Eliciting users' preferences and values in urban parks: Evidence from analyzing social media data from Hong Kong

Abstract

Users' preferences and values in urban parks is important information for establishing social marketing strategies and therefore policymakers to consider. This study investigates the issue by analyzing social media data. User-generated data were collected from Instagram and content analysis was employed to identify physical features and values people assigned to urban parks from text descriptions of Instagram posts. Findings revealed that natural features are more frequently mentioned than non-natural elements. Aesthetic quality, happy feeling, and restorative experience are the most frequently mentioned value expressions among the six categories of identified values. Significant association rules are established between physical features and values. Natural elements such as lawns, water features, wildlife and plants are more likely to be associated with happiness and restorative experience than aesthetic value. Artificial elements, flowers, and public art stimulate aesthetic quality. Implications for planning urban green environments are discussed. Social media platforms offer a novel entry point to uncover and monitor public interests and perceptions of specific venues such as recreational settings. Social media data provide actionable insights for promotional campaigns and inform decision-making pertaining to individuals and collective well-being.

Keywords: Urban Park; Preferences; Values; Social Media; Social Marketing

1. Introduction

With rapid urbanization and stressful urban lifestyles, urban parks play a prominent role in delivering a broad range of physical, psychological and social benefits to city dwellers (Chiesura, 2004). Urban parks provide people with essential venues to undertake physical exercises, contributing to users' physical health (Kaczynski & Henderson, 2008) and offering a wide range of health outcomes (Twohig-Bennett & Jones, 2018). Thus, provision of green spaces narrows socioeconomic differentials in physical inactivity and reduces health inequalities (Lee & Maheswaran, 2011). Green interventions minimize the impact of increased temperatures resulting from climate change on human health (Bowler, Buyung-Ali, Knight, & Pullin, 2010). Contact with natural environments promotes restorative experience (Ulrich et al., 1991), evokes positive emotions (Pasanen, Neuvonen, & Korpela, 2017) and alleviates stress (Hartig, Evans, Jamner, Davis, & Gärling, 2003). Vegetated common spaces also facilitate social interactions among people (Coley, Kuo, & Sullivan, 1997). Overall, urban parks are recognized for distinctive positive effects on individual health and collective well-being.

Yet, the benefits will only be realized by making visits to urban parks. Research suggested that physical features promote park visitation (Dallimer et al., 2014; McCormack, Rock, Toohey, & Hignell, 2010). For example, people prefer features such as trees and water bodies in park settings (Bjerke, Østdahl, Thrane, & Strumse, 2006). Facilities like walking trails and playgrounds are influential for park use (McCormack et al., 2010). Green spaces which are not able to accommodate the preferences of users may result in a decrease of utilization (Wright Wendel, Zarger, & Mihelcic, 2012). Besides preferences for physical features, users' perceptions and assigned values of green spaces should be emphasized in guiding urban planning. Landscape preferences are associated with people's valuation (Kaltenborn & Bjerke, 2002). Values here can be understood as attributes and functions related to green spaces that people consider to be important (Ives et al., 2017; Ordóñez, Beckley, Duinker, & John Sinclair, 2017). People assign a range of values to green spaces (Tyrväinen, Mäkinen, & Schipperijn, 2007; Özgüner & Kendleb, 2006; Kyttä, Broberg, Tzoulas, & Snabb, 2013), and values play an important role in decision-making processes behind green spaces management (Tyrväinen et al., 2007). Previous studies showed that, for example, natural scenes and the presence of water features contribute to restoration from stress (Ulrich et al., 1991; Berto, 2005). Some people value scenes of flowers for the stimulated aesthetic experience (Hoyle, Hitchmough, & Jorgensen, 2017). However, others may find that naturalistic landscape threatening (Özgüner & Kendleb, 2006) and that may affect the tendency of use. Thus, understanding users' preferences for green space features and associated values is justified by the need to inform green spaces planning which aims to maximize park utilization.

Government agencies and researchers have long been relying on traditional data collection techniques such as self-reported surveys, focus group interviews, and controlled experiments to elicit preferences and perceptions. However, traditional data collection techniques are subject to various limitations. The traditional techniques are time-consuming and cost inefficient. Close-ended questions could limit respondent's choices. Similarly, pictures for preference rating in questionnaire surveys are usually pre-selected by researchers who may not share the same preferences with laypersons, resulting in under-representation of respondent's opinions (Daniel & Meitner, 2001; Hanley, Mourato, & Wright, 2001). Moreover, inaccurate answers may stem from self-report measures due to response bias such as social desirability bias (i.e., the tendency that respondents give answers that will be considered favorably by others) (Peterson & Kerin, 1981). From a policy decision perspective, traditional data is not generated through public participation processes; thereby, policymakers may fail to gain a broad spectrum of public insights from traditional data.

The advent of interactive computer-mediated technology over the past decades has facilitated research data collection. For example, contemporary virtual reality and augmented reality modeling systems (e.g., Patterson et al., 2017; Portman et al., 2015) have increasing applications for engaging with stakeholders and testing preferences. Another new research data source is social media data. There is an increasing trend of sharing daily experiences and personal feelings on social media platforms such as Facebook and Twitter. Social media data refers to user-generated content shared on these platforms. It can be termed as crowdsourced data because the information is made available by non-professionals organizations and citizens but not professional experts and scientists (Ghermandi & Sinclair, 2019). The data is wide ranging in form, including but not limited to images, videos, and textual materials. Compared to traditional data collection methods, there are less spatial and temporal restrictions when accessing social media data. Provided that some social media data is free of charge and instant in nature (Teles da Mota & Pickering, 2020), researchers may collect a large quantity of data at substantially lower cost. Crowdsourced data is considered to advance the field of landscape perception and preference research (Bubalo, van Zanten, & Verburg, 2020).

2. Literature review

2.1. Passive crowdsourcing and social media data

Policymakers have been increasingly considering citizens' opinions in addition to knowledge of experts and scientific evidence when formulating public policies (Linders, 2012). Crowdsourcing is gradually recognized by government agencies for collecting information from a large number of individuals. It is defined as a "new web-based business model that harnesses the creative solutions of a distributed network of individuals" (Brabham, 2008). The collection of citizen-driven social media content constitutes a passive crowdsourcing as it is without direct stimulation and direction by government agencies (Charalabidis, Loukis, Androutsopoulou, Karkaletsis, & Triantafillou, 2014). It enables government agencies to listen to and analyze citizens' opinions and attitudes toward policies (Charalabidis et al., 2014; Linders, 2012). It largely reduces the risk of excluding voices from important stakeholders while widening public participation for opinions collection and gaining insights into citizens' attitudes toward social issues (Charalabidis et al., 2014). Passive crowdsourcing could also improve situational awareness and responsiveness of government departments (Linders, 2012) such as sorting out imperative but overlooked social problems in a timely manner (Mehmet Mehmet & Simmons, 2019).

2.2. Social media data and green spaces planning

Social media data is a form of passive crowdsourcing that has been increasingly used to inform visitor preferences and perceptions in urban parks. On one hand, people freely express feelings and evaluations of using urban parks on social media platforms. Abstract ideas are now available online and opinion extraction becomes easier compared to the use of traditional approaches. Conversations among citizens represent a voice of the public. Analyzing user-generated social media data represents a widespread inclusion of the public voices in decision-making processes (Ferro, Loukis, Charalabidis, & Osella, 2013). On the other hand, investigating social media data can avert suffering from hypothetical bias because user-generated content is a trace of users' actual behavior (Buntain, McGrath, Golbeck, & LaFree, 2016) but not stated preferences of respondents. The content is created without initiation, stimulation or moderation (Charalabidis et al., 2014). The citizen-driven information implies that findings are more accurate in representing users' opinions compared to those obtained from traditional data. Marketers can also benefit from detecting new thoughts and trends embedded in social media data (Patino, Pitta, & Quinones, 2012; Stieglitz, Mirbabaie, Ross, & Neuberger, 2018). The large quantity and real-time information circulated on social media platforms offers analysts opportunities to gain insights into emerging trends of products, services, or social issues in a timely manner. By analyzing the data, marketers can design user-centric definitions of products or services which aim to improve satisfaction among users.

2.3. Social media data and green spaces research

Social media data has been increasingly recognized in urban planning studies (for a review, see Wilkins, Wood, & Smith, 2021). For example, geo-tagged data extracted from social media platforms serves as a proxy from actual park visitation and assists in exploring users preferences for urban parks (Donahue et al., 2018; Hamstead et al., 2018). Some studies used photograph data harvested from crowdsourced platforms such as Flickr and Wikiloc to analyze different types of park users, frequency of park use, and preferences for landscape characteristics (Song, Richards, & Tan, 2020; Callau, Albert, Rota, & Giné, 2019). Twitter data were used to examine activities taking place in urban green spaces (Roberts, 2017) and visitors' emotions (Roberts, Sadler, & Chapman, 2018). Instagram data was collected for exploring individuals' perceptions and values of their surrounding environments (Chen, Parkins, & Sherren, 2018; Guerrero, Møller, Olafsson, & Snizek, 2016). Previous studies also examined the relationship between landscape characteristics and preferences (Tieskens, van Zanten, Schulp, & Verburg, 2018) or between features and cultural ecosystem services (Oteros-Rozas, Martín-Lópe, Fagerholm, Bieling, & Plieninger, 2017) by using data collected from Flickr and Panoramio. From these studies we learn that user-generated content is relevant to the understanding of human behavior in urban green spaces and facilitates the work of features and values elicitation.

2.4. Research objectives and questions

This study will use social media data to understand users' preferences and values in urban parks. The study aims to inform urban green spaces design and management implications that can nudge behavior toward frequent use of urban park, that in turn realize individual health and societal well-being. Specifically, this study adopts a passive crowdsourcing approach to answer the following research questions:

(1) Which physical features emerge as the core dimensions contributing to park visitation?
(2) What kind of values are stimulated by the physical features?
(3) Are there any associations between identified features and values?

3. Methods

3.1. Study area

The study was conducted in Hong Kong, a city situated in the eastern side of the Pearl River estuary in southern China. The city covers 1,106 km^2 (110,600 hectares) of land area and has a population of around 7.4 million (Census and Statistics Department, 2019). There are over 1,500 publicly managed parks, gardens and sitting-out areas dispersed in 18 districts of 3 main territories in the city, with a total area of around 957 hectares (Leisure and Cultural Services Department, 2019). Most public urban green spaces are in a combination of ornamental and naturalistic landscape, along with a range of recreational facilities, such as jogging tracks, sports venues, and children's play areas. According to the suggested planning standard of Hong Kong (Planning Department, 2005), regional open space should be at least 5 hectares large. Area of district open space is between 1 to 4 hectares. Local open space refers to an area with at least 500 m^2 but less than 1 hectare.

3.2. Data source

User-generated data from Instagram was chosen as the data source in this study. Instagram is a platform for real-time photos or videos sharing along with descriptive content (i.e., text and hashtags). It compares favorably to Twitter and Facebook for data retrieval. Instagram has 45% active social media users whereas Twitter only shares 19% of the market in Hong Kong (Statista, 2018). The popularity of Instagram enables researchers to retrieve sufficient data for analysis. Unlike Facebook which public posts are no longer available for scrapping because of the depreciation of all public post search functionality since 2014, Instagram permits the search and download of public content at the time of conducting this research.

We used *Netlytic* (Gruzd, 2016), a cloud-based text and social network analyzer, to retrieve Instagram posts. This function no longer exists since Instagram shut down their API in late 2018. The searching process was facilitated by the hashtag query function provided by *Netlytic*. The search strategy is entering Chinese name of eligible urban parks (e.g., #沙田公園 "Sha Tin Park") into hashtag query field for searching. Before the main search, a preliminary inquiry was conducted to test the feasibility of the search strategy. Results revealed that there are limited Instagram posts mentioning urban parks with area less than 1 hectare. Thereby, we decided to search 1 hectare or above urban parks only in the main search. It turned out that 193 urban parks meet the criterion – park size with 1 hectare or above, which account for 74% (711 hectares) of the total area of public urban green spaces. Appendix A lists Chinese name of all the urban parks used for searching.

153 out of 193 eligible parks had been mentioned by Instagram users. A total number of 19,658 posts covered a 4-year time from 1 May 2014 to 30 April 2018 were retrieved in May 2018. Each retrieved post contains an URL of the post, published date, username, descriptive content, media link, and coordinates. The descriptive content is the only source where physical features and values would be identified in this study. It is a form of text content which contains post captions and hashtags. The search results were exported to Microsoft Excel spreadsheet for data processing.

We have obtained written consent from *Netlytic* for the academic use of collected data. The research team strictly observes ethical guidelines established by authors' institutions when conducting this study. We have also reviewed and followed the Ethical Decision-Making and Internet Research Recommendations suggested by *Netlytic*. To further protect individual privacy, no discernible identifiers such as username, coordinates, images, and direct quotes are revealed in this study. All data is saved in a folder which is fully encrypted. Only research team members are granted for access rights. Data will be deleted once the project is completed.

3.3. Filtering, coding, and categorizing data

Data filtering consists of three stages. It focused on descriptive content, supplemented with image content for clarification when necessary. First, 8,090 duplicate posts (i.e., posts uploaded by the same user using identical sets of descriptive content) were removed to avoid double counting of features and values. Second, advertisements and irrelevant posts (i.e., semantic contents do not match with image contents) were deleted. Third, posts written in language other than Chinese and English were excluded given that these two languages are the official languages of Hong Kong. A total number of 4,308 posts were removed in stages 2 and 3. The number of posts eligible for analysis is 7,260. There were 5,128 Instagram users in the dataset, averaging 1.4 posts per user.

Data coding was undertaken in the Excel spreadsheet. Physical features and values were extracted from the descriptive content. Wordings that are irrelevant to features and values of urban parks were not considered as data (e.g., picnic, Sunday, food, sister, brother, running, eating). Both text and a full understanding of contexts were taken into consideration for data coding (Chen et al., 2018). Different from sentences and text, descriptive content of most Instagram posts consists of an array of single words, phrases, or hashtags only, making the extraction process straightforward (see Examples 1 to 3 presented below). Features and values in Chinese language were translated into corresponding English terms. Most physical features of urban parks such as trees and pavilions are universal expressions that did not cause many disputes during the translation process. Similarly, most expressed values were adjectives which have widely recognized corresponding English translation (e.g., #漂亮 "pretty"; #舒服 "comfortable") that did not cause translation difficulty. To increase the accuracy of translation work, we have consulted authoritative dictionaries (Merriam-Webster's Collegiate Dictionary Eleventh Edition and Oxford Advanced Learner's Dictionary) for rare term translation. Table 1 presents examples of coding of descriptive content.

Example 1: *"#grass #relax Sunday #tamarpark"*

Example 2: *"#hkzoologicalandbotanicalgarden #meerkat #pretty #exciting"*

Example 3: *"#quarrybaypark #trees #swings #happy #natural"*

Table 1. Examples of coding

Descriptive content	Feature 1	Feature 2	Value 1	Value 2
Example 1	grass		relax	
Example 2	meerkat		pretty	exciting
Example 3	trees	swings	happy	natural

Extracted features and values were grouped into categories according to meaning or synonyms using a representative word. For example, "facilities" was chosen as a representative word for chair, bench, and the like. Similarly, "happiness" was selected to represent words such as happy, smile/laugh, happiness, and pleasant. Table 2 demonstrates the categorization using examples presented above. Categorization of features has been referenced to literature of people-landscape interaction (e.g., Özgüner & Kendleb, 2006; van Zanten et al., 2016; Zhang, Chen, Sun, & Bao, 2013). Values categorization was worked out with reference to Bengston and Xu (1995), Chen et al. (2018), Ordóñez et al. (2017), Peckham, Duinker, and Ordóñez (2013), and Schroeder (2002). A detailed categorization of physical features and values is presented in Table 3 and 4, respectively.

Table 2. Examples of features and values categorization

Descriptive content	Feature 1	Feature 2	Value 1	Value 2
Example 1	lawns		restoration	
Example 2	wildlife		aesthetics	excitement
Example 3	trees	playgrounds	happiness	aesthetics

The guidelines and procedures of data processing (i.e., filtering, coding, categorizing) were discussed between authors beforehand. Data processing was first conducted by one of the authors, and the results were double-checked by another author. We have resolved disagreements arising during the checking process through discussions.

3.4. Data analysis

Frequency of coded features and values were counted. Previous studies hypothesized a positive association between photo density and preference for landscape attributes or aesthetic appreciation (Tieskens et al., 2018; van Zanten et al., 2016). Similarly, we took the assumption that the frequency of words being mentioned serves as a proxy to preference rating and implies degree of importance of features and values. The higher the frequency, the more the features and values are concerned. We aim to investigate if there were associations between identified physical features and specific values. Market Basket Analysis was used to examine the strength of physical features and values that co-occur together using *arules* package in R version 3.4.2.

Market Basket Analysis was first developed to provide a series of association rules indicating which items are frequently purchased together in a transaction database (Agrawal, Imieliński, & Swami, 1993). It has been extended and applied to text mining practices to find out associations between variables (Netzer, Feldman, Goldenberg, & Fresko, 2012), that is, correlations between physical features and values in this study. The relationship is usually in the form of a rule "***A* → *B***," where ***A*** is the antecedent (i.e., physical features) and ***B*** is the consequent (i.e., values). The presence of antecedent will imply the occurrence of consequent. The analysis is particularly useful to derive relationship patterns amongst variables in the form of rules and is free from the strict and untenable assumptions such as the linearity required by regression modelling (Aguinis, Forcum, & Joo, 2013).

The strength of an association rule can be evaluated by three indexes: support, confidence, and lift. Support is the number of posts containing antecedent or consequent or both antecedent and consequent divided by the number of posts. Confidence refers to the ratio of the number of posts containing both antecedent and consequent to the number of posts records with antecedent only. Lift is the support for both the antecedent and consequent divided by the product of the antecedent and consequent occurring as if they are independent of each other. It provides information on whether an association exists. Lift value greater than 1 implies that there is a positive relationship between the antecedent and the consequent and the association rule is not due to chance. In the present study, threshold values for support and confidence were set as 2% and 25% to screen out rules that have low levels of support and confidence. Lift value was set as greater than one to measure the interestingness of extracted rules, that is, how much the antecedent and consequent of a rule are related.

4. Results

4.1. General description of data

Of the 7,260 posts, 3,548 (49%) entries contained physical features. The remaining 3,712 posts (51%) had no identifiable features in the posts, implying that users did not mention physical features in the descriptive content. Percentage of posts that contain physical features is similar to results of studies which social media data have been used for investigation. For example, around 50% retrieved Panoramio photos were themed with landscape features in a study by Tieskens et al. (2018). In a comparative study which data was collected from free lists with participants, blogs, and Flickr, Flickr tags contained nearly half of the toponyms of all three data sources (Wartmann, Acheson, & Purves, 2018).

The number of posts showing at least one value expression was 1,614, counting for about 22% of the total sample size. Percentage of posts assigned with values can be different across media platforms and study location. For example, 31.6% of collected tweets were assigned to either a positive or negative expression in a recent study by Roberts et al. (2018). Chen et al. (2018) found that the percentage of landscape values (i.e., aesthetics, sense of home, community attachment, cultural identity, lifestyle, and memory) identified from Instagram photo captions varies across study areas, ranging from 15% to 25% of the collected posts.

4.2. Physical features mentioned by park visitors

There were 4,449 codable physical features extracted from 3,548 posts. 16 distinct features were identified from the descriptive content. Table 3 shows the categories, examples of each categorized features, frequency, and percentage. There was a clear pattern in the preferences of park visitors based on natural elements (71.7%) and non-natural components (27.3%). Regarding the natural elements, visitors tended to mention flowers, open views, wildlife, and trees. Some non-natural features were able to draw visitors' attention. For example, public art, facilities, and culture, heritage and history were more popular than other non-natural features like architecture, artificial elements, and playgrounds.

Table 3. Frequently mentioned physical features

Physical features	Sample words	*N**	%
Natural features		***3,188***	***71.7***
Flowers	flowers, flowerbloom, flowermaze	953	21.4
Trees	trees, oldtrees, redleaves, maple	381	8.6
Plants	plants, greenery, cactus, bonsai, green	160	3.6
Lawns	grass, lawn, grassland	205	4.6
Water features	fountain, waterfall, pond	218	4.9
Wildlife	birds, monkey, meerkat, flamingo	575	12.9
Fresh air	freshair	28	.6
Rockeries & stones	rocks, rockery	38	.9
Open views	sunset, bluesky, seaview	630	14.2
Non-natural features		***1,218***	***27.3***
Culture, heritage & history	lantern, oldbuilding, history	210	4.7
Public art	artstaircase, lightrosegarden, statue	329	7.4
Architecture	architecture, Jiangnan garden style, Chinese garden	176	4.0
Artificial elements	spiral lookout tower, christmaslights	134	3.0
Facilities	bench, pavilion, jogging track, green house	257	5.8
Playgrounds	playgrounds, swing, slide	112	2.5
Others	sound, design, gardening	***43***	***1.0***

Note. *Each post may contain more than one physical feature.

4.3. Values assigned by park visitors

There were 2,343 codable value expressions contributed by 1,614 posts. 112 unique value expressions were identified (Table 4). The expressions were represented by aesthetic and affective value (44.0% and 56.0% respectively). Moreover, affective value can be further divided into five sub-categories, namely, happiness (21.7%), restoration (21%), excitement (6.2%), affection (4.4%), and memory (2.7%).

The word beautiful lied in the heart of aesthetic responses to physical features. Visitors also described aesthetic quality by using a diverse array of synonyms such as cute, pretty, lovely, and picturesque. The aesthetic quality could be represented in terms of naturalness; thus, colorful, natural, verdant, and fresh character of physical features were marked. The quality was also reflected by the frequent use of words such as nice, good, great, best, and cool. In some cases, the aesthetic experience went beyond visual beauty to involve a sense of awe-inspiring, romantic, magic, and enchanting. The rest of the aesthetic responses showed a great variety, but the number of each expression was remarkably insignificant.

Visitors expressed happy feelings and other closely related emotions such as enjoyment, smile, happiness, and pleasantness during their use of urban parks. For some extreme cases, visitors marked themselves as thrilled and elated. From the results engaging in urban parks was a restorative experience. The environment was perceived as relaxed, comfortable, and tranquil where visitors indicated a good mood and healthy status. Some park users indicated excitement for their visitation. Visitors expressed a feeling of fondness towards urban parks by using the word like and love. A small number of visitors have connected their memories to urban parks.

Table 4. List of unique value expressions

Aesthetics	*N*	%
beautiful	500	21.4
nice	80	3.4
cute	52	2.2
awesome	49	2.1
good/great/best	33	1.4
pretty	29	1.2
lovely	26	1.1
colorful	26	1.1
natural	25	1.1
romantic	21	0.9
magic/magical	15	0.6
picturesque	14	0.6
verdant	14	0.6
enchanting	13	0.6
cool	13	0.6
fresh	12	0.5
splendid	11	0.5
warm	9	0.4
fairy-like	7	0.3
stunning	7	0.3
attractive	6	0.3
scent	5	0.2
poetry	5	0.2
vintage	5	0.2
perfect	4	0.2
superb	4	0.2
special	4	0.2
scenic	3	0.1
spectacular	3	0.1
gorgeous	3	0.1
incredible	3	0.1
secluded	3	0.1
charming	2	0.1
sharp	2	0.1
harmony	2	0.1
lush	2	0.1
dreamy	2	0.1
antique	2	0.1
unique	2	0.1
breathtaking	1	0.0
elegant	1	0.0
unadorned beauty	1	0.0
fine	1	0.0
small	1	0.0
big	1	0.0
exotic	1	0.0
spacious	1	0.0
lively	1	0.0
clean	1	0.0
subtlety	1	0.0
brilliant	1	0.0
classical	1	0.0
clear	1	0.0
impressed	1	0.0
Total	***1033***	***44.2***

Happiness	*N*	%
happy	299	12.8
enjoy	85	3.6
smile/laugh	27	1.2
happiness	21	0.9
pleasant	16	0.7
joy/joyful	11	0.5
thrilled	11	0.5
sweet	9	0.4
contented	9	0.4
cheerful	4	0.2
thankful	4	0.2
blessed	4	0.2
elated	3	0.1
grateful	2	0.1
blissful	1	0.0
Total	***506***	***21.6***

Restoration	*N*	%
relaxing	174	7.4
comfortable	52	2.2
good mood	45	1.9
tranquillity	37	1.6
peace/peaceful	34	1.5
leisurely	29	1.2
healthy	16	0.7
chill/chilling	15	0.6
refreshing	12	0.5
free	10	0.4
therapeutic	10	0.4
calm	8	0.3
serene	8	0.3
quiet	8	0.3
rest/restful	7	0.3
silent	7	0.3
forget worries	6	0.3
escape	3	0.1
relieved	3	0.1
feel better	2	0.1
recharge	1	0.0
self-satisfaction	1	0.0
detoxing	1	0.0
better life	1	0.0
well-being of mind	1	0.0
Total	***491***	***21.0***

Excitement	*N*	%
fun/funny	63	2.7
amazing	41	1.8
wonderful	24	1.0
exciting	4	0.2
surprising	4	0.2
astonishing	3	0.1
interesting	1	0.0
screaming	1	0.0
never get bored	1	0.0
Total	***142***	***6.1***

Affections	*N*	%
love	81	3.5
like	22	0.9
Total	***103***	***4.4***

Memory	*N*	%
reminiscent	42	1.8
nostalgic	11	0.5
memorable	7	0.3
unforgettable	3	0.1
Total	***63***	***2.7***

Note. Each post may contain more than one value. Negative values: boring (3), sadness (1), and soulful (1) were excluded from the table.

4.4. Values associated with physical features

We examined if there were associations between physical features and values (H_0: physical features are not associated with values). Only posts which contain at least one physical feature and one value were examined 1,133 posts met the criteria. The Pearson's Chi-squared test indicated that null hypothesis is rejected ($\chi^2 = 130.4$, $df = 15$, $p < .001$). There is strong evidence of an association between physical features and values. Figure 1 shows that flowers, public art, and artificial elements tend to induce aesthetic experiences; trees, plants, lawns, water features, fresh air, facilities, and playgrounds are likely to induce affective feelings.

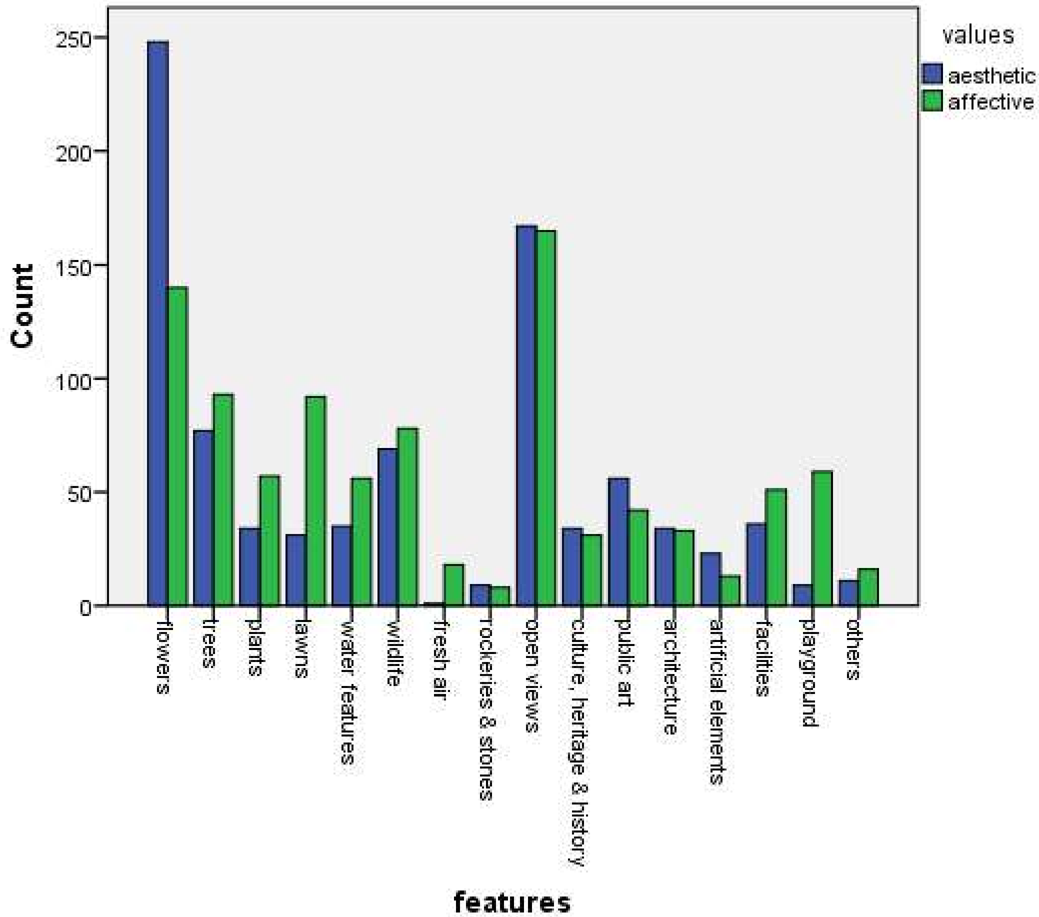

Figure 1. Clustered bar chart of physical features by values

To further explore which physical feature is associated with specific kinds of values, market basket analysis was conducted. Table 5 illustrates 12 interesting association patterns in which the lift ratio is greater than 1 and threshold values for support and confidence are greater than 2% and 25%, respectively. Park visitors tended to associate playgrounds, lawns, and wildlife with the feeling of happiness. Restorative experience was primarily induced by natural physical features including lawns, plants, trees, water features, and open views. Facilities were the only non-natural features that contributed to restoration. Artificial elements, flowers, and public art were found stimulating aesthetic experience.

Table 5. List of association rules

Rule ID	Antecedent	Consequent	*Support*	*Confidence*	*Lift*
[1]	Playgrounds	Happiness	.03	.55	2.79
[2]	Lawns	Restoration	.05	.60	2.44
[3]	Water features	Restoration	.03	.45	1.83
[4]	Plants	Restoration	.02	.39	1.59
[5]	Lawns	Happiness	.02	.28	1.43
[6]	Wildlife	Happiness	.03	.26	1.32
[7]	Facilities	Restoration	.02	.31	1.27
[8]	Artificial elements	Aesthetics	.02	.79	1.27
[9]	Flowers	Aesthetics	.23	.76	1.22
[10]	Public art	Aesthetics	.05	.74	1.18
[11]	Open views	Restoration	.07	.29	1.18
[12]	Trees	restoration	.03	.27	1.12

5. Discussion

5.1. Preferences for physical features of urban parks

People prefer scenes with flowers (Özgüner & Kendleb, 2006) and trees (Lohr & Pearson-Mims, 2006); it explains why flowers and trees received a high frequency of mention in this study. By contrast, both lawns and plants were less popular. Considered that our attention is always given to ornamental-impressed objects (Grahn, 1991), one would expect that flowers and flowering trees could gain greater popularity compared to lawns and plants.

Outdoor scenes with visual openness are related to landscape preferences (Daniel, 2001; Grahn & Stigsdotter, 2010). Since Hong Kong is packed with high-rise buildings, the crowded living environment prompts citizens to seek out an open area where they can take pleasure in natural scenes without obstruction while enjoying space and freedom (cf. Tyrväinen et al., 2007).

Hong Kong people enjoy watching wildlife in urban parks. Observing wildlife like birds is a commonly found motive of engaging in urban natural areas (Bjerke & Østdahl, 2004; Dick & Hendee, 1986), for the reasons that the activity not only induces satisfaction with the environment and improves quality of life (Bjerke et al., 2006; Maller et al., 2009) but also reduces mental fatigue because responses to animals do not require focused attention (Kaplan, 1995).

Water features had relatively low frequency of mention, a result which is inconsistent with previous studies (e.g., Brown & Brabyn, 2012; Pietrzyk-Kaszyńska, Czepkiewicz, & Kronenberg, 2017). Setting of investigation may count for the discrepancy between the results. Study participants in previous studies can take a range of activities with waterscape (e.g., swimming, fishing and diving). However, water features in publicly managed parks in Hong Kong usually refer to fountains, waterfalls, and ponds, where most aforementioned activities are prohibited. Since cognitive processes of making sense and involvement with the object in question contribute to preferences (Herzog, 1985), the prohibition of water-based activities may have adverse effects on preferences.

The finding of fresh air contradicts with the result reported by Özgüner (2011) that good air quality is the reason people like most about urban parks. Getting fresh air is a driver of park visitation (Irvine, Warber, Devine-Wright, & Gaston, 2013). The low frequency of mention for fresh air here may be linked to the nature of sharing information on Instagram. The photo sharing platform is especially advantageous to eye-attractive physical features; intangible quality like fresh air may easily be neglected. Regarding rockeries and stones, both the finding from current study and past research indicated that it is not a valued attribute compared to other features in urban parks (Zhang et al., 2013).

Some findings are exceptions to the argument that human modifications in natural environments are generally intrusive and more likely to have a negative effect on perceptions (Kaplan, 1985; Strumse, 1994). For example, public art has successfully drawn visitors' attention; the attractiveness and value of a place was increased by setting up public art displays (Motoyama & Hanyu, 2014). Similarly, facilities for encouraging park visitation were evidenced. Provision of facilities supports both active and passive activities and keeps people a longer time in urban green spaces (Van Herzele & Wiedemann, 2003). In contrast, negative perceptions of facilities reduce intention of using parks; poorly managed (Lloyd, Burden, & Kiewa, 2008) and physically unappealing (Veitch, Bagley, Ball, & Salmon, 2006) play equipment could adversely affect park use.

Cultural and historical elements such as monuments did not enjoy wide popularity, a finding which gives further support to studies by Brown and Brabyn (2012) and Ives et al. (2017). Visitors also put less emphasis on architecture and artificial elements. Only non-natural features that are instantly beneficial would be given preferences. Such kind of pragmatic-utilitarian perception of urban green spaces (Jim & Chen, 2006) may result in difficulty in perceiving functions of the landscape like cultural heritage functions (cf. Chen, Adimo, & Bao, 2009).

5.2. Values assigned to urban parks

A significant number of expressions carry positive feelings, which has been suggested as a widespread response to the natural environment (Chiesura, 2004; Kyttä et al., 2013). Aesthetics as a frequent response to landscape environments (Brown & Brabyn, 2012; Daniel, 2001) is echoed by a large array of aesthetic expressions elicited in the present study. The frequent use of aesthetic words such as beautiful confirmed that visual-driven aesthetic perception is still given a great attention in landscape evaluation (Parsons & Daniel, 2002). Our results conform to previous studies (Chiesura, 2004; MacKerron & Mourato, 2013; Roberts et al., 2018) that a high level of happiness as a result of experience of nature. People would be happier along with more parks and green spaces in their living environments (Ambrey & Fleming, 2013; Kim & Jin, 2018). Being restorative has emerged as another common experience of using public green spaces (Irvine et al., 2013). Visitors have considered the urban green environment as a stress-reducing setting where they found it comfortable, tranquil and peaceful. The desire for stressful city dwellers to be immersed in a relaxing natural environment is strong (Chiesura, 2004).

Some visitors found urban parks full of fun that by engaging in the setting would lead to great surprise and wonder. The finding may explain why excitement has been found as an aspect contributing to favorable ratings of the scene in urban parks in Hong Kong (Wong & Domroes, 2005). A group of visitors indicated fondness for urban parks. Since affection is one of the three elements of place attachment (Jorgensen & Stedman, 2001), it is likely that the established affection contributes to the development of attachment towards the place. The setting could also revive visitors' childhood memory and the days they spent time with family and friends there. Childhood memories of experiencing landscape contribute to forming preferences (Ward Thompson, 2004). Although the number of visitors expressed excitement, affection, and memory is comparatively lower than those of other values, the results offer insight into how people perceive the environment around them in relation to values which have been overlooked in the current literature.

5.3. Associations between physical features and values

Flowers are more likely to engender aesthetic value. Hoyle et al. (2017) explained that it is the attractive and stimulating character of flowers that enhance aesthetic experience. Aesthetic appreciation was also elicited as a response to public art and artificial elements. Artificial elements (e.g., decorative lighting, artful-designed building) and art items (e.g., sculptures, artwork displays) are visually attractive that can foster aesthetic experience and in turn contributes to perceived quality of and attitudes toward urban parks (Wan & Shen, 2015). The results echo the viewpoint that human creations also have the potential for contributing to individuals' aesthetic appreciation of the environments (Gobster & Westphal, 2004).

Studies inferred that green environments lead to increasing happiness by facilitating physical, recreational activities and social interactions (Barton & Pretty, 2010; Morris, 2003). The established association rules between playgrounds, lawns, and wildlife and the feeling of happiness may provide some hints for the phenomenon. Playgrounds are not only recreational areas where children can engage in active playing, they also create opportunities for guardians to socialize and get familiar with each other (Huang, 2006). Lawns possess a similar function by providing individuals with spaces for holding a range of recreational activities like social gathering and picnic (Ignatieva, Eriksson, Eriksson, Berg, & Hedblom, 2017). Observing wildlife is an enjoyable activity (Dick & Hendee, 1986) which can bring park visitors a sense of familiarity and induce happy feelings (Folmer, Haartsen, & Huigen, 2018).

Vegetation are influential components when people search for restorative environments (Nordh, Hartig, Hagerhall, & Fry, 2009). Hong Kong park visitors associated restorative experience to natural features such as trees, plants, and lawns, a result which resonates with a study conducted in pocket parks by Nordh and Østby (2013). Moreover, visitors assigned water features for restorative effects because the feature could evoke a sense of tranquility and facilitate stress reduction (Berto, 2005; Schroeder, 1991). The openness of space provides a sense of refuge to people (Appleton, 1975), which explains why visually open spaces were linked to visitors' restorative experiences in the present study. Recreational facilities accommodate the need of being physically active has been suggested to facilitate recovery from stress (Hansmann, Hug, & Seeland, 2007).

No strong link was found between physical features and excitement, affection and memory Both affection and memory were found to be typical effects of park visitation (Irvine et al., 2013), conveying deep attachment of a place (Neal, Bennett, Jones, Cochrane, & Mohan, 2015), and contributing to a sense of community (Arnberger & Eder, 2012). However, park visitors may project such kind of intimacy upon the urban parks as a whole but not a specific physical substance. In a similar vein, excitement expressed for new experiences encountered in urban parks is less likely to have physical substances to take form.

5.4. Policy recommendations and implications

The findings offer insights into the development of social marketing and management strategies for urban green spaces. An important finding of this study is significant associations between features and values. Physical features like playgrounds, lawns, wildlife, trees, flowers and facilities can induce positive psychological effects such as happiness and restorative experience as well as aesthetic value. Park managers in this regard should have a sound maintenance of physical structures of urban parks while promoting associated values of using urban parks in order to maximize benefits of participating in urban green environments.

Preference for vegetation and the associated positive values call attention to better planning work such as increasing the coverage of vegetation in urban parks. Early planning is suggested for the ornamental features because they take time to grow (Nordh, Alalouch, & Hartig, 2011). Preference for an open area and the associated restorative value signify that having an unblocked view would be a primary consideration of park design and location selection in the future. The positive emotional services offered by wildlife justifies the need of more biodiversity conservation. Our findings demonstrated that water bodies such as fountains designed only for ornamental enjoyment may have gone out of fashion. Managers of green spaces should introduce interactively designed water amenities that would engage more park visitors while contributing to restorative experience. Besides, rules on using water amenities need to be constantly updated for removing institutional barriers of enjoying water features.

Regarding non-natural physical features, an appropriate amount of art events and artistic design immersed into different parts of urban parks such as stairways is a possible solution in response to the preference for public art and its potential of leading to aesthetic experience. Diversified facilities and innovative playgrounds are expected to boost utilization of urban parks and provide happy and restorative experience for both children and their guardians. Future park management also involves the challenge of increasing users' awareness of perceived values in urban parks. There is a need for education and publicity work to inform the public of the benefits and values of urban parks.

5.5. Limitations and future research

There remain limitations of using social media data. Linguistics ambiguity is a major barrier for analyzing social media data. Misspelling, mixed languages and vernacular used by social media users increase the level of difficulty for extracting meaningful insights. It is also difficult to collect socio-demographic information of social media users. Researchers are unlikely to validate the representativeness of any target population and impact of socio-demographic background on behaviors (Wilkins et al., 2021). Besides, people are more likely to share joyful moments or post things that will get likes and be acceptable (Pilař, Balcarová, & Rojík, 2016; Toubiana & Zietsma, 2017). The positivity bias of Instagram posts may result in incomplete representation of human-environment relationship and users' perceptions towards the environments.

Using hashtags for social media data extraction also sets challenges for researchers. Social media data may not be labelled with relevant hashtags, resulting in additional time for data collection. Data analysis confined to a single platform may exclude useful information (Tufekci, 2014). Analyzing text content only as in this study also implies that we might miss information provided by other sources such as photos. In spite of the limitation, we continue to see the merit of single platform analysis under certain scenarios. Taking the current study as an example, inaccessible content of Facebook and low usage of Twitter among Hong Kong leaves only Instagram available for data collection.

Another limitation is that future studies could not replicate this research study by collecting data from Instagram via *Netlytic* because the platform no longer offers hashtag searching function for Instagram posts. However, research may try alternative social monitoring platforms such as CrowdTangle which allow research and academics apply for data access. Besides, future research should move beyond and seek to take advantage of traditional and social media data to explore social issues rather than adopting either type of research data. For example, qualitative research such as focus groups could include data from a broader range of age groups like older group people and explore social issues in greater depth. Quantitative studies like mail surveys could validate the findings of this study and results of qualitative research. Therefore, future studies could benefit from a mixed research method to address not only limitations of the current study but also to narrow possible contradictory results and achieve generalization of findings.

6. Conclusion

This study presents a content analysis for eliciting users' preferences for physical features and assigned values of urban parks using social media data harvested from Instagram. To promote park visitation and individual health as well as collective well-being, government agencies should design urban green spaces which satisfy citizens' needs. Passive crowdsourcing enables decision-makers to include a broad spectrum of citizen's opinions, facilitating the practice of public participation and open government. Like other user-generated data, text content from Instagram provides an alternative data source to inform urban green spaces planning.

As shown in this study of Hong Kong, the analysis of citizen-driven social media data revealed that natural physical features including vegetation, natural scenes, wildlife, and non-natural physical features such as artistic design, different kinds of facilities and playgrounds are more popular among park visitors. Moreover, these physical features are more likely to enhance a variety of positive experiences in urban parks, such as happy and restorative experience. The findings provide evidence to urban green spaces planning and social marketing strategies development for promoting urban park utilization in the future.

Appendix A. Name of urban parks for hashtag searching

Chinese name:	English name:
中山紀念公園	Sun Yat Sen Memorial Park
中西區海濱長廊	Central and Western District Promenade
卑路乍灣公園	Belcher Bay Park
山頂花園	Victoria Peak Garden
添馬公園	Tamar Park
遮打花園	Chater Garden
香港佐治五世紀念公園	King George V Memorial Park, Hong Kong
香港公園	Hong Kong Park
香港動植物公園	Hong Kong Zoological and Botanical Gardens
小西灣海濱公園	Siu Sai Wan Promenade
愛秩序灣公園	Aldrich Bay Park
愛秩序灣海濱花園	Aldrich Bay Promenade
愛秩序灣遊樂場	Aldrich Bay Playground
柴灣公園	Chai Wan Park
柴灣北配水庫遊樂場	Chai Wan North Service Reservoir Playground
永泰道花園	Wing Tai Road Garden
筲箕灣配水庫遊樂場	Shau Kei Wan Service Reservoir Playground
賽西湖公園	Choi Sai Woo Park
鰂魚涌公園	Quarry Bay Park
文東路公園	Man Tung Road Park
昂坪廣場	Ngong Ping Piazza
東涌北公園	Tung Chung North Park
九龍仔公園	Kowloon Tsai Park
九龍寨城公園	Kowloon Walled City Park
和黃公園	Hutchison Park
啟德跑道公園	Kai Tak Runway Park
啟德郵輪碼頭公園	Kai Tak Cruise Terminal Park
土瓜灣遊樂場	To Kwa Wan Recreation Ground
樂富公園	Lok Fu Park
海心公園	Hoi Sham Park
聯合道公園	Junction Road Park
賈炳達道公園	Carpenter Road Park
靠背壟道遊樂場	Kau Pui Lung Road Playground
高山道公園	Ko Shan Road Park
三家村遊樂場	Sam Ka Tsuen Recreation Ground
九龍灣公園	Kowloon Bay Park
九龍灣遊樂場	Kowloon Bay Playground
佐敦谷公園	Jordan Valley Park

Chinese name:	English name:
佐敦谷遊樂場	Jordan Valley Playground
坪石遊樂場	Ping Shek Playground
康寧道公園	Hong Ning Road Park
彩榮路公園	Choi Wing Road Park
彩禧路公園	Choi Hei Road Park
晒草灣遊樂場	Sai Tso Wan Recreation Ground
月華街遊樂場	Yuet Wah Street Playground
牛頭角公園	Ngau Tau Kok Park
秀雅道遊樂場	Sau Nga Road Playground
藍田公園	Lam Tin Park
觀塘海濱花園	Kwun Tong Promenade
觀塘遊樂場	Kwun Tong Recreation Ground
麗港公園	Laguna Park
中葵涌公園	Central Kwai Chung Park
石排街公園	Shek Pai Street Park
葵順街遊樂場	Kwai Shun Street Playground
青衣公園	Tsing Yi Park
青衣東北公園	Tsing Yi Northeast Park
青衣海濱公園	Tsing Yi Promenade
北區公園	North District Park
百福田心遊樂場	Pak Fuk Tin Sum Playground
粉嶺康樂公園	Fanling Hong Lok Park
粉嶺遊樂場	Fanling Recreation Ground
瀑布灣公園	Waterfall Bay Park
石澳海角郊遊區	Shek O Headland Picnic Area
舂坎角公園	Chung Hom Kok Park
香港仔海濱花園	Aberdeen Promenade
鴨脷洲公園	Ap Lei Chau Park
鴨脷洲風之塔公園	Ap Lei Chau Wind Tower Park
黃泥涌水塘花園	Wong Nai Chung Reservoir Park
唐明街公園	Tong Ming Street Park
坑口文曲里公園	Hang Hau Man Kuk Lane Park
寶康公園	Po Hong Park
寶翠公園	Po Tsui Park
將軍澳海濱公園	Tseung Kwan O Waterfront Park
常寧遊樂場	Sheung Ning Playground
環保大道寵物公園	Wan Po Road Pet Garden
香港單車館公園	Hong Kong Velodrome Park
上李屋花園	Sheung Li Uk Garden

Chinese name:	English name:
南昌公園	Nam Cheong Park
大坑東遊樂場	Tai Hang Tung Recreation Ground
歌和老街公園	Cornwall Street Park
深水埗公園	Sham Shui Po Park
石硤尾公園	Shek Kip Mei Park
石硤尾配水庫遊樂場	Shek Kip Mei Service Reservoir Playground
花墟公園	Fa Hui Park
荔枝角公園	Lai Chi Kok Park
通州街公園	Tung Chau Street Park
長沙灣遊樂場	Cheung Sha Wan Playground
圓洲角公園	Yuen Chau Kok Park
安景街公園	On King Street Park
小瀝源路遊樂場	Siu Lek Yuen Road Playground
曾大屋遊樂場	Tsang Tai Uk Recreation Ground
沙田公園	Sha Tin Park
源禾遊樂場	Yuen Wo Playground
車公廟路遊樂場	Che Kung Miu Road Playground
鞍祿街公園	On Luk Street Park
顯田遊樂場	Hin Tin Playground
馬鞍山公園	Ma On Shan Park
馬鞍山海濱長廊	Ma On Shan Promenade
馬鞍山西沙路花園	Ma On Shan Sai Sha Road Garden
馬鞍山遊樂場	Ma On Shan Recreation Ground
屯門公園	Tuen Mun Park
屯門文娛廣場	Tuen Mun Cultural Square
屯門河畔公園	Tuen Mun Riverside Park
屯門海濱花園	Tuen Mun Promenade
楊小坑錦簇花園	Yeung Siu Hang Garden
楊景遊樂場	Yeung King Playground
湖山河畔公園	Wu Shan Riverside Park
湖山遊樂場	Wu Shan Recreation Playground
蝴蝶灣公園	Butterfly Beach Park
青田遊樂場	Tsing Tin Playground
元洲仔公園	Yuen Chau Tsai Park
大埔中央廣場	Tai Po Central Town Square
大埔海濱公園	Tai Po Waterfront Park
大埔滘公園	Tai Po Kau Park
大埔舊墟遊樂場	Tai Po Old Market Playground
大埔頭遊樂場	Tai Po Tau Playground

Chinese name:	English name:
完善公園	Yuen Shin Park
廣福公園	Kwong Fuk Park
梅樹坑遊樂場	Mui Shue Hang Playground
白石角海濱長廊	Pak Shek Kok Promenade
國瑞路公園	Kwok Shui Road Park
城門谷公園	Shing Mun Valley Park
沙咀道遊樂場	Sha Tsui Road Playground
荃灣公園	Tsuen Wan Park
荃灣海濱公園	Tsuen Wan Riviera Park
賽馬會德華公園	Jockey Club Tak Wah Park
維多利亞公園	Victoria Park
跑馬地遊樂場	Happy Valley Recreation Ground
香港網球中心	Hong Kong Tennis Centre
南蓮園池	Nan Lian Garden
彩虹道遊樂場	Choi Hung Road Playground
摩士公園	Morse Park
斧山公園	Hammer Hill Park
樂富遊樂場	Lok Fu Recreation Ground
牛池灣公園	Ngau Chi Wan Park
獅子山公園	Lion Rock Park
石鼓壟道遊樂場	Shek Ku Lung Road Playground
蒲崗村道公園	Po Kong Village Road Park
馬仔坑遊樂場	Ma Chai Hang Recreation Ground
鳳德公園	Fung Tak Park
元朗公園	Yuen Long Park
天柏路公園	Tin Pak Road Park
天水圍公園	Tin Shui Wai Park
天秀路公園	Tin Sau Road Park
九龍佐治五世紀念公園	King George V Memorial Park, Kowloon
九龍公園	Kowloon Park
京士柏休憩花園	King’s Park Rest Garden
京士柏遊樂場	King’s Park Recreation Ground
尖沙咀海濱花園	Tsim Sha Tsui Promenade
市政局百週年紀念花園	Urban Council Centenary Garden
櫻桃街公園	Cherry Street Park
界限街遊樂場	Boundary Street Recreation Ground
訊號山花園	Signal Hill Garden

References

Agrawal, R., Imieliński, T., & Swami, A. (1993). *Mining association rules between sets of items in large databases*. Paper presented at the Proceedings of the 1993 ACM SIGMOD International Conference on Management of Data, Washington, D.C., USA.

Aguinis, H., Forcum, Lura E., & Joo, H. (2013). Using Market Basket Analysis in Management Research. *Journal of Management, 39*(7), 1799-1824.

Ambrey, C., & Fleming, C. (2013). Public Greenspace and Life Satisfaction in Urban Australia. *Urban Studies, 51*(6), 1290-1321.

Appleton, J. (1975). *The experience of landscape*. London: Wiley.

Arnberger, A., & Eder, R. (2012). The influence of green space on community attachment of urban and suburban residents. *Urban Forestry & Urban Greening, 11*(1), 41-49.

Barton, J., & Pretty, J. (2010). Urban ecology and human health and wellbeing. In K. J. Gaston (Ed.), *Urban Ecology* (pp. 202-229). Cambridge: Cambridge University Press.

Bengston, D. N., & Xu, Z. (1995). Changing National Forest Values: A content analysis. St. Paul, MN: Dept. of Agriculture, Forest Service.

Berto, R. (2005). Exposure to restorative environments helps restore attentional capacity. *Journal of Environmental Psychology, 25*(3), 249-259.

Bjerke, T., & Østdahl, T. (2004). Animal-related attitudes and activities in an urban population. *Anthrozoös, 17*(2), 109-129.

Bjerke, T., Østdahl, T., Thrane, C., & Strumse, E. (2006). Vegetation density of urban parks and perceived appropriateness for recreation. *Urban Forestry & Urban Greening, 5*, 35-44.

Bowler, D. E., Buyung-Ali, L. M., Knight, T. M., & Pullin, A. S. (2010). Urban greening to cool towns and cities: A systematic review of the empirical evidence. *Landscape and Urban Planning, 97*, 147-155.

Brabham, D. C. (2008). Crowdsourcing as a Model for Problem Solving:An Introduction and Cases. *Convergence, 14*(1), 75-90.

Brown, G., & Brabyn, L. (2012). An analysis of the relationships between multiple values and physical landscapes at a regional scale using public participation GIS and landscape character classification. *Landscape and Urban Planning, 107*, 317-331.

Bubalo, M., van Zanten, B. T., & Verburg, P. H. (2020). Crowdsourcing geo-information on landscape perceptions and preferences: A review. *Landscape and Urban Planning, 184*, 101-111.

Buntain, C., McGrath, E., Golbeck, J., & LaFree, G. (2016). *Comparing Social Media and Traditional Surveys Around the Boston Marathon Bombing.* Paper presented at the 6th Workshop on Making Sense of Microposts, Montréal, Canada.

Callau, A. À., Albert, M. Y. P., Rota, J. J., & Giné, D. S. (2019). Landscape characterization using photographs from crowdsourced platforms: content analysis of social media photographs. *Open Geosciences, 11*(1), 558-571.

Census and Statistics Department. (2019). Population. Retrieved December, 3, 2019, from https://www.censtatd.gov.hk/hkstat/sub/so20.jsp

Charalabidis, Y., Loukis, E. N., Androutsopoulou, A., Karkaletsis, V., & Triantafillou, A. (2014). Passive crowdsourcing in government using social media. *Transforming Government: People, Process and Policy, 8*(2), 283-308.

Chen, B., Adimo, O. A., & Bao, Z. (2009). Assessment of aesthetic quality and multiple functions of urban green space from the users' perspective: The case of Hangzhou Flower Garden, China. *Landscape and Urban Planning, 93*, 76-82.

Chen, Y., Parkins, J. R., & Sherren, K. (2018). Using geo-tagged Instagram posts to reveal landscape values around current and proposed hydroelectric dams and their reservoirs. *Landscape and Urban Planning, 170*, 283-292.

Chiesura, A. (2004). The role of urban parks for the sustainable city. *Landscape and Urban Planning, 68*, 129-138.

Coley, R. L., Kuo, F. E., & Sullivan, W. C. (1997). Where does community grow? The social context created by nature in urban public housing. *Environment and Behavior, 29*(4), 468-494.

Dallimer, M., Davies, Z. G., Irvine, K. N., Maltby, L., Warren, P. H., Gaston, K. J., & Armsworth, P. R. (2014). What Personal and Environmental Factors Determine Frequency of Urban Greenspace Use? *International Journal of Environmental Research and Public Health, 11*(8), 7977-7992.

Daniel, T. C. (2001). Whither scenic beauty? Visual landscape quality assessment in the 21st century. *Landscape and Urban Planning, 54*, 267-281.

Daniel, T. C., & Meitner, M. M. (2001). Representational validity of landscape visualizations: The effects of graphical realism on perceived scenic beauty of forest vistas. *Journal of Environmental Psychology, 21*(1), 61-72.

Dick, R. E., & Hendee, J. C. (1986). Human Responses to encounters with wildlife in urban parks. *Leisure Sciences, 8*(1), 63-77.

Donahue, M. L., Keeler, B. L., Wood, S., A., Fisher, D. M., Hamstead, Z. A., & McPhearson, T. (2018). Using social media to understand drivers of urban park visitation in the Twin Cities, MN. *Landscape and Urban Planning, 175*, 1-10.

Ferro, E., Loukis, E. N., Charalabidis, Y., & Osella, M. (2013). Policy making 2.0: From theory to practice. *Government Information Quarterly, 30*, 359-368.

Folmer, A., Haartsen, T., & Huigen, P. P. P. (2018). How ordinary wildlife makes local green places special. *Landscape Research*, 1-11.

Ghermandi, A., & Sinclair, M. (2019). Passive crowdsourcing of social media in environmental research: A systematic map. *Global Environmental Change, 55*, 36-47.

Gobster, P. H., & Westphal, L. M. (2004). The human dimensions of urban greenways: planning for recreation and related experiences. *Landscape and Urban Planning, 68*(2-3), 147-165.

Grahn, P. (1991). Landscapes in our minds: People's choice of recreative places in towns. *Landscape Research, 16*(1), 11-19.

Grahn, P., & Stigsdotter, U. K. (2010). The relation between perceived sensory dimensions of urban green space and stress restoration. *Landscape and Urban Planning, 94*(3), 264-275.

Gruzd, A. (2016). Netlytic: Software for Automated Text and Social Network Analysis. from http://Netlytic.org

Guerrero, P., Møller, M. S., Olafsson, A. S., & Snizek, B. (2016). Revealing Cultural Ecosystem Services through Instagram Images: The Potential of Social Media Volunteered Geographic Information for Urban Green Infrastructure Planning and Governance. *Urban Planning, 1*(2), 1-17.

Hamstead, Z. A., Fisher, D., Ilieva, R. T., Wood, S., A., McPhearson, T., & Kremer, P. (2018). Geolocated social media as a rapid indicator of park visitation and equitable park access. *Computers, Environment and Urban Systems*.

Hanley, N., Mourato, S., & Wright, R. E. (2001). Choice modelling approaches: A superior alternative for environmental valuation? *Journal of Economic Surveys, 15*(3), 435-462.

Hansmann, R., Hug, S.-M., & Seeland, K. (2007). Restoration and stress relief through physical activities in forests and parks. *Urban Forestry & Urban Greening, 6*, 213-225.

Hartig, T., Evans, G. W., Jamner, L. D., Davis, D. S., & Gärling, T. (2003). Tracking restoration in natural and urban field settings. *Journal of Environmental Psychology, 23*(2), 109-123.
Herzog, T. R. (1985). A cognitive analysis of preference for waterscapes. *Journal of Environmental Psychology, 5*, 225-241.
Hoyle, H., Hitchmough, J., & Jorgensen, A. (2017). All about the 'wow factor'? The relationships between aesthetics, restorative effect and perceived biodiversity in designed urban planting. *Landscape and Urban Planning, 164*, 109-123.
Huang, S.-C. L. (2006). A study of outdoor interactional spaces in high-rise housing. *Landscape and Urban Planning, 78*, 193-204.
Ignatieva, M., Eriksson, F., Eriksson, T., Berg, P., & Hedblom, M. (2017). The lawn as a social and cultural phenomenon in Sweden. *Urban Forestry & Urban Greening, 21*, 213-223.
Irvine, K. N., Warber, S. L., Devine-Wright, P., & Gaston, K. J. (2013). Understanding Urban Green Space as a Health Resource: A Qualitative Comparison of Visit Motivation and Derived Effects among Park Users in Sheffield, UK. *International Journal of Environmental Research and Public Health, 10*, 417-442.
Ives, C. D., Oke, C., Hehir, A., Gordon, A., Wang, Y., & Bekessy, S. A. (2017). Capturing residents' values for urban green space: Mapping, analysis and guidance for practice. *Landscape and Urban Planning, 161*, 32-43.
Jim, C. Y., & Chen, W. Y. (2006). Perception and Attitude of Residents Toward Urban Green Spaces in Guangzhou (China). *Environmental Management, 38*(3), 338-349.
Jorgensen, B. S., & Stedman, R. C. (2001). Sense of place as an attitude: Lakeshore owners attitudes toward their properties. *Journal of Environmental Psychology, 21*, 233-248.
Kaczynski, A. T., & Henderson, K. A. (2008). Parks and Recreation Settings and Active Living: A Review of Associations With Physical Activity Function and Intensity. *Journal of Physical Activity & Health, 5*(4), 619-632.
Kaltenborn, B. P., & Bjerke, T. (2002). Associations between environmental value orientations and landscape preferences. *Landscape and Urban Planning, 59*, 1-11.
Kaplan, R. (1985). The analysis of perception via preference: A strategy for studying how the environment is experienced. *Landscape Planning, 12*, 161-176.
Kaplan, S. (1995). The restorative benefits of nature: Toward an integrative framework. *Journal of Environmental Psychology, 15*(3), 169-182.
Kim, D., & Jin, J. (2018). Does happiness data say urban parks are worth it? *Landscape and Urban Planning, 178*, 1-11.
Kyttä, M., Broberg, A., Tzoulas, T., & Snabb, K. (2013). Towards contextually sensitive urban densification: Location-based softGIS knowledge revealing perceived residential environmental quality. *Landscape and Urban Planning, 113*, 30-46.
Lee, A. C. K., & Maheswaran, R. (2011). The health benefits of urban green spaces: a review of the evidence. *Journal of Public Health, 33*(2), 212-222.
Leisure and Cultural Services Department. (2019). Statistics Report - Leisure Services. from https://www.lcsd.gov.hk/en/aboutlcsd/ppr/statistics/leisure.html
Linders, D. (2012). From e-government to we-government: Defining a typology for citizen coproduction in the age of socia media. *Government Information Quarterly, 29*, 446-454.
Lloyd, K., Burden, J., & Kiewa, J. (2008). Young Girls and Urban Parks: Planning for Transition Through Adolescence. *Journal of Park & Recreation Administration, 26*(3), 21-38.
Lohr, V. I., & Pearson-Mims, C. H. (2006). Responses to Scenes with Spreading, Rounded, and Conical Tree Forms. *Environment and Behavior, 38*(5), 667-688.

MacKerron, G., & Mourato, S. (2013). Happiness is greater in natural environments. *Global Environmental Change, 23*(5), 992-1000.
Maller, C., Townsend, M., Leger, L. S., Henderson-Wilson, C., Pryor, A., Prosser, L., & Moore, M. (2009). Healthy Parks, Healthy People: The Health Benefits of Contact with Nature in a Park Context. *The George Wright Forum, 26*(2), 51-83.
McCormack, G. R., Rock, M., Toohey, A. M., & Hignell, D. (2010). Characteristics of urban parks associated with park use and physical activity: A review of qualitative research. *Health & Place, 16*(4), 712-726.
Mehmet Mehmet, I., & Simmons, P. (2019). Operationalizing social media in upstream social marketing: A case of shark policy in New South Wales. *Journal of Social Marketing, 9*(3), 288-308.
Morris, N. (2003). Health, Well-Being and Open Space Literature Review. Edinburgh: OPENspace.
Motoyama, Y., & Hanyu, K. (2014). Does public art enrich landscapes? The effect of public art on visual properties and affective appraisals of landscapes. *Journal of Environmental Psychology, 40*, 14-25.
Neal, S., Bennett, K., Jones, H., Cochrane, A., & Mohan, G. (2015). Multiculture and Public Parks: Researching Super-diversity and Attachment in Public Green Space. *POPULATION, SPACE AND PLACE, 21*, 463-475.
Netzer, O., Feldman, R., Goldenberg, J., & Fresko, M. (2012). Mine Your Own Business: Market-Structure Surveillance Through Text Mining. *Marketing Science, 31*(3), 521-543.
Nordh, H., Alalouch, C., & Hartig, T. (2011). Assessing restorative components of small urban parks using conjoint methodology. *Urban Forestry & Urban Greening, 10*, 95-103.
Nordh, H., Hartig, T., Hagerhall, C. M., & Fry, G. (2009). Components of small urban parks that predict the possibility for restoration. *Urban Forestry & Urban Greening, 8*(4), 225-235.
Nordh, H., & Østby, K. (2013). Pocket parks for people – A study of park design and use. *Urban Forestry & Urban Greening, 12*, 12-17.
Ordóñez, C., Beckley, T., Duinker, P. N., & John Sinclair, A. (2017). Public values associated with urban forests: Synthesis of findings and lessons learned from emerging methods and cross-cultural case studies. *Urban Forestry & Urban Greening, 25*, 74-84.
Oteros-Rozas, E., Martín-Lópe, B., Fagerholm, N., Bieling, C., & Plieninger, T. (2017). Using social media photos to explore the relation between cultural ecosystem services and landscape features across five European sites. *Ecological Indicators*.
Özgüner, H. (2011). Cultural differences in attitudes towards urban parks and green spaces. *Landscape Research, 36*(5), 599-620.
Özgüner, H., & Kendleb, A. D. (2006). Public attitudes towards naturalistic versus designed landscapes in the city of Sheffield (UK). *Landscape and Urban Planning, 74*(2), 139-157.
Parsons, R., & Daniel, T. C. (2002). Good looking: in defense of scenic landscape aesthetics. *Landscape and Urban Planning, 60*(1), 43-56.
Pasanen, T. P., Neuvonen, M., & Korpela, K. M. (2017). The Psychology of Recent Nature Visits: (How) Are Motives and Attentional Focus Related to Post-Visit Restorative Experiences, Creativity, and Emotional Well-Being? *Environment and Behavior, 50*(8), 913-944.
Patino, A., Pitta, D. A., & Quinones, R. (2012). Social media's emerging importance in market research. *Journal of Consumer Marketing, 29*(3).
Peckham, S. C., Duinker, P. N., & Ordóñez, C. (2013). Urban forest values in Canada: Views of citizens in Calgary and Halifax. *Urban Forestry & Urban Greening, 12*(2), 154-162.

Peterson, R. A., & Kerin, R. A. (1981). The Quality of Self-Report Data: Review and Synthesis. In B. M. Enis & K. J. Roering (Eds.), *Review of Marketing 1981* (pp. 5-20). Chicago: American Marketing Association.

Pietrzyk-Kaszyńska, A., Czepkiewicz, M., & Kronenberg, J. (2017). Eliciting non-monetary values of formal and informal urban green spaces using public participation GIS. *Landscape and Urban Planning, 160*, 85-95.

Pilař, L., Balcarová, T., & Rojík, S. (2016). Farmers' Markets: Positive Feelings of Instagram Posts. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis, Mendel University Press, 64*(6), 2095-2100.

Planning Department. (2005). *Hong Kong Planning Standards and Guidelines*. Hong Kong: The Government of the Hong Kong Special Administrative Region Retrieved from https://www.pland.gov.hk/pland_en/tech_doc/hkpsg/full/pdf/ch4.pdf.

Roberts, H. V. (2017). Using Twitter data in urban green space research: A case study and critical evaluation. *Applied Geography, 81*, 13-20.

Roberts, H. V., Sadler, J., & Chapman, L. (2018). The value of Twitter data for determining the emotional responses of people to urban green spaces: A case study and critical evaluation. *Urban Studies, 56*(4), 818-835.

Schroeder, H. W. (1991). Preference and meaning of Arboretum landscapes: Combining quantitative and qualitative data. *Journal of Environmental Psychology, 11*, 231-248.

Schroeder, H. W. (2002). Experiencing Nature in Special Places: Surveys in the North-Central Region. *Journal of Forestry, 100*(5), 8-14.

Song, X. P., Richards, D. R., & Tan, P. Y. (2020). Using social media user attributes to understand human–environment interactions at urban parks. *Scientific Reports, 10*(1), 808.

Statista. (2018). *Penetration of leading social networks in Hong Kong as of 3rd quarter 2017*. Retrieved from: https://www.statista.com/statistics/412500/hk-social-network-penetration/

Stieglitz, S., Mirbabaie, M., Ross, B., & Neuberger, C. (2018). Social media analytics – Challenges in topic discovery, data collection, and data preparation. *International Journal of Information Management, 39*, 156-168.

Strumse, E. (1994). Perceptual dimensions in the visual preferences for agrarian landscapes in western norway. *Journal of Environmental Psychology, 14*(4), 281-292.

Teles da Mota, V., & Pickering, C. (2020). Using social media to assess nature-based tourism: Current research and future trends. *Journal of Outdoor Recreation and Tourism, 30*, 100295.

Tieskens, K. F., van Zanten, B. T., Schulp, C. J. E., & Verburg, P. H. (2018). Aesthetic appreciation of the cultural landscape through social media: An analysis of revealed preference in the Dutch river landscape. *Landscape and Urban Planning, 177*, 128-137.

Toubiana, M., & Zietsma, C. (2017). The Message is on the Wall? Emotions, Social Media and the Dynamics of Institutional Complexity. *Academy of Management Journal, 60*(3), 922-953.

Tufekci, Z. (2014). Big Questions for Social Media Big Data: Representativeness, Validity and Other Methodological Pitfalls. *ICWSM, 14*, 505-514.

Twohig-Bennett, C., & Jones, A. (2018). The health benefits of the great outdoors: A systematic review and meta-analysis of greenspace exposure and health outcomes. *Environmental Research, 166*, 628-637.

Tyrväinen, L., Mäkinen, K., & Schipperijn, J. (2007). Tools for mapping social values of urban woodlands and other green areas. *Landscape and Urban Planning, 79*(1), 5-19.

Ulrich, R. S., Simons, R. F., Losito, B. D., Fiorito, E., Miles, M. A., & Zelson, M. (1991). Stress recovery during exposure to natural and urban environments. *Journal of Environmental Psychology, 11*(3), 201-230.

Van Herzele, A., & Wiedemann, T. (2003). A monitoring tool for the provision of accessible and attractive urban green spaces. *Landscape and Urban Planning, 63*, 109-126.

van Zanten, B. T., Van Berkel, D. B., Meentemeyer, R. K., Smith, J. W., Tieskens, K. F., & Verburg, P. H. (2016). Continental-scale quantification of landscape values using social media data. *PNAS, 113*(46), 12974-12979.

Veitch, J., Bagley, S., Ball, K., & Salmon, J. (2006). Where do children usually play? A qualitative study of parents' perceptions of influences on children's active free-play. *Health & Place, 12*(4), 383-393.

Wan, C., & Shen, G. Q. (2015). Salient attributes of urban green spaces in high density cities: The case of Hong Kong. *Habitat International, 49*, 92-99.

Ward Thompson, C. (2004). *Playful natures?* Paper presented at the Open Space: People space' Conference on Inclusive Outdoor Environments, Edinburgh.

Wartmann, F. M., Acheson, E., & Purves, R. S. (2018). Describing and comparing landscapes using tags, texts, and free lists: an interdisciplinary approach. *International Journal of Geographical Information Science, 32*(8), 1572-1592.

Wilkins, E. J., Wood, S., A., & Smith, J. W. (2021). Uses and Limitations of Social Media to Inform Visitor Use Management in Parks and Protected Areas: A Systematic Review. *Environmental Management, 67*, 120-132.

Wong, K.-K., & Domroes, M. (2005). The Visual Quality of Urban Park Scenes of Kowloon Park, Hong Kong: Likeability, Affective Appraisal, and Cross-Cultural Perspectives. *Environment and Planning B: Planning and Design, 32*(4), 617-632.

Wright Wendel, H. E., Zarger, R. K., & Mihelcic, J. R. (2012). Accessibility and usability: Green space preferences, perceptions, and barriers in a rapidly urbanizing city in Latin America. *Landscape and Urban Planning, 107*(3), 272-282.

Zhang, H., Chen, B., Sun, Z., & Bao, Z. (2013). Landscape perception and recreation needs in urban green space in Fuyang, Hangzhou, China. *Urban Forestry & Urban Greening, 12*, 44-52.