Measuring Beauty in Urban Settings.

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Summary

With more than half of the global population living in cities, urban planning has become key to improve our quality of life. This work aims at conceptualizing and operationalizing the notion of beauty in urban settings to ultimately provide a supporting tool for decision making in the planning activity. A score to measure the urban beauty is introduced, and it has been developed by taking inspiration from well recognized best practices in urban planning: such as promoting walkability, greenness, the historical value and the human scale. The score has been tested on Greater London and produced promising preliminary results which are presented here. It opens up further avenues for future research, including computer vision methods to render the score more accurate, and can be applied to asses the quality and impact of new planning applications.


1 Introduction

Beauty is an elusive but nevertheless universally acknowledged concept; it may inhabit objects, ideas, experiences, people, and the capacity to recognise it is tied with perceptions and subjective taste. This makes such a notion very difficult to grasp but, at the same time, extremely influential in our life. The beauty which surrounds us has fed the minds of philosophers, pushing them towards digging into its very nature and try unravelling the secrets behind the pleasure that we gain from it. The places we live in can be beautiful too, and when we find ourselves in those places we benefit from the positive sensations triggered by the beauty. Several urban planners have underlined the critical role of beauty in their practice. Brent Toderian, urban planning practitioner and Vancouver’s former Director of City Planning, in an open letter underlined that: “Good cities need infrastructure, efficiency and economic activity, and smart cities give equally strong attention to sustainability, arts and culture, and social compassion. But great cities need more than that. They need beauty” (Toderian, 2007). In his manifesto, philosopher Alain De Botton challenges citizens and cities’ policy makers to deal with developers to safeguard the sense of beauty in the life of the city (De Botton). He argued that beauty needs to be defined in order to address the planning

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of better and more livable cities. In this work an humble attempt at defining, and also quantifying, beauty is presented. Building on top of acknowledged best practices in urban planning, an urban beauty score is proposed and tested on Greater London. Such a score does not only aim at assessing the current state of urban areas, but it is meant to be further developed to automate the evaluation of the quality and impact of new planning applications, which are increasingly provided in a digital format.

2 The Domains of Urban Beauty

Beautiful in Latin is “bellus” which is the diminutive of an ancient form of “bonus”, that means good, well. Therefore, according to the word’s etymology, an urban area is beautiful when it is well planned and, to be properly planned, it needs to render life in cities happier and healthier. Scholars trying to quantify beauty have explored different approaches. A study by Florida et al. (2011) relied on a survey administered in US cities, where an overall rating of urban areas was accompanied with the evaluation of a number of environmental aspects, including beauty. Regression analysis showed that beauty is the second most positively correlated variable with community satisfaction, just after the economic condition. Quercia et al. (2014) extracted an idea of beauty based on crowdsourcing the rating of street view images, which confirms most of the guidelines proposed in urban planning. Carmona (2019) develops the notion of place quality based on an extensive review of works providing evidences that certain urban features are beneficial to our living. In this work, similarly to Carmona (2019)’s definition of place quality, the beauty of urban settings is not merely focused on the aesthetics of urban forms, but it is ultimately and deeply tied with the composite way people experience an architectural complex (Rossi et al., 1982). In line with some of the pillars of Urban Planning introduced by well recognized scholars and practitioners, such as Gehl et al. (2011), Jacobs (1961), Alexander (1977) and Rossi et al. (1982), the following domains have been combined to develop the Urban Beauty Score.

Walkability. One intervention which is now widely considered helpful to make cities more livable (and sustainable) is to increase walkability. Jan Gehl, pioneering Danish architect and urban planner, has persistently advocated the crucial role of pedestrians in cities. His book, Cities for the people, describes how important walkability is to create cities centered on the human scale. In addition, several studies have provided us with clear evidences on the benefits of walkability for both our mental and physical health. While state-of-art methods to measure walkability may vary (Shashank and Schuurman, 2019), the underpinning ideas of what walkability is converge into the following features: lively environment (residential density and business activities); urban density and compactness; connectivity.

Historical Properties and the Character of Place. Historical properties also play an important role in making a place feel beautiful. A study carried out by Ipsos MORI showed that “there tends to be a preference for older buildings over newer ones – for a variety of reasons that go beyond purely visual taste” (Ipsos MORI, 2010). The presence of historical forms in a city results in places with identifiable character (Jive’n and Larkham, 2003), emerging from those distinctive features which make it unique and clearly recognizable (i.e. the sandstone of Glasgow’s tenements, Lisbon’s tile-covered buildings or Bologna’s red painted buildings with its famous porticos). Furthermore,
a study by Venerandi et al. (2016) showed that London’s neighborhoods with a predominance of historic properties also display good levels of well-being.

**Size and Sense of Order.** It is acknowledged that three-five story buildings fit better with the human dimension, triggering more activities in their proximity than tall constructions (Gehl et al., 2011). Additionally, Lindal and Hartig (2013) report that such buildings’ height might increase our sense of enclosure, with a consequent restorative effect on people. Another aspect concerning the geometry of urban forms is related to the sense of order, which has long been considered a key aesthetic aspect in architecture (Karimi, 2012). Sharp differences in buildings’ heights may easily produce a lack of sense of order.

**Greenness.** The positive role green spaces play for our health is extensively demonstrated by several studies, likewise it is associated with higher property values\(^1\). The presence of public parks and maintained trees have been calculated to account for the greenness domain.

### 3 Data and Methods

Although some studies have assessed beauty or walkability at street level (i.e. Quercia et al. (2014); Walk Score), the LSOA level has been chosen as reference geography in this study. Such level of analysis allows to: 1) access a wide variety of socio-demographic and economic information which on one hand inform the construction of the score (i.e. population density), and on the other hand, will enable the analysis of the score against other indicators. 2) create a synthetic measure that account for a broader context than individual streets.

To transform the domains described above into measures, the following data\(^2\) have been used:

<table>
<thead>
<tr>
<th>Domain</th>
<th>Datasets</th>
<th>Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walkability</td>
<td>2018 Estimates of the usual resident population for LSOA</td>
<td>Population Density</td>
</tr>
<tr>
<td></td>
<td>2011 Census Total Number of Dwellings</td>
<td>Dwelling Density</td>
</tr>
<tr>
<td></td>
<td>CDRC 2017 Retail Centre Boundaries</td>
<td>Retail Score</td>
</tr>
<tr>
<td></td>
<td>OS Road</td>
<td>Intersection Density</td>
</tr>
<tr>
<td>Historical Character</td>
<td>Historic England Listed Buildings</td>
<td>Proportion of Listed Buildings</td>
</tr>
<tr>
<td>Size and Order</td>
<td>OS Master Map Building Height Attribute</td>
<td>Mean and Standard Deviation in Buildings Height</td>
</tr>
<tr>
<td>Greenness</td>
<td>OS Open Green Space</td>
<td>Public Parks Score</td>
</tr>
<tr>
<td></td>
<td>Greater London Authority Maintained Trees</td>
<td>Trees Density</td>
</tr>
</tbody>
</table>

\(^1\)For a detailed review see Carmona (2019) section A1 on health evidences and section C1 on economic evidences.

\(^2\)when information was not provided at the LSOA level, the data has been aggregated accordingly.
The score aims at assessing the built environment, therefore data have been pre-processed to maintain only LSOAs classified as urban by the ONS urban/rural classification (ONS, 2011). To this respect, it is important to note that the LSOAs whose area is mostly covered by large public parks (more than 70%) have been removed, although the park presence is accounted for in the neighbouring LSOAs through the public parks score. Such a score ranges 1 to 4 depending on the park’s size: the lowest score corresponds to smaller parks - the first quartile in the parks’ size distribution - while the highest to larger parks. According to Mazziotta and Pareto (2013) there are several strategies to develop a multidimensional index; here, the selected variables have been normalised and combined in two steps. First, the z-score of each domain have been multiplied objective weights - obtained through factor analysis - and combined. The resulting domain scores have been ranked, transformed using the exponential distribution employed for the Multidimensional Deprivation Index, and scaled to range 0 to 100. Second, the domain scores have been combined using, again, objective weights and the result scaled to values within a 0 to 100 interval.

4 Urban Beauty in London

A preliminary study of the score has been carried out based on Greater London. To appreciate the features characterizing beautiful places some street view images have been captured from Google Maps. The figures below correspond to points within LSOAs displaying the highest and lowest scores for each domain (walkability, historical character, size and sense of order, greenness). Finally, the map of the combined score (Urban Beauty Score) is presented.

Walkability

![Walkable areas](https://bit.ly/2NeqLjF)  ![Walkable areas](https://bit.ly/2FCF0dS)

Figure 1: Walkable areas are dense and characterized by the presence of amenities. They are likely to be lively areas.

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3Weights for the size and order domain are an exception as a higher weight has been given to the buildings’ high dimension rather than symmetry.
Figure 2: Unpopulated and sparse areas are meant to be passed through with a vehicle.

Historical Character

Figure 3: Chester Street (a) built between 1800 and 1830 and early Victorian terraced houses (b).

Figure 4: (a) clearly does not have any trait of the historic London; however, (b) has a very low historic character score despite maintaining more traditional features.\(^4\)

\(^{4}\text{Relying on listed buildings is not enough to grasp the historical character of certain areas. To increase accuracy the year of construction will be incorporated and a classifier trained to identify all buildings with traditional features.}\)
Size and Sense of Order

Figure 5: Three-five story buildings allow population density and the human scale.

Figure 6: Sharp differences in building heights generate a sense of chaos and emptiness.

Greenness

Figure 7: Parks and trees trigger positive sensations in the viewer.
Combining these domains results in the Urban Beauty Score of London, shown in Figure 9.

Figure 9: Map of the Urban Beauty Score in London. It reports where the street view images corresponding to the figures above have been captured. The number of LSOAs belonging to the 10th decile (most beautiful) increases while moving towards the city centre. It is important to note that the definition of urban beauty leading to this score is centered on the planning of rather dense urban environments. This motivates the low score characterizing the LSOAs at the outskirts of the city, which are mostly residential and sprawled areas. An interactive map of the score is available here: https://aelissa.shinyapps.io/UrbanBeautyLondon/.
5 Future Works and Application Prospects

In this paper, preliminary but promising results of a novel Urban Beauty Score have been reported. The accuracy of the score, particularly concerning the recognition of non listed buildings which nevertheless maintain the historical character of the city, will be increased by adopting more imageries and using computer vision techniques. Applying such a score to urban planning procedures can significantly innovate the practice: planning applications are already provided in a digital form and the Urban Beauty Score can be implemented into an automatized procedure to evaluate what impact a new plan may have on the area. This will serve as a support for decision makers; eventually, suggestions to render a plan more beautiful and integrated in the surroundings can be provided through AI techniques, i.e. GANs (zhu, 2017; Joglekar et al., 2020) trained on images of LSOAs with an high score value can be used to generate improved renderings of existing or new planned areas.

6 Biography

Alessia Calafiore is Research Associate at the Geographic Data Science Lab, University of Liverpool. She has a markedly interdisciplinary background, spanning social sciences and statistics, and obtained a PhD in Computer Science defending a thesis in Geo-Informatics. Her research interests lie at the intersection of geography, social science, data science and urban planning.

References


