken (Nordh et al., 2017), we used the items from the Restorative Scale (Purcell et al., 2001) and restorative properties as described in ART (i.e., being away, fascination, extent, compatibility) as the basis for the top-down analysis. Therefore, the data analysis began inductively but progressed deductively (Creswell & Creswell, 2018). The final stage involved reviewing the data to ensure an exhaustive set of data supporting each theme. We rechecked the consistency of coding by repeating the process.

Focusing on the data generated by Flickr users, frequency analysis was undertaken on the combined title and description of each photo using a ‘bag of words’ approach (Sim & Miller, 2019). This matched against a list of keywords derived from the framework generated by the coding of interviews (Appendix B of Supplementary material). The vast majority of text records were purely descriptive and did little to inform higher-order information relating to values (Appendix C of Supplementary material). We, therefore, excluded Flickr textual data from this study because they generated little content.

The visual analysis of the photographs taken during the fieldwork activities and Flickr photos occurred after realizing the interview material fitted well with the restorative properties as described in ART and followed the steps suggested by Creswell and Creswell (2018). The first step consisted of optically scanning and preparing the photographs for visual analysis. In the second step, the photos were coded by tagging areas of the image and assigning themes (Appendix D of Supplementary material). In this stage, each new photo was compared with previous ones and with the themes

already developed to check whether a different theme would need to be created (Braun & Clarke, 2006; Creswell & Creswell, 2018). The choice of themes reflects the entire data set, which, in turn, does not mean that all units of text and photos were featured with all themes. A codebook was developed to maximize coherence among codes (Creswell & Creswell, 2018).

Results

The findings of this study elaborate on the microscale aspects of commercial streets that support restoration. The restorative properties (i.e., fascination, being away, extent and compatibility) were found in the descriptions of the commercial streets. Taken together, the analysis of the entire data set showed that interesting, well-cared, hospitable and human-scaled green configurations made commercial streets different from other urban options for restoration in the city.

Interesting configurations

In both countries, photos taken during the fieldwork activities showed people spending time in outdoor spaces richly decorated with different small-scale elements (e.g., balloons, works of art). Observers photographed people engaged in reading signs, window-shopping and touching objects in front of storefronts personalised with planters, flowers, canopies, awnings and overhangs. Confirming the fascination that interesting configurations (or elements) exert on people, 19 (29.68%) and 27 (30.68%) of the Flickr photos from the US and Brazil, respectively, had some area tagged and assigned as interesting (Appendix E of Supplementary material).

Interviewees in both countries associated interesting configurations with restorative benefits. Permeable façades, music, personalisation of street frontages, entrances, setbacks and sidewalks afforded fascination by adding curiosity, and creating

opportunities for people to explore these interesting configurations (Figures 1-2).“There are interesting things showcased for you to see while you’re walking” (BRA040); “Music attracts, draws more attention, people stop” (BRA076).

I prefer to walk on the JP Licks side of the street. There are a variety of shops and displays to see. There are flowers. ... and seating at Zathmary’s. It is more interesting. There is much more foot traffic on that side. I see more people I know on that side of the street (US8.1)

FIGURES 1-2 ABOUT HERE

Figures 1-2. Personalisation and permeability of street fronts in the US (left) and Brazil (right) generated interest.

From the interviewees' perspective, the presence of people on the streets created an interesting setting that was a factor in adding to fascination. “It is interesting: the same people spend the same hours here. They are intimate strangers. People who see each other, perceive each other, do not talk with each other but respect each other, which is the most important thing” (BRA016).

This is my favourite block. It has got a little of everything, which I like – videos, food, Asmara has good food, sort of decent Mexican place, even the places I don’t visit. It’s nice that they are there. There is a lot of people hanging out, sitting around on the sidewalk here, a variety of people. [It is a] great place to people-watch (US26.2)

Photos showed that those dull and impermeable street fronts, on the other hand, would usually not attract and retain people. In the US, participants perceived low degrees of permeability and personalisation as barriers to the experience of fascination. “They should get rid of the Sovereign Bank building. It’s uninviting, ugly, [and] blank” (US26.6); I wish the façade were more interactive with the street. It’s very alienating. It is like a blackhole” (US42.12); “The buildings there have nothing to draw the eye”

(US26.6).

Human-scaled green configurations

Photos taken during the fieldwork activities show people spending time reading, smoking, relaxing, people-watching and socialising in outdoor spaces featured with greenery, trees and benches. Confirming that people value human-scaled green configurations, 11 (17.18 %) and 28 (31.82 %) of the Flickr photos from the US and Brazil, respectively, had some area tagged and assigned as human-scaled green configuration. The postures, body languages, and activities that featured the images classified and posted as human-scaled green configuration confirm the restorative potential of natural elements in cities. In Brazil, some human-scaled green configurations created a sense of being in a “pracinha”, a Portuguese word for “small urban square” (cf. being away) (Figures 3-4). “I feel that the city is somewhat inhospitable. When I sit and stay in the shade [of trees], I have a feeling of privacy, rest, relief” (BRA032).

The “pracinha” [emphasis added] in front of the Livraria Ouvidor [is one of my favourite places because of the] shadow, art, books, music. It is open. It gives the impression that everywhere you look, you have something to see. It’s a very good meeting place (BRA075)

FIGURES 3-4 ABOUT HERE

Figures 3-4. Human-scaled green configuration featured with trees, greenery, seating, shade and shelter in front of the Livraria Ouvidor, Brazil.

In both countries, participants wished there were more natural elements to help them feel refreshed. “A flower or plant store would be nice. Those products give a feeling of life, beauty, and things alive. It’s a sense of nurture. It’s a good way to express

happiness and love” (US42.4); “I would add more flowers and trees for the beauty and oxygen. ... I would fill the whole city with flowers, to bring life and joy. That is what the city needs” (BRA094). Furthermore, in Brazil, naturalness evoked a strong sense of order (cf. extent): “I would add more trees. ... The presence of trees I associate with attention, care. It is a record of the time. I feel in a calmer and ordered place. I really like trees” (BRA032).

Hospitable configurations

In both countries, people, most of them in groups, were photographed eating, drinking, laughing, people-watching and socialising in outdoor seating spaces adjoining bars, restaurants, coffee shops, and other land uses likely to activate the public realm.

Moveable chairs, tables, planters, awnings, signs and other small-scale objects afford comfort or express territorial claim within many of these gathering spaces. From all Flickr photos included in the visual analysis, 12 (18.75%) and 27 (30.68%) from the US and Brazil, respectively, were assigned as hospitable configurations.

Many of these configurations were described as spaces to meet friends, family members, and even strangers, particularly those perceived as *third places*. Oldenburg (1991) defined third places as “public places that host the regular, voluntary, informal, and happily anticipated gatherings of individuals beyond the realms of home and work” (p.16). Participants described going and spending time with friends or family in gathering outdoor spaces as an opportunity to pause from their daily obligations and activities (cf. being away).

“Ponto Savassi is a place of rest, entertainment, comfort. It’s a place where I forget about problems because that’s where I meet my friends” (BRA079); “I’m here two-three times a day. Every day I have coffee at Peet’s. ... It takes me out of my

house. I come here to read. It's very relaxing for me. My friends know where to find me" (US10.3).

In both countries, the presence of a varied range of hospitable configurations added much to fascination by creating a heterogeneous streetscape with many things to see, hear, touch and smell. "The existence of this variety of stores is what makes the street interesting. There is the possibility of coming to a street and choosing different experiences in these spaces" (BRA097).

Booksmith offers certain books that are not available at other stores, good, interesting collection of books. It has an interesting vibe; it's funky. They play good music. I like the bulletin boards outside. You get to see interesting people there. ... it's not too big or too small. ... yes, it offers movies as well (US1.1)

The feeling of a place being a good fit with an individual's inclinations characterises compatibility. In such cases, a person feels at ease in gathering spaces that evoke a sense of belonging. For people interviewed in both countries, well-cared, sheltered, lively, engaging, and hospitable configurations aided the compatibility of the street (Figures 5-6). "[Quixote bookstore is my favourite place] because it has good books, good coffee and nice people. The booksellers and the costumers are people I enjoy talking to. I feel welcomed there" (BRA058).

Booksmith is my favourite because it's locally owned. I like the atmosphere there. It is very personal. People are very friendly, and I know the people who work there.... I like that they change the [window] displays and put out so many things to add colour to the street. Like the flowers and book displays and the signs about the readings that they arrange... It is the centre of cultural life [in Coolidge Corner]. It's one of the reasons we chose to move here (US14.1)

FIGURES 5-6 ABOUT HERE

Figures 5-6. Lively, well-furnished and sheltered outdoor rooms in the commercial streets studied in the US (left) and Brazil (right) fulfilled common needs.

Well-cared configurations

During the fieldwork activities, the commercial streets studied in the US were well-kept, while in Brazil, well maintained and managed street segments contrasted with dirty, derelict, darker and misused ones. The frequency of Flickr photos from the US (54, 84.37%) and Brazil (65, 73.86%) assigned with the theme well-cared configuration confirms the value of well maintained and managed spaces for people.

Extent is a restorative property that refers to the quality of all the parts adding up, resulting in a wholesome place. Participants in both countries associated the well-cared façades, setbacks and sidewalks with a sense of order (Figures 7-8). “Cadê Meu Brigadeiro is a cosy, welcoming small place. It invites us to sit down. There are the small chairs. [It is] smaller, cosy and clean. It is bright, well-ordered, without many objects, it looks like it was designed” (BRA101); “[Diesel] is well designed. It’s comfortable. It has bathrooms. I like the ceilings” (US44.4).

FIGURES 7-8 ABOUT HERE

Figures 7-8. Personalisation of street fronts studied in the US (left) and Brazil (right) evoked a sense of care.

From ART and SRT perspectives, aspects that place demands on directed attention hinder the experience of restoration. People interviewed in Brazil associated the absence (or inadequacy) of traffic calming measures and poorly maintained sidewalks with a lack of safety against accidents. “I find this entrance to the little square dangerous because of the cars. One day I was almost run over” (BRA031); “[The pavements] are irregular, there are holes, we trip and fall, we twist the foot” (BRA040).

In Brazil, spaces used by people perceived as threatening, the absence of guards carrying out formal surveillance, inadequate illumination levels, and a low degree of permeability combined with land uses that do not activate the public realm evoked a sense of lack of protection against crime and violence. “I would add lighting because there is a lot of assault, homeless” (BRA021); “I would perhaps change formal surveillance ... because of the high number of car thefts.” (BRA007); “It would improve the lighting, for safety; Tomé de Souza has very dark sections” (BRA094); “The area near Getúlio Vargas became empty with the closing of the bars, it needs an improvement in lighting. ... People avoid passing in that darker segments” (BRA005).

The results indicate that interesting, human-scaled green, hospitable and well-cared configurations define interwoven wholes. The interviewees, for example, mentioned various restorative properties in the same sentence or throughout the interview when describing their experience at a specific commercial street. Likewise, 31 (48.44%) and 54 (61.36%) of the Flickr photos recording interactions between people and the commercial streets selected as study areas in the US and Brazil were assigned with more than one theme, respectively.

Discussion

This study deepened our understanding of what constitutes restorative urban environments from the perspective of their users by assessing the experiences afforded by the lively commercial streets studied in the US and Brazil. The results indicate that commercial streets may function (for some people and at specific occasions) as destinations to sit down and recover from emotional, physiological and attentional distress. More specifically, evidence showed that meaningful aspects (e.g., positive memories), immediate social context (e.g., friends), urban design qualities (e.g., permeability), land use (e.g., variety of uses and services), managerial strategies (e.g.,

upkeep), built (e.g., bench) and natural (e.g., trees) elements, in certain combinations, tend to afford restoration.

Permeability and personalisation of the façades were referred to as attributes that generated curiosity; trees, greenery and flowers were associated with perceptions of fascination; pleasant music drew people's attention; and the presence of people carrying out social activities hold their interest. These results reinforce the restorative value of natural elements (Kaplan & Kaplan, 1989; Rosenbaum et al., 2018; Ulrich, 1993) and non-visual multisensory aspects of urban environments (Herranz-Pascual et al., 2019; Ratcliffe et al., 2016; Shu & Ma, 2020). Furthermore, the findings confirm that people-watching and conversing may spark interest and evoke a sense of being away (Dixon & Durrheim, 2004; Nordh et al., 2011).

In both countries, researchers photographed many people carrying out stationary social activities in seating provided by the private and public sectors. Interviewees in the US and Brazil described seating as a prop that enabled relaxing, socialising, reflecting, eating, drinking and contemplating (cf. compatibility). This result confirms that seating allows restorative experiences in urban environments (Abdulkarim & Nasar, 2014).

Apart from settings for consumption, some hospitable configurations provided by commercial establishments evoked a sense of belonging, a common psychological need (cf. compatibility), and afforded conversations that helped people stop thinking about activities needed to get done (cf. being away). Results, therefore, confirm the restorative value of meeting places (Rosenbaum, 2019), certain activities (Nordh & Østby, 2013), and being in the company of a friend (Staats et al., 2016).

Overall, evidence reinforces that third places may possess restorative properties (Rosenbaum, 2009). The outdoor dining rooms provided by Ponto Savassi and Pizza

Pezzi in Brazil exemplify this well (Figures 9-10). Although these commercial establishments had similar physical characteristics and patterns of use, interviewees only described Ponto Savassi as a meaningful space to eat, drink, socialise and withdraw. Personal experiences, therefore, may explain why not all visually similar configurations were described as restorative. The thematic analysis of the interview data confirms that place attachment may enhance the restorative potential of urban environments.

FIGURES 9-10 ABOUT HERE

Figures 9-10. The physical configurations of the outdoor rooms provided by Ponto Savassi (left) and Pizza Pezzi (right) in Brazil are similar.

Main theories to restoration neglect the importance of place bonding (e.g., place attachment, place identity, positive memories) in the experience of psychological and physiological recovery, understanding that restoration is an evolutionary-based response. The results of this research, on the other hand, are in line with recent studies that found that human subjectivity is a fundamental building block of restoration (Menatti et al., 2019; Ratcliffe & Korpela, 2016; Subiza-Pérez et al., 2020).

Focusing on the differences in output from the two countries, according to the participants' descriptions, blank and monotonous façades hindered the restorative potential of the commercial street studied in the US. It confirms that architectural quality impacts the perceived restorative potential of urban open spaces (Lindal & Hartig, 2013, 2015). Although impermeable and boring façades also featured within streets studied in Brazil, participants did not mention this architectural aspect probably because they perceived the lack of adequate maintenance and management of the public realm as a more pressing issue.

People interviewed in Brazil emphasised concerns regarding maintenance, management, crime, violence, accidents and annoyance from vehicular traffic. Their descriptions confirm the relationship between untidiness and perceived insecurity (Herzog & Chernick, 2000; Welsh et al., 2015) which, according to the literature, reduce the restorative potential of environments (Kaplan, 2001; Ulrich, 1993). Although adequate upkeep may enable the experience of restoration (Subiza-Pérez et al., 2019), participants in the US probably did not mention their appreciation for neatness because the streets were well cared for, as the photos taken during the fieldwork show.

In Brazil, participants described “pracinhas” as refuges from the rest of the city (cf. being away). The psychological buffering of traffic-related annoyances (e.g., noise) afforded by these spaces resembling small urban squares may explain why human-scaled green configurations were perceived as valuable assets by the regular users of the streets studied in Belo Horizonte. In this city, heavy motorised traffic flows characterise many commercial streets. The visual analysis of the content of the photos, however, indicates that human-scaled green configurations support restorative experiences across the commercial streets selected for the study.

These findings indicate that commercial streets as restorative destinations differ from other types of restorative urban environments in that meaningful aspects, immediate social context, urban design qualities, land use, managerial strategies, built and natural elements are combined to compose interesting, human-scaled green, hospitable and well-cared inter-linked configurations (Figure 11).

FIGURE 11 ABOUT HERE

Figure 11. Conceptual framework of commercial streets as restorative destinations.

Methodological reflections and further research

The triangulation of different sources of evidence and across the commercial streets selected as study areas in the US and Brazil is one of the strengths of this research. It led to a comprehensive notion of commercial streets as restorative destinations to carry out a range of sustained social activities. Although this article adds to a growing body of research on the restorative potential of urban environments, there are some limitations to be addressed. This line of research may benefit from studies in other cultural contexts that seek to replicate and extend the current research.

Since we aimed to initiate research on lively commercial streets as restorative destinations, we applied a qualitative explorative approach to identify if restorative properties (i.e., fascination, compatibility, being away, extent) would emerge in the interviews with regular users of the research sites. The next step would be to use the Restorative Scale (Purcell et al., 2001) to measure their restorative quality. Since our interview sample was skewed toward young and adult people, in future, it would be worth comparing how different age groups may experience lively commercial streets for restorative purposes.

Focusing on the value of Flickr data for informing the restorative potential of commercial streets, relevant data volumes from Flickr were modest (7% of captions and 8% photos), although broadly in line with other similar research - for example, only 10% of Tweets were found to contain insights into restorativeness (Wilkie et al., 2020). Interpretation of the photos themselves was more insightful than the captions alone. The Flickr photos provided insights into the use of the spaces at different times of the day/season. For example, many of the US photos depicted nighttime lighting, snowy scenes or sunsets. Whilst the analysis was helpful to supplement other data (such as

from interviews), it is hard to conceive that visual examination of Flickr photos alone could provide robust insight into the restorativeness of commercial streets.

There appears an inherent skew within the commercial streets locations towards Flickr photos taken relating to special events instead of everyday scenarios. While this perhaps is not unexpected, it raises concerns about the data's representativeness if such photos are not removed from the analysis. It should be acknowledged that the Flickr photos were taken over a broad period (2003-18), but sample sizes were not sufficient to identify change over time.

We appreciate the many issues that frequently accompany the use of social media data – including the bias and unrepresentativeness that exists within their usage (Ruths & Pfeffer, 2014). Inaccuracies in recording location (including photos associated with distant viewpoints and GPS issues) are noted. In contrast to other research (Li & Goodchild, 2012), however, we encountered few distant photos in our settings, and the general accuracy of the photos appeared acceptable. Other limitations include the potential for fake accounts/users; and ethical issues such as informed consent and right to withdraw, alongside adherence to terms and conditions and General Data Protection Regulation (GDPR) constraints where appropriate.

Numerous studies have demonstrated the wide-ranging suitability of social media in providing insight for a wide range of concerns, including measuring landscape value (Gosal & Ziv, 2020) and greenspace visitation (Donahue et al., 2018), for instance. In contrast, this study raises concerns for the appropriateness of Flickr data for investigating the restorative potential of commercial streets due to the relatively modest sample sizes, the precise nature of the data and the insights that it can afford. It appears that in some scenarios, social media data might be unable to provide an appropriate framework for analysis of opinions on specific topics in their own right. More work is

needed that explores the appropriate thresholds at which output become robust. Without which the widespread use of social media extractions risks potentially being oversold as universally applicable without full consideration of their suitability.

Whilst photos can help inform on streetscape features and users' activities, they cannot express how people feel in a space or provide information for other senses (such as sound or smell). Similarly, Flickr captions failed to provide such insight. Image classification (/object detection) through machine learning may offer future opportunities to automate the currently labour-intensive process of photo interpretation.

Implications for policymakers, planners, designers and business owners

Based on our results, commercial streets as restorative destinations can be read as a snapshot of inter-linked interesting, human-scaled green, hospitable and well-cared configurations that change at different speeds over time. Their building blocks include meaningful aspects, immediate social context, urban design qualities, land use, managerial strategies, built and natural elements.

Outcomes from this research confirm that policymakers, planners, designers, and private businesses need to be aware of the value of fine-grained and small-scale locally orientated interventions to enhance the perceived restorative potential of commercial streets (Thwaites et al., 2020). For example, low degree of permeability and dull façades were mentioned as significant issues to be counteracted in some streets examined in the US. At the same time, lack of adequate maintenance (e.g., insufficient streetlight) and management (e.g., heavy vehicular traffic) have prevented restoration in the context of the commercial streets studied in Brazil.

The apparent restorative value of third places across the commercial streets studied in the US and Brazil urges policymakers in both locations to develop specific economic programs to support them. We hope this research will offer insights into how

top-down and bottom-up approaches to planning, designing and managing commercial streets may enhance their perceived restorative potential as part of a larger strategy to promote public health and well-being.

Acknowledgements

This collaboration arose from discussions at a British Council Newton Fund Researcher Links workshop held at the Universidade de Brasília, Brazil, in 2019. We would like to thank people who took part in interviews for this research. We are deeply grateful to Carolina Amaral Guimaraes de Lima Souza and Thiago Lima e Lima for their help with the pilot tests; Maria Clara Santos Rodrigues for her support with organizing the interview data; Verônica Flores for her assistance in visual data systematization. We immensely appreciated comments on earlier versions of this paper shared by two reviewers.

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Funding source declaration

This work was supported by the [Universidade Federal de Minas Gerais] under grant [ADRC 05/2016] and [Fundação de Amparo à Pesquisa do Estado de Minas Gerais] under grant [PIBICEM 09/2017].

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Figures 1-2. Personalisation and permeability of street fronts in the US (left) and Brazil (right) generated interest



Figures 3-4. Human-scaled green configuration featured with trees, greenery, seating, shade and shelter in front of the Livraria Ouvidor, Brazil



Figures 5-6. Lively, well-furnished and sheltered outdoor rooms in the commercial streets studied in the US (left) and Brazil (right) fulfilled common needs.



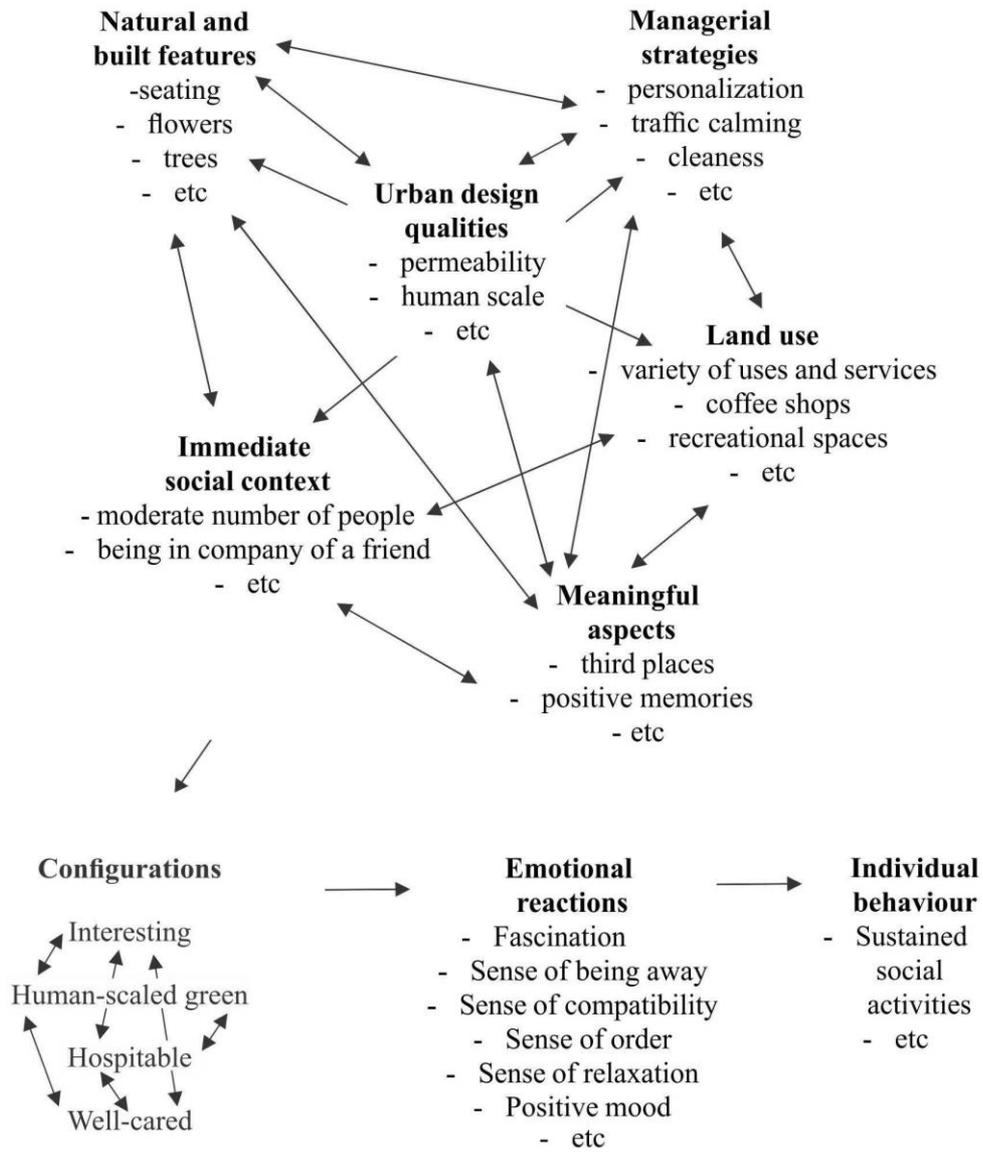
Figures 7-8. Personalisation of street fronts studied in the US (left) and Brazil (right) evoked a sense of care.



Figures 9-10. The physical configurations of the outdoor rooms provided by Ponto Savassi (left) and Pizza Pezzi (right) in Brazil are similar



Figure 11. Conceptual framework of commercial streets as restorative destinations



Appendix A: Questions asked during the interviews applied in the US and Brazil

The questions asked in Brazil were: Do you have a favourite place in this street segment? What are they, and what do they have that make them your favourite? Is there something in this street segment that you wouldn't want to see changed? What wouldn't you like to see changed? Why? Is there something in this street segment that you would change or add? What would you change or add? Why? The questions asked in the US were: What brings you here? What do you do when you are here? Do you use this block more often compared to other blocks on this street? If yes, why? If not, why not? Do you have any favourite stores and shops on this block? If yes, what are they, and what makes them your favourite? What are the three most important things about this block that you would not want to change? What are the three most important things that you would like to change or add on this block?

Appendix B: Keywords used in bag of words approach to the social media extraction

Theme	Subtheme	Words (English)	Words (Portuguese)
Social Belonging	Sense of Coziness Sense of Freedom Sense of Belonging Sense of Welcoming	Coziness; Cozy; Cosiness; Cosy Freedom Belonging; Belong Welcoming	Aconchegante Liberdade Senso De Pertencimento Bem-Vindo
Reduced Stress	Sense of Relaxation Sense of Pleasantness Sense of Happiness Sense of Excitement Sense of Well-Being Sense of Delight Sense of Privacy Interesting	Relaxation; Relax; Relaxed Pleasantness Happiness; Happy Excitement; Excited Well-Being; Wellbeing Delight Privacy Interesting	Relaxante; Relaxado Agradável; Bom Felicidade; Alegria Excitante; Excitado Bem-Estar Prazer; Delícia Privacidade Interessante
Commercial Seat	Commercial Seat	Seat; Bench	Cadeira; Cadeiras; Mesinhas
Other Small Objects	Small Scale Objects	Small	Pequeno; Pequena
Sidewalk Width	Sidewalk Width	Sidewalk; Pavement	Largura Dos Passeio; Largura Dos Passeios
Shelter	Shelter	Shelter	Cobertura; Toldo
Public Seat	Public Seat	Seat; Bench	Banco; Bancos
Type of Building	Type of Building	Building	Prédio; Prédios
Colours	Colours	Colour; Colours; Red; Blue; White; Black; Green; Yellow; Purple; Pink etc	Cor; Cores; Azul; Branco; Amarelo; Verde; Vermelho; Preto; Cinza
Parklet	Parklet	Park	Parklet
Street Light	Street Light	Street Light	Iluminação; Luz; Poste
Sidewalk Pavement	Sidewalk Pavement	Sidewalk; Pavement	Calçada; Calçadas; Pavimentação; Piso
Air Quality	Air Quality	Pollution	Poluição
Micro Clime	Micro Clime	Temperature; Hot; Cold; Weather; Dry; Wet	Temperatura; Quente; Frio; Tempo; Seco; Molhado
Sky	Sky	Sky	Céu
Wind	Wind	Wind; Windy; Blustery; Winds	Vento; Brisa; Ventos; Brisas; Ventando
Silence	Silence	Silent; Silence; Quiet	Silêncio; Quietos; Silencioso
Greenery	Trees_Planters_Flowers	Trees; Plants; Flowers	Árvores; Plantas; Flores; Arbustos
Music	Music	Music	Música

Noise	Less Noise	Silent; Silence; Quiet	Menos Barulhento
Comfort	Sense Of Comfort	Comfort	Conforto; Confortável
Safety Against Crime	Sense of Safety Against Crime	Crime	Crime
Protection Against Accidents	Sense of Safety Against Accidents	Accidents	Acidentes
Block Variety	Block Variety	Block	Variedade Na Quadra; Variedade No Quarteirão
Independent Business	Independent Business	Independent	Negócios Independentes
Community Place	Community Place	Community	Lugar
Multifunctionality Of Some Business	Multifunctionality	Multifunctionality	Multifuncionalidade
Cluster of Shops	Cluster of Shops	Shops	Lojas
Cluster of Restaurants	Cluster of Restaurants	Restaurants	Restaurantes
Cluster of Book Stores	Cluster of Book Stores	Book Stores	Loja De Livros
Cluster of Bars	Cluster of Bars	Bar; Bars	Bar; Bares
Residential Use	Residence	Residence	Residência; Casa
Cluster of Coffee Shops	Cluster of Coffee Shop	Coffee Shop; Café	Cafeteria; Café
Franchise	Franchise	Franchise	Franchise
Specific Gallery	Galleria	Galleria	Galeria
Specific Shopping	Shopping	Shopping	Shopping
Specific Business	Type Of Business	Specific	Tipo De Negócios
Goods	Type, Singularity, Quality Of Goods	Quality; Goods	Produtos; Café; Cerveja; Comida
Service	Type, Singularity, Quality Of The Service	Quality; Service	Serviço
Price	Price	Price	Preço
Events	Events	Events	Eventos
Free	Free or no Need to Consume	Free	De Graça
Opening Times	Opening Times	Opening Times	Horário De Funcionamento
Proximity	Proximity	Close; Proximity	Proximidade
Location	Location	Location	Localização
More Affordances	More Options	Affordance	Mais Options
Atmosphere	Atmosphere	Atmosphere	Atmosfera; Ambiente
Internet	Internet	Internet	Internet
Personal Memories	Personal Memories	Memories	Memória; Memórias
Familiarity	Familiarity	Familiarity	Familiaridade

Permeability	Permeability	Permeability	Permeabilidade
Personalization	Personalization	Personalisation; Personalization	Personalização
Human Scale	Human Scale	Human Scale	Escala Humana
Spaciousness	Spaciousness	Spaciousness	Espaçoso; Amplo
Upkeep	Sense of Well-Cared	Upkeep; Well Cared	Bem Cuidado
Singularity	Local Heritage	Heritage	Patrimônio
Singularity	Resilience / Traditional	Resilience; Traditional	Tradicional
Singularity	Local Identity / Character	Identity; Character	Identidade; Caráter
Singularity	Night Life	Night Life; Nightlife	Boemia
Singularity	Unique Experience	Unique Experience	Experiência Única
Singularity	Unique	Unique	Único
Upkeep	Garbage	Garbage	Lixo
Upkeep	Cleanness	Clean; Dirty; Litter; Rubbish; Cleanliness	Limpeza; Limpo; Sujo; Lixeira
Upkeep	Maintenance	Maintenance	Manutenção
Desirable People	Type of People	People	Pessoas
Range Of People	Social Diversity	Diversity	Diversidade
Close Servers	Servers	Servers	Logistas; Garçons
Close People	Social Relations	Social	Social
Undesirable People	Undesirables	Undesirable; Undesirables	Indesejáveis
Guards	Guards	Security Guards; Guards; Police	Guardas
People	Social Anchor_Presence of People	People	Pessoas
Parking Facilities	Parking Facilities	Parking	Estacionamento
Vehicular Traffic	Vehicular Traffic	Traffic	Tráfego; Trânsito
Traffic Calming	Traffic Calming Solutions	Traffic	Tráfego; Trânsito

Appendix C: Results from the social media captions extracted from Flickr

Theme	Belo Horizonte % of (278) records	Belo Horizonte rank of theme	Boston % of (140) records	Boston rank of theme	Combined (Belo Horizonte / Boston) average %
coffee shops	36.33	1	7.14	5	21.74
graffiti	0.36	24	26.43	1	13.39
maintenance	18.35	2	0.00	n/a	9.17
music	0.72	15.5	11.43	2	6.07
type of building	1.44	10	10.00	3	5.72
street light	7.19	3	0.00	n/a	3.60
social anchor / presence of	0.00	n/a	7.14	5	3.57
type of people	0.00	n/a	7.14	5	3.57
colours	6.83	4	0.00	n/a	3.42
micro clime	0.72	15.5	5.71	6	3.22
sky	3.24	8.5	2.14	9	2.69
type, singularity, quality of	5.04	5	0.00	n/a	2.52
cluster of bars	3.96	6	0.00	n/a	1.98
trees/planters/flowers	0.36	24	3.57	7.5	1.97
sense of pleasantness	3.60	7	0.00	n/a	1.80
parklet	0.00	n/a	3.57	7.5	1.79
shopping	3.24	8.5	0.00	n/a	1.62
commercial seat	1.08	12	1.43	12	1.25
public seat	0.36	24	1.43	12	0.89
sense of delight	0.72	15.5	0.71	20.5	0.72
sense of excitement	0.00	n/a	1.43	12	0.71
sidewalk pavement	0.00	n/a	1.43	12	0.71
sidewalk width	0.00	n/a	1.43	12	0.71
community place	1.08	12	0.00	n/a	0.54
residence	1.08	12	0.00	n/a	0.54
cluster of restaurants	0.36	24	0.71	20.5	0.54
less noise	0.36	24	0.71	20.5	0.54
personal memories	0.36	24	0.71	20.5	0.54
traffic calming solutions	0.36	24	0.71	20.5	0.54
vehicular traffic	0.36	24	0.71	20.5	0.54
sense of happiness	0.72	15.5	0.00	n/a	0.36
wind	0.00	n/a	0.71	20.5	0.36
cleanness	0.00	n/a	0.71	20.5	0.36
location	0.00	n/a	0.71	20.5	0.36
parking facilities	0.00	n/a	0.71	20.5	0.36
proximity	0.00	n/a	0.71	20.5	0.36
sense of relaxation	0.00	n/a	0.71	20.5	0.36
silence	0.36	24	0.00	n/a	0.18
cluster of shops	0.36	24	0.00	n/a	0.18
galleria	0.36	24	0.00	n/a	0.18
garbage	0.36	24	0.00	n/a	0.18
local heritage	0.36	24	0.00	n/a	0.18

Appendix D: Example of photos coded by tagging areas of the image and assigning the themes

Themes	Visual analysis
01 Interesting	
02 Well-cared	
03 Human-scaled green	
04 Hospitable	
	

Appendix E: Classification of the Flickr photo contents to the four themes

Category / themes:	Belo Horizonte (Brazil)			Boston (US)		
	Count	% total	% of relevant	Count	% total	% of relevant
Photos not relevant to streetscapes:						
Photos of inside spaces (including inside marquees)	912	91.2	N/A	936	93.6	N/A
Not of the street (e.g., buildings)	622	62.2	N/A	571	57.1	N/A
Streetscapes but showing special events	259	25.9	N/A	248	24.8	N/A
	31	3.1	N/A	117	11.7	N/A
Relevant photos for streetscapes:	88	8.8	100	64	6.4	100
None of the four themes present	14	1.4	15.9	7	0.7	10.9
Hospitable theme alone present	2	0.2	2.3	1	0.1	1.6
Human-scale theme alone present	2	0.2	2.3	0	0	0.0
Interesting theme alone present	3	0.3	3.4	2	0.2	3.1
Well-cared theme alone present	13	1.3	14.8	23	2.3	35.9
Human-scale & hospitable themes present	1	0.1	1.1	0	0	0.0

Category / themes:	Belo Horizonte (Brazil)			Boston (US)		
	Count	% total	% of relevant	Count	% total	% of relevant
Human-scale & well-cared themes present	10	1	11.4	5	0.5	7.8
Interesting & well-cared themes present	13	1.3	14.8	13	1.3	20.3
Well-cared & hospitable themes present	14	1.4	15.9	5	0.5	7.8
Interesting; well-cared; hospitable themes (not human-scale)	1	0.1	1.1	2	0.2	3.1
Interesting; human-scale; hospitable themes (not well-cared)	1	0.1	1.1	0	0	0.0
Human-scale; well-cared; hospitable themes (not interesting)	5	0.5	5.7	4	0.4	6.3
Interesting; human-scale; well-cared themes (not hospitable)	6	0.6	6.8	2	0.2	3.1
All four themes: interesting; human-scale; well-cared; hospitable	3	0.3	3.4	0	0	0.0