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**Landscape Preference and Everyday Use of Urban
Green Space in the Age of Social Media:
A case study of Beijing**

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Abstract

Burgeoning social media sites characterize a highly connected cyberspace, whereby personal expressions can be easily created in rich forms – image, text, video – and are visible to a broad range of audiences. Substantial studies illustrate the great potential of social media data to explore preferences for a place. It is especially valuable for Chinese cities because green space has been made central to top-down planning initiatives associated with place branding and envisioning a liveable urban life over the last decades. Given that extensive studies suggest a positive connection between well-being and exposure to nature, examining people's preference for urban green space is crucial to understand the relationship between positive response and nature experience in cities.

This thesis aims to investigate the questions of landscape preference in the context of social media, with Beijing's parks as the study site. By exploring social media use and everyday practice related to green space, this thesis demonstrates the impact of place popularity on representations of urban green space and uncovers the dynamic reactions to natural environment as it integrates experiences, place practice and social media as a mediator in interacting with green spaces. Drawing on data from an online questionnaire survey, social media data mining, and records from fieldwork between 2020 to 2021, this thesis finds that: (1) the use of visual social media is positively associated with the use of urban green space and subjective well-being; (2) diversity of visual representations is influenced by place popularity, while the social group (resident vs. tourist) has no significant impact on visual representations of nature experience in urban parks; (3) daily practice is also involved in forming preference, but in an affordance-oriented fashion; it embodies a process of space production and gives value to the landscape as

physical and social space. Building upon these findings, this thesis argues that the preference for natural environment is not a purely evolution-based inclination but rather a consensus between everyday living and biophilic mental image, taking the form of aesthetic appreciation.

Lay Summary

Social media saturates our everyday living in the manner that digital information intervenes in mundane activities, such as communicating, eating, travelling and socializing. People do not only acquire information from diverse social media platforms; they present, comment, and photograph the environment and then post on these platforms. This ongoing change offers the overarching aim of this thesis: What can social media data tell about the preferred environmental settings embedded in everyday practices? Designers and planners have endeavoured to maximize the well-being outcomes of green spaces, and people's preferences serve as important guidelines in this process.

Therefore, this thesis is attentive to exploring (1) preferred environmental settings reflected in digital images by considering the influence of place branding and different social groups (residents vs. tourists); and (2) how everyday use of green space in cities shapes landscape preference; and (3) the role of social media in those daily engagements. In doing so, it develops a mixed method, including qualitative and quantitative approaches. It first explores correlations of visual social media use, green space use, and subjective well-being via an online survey. Then it analyses image contents and users' photo-taking behaviours by collecting geo-tagged photos from visual social media. Lastly, it explores how people express the characteristics of preferred green spaces and everyday use of green spaces by using semi-structured interviews. The main conclusions lay two-fold. People's preference for different environment settings is shaped by their practices, as green space is closely integrated into people's everyday living in different fashions. Social media intervenes in how green space is used and represented. The work has implications on design, manage and place redevelopment of urban green spaces, as it facilitates people's well-being.

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Glossary

Crowdsourcing: the collection of information shared by a large group of people via the Internet, social media, and smartphone applications

Daka shengdi 打卡圣地: photogenic spots for social media

Destination park: a park with inclusiveness, large size and multiple separated areas

Geo-tagged photos: photographs attached with coordinates

Neighbourhood park: a park with a small size that serves neighbourhoods

Satisfaction outcome: general satisfaction related to the visit to urban parks

Subjective well-being: health-related quality of life

Urban green space: vegetated areas within an urban area

User-generated content (UGC): content posted on online platforms

Visual social media: sharing visual content via social media tools

Volunteered Geographic Information (VGI): geographical information voluntarily provided by individuals

Wanghong Jingji 网红经济: Internet celebrity economy

Web 1.0: a read-only web for users

Web 2.0: a participatory web for users

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Chapter 1 Introduction

1.1 Social media and “Urbanization of Information”

1.1.1 The age of social media

Social media has been growing tremendously over the past decades. Social networking applications saturate people’s everyday living as of when these applications are embedded in smartphones, such as Facebook (created in 2004), Flickr (created in 2004), Twitter (created in 2006), and Instagram (created in 2010). During the final quarter of 2021, Facebook registered 84 million users with 1.93 billion daily active users. The photo and video sharing application – Instagram – has 1.074 billion users worldwide, with around 1.9 billion daily active users. At the same time, on average, 6000 Tweets –short messages no longer than 140 characters – were sent to the social media site Twitter. More than 10 billion digital images had been accessible to users on the image hosting site Flickr by 2015.

It is a common scenario today for people to take food pictures before drinking their coffee in a cafeteria and share them on Instagram. This “camera eats first” phenomenon¹ has become prevalent with the emergence of smartphones and social media. As Cocks et al. (2018)² argue, taking instagrammable pictures is one of the crucial parts of cafe consumption. Therefore, interior design takes photography practice into consideration since an instagrammable cafeteria attracts more customers in this circumstance. It is also true for photogenic sites, where people are prone to visit for instagrammable photos. In the field of tourism, tourists’ destination image, which means mental representative of

¹ Wikipedia contributors. “Camera eats first” Wikipedia, The Free Encyclopedia, <http://en.wikipedia.org/wiki/Facebook> (accessed June 20, 2022).

² “Instagram and Cafe Culture”, made by Daisy Cocks, Raphaela Major and Connor Ovenstone, https://media.ed.ac.uk/media/Instagram+and+Cafe+Culture/1_4ebjbhx6(accessed June 20, 2022)

destinations, is affected by information (e.g., pictures and textual messages) posted by other users on social media sites (Bronner & De Hoog, 2011; Currie et al., 2008, p. 5). Suppliers of consumer goods are no longer the primary factors in this process (Ghazali & Cai, 2013). Specifically, diversified social media platforms, such as TripAdvisor and Twitter, influence different aspects of vacation decision-making before and during the trips (Bronner & de Hoog, 2014). However, concerns are that visitors concentrate on smartphones and photography practice without authentically being connected with the place. Visitors are in their effort to pursue an experience that serves Instagram posts or other social media platforms (Siegel et al., 2020; Tribe & Mkono, 2017). Other downsides of social media in tourism include negative “word-of-mouth” from dissatisfied visitors (Zeng & Gerritsen, 2014) and tensions with local communities (Andereck et al., 2007). As Graham et al. (2013) have noticed, there is abstract cyberspace in which digital information offers ways of interaction in a new fashion, and that “virtual” space is inextricably bonded with material space.

Shaw and Graham (2017) describe the current phase as “urbanization of information”, indicating that the unprecedented accessibility to digital information and development of communication technologies (ICTs) are producing an abstract urban space through the Internet. Barns (2019) proposes that digital platforms, from Facebook to Uber, have inextricably linked with people’s practices such that their implications are not only market-oriented but also embody a dynamic process of socio-spatial transformation. On the one hand, corporations and city managers value social media platforms as important cyberspace for marketing products (Constantinides, 2014; Dwivedi et al., 2015; Yadav & Rahman, 2018) and city branding (Paganoni, 2012; Sevin, 2016). For example, abstract advertisements are embedded in both abstract and material spaces. On the other hand, users publicly share their experiences, attitude, and comments on specific objects, making it possible for users to be

influencers on different topics, platforms, or networking relations (Cha et al., 2010).

1.1.2 Defining social media

To comprehensively understand this phenomenon, it is worth taking a step back to look at where social media comes from and how it develops. The term “Social Media”, explained by Kaplan and Haenlein (2010), is:

“... Social Media is a group of internet-based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of User Generated Content.”

The statement indicates two key aspects of social media. Firstly, all the applications are built based on Web 2.0, a platform that consists of various new technologies, such as Adobe Flash for adding audio/video streams web pages, AJAX (Asynchronous Java Scripts) for retrieving and updating data from web server without interfering the display of the whole page (Cormode & Krishnamurthy, 2008). Secondly, Web 1.0 is the “read-only web” and users only consume content created by a small group of people, according to the innovator of the World Wide Web – Berners-Lee(1998). Web 2.0 is characterized by interaction, in other words, any user can be a content creator and a content consumer (Cormode & Krishnamurthy, 2008). Information is disseminated in one direction on Web 1.0 websites, while Web 2.0 concentrates on interpersonal interaction and participation (Williams, 2010).

A new trend contributes to this user-based objective – the emergence and prevalence of smartphones and Mobile Web 2.0 (Kaplan & Haenlein, 2010). In the spirit of Web 2.0, mobile social media refers to the phenomenon that social media can be accessed via a mobile device (Kaplan, 2012), which offers opportunities for people to engage in the real world from cyberspace, for example, know where their friends currently are so that they can meet in real life , or know where and what time their friends visit an attracting place so that

others can pay a visit either. Users do not have to login to their social networking accounts via desktop PCs or laptops since it is incredibly easy and convenient to browse updates and interact with friends on Facebook or Instagram through their phones. Naturally, digital information generated by users exponentially rockets with the increasing number of smartphone users. As of 2022, nearly 83.72% of the world's population owns a smartphone and generates digital information every second through social media applications.

1.1.3 Functions of social media

There is no fixed classification for social media applications. Kaplan and Haenlein (2010) classify social media applications into six categories from the perspective of social presence/media richness and self-presentation/self-disclosure (Figure 1.1).

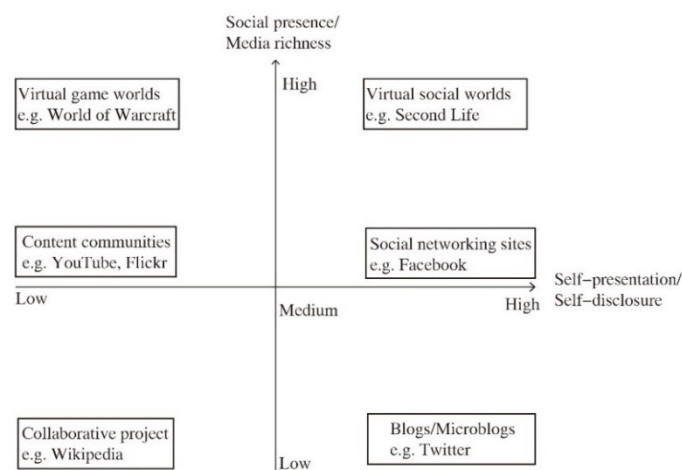


Figure 1.1 Classification of social media by social presence/media richness and self-presentation/self-disclosure

Source: Kaplan & Haenlein, 2010

Kietzmann et al. (2011) break social media down into several functional traits:

- **Identity:** users reveal their identities in a social media setting, e.g., name, age, gender, and location.
- **Conversations:** users communicate with others via social media platforms.
- **Sharing:** users exchange, distribute and receive content in a social media

setting.

- Presence: users can know if other users are accessible, e.g., status lines like “available” or “hidden”.
- Relationship: users are connected via platforms, e.g., list each other as friends or fans.
- Reputation: users can identify the standing of others in a social media setting, e.g., “view counts” or “ratings” for reputation of a video on YouTube.
- Groups: users can form communities and sub-communities via social media platforms, e.g., groups on Facebook and Flickr.

These classifications indicate the richness of functionality and target users of social media applications. With this trend, social media platforms appear to be the abstract place where power has been given to individuals and communities that create, share and consume blogs, tweets, Facebook and so forth (Kietzmann et al., 2011). Shaw and Graham (2017) have noticed this ubiquity of digital information, power, and virtual space production derived from Lefebvre’s discussion of the production of space (Lefebvre, 1991) from the perspective of spatial justice and the information right to the city. In this viewpoint, urban space is not only created by the traditional power of planners, developers, and property owners, but also created by forces of actors such as big technology corporations (e.g., Google and Facebook) and individuals (e.g., users of social media) begin to reshape the city.

1.1.4 Characteristics of social media

For starters, big corporations, such as Amazon and eBay, historically took power from individuals in cyberspace promoting products and thus controlling consumers’ decisions. Then, as Kaplan and Haenlein (2012) argue, a social media evolution is creating more platforms to encourage information exchange and interaction between users. There is little chance for firms to regulate or alter publicly posted comments by their customers (Kaplan & Haenlein, 2010).

However, social media is entirely different from its counterpart in the late 1970s, the Bulletin Board System (BBS), for users to exchange information. At this stage, Web 2.0 lays the technical groundwork for social media, while User Generated Content (UGC) represents how users make use of social media. UGC is defined as personally contributed (Naab & Sehl, 2017), accessible to the public, and created outside professional routines (Vickery & Wunsch-Vincent, 2007). UGC includes all forms of user interactions on social media, such as sharing photos, blogs, comments, videos, and even networking relations. For example, Facebook had one billion monthly active users in October 2012, sharing text, photos, and multimedia with their “friends” on that platform³. As of May 2019, 500 hours of video content were uploaded to YouTube per minute⁴. This astounding growth of UGC has a considerable impact on the practice of marketing (Daugherty et al., 2008; Fader & Winer, 2012), users’ behaviours in real life (McGloin & Eslami, 2015; Sujata et al., 2019; Young et al., 2017) and even political movements (Carney, 2016; Sandoval-Almazan & Gil-Garcia, 2014; Shirky, 2011).

How interaction is facilitated via social media needs to be elaborated for a comprehensive understanding of this process. There are two directions of information flow, including getting information from social media and sharing information on social media. The former scenario is similar to how Web 1.0 works: users gather information from websites or social media applications (Bronner & de Hoog, 2014; Sultan et al., 2019). However, creators are neither only big corporations nor a small group of people. Every user of specific social media is a creator in this circumstance. The latter is characterised by the UGC phenomenon. UGC data is usually an unstructured dataset consisting of images, text, and numerical data. Utilizing UGC as a research resource to

³ Wikipedia contributors. “Facebook.” Wikipedia, The Free Encyclopedia, <http://en.wikipedia.org/wiki/Facebook> (accessed June 20, 2022).

⁴ Wikipedia contributors. “YouTube.” Wikipedia, The Free Encyclopedia, <https://en.wikipedia.org/wiki/YouTube> (accessed June 20, 2022).

produce knowledge is a process of crowdsourcing, which means web participation, and the study is also called citizen science (van Lammeren et al., 2016). Citizen science refers to communities or networks of citizens acting as observers in some domain of science (Goodchild, 2007). With mobile Web 2.0, users (or “citizens” of cyberspace) interconnect as a network of observing, reporting, collecting, analysing, and disseminating information via text, image, audio, or video message (Sheth, 2009). Figure 1.2 illustrates the UGC of Flickr, where users share geo-tagged photos in public.

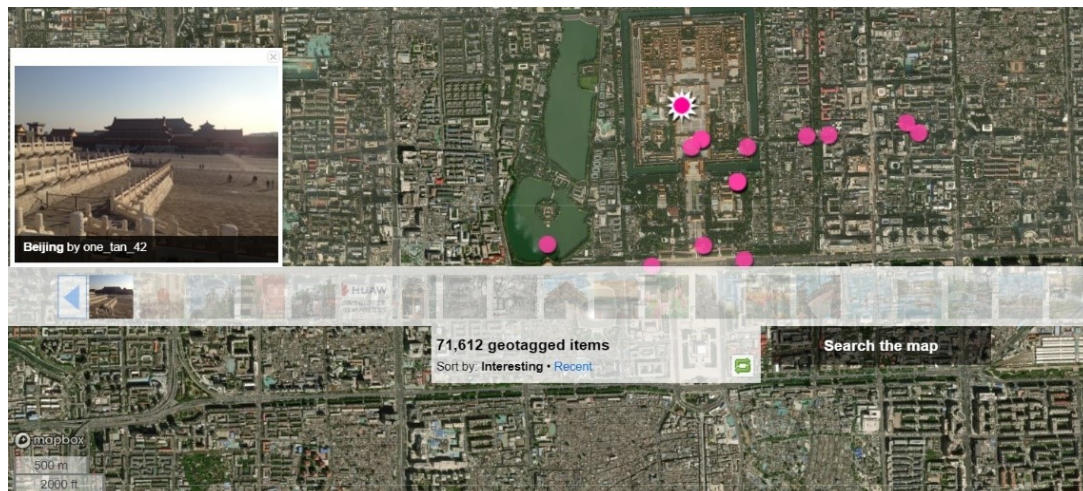


Figure 1.2 Information from the Flickr site for the area of Forbidden City in central Beijing, China.

Note: each symbol denotes the availability of a geo-tagged photograph; at the time of writing, more than 71,612 were available for the area shown.

1.1.5 Volunteered Geographic Information

The Volunteered Geographic Information (VGI) generated by users in cyberspace is a remarkable case of the UGC phenomenon, forming a social media landscape corresponding to an activity in the real world. The widely used smartphones with Internet connectivity, growth of content authors, and implementation of geocoded Web content foster the kind of social media applications such as OpenStreetMap and Flickr (Figure 1.2). They provide a more participatory form of virtual space where users are allowed to locate photos on the map by longitude and latitude (Goodchild, 2007).

As Stefanidis et al. (2013) argue, geographic information is valued again because of tools like Google Maps and Google Maps Application Programming Interface (API), which enable users to create mashups (see Haklay et al., 2013 for more information and also quoted by Strfanidis et al., 2013). Unlike a top-down government initiative, geographic information is collected by experts and amateurs alike via digital platforms such as OpenStreetMap and Google Map Marker. However, geographical information (even temporal information) is not the message that social media intends to. In other words, users share other types of information, such as short textual messages on Twitter, and photos on Flickr and Instagram, while attaching geospatial and temporal data. The corresponding spatio-temporal information with contents shared by users makes the association meaningful for exploring the following topics (Stefanidis et al., 2013):

- Mapping how ideas and information propagate in a society.
- Mapping people's opinions and reactions toward specific events or topics.
- Identifying emerging socio-cultural hotspots.

These kinds of social media that relate content to specific locations (such as geo-tagged and time-embedded tweets and Flickr photos) are not merely offering spatio-temporal information, but the data that capture momentary hotspots, which present human activities and social processes (Stefanidis et al., 2013). For example, geo-tagged UGC contributes to identifying places (Kennedy et al., 2007), events (Becker et al., 2010), mobility patterns (C. Yang et al., 2019), and perception of environment (Figueroa-Alfaro & Tang, 2017).

1.1.6 Social media and image of contemporary cities

Social Media City was proposed by Sahar Massachi⁵ on December 20, 2021,

⁵ "How to save our social media by treating it like a city" by Sahar Massachi, <https://www.technologyreview.com/2021/12/20/1042709/how-to-save-social-media-treat-it-like-a-city/> (accessed June 20, 2022)

to depict the phenomenon that we are living in social media cyberspace just like we live in a city. This metaphor for me can be explained as two aspects of digital society. On the one hand, it refers to an increasing number of people connected through social media in cities where multifaceted concentrations are happening, including urban population, physical development, and social process of being “urbanised”. Electronic networks enable these interactions built with shared interests or purposes (Castells, 2011, p. 386). As Athique (2013) argues, digital systems are increasingly an integral part of everyday life (p.1). On the other hand, “social media city” indicates a new cityscape – that is, as discussed in section 1.1, abstract spaces produced by social media restructure space practice, thus reshaping urban space. In the age of social media, community-driven platforms have changed how people interact and, more importantly, how people express themselves.

With the advent of digital technology, as discussed in section 1.1, social media documents users’ experience and perception of urban space in terms of mental representations, social lives, and spatial interpretations (Manfredini et al., 2015). Besides, social media is a powerful tool in information dissemination to an unprecedentedly large population due to the widespread adoption of smartphones. The information in cyberspace has tremendously influenced the real world in terms of social activism, economic activity, and political movements, such as the events of Arab Spring (Wolfsfeld et al., 2013) and the #Metoo movement (Manikonda et al., 2018), more examples see Sauda et al., 2021.

Regarding economic activity, city branding or destination branding is widely conducted via social media for investment, tourists, talented people, and events in the competitive global market (Dinnie, 2010; Sevin, 2016). Managers constantly endeavour to differentiate themselves from other cities to attract target groups, such as tourists (Middleton, 2011). British sociologist John Urry

explains why people travel to a place by using the theory of “the tourist gaze” (Urry, 2002). In this, tourists visit a place to see anticipated “signs” or features. Against this backdrop, tourists’ image of a place is constructed by television, brochures, and social media. The city “imageability”, proposed by Kevin Lynch (1964), suggests that observers’ mental impression of a city is a set of predominately built objects. In particular, paths, edges, nodes, districts and landmarks are visual elements that holding the physical surroundings and forming people’s image of a city (Harrison & Howard, 1972; Lynch, 1964). Hoppers (2011) argues that edges and landmarks function as image carriers for tourists, while McCunn and Gifford (2018) find that paths and landmarks strongly contribute to the construction of city imageability and thus strengthen residents’ sense of place.

Notwithstanding Lynch’s place imageability and Urry’s tourist gaze theory were not developed in the context of city branding, more importantly, in the age of social media, these theories foster my passion for enquiring about the relations between social media and urban space, especially green space, which is not only the dominant object of an instagrammable outdoor spot (Arts et al., 2021b) but also a crucial component of urban environment. Li and Yang (2022) point out that social media data, especially images and affiliated information (such as geolocation and text information), has great potential in investigating intangible dimensions of human-nature interactions, such as perceptions and preferences, in the field of landscape architecture.

Studies have shown that natural features, such as parks, street trees, and other urban green spaces, can facilitate physical activities (Humpel et al., 2002; Kaczynski & Henderson, 2007; Richardson et al., 2013), social cohesion (Kawachi & Berkman, 2000), stress reduction and attention restoration (Groenewegen et al., 2006; Wolch et al., 2014), even prevent the annual number of deaths (Barboza et al., 2021). According to United Nations, nearly

55% of the world's population lived in urban areas by 2018, and the proportion is expected to increase to 68% by 2030⁶. That means more than half of the world's population is exposed to stressful urban conditions, such as crowding, noise, and environmental pollution, leading to the risk of mental disorders (Association, 2005). It is especially true for densely populated cities (Berry & Okulicz-Kozaryn, 2011; Okulicz-Kozaryn & Mazelis, 2018; Taylor et al., 1998).

Therefore, urban green space and nature experience are vital to citizens' mental and physical health. Moreover, cities with abundant urban green space have competitive advantages in terms of attracting corporations and workforces, and branding cities with urban green space is regarded as the key to facilitating economic growth (Abass et al., 2019; Braiterman, 2011; Chan, 2017; Hendriksen & Peereboom, 2013). Local governments and city planners have taken action to build a liveable environment by increasing urban green space. Branding for urban green space and city sustainability is regarded as an important strategy for local governments' environmental policy-making (Andersson, 2016), creating a green city image (Gulsrud et al., 2013), attracting tourists (Chan et al., 2015), and promoting health benefits (Chan, 2017).

1.2 Social media in Chinese cities

1.2.1 Social media use in contemporary Chinese cities

China has the largest urban population. There were more than 900 million social media users in 2021, making China the world's biggest social media market⁷. Despite Facebook, Instagram, and Twitter being blocked in mainland China, local social media have become more popular among the Chinese, such as Tencent WeChat (created in 2011, a Chinese instant messaging, social media, and mobile payment app), Sina Weibo (created in 2009, comparable to

⁶ "68% of the world population projected to live in urban areas by 2050, says UN", <https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html> (accessed June 20, 2022)

⁷ "DIGITAL 2021: CHINA", <https://datareportal.com/reports/digital-2021-china> (accessed June 20, 2022)

Twitter) and TikTok (a short-form video sharing platform, created in the Chinese market in 2016). As of 2021, more than 120 million active users post on Wechat social networking Moments, while Sina Weibo had 523 million active monthly users, with 3 in 7 of those using the site daily⁸; ⁹. Inspired by the unprecedented number of Internet users, local governments increasingly utilise social media platforms for city marketing (Zhou & Wang, 2014). Compared with traditional media (e.g., Television, magazines), social media is not only cost-efficient but also encourages interaction and participation of customers with the city governments or other official departments (Cao, 2011).

Naturally, social media has become the targeted platform for promoting cities and tourism destinations because it can expand the influence of customers on an unprecedented scale. It is especially phenomenal in Chinese cities. For example, Chinese city governments opened their official microblogs via Sina Weibo platform, labelling the city names (Zhou & Wang, 2014). These accounts build an overall image of the city by sharing scenic photos, city news, food, and other resources. “Wenlv Beijing” (cultural tourism in Beijing), the official microblog of Beijing Tourism Bureau, has gained nearly 1 million followers as of 2020. It shares travel guidance, nature photography of Beijing parks, seasonal events, and cultural activities. “Wei Chengdu” (microblog of Chengdu), is another example. It has nearly 8 million followers as of 2020 and presents Chengdu's cultural, tourism, and news information to public audiences. Popular destinations also launch their official microblogs. The “Gugong Bowuyuan” (Palace Museum, famous for The Forbidden City), an official microblog of The Palace Museum, has attracted more than 10 million followers via sharing cultural events, exhibition information, exquisite collections, knowledge of Chinese traditions, and advertisement of souvenirs. Providing a dialogue

⁸ Wikipedia contributors. “Sina Weibo” Wikipedia, The Free Encyclopaedia, https://en.wikipedia.org/wiki/Sina_Weibo (accessed June 20, 2022).

⁹ “WeChat users & platform insights 2022”, <https://www.chinainternetwatch.com/31608/wechat-statistics/> (accessed June 20, 2022)

platform for the public, social media is not only widely used by Chinese customers but also the most widespread vehicle for city marketing in China.

1.2.2 City branding, shifting urban green space and state-led planning initiatives

There has been a growing concern across social science that the theories of urban study are mostly rooted and developed in western experiences. Thus, lessons should also be rested on more types of cities, which are not only those of North America and Western Europe but also those of Pacific Asia or “a different category” (by contrast with “the West”) (Hilal et al., 2018; Robinson, 2002; Roy, 2013; Smith, 2001; Vogel et al., 2010). Batisse and Brun (2006) conclude that developing countries with dense urban populations endure the present urbanization; for example, “the urbanization process that occurred in Europe and North America during the nineteenth and twentieth centuries are quite different from the one currently observed [in China]”. With rapid urbanization, changing urban landscapes of large Chinese cities, such as Beijing and Shanghai, are aligned with the transition of economic reforms and land policy (Giroir, 2006; Wang, 2018). More than the growth of the urban population, urbanization is understood as a process containing physical and social change (Champion, 2001), such as concentration of the urban population and adoption of new behaviour norms (Wu et al., 2006, p. 6).

As Kabisch et al. (2015) point out, a growing number of studies address social benefits provided by urban green space, which can increase the liveability of urban environment and mitigate environmental problems induced by urbanization. Breuste and Artmann (2015) explain that urban green spaces (UGS) are “forests, trees, parks, allotments or cemeteries”, or the system that “can provide residents a whole range of ecosystem services”. Urban green space is no longer only an “escape from urban air pollution”. It is especially true for Chinese cities that UGS is a catalyst for wider social and economic benefits

(Wu, 2012).

Urban green space is closely related to contemporary China's urbanization (Wang, 2018), which is in the framework of economic growth promotion, or as Wu (2015, p. 193) states, the aim of China's urbanization is shifted from "serve production and facilitate the living of the working class" to "enhancing economic competitiveness, branding the place, and attracting investment". In this vein, there is nothing new for Chinese local governments to brand cities with urban green space. For example, after the China Ministry of Housing and Urban-Rural Development announced "Garden City" initiative in 1992, there was an increasing number of urban green spaces built for winning the title.

Beijing, as the capital of China, has a rapid expansion of urbanization along with the rise of environmental pollution and growing concern for health (see examples of Edmonds, 1999; Mead & Brajer, 2006; Word Bank, 2007). Beijing has been criticised for its heaviest air pollution. For example, it experienced several haze pollution episodes in January 2013 (Ji et al., 2014). In order to manage urban expansion and environmental issues, the local government approved a green belt policy and established Olympic Park (Du et al., 2014). Beijing's government also tried to establish a green image to the public by utilising the Summer Olympic Games 2008, with the theme "Green Olympics"(Zhang & Zhao, 2009). Control actions included converting coral furnaces into clean fuels, retiring old automobiles, cutting pollutant emissions, and increasing green coverage (Zhang et al., 2016). In 2017, the CPC Central Committee and the State Council approved a general city plan for Beijing from 2016 to 2035, setting the goal of becoming a "world-class harmonious and liveable city". One of the main objectives of this latest plan is that city's percentage of green area will grow from 41.6 percent to 44 percent by 2020 and no lower than 45 percent by 2035. Two green belts will be built and the originally built first green belt is restated as a "city park ring".

As a world-famous tourism destination, Beijing has abundant cultural heritages attracting both domestic and foreign tourists every year. As a global destination, Beijing has relatively sufficient social media data generated from tourists and residents. Besides, national heritages and international events (e.g., Asian Games in 1990, Summer Olympic Games in 2008, and Winter Olympic Games in 2022) lay the foundation for urban park sources, leading to diversified types of urban parks in Beijing (Zhang et al., 2021), such as Traditional Chinese Gardens, especially Imperial Gardens (i.e., The Summer Palace, Beihai Park, Yuanmingyuan Park etc.), Public Parks (i.e. Olympic Park, Olympic Forest Park etc.) and religious temples (i.e. Temple of Heaven, White Cloud Daoist Temple etc.). Thus, Beijing is well suited to the purpose of exploring the representation of urban green space via social media space.

1.2.3 China's Wanghong economy and urban green space

There is a trending phenomenon in China's social media – Wanghong economy. Wanghong, short for “Wangluo Hongren” or “red on the internet” (analogical term in Chinese), is the vernacular term for internet celebrities (Abidin, 2018, p. 2). In a narrow view, it is a nascent digital economy in China based on online-advertising by internet influencers, in other words, a new marketing strategy for companies (Abidin, 2018, p. 3). Wanghong economy is probably a pertinent phenomenon that digital information is deliberately created and spread to influence peoples' perceptions and behaviours. However, digital information is also distributed by ordinary people, who “merely convey that they are not experts or celebrities and are famous for assorted reasons”(Abidin, 2018, p. 5). According to QuestMobile, one of the top China's big data service providers the Chinese monthly average MAU (Monthly Active Users) was 1.135 billion in 2019, indicating that Internet celebrities now have a wider audience of potential fans than ever before. Thus, a more diversified group of internet influencers are thrust into the spotlight, when the contents of whose are self-determined and social media are opened to a wide array of class positions (Turner, 2010)

(Turner, 2010). Turner terms this phenomenon as “demotic turn” (p. 2).

The Wanghong economy is followed by Wanghong Jingdian (Internet-famous places) or Daka Shengdi (photogenic spots for social media) in China. It means that rather than branding commodities, users tend to show locations that are very popular across social media by taking photos and upload to social networking site. Locations can be open space, a shopping mall, a small restaurant or a museum. Main difference between Internet-famous places and traditional places of interest is that people obtain visiting information about Wanghong Jingdian from social media, usually in the form of photos shared by users, and tend to share images of these places online when they visit. Thus, these online photos not only present perceived city images and explain the public perception of a place in the real world (Huang et al., 2021) but also function as evidence for the correlation between specific landscape attributes and landscape preference (Tieskens et al., 2018), human-nature interaction in urban green space (Ghermandi et al., 2022), landscape features associated with cultural ecosystem services through cross-site comparison (Oteros-Rozas et al., 2018), and characteristics of different cities (Zhang et al., 2019).

These new interactivities are produced through user-generated content and mobile devices (Turner, 2010, p. 125). Social networking sites deeply rely on users and user-generated content. To complete its brand, these sites act as an infrastructure for users to hold their content, a community then is emerged in cyberspace (Petersen, 2008). These sites also offer multiple ways of interacting with their friends. For example, in addition to sharing content, users can comment, like or dislike content, add tags, add notes, add friends to a list and create a profile. It is the richness of interaction and participation that bond social media sites with everyday life. Petersen (2008) argues that users share photos online with enthusiasm because “the huge amount of work that goes into each personal site is paid back in an affective currency: the joy and

significance these sites bring to their users.”

1.3 Research question and objectives

The overarching aim of the research is to explore landscape preference of urban green space in Beijing from the perspective of everyday practice in the context of web 2.0. More importantly, it focuses on exploring how social media influence the everyday use of urban green space and, in turn, what representations and picturing practices reflected by social media can reveal about experience and preference. Therefore, the key research question is:

What characterizes landscape preferences which are embedded in everyday use of urban green space in the age of social media?

As discussed in section 1.1 and section 1.2, social media is widely used in place branding practice, which may influence visitors, especially tourists' behaviour and photography practice, this research concerns explicitly the nuance of landscape preference caused by different sociocultural factors, namely place popularity, social groups, and everyday practice. Accordingly, the objectives of this research and sub-questions for each objective are:

(1) To explore the correlation among visual social media use, urban green space use, and subjective well-being.

- Is there a correlation between the utilization of visual social media and the use of urban green space?
- Does the use of social media, especially visual social media, associate with subjective well-being?
- How does the nature experience affect subjective well-being?

(2) To investigate landscape preference reflected by visual social media from perspectives of place popularity and social group.

- How do spatio-temporal patterns of photo-taking behaviour correspond to advertised attractions and unadvertised attractions in urban parks?
- How do the contents of photos differ between advertised attractions and unadvertised attractions in urban parks?
- How do spatio-temporal patterns of photo-taking behaviour differ between residents and tourists in urban parks?
- How do contents differ between the photos taken by residents and those taken by tourists?

(3) To understand landscape preference embedded in everyday use of urban green space and the role of social media in shaping it.

- How landscape preference embodies everyday use of urban green space in the age of social media?

1.4 Thesis structure

This research starts with an introduction including research background, key theoretical arguments, rationale of case study location, research questions and objectives, and summary of thesis contents.

Chapter 2 firstly reviews existing definitions, theoretical debates, and empirical studies in relation to perception and preference of landscape. Then it focuses on the interaction between use of visual social media and use of urban green space. Specifically, an overview of online photo sharing by reviewing the affordance of visual social media, photo-taking behaviour in everyday living, and users' motivation for online sharing. Moreover, drawing on the concept of "tourist gaze" proposed by Urry, it discusses the sightseeing practice of nature in cities from both evolutionary and social perspectives. Then, it discusses the background of case study area. It provides an overview of changing landscape of contemporary Chinese cities by reviewing the ecological

shifting background and the influence of planning initiatives on the appearance of urban green space. Finally, it concludes with visual social media as a research object and approach to examine landscape preference and to explore its reflexive influence on the everyday use of urban green space.

Chapter 3 highlights how the theories and empirical studies underpin the formulation of methodology for this research. In doing so, it first discusses a conceptual research design, including a justification for selecting case study research and utilization of mixed method, including quantitative and qualitative analysis. Then it describes techniques and approaches applied in this research, namely social media data harvesting, social media analytics, questionnaire survey, and semi-structured interview. Then it introduces the background of case study area and outlines the method of selecting case study parks. Ten urban parks in Beijing are selected for the case study. The chapter also includes data analysis corresponding to the three techniques and approaches mentioned above. Lastly, it discusses research ethics with respect to harvesting data from social media.

Chapter 4 concentrates on outlining interactions between use of visual social media and everyday use of urban green space and the well-being consequences. The data presented in this chapter is taken from the result of analysing online questionnaire surveys by applying an adjusted questionnaire (GSU&SMU questionnaire). Descriptive analysis, ANOVA test/t-test and fixed model regression analysis are implemented for data analysis. In doing so, the chapter discusses three subthemes in relation to visual social media, urban green space and subjective well-being: the connection between use of visual social media and subjective well-being; well-being consequences comparison between destination park use and neighbourhood park use; and the connection between nature experience and subjective well-being. This chapter provides an insightful start point to further explore landscape preference embedded in the

interactions between urban green space use and social media use.

Chapter 5 focuses on what visual social media reveals about landscape preference. Drawing on the theoretical discussions on “tourist gaze” and online photo-sharing, this chapter discusses the influence of place popularity and social group (residents vs tourists) on representations of nature experience and spatio-temporal patterns of photo-taking behaviour extracted from visual social media. It presents the result of social media analytics, including spatio-temporal patterns of hotspot-trajectory maps and textual themes of photo contents. In doing so, it identifies the distinctiveness of photo topics between advertised places and unadvertised places, while the social group has no evident influence on photo topics. Different visit strategies are identified between the resident group and tourist group. In the end, it evokes a reflection on a blurry boundary between residents and tourists in terms of nature experience and evokes a consideration of what landscape preference means in individuals’ everyday living.

Chapter 6 depicts the way people integrate urban green space into their everyday practices, their perception of natural elements and the role of social media in the interaction between urban green space and everyday living. This chapter reveals how landscape preference is shaped by individual’s everyday practice and use of social media. It identifies rich meanings of preferred landscape in a sociocultural context.

The thesis concludes in chapter 7 by firstly summarising research aims and key findings. Then it discusses the appropriateness of methodology developed for addressing research objectives. It highlights limitations, key implications, and contributions the present research has made. At last, issues for future research are identified.

Chapter 2 Literature Review

2.1 Introduction

As discussed in the previous chapter, user-generated content is increasingly an integral part of everyday lives via ubiquitous social networks, affecting everyday practices. This chapter seeks to understand landscape preference when visual media intertwine with social networking sites. In order to shed light on understanding the relationships between digital technologies and landscape preferences, the first section reviews existing theories and empirical studies related to landscape perception and landscape preference. It is recognised that studies of landscape perception and preference cannot always verify evolutionary explanations because humans perceive living environments ecologically and socially. Rather, it can be confirmed that a strong connection exists between the natural environment and landscape preference.

Section 2.3 first discusses the research on interactions between visual social media and photographing practice. Then it takes a step back to two fundamental aspects. First, the relationships between sightseeing and urban nature is highlighted from ecological and social perspectives. Second, a detailed investigation is conducted in terms of how digital photos and photo-taking behaviour are integrated into everyday living. Then it illustrates a growing body of research on how nature is visually represented on social media and users' motivations for sharing photographs on social media. It then reviews the consequences of social media use from perspectives of physical activities and subjective well-being. Lastly, it reviews existing studies of landscape preference through mining big data in Chinese cities.

Furthermore, section 2.4 provides an overview of how natural elements are institutionally situated in contemporary Chinese cities, specifically the top-down

planning system of ecological modernization and initiatives on urban green space. The implemented strategies offer the background of how natural elements are incorporated in forming contemporary Chinese cities. It shapes residents' imagery of urban green space and sightseeing practices in cities.

2.2 Landscape perception and preference: theories and empirical studies

A growing body of theories and studies concentrate on exploring human perceptions of living environment and landscape preference from the perspective of environmental psychology. A brief introduction of prevalent theories and empirical studies is presented and underpins the basis of formulating research questions.

2.2.1 Definition of perception and landscape preference

Perception is a process of organization, identification, and interpretation of sensations to form a mental representation of the environment (Schacter et al., 2009). The key to understanding experience of the environment is how surrounding information is perceived and transformed into perceptions through sensory receptors. Foster (2000) identifies three fundamental positions: direct realism, representative realism, and idealism. The first two stances accept the claim that physical environment is independent of the human mind. In contrast, a direct perceptual process accounts for direct realism, while a mediated mental process accounts for representative realism. In the framework of realism, the dispute is whether humans are aware of their surroundings through the direct perception or indirect perceptual process. Idealism is more radical in rejecting the claims that the physical world is ontologically independent of human mind (Foster, 2000). Thompson (2013b) describes the divide as a “bottom-up approach” and a “top-down or constructivist” stance. The former, as Gibson (1961) points out in the study of vision, is concerned with an optic array that

may stimulate human ocular system, and the latter focus on the cognitive processes of constructing awareness of what is out there (such as previous experience, expectations, and interpretations contribute to this process). The Gibsonian definition (2014) of direct perception is the “process of information pickup” through exploratory actions, while mediated perception describes retinal images (or mental images) are the mediators between inputs of the optic nerves and attaining information.

The value of the theoretical perspectives resides in organising and framing further inquiries to research objects. Both theoretical stances mentioned above are developed in different scientific domains. Firstly, the science of ecology addresses the interface of physical and biological processes (Odum & Barrett, 1971). Ecosystem, coined by A.G. Tansley in 1935, is used to describe an interaction system containing the environment and the organisms (Evans, 1956). An ecosystem can be a population with its environment or the biosphere with the total environment. Organisms are isolated neither from each other nor from the environmental factors. Rather, they are connected in a network through energy exchange among biotic and abiotic. This systematic viewpoint bears a resemblance to Gibson’s notion of perceptual systems, in which senses work as interrelated subsystems. Gibson (1966) states that:

“The perceptual systems, including the nerve centres at various levels up to the brain, are ways of seeking and extracting information about the environment from the flowing array of ambient energy.” (p. 5)

From an ecological perspective, perceptions are not a series of discrete frozen retinal images from which humans can pick up information, but the flows of stimulations derived from invariances in the environment (Haber, 1980). However, the cognitivist viewpoints focus on the workings of human mind. Purcell (1986) argues that the environmental experience is prototypically

organized. A *schema* of an object is previously formulated as a set of hierarchical knowledge stored as physical attributes of the environment (Purcell, 1987). Accordingly, judgments of the environment, such as aesthetic responses and affective responses, are derived from the comparisons between the *schema* and the specific instance. Purcell's experiments suggest that visual stimuli are seemingly inadequate to describe human perceptual experience because of the enriching cognitive processes. Indeed, Grush(2004) argues that the brain not only engages with the body and environment but also constructs neural circuits that act as the models of the body and environment. Thus, an emulation theory of representation was developed to reveal various representational functions of the brain. "Perception just is, in my account, sensation given an interpretation in terms of the environment emulator", Grush mentioned. Whilst his cognitivist stance ignores the animacy in exploring perception, the studies of embodied cognition may differ from this aspect (Johnson, 2007; Rowlands, 2010; Shapiro, 2010; Varela et al., 2017). Focusing on the relationships between the environment and active individuals is a promising shift to understand landscape perceptions.

2.2.2 Perceived landscape structure

Landscape structure is the physical features of the environment, including the configuration of the detached parts and the landscape form as a whole. Higuchi (1983) concludes with eight indexes of landscape visual structure:

- Visibility: what the observer can see and cannot see.
- Distance: The distance between observers and objects.
- Angle of incidence: The degree of visibility of different concatenations of surfaces in a landscape.
- Depth of invisibility: The degree of invisibility that measures the depth of unseen section in relation to the line of vision.
- Angle of depression: The positions of observers when looking at a scene from above.

- Angle of elevation: The degree of visibility of the observer's upward view.
- Depth: The degree of three-dimensionality of the landscape
- Light: The changing appearance of the landscape depending on the position of the light.

In Higuchi's view, for example, trees are visible as individual units in a short-distance view, as textual units in a middle-distance view, and as a backdrop in a long-distance. In light of Gibson's visual perception of space, depth is the key to perceive the three-dimensionality of space(Higuchi, 1983). Hilal et al. (2018) developed a GIS based-method to model the potential view shed of observers' standing point. This study follows Higuchi's visibility and invisibility of landscape, which are determined by the topography, built structures, and vegetation. Dramstad et al. (2006) examined the correlations between landscape structure and preference. It shows that the view sheds containing water is preferred over those without water. Clear vegetation belts are also preferred because they indicate the presence of waterways. This study also demonstrates that the groups of observers differ on the preference for landscape heterogeneity. Fry et al. (2009) further discuss the landscape structure based on the common ground of visual characters and ecological functioning (Figure 2.1). This study systematically reviews the structural indicators of aesthetics and ecology, suggesting an overlap at the indicator level. In other words, many visual landscape indicators are derived from landscape ecology, such as complexity and naturalness. However, some landscape features seem to give a landscape identity and uniqueness, such as old trees, boundaries, panoramic views (Fry et al., 2009).

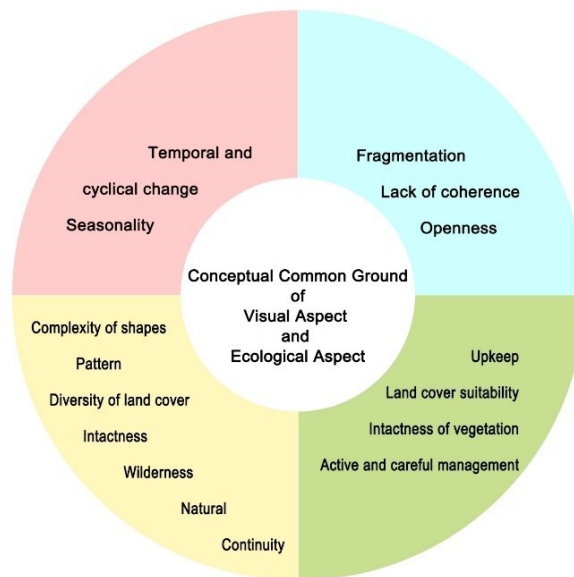


Figure 2.1 Overlap between visual landscape structures and ecological functions at the concept level

Source: Fry et al., 2009

Krause (2001) has discussed the correlations between perception of spatial landscape structure and landscape identity, arguing that the spatial characters in an area are crucial standards in evaluating landscape aesthetic qualities. Ode et al. (2010) further discuss the connotation of complexity in assessing the visual quality of landscape. The study shows two dimensions related to the visual complexity of landscape, namely the richness and distribution of landscape elements, and variance in the linear geometry of landscape. Many studies (de Val et al., 2006; Dramstad et al., 2006; Fry et al., 2009) illustrate that visual elements of environment structure are related to ecological functions, which aligns with the stance of Gibson's ecological approach and Kaplan's preference studies (Kaplan & Kaplan, 1989).

2.2.3 Lewin's Field Theory

Kurt Lewin (1943) proposes the formula $B = f(P, E)$, namely 'behaviour = function of person and environment', to indicate that behaviour is the resultant totality of person and environment. He characterises the field theory as a method to "analyse causal relations and build scientific constructs" and explains

the Field Theory as:

Any behaviour or any other change in a psychological field depends only upon the psychological field at that time.

The formula $B = f(P, E)$, as Lewin expresses, is:

“In this formula for behaviour, the state of the person (P) and that of his environment (E) are not independent of each other... In this equation, the person (P) and his environment (E) have to be viewed as variables that are mutually dependent upon each other. In other words, to understand or to predict behaviour, the person and his environment have to be considered as one constellation of inter dependent factors”. (Lewin, 1951, pp. 239-240)

In Lewin's viewpoint, totality is examined throughout the field-theoretical approach, which examines certain types of behaviour depending upon the constellation of the person-environment factors rather than isolated facts (Lewin, 1939). For example, in the explanation of *social group* and *adolescence behaviours*, Lewin analyses the adolescents' (1) general situation from perspectives of life-space and cognitive character; (2) social position among different social groups and; (3) other specific factors such as attitudes and emotions (Lewin, 1939). He points out a principle of characterising events and objects: “exploring their interdependence rather than their similarity or dissimilarity of appearance”, which align with the key statement of Gestalt psychology -- the whole is more than the sum of its part, but has different properties. Another example of this constructed *field*, cited by Heft (2012), is that sound of the drum (the phenomenon) only happens when the drum and drummer jointly constitute the event (Keller, 2010). The properties of this event (or *the field*) are the practice of drumming (tests of the present) or the knowledge of how to drum (conclusions from history) in a Lewinian vein (Lewin, 1943). Finally, field theory concerns concurrence and history, previous

experience, and sociocultural context, which is commonly misunderstood in the literal sense (Lewin, 1943). As such, the meanings (or the properties) of a psychological phenomenon do not reside in physical or mental factors alone, but in the relational property of all factors in the framework of space/time dimension.

2.2.4 Gibson's ecological method

The nature of perception is not the process of receiving lights from the environment and simply constructing a stationary mental image but 'what the environment affords' from an evolutionary stance (Heft, 2010). Darwin's theory of evolution, as Heft argues, sets the foundation of this argument because the studies of vision shift from a physiological investigation to a functional consideration, namely, what perception means to living of organisms. The concept of affordance, which is coined by Gibson (2014) in 1979, bridges the physical properties of the environment and psychological perception of the environment. The environment is perceived with functional meanings or possibilities resulting in specific responses (or actions). In this regard, affordance cut cross the dualism of subjective-objective, as Gibson stresses that 'an affordance is neither an objective property nor a subjective property; or it is both if you like'.

There are three basic observations or ideas as prerequisites of affordance: firstly, the process we experience the environment is not merely an action of gathering information from surroundings. Rather, we do it in a continuous, ongoing manner. Stimulus are input in a stream into heads within the process of constructing, comparing, and representing. Secondly, perceiving is the process in which perception and action are intertwined. Specifically, the perceiver and environment are in a dynamic, active and reciprocal relationship. In this regard, an environment-person dichotomy, which sets the foundation of an interactional and a transactional viewpoint, is inadequate in grasping

environmental properties because subjective meanings imposed into the environment can be distorted and unidentifiable (Wohlwill, 1973). Thirdly, awareness is the primary function of *knowing* in context. Dewey (1896) pointed out that “sensation as stimulus” was not a physical entity but a function acting as a start phase of an action. James (1976) urged to abandon the view that consciousness (or awareness) is an entity from which our thoughts are made. Rather, he argued that awareness was the process of knowing, a function of the mind, which was the relationship towards one to another.

Affordances are functional possibilities that the environment affords organisms. This notion implies that environmental properties are perceivable. Animals directly perceive the meanings and values of things in the environment (Gibson, 2014, p. 119). Warren’s (1984) investigation of step affordance illustrates that the affordance property – *Pi* value ($Pi = \text{leg length}/\text{riser height}$) – can be objectively calculated and perceived by participants. The experiments suggest that observers are capable of perceiving climb-ability of the environment visually. Gibson describes other instances: people perceive the property of a surface as stand-on-able or walk-on-able because it is a surface of support, while the surface of water is sink-into-able; a bench is sit-on-able for its keen-high property. Studies have expanded perceived affordance properties in terms of climbing (Konczak et al., 1992), sitting (Mark, 1987), lifting (Runeson & Frykholm, 1981) and walking (Wagman & Malek, 2008). Research has shown that perceptions of affordance is body-scaled as it is the process of relating environmental properties with individual’s action systems (Warren Jr & Whang, 1987). In Wraga’s (1999) experiments, eye height influences the judgement of object height than object width. Wagman and Malek’s study (2008) further illustrates that the affordance of walking under the barrier is body-scaled regardless of standpoints. Ellis and Tucker (2000) point out that the visual world also provides viewers with the selections of possible action components. Further, perceiving environmental affordance is a dynamically changing

process rather than a static, one-off judgement. Mark et al. (1990) argues that, in addition to visual exploration (usually sufficient in most cases), information-gathering activities enable observers recalibrate their own capabilities and judge environmental affordance. Action feedback is proved to facilitate accurate judgements (Franchak et al., 2010).

The literature mainly focuses on the physical properties of the environment, partly because cultural metrics are difficult to measure, such as the meaning of a place. Separating natural and cultural environments is problematic (Gibson, 2014; Heft, 1989, 2001). Physical and sociocultural contexts jointly elicit certain behaviour in planning and designing outdoor spaces (Thompson, 2013a). Perceiving environmental affordance is a process of identifying structures and relations of things, which are carried by ambient lights. However, as social engagement pervasively saturates our everyday life, the interactions with others influence our physical and mental well-being. In this sense, if perceiving is the process of picking up structures and relations in the environment, the structures and relations are not necessarily physical or material. They are also derived from wider sociocultural surroundings, such as from identifying others' behaviours (Baldwin et al., 2008), the place constructed by collective human actions (Heft, 2007), and the knowledge learned from other members of the culture (Heft, 1989).

2.2.5 Lynch's Image of the City

Kevin Lynch proposes that human's mental representations is central to identifying the environment, since we are mobile animals. In this regard, the legibility of the human settlement or the city is critical to way-finding behaviour. Visual elements of the environment are restructured into observers' mental image by imposing meaning and identity to striking physical features (Lynch, 1964). Five basic elements, as Lynch illustrates, form people's image of the city, which are (Figure 2.2):

- Paths: streets, walkways, canals, and railroads that observers can move through.
- Edges: linear elements that are not used as paths, such as rivers and walls.
- Districts: city sections that can be entered into and recognised from outside.
- Nodes: point-reference that observer can enter into. Intensive foci of the districts or conjunction, convergence of the paths.
- Landmarks: point-reference that observer does not enter within, an external reference, and can be buildings, sign, store, mountains, isolated tower, trees and so on.

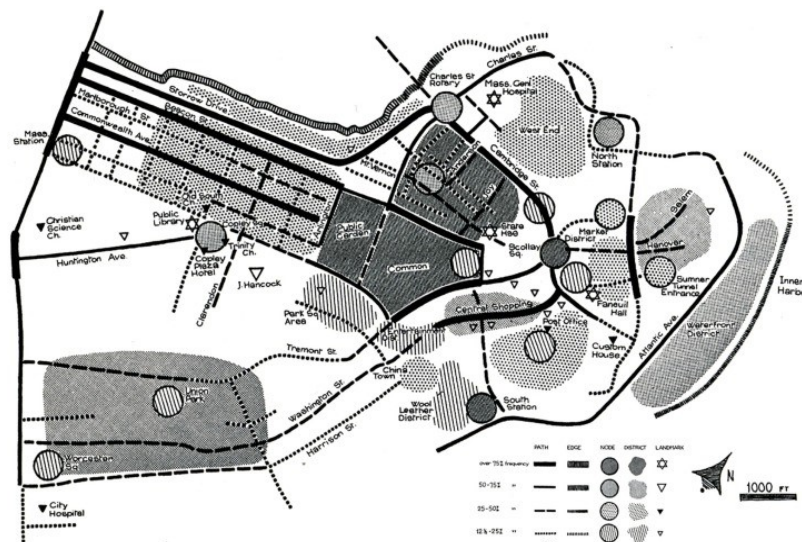


Figure 2.2 Image of Boston by Kevin Lynch (1964)

Accordingly, Lynch argues that, for aesthetic purposes, urban planners and designers are supposed to make the physical features of cities legible. For example, the flows of visual information gained by drivers and passengers when moving through highways is enjoyable if the motion is continuous (Lynch, 1964). Indeed, from a functional viewpoint, shapeless environments and orientation blindness is disappointing for people to orient themselves and calculate the distance to goals. Therefore, the image of highway should be clarified from following dimensions (Appleyard et al., 1964):

- Successive sections need to be a rich, coherent sequential form.

- Clarify and strengthen a well-structured environment image so that observers can locate themselves on the way approaching the goal.
- Regulate the attention tempo with rhythm: a rapid tempo is when people concentrate on specific objects, while a slow tempo is when people scan the roadscape.
- Impose meanings and values to the scenes along the highway so that give observers an understating of the nature, history or symbolism of the landscape.

Mental map adopts a bird-view approach when sketching perception of environment, while people, as a mobile animal (as Lynch mentioned before), perceive objects not only from physical standpoints (such as texture of surface, colour of buildings, and silhouette of landmarks) but also from an ecological perspective that optic array of information is generated by locomotion. Jones and Boltz (1989)'s laboratory research suggests that there exists an event structure when people estimate time intervals: the transformations (changes), invariants (non-changes) and their functional properties to organisms (Gibson, 2014). This idea aligns with Heft's statement: there are two types of perceptual information: perspective structure, which is generated by actions, and invariant structures, which remains constant, in process of locomotion (Heft, 2012). The study illustrates that temporal patterns are inherently related to attending activities, in other words, time is not independent from events. Rather, organisms have inherent rhythmicity so that they are related to the temporal patterns of environment reciprocally in an event-timed world.

In Lynch's Site Planning (1984), the temporal dimension is essential. He focuses on human behaviours responding to environmental settings. In this regard, designers are encouraged to concentrate on activities elicited by specific environments. For example, different types of clients are supposed to be identified and arranged in separated spatial and temporal territories (p. 98).

The site planning orientation differs from labelling the site with 'path', 'benches', 'shelters' and so on by paying attention to activities that the site furnishes, such as jogging, walking and sitting (Thompson, 2013a). This idea aligns with the concept of affordance as they focus on the relational properties of the environment. Temporal order, as Lynch further states, can be 'expressed' through design. For example, the sense of passage is strengthened by landscape or cycles of the sun. Establishing a mental map is helpful for designers to understand the site and develop new plans for it. However, observers' mental image is not necessarily map-like but could be an optic flow of landscape features following certain temporal rhythms (Heft, 2012; Jones & Boltz, 1989).

2.2.6 Appleton's Prospect Refuge Theory

Vision is central to percept environmental information. Appleton (1996) describes the primitive behaviour of creatures: hunting, the foundation of which is to seek a place where the quarry or predator can easily be seen without being seen so that they can achieve to catch or escape immediately. Therefore, animate beings prefer the condition of seeing (the prospect) without being seen (the refuge), and this survival needs have been expressed by Lorenz (1952):

"... We reconnoitre, seeking, before we leave our cover, to gain from it the advantage which it can offer alike to hunter and hunted, namely, to see without being seen...this age-old strategy proves beneficial. We do actually see someone who is not yet aware of our presence..."(pp. 181-182)

The settings providing openness and seclusion are illustrated as preferred types of landscape. For example, the savanna is reported as preferred landscape due to the hypothesis that there forms an innate preference for certain types of environmental settings (Balling & Falk, 1982). Appleton (1996) describes how the prospect-refuge theory attributes to landscape preference:

“... because the ability to see without being seen is an intermediate step in the satisfaction of many of those needs, the capacity of an environment to ensure the achievement of this becomes a more immediate source of aesthetic satisfaction.” (p. 73)

The objects symbolising prospects and those symbolising refuge are interacted with each other and there is no absolute demarcation between them. Ruddell and Hammitt (1987) propose that the prospect refuge theory is a psychological explanation of preference for edges in the realm of recreation in a study of exploring prospect-refuge patterns in the natural environment. Their study shows that the most preferred location is where people can easily go to the woods (labelled as a refuge) and freely move through in open space (labelled as a prospect). Ecologists stress the crucial role of ecotone (the edge), which is a linear transition space between two or more communities, and the term *edge effect* to describe a phenomenon of “increased variety and density at community junctions” – between forest and meadow, water and land etc. (Odum, 1971). Other studies also indicate that forest edge is a positive predictor of scenic preference (Hammitt et al., 1994) and thus can be utilised as resource of amenity (Fry & Sarlöv-Herlin, 1997).

However, Hagerhall’s (2000) findings demonstrate that the feeling of openness (the prospect) is not grouped with that of safety (the refuge) but with object-related questions, indicating that people may perceive overviews and the objects in sight simultaneously than perceive feelings of enclosure. The result of examining prospect refuge theory is inconsistent despite its wide acceptance, see results of (Stamps, 2008a, 2008b)). This may be due to the small number of participants, inaccuracy of controlled stimulus, lack of in-depth survey and exploration of different cultural backgrounds (Dosen & Ostwald, 2016).

2.2.7 Landscape preference in sociocultural context

Human beings are also social individuals, who create cultural meanings and values to place, meanwhile they are reflexively influenced by the accumulated meanings and values (Tuan, 1977). Perceived well-being outcome which is associated with green space interactions is also influenced by sociocultural factors such as life stages, shifting life circumstances, cultural metaphor and personal orientations (Bell et al., 2014).

The existing studies on why people's choices differ in urban green spaces lie two-fold. First, memories and experiences attune individuals to ways of interaction with green spaces. Given that green space is the backdrop of social interactions, it serves as reminder of past life circumstances, such as childhood and community life (Burgess et al., 1988). For example, the woodland visit has a strong connection with childhood experience (Thompson et al., 2005). Specifically, an early contact with nature in childhood contributes to adult attitudes toward natural environment and green space use (Thompson et al., 2008). Asah et al. (2012; 2018) propose the phenomena of nature-acculturation to explain the importance of childhood contact with nature on forming preference for adulthood nature-based activities. Bonnes et al. (2011) elaborate how habit influences green space use and hence what kind of activity the green space afford that counts. In order to find a suitable place for specific activities, such as meeting friends and walking the dog, people may end up choosing an alternative place nearby, which happens to be a green space. This argument is challenged by another study (Chang et al., 2020), which illustrates the connection between fun activities (or relaxing moments) and the presence of nature as background via examining content of social media photographs in cross-national level. This suggests that positive responses are likely a result of cultural practice (including daily routine) and biophilic inclination.

Further, much research focuses on barriers that prevent people from using green space. For instance, ethnic individuals tend to recreate in large groups when using urban parks (Sasidharan et al., 2005). The barriers are situated in wide sociocultural context, such as social norms, attitudes, economic status, life/age stage, ethnic groups and personal perceptions (Bell et al., 2007; Morris et al., 2011). In a study of green space use in Denmark, different social groups show different patterns of green space use, whilst distance is still significantly associated with use of green space (Schipperijn et al., 2010). In recent years, efforts have been made to explore the negative effects of gentrification process accompanied with greening interventions (Anguelovski et al., 2019; Cole et al., 2017; Jelks et al., 2021; Wolch et al., 2014). Rigolon and Németh (2020) challenge previous hypothesis that “small and scattered do not trigger green gentrification while larger parks do”. They demonstrate that functions (such as functions of greenway) and locations of green space (such as downtown vs. periphery) contribute to the gentrification process.

2.3 Visual social media and urban green space

The practice of seeing and representation of seeing are important aspects in people’s everyday lives. Smartphones and cameras make it much easier to take photographs. Growing social media platforms with cheaper internet services afford visual content sharing for everyone. This section concentrates on how features of social media, especially visual social media, afford photo-sharing practice and, more importantly, to understand the phenomenon that visual social media is incorporated in the sightseeing practice. In the field of landscape architecture,

2.3.1 Affordance of visual social media

Drawing on the notion of *affordance* from ecological psychology, which refers to the “opportunities for action” perceived by organisms from living environment

(Gibson, 2014), it is a helpful lens when it comes to understanding human-technology interactions (Cabiddu et al., 2014). Technology affordance suggests that:

“... technology can be understood as artefacts which may be both shaped by and shaping of the practices humans use in interaction with, around and through them.” (Hutchby, 2001)

When Web 2.0 and the ubiquity of social media platforms afford individuals' remote communicating and sharing information. User-generated content, as Kaplan and Haenlein (2010) argue, is a sum of all ways about how individuals make use of social media. The hidden idea is about publicly exchanging information created by end-users. Social media allow users to easily produce, edit and share content through mobile-based apps or by entering a link to a browser. Visual social media, such as Flickr and Instagram, is image-centred platforms that allow and encourage users to produce and share photos captured in their everyday lives. Visual representations are also shaped by different ways of visual elements. Multimodal resources are configured on certain social media platforms (Adami & Jewitt, 2016). A review study suggests that the affordance of social media is functional and user-dependent according to their goals, capabilities and practice (Hafezieh & Eshraghian, 2017).

Though users' online engagement and interaction is realised by similar features of social media platforms, such as likes, shares, comments, geotags and hashtags, no two platforms are used in the same manner (Bucher & Helmond, 2017; Lim et al., 2015). For example, both Flickr and Instagram concentrate on photo sharing. However, Flickr is designed for establishing a photography community of photo hosting and sharing (<https://www.flickr.com/about>), allowing users to create virtual photo albums and manage digital photos based on timelines or topics that are meaningful to them. It is commonplace for Users of Flickr including professional photographers and amateurs (Burgess, 2006)

to share photos within different groups (Negoescu & Gatica-Perez, 2008). In comparison, Instagram emphasises on connecting, sharing and self-representing (<https://about.instagram.com/>) via images. It contains three modes for sharing: a single post with one to ten images, maximum of 2200 characters for each post and maximum of 30 hashtags for each post. The *like* feature (a heart button) for each post, as Bucher and Helmond (2017) point out, is generated by audiences and the post function as a standardized moment or shared experience that feeds back to end-users. Moreover, this feature serves as a universal currency in social media for the measurement of engagement. In this regard, individual's photo content is more likely to follow influencers' visual aesthetics and reflect dominant values if they want more followers or *likes* (Smith, 2021). In short, photographic representation is not only associated with personal preference and social norms but also limited by platform affordance.

2.3.2 Sightseeing and nature in city

2.3.2.1 Gaze in research

Foucault proposes the practice of seeing – the gaze – establishes its power to know and decide:

“... The clinic was probably the first attempt to order a science on the exercise and decisions of the gaze ... the medical gaze was also organized in a new way ... it was not bound by the narrow grid of structure (form, arrangement, number, size), but that could and should grasp colours, variations, tiny anomalies ... was not content to observe what was self-evident; it must make it possible to outline chances and risks; it was calculating.” (Foucault, 2012, p. 101)

The medical gaze concerns the process of “see” to obtain knowledge about diseases (Greenhalgh, 2001). Indeed, Foucauldian ‘power of eye’ sheds light on the awareness of normalised behaviours and decisions in tourism (Hollinshead, 1999). Vickers (1995) explains the gaze behaviour as “a fixated

gaze on a location in the targeting environment or a shift in gaze from one environmental location to another”. Urry proposes the term *Tourist Gaze* to describe the gaze behaviour of tourists. He states, “We gaze at what we encounter. And this gaze is as socially organised and systematised as is the gaze of the medic... such practices involve the notion of *departure*, of a limited breaking with established routines and practices of everyday life and allowing one’s sense to engage with a set of stimuli that contrast with the everyday and the mundane. ...”. In this sense, the tourist’s gaze is a series of expectations that are socially constructed to seek for authenticity experience of the local environment. In contrast, Maoz (2006) coined the notion *Local Gaze* as a complementary term to *Tourist Gaze* to “discuss the agency and the power of locals in Third World countries”. Wassler and Kirillova (2019) explain the local gaze as the “locals’ own construction of tourists as the ‘exotic’ other”. The tourist gaze and local gaze are a pair to describe the interactions between tourists and locals. Mareggi (2017) discusses the gaze in everyday living and describes it as “...the everyday as what is over-familiar in our urban landscapes and as what escapes to the absent-minded gaze, ...”. The three types of gazes are able to transform into each other depend on the observer’s response to the environment. For example, locals possibly have tourist gazes if they are in a new park. Tourists may have local gazes if they revisit a park regularly. They would have absent-minded gaze on the way to the place of interest. For Lutz and Collins, the practices of seeing by photographers, readers and other viewers form intersections of gazes, and multitude lines of gaze suggest the forces work together to create photographic meanings (Lutz & Collins, 1993, p. 188).

2.3.2.2 Evolutionary perspective

From an evolutionary/ecological stance, Kaplan and Kaplan have put forward the key concept of attention restoration theory (ART), which suggests that objects related to human evolution, such as natural landscapes, likely draw

people's directed attention/involuntary attention (Kaplan & Kaplan, 1989). In contrast to the direct attention/voluntary attention that requires effort which induces fatigue from repeated use, Kaplan and Kaplan (1989, p. 182) argue that involuntary attention or "resting directed attention" contributes to recovering effective cognition functioning. James William (1984, p. 173) points out that experience is individualised due to different habits of attention, in other words, an object will not become part of our experience unless we notice it, even if it presents to a person one hundred times. Another condition, as James notes, is akin to the tourists' experience because tourists likely visit a place once in a lifetime and bring back home picturesque impressions and memory, while locals are more likely selective for the usefulness, such as where is the restaurant or bank. James stresses on the power of habit formulated and constructed by modern society as the "instinct" of individuals. What stimulate involuntary attention, in James's viewpoint, is a sense-impression or an instinctive stimulus with "a directly exciting quality", such as "strange things, moving things, wild animals, bright things, pretty things, metallic things, words, blows, blood".

2.3.2.3 Social construction and city branding

The benefits of *back to the nature* are explored in depth through evident-based studies (Bowler et al., 2010; Chen et al., 2011; Cimprich & Ronis, 2003; Kaplan, 1995; Ohly et al., 2016). Nature imagery stimulates similar emotional responses to the interaction with pleasant natural settings (Hartmann et al., 2013). Therefore, citizens often relate the natural environment to well-being (Fretwell & Greig, 2019). Accordingly, this attitude towards nature promotes activities in urban green space (Sang et al., 2016). Awareness of benefits of connecting with nature motivate people to spend time in natural environment (Abass et al., 2019; Fretwell & Greig, 2019). Positive social acceptance of urban greenery contributes to the expectation and attention to green space. The gaze at natural environment, in turn, shapes the urban green space. For example, green spaces and symbolic parks of cities are utilised for city branding by municipal

leaders and managers.

City branding, as Vanolo (2008a, 2008b) has defined, is the process of establishing charming images, meanings, and identities of a city to gain development opportunities. In this sense, city branding becomes the agenda for policymakers and managers. Vanolo's studies stress the role of nature in framing city narratives and promoting city images. A study conducted in Denmark shows that the promotion of environmental assets, such as parks and street trees, relates to citizens' high quality of life, thereby guiding the municipal development and constructing its political framework (Gulsrud et al., 2013). Under the context of prevailing top-down administration, Chinese greening policies in cities aim to compete for resources, improve liveability and attract attention, tourists and investment (Chan, 2017; Zhang & Zhao, 2009). In the context of ecological modernization (EM), administrators of Chinese cities adopt EM-related labels for promotion purposes (De Jong et al., 2018; Lu & De Jong, 2019). The generic labels are forest city, sponge city, park city, eco city. In this condition, Chinese environmental governance focuses on increasing the amount and quality of urban green space as a principal strategy of city branding.

2.3.3 Digital photos and photo-taking behaviour in everyday living

Ordinary people are accessible to cameras and produce photography since Kodak launched user-friendly and cheap cameras in 1882. Picturing practice is transformed from a highly specialised, expert-based commercial activity to one in which people engage daily (Munir & Phillips, 2005). Taking photos is not a natural step in travelling and going out. According to Munir and Phillips' perspectives, Kodak advertisements encourage people to take cameras when going for a trip and to bring back bunches of pictures of exotic people and places. Technology is embedded in the notion of vacation and capturing sightseeing moments, which serve the desire to freeze time and conserve the 'vanishing' and candid moments. Another successful discursive strategy of

Kodak is linking critical concepts of *Kodak album*, *Kodak moments*, *snapshot* with photography and thus suggesting that individuals' fallible memory can be stored as, for example, a book of "the home version of history", materialised objects, and can be organised. Accordingly, memories are preserved whenever on holidays, graduation ceremonies, weddings or at home with cameras at hand so that photography increasingly become an integral part of people's everyday living. The gazes are extended through photographs, as Crang (1997) puts, the interactions are recorded not only for the experience but for future viewing.

Tourists' photo-taking behaviour is not only the process of collecting signs of places but also contains a sequence of cognitive acts that allow people connect the reality with the prototypical images in their mind (Urry & Larsen, 2011). The practice of picturing, as Crang (1997) describes, is closely related with photographing technologies and, as Urry and Larsen have mentioned, the Web 2.0, through which tourists and locals increasingly produce and circulate digital images on public display, such as the burgeoning social media platforms. Urry and Larsen (2011) critically point out that the cameras or smartphones systematically mechanised tourists' vision, leading to a fragmented, pre-arranged imageability of a complex place. Photography practice simplifies individual experience as seeing, glancing and clicking camera buttons. These mediated subjects inevitably affect the way observers frame, organise, and establish their visit routes, behaviours and personal experiences of the places. Taylor (1994) divides photographers into travellers, tourists, and trippers according to different habits of seeing, while he describes them as those who "set out to confirm what they already know through tour guides and brochures" (p. 7) without immersing in the environment and focusing on the details. As a result, picturing practice and photography are condemned in modern mass tourism because they speed up and strengthen the centrism of visual and refuse the experience of places (Urry & Larsen, 2011).

However, thoughtful photographers utilise cameras as recording tools to study natural phenomena, seek landscape patterns, and explore the culture behind people's everyday activities (see examples in Spirn 2014, *Photography and the Art of Visual Thinking*). Photography preserves the wholeness of behaviours and things, which contributes to discovering the unknown for professionals because "... Knowledge may recognize pattern but may instil habits of seeing that inhibit perception of the unknown..." (Spirn, 2014). Unlike most tourists chronologically group their photos, professionals classify, compare and juxtapose photos thematically to recognize patterns according to Spirn's conclusions (Spirn, 2014). Differences are that tourists' perceptions of the place are not purely individual experiences but are constructed by social discourses, tourism marketing, travel writers, and even trending pictures on social media (Crawshaw & Urry, 2002). Therefore, the fundamental difference is the motivation of picturing practice. For professionals, the subjects (the wanting-to-know), when and where to stand should be clear (Spirn, 2014) after framing questions and developing strategies. Urry and Larsen (2011) indicate that tourists seek for pleasurable experiences by "going away" from those encountered in everyday living, while "ways of seeing and being seen" are manipulated by the construction of modern spaces (p. 160). The visiting routes, where to stand and when to capture the expected picturesque sceneries are predetermined by space patterns, tourism marketing managers, commercial media, and professional photographers. It is also important to notice the unpredictability of peoples' behaviours and the power of presence. As Urry reminds us, tourists are also producers in the era of social media. Their photography practices are connected through an information network, within which various communities are formed to share interests and knowledge in Web 2.0. Digitalised images are circulated through social-networking sites and exhibited on screens. Locals and tourists also exercise power against the pre-programmed imaginative systems, which provoke their desires and imagination of the places, as Urry and Larsen (2011) stress the importance of photography

in the study of tourist gaze :

“The gaze is constructed discursively and materially through images and performances of photography, and vice versa”.

Following the debate on the medium nature of photography, there emerges studies of photography's role in the relationship between vision and modern life. Photographs are undoubtedly tools for record as they are destined to be, as Schwartz and Ryan argue(2021), “through photographs, we see, we remember, we imagine: we ‘picture place’ ”(2021). Photography is “recognised as the modernisation by science of its own privileged vision”related to realism (Slater, 1995). Edwards and Hart (2004) argue that photographs are more than an optical-chemical process for fixing an image on paper. As such, they materially exist because they have physical appearances and can be trimmed into different sizes, mounted in different colours, moulded into cards, and circulated from one to another.

The image content, image arrangement and projection of the information makes photographs a socially salient object, they are ‘both images and physical objects that exist in time and space and thus in social and cultural experience’ (Edwards & Hart, 2004, p. 13). For example, landscape architects Alan Berger utilise aerial photographs to capture large-scale landscape changes, which are evidence of the temporal-spatial transformation of land use. Photographs serve as visual images, historical documents and material objects of landscape construction (Schwartz & Ryan, 2021). Therefore, photography is closely related to visual representations and shapes our perceptions of places, as Donna Haraway notes:

“The ‘eyes’ made available in modern technological sciences shatter any idea of passive vision; these prosthetic devices show us that all eyes, including our own organic ones, are active perceptual systems, building in translations and specific ways of seeing, that is, ways of life. There is no unmediated photograph

or passive camera obscure in scientific accounts of bodies and machines; there are only highly specific visual possibilities, each with a wonderfully detailed, active, partial way of organizing worlds.” (2013, p. 190)

The attempts to understand how space, time and landscape are represented through photographs are incorporated into the study of imaginative geographies, which means the identity and perceptions of places (Gregory, 1995). Schwartz and Ryan (2021) stress that the photographic practice of tourists and residents are essential agencies for constructing place identities, which reflexively influence the social groups’ appreciation of photographs. David Harvey (1990) uses the term geographical imagination to suggest the significance of space in contemporary social life. He argues that geographical imagination enables individuals “to recognize the role of space and place in own biographies, to relate to the spaces [they] see around [them] ..., to fashion and use space creatively, and to appreciate the meaning of the spatial forms created by others” (Gregory et al., 2011, p. 283).

Another inevitable tendency implied by Donna Haraway is the development of technology related to vision in modern lives, namely “vision in this technological feast becomes unregulated gluttony...” (2013, p. 189). The prevailing digital technology transforms photographs from a material form with a specific physical appearance to pixels stored digitally. Digitising the original images in archives, art galleries, museums, and libraries influences the availability, management, and placement of these photographic objects. However, tons of digital images are produced, circulated and viewed in the context of Web 2.0, which encourages users to engage in the online sharing practice (O’reilly, 2009). Digital images differ from digitised data because they are natively digital and entirely created for and embedded in online photo-sharing systems, such as social media platforms and apps. Rogers (2013) points out that the webpages, where digital data are situated, are not merely the platform for data storage but

the source for reading and exploring people's cultural life. Moreover, web services, such as search engines and social media platforms, potentially act as filters to establish structured datasets according to the research aims.

Digital images that "born" in virtual space share similarities with photographs because of their critical role in vision. However, a new viewing experience is created by looking at the digital screen, in contrast to that of the 'original' photographic objects. Viewing digital images requires a keyboard, mouse or touching of the screen while digital images are accessible to all viewers if made public by owners on social media. The interactive experience is profoundly altered in the age of social media. For example, users are allowed to *like*, *share* and *forward* digital images through social media networking and these operations also intentionally leave traces that can be viewed by others. The way digital images organised in cyberspace is not similar to material objects tucked in an album or pasted on papers, although designers claim the habits of collecting, ordering and viewing are reproduced in the virtual space. Besides, the display strategy, screen design, and organisation work together to encourage viewers to focus on the image content and interactions between users. In this regard, digital technology and affiliated devices have changed ways of seeing in cultural life.

Indeed, there is a discussion on the materiality of photographs (Edwards & Hart, 2004; Packer & Crofts Wiley, 2012). The material qualities of digital photographs are manifested through the digital devices, which, as Cubitt (2014, p. 113) argues, share similar affordances with technical systems since the birth of computer, such as the available dyes, pixel display and "the minute gap between samples which the digital recording can never fill" (2006). In a work called *Spiral Jetty* by American artist Robert Smithson, the materials, the site and physical properties actively engage in the process of creation or "acted as affordances in Gibson's sense ... that enable specific thought and action"

preventing of other possibilities (Domínguez Rubio & Silva, 2013; Gibson, 2014; Rubio, 2012). The practice aiming for aesthetic values align with the primary motivation on taking photos in the recreational places. A study reveals (Lux et al., 2010) that whatever the intention is for recording or sharing, people want to tell a story of a beautiful moment at scenes pictured. However, another study shows a negative correlation between the enjoyment of experience and the goal of taking photos for sharing on social media (Barasch et al., 2018). It further illustrates that the concern of self-presentation and being judged by acquaintances impede people's enjoyment, while sharing with close friends or for private use are more enjoyable. Another study conducted by Diehl's group (2016) examines the mechanism of how photo-taking influence the enjoyment of the experience at three fields and six lab experiments. The results show that photo-taking enhances the enjoyment of experiences by enabling people engage with the environment. This study is conducted under three scenarios: a city bus tour, midweek lunch and in a museum, so other real-life situations need to be explored, such as visiting an urban park or meandering the city streets. Photo-taking behaviour needs to be examined further because it is so ubiquitous in everyday living, which affects the experience and people's well-being.

2.3.4 Representation of nature in social media space

Degen and Rose (2022) describe how digital mediations construct the feel (or atmosphere) of cities in the book *The New Urban Aesthetic*. They illustrate an image-centred strategy for place branding by exploring redevelopment projects. Individuals are also actively involved in creating, consuming and mediating experience of the place with smartphone apps. Visual social media sites (e.g., Flickr and Instagram) have been increasingly utilized as a data source to investigate the benefits of human-nature interactions, such as aesthetic quality (Van Berkel et al., 2018), sentiment value (Fox et al., 2021), preference for biodiversity and biodiversity-related activities (Hausmann et al., 2018), wildlife

watching (Mancini et al., 2019), and outdoor recreation (Graham & Eigenbrod, 2019; Wood et al., 2013). Chang et al. (2020) also find that the presence of nature elements, such as trees, grass, and flowers, in photos is more likely related to positive social context (e.g., fun activity, honeymoon and vacation) than that in photos of daily routine. This study also shows a positive association between life satisfaction and the presence of natural elements in fun activity photos. However, visual social media influence users' nature-based experience by mediating outdoor activities and homogenizing what is worth to take photos of, resulting in sharing uniform stories and visual representations (Arts et al., 2021b). In this study of Instagram, it appears that standardized imagery is dominant in visual representations of outdoor environment. Users are inclined to follow certain norms of what to post. Therefore, if it is the case for people's visual representations of nature on social media, the question is what are the collective norms of aesthetics, and if this homogenous image landscape can shed light on exploring landscape preference. Researchers have conducted content analysis for these shared online photos in order to capture individuals' interest toward natural elements (Figuroa-Alfaro & Tang, 2017; Ghermandi et al., 2022), whereas an in-depth content analysis of photos taken in urban parks requires further research, as does the distinctness between advertised and unadvertised places.

Displaying images of nature-based experiences on social media, as Conti and Heldt Cassel (2020) point out, is "also about the staging of experiences through the post-processing of images and the adding of hashtags and geotags,..." and it is "where nature and wilderness are expressed as related, for example, to the genuine, the authentic and the true inner self". Photography is not only a tool for capturing memory but also for communication. On the one hand, visitors seek "authenticity in other 'times' and other 'places' away from that person's everyday life" (Urry & Larsen, 2011), which is interpreted by Molz (2012) as staying connected with the local environment while physically on the move. On

the other hand, collective norms and social pressures seem to be responsible for visitors' popularity-seeking photography and reduction of individual creativity (Conti & Heldt Cassel, 2020). For example, where the camera should be set up and what should be aimed are influenced by a frame set by previous trending imagery, even forming a landscape for "likes" (Lo & McKercher, 2015; Smith, 2021). Elements of designed landscapes lay the basis of their visual representations on social media, while the collective imagery mediates what people expect, experience, and notice in everyday use (Despard, 2015). Indeed, individuals are inclined to pursue "classic" photos of the place for hosting the place identification as evidences of "being there", but knowledge of the places beyond popular, which elicit the urge to holding up smartphone or camera remains unknown.

2.3.5 User's motivation for online photo-sharing

Considering platform specificity, the motivations of photo-sharing holds true for visual social media. Photos have been used to construct memories, share experiences, and display meaningful scenes before the invention of the Internet and the ubiquity of social media platforms. Social networking sites (SNSs) foster a revolution of these practices and increasingly serve as information sources for arranging trips (Chung & Koo, 2015; Xiang & Gretzel, 2010).

Sharing and browsing photos on social media are encouraged due to the visual turn of technology and the visual representation culture (Mitchell, 2002) or, as Ibrahim (2015) terms, the popularity of mobile telephony. The imagery of everyday life is commodified for consumption by self and others Because the social interaction plays an important role in online photo-sharing (Malinen, 2010; Oeldorf-Hirsch & Sundar, 2016). Photographs not only function as documentation (Sheldon & Bryant, 2016) but also function as "anchors" for storytelling (Van House, 2009), self-representation (Lee et al., 2015; Van House, 2009), visual storytelling, and proxy of connectivity (Lobinger, 2016; Negoescu

& Gatica-Perez, 2008). Social interactions are involved in the process of online photo-sharing, such as communication with others about the photos, clicking “like” for interesting photos, hash-tagging, and giving comments.

Since social relationships are at the core of SNSs, including maintenance of existing social bonds and building new connections among users (Boyd & Ellison, 2007). Digital photos are no longer shared with specific audiences (e.g., face-to-face or email), on the contrary, they are visible to a large number of audiences. This fundamentally changes the way experience is presented and the role of images in users’ everyday lives. Photo-taking behaviour is influenced by affordances of visual social media, according to previous studies of online photo-sharing practice (Lobinger, 2016; Miller & Edwards, 2007). For example, Miller and Edwards identified a group of amateur photographers from Flickr and call them *Snaprs*, referring to those who capture the aesthetically attractive moment in their daily lives and “took to share” with strangers. This practice is closely related to online groups and communities established on Flickr. Another group of photographers is influenced by *Kodak Culture*, which refers to those who, as explained by Chalfen (1987), “watch home movies, take pictures of new-born babies, and even, in their darker moments, scratch out the faces of disliked relatives in group photographs.” Miller and Edwards (2007) further demonstrate characteristics of Kodak culture people engaging with Flickr: primarily sharing with relatives or people they know, taking photos for archives, and focusing on family events, such as birthdays, weddings and holidays. In this sense, Snaprs and people of Kodak culture could be tourists or residents in different scenarios. Online photo-sharing has become integral part our lives, tourists’ online photo-sharing and photo-taking behaviour has been studied in depth (Lo & McKercher, 2015; MacCannell, 2013; Urry & Larsen, 2011; H. Zhang et al., 2022), whereas little is known about the difference between tourists and residents with respect to photo-taking behaviour and photographic subjects.

2.3.6 Social media use and offline activities

Serafinelli's (2017) findings derived from Instagram communities suggest that online communities can promote offline activities, such as InstaMeets and InstaWalks, by which users meet or go for a walk in a park in pursuit of communication or taking beautiful photos. Oeldorf-Hirsch and Sundar (2016) point out that photo-sharing behaviour is motivated by seeking and showcasing experiences through viewing and uploading photos. Technological affordance lays the fundamental ground for this behaviour. For those who have passive consumption of photos, they argue that "viewing others' shared photos is not about seeking out the content, but about seeking out the user", such that visual social media functions beyond a sharing and viewing platform, like a gallery. It fulfils other higher needs, such as a medium of bonding, interpersonal communication and experience storytelling. Those who have a high level of social activity (e.g., travelling and going to sporting events), appear to use visual social media as a means of documentation (Sheldon & Bryant, 2016). Oeldorf-Hirsch and Sundar (2016) also conclude other motivations, such as relationship maintenance, making new friends and reaching a broader audience. As Stinson (2017) argues, new media technologies have blurred boundaries of virtual content and actual experience, whereby the perception of nature is mediated by the consumption of representations on social media. Therefore, offline activities are increasingly oriented toward creating online content. This movement from online to offline has been explored and utilized in the fields of city branding and tourism (Björner, 2013; Molina et al., 2017; Wang & Feng, 2021).

2.3.7 Social media use and subjective well-being

In a longitudinal study, researchers find that use of Facebook is a significant predictor of participants' subjective well-being, while subjective well-being fails to predict changes in Facebook use, indicating a causal relationship between Facebook use and subjective well-being (Kross et al., 2013). The former is

more likely to be an explanatory variable rather than the other way around. Whether the use of social media improves or impairs subjective well-being is still controversial. Some studies illustrate a positive relationship between social media use and subjective well-being, such as Facebook (Ellison et al., 2007; Valenzuela et al., 2009) and Instagram (Pittman & Reich, 2016; Yang, 2016), while some studies find the opposite results (Farahani et al., 2011; Lin et al., 2016). Some studies point out that contradictory outcomes result from the nuances of different personalities (Gerson et al., 2016), extent of self-disclosure (G. Lee et al., 2011), and authentic self-presentation (Bailey et al., 2020). However, frequent exposure to social media is positively associated with mental health problems during outbreak of COVID-19 (Junling Gao et al., 2020). Verduyn et al. (2017) conclude that whether passively using social media (i.e., monitoring of other people's lives without engaging in direct exchanges with others), or active engaging in social media (i.e., activities that facilitate direct exchanges with others) is associated with opposed well-being outcomes.

However, visual social media use appears to be beneficial for subjective well-being. Pittman and Reich (2016) argue that "Instagram image worth more than a thousand Twitter words", stressing that using image-based social media is significantly associated with a decrease in self-reported loneliness, while it is associated with an increase in happiness and satisfaction with life. Another study conducted by Yang (2016) supports this hypothesis and finds a nuance of the feeling of loneliness connected with Instagram interaction, browsing, and broadcasting. Specifically, Instagram interaction and browsing relate to a lower level of loneliness, whereas Instagram broadcasting correlates with a higher level of loneliness. As such, there is no clear boundary between passive and active ways of using visual social media regarding its influence on subjective well-being. Maclean et al. (2020) find that social rewards and sharing of oneself are probably the reason why the use of visual social media has a positive connection with users' self-reported well-being.

2.3.8 Landscape preference research via crowdsourcing data in China

A growing body of studies have explored landscape preference via crowdsourcing data from local social media platforms (e.g., Weibo and Dazhong Dianping) in Chinese cities. These studies primarily focus on two information sources: textual comments and shared photos. For example, Wang et al. (2021) retrieve comments of 50 urban parks in Beijing from Dazhong Dianping (a Chinese version of Yelp). By coupling a machine-learning model and manual annotation of satisfaction with each sampled comment, they find that natural features and supportive facilities are significantly associated with greenspace satisfaction. Similarly, some studies (Cheng et al., 2022; Li et al., 2022) show that supporting facilities are as important as natural characteristics to landscape preference by analysing online reviews on social media. Yet the online comments may differ from survey data due to users' hidden motivations of showing off on social media (Z. Wang et al., 2018). In contrast to textual information, image is related to the visual characteristics of landscapes. For instance, Zhang et al. (2022) harvested photographs tagged with Wuhan University from Weibo (a Chinese version of Twitter) and analysed photo contents from perspectives of complexity, visual scale and colour. They find that landscape diversity, colour variations and hue values account for landscape preference. Another study (Ding et al., 2022) integrates photographic information from three Chinese travel review platforms: Dazhong Dianping, Trip.com Group, and Mafengwo, to investigate tourists' satisfaction with mountain landscapes in Beijing. Another type of crowdsourcing data is geo-tagged check-in data, which is used for preference comparison between parks based on (Zhang & Zhou, 2018). However, Chinese social media platforms rarely provide datasets in which photographs and their geographic coordinates are accessible. The questions of what contents are documented and where they are taken cannot be answered directly without shared photographs and their geographic information. Some studies (Wang et al., 2022; Yao et al., 2020) have collected geo-tagged photos and routes from a Chinese social media

platform Sixfoot, which is a tracking-oriented application for outdoor activities, such as running and Nordic walking. They find that data collected from outdoor social media, such as Sixfoot, is primarily shared by outdoor enthusiasts. The data may not include those who enjoy sightseeing and recreation in urban parks. To this end, Flickr is an appropriate social media platform to explore landscape preference in the everyday use of urban green space as it provides shared photos and geographic information. More importantly, nature-based activities, social recreation, sightseeing and aesthetic appreciation of nature can be detected from its user-generated data (Heikinheimo et al., 2020; Richards & Friess, 2015).

2.4 Urban green space in contemporary China

An overview of the changing landscape caused by the rapid urbanisation process in contemporary China reveals how natural elements are included and mediated in public open spaces of Chinese cities. It implies that China's citizens have experienced a dramatic change of urban landscapes. Accordingly, they likely develop different landscape preferences. This section underpins the research by outlining the changes of urban green space in China's context.

2.4.1 The ecological shifting in Chinese cities

A growing number of studies address the social benefits provided by urban green spaces (UGSs), which can increase the liveability of the urban environment and mitigate environmental problems induced by urbanization (Kabisch et al., 2015). Urban green spaces (UGS) are "forests, trees, parks, allotments or cemeteries" or the system that "can provide residents a whole range of ecosystem services" (Breuste & Artmann, 2015). It is not merely an "escape from urban air pollution" but a catalyst for gaining wider social and economic benefits.

In the 2000s, the urbanisation process of Chinese cities occurred in tandem with an ecological transformation. The central government announced a carbon reduction target in the 11th plan period (2006-2010) and that carbon intensity would be reduced by 40 – 45% from the 2005 level by 2020 (Wu, 2012). Unprecedented urbanisation and top-down planning mode showed significant influence on the quality of the living environment and the perception of these spaces. In other words, interrogating the perception and practice of China's redesigned green space is increasingly important for understanding world greening plans. First, China has become the location for wide experimentation in ecological urbanisation in response to the energy-consumptive lifestyles (May, 2011). Second, the massive rural-to-urban migrants and residents are experiencing substantial physical and mental challenges due to urbanisation propaganda, changes of living environments, environmental pollution, and the spread of infections (Gong et al., 2012). Third, Chinese cities are in the phase of urbanisation driven by the service industry (Yeh et al., 2011). Urbanisation is a tool for economic development, which is in the spirit of what Wu (2015) describes *planning for growth*. In other words, urban planning was adapted to the overarching goal of economic growth across the nation. Tourism, industrial development and urbanisation are imposed on urban development, challenging cities' sustainability and liveability (Wei, 2012).

Chinese new town and the following eco-city planning are providing residents with a vision of ecological modernisation with more parks and green open space. The central authority forges ahead in its green approach because of the awareness of the damages caused by growth-oriented development (Wu et al., 2006). Wu (2012) points out that environmental damage results in increased economic costs. The living environment could be improved when the local state goes beyond the quantity of eco-city. Further, China is experiencing an unprecedented urbanisation process in a short period. In 2016, about 16 million people settled in cities, and the urbanisation rate of permanent residents

reached 58.5 percent in 2017, while in 1978 was only 17.9 percent (Source: China Statistical Yearbook). The tension between environmental health and economic-oriented development mode is highly accelerated in this context. For example, water and air pollution, water scarcity, land loss, and rural-to-urban migrants elicit alarming environmental and social consequences (Yeh et al., 2011). The international pressure of cutting carbon emissions and maintaining a high-quality living environment put Chinese cities into the spotlight (Wu, 2012). Last but not least, the local government increasingly cooperate with international design and planning corporations to address environmental and social problems caused by unsustainable development. This process reveals how knowledge of sustainability and liveability is used in Chinese cities. Chinese cities have different social and environmental backgrounds. Ethnic minority disparities, urban transformation, and urban growth impact how people percept the living environment. Therefore, the Chinese experience of greening practice can offer lessons to cities of the Global North (Wolch et al., 2014).

2.4.2 An overview of Chinese green space system planning (GSSP)

GSSP-related hierarchical regulations

Related research has demonstrated the benefits of green space for residents' mental and physical well-being, such as stress reduction (Hartig et al., 2003; Kaplan, 1995; Song et al., 2014; Ulrich et al., 1991), enhancement of physical activity (Frank et al., 2003; Kaczynski & Henderson, 2007; Richardson et al., 2013; Schipperijn et al., 2013; Thompson, 2013a) and social integration (Germann-Chiari & Seeland, 2004; Groenewegen et al., 2006; Hunter et al., 2019). The planning comprises green space as a key factor for a quality life. For example, green space planning is part of spatial planning in European countries (Kabisch, 2015; Laforteza et al., 2013), while China has a different organization of multi-level planning due to the hierarchical legislative system (Figure 2.3). The regulations of the lower legal level are commonly guided by those of the higher level and linked upwards to corporate goals proposed by

the central state. Chinese planning system differs from other countries, where municipal planning needs to be assessed on the state level before being submitted to the federal level (Akmar et al., 2011). The Chinese central government remains the most influential in guiding GSSP in the context of a top-down administration system with strong engagement in local practice. Chinese cities differentiated itself from the European cities and the US, where local municipalities are responsible for green space planning (Davies & Laforteza, 2017).

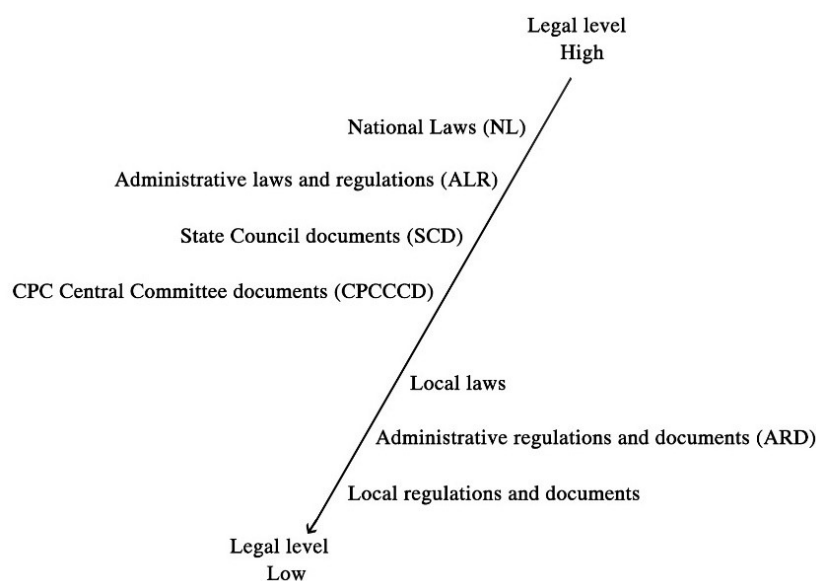


Figure 2.3 Hierarchy of the legislative system for GSSP in China.
Source: Zhou et al., 2021

Shifting role of green space in the city

Urbanisation has been an overarching mission for both local and state governments since economic reform launched in 1978. It was included in the 10th Five-Year Plan (2001-2005) for the first time and became a national strategy for economic growth (Yeh et al., 2011). After 2001, China's urbanisation process started to take off (Figure 2.4). This accelerating phase resulted from (1) opening borders and loosening restrictions for foreign traders and investors; (2) participating in the global economy and trading network; (3) promoting rural labours to the industrial sector and construction for urban infrastructure (Pannell,

2002). As the most influential national trends, this progressing urban transition shaped the landscape of Chinese cities and peoples' everyday living.

China's practice of landscape, from Wang's (2018) viewpoint, is involved with different stages of urbanisation (Figure 2.5):

- Phase 1 (1949-1992): Green space is a 'fill-in' space among buildings and landscape practice is subordinated to the building sector.
- Phase 2 (1993-2003): Green space is considered as the symbolic image of cities and functioning as a boost for economic development.
- Phase 3 (2004-2012): Local governments invest in green space to increase land finance, especially those adjacent to parks.
- Phase 4 (2013-current): Green space is incorporated into ecological urbanization and is one of the key solutions to cities plagued by environmental issues.

The state attached importance to green space since urbanization was a nationwide solution for economic growth from the 1990s to 2010s. On the one hand, the prevalent buildings and residential areas of western forms suggest a nationwide branding practice in Chinese cities. These practices brings about local estate competitions and high-quality environment by constructing the social mentality that it is not merely a style but is equivalent to modern and quality life (Wu, 2010). Similarly, magnificent squares and parks are not only decorations of built-up areas but a hydration of different ideas: symbolic status, quality city life, environmental aesthetic, attraction for investments, promotion of land conveyance, and support for economic growth (Wang, 2018; Wu, 2012; Wu & Yeh, 1997; Zhou et al., 2021). On the other hand, urbanisation is otherwise controlled by planned green space by buffering the outer natural environment (see *green belt* planning in Beijing and Guangzhou). It is very much in the spirit of green belt in the UK, which aims at preventing urban sprawl (Wu & Yeh, 1997). Constructions of Garden Cities, Ecological Garden Cities,

Forest Cities and Ecological Cities were implemented during this period with increasing awareness of unsustainable development. Moreover, the green space system is developed unevenly across Chinese cities. An evidence-based study illustrates that the level of urban greening effort is positively related to economic growth, especially in implementing greening policies and optimizing built-up environment (Wu et al., 2021).

Along with the promotion of ecological civilization construction in 2013, planning initiatives and regulations were proposed by the central government to tackle the compounded challenges for cities, such as air pollution, floods and water pollution. The green space was valued as solution for urban diseases due the flexibility nature. Parks, greenways were constructed as interconnected spaces in practice. Two milestones at this time were 'Ecological Red Line' (ECR) and 'Sponge City'. The former was enacted by the state in 2013, aiming at environmental conservation, and it defined limits to development and construction activities. Areas that were designated as ECR were fragile and valuable ecosystems(Jixi Gao et al., 2020). The latter was put forward in 2014 and was established in 2015 to deal with storm water issues in cities. Sponge City program was an integrated urban water management that was adapted to the climate, urban environment and socioeconomic conditions in different China's cities (H. Wang et al., 2018). Green space is systematically understood and established as an integral part of urban ecosystem, a network furnishing ecological and cultural services for citizens at this stage.

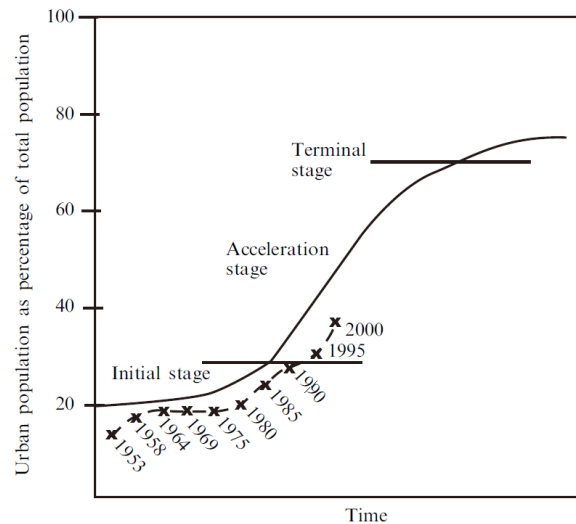


Figure 2.4 China's urbanisation level in every five years (1953 - 2000)

Note: the curve (—) denotes the urbanisation trend.

Source: Pannell, 2002

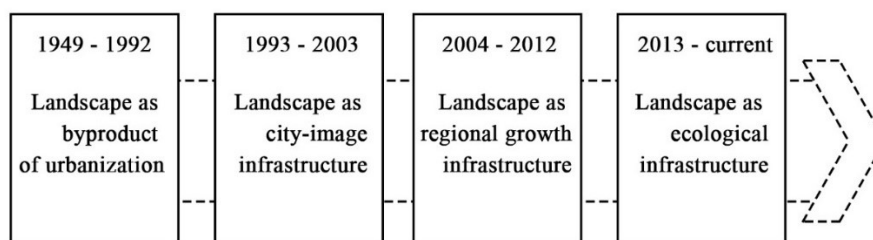


Figure 2.5 Landscape's different roles in four phases of development in China

Source: Wang, 2018

2.4.3 The evolving planning initiatives in Chinese cities

Being aware of rapid otherwise unsustainable process of urbanization and severe environmental issues that haunt China's cities, the central authority has taken proactive steps to improve environmental quality (see regulations and policies in Table 2.1). National Garden City is the first national reward proposed by Ministry of Housing and Urban-Rural Development (MHURD) of PRC to promote green space in cities (Wu & Kim, 2021a; Zhou et al., 2021). Cities should fulfil the evaluation criteria to win the title and the list of recipients will be published by MHURD. Nationwide institutions (such as planning initiatives, greening policy, afforestation agenda, and Standards of National Garden City)

not only contribute to increasing quantity (Chen & Wang, 2013a, 2013b) but distribution equity (Wu & Kim, 2021a) of green spaces in cities. It is an effective way of improving natural amenity when the government has a strong administrative capacity in terms of policy/regulation implementation, consistent enforcement, and sufficient financial support (Konijnendijk et al., 2004). However, Wu and Kim (2021b) argue that the official quantity-based measurements for green space have limited improvement in equity based on a study of 341 prefecture and above-level cities in China. Discrepancies between one-time evaluation and continuous management by policymakers also impede equities of green space provision (J. Zhang et al., 2020).

The greening policies emphasize general evaluation standards of green space. For example, the National Garden City Standards (2016) consist of seven aspects related to green space: management, construction, construction management, ecological environment, civil infrastructure, energy conservation and pollution reduction, social welfare, and vote items (when listed incidents occur, the city will not be qualified to compete for the title). Practical, quantity-based, and non-locality metrics are selected for each aspect. For instance, construction management includes built-area green coverage rate (requirement: $\geq 36\%$), built-area green space rate (requirement: $\geq 31\%$), parks per capita in built-area, the 500-m coverage area of parks, the ratio of trees/shrubs to the total green area (requirement: $\geq 60\%$) etc. Although there lacks a compelling measurement of green space patterns, the specified service radius of urban parks and total coverage of urban parks in built areas positively impact the evenness of park distribution (Wu & Kim, 2021a). The subsequent planning initiatives, for one thing, inherit this hierarchical framework for assessment and aspire cities to meet all the mandatory requirements, for another, draw lessons from developed countries.

Table 2.1 Planning initiatives related to green space system planning (GSSP)

Landscape Initiative	Time	Document	Content/Practice
National Garden City	1992	National Garden City Standards (enacted in 2010, repealed in 2016) National Garden City Standards (2016)	Three general goals are added to the latest standards: ecological and liveable environment, safe and resilient environment, and preserving locality and heritages. Index concerns accessibility of urban green space, green coverage, green-blue space, green space for emergencies and so on.
National Ecological Garden City	2004	National Ecological Garden City (Interim) (repealed in 2010) National Ecological Garden City Standards (2016)	The standards focus on greenspace-related index, such as public satisfaction of urban greening, greenery coverage rate in built-up area, per capita park space, service radius of parks.
National Forest City	2005	Assessment Indicators of National Forest City (Trial) Indicators for National Forest City GB/T37342-2019	Index concentrate on assess ecological and cultural services provided by urban forest and greenness, such as forest coverage rate, accessibility of parks, length of greenways, public satisfaction and ecological education.
Ecological County; Ecological City; Ecological province	2007	Construction Index of Ecological County, Ecological City and Ecological Province (revised version)	Promote sustainable development from aspects of economic development, ecological environment conservation and social development. Landscape-related index are public green space per capita, forest coverage rate.
Sponge City	2014	Guidelines for Sponge City Construction Construction of Low Impact Development Rainwater Systems (Trial)	Stress functional rainwater regulation in construction of urban infrastructures, including city roads, parks, squares, buildings and residences. promote a series of techniques for designers to choose from, such as sunken green space, green roof, stormwater wetland and permeable pavement.

Park City	2018	Master plan for establishing a model district by Chengdu city under the Park City Initiative (2022) [Chengdu Jianshe Jianxing xinfazhan lilian de gongyuan chengshi shifanqu zongti fangan]	Greenway connecting parks and natural resorts. human life-oriented planning for 'city within a park' (Chengdu as first pilot city) and residents' well-being. Promote the cohesion of green space and grey space, create a park-like cityscape, increase proportion of green space and green coverage ratio. Establish a blue-green space system consisting of greenways, multitude parks, fitness facilities and high-density water network.
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Note: adapted from Zhou et al., 2021 and enacted official documents.

Table 2.2 Greenspace-related technical measures of Sponge City

Technical measures	Function and effectiveness					
	Rainwater utilization	Groundwater recharging	Peak-flow reduction	Rainwater purifying	Transfer	Total runoff reduction
Green roof	○	○	◎	◎	○	●
Sunken green space	○	●	◎	◎	○	●
Rain garden	●	○	●	●	○	●
Transfer vegetative swale	◎	○	○	◎	●	◎
Dry vegetative swale	○	●	○	◎	●	●
Wet vegetative swale	○	○	○	●	●	○
Vegetation buffer zone	○	○	○	●	—	○

Note: ● above average, ◎ average, ○ below average.

Adapted from Wang et al., 2018

National Forest City

Following the fever of eco-city, the construction of National Forest City started in 2004 in Chinese cities. More than 200 prefecture-level cities have joined this initiative, and 137 cities had been awarded forest city. Inspired by sector of urban forestry (Konijnendijk, 2003; Pei et al., 2019), National Forest City is a derived development mode from eco-city movement and in spirit of the following national-level Construction of Ecological Civilization (CEC) policy (Sutherland et al., 2016), or as Wu (2012) stresses, an eco-revolution, because the long-termed influence local land-use planning and grand scale of construction, including new town on peri-urban areas. Chinese state council and state forestry bureau proposed the initiative of forest city and issued Indicators for national forest city in 2012. In this guidance, national forest city was “within city field, forests and trees are as tools to provide stable, healthy ecosystem services that could serve for residents” physical and mental health and linking urban and rural areas (Figure 2.6). The urban forest is “the ecosystem composed of forest, trees and their surrounding environment in city field”. A network of urban forest landscape is defined as “the landscape of connected space that consists of patches of forests and trees within urban and rural areas”. The indicator is not detailed in planning the network and designing vegetated space but a guidance incorporating general explanations of what a forest city should be and quantity indexes. Specifically, forest coverage should be no less than 25%, 30% and 35% in built areas, corresponding to 400 mm, 400 - 800 mm and >800 mm annual precipitation, respectively. The shady road should account for at least 60% of the total road network. Beijing, for instance, has launched an afforestation project in 2012, planting 70,000 hm² of trees and shrubs, therein increasing 4% forest coverage in Beijing administrative area (Wang et al., 2017).

Sponge City

The management of run-off in an urban area is not a new issue for the Chinese

government in urban planning. Water drainage system is considered one of the most important civil infrastructures in Chinese history. The ancient city of Liangzhu (3300-2300 BC) already has a systematic flood regulatory network, consisting of embankments, lakes and rivers, which is the prototype of Chinese 'green infrastructure' (Renfrew & Liu, 2018). Stormwater management in an urban area is also not a new issue that the central government concerns about, starting from the 1980s, the rainwater utilisation was at the core, while current main task was rainwater management and pollution control (Chen, 2015).

The concept of Sponge City is originally proposed to describe the dynamics of population and economic growth in major metropolitan areas, where the economic growth, job creation, and population outperform rural areas in small towns, such as suburb or extending areas and coastal cities (Budge, 2005). From a socioeconomic perspective, big cities/ central areas "absorb" the population from rural areas and outstand in a sea of population decline (Argent et al., 2008). Likewise, the nature of 'Sponge' – soaking up water – inspires a resilient way of managing flood (Bunster-Ossa, 2013; Pickett et al., 2013), that is, instead of collecting and disposing stormwater as fast as we can, rainwater will be accumulated, infiltrated and cleaned for potential use. Moreover, in a practical sense, the inspiration of Sponge City is from low impact development (LID) in the America (Eckart et al., 2017; Li et al., 2016; H. Wang et al., 2018), best management practices (BMPs) in Europe (Petit-Boix et al., 2017), sustainable urban drainage systems in the UK (Ellis & Lundy, 2016), water sensitive urban design (WSUD) in Australia (Radcliffe, 2019), low impact urban design and development program (LIUDD) in New Zealand (Fletcher et al., 2015). After the central government proposed the Sponge City program in 2013, Guidelines for Sponge City Construction was published for designers and local administrators. According to the Guidelines, green spaces (such as wetland parks, sunken green spaces, green roofs, and vegetated swales) are included in a green infrastructure system (Lee et al., 2018) to store runoffs, replenish groundwater,

and purify water (see Figure 2.7 and Table 2.2). The Sponge City pilot project was launched in 2015. MOHURD (Ministry of Housing and Urban-Rural Development of PRC) and NDRC (National Development and Reform Commission) promoted “water-efficient city” concept and a top-down assessment criterion for Chinese cities in February 2018.

National ecological garden city and Park City

In 1992 and 2004, the counterpart in China were the notion of National Garden City and National Ecological Garden City (an upgraded version of the National Garden City), within which gardens and parks are mainly constructed for decoration based on historical sites. Park City initiative was proposed in 2018. The main difference between an ecological garden city and a park city is that an ecological garden city contains various ecological indicators, such as PM2.5, food safety. By contrast, the connotation of park city primarily concerns environmental liveability, which is a human-centred strategy. Park City is a park-centred developmental mode. Li and Zhang (2018) point out that the initiatives of garden city and ecological garden city aim to improve cities' greening rate, while park city is under a broader context of liveable human settlement. Park city has four connotations: first, it concerns synergetic development with the local economy and can be a stimulator to promote green industry; second, an accessible park system is at its core area of human-centred idea; third, a park city should have a healthy ecosystem, focusing on ecosystem restoration and reliance; fourth, a park city should present local identity and culture (Li & Zhang, 2018). This initiative of *Building City in a Park* (see Figure 2.8), rather than the previous *Building Parks in a City*, suggests a more systematic way of landscape planning.



Figure 2.6 Park in Lujiazui financial centre in Shanghai, located in the first demonstration zone of a national forest city cluster

Photo source: iStock

<https://asiatimes.com/2018/01/china-build-six-national-forest-city-clusters-2020/>



Figure 2.7 'Sponge Park', Lingang area, Shanghai, China

Note: Shanghai was selected as one of the pilot cities under Sponge City Initiative in 2016.

Source: https://global.chinadaily.com.cn/a/202110/29/WS617b41bca310cdd39bc71fea_1.html



Figure 2.8 Green space around Xinglong Lake under Park City Initiative, Tianfu New Area, Chengdu, China

Source: http://www.chinadaily.com.cn/regional/2020-05/15/content_37535981.htm

2.5 Conclusion

This chapter begins by reviewing key theories and empirical studies in relation to landscape perception, which will underpin a discussion from wide range of physical and sociocultural factors which affect individual's landscaper preference. Then it has focused on the relationship between visual social media and urban green space from perspectives of visual social media affordance, sightseeing practice, and how the process of photo-taking and photo-sharing practice bridges visual social media use and sightseeing practice. It reveals the potential of visual social media information that affects and represents landscape preference. Finally, given the rapid change of urban landscape in Chinese cities, it is vital to understand landscape preference under this typical circumstance.

Chapter 3 Research Methods

3.1 Introduction

This chapter starts with the conceptual research design (section 3.2). It shows a conceptual framework of theories and definitions underpinning the thesis, formulating research objectives and research questions. Then it introduces mixed methods and case study approach implemented in this study and explains why big data analytics and ethnographic approaches should be included in this research. In Section 3.3, a technical research design is formulated by outlining a mixed approach to answer the research questions. It first represents the process of harvesting geo-tagged image data from Flickr and then triangulating social media big data analytics, quantitative survey and qualitative interview in order to have a comprehensive understanding of the research questions. Case study research, the city context, process of selecting urban parks in Beijing and park features are introduced in section 3.4. The data collection part (section 3.5) introduces the data derived from three sources: an online survey, an online photo-sharing platform, and on-site interviews. In section 3.6, quantitative and qualitative methods are applied to different types of data. Then section 3.7 discusses research ethics. In section 3.8, the conclusion highlights how the contents above formulate research questions and generate knowledge.

3.2 Conceptual research design

The conceptual framework is the foundation of formulating the general research question and specific research questions by addressing the “why” and the “what” of research (Brink et al., 2017, p. 19). The epistemological stance that research methodology take determines research questions and research methods. Guba and Lincoln (1994) introduce four competing paradigms: positivism, post-positivism, critical theory and related ideological positions, and constructivism,

which guide the acceptance and choice of qualitative or quantitative research methods. However, Morgan (2007) suggests that attention should be shifted to “belief systems and practices within a field” instead of selecting an epistemological position. Thus, it is possible to combine qualitative and quantitative methods in research. As such, landscape architecture research has a similar borderline position of utilising mixed methodology due to its interdisciplinary nature (Thompson, 2016). For example, interviews, texts, and visual materials of the project can be analysed using computer applications and qualitative methods (Brink et al., 2017, p. 26). Indeed, a conceptual framework consisting of theories and concepts of different disciplines forms the basis for developing methodology and answering research questions.

Van Lammeren et al. (2016) describe social media sites as virtual places in which people communicate and interact with volumes of data generated every second. In order to examine what has been produced (social media data) and who has produced it (social media users and users’ practice), using qualitative or quantitative approaches alone limits a holistic understanding and exploration of data yielded from social media. A “pragmatic approach” is proposed by Morgan (2007) to describe the stance whereby the abstract level of epistemology is connected with the mechanical level of actual methods (Figure 3.1). In this regard, methodology is privileged over epistemology. Thus, researchers are able to concentrate on issues related to research itself, with equal attention to epistemological and technical ‘warrants’ that influence how we can conduct the research.

Placing Methodology at the Center

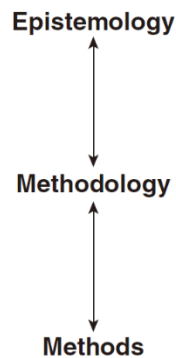


Figure 3.1 Bridging role of methodology between epistemology and methods
Source: Morgan (2007)

Returning to connections between digital technologies (i.e., social media, photography applications, smartphones etc.), people and urban green spaces, the overarching aim of this study is to examine the connections through the lens of everyday photography practice and thus shed light on the question of what characterizes landscape preference when social media use intervenes human-nature interactions on a daily basis. Set against this backdrop, the study is inspired by Urry's theory of tourist gaze, Lefebvre's theory of everyday life, evolutionary and cultural preference theories. A quantitative analysis of visual social media data and a qualitative analysis of interviews are integrated to understand people's perceptions of urban green spaces.

The dataset of geo-tagged images has potential for landscape research because it aggregates visual representations of a place(image), people's activities there (action) and the geo-referenced location (structure) (Brink et al., 2017, p. 137). This visual material requires a theoretical framework to formulate the research methodology. Rose (2016, p. 25) suggests that image production, content (image), circulation and audiencing are four key fields for researchers to explore visual materials. She also points out three critical aspects of each field to critically and holistically understand images. Figure 3.2 shows the three aspects and content of each aspect in interpreting an image

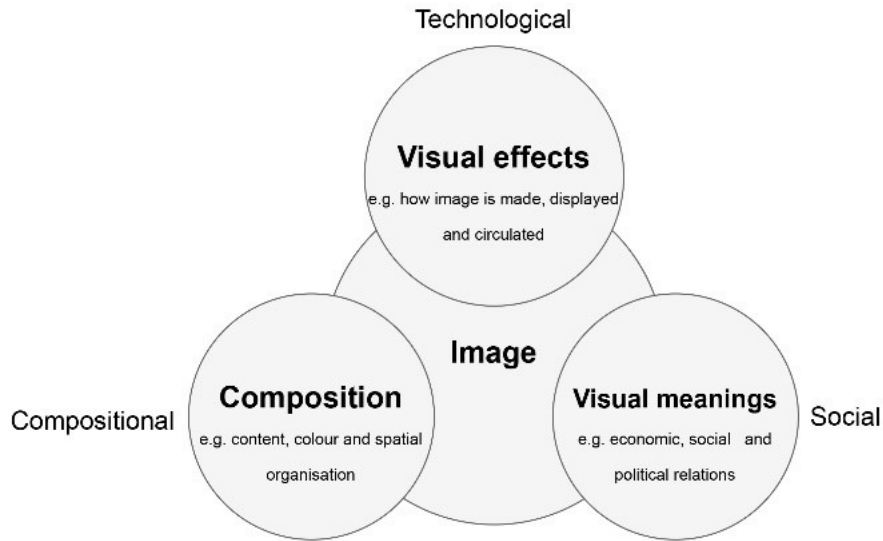


Figure 3.2 Interpreting image framework
 Source: adapted from description of Rose (2016).

3.2.1 Research questions

Although the general philosophical orientation decides the nature of research (Creswell, 2009), the research questions determine the research design (Brink et al., 2017, p. 26). Table 3.1 is the conceptual framework describing how the research aim, objectives and research questions are organised and related to the research methodologies. Figure 3.3 shows the research methodology flowchart based on the key research question three research objectives listed in Table 3.1.

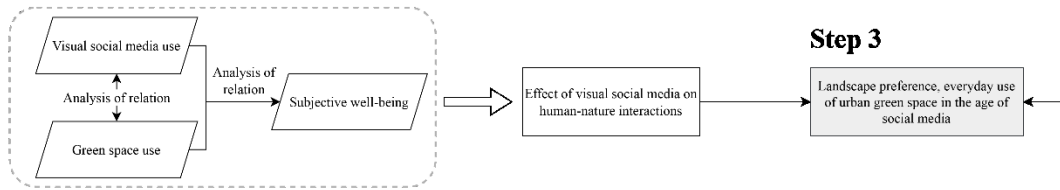
Table 3.1 The conceptual framework of research methodologies

Research aim: To understand the interaction and association between social media and landscape preference in urban parks in Beijing.					
Key research question	Research Objectives	Methods			Results
What characterizes landscape preference embedded in everyday use of urban green space	(1) To explore the correlation among visual social media use, urban green space use and	Case study research	Quantitative methods	Online survey (n= 347)	A 24-item questionnaire is formulated to explore correlations among sociodemographic characteristics, social media use, green

in the age of social media?	subjective well-being.				space use and subjective well-being.
	(2) To investigate landscape preference reflected by visual social media from perspectives of place popularity and social group.		Quantitative methods	Spatial-temporal pattern analysis (cluster analysis)	(1) Hotspots of geo-tagged photos are identified in study sites via point clustering algorithm. (2) Representative trajectories (visit sequences) of visitors in study sites are detected via trajectory clustering algorithm.
	(3) To understand landscape preference embedded in everyday use of urban green space and the role of social media in shaping it.			Content analysis	A total of approximately 22000 images that are taken in study sites are labelled and categorised with analytical significance.
		Qualitative methods	Semi-structured interviews with visitors in urban parks (n=73)	Revealing complex meaning and nuance of landscape preference compared with digital photos yielded from social media.	

Step 1

Questionnaire survey



Step 2

Case study of urban parks in Beijing: Social media crowdsourcing Semi-structured interview

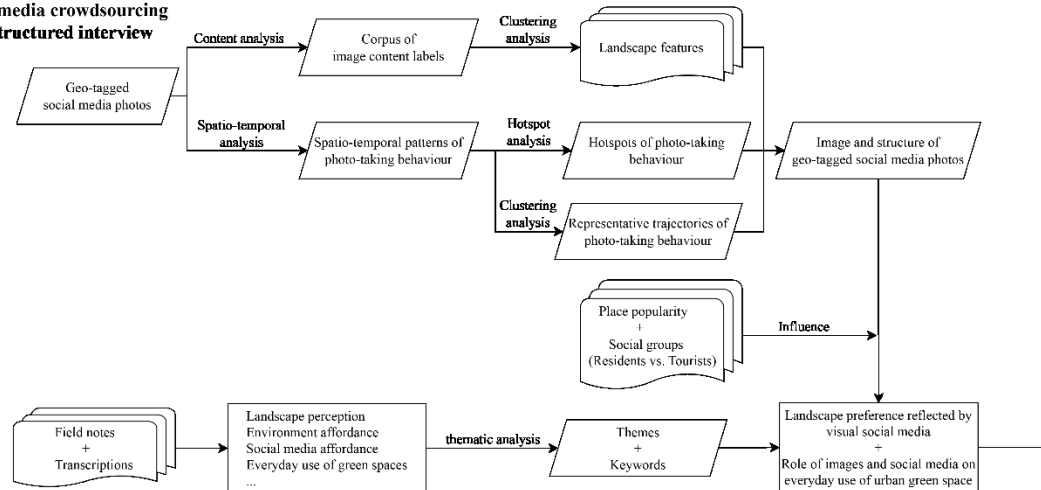


Figure 3.3 Flowchart of research methods

3.2.2 Mixed methods study

According to the research objectives, a mixed method is adopted. Specifically, both qualitative and quantitative methods are valued due to their complementarity for this study (Tobi & van den Brink, 2016). Notwithstanding the evolving discussion of mixed methods research, it is defined as research in which the researcher integrates qualitative and quantitative approaches across the process, namely the process of data collection, data analysis and finding discussion (Snelson, 2016). Accordingly, integration is the key to mixed method, residing in the idea that different weaknesses of quantitative and qualitative data can be neutralised through combining and triangulating data sources (Creswell, 2009; Morse, 1991). Both qualitative and quantitative methods are advantageous because one dataset contributes to check validity and explain the other dataset. Qualitative data is more open-ended, while quantitative data is usually closed-ended, such as highly structured questionnaires and sampling

methods (Figure 3.4). For example, qualitative approaches are especially useful in obtaining specific views; attitudes and detailed experience in depth after a structured survey have been conducted among a large number of individuals. Noticing that environment-behaviour interactions elicited by prevailing social media use, practices of photography with consequent online sharing is a representative phenomenon in this context. Mixed methods contribute to develop a holistic understanding of photo-taking behaviour.

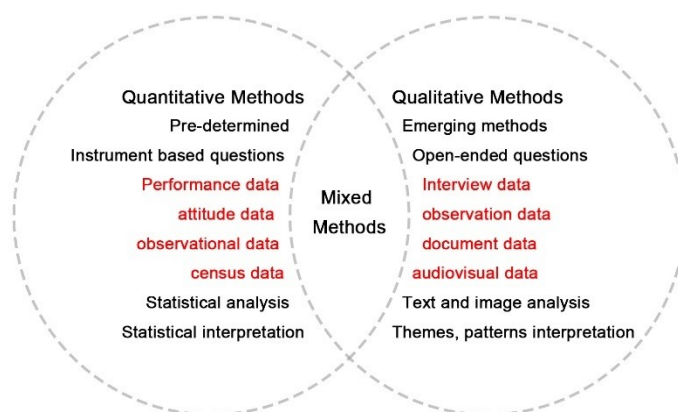


Figure 3.4 Comparison among quantitative (left), mixed (middle), and qualitative methods (right)
Source: Creswell (2009)

3.2.3 Case study research

The impact of social media derived from the development of Web 2.0 makes photographing together with online photo sharing a prominent phenomenon at present. Case study research is the very form of research that investigates contemporary phenomenon – the case – in its real-world context (Yin, 2009). In terms of research methods, case study can include both quantitative and qualitative methods – a mixed methods research, because multi-source data have significant explanatory power to the same issue. A desirable case, as Yin proposes, should be some real-life phenomenon with concrete manifestation. Swaffield (2017) points out that comparing cases (i.e. within-case and cross-case comparison) (Figure 3.5) provides a holistic understanding of variation and may shed light on similarities, differences and connections related to other cities

in China and those of other countries. A comparative method in a case study framework is very useful to examine covariation cross case data as well as conduct 'in-depth' exploration to understand the complexities of the situation in specific urban space (George & Bennett, 2005; Mills et al., 2009).

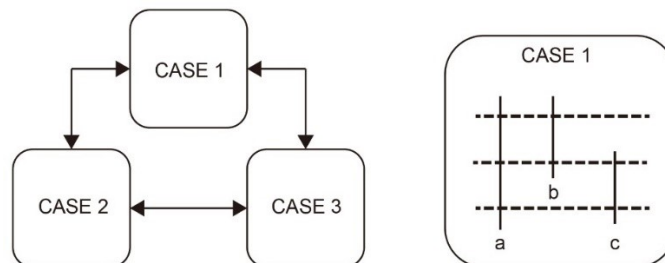


Figure 3.5 Cross-case (left, three cases comparison) and within-case (right, a, b and c comparison) comparisons
Source: Swaffield (2017)

The suggestions inspire case selection for this study, namely a comparative method to deal with research objective 2: (1) comparison of advertised attractions in urban parks with different cultural contexts, namely Traditional Chinese Gardens and Public Parks; and (2) comparison of residents and tourists. Cross-case comparison was implemented in two groups of urban parks. Specifically, two types of parks in Beijing were selected with different place identity, design strategies and visitors' expectations. According to Swaffield (2017, p. 112), compared with a single case, it is more compelling to examine multiple smaller embedded cases undertaken within the overall case study, as it allows comprehensive and robust comparison. Accordingly, ten urban parks were selected. Five urban parks were identified as Traditional Chinese Gardens therein, while the others were Public Parks built after 1949 when the People's Republic of China was established. Besides, the ten urban parks are mainly located at the northern part of Central Beijing and thus share similar population and contextual conditions. For comparison of different social groups (residents vs tourists), a case-within comparison was conducted between residents and tourists in case study parks, including Traditional Chinese Gardens Public Parks.

3.3 Technical research design

This research employs a combination of quantitative and qualitative methods, which are vital in relating research work with designing practice. In order to understand research objectives thoroughly, a mixed-methods approach has been developed. Focusing on social media data mining, this thesis also values qualitative research complimented with spatial analysis and mapping techniques. Figure 3.6 summarises key research methods involved.

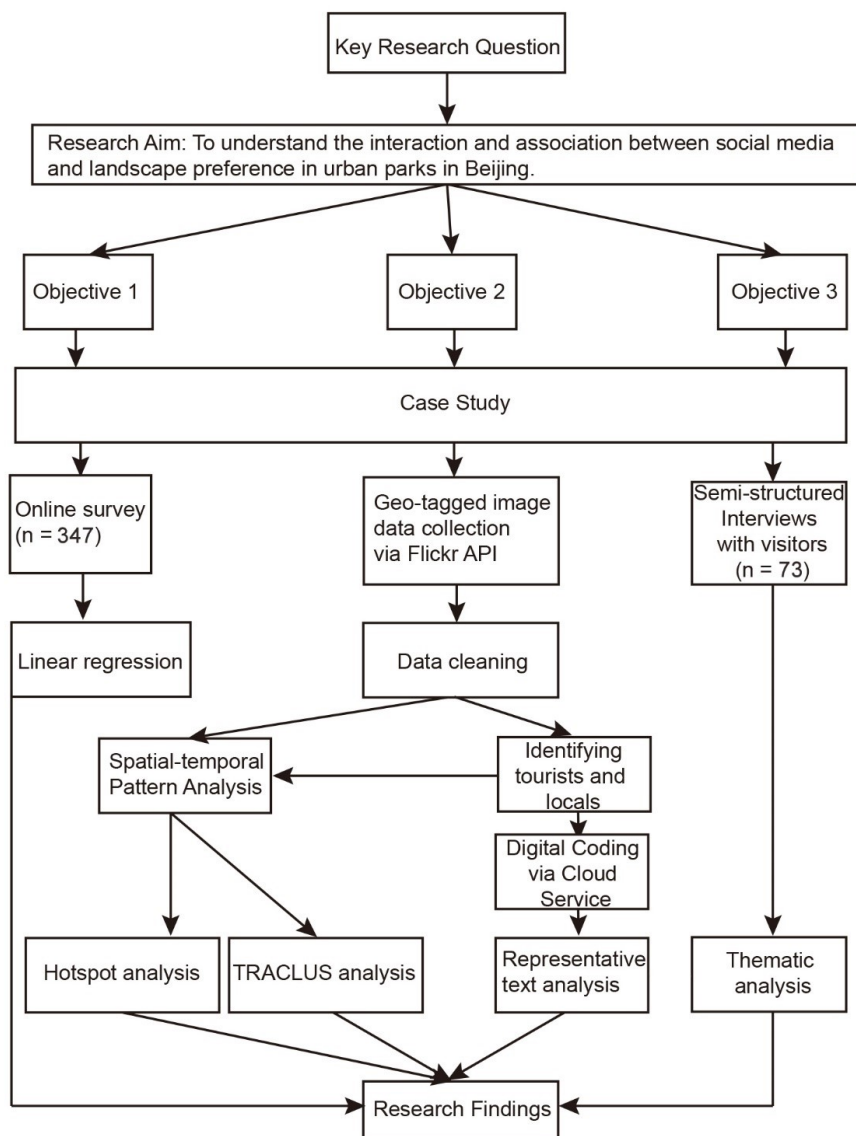


Figure 3.6 Summary of research methods and analysis

3.3.1 Harvesting social media data

Pilot attempts to harvest geo-tagged photos from Chinese social media platforms were conducted in 2019 because most platforms for microblogging (such as Twitter and Facebook) have been blocked since 2009. WeChat was released in 2011 and took the lead in Chinese social media platforms, just behind Facebook's WhatsApp and Messenger (Kharpal, 2019). It is known as Chinese Facebook, with which users can share images, text and short videos in its Moments platform with geographical position by geo-tagging. However, only friends in the user's contact list have access to these contents, nor open APIs (application programming interface) were provided by developers. Then I turned to the second popular platform launched in 2009 (Daily, 2011), Sina Weibo (Chinese word for "microblog"), a Chinese Twitter, through which users upload images, videos, texts publicly with geo-tagging. Although Sina Weibo is more open than WeChat and open API is available since 2014 for geo-tagged photo collection, its micro-blogging services mainly provides a public space with emotion, attention, attitudes and viewpoints about various issues readable to researchers (see Xue et al., 2014; Rauchfleisch and Schäfer, 2015; Li et al., 2020; Cui and Kertész, 2021). A study shows that Sina Weibo is less likely to be used for photo sharing (Prideaux et al., 2018) since released. Users tend to share, disseminate, and get news, trending content on Sina Weibo. However, Sina Weibo has the potential for research on image data mining with increasing active users and updated functions (Prideaux et al., 2018).

Compared to WeChat and Sina Weibo, Flickr is a more suitable social media platform for harvesting data based on research aims. Flickr is an online community for users who want to manage, store and show off their photos and videos with geotagging through its website page or mobile apps¹⁰. The geographical positioning accuracy of Flickr is at a neighbourhood level, ranging

10 <https://www.flickr.com/about>

from 46 meters (North America) to 1606 (Latin America), in which Asia is presented as 234.5 meters (Zielstra & Hochmair, 2013). Its core users are professional or semi-professional photographers at an early stage. Launched in 2004, Flickr provides image, video hosting services and open APIs¹¹ for more than 10 billion images based on its statistics¹². Therefore, our environment and culture are more likely to be documented and stored on Flickr and extract knowledge about places (Kennedy et al., 2007). According to a pilot trial, the number of photos uploaded from Beijing sharply decreased in 2020. However, this limitation does not detract from the new understanding that may emerge from the research, particularly in the fashion of collecting a 15-year length (from 2005 to 2019) data to explore landscape preference. Another challenge is extracting information from thousands of images collected from Flickr, which requires researchers to consider not only the efficiency of the methods but also the accuracy of analysing image contents in general. A previous study points out that a number of images on Flickr record events held indoors (Kachkaev and Wood, 2014). According to the research objectives, an ideal dataset should contain photos that fulfil the following criteria:

- available online
- contain timestamps and location attributes
- spatial-temporal information is reasonably accurate
- taken within study sites

The following sections further explain why digital data harvested from Flickr APIs satisfy these criteria.

3.3.1.1 Harvesting Flickr data

The Flickr metadata contains users' uploaded images, images' affiliated location attributes and taken time. This spatial-temporal information and image are valuable because they reveal social and cultural life (Rose, 2016, p.290).

¹¹ <https://www.flickr.com/services/api/>

¹² <https://thesmallbusinessblog.net/flickr-statistics/>

These images are produced digitally (by mobile phones or cameras) and organised digitally (uploaded to an online social media platform and circulated publicly). Figure 3.7 shows the process of harvesting and pre-processing images and related attributes from the automated Application Programming Interface (API) provided by Flickr. An API takes requests, tells the system and then returns the responses and results. The first step aims to harvest all the unique photo IDs that were taken between January 1, 2005, and January 1, 2020, within the bounding boxes. In order to collect outdoor photos, bounding boxes only include urban green open space. Then additional information about these photos, such as the geographic location and taken time, are harvested by entering the photo IDs as parameters. Although the bounding boxes cover the whole case study area, the boundaries of the study area are not overlaid perfectly with them. Therefore, the third step is to eliminate geotagged photos that are taken outside the study area. A prior trial shows that many users do not report their home location to Flickr, so a mixed strategy is used to classify residents and tourists in this step. Appendix A shows the calling methods and explanations of related parameters used in this research.

A database was built in MongoDB. MongoDB is a NoSQL document store model, which stores data as a key-value format rather than table format, which is the format of a Structured Query Language (SQL) document store model based on a relational database management system (RDBMS). The data harvesting application in this research generates intensive data and queries lots of data. MongoDB is more flexible and efficient in storing data without designing data structure before inserting data, especially to process a huge volume of data, such as digital information (Györödi et al., 2015). Thus, it is suitable for storing a large number of data harvested from public API. Table 3.2 shows the types of information that are stored in the database. All the steps of scraping photos and their relevant metadata from online sources were executed with a Python software programme designed for this research. A Python Flickr API

package created by Beej was applied because it was the easiest one to use and is maintained to date.

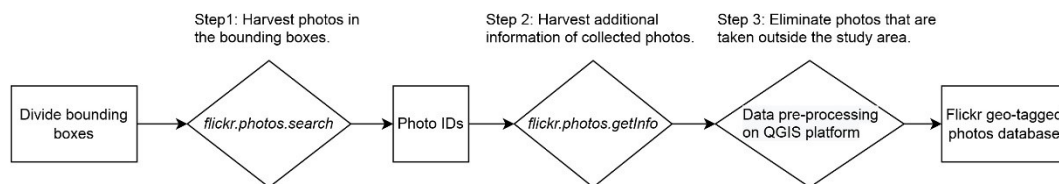


Figure 3.7 Flowchart of harvesting geo-tagged photos by using Flickr API calling methods

Table 3.2 Attributes of collected information

Collected information	Descriptions
Photo ID	The unique id of a photo
User ID	Identifier of photo users
hometown	Self-reported users' hometown
Home location	Self-reported users' home location
aTaken time	Timestamp of a photo
Latitude	Latitude of photo location
Longitude	Longitude of photo location
URL	Photo image URLs (Constructed by returned three parameters: id, server id, and secret)

3.3.1.2 Parameter setting for collecting photos

In order to collect photos that match research objectives, several arguments are set up with Python. The first calling method is *flickr.photos.search* to find and harvest photos within the specific spatial and temporal extent. This step yields a large number of photos taken between January 1, 2005, and January 1, 2020, within the central area of Beijing (within the 5th Ring Road). Responses of photo ID (id), user ID (owner), title (title) and URL of the image (constructed by using parameters farm, server, id and secret) are stored in a MongoDB database.

The parameter *bbox*, by which information can be collected within a bounded

area, will search images and affiliated attributes if a bounding box of four geographical positioning values is set. These values are minimum longitude, minimum latitude, maximum longitude and maximum latitude, which define the bottom-left corner and the top-right corner of the box. The case study area consists of ten urban parks in Beijing. Thus, ten bounding boxes covering the parks are formulated. Then, a routine of data harvesting is to divide the boxes into amounts of adjacent spatial cells as the smallest spatial search unit for data collection. However, the researcher finds that photos are unlikely to be organized in temporal sequence, which is the key to generating visitors' trajectories. Therefore, instead of dividing the ten big bounding boxes into smaller cells, the ten boxes are used as basic units for data collection. Besides, in order to gather as much geo-tagged photos as possible, data within each bounding box is collected in one-year time interval.

Then accuracy is 16, which represents the location accuracy level is street. Content type is 1, which means only still images and affiliated information will be collected. The *per_page* and *page* are defined as 250 and 500 respectively, which means maximum number of 250 unique photos per page and maximum number of 500 pages will be searched within every bounding box, because the maximum allowed values are 250 photos per page and 500 pages to be searched. The *min_taken_date* and *max_taken_date* are adjusted to one year (365 days) to deal with the maximum allowed limitation so that up to 12500 photos can be collected within a bounding box per year. An image URL is the source to find and download the image. Once the photos' ID, server ID, and secret are returned via *flickr.photos.search* API method. To this end, photos can be collected by constructing their URLs.

3.3.1.3 Parameter setting for collecting additional information

After photos' IDs are harvested in the previous step, the method *flickr.photos.getInfo* is applied to obtain additional information of these photos

(see Appendix A). In order to exclude the spatially irrelevant photos and shorten the process of information collection, once the geographical information is harvested, the data are imported to QGIS application and photos outside the study area are eliminated (Figure 3.8).

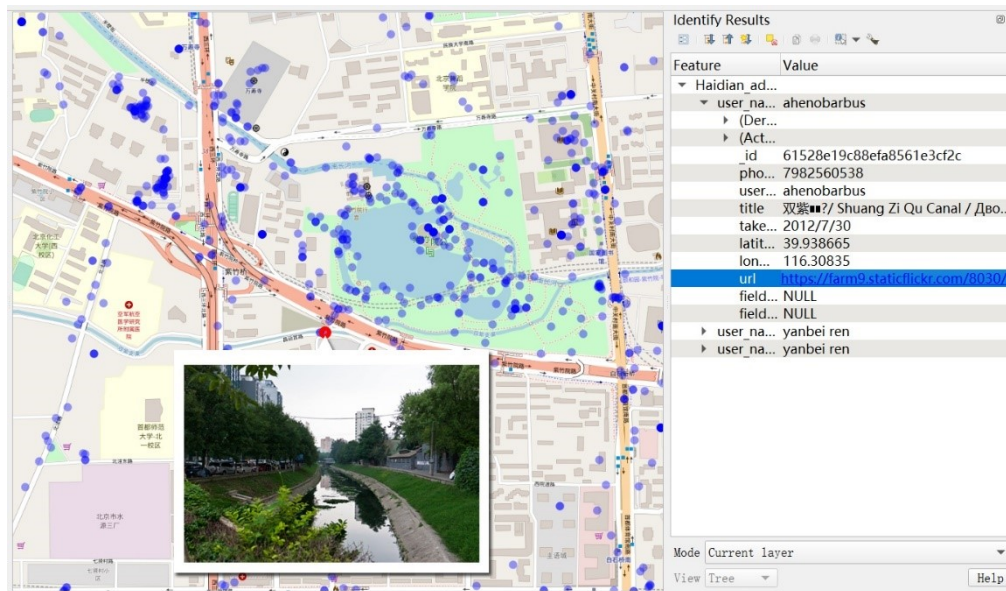


Figure 3.8 Sample of harvested photos with geographical information in QGIS platform

Source: by author

3.3.1.4 Data pre-processing and classification of users

A total of 107065 pieces of information and images are collected. Using a rectangular bounding area yielded a large number of photos, thus the collected data were spatially trimmed by using GIS software, in other words, images' geographic information which are located outside the study area are eliminated. Figure 3.9 outlines two fundamental processes: (1) harvesting geo-tagged photos and affiliated information from Flickr API, and (2) analysing content of Flickr photos using Google Cloud Vision service.

For the classification of tourists and residents in Flickr metadata, some researchers analyse individuals' behaviour in a period of uploading photos. Those who upload photos at a more than intervals of 30 days as residents and within intervals of 30 days as tourists (Girardin et al., 2007; Girardin et al., 2008).

Sun et al. (2015) suggest that tourists usually take photos within a month or successive months, whereas residents usually take photos every month of a year. Other researchers identify the domestic visitors and foreign visitors by collecting users' location from their Flickr profile (Straumann et al., 2014; Wood et al., 2013; Tenerelli et al., 2017). It is proved that attribute of user location is generally in line with user's home location. For example, through analysing all geo-tagged image data uploaded from 2005-2012, Wood et al. (2013) compare origin information that are derived from users' Flickr profile with nationalities collected from national entry points and conclude that self-reported home location by Flickr users serves well in predicting originating nations of visitors.

Accordingly, self-reported home location and time intervals of taking photos in the same park were combined to classify residents and tourists. More specifically, for those who reported home locations were easily classified as residents or tourists; and for those who did not report any location information, if those revisited the same park at an interval of more than a month, they were classified as residents, otherwise as tourists.

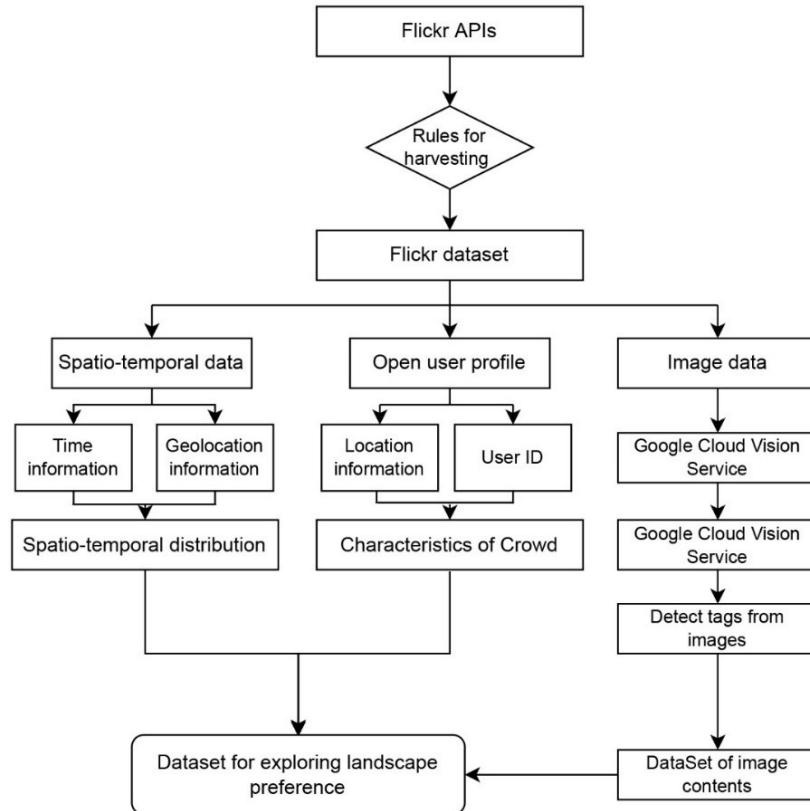


Figure 3.9 Process of data collection and pre-processing from Flickr

3.3.2 Selecting social media big data analytics

With the collection of massive geo-tagged photos and affiliated information generated by users in their daily life, there is valuable information contained in social media big data. Analytics are developed for trajectory exploration (Yin et al., 2011), event detection (Carney, 2016; Huang et al., 2018; Krumm & Horvitz, 2015; Peca et al., 2012), city identity study (Zhou et al., 2014), travel recommendation (Jiang et al., 2013; Liu et al., 2012; Lu et al., 2010; Sun et al., 2015), land use patterns (Wang et al., 2016) and health issues such as predicting disease transmission (Sadilek et al., 2012) and air pollution (Yan et al., 2019). As big data is the set of information characterised with high volume, high velocity and high variety (De Mauro et al., 2015; Khan et al., 2014), analytics techniques are selected corresponding to different types of data, namely text, visual, voice, network (e.g. telecommunication networks, transport information) and geospatial (Amalina et al., 2019). The proliferation nature of

user-created content from social media is where artificial intelligence and data analytics can be implemented.

Figure 3.10 illustrates categories of techniques with respect to social media big data mining. In this, text mining is commonly implemented in extracting social media information. In this study, the Flickr dataset was made up of images (photos), geographical coordinates (latitude and longitude), user profile (e.g., home location), and temporal information (taken-time format: YY/MM/DD). In this regard, the content-based analysis from text mining genre is selected to investigate contents of Flickr photos (Aggarwal & Wang, 2011, p. 5).

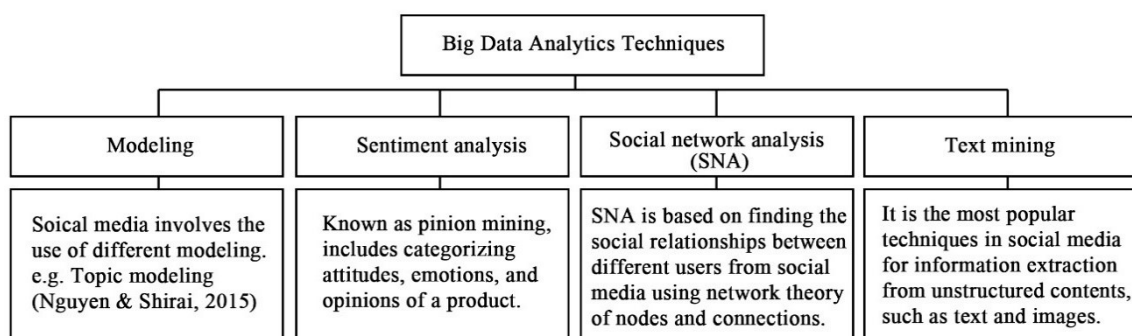


Figure 3.10 Classification of techniques for big data analytics on social media
Source: Adapted from Ghani et al., 2019

Moreover, geotags together with time stamps are useful in exploring environment-behaviour interactions, such as movement patterns (Chen et al., 2015) and trajectory recommendation (Yin et al., 2011). Detecting similarities/dissimilarities of spatio-temporal (ST) data, including point similarity, trajectory similarity and time-series similarity, is paramount in data mining tasks, such as clustering and classification (Atluri et al., 2018). Table 3.3 shows exploratory methods to analyse ST data with respect to social media. According to research objectives discussed in 3.2.1, firstly, clustering method – clustering points – is used identify hotspots and find clusters of ST points, namely the most photographed places. Secondly, sequential patterns in trajectories and

clustering trajectories are used to explore visitors' move patterns of photographing in parks. This section further discusses models, algorithms and techniques used in this study.

Table 3.3 Exploratory methods of spatio-temporal (ST) data mining in social media context

Methods	Definition	Analysis objectives
Clustering	Grouping of instances in a dataset that share similar feature values.	<ul style="list-style-type: none"> • Clustering points: finding the hotspots. • Clustering Trajectories: finding similar trajectories. • Clustering Time Series: finding spatially coherent and temporally similar groups. • Clustering Spatial Maps: finding groups of time stamps that have similar spatial maps.
Frequent Pattern Mining	Discovering patterns that occur frequently over multiple instances.	<ul style="list-style-type: none"> • Co-occurrence Patterns in ST Points: detecting events that occur in close spatial and temporal proximity. • Sequential Patterns in ST Points: exploring the occurrence of ST events of a particular type can trigger a sequence of ST events of other types. • Sequential Patterns in Trajectories: detecting the sequences of spatial locations that are visited by multiple moving objects in the same order and are thus covered by multiple trajectories (e.g., trajectories of tourists).
Anomaly Detection	Detecting instances that are remarkably different from the majority of instances in the dataset.	<ul style="list-style-type: none"> • ST Point Anomalies: detecting a spatio-temporal outlier that breaks the natural ST auto-correlation structure of the normal points. • Trajectory Anomalies: identifying anomalous trajectory. • Group Anomalies in ST Rasters: detecting anomalies appear in ST raster data.
Relationship Mining	Finding similar relationships among pairs of time series.	<ul style="list-style-type: none"> • One type of relationship is defined as a similarity/dissimilarity between two distant groups of contiguous locations.
Change Detection	Identifying the behaviour of a system changed from its past behaviour.	<ul style="list-style-type: none"> • Detecting changes in the context of time-series data.

Source: Adapted from Atluri et al. (2018)

3.3.2.1 Cluster analysis – clustering points

Clustering points – hotspot analysis

Classification is the key to make probability judgements by grouping objects that are similar to each other based on some criteria (Hartigan, 1985). Partitioning clustering and density-based clustering are two commonly used approaches. K-Means Clustering method, which is the representative algorithm of partitioning clustering, has been used for the classification of geo-tagged data in many studies (Chen et al., 2015; I. Lee et al., 2014; R. Lee et al., 2011; Liu et al., 2012; Wang et al., 2016). Hartigan and Wong (1979) describe the aim of k-means algorithm is “to divide M points in N dimensions into K clusters so that the within-cluster sum of square is minimized”. Euclidean distance is measured between points and cluster centres. The K, as Hartigan and Wong put, is K partitions that have the optimal within-cluster sum of squares on movement of a point from one cluster to another. Thus, the procedure is to search for the K cluster centres, which is similar to Euclidean cluster analysis but the K-Means algorithm provides locally optimal solution (Hartigan & Wong, 1979). Another popular clustering approach is density-based spatial clustering of applications with noise (DBSCAN), which is more effective in detecting arbitrary shapes than an improved k-medoid method (Ester et al., 1996). The process of DBSCAN starts with an arbitrary point p and retrieves all points density-reachable from p (Ester et al., 1996). Two main parameters are ϵ (*Eps*), which means the domain of central points, which can be used to determine whether the observed points lie within the cluster; and *MinPts*, which means a minimum number of points in an *Eps*-neighbourhood. These two parameters are set manually from the beginning. The clustering results of k-means and DBSCAN are compared in Figure 3.11, which illustrates that DBSCAN performs effectively in dealing with noises and different shapes.

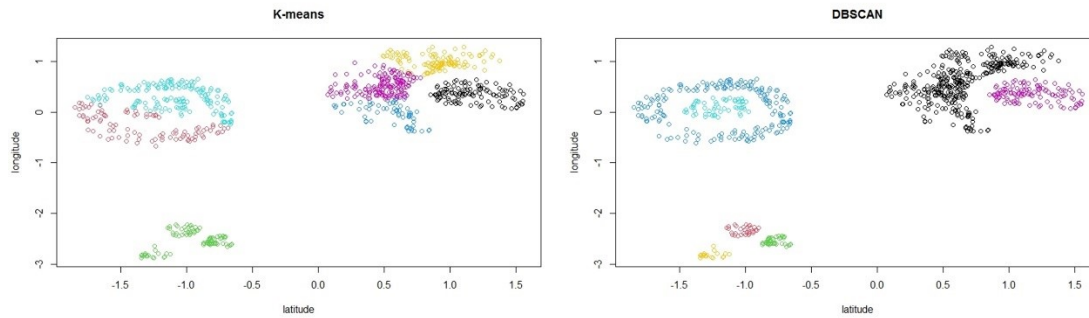


Figure 3.11 Comparison of clustering performance between k-means and DBSCAN methods

Source: by author

K-means method based on the distance of objects, in another word, the closer the objects, the similar the objects are, while DBSCAN method is useful for classifying densely clustered data but it does not work well if the spatial distribution is uneven(Wang et al., 2016). Kennedy et al., (2007) conduct k-means clustering to classify digital images by using concatenated colour and texture feature vectors because this method is considered as a standard and straight-forward approach. Lee et al. (2011) have measured the spatial distribution of geo-tagged tweets and the presence of patterns through k-means clustering on the bases of latitudes and longitudes information. However, DBSCAN is robust when dealing with noise and has good potential to classify data with irregular shapes (Shen et al., 2016). This technique has been implemented in detecting criminal hotspots (Mohammed & Baiee, 2020), forest fires events (Nisa et al., 2014; Sukmasetya & Sitanggang, 2016), disease outbreaks (Nandana et al., 2019) and Points of Interest (POI) (Angkhawey & Muangsin, 2018). Therefore, DBSCAN algorithm is adopted due to the complexity nature of park space, leading to the arbitrary distribution of geo-tagged photos.

3.3.2.2 Cluster analysis – clustering trajectories

TRACLUS analysis

Trajectory data is one of the key aspects embedded in social media photos,

associated with temporal and geographical information. In order to explore the hidden patterns of environment-behaviour interactions, potential patterns of picturing behaviour can be revealed through mining trajectories. A travelling visitor generates two main attributes: affiliated geotags and timestamps, whereby the geotags is stored as geographical coordinates x and y, and timestamps are stored in the format DD/MM/YY. Figure 3.12 shows the sequencing of spatial points and a simple connection of them as a trajectory. Flickr provides geographical information at fine granularity for geo-tagged photos, thus making extracting trajectories possible. A representative trajectory pattern contributes to revealing collective interests of places, Yin et al. (2011) mine frequent sequential patterns as a consolidated representation of trajectory patterns. Trajectory clustering is utilized in many domains, such as vehicle trajectory clustering (Fu et al., 2005), identifying flight trajectory patterns (Conde Rocha Murca et al., 2016; Olive & Morio, 2019), pedestrians counting (Antonini & Thiran, 2006), animal movement and hurricane track (Lee et al., 2007).

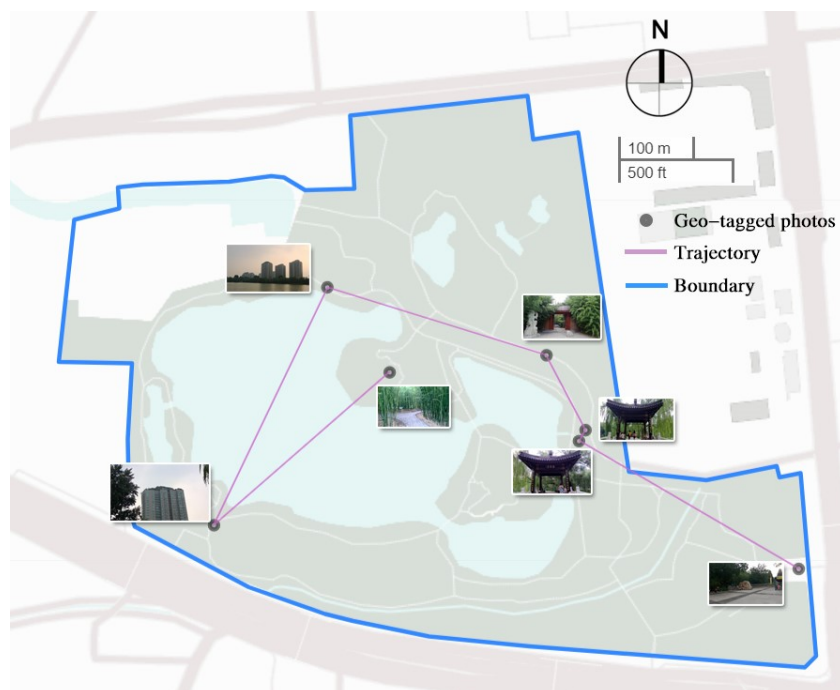


Figure 3.12 Example of a visitor's movement trajectory based on geographical information of Flickr photos

Source: by author

In trajectory clustering problems, grouping objects that share similarity and identifying representative trajectories are the key to recognise potential patterns when trajectories are intensively intertwined (Atluri et al., 2018). Representative trajectory of a cluster describes overall movement of objects in that cluster; thus, it is required in trajectory clustering. Furthermore, trajectory data may have complicated and long paths for a large number of objects. TRACLUS is a typical clustering algorithm for trajectories of moving objects, such as hurricane track data, animal movement data (Lee et al., 2007). It consists of two steps in a partition-and-group framework: first, minimum description length (MDL) principle is used to partition trajectories; second, a density-based line-segment clustering algorithm is conducted to generate clusters and representative trajectories of these clusters. TRACLUS is based on the assumption that the common behaviour showed by some portions of trajectories is of importance in trajectory data analysis, while simply clustering the whole trajectories might not reveal this hidden information. Specifically, it is interested in the same types of places that have been visited according to how trajectories traverse across different locations (Mazimpaka & Timpf, 2016).

In partition phase, trajectories are partitioned into a set of line segments. MDL is used to ensure preciseness and conciseness, whereby difference between original trajectories and their partitions should be as small as possible, and the number of trajectory partitions should be as small as possible. Since to some extent the two properties are contradictory to each other, MDL also conduct a desirable trade-off between them. In grouping phase, line segments of the same cluster are close to each other according to a distance measure. Then a density-based clustering is conduct to group line segments. Lastly, representative trajectories are calculated according to the common subtrajectories per cluster to reveal major moving behaviour of a cluster. In this, parameters should be set in advance (see Appendix B). TRACLUS analysis is

conducted based on a Github project *traclus_impl* (code is available online¹³).

3.3.2.3 Content analysis – computer-aided coding

Definition

Content analysis is defined as “systematic, objective, quantitative analysis of message characteristics” (Neuendorf, 2017, p.1). Rose (2016, p.85) points out that content analysis is originally utilised to inquire hidden meanings or implicit messages of text materials, while the methods of it are not necessarily quantitative, such as semiology and discourse analysis. Neuendorf (2017) makes it clear in the discussion of content analysis, content analysis shares the similar objectivity, generalisation and drawbacks of self-report with survey research. Contrast to experiment research approach, which manipulates independent variables and control settings (Campbell and Stanley, 1963), a survey measures all variables occurred and thus has higher external validity and lower internal validity. According to research purposes, texts can be collected from various sources, such as newspaper coverage (Atkinson and Herro, 2010; Hase et al., 2021), letters to the editor (Perrin and Vaisey, 2008), mathematics textbooks (Özgeldi and Esen, 2010), written works (Baddeley et al., 2011), webpages (Danowski and Park, 2009; Zhu et al., 2009), views from social media (Himmelboim et al., 2013; Thelwall and Buckley, 2013), and greenways planning (Floress et al., 2009). Content analysis is one of the optional methodologies to inquire new phenomena. Neuendorf suggests that there is an expansion that content analysis can be conducted not only on written word but images, sounds or any other messages with the computer-aided techniques, although it historically refers to examination of written words (2017, p. 34). Interactive media is also an important source other than mass media (e.g., television, newspapers, journals and radio) for content analysis, especially when mobile devices are designed to promote the use of social

¹³ https://github.com/apolcyn/traclus_impl

media platform, such as Facebook, Instagram, Twitter.

Coding images

Rose (2016, p. 88) concludes a general process to conduct content analysis for images: (1) Finding images; (2) devising coding categories; (3) coding the images and (4) analysing the results. The first step is to find and collect all the images that are pertinent to research questions or hypotheses, namely the representativeness should be fulfilled.

Coding is the key to prepare the data for analysis. There are two types of coding methods according to who decode the data, namely human coding and computer coding (Neuendorf, 2017). Both methods are using well-defined code categories to ensure the results are replicable (Rose, 2016, p.96). Neuendorf (2017, p.39) calls computer coding as “computer-aided text analysis” and variables, which are what Rose (2016) terms coding categories in analysing visual images, are preestablished. In order to develop a coding categories framework, theory and past empirical research contribute to collecting and selecting relevant variables. Rose suggests three criteria for choosing variables of an image:

- exhaustive: categories should cover all the aspects that can answer the research questions.
- exclusive: categories should not overlap.
- enlightening: ways of breakdown an image should be coherent and interesting.

However, components of an image may be not categorised exclusively, for example, Lutz and Collins (1993) uses “surroundings of people photographed” and “urban versus rural settings” as two coding categories, which are to some extent overlapped. Depending on Kevin Lynch’s theoretical literature about “elements of city image”, Huang et al. (2021) code images for paths, edges,

districts, nodes and landmarks to present visual qualities of urban space from the perspective of social media users and overlapping cases exist, for example, a photo of iconic buildings or plaza is labelled as *node* and *landmark*. There are also some disputes on Lynch's classification of urban physical forms. Legibility of a city lays the foundation of formulating Lynchian elements. However, navigation and location services are embedded in smart phones and saturate in many aspects of everyday life, such as using Google map, adding location to tweets and preconceiving a place without being there, thus inhabitants' experience of navigating, forming mental maps of cities may have changed with the distribution of digital media (Al-ghamdi et al., 2015).

Through computer-aided techniques, contents of images are normally broken down into several scene attributes, such as trees, asphalt, canal (Patterson and Hays, 2012). Therefore, Zhou et al., (2014) merge 42 scene attributes from SUN database into seven general categories: green space, water coverage, transportation, architecture, vertical building, athletic activity and social activity. Liu et al. (2016) recoded images as seven categories: green perception, water perception, transportation perception, high-rises perception, architecture perception, socialising perception and athletic perception as well. In this study, there are no clear criteria of recoding. Rather, the seven categories seem to be resorted to reclassification, mergence and elimination of original scene attributes from the database. Egorova's (2021) model was used in classification of human-nature interaction scenes when comparing different image recognition online services (Ghermandi et al., 2021). There are three general categories of image content in Ghermandi's research: activities, environment, feelings and cognition, and 12 sub-categories. Another evidence-based classification of geo-tagged photos finds nine categories of auto-generated tags: landscape aesthetic, existence, indoors/people, car racing, festival, cultural landmark, transportation, concert and equipment (Lee et al., 2019). Breaking down photos and detecting objects are still valuable in exploring human

perceptions of urban environment. A study proves that negative/positive correlations exist between urban physical factors with perceptual responses (Zhang et al., 2018). However, these methods have limitations in exploring and answering questions about everyday life.

Rose (2016, p.57) argues that image itself is deemed to be examined carefully and thus the appearance of images offers clues to describe them, which is elicited from 'painting in the Western tradition of fine art'. There are several aspects in compositional modality of a still image. They include:

- content: the genre or theme of an image.
- colour: hue, saturation and value are used to describe colour of an image.
- spatial organization: geometrical perspective presented by an image.
- light: light sources (candlelight, daylight, electric light) convey by an image.
- expressive content: "atmosphere" of an image.

Neuendorf (2017, p.70) describes five sampling strategies: (1)random: label unites with numbers and use a random number generator to pick cases; (2)stratified: choosing target subgroup from the dataset and resampling in the subgroup; (3)systematic: selecting every case from dataset with same interval; (4)cluster: a random sampling of a group; (5) multistage: sampling methods are used in different steps of research based on the objectives. Choosing one or more as a combination contributes to make the sheer scale of data manageable.

Computer-aided coding

Content analysis of substantial images is not easy for reviewers; especially big data resources are accessible in the era of social media (Oteros-Rozas et al., 2018). Because of the capability of recognising image rapidly, pre-trained image recognition models are increasingly utilised by researchers. Among well-known online image recognition services, Google Cloud Vision¹⁴ have been used for

14 <https://cloud.google.com/vision>

assessing cultural ecosystem services (Richards and Tunçer, 2018; Runge et al., 2020; Song et al., 2020) and aesthetic value (Gosal and Ziv, 2020). Ruiz-Frau et al. utilise Microsoft Computer Vision¹⁵ to assess cultural ecosystem services (2020). Clarifai¹⁶ is also used for mapping cultural ecosystem services with tag clustering (Karasov et al., 2020) and mapping aesthetic and recreational values (Lee et al., 2019). Other two studies used Places Convolutional Neural Network (CNN) (Seresinhe et al., 2018) and ResNet50 pretrained on MIT Places (Payntar et al., 2021). IBM's Watson Visual Recognition¹⁷ and Amazon Rekognition¹⁸ are also provide free image recognition service in a limited number of image and in a limited period.

In terms of the generated results, for example, the documentation of Google notes that "Google Vision API can detect and extract information about entities in an image, Labels can identify general objects, locations, activities, animal species, products, and more." *Score* means that the confidence score, which ranges from 0(no confidence) to 1(very high confidence); *topicality* means that the relevancy of ICA (Image Content Annotation) label to the image. For each detected image, Label detection model returned maximum 10 labels and for each label, returns a textual description, confidence score and topicality rating.

Features of image, such as orientations, background texture and colour significantly influence performance of cloud-based recognition platforms in an experiment of Amazon Rekognition and Microsoft Azure, while image quality has minor influence on accuracy (Temel et al., 2019). Nilsson and Jönsson (2019) compare five cloud image recognition services (Google Cloud Vision, Microsoft Computer Vision, IBM Watson, Clarifai and Amazon Rekognition), the results show that Google Cloud Vision performs the best on average, however,

15 <https://azure.microsoft.com/en-gb/services/cognitive-services/computer-vision>

16 <https://www.clarifai.com/models/general-image-recognition>

17 <https://visual-recognition-code-pattern.ng.bluemix.net>

18 <https://aws.amazon.com/rekognition>

services have different performance levels in different image categories. In terms of detecting emotions, Microsoft Azure is proved to acquire the highest accuracy and confidence compared to Amazon Web Services and Google Cloud (Al-Omair and Huang, 2018). An in-depth study has analysed three cloud services (Google Cloud Vision, Clarifai and Microsoft Azure Computer Vision), the results show that there are significant variation of vocabulary and frequency of retrieving tags among different services, and Google is favoured in exploring environment features because its largest number of biological and ecological tags, while Clarifai may have advantages over detecting feelings and Microsoft Azure has the lowest number of human-nature interaction tags (Ghermandi et al., 2022). Compared to manual codes, a study indicates that Google Vision may underrepresent nature features, especially specific types of wildlife and plant communities, but automated coding is less biased for other features (Wilkins et al., 2022). A trail was conducted to test how these automatic tagging services perform in extracting information of green space in cities, due to the complexity of urban environment.

Coding service selection

After reviewing previous content classification of digital photos, four groups, each of which contains 30 photos taken by writer (see Figure 3.13 and Figure 3.14), are used to test three most commonly used computer vision cloud services: Microsoft Azure Computer Vision (henceforth 'Azure'), Google Cloud Vision (henceforth 'Google') and Clarifai. Each photo is uploaded and detected through services' API with up to 25 tags are extracted. One pair of groups: "urban green space" (gardens, parks, urban nature sites) and "other urban space" (city streets and other open space), are used to test 1) which model performs the best in detecting greenness in urban environment and 2) the richness of vocabulary in describing urban environment and plant community. Theses two groups of photos were taken in Beijing when writer went for a field trip. The next pair of groups are: "nonpanoramic" (zooming in several objects

that interest photographers) and “portrait photography or selfie” (the photographs of persons), are to 1) explore the potential of identifying objects related to urban environment and 2) differentiating landscape pictures with portrait photos. The photos in “nonpanoramic” group were taken by writer in parks of Beijing and the “portrait photography or selfie” group were selected from writer’s picture storage disk, in which photos were all taken by writer.

Word cloud or static tag cloud visualization is used as a straightforward to represent the content overview of a set of texts (Cui et al., 2010; Heimerl et al., 2014). A common word cloud file is a rectangular tag arrangement filled with tags or words in different sizes, which highlight the different frequency or importance of detected words (Hearst et al., 2019). The perception of word cloud is proved to be effective and initiative in text analysis tasks. The WordCloud package (Jin, 2017) and its API is used to conduct word frequency analytics and visualise the result in Python.

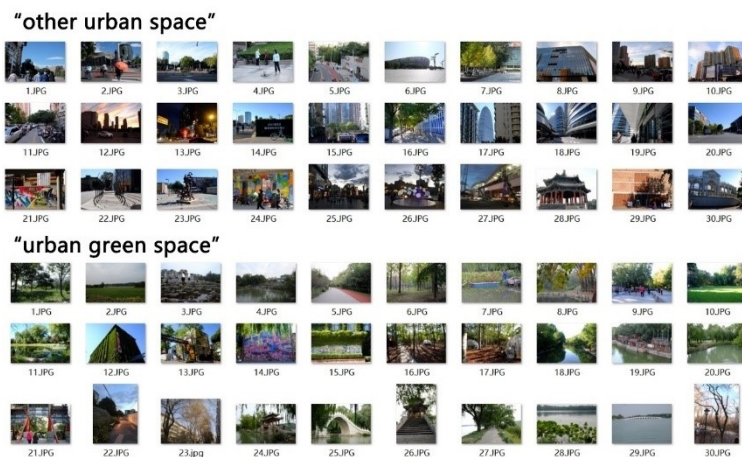


Figure 3.13 Selected photos in the groups of “other urban space” (n=30) and “urban green space” (n=30)

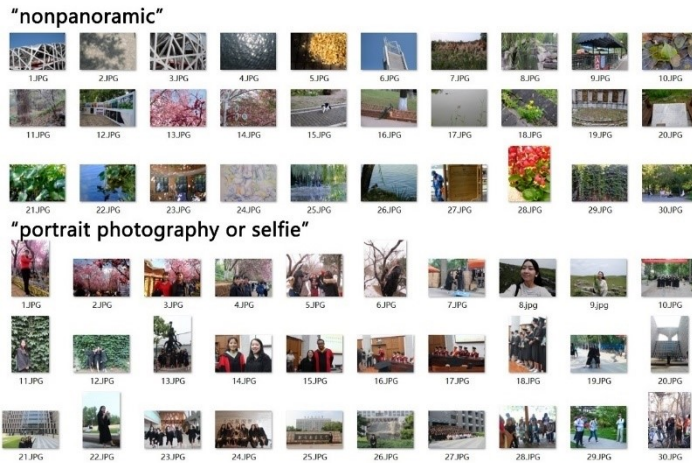


Figure 3.14 Selected photos in the groups of “nonpanoramic” (n=30) and “portrait photography or selfie” (n=30)

Figure 3.15 demonstrates the result of word cloud analysis for “other urban space” group. According to size of the words, Azure and Clarifai generate most tags related to cityscape, such as street, outdoor, city, urban and building, while Google contains most tags of tree, building and plant. Tags that are related to greenness is hardly recognizable in Clarifai, Azure has identified tree from photos, through not as much tags as Google extracts. As Figure 3.19 illustrates, Google has detected the greenness in two photos of “other urban space” group, however Azure and Clarifai fail to identify greenness of the environment, which is likely due to the regular shape of pruned shrubs and the small proportion of trees. In terms of “urban green space” group, these three services contain rich vocabulary to tag the contents (Figure 3.16). In terms of ‘nonpanoramic’ group (Figure 3.17), Clarifai tag the content with more general words, such as nature, outdoors, park, no person, while Google mostly tags photos with more specific words, such as grass, tree, wood, flower and plant. Azure performs in-between Google and Clarifai, which uses general words, such as outdoor and nature, and uses specific words, such as tree, plant and flower. Figure 3.18 suggests the capability of detecting greenness in the background when people are present in the photos. In this, Google has identified vegetation in the background (see the largest words: plant and tree) and people’s sentiment (see

latter were score and topicality. The score, according to official guides¹⁹, presents “confidence score”, literally means the probability of the image being detected correctly, ranging from 0 (no confidence) to 1 (very high confidence). The topicality denotes the relevancy of the ICA (Image Content Annotation) label to the image, measuring how important a label is to the overall context of a page. However, the trial illustrated that the confidence score and topicality score are always the same, through it is possible to be coincidentally the same. This problem was reported to Vision API and considered to be a bug needed to be fixed. In this case, these numeric responses were not included in this study.

Accuracy discussion

Google Cloud Vision applies convolutional neural networks (Girshick et al., 2015) and a deep learning algorithm (LeCun et al., 2015), trained with a large number of images (Chen & Chen, 2017). Google Cloud Vision can be misled and the accuracy of predicting labels for the image is dramatically reduced if noises are present in the image (Pathak et al., 2019). The features and attributes can be correctly detected by Google’s API again by passing images through noise filter algorithms (Hosseini et al., 2017). In another study measuring the effectiveness of Google Cloud Vision API, the experimental results were quite competitive compared with other algorithms when the image is noise-free (Chen & Chen, 2017). Considering the result of the pilot tests of greenness detection illustrated in Table 3.4 and the condition that study sites are all in urban parks, Google Cloud Vision satisfies the study objectives in the natural environment.

3.3.2.4 Content analysis – text representation

As discussed in 3.3.2.3, Google Cloud Vision service (henceforth ‘Google’) performed better detecting greenness in the environment, thus it was chosen

¹⁹ see website: <https://cloud.google.com/vision/docs/labels>

to extract features that describe Flickr photos in this study. However, categories of labels are massively diverse, which makes it difficult to describe landscape features embedded in the photos. So it is highly desirable to classify detected items and reduce dimensions of feature space (Zhang et al., 2011). For example, categories acquired from Google through uploading the photos of a park in Beijing (The Summer Palace) reached up to 1118. Identifying most representative key labels contributes to get rid of redundant information and formulate a more comprehensible scenario. To this end, this study referred to text mining.

Text mining is the process of discovering interesting and non-trivial patterns or knowledge from text documents or textual database (Tan, 1999). Information retrieval is at the key for text data mining, which, as Hearst suggests, is a mixture of computationally-driven and user-guided analysis (1999). One of key objectives in text mining is to extract sets of keywords or terms that can represent their contents, namely text representation (Zhang et al., 2011). This seems fit within text categorization framework, which is to 'boil down of the specific content of a document into one (or more) of a set of pre-defined labels' and thus to discover patterns or trends among textual data (Hearst, 1999).

There are two kinds of work for text representation: indexing and weighting, the former means to extract keywords for document and the latter is the job to assign weight for the keywords, reflecting importance of keywords to documents (Lewis, 1992; Zhang et al., 2011). For evaluating performance of representation, two kinds of properties are concerned: semantic qualities, referring to the extent that a term can describe a text, and statistical qualities, referring to the discriminative power of indexing terms in identifying a category of content (Hidalgo, 2003). In terms of text representation methods, TF*IDF (Frequency Inverse Document Frequency), LSI (Latent Semantic Indexing) and multi-word are commonly used indexing methods. In an comparative study

(Zhang et al., 2011), the performance of these three methods are evaluated from perspectives of information retrieval and text categorization.

In terms of the content-based image detection, annotations or labels yielded by Google Cloud Vision for a single image contains synonymy (Table 3.5), such as branch and twig, flower and blossom, where the approach uses different terms to describe the same information. This may result in that two synonyms have same high frequency in the document being retained as topics. For example, the method TF*IDF proposed by Jones (1972; 2004), calculates the frequency that a term occurs in documents weighing with the number of documents in which a term appears in the document collection (Ramos, 2003). In text representation task, percentages of individual words with top scores are commonly used as the representative descriptions of the document (Ghermandi et al., 2022; Zhang et al., 2011). TF*IDF method has been implemented to identify representative tags from a large amount of tags derived from image labelling model (Ghermandi et al., 2022). Since the TF*IDF score increase proportionally to the number of times that a term appear, synonymy of high frequency is inevitably included, while the coupled features are excluded in the feature set for potential topic interpretations.

Moreover, it is worth noting that generated labels are not always in the same level of the ontology tree, such as 'tree' and 'branch', 'natural landscape' and 'flowering plant'. Figure 3.20 shows a typical ontology tree, which is a top-down hierarchical structure of a domain, consisting of comprehensive set of concept classes and relationships between them (Hare et al., 2006; Osman et al., 2014). An ontology is defined as 'a formal, explicit specification of a shared conceptualisation' (Studer et al., 1998). An ontology element refers to the shared concept in the context of semantic annotation (Pesquita et al., 2014). In this regard, ontology-based annotation is commonly used by semantic annotation systems (Rodríguez-García et al., 2014).

The diverse level of extracted labels in ontology tree provides exciting opportunities for exploring preference. On the one hand, it sheds light on exploring detailed features of people’s landscape preference compared to several vague terms, such as tree, flower, sky and natural landscape. On the other hand, these detailed terms may not present as much as the general words, rather they appear in the document coupled with the general words, such as tree and branch, flower and petal. Thus, the detailed features are likely not retained to construct the feature set because of its smaller number of times the term appears in documents. In another word, lacking different levels of words, the information of a feature set is too limited to interpret and distinguish from others. To this end, it is appropriate to select a method that can extract the representative general word as well as take relations between words into account.

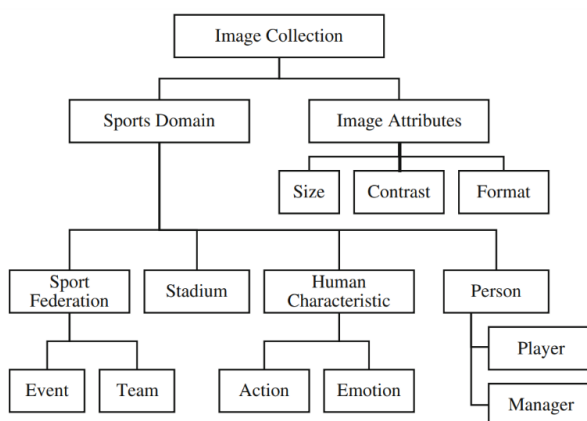


Figure 3.20 Subset of the ontology tree

Source: Osman et al., 2014

Table 3.5 Samples of retrieved labels through Google Cloud Vision

Photo codes	1	2	3	4	5
Label_1	Flower	Sky	Sky	Flower	Water
Label_2	Sky	Plant	Cloud	Plant	Sky
Label_3	Twig	Natural landscape	Daytime	Petal	Building
Label_4	Petal	Tree	Plant	Twig	Water resources
Label_5	Natural landscape	Twig	Flower	Branch	Skyscraper

Label_6	Sunlight	Wood	Tower	Sunlight	Natural landscape
Label_7	Pink	Terrestrial plant	Branch	Tints and shades	Lake
Label_8	Shrub	Trunk	Twig	Flowering plant	Sunlight
Label_9	Tints and shades	Tower	Building	Blossom	Tower block
Label_10	Flowering plant	Deciduous	Vegetation	Tree	Watercourse

Note: ten labels are sorted descending according to the corresponding topicality score.

In this study, LSI method is chosen for text representation according to features of collected dataset. Labels are structured text for they are derived from the scene recoded by a photo, which presents a “way of seeing” with inherent subjectivity, such as the decision of what and when to record, what angle (Schwartz & Ryan, 2003, pp. 1-18). In this sense, relationships among labels are worthy of attention. In the field of text representation, there are two sides of mismatch problem: synonymy and polysemy (Deerwester et al., 1990). Because the fact that people use different terms to describe the same object in different contexts and they also use the same term to refer to distinct meanings.

LSI method is a computational technique using linear algebra for information retrieval (Evangelopoulos, 2013). It has been used in mining topics, public opinions from twitter (Bansal et al., 2016; Di Corso et al., 2017), assessing textual relationship between biodiversity and geodiversity (Fox et al., 2021), discovering topics of Flickr groups (Negoescu & Gatica-Perez, 2008) and investigating social interactions from Instagram (Ferrara et al., 2014). The basic idea is that “the aggregate of all the word contexts in which a given word does and does not appear provides a set of mutual constraints that largely determines the similarity of meaning of words and sets of words to each other” (Landauer et al., 1998). Deerwester et al. explain that this retrieval system concerns if there is correlation between the occurrence of one term and another, showing a superior performance to simple term matching in one standard case and equal in another. LSI method deals with the synonymy problem and

partially solves the polysemy problem, which comes from a good discriminative power (Zhang et al., 2011).

In order to conduct an LSI, documents need to be transformed into machine-readable language, namely vectors that are made of Boolean values. That is, a word will be set as 1 if it appears in the sentence more than once, otherwise, it will be set as 0. Then, a SVD (Singular Value Decomposition) is used to decompose the original term-document matrix, thus returning a percentage of singular values in Σ of Equation 1 to produce the approximation matrix. Given a term-document matrix $X = [x_1, x_2, \dots, x_n]$, LSI decomposes the X using SVD into the product of three other matrices (Dumais et al., 1988):

$$X = U\Sigma V^T \quad (1)$$

Where r is the rank of X and Σ is diagonal. $\Sigma = \text{diag}(\sigma_1, \dots, \sigma_r)$ and $\sigma_1 \geq \sigma_2 \geq \dots \geq \sigma_r$ are the singular values of X . $U = [u_1, \dots, u_r]$ and $V = [v_1, \dots, v_r]$ are left singular vectors and right singular vectors respectively. Both vectors have orthonormal columns in this linear algebra. They are so-called singular value decomposition of X . LSI uses the first k vectors in U as the transformation matrix to embed the original documents into a k -dimensional space. Therefore, the SVD captures most important underlying structures derived from terms and documents, while removing the noise or variability in word usage (Berry et al., 1995). The derived k -dimensional feature space reveals term interrelationships, for example, the query car will not only retrieve the precise word, but other related words that occur with cars (e.g., automobile, vehicle and motor). Choosing the number of dimensions k can remove much of the noise but too few dimensions may lose important information.

3.3.3 Developing methods of questionnaire and interview

Questionnaire survey remains an important and prevailing tool for quantitative research. For example, tourists' motivations are influenced by destination

branding and photo-sharing behaviour through social media (Buhalis & Inversini, 2014; Lim et al., 2012; Thurlow & Jaworski, 2011). In this regard, social media may also influence people's visitation to urban green space, considering that urban parks and other symbolic urban green spaces are included in city branding strategies (Chan, 2017; Gulrud et al., 2013) and that photo-sharing practice on social networking sites is ubiquitous in people's everyday living (Keep et al., 2019). This hypothesis intrigues a questionnaire survey with respect to the evaluation of well-being, urban green space use and correlations between online information and urban green space visitation. A pilot study was conducted in face-to-face mode in June 2020, but majority of the visitors in parks of Beijing refused to fill the questionnaire due to concerns for COVID. Therefore, the survey was made online through programmed questionnaires, which were distributed based on a non-probabilistic, convenience sampling strategy, by which researching subjects were easily accessible to the researcher (Etikan et al., 2016).

There are different types of research interview methods developed for qualitative research: structured interviews, unstructured interviews, semi-structured interviews and group interviews (e.g. focus group) (Fontana & Frey, 2005). Structured interviewing contains a series of pre-established questions with limited set of responses, thus has little room for variation. In unstructured interviewing, interviewer commonly asks respondents open-ended questions and sometimes in-depth questions, while semi-structured interviews not only consist of a list of predetermined questions but offer opportunities for interviewees to explore the issues that they are interested in, e.g. open-ended sub-questions (McIntosh & Morse, 2015). In terms of group interviews, the interaction between interview and interviewees varies from a very structured fashion to a very unstructured manner depends on interview's purpose. This section discusses how a semi-structured interview method and questionnaire method were implemented corresponding to the research questions.

3.3.3.1 Developing questionnaire

A growing number of studies have adopted geo-tagged photos harvested from social media as indicators for greenspace perception (Brindley et al., 2019; Figueroa-Alfaro & Tang, 2017; Richards & Tunçer, 2018; Z. Wang et al., 2021). However, little is known about the correlation between social media use and green space use. Urry and Larsen have (2011) stressed that social media, like guidebook, brochures or souvenir, assists construction of visitors' expectation to places, thus it may act as a powerful means to control visiting behaviours. This hypothesis guides development of questionnaire for Green Space Use and Social Media Use survey (**GSU&SMU**). The questionnaire (See Appendix D) consists of four parts and each part has a theme related to the research questions. Part one is sociodemographic information, including gender, age, occupation, length of residency and accessibility to green space. Part two is derived from WHO-5 Well-being Index, which has been applied to assess subjective well-being across a wide range of study fields (Topp et al., 2015). Part three focuses on measures of correlation between social media usage and visiting motivation. Part four aims to investigate people's engagement with natural environment and visiting preference.

Provenance of survey items

The items in GSU&SMU are not original but are taken from the existing surveys or international surveys, which have been successfully implemented in previous studies. In GSU&SMU, the section of green space use was mainly derived from BlueHealth Community-Level Survey (BCLS) in BlueHealth project, which was formulated to investigate community-level interventions of blue space in terms of promoting health and well-being (Grellier et al., 2017). Moreover, several survey items of BCLS are either made or improved from Monitor of Engagement with the Natural Environment (MENE) survey (England, 2012) and European Social Survey (ESS). All questions and instructions in the questionnaire are either translated into Chinese or Chinese version (e.g., WHO-5 Well-being Index).

Q1 and Q4 aimed at collecting respondents' gender and age. Q5 was modified from BCLS in order to question respondents' work status, as it can often explain health-related issues such as subjective well-being, outdoor activities and may relate to social media use.

Q2 was to check respondents' familiarity of the resident place through asking the length of residency. It was originally act as independent variable to measure resident attachment level from The Tourism Impact Attitude Scale (TIAS) (Lankford & Howard, 1994). The question 'how long have you lived in this area' was slightly modified as dropdown questions and included in GSU&SMU, as the place attachment and the most familiar everyday experience were also related to landscape preference (Dearden, 1984; Falk & Balling, 2010; Purcell et al., 2001).

Q3 was derived from BCLS and questioned whether respondents have access to private outdoor space, because those, for whom private outdoor spaces are available, may not use public green spaces as regularly as those who do not have one. Besides, having access to private outdoor space may affect the subjective well-being status.

Q6 consisted of five subquestions, which were derived from WHO-5 Well-being Index and also included in BCLS. The index measures a generic well-being status and performed well with regard to many study fields (Topp et al., 2015). It is routinely asked for measuring positive quality of life in BCLS and European Quality of Life Survey. It was included in GSU&SMU for the similar reason; to investigate whether social media use has an association with subjective well-being.

Q7 to Q9 measure social media use with reference to a survey of online social network sites usage (Ellison et al., 2007) through formulating 6-point Likert-scale questions, which has higher discrimination than Likert's scale 5 points (Chomeya, 2010). Specifically, Q7 questioned the total duration of social media use per day in the past week for measuring social media intensity, the wording is taken from social media usage study by Ellison et al (Ellison et al., 2007). Q8 and Q9 were adjusted from Likert-scale attitudinal questions of Facebook use (Ellison et al., 2007) in order to investigate visual social media intensity. They measure the extent to which respondents are passively or actively engaged in usage of visual social media, namely browsing online photos or sharing photos on social media.

Q10 and Q11 questioned the willingness to visit a place when respondents browsed through online photos on social media, which were modified from the scale of "inviting to visit" in the experiment of rating scenic photographs with respect to aesthetic values (Sevenant & Antrop, 2009, 2011).

Q12 was developed from surveys related to the influence of online reviews when travellers are planning trips (Bambauer-Sachse & Mangold, 2011; Jalilvand et al., 2012). Specifically, the item "I frequently gather information from tourists' online travel reviews before I travel to a certain destination (like Iran)" was modified into "I frequently gather information from social media before I decide to visit a certain destination".

Q13 and Q14 were derived from BCLS and MENE and were used for inferring individual's general level of natural environment contact. They question respondents' green space use (consists of neighbourhood parks and other urban parks) in the past 6 months due to outbreak of COVID was half years ago when conducting the survey, while the original asked for the past 12 months.

Q15 was formulated to gather certain information that may relate to landscape preference including environmental elements (trees/forest, mountains/hills, river/lake), types of parks (neighbourhood park/city park) and facilities (children's playground/exercise facilities). The "most recent visit" was derived from Q4 in BCLS, which was originally taken from the Welsh Outdoor Recreation Survey. The information and evaluation queried in Q16 and Q17 can be used to infer the general preference for the certain types of landscape.

Q16 was derived from BCLS in order to investigate the duration of time the respondent spent in the natural environment, which was improved upon the question asked by MENE, in which an actual contact time with natural environment was questioned rather than the duration of a trip.

Q17 contains 4 sub-questions that are all derived from BCLS. In this, Q17-1 measures generic evaluation of well-being outcome to the most recent visit. Q17-2 was used here to measure the connectedness with nature in specific settings from Q13, as certain environmental element (e.g., water) can be related to positive landscape perception. Q17-3 and Q17-4 questioned respondents' evaluation of the quality of environment and they were included as key covariates with regard to landscape preference.

3.3.3.2 Semi-structured interview

A semi-structured interview method was adopted to further explore peoples' landscape preference due to its versatile and flexible nature. More open-ended questions were needed to explore landscape preference, for which a standard questionnaire was inadequate (Adams, 2015). According to the framework of semi-structure interview proposed by Kallio et al. (2016), namely the five phase of formulating interview guide: prerequisites identification, preliminary interview guid formulation, pilot testing, presenting complete version. Five open-ended questions were prepared:

- What do you like/dislike of this park?
- Why do you come to this park?
- Are there any other parks you like in this city, if there are, why you like it?
- What kinds of activities you will have in parks and how often you visit a park?
- Do you think social media influence your outdoor activities?

As the research evolved, main questions were accompanied with a set of follow-up questions during the interviews. Duration of interviews varied from 5 minutes to 30 minutes depended on interviewees' willingness to further discuss related issues they were interested in. It was found that almost all respondents refused to have a recording for concerning anonymity although neither their personal information would be asked nor they would not be identified by the questions. Rather, they were willing to let interviewers take notes when they were talking as they thought it was a formal way to conduct the interview and it offered more time to think of the questions.

3.4 Case study

Ten urban parks in Beijing were selected for this study within case study framework. This section further explains reasons for choosing Beijing and ten urban parks of it from perspectives of city context, park types and tourism development, which closely related to understand complex meanings and nuances of landscape preference toward parks with different popularities and among residents and tourists.

3.4.1 City context of Beijing

Beijing is the capital of China and is one of the most populous national cities in the world, with 21.89 million residents lived within an administrative area of 16,410.5 km² (Beijing Statistical Yearbook, 2020). Influenced by monsoon, the climate of Beijing is characterised by hot, humid summers but dry, cold winters. The monthly temperature in January is around -7~-4 degrees Celsius, while in

July is 31 degrees Celsius. In terms of administrative divisions in Beijing, Dongcheng District and Xicheng District formed the downtown area of Beijing, together with other four districts – Chaoyang, Haidian, Fengtai and Shijingshan – form the Central Urban Area (see Figure 3.21 and Figure 3.22).

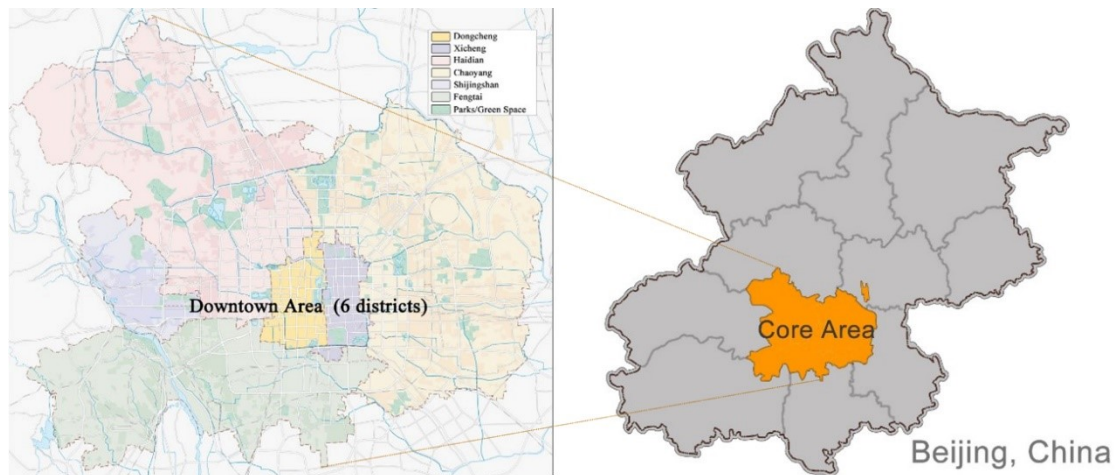


Figure 3.21 Location Map of Beijing and its Six Core Districts of Downtown Area
Source: <http://mzj.beijing.gov.cn/col/col7288/index.html>

In the past 20 years, central Beijing had endured a remarkable urbanization process and rapid urban sprawl. As an imperial capital city of nearly 2000 years, central Beijing lies its famed heritages: The Forbidden City, The Summer Palace, Beihai Park and Temple of Heaven etc. It is also an internationalised city, which hosted numerous international sporting events, such as the 2008 Summer Olympics and Paralympic Games and 2022 Winter Olympics. Beijing has attracted 322 million tourists, including 3.8 million foreign tourists and 318.2 million domestic tourists. In this sense, Beijing fulfils the third research objective because it is feasible to identify a comparable number of residents and tourists in the same urban park.

Beijing has a population of more than 30 million permanent resident population (Beijing Municipal Bureau of Statistics, 2021) with over 344 urban parks (China Statistical Yearbook, 2020). Park Area (PA) has increased to over 35 thousand

hectares in Beijing, and the coverage ratio of green space in the ecological service zone (500-meter radius from urban parks) reached 20 percent of the built area by the end of 2019 (Beijing Municipal Forestry and Parks Bureau). Figure 3.20 shows the green space planning for Beijing from 2016 to 2035, approved by the central government. It shows “country park ring” and “city park ring” are two key areas where most of the urban parks were placed. Moreover, this plan stressed well-being of residents and proposed a green space network with the association of urban parks and other green spaces across the city via improving accessibility. As in other highly urbanized and densely populated cities, residents in Beijing benefit from urban green spaces in terms of promoting physical activity, social cohesion, and interaction with nature.

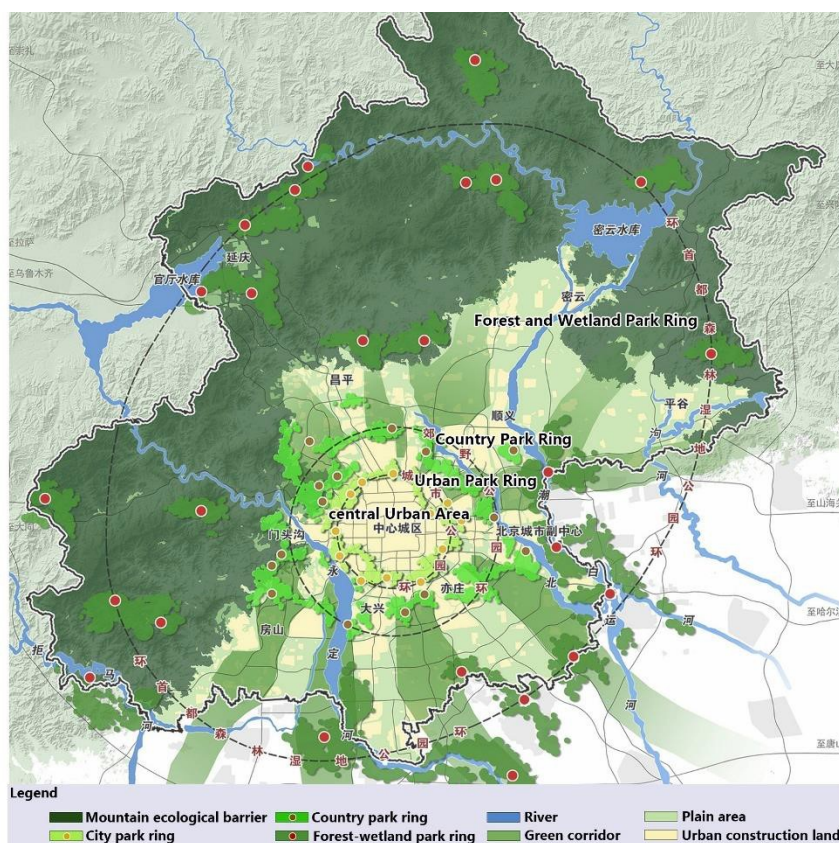


Figure 3.22 Green Space Structure Planning of Beijing (2016-2035)
 Source: Master Plan of Beijing City (2016-2035), Beijing Municipal People's Government

Imperial Gardens are important components consisted in green space system in Beijing. For example, the local government of Haidian District approved

“Three Hills and Five Gardens” planning in 2014, which is aiming at creating connected open green space for recreation, exercise and tourism, as well as spatially connecting five Imperial Gardens, namely Jingyi garden (Xiangshan mountain), Jingming garden (Yuquanshan mountain), The Summer Palace (Wanshoushan hill), Yuanmingyuan garden, Changchun garden and the surrounding areas.

Shifted from their historical role – the embodiment of imperial power, Imperial Gardens are transformed from a private space into a public urban space, where residents have their own forms of public recreation and entertainment (Shi, 1998). With the richness of Imperial Gardens in Beijing, the transformation was promoted in the both economic and political senses. In these conditions, the old and imperial landscape needs to be changed to improve people’s lives. Table 3.6 shows some of the public park projects built upon Imperial Gardens in Beijing. Imperial Gardens are popular tourist destinations, at the same time, these newly constructed public space changes the lives of citizens. Residents paid regular visits or other daily use of the park, and some went to parks only on special occasions, such as for events and festivals. Public parks in Beijing provide an environment to accommodate different activities, especially unplanned activities (see figure 3.23), such as recreational, athletic, educational, cultural and social activities (Shi, 1998).

Table 3.6 Public Park projects in Beijing

Imperial Gardens	Completion time
Central Park	1914
Altar of Heaven	1918
Beihai Park	1925
Earth Altar	1925
The Summer Palace	Mid 1920s

Source: Shi, 1998.



Figure 3.23 Unplanned use of public parks for residents in Beijing

Note: Photos were taken in Purple Bamboo Park (left) and Jingshan Imperial Park (right).

Source: by author

3.4.2 Site selection

Cases are selected within the 5th Ring Road in Beijing. Firstly, a total of 199740 geo-tagged photos were collected from Flickr within 5th Ring Road in Beijing. To avoid bias caused by extremely active users, who upload a large number of photos, the study sites were divided by fishnet unit (100*100 meter) and only one randomly selected photo per unique user was retained within each unit. Thus, 34317 geo-tagged photos were retained. Secondly, a hotspot analysis was conducted with the geo-tagged data by using Python programming language. As discussed in section 3.3.2.1, DBSCAN approach was applied to clustering hotspots in the study area. Figure 3.24 illustrates the result of hotspot analysis and the cases (urban parks) were selected based on these hot spots.

Based on the research objectives, ten urban parks with different features were selected in central and north Beijing (Figure 3.25) to ensure these study sites have similar temperature conditions and sociodemographic characteristics. These ten urban parks consist of two symbolic types of public parks: the first group contains Imperial Gardens, which were previously private and transformed into open urban space for people (see Table 3.7); the second group contains public parks, which were constructed for the purpose of open space

provision (see Table 3.8).

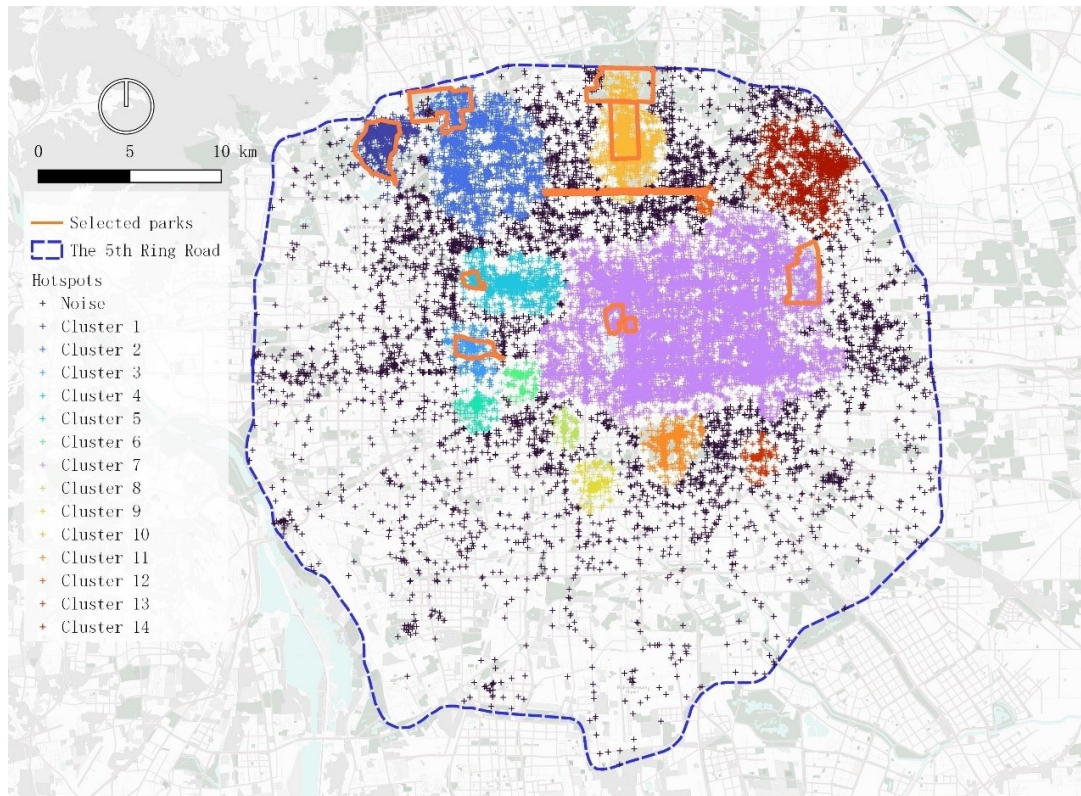


Figure 3.24 Result of hotspot analysis of collected geo-tagged photos
 Note: Black signs denote the data identified as noise and excluded for clustering, and coloured signs denote different groups that the data is assigned to.

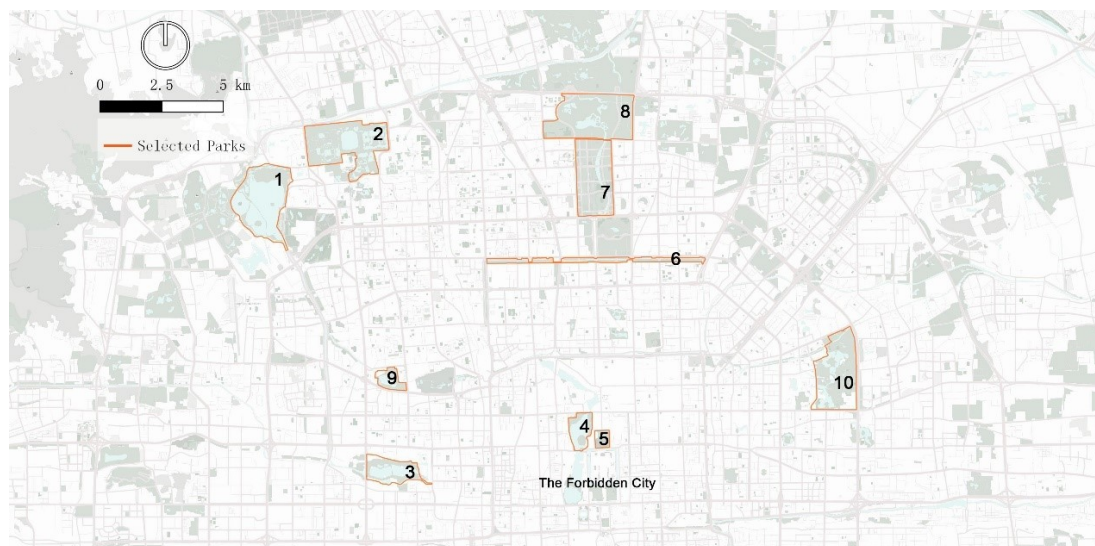
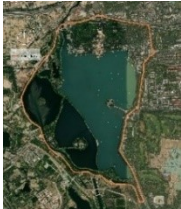






Figure 3.25 Selected cases in Beijing
 Note: 1 The Summer Palace; 2 Yuanmingyuan (Old Summer Palace); 3 Yuyuantan Park; 4 Beihai Park; 5 Jingshan Park; 6 Yuan Dadu City Wall Ruins Park; 7 Olympic Park (Olympic Green); 8 Olympic Forest Park; 9 Purple Bamboo Park; 10 Chaoyang Park.

Table 3.7 Comparison of five Imperial Gardens (Traditional Chinese Gardens) in terms of areas, locations and park features

Study sites	Park 1 The Summer Palace	Park 2 Yuanmingyuan Park (Old Summer Palace)	Park 3 Yuyuantan Park (Jade Lake Park)	Park 4 Beihai Park (North Sea Park)	Park 5 Jingshan Park (Hill of Scenic Beauty)
Areas	3.009 square kilometres	3.5 square kilometres	1.3669 square kilometres	0.682 square kilometres	0.23 square kilometres
Locations	Northwest Beijing, Haidian District	Northwest Beijing, Haidian District	West of the Beijing centre, Haidian District	The centre of Beijing, Xicheng District	The centre of Beijing, attached to the Forbidden City, Xicheng District
Park Features	<ul style="list-style-type: none"> ○ Imperial Garden ○ Long history-1764 ○ Top choice for tourists^[1] ○ High popularity among tourists^[2] ○ High Popularity among residents^[2] 	<ul style="list-style-type: none"> ○ Imperial Garden ○ Long history-1744 ○ Alternative choice for tourists ○ Medium popularity among tourists ○ Low Popularity among residents 	<ul style="list-style-type: none"> ○ Imperial Garden ○ Long history-1773 ○ Alternative choice for tourists ○ Medium popularity among tourists ○ Medium Popularity for residents 	<ul style="list-style-type: none"> ○ Imperial Garden ○ Long history-1420 ○ Top choice for tourists ○ High popularity among tourists ○ Medium popularity among residents 	<ul style="list-style-type: none"> ○ Imperial Garden ○ Long history-1420 ○ Top choice for tourists ○ High popularity among tourists ○ High Popularity among residents
Maps					






Note: [1] Classified based on Beijing attraction ranking from popular Online Travel Information Websites (Tripadvisor): Top choice for tourists = top 20 attractions in Tripadvisor; alternative choice for tourists = top 40 attractions in Tripadvisor and mentioned by Lonelyplanet; Not recommended for tourists = not recommended in top 40 attractions in Tripadvisor.

(https://www.tripadvisor.co.uk/Attractions-g294212-Activities-a_allAttractions.true-Beijing.html accessed June 20, 2022)

[2] Based on the study conducted by Song et al. (2020) and Wood et al. (2013), park popularities among residents were classified according to user-days (PUD), which is defined as the total number of days, across all users, that each person took at least one photograph within each site (see Appendix C); while park popularities among tourists were classified based on number of unique tourists

identified within each site. Thereinto, for residents, high popularity: PUD > 99; medium popularity: PUD = 99 ~ 49 photos; low popularity: PUD < 49. For tourists, high popularity: more than 200 unique tourists; medium popularity = 100 ~ 200 unique tourists; low popularity = less than 100 unique tourists.

Table 3.8 Comparison of five Public Parks in terms of areas, locations and park features

Study sites	Park 6 Yuan Dadu City Wall Ruins Park	Park 7 Olympic Park (central zone)	Park 8 Olympic Forest Park (southern part)	Park 9 Purple Bamboo Park (Black Bamboo Park)	Park 10 Chaoyang Park
Areas	0.67 square kilometres	3.15 square kilometres	3.8 square kilometres	0.4735 square kilometres	2.887 square kilometres
Locations	North Beijing, Haidian and Chaoyang District	North Beijing, Chaoyang District	North Beijing, attached to the central zone of Olympic Park, Chaoyang District	West of the Beijing centre, Haidian District	Northeast Beijing, Chaoyang District
Park Features	<ul style="list-style-type: none"> ○ Public Park ○ Short history-1988 ○ Not recommended for tourists ^[1] ○ Low popularity for tourists ^[2] ○ Medium Popularity for residents ^[2] 	<ul style="list-style-type: none"> ○ Public Park ○ Short history-2008 ○ Top choice for tourists ○ High popularity among tourists ○ High popularity among residents 	<ul style="list-style-type: none"> ○ Public Park ○ Short history-2008 ○ Alternative choice for tourists ○ Medium popularity among tourists ○ High Popularity among residents 	<ul style="list-style-type: none"> ○ Public Park ○ Medium history-1953 ○ Not recommended for tourists ○ Low popularity among tourists ○ Low Popularity among residents 	<ul style="list-style-type: none"> ○ Public Park ○ Short history-1984 ○ Not recommended for tourists ○ Medium popularity among tourists ○ High Popularity among residents
Maps					

Note: [1] Classified based on Beijing attraction ranking from popular Online Travel Information Websites (Tripadvisor): Top choice for tourists = top 20 attractions in Tripadvisor; alternative choice for tourists = top 40 attractions in Tripadvisor and mentioned by Lonelyplanet; Not recommended for tourists = not recommended in top 40 attractions in Tripadvisor.

(https://www.tripadvisor.co.uk/Attractions-g294212-Activities-a_allAttractions.true-Beijing.html accessed June 20, 2022)

[2] Based on the study conducted by Song et al. (2020) and Wood et al. (2013), park popularities among residents were classified according to user-days (PUD),

which is defined as the total number of days, across all users, that each person took at least one photograph within each site (see Appendix C); while park popularities among tourists were classified based on number of unique tourists identified within each site. For residents, high popularity: PUD > 99; medium popularity: PUD = 99 ~ 49 photos; low popularity: PUD < 49. For tourists, high popularity: more than 200 unique tourists; medium popularity = 100 ~ 200 unique tourists; low popularity = less than 100 unique tourists.

3.5 Data collection

Three types of data, namely geo-tagged photos and affiliated information, survey and interview data were collected for exploring landscape preference in the context of social media age. Digital data can be useful in exploring user-generated preferences from social media. Questionnaires and interview methods contribute to collecting individuals' opinions, and attitudes towards certain issues.

3.5.1 Geo-tagged photos in ten urban parks

As discussed in section 3.3.1, geo-tagged photos in case study sites were collected through calling API services from Flickr. In the dataset, a total number of 22765 photos uploaded by unique individuals were taken from January 2005 to December 2019. Figure 3.26 shows counts of collected photos and unique owners in each urban park. The Summer Palace has a remarkable number of photos and most unique owners than those of other parks, while Yuan Dadu Wall Ruins Park has the least number of photos and unique users. Among the top 5 parks, three of which are Traditional Chinese Gardens, namely The Summer Palace, Beihai Park, Jingshan Park and Yuanmingyuan Park.

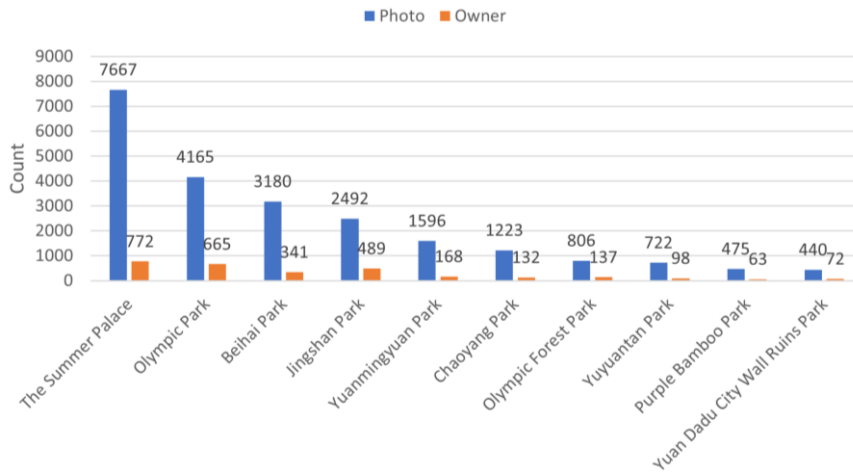


Figure 3.26 Summary of photo count and unique owner count in ten urban parks

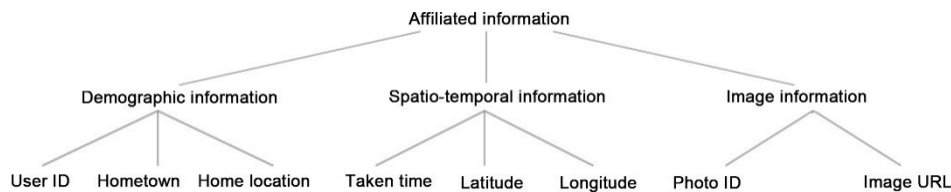


Figure 3.27 Categories of affiliated information collected from Flickr API

Affiliated information of each photo was harvested by using different calling methods (see section 3.3.1.3). Three types of information are presented in Figure 3.27: (1) Hometown and home location are useful in identifying tourists and residents; (2) Taken time means when this photo was taken; latitude and longitude are used to plot where this photo was taken; (3) Image URL is a web address whereby the image can be downloaded.

3.5.2 GSU&SMU Questionnaire

The researcher set out to conduct an administrated survey with GSU&SMU in urban parks of Beijing from 1st June 2020 to 1st July 2020. Only a total of six visitors agreed to fill out the questionnaire during this period and they were all aged between 20 to 30. Those who refused to participate in the face-to-face survey due to their concern for COVID-19 when talking to strangers, although the researcher and the respondents were wearing masks. To collect the questionnaires filled by a wider range of age groups and targeted social media

communities, who tend to share and browse photos online, the researcher referred to an online survey as it has the advantages of accessibility to certain groups, saving time and cost (Wright, 2005).

There are generally two kinds of Internet-based surveys: e-mail and web surveys (Evans & Mathur, 2005). The former manner is reported with a lower response rate compared with the traditional mail survey as the email may be recognised as “junk mail” or “malicious” by mistake; while the latter depends on sending a link that directs respondents to web site doing the research, herein lies the concern of sampling bias because the number of individuals who have access to the web is small compared to those have emails or mobile phones in the review of Tuten et al.(2002). The situation has changed since the rapid growth of smartphone owners, together with social media platforms and their active online users, such as Facebook, Instagram, Twitter and Flickr (Greenwood et al., 2016). For example, millions of user-generated data are collected and analysed in social media big data research (Abkenar et al., 2021; Ghani et al., 2019; Tsou, 2015). In a survey conducted in the US, 72.5% of the total sample (n = 1482) use social media and the average social media use is rated at 8.03 (on a scale from 1 to 10) (Correa et al., 2010), making online survey with social media a feasible alternative when face-to-face survey is restricted.

Common disadvantages related to an online survey need to be considered. Wright points out that online surveys can encounter sampling issues, such as demographic accuracy, self-selection bias and confidential issues. Furthermore, Dillman and Bowker (2001) stress that it is necessary to find an optimal balance between, on the one hand, respondents' fatigue impedes their commitment to fill the online questionnaire; on the other hand, the quantity of items is too small to collect comprehensive information. Therefore, a convenience sampling strategy was adopted for the reason that (1) a list of all elements is not required;

(2) respondents are chosen based on the investigator's convenience; (3) it is simple and efficient to implement (Acharya et al., 2013; Jager et al., 2017).

Accordingly, a self-administrated online survey was formulated for social media use and green space use and was conducted using an online survey tool Wenjianxing (<https://www.wjx.cn>), a popular web survey product for Chinese online surveys. It was distributed through WeChat, the most popular messaging application in China. Many online survey research in China have adopted WeChat as it is the most widely used social communication application with a powerful friend network among Chinese, especially in the context of COVID-19 (Tian et al., 2020; X. Wang et al., 2021; L. Zhang et al., 2020). The respondents were sampled randomly across the country and volunteered to participate in the survey.

A pilot survey was conducted on 25 August 2020 through Tencent WeChat platform. Two professionals whose majors were Landscape Architecture and five non-professionals (three of five were in the 20- 30 age group and the others were in 50-60 age group) were invited to complete the initial version of the questionnaire, including 27 terms. The researcher collected the feedback through either face-to-face interviews or making phone calls with respondents. Two professional's comments were generally positive and one commented that "I think it is interesting to think of these questions, so I expected more questions to answer when I was doing the survey". However, in terms of the non-professional group, two of three in the 20-30 group complained about the length of questionnaire and the other suggested that he lost interest after three minutes. Two respondents of the 50-60 group presented a similar issue that there were too many items for them to focus on, which was in accordance with the finding that Internet users easily lose interest after 25 to 30 questions (Krasilovsky, 1996; Tuten et al., 2002). Under these circumstances, the quantity of survey items was adapted into 24 (including sub-questions) by eliminating

three demographic items related to income level, respondents' household composition and marital status. A measure of self-reported general health was excluded since the well-established WHO-5 well-being index was included for assessing subjective well-being. The survey was released on 28 August 2020 and collected after a month. A total of 355 questionnaires were collected mainly from 28 provinces.

3.5.3 Semi-structured interview

A semi-structured interview strategy was implemented to interpret the survey with open-ended questions. Four sites were selected for recruiting interviewees (Figure 3.28). Of the selected sites, three were located at the chosen parks (Olympic Forest Park and Yuan Dadu City Wall Ruins Park) and two were located at two neighbourhood parks near the selected two parks.

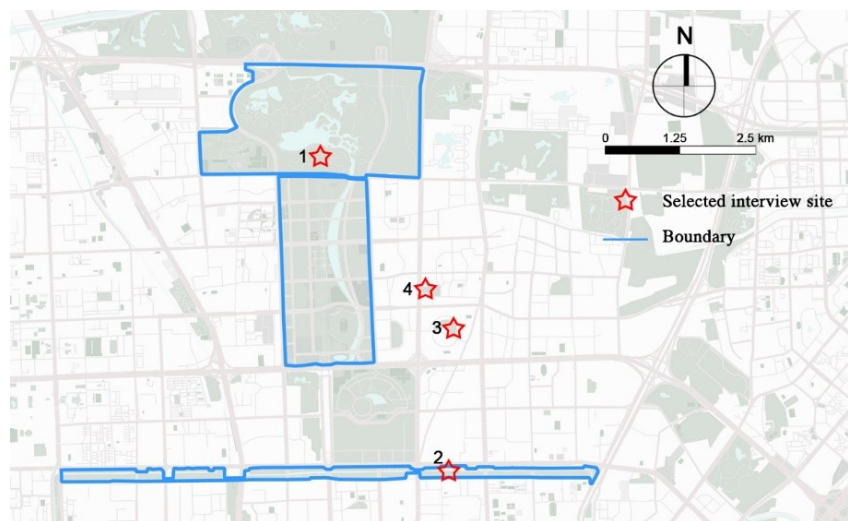


Figure 3.28 elected sites for the semi-structured interview

Note: Site1 and Site2 were in two urban parks chosen for geo-tagged data collection; Site3 and Site4 were in two neighbourhood parks near Site1 and Site2.

Interviews were launched in July 2020 and lasted for three months. Another round of interviews was conducted in October 2021 as a supplement and lasted for a month. A total of 95 individuals aged from 20s to 60s participated in the interview and the duration varied from 5 minutes to 30 minutes, as discussed

in 3.3.3, interviewees were encouraged to further talk about the related issues that interested them. At the early stage of interviewing, a behaviour observation together with pilot interview was conducted for a week in order to: (1) locate the environmental settings where individuals normally get together and are willing to have small talks with strangers; (2) familiarise the investigator with the sites; and (3) help the investigator to frame a more strategic communication with interviewees. Based on the results, participants were recruited at various places such as the entrance of urban parks, benches by the lake and exercise facilities. The interviews were generally one-on-one but there were conditions that one or more individuals engaged in during the process of interviewing, thus individuals spontaneously formulated a focus group. In terms of recording, as discussed in 3.3.3, instead of recording audio, the investigator took notes during and after the interview.

3.6 Data analysis

This section introduced both quantitative and qualitative methods applied to digital data, questionnaires and interview data. The online survey aims to explore correlations among subjective well-being, landscape preference and social media use. In terms of geo-tagged photos harvested from social media platforms, two levels of data analysis were included in analysing this type of data: cross-case level and within-case level. Differences in landscape preference were investigated between advertised attractions and unadvertised attractions in urban parks (research objective 2) in the cross-case level, while the within-case level corresponds to understanding landscape preference between residents and tourists toward the same park (research objective 3). Thematic analysis was conducted for interview data to compare with the knowledge generated from social media and to have a comprehensive understanding of hidden information and meaning revealed by online photographs in relation to landscape preference.

Errors, inconsistencies or invalid items within collected data should be detected and excluded to improve data quality before launching data analysis. (Rahm & Do, 2000). Regarding digital data derived from Flickr, it is vital to have valid temporal annotations attached. For example, the format '2013-00-00' should be eliminated for its missing month and day information. For survey data, SPSS Statistics 26 was used to screen, diagnose and treat the dataset (Van den Broeck et al., 2005). A total of 8 questionnaires were deleted due to 4 of which the answer time was less than 60 seconds and 4 of which had regular options. At last, the dataset retained 347 questionnaires.

3.6.1 Quantitative analysis of questionnaire

A quantitative analysis of survey data was performed using Excel and IBM SPSS Statistics 26. Firstly, a descriptive analysis was conducted via SPSS. Lastly, a linear regression was performed to explore the correlation of sociodemographic characteristics, social media use, subjective well-being and green space use.

Sociodemographic characteristics contain gender, age, occupation, residency length and the question of whether respondents have access to a private outdoor space. Age was divided into six groups: 18-24, 25-34, 35-44, 45-54, 55-64 and above 65. In terms of dwelling conditions, respondents chose from "I have access to a private garden", "I have access to a private outdoor space, but not a garden (e.g., balcony)", and "I don't have access to a private garden or outdoor space". Residency length is divided into five groups: less than one year, 1-3 years, 3-5 years, 5-10 years and more than ten years.

The subjective well-being section consists of five statements, which require respondents to rate according to their feelings in the past two weeks (5 = All of the time; 4 = Most of the time; 3 = More than half of the time; 2 = Less than half

of the time; 1 = Some of the time; 0 = At no time). A total raw score is ranging from 0 to 25 and is multiplied by 4 to obtain the final score, in which 0 represents the worst imaginable well-being and 100 represents the best imaginable well-being. The statements are as follows:

- I have felt cheerful and in good spirits.
- I have felt calm and relaxed.
- I have felt active and vigorous.
- I woke up feeling fresh and rested.
- My daily life has been filled with things that interested me.

Social media use includes social media intensity and attitude towards photo-sharing and online photos presented by social media. Social media intensity is measured by daily time spent on social media on average (in the past two weeks) (0 = Less than 10 minutes, 1 = 10-30 minutes, 2 = 31-60 minutes, 3 = 1-2 hours, 4 = 2-3 hours, 5 = more than 3 hours). In terms of attitude evaluation, six statements for respondents to rate according to the 6-point scale ranged from strongly disagree = 0 to strongly agree = 5. The statements are as follows:

- Sharing photos to social media has become part of daily routine.
- Browsing online photos from social media is part of my every activity.
- I desired to visit the places in online photos several times.
- I have had a strong desire to visit the places in online photos.
- I frequently gather information from social media before I decide to visit a certain destination.

Green space use consists of neighbourhood park use and urban park use (neighbourhood parks are not included), the most recent visit information and evaluation. Green space use is divided into several times a day; once per day; several times a week; once a week; once or twice a month; once every two or three months; once or twice in the last 6 months; not in the last 6 months. Description of green space with multiple-choice questions includes a grove or forest, a hill or mountain, a river or lake, a neighbourhood park, an urban park

(neighbourhood parks are not included), children's playground, and green space with exercise facilities in terms of the most recent visit information. The most recent visit duration is divided into less than 30 minutes; 31-60 minutes; 1-2 hours; 2-3 hours; more than 3 hours. For evaluation of the visit, four statements are used according to a five-point scale ranging from strongly disagree = 0 to strongly agree = 5.

3.6.2 Quantitative analysis of geo-tagged photos

Cross-case level

Ten selected urban parks, characterised as Traditional Chinese Gardens and public parks with different extents of popularity among visitors, were included in a cross-case level to understand the impact of attraction popularity on visitors' photo-taking behaviour and landscape preference. This section focuses on the hidden landscape preference and patterns of photo-taking behaviour revealed by digital data.

Within-case level

Two factors that may affect the representations of landscape preference were examined at this level. The differences between advertised and unadvertised attractions were explored to find out the influence of place popularity on photo-taking behaviour. In order to further explore the difference between tourists and residents in terms of photographing behaviour patterns and landscape preference, a total of six parks were selected from the ten urban parks based on their larger volumes of both tourists' and residents' data. Therein, three parks were chosen from Traditional Chinese Gardens, namely The Summer Palace, Beihai Park and Jingshan Park; and the other three parks were selected from public parks, namely Chaoyang Park, Olympic Park and Olympic Forest Park. This study assumes that individuals who take more photos at a place tend to have a regularly routine of photo-taking behaviour. Therefore, the top 50 individuals according to the counts of photos owned by one, were selected as

instances for within-case study. There were cases with less than 50 residents (e.g., 48 or 49 residents), of which the counts were close to 50. Under this condition, all residents were included in the analysis.

Two types of analysis were applied to within-case data, cluster analysis and content analysis. Cluster analysis, as discussed in 3.3.2, included clustering points and clustering trajectories for the tourist group and resident group. Content analysis consists of two steps: first, computer-aided labelling was performed using Google Cloud Vision service with photos harvested in six selected urban parks; second, a Latent Semantic Indexing algorithm was performed using Python programming language to generate representative tags among tourists and residents.

3.6.2.1 Resident and tourist identification

As discussed in 3.3.1.4, 2056 unique users' data was harvested and classified, including 217 residents and 1839 tourists. The next step was to check the performance of classification approach by carefully looking at the true identities of the sampled results.

Validity of classification

To check the quality of social group classification, 100 tourists and 100 residents are randomly sampled from classified dataset to manually check if they are real tourists or residents via carefully looking at users' public profiles on Flickr and textual information. For example, album titles such as "Beijing Day 1", "Beijing Day 2", "China trip", and "China Tour" are signs of a tourist way of noting their journey, while residents usually named photo albums as "daily life in Beijing" or noted how long they have stayed in Beijing. Raising a dog or a cat in Beijing suggests the owner as a resident, while the photo in tourists' handbook suggests that the photographer is a tourist. Users' descriptions were key clues for checking, for example, the description "After 3 years exciting

experience in Beijing”, “Live in Beijing” or “Flickr has been my photo album since 2010 when I moved to Beijing, China” indicated a resident. Another description “After 3 years exciting experience in Beijing” indicates familiarity with Beijing. This study defines residents as those who have lived in Beijing for more than three years. Therefore, university students in Beijing or foreigners who worked in Beijing are classified as residents.

Table 3.9 shows the results of checking resident identification. There were 10 incorrectly identified as residents. They could be classified into three groups (1) Two users were professional photographers and either went to Beijing several times or stayed in Beijing for a few months so that they were able to take photos in the same park at more than a month interval; (2) Another five users went to the same park for several times with more than a month interval, and they were either Chinese but from other provinces of China or foreigners on a business trip; (3) The last two users were not professional photographers but stayed in Beijing for a few months. The common characteristic of those tourists was that they revisited a park for some reason. For them, the parks were not one-off destinations, and this was discussed in chapter 5.

Table 3.9 Residents identification quality based on users’ textual descriptions on Flickr profiles

Classified		True identities		Precision
		Tourists	Residents	
Tourists	100	100	0	100%
Residents	100	9	91	91%
Sum	200	110	91	—

3.6.2.2 Cluster analysis

Cluster analysis, as discussed in 3.3.2, is useful in data-mining tasks by detecting behaviour patterns hidden behind a large volume of digital data. The basic unit of the dataset that operated in a specific algorithm is also called a data instance (Atluri et al., 2018). For spatio-temporal data yielded from Flickr,

every geo-tagged photo can be presented as a point instance, while the trajectory is presented as a trajectory instance, which is a list of location coordinates connected based on the temporal sequence. The trajectory instances represent spatio-temporal patterns of moving objects. Clustering refers to grouping the instances that share similar features. Two clustering algorithms were applied: hotspot analysis for point instances and TRACCLUS analysis for trajectory instances.

Hotspot analysis

DBSCAN clustering algorithm (Ester et al.) was conducted in QGIS (Version 3.22.6) platform. Geo-tagged data of study sites was imported and plotted on online maps of QGIS, which was created by the researcher through Mapbox Studio. Data was then analysed in selected ten parks respectively.

There were three steps to perform DBSCAN clustering. Firstly, it is necessary to avoid bias of very active users, who tended to upload extremely more photos leading to an identified cluster made up of one unique user's photos (Drift, 2015; Tieskens et al., 2018). Thus, the study sites were divided by fishnet unit (100*100 meter) and only one randomly selected photo per unique user was retained within each unit. Secondly, as introduced in 3.3.2.1, two input parameters – the radius of a cluster (*Eps*) and the minimum number (*MinPts*) of points – were required for conducting DBSCAN algorithm. To our knowledge, there was no fixed method to determine these two values. It was commonly based on the investigator's knowledge of the research field, the study area and the research objectives. Different combinations of *Eps* and *MinPts* are tested so that the optimal pair can be found to reveal spatial patterns of Flickr photography (Drift, 2015).

Another approach is to measure the distance from a point to its Kth nearest neighbour (the *k*-dist) (Liu et al., 2007). Naturally, the distance of every data

point to k nearest points is computed sorted in ascending or descending order. Then the values are plotted to find sharp changes, where the value of k -dist responds to expected Eps value. For large data, the k -nearest neighbours (k -NN) of a point is averaged so that noise can be removed and density-threshold can be easily identified (Mitra & Nandy, 2011; Nisa et al., 2014). More specifically, there are four steps to determine suitable parameter values for DBSCAN hotspot detection: (1) Average distance of every data point to its k -NN is calculated. (2) Then, these averaged k -distances are plotted in an ascending order. (3) The sharp change of gradient, namely the “knees” will be identified manually along the gradient curve for estimating suitable Eps values. (4) One to three ‘knees’ are found and tested in the DBSCAN algorithm with corresponding k values to determine the optimal combination. K values here are tested the threshold set: $k = 10, 30, 50, 70, 90$. Figure 3.29 shows an example of sorted average k -dist plot. Figure 3.30 illustrates result of cluster analysis (The Summer Palace as an example). In this, cluster ID (namely codes of clusters) is attached to every identified georeferenced dot. Distinct clusters are recognised by different colours on the map.

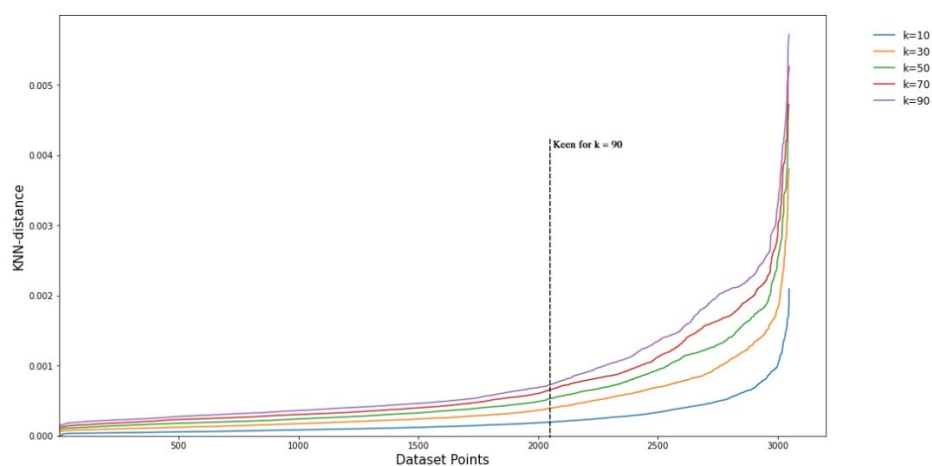


Figure 3.29 Sorted average k -dist plot of The Summer Palace

Note: A ‘keen’ for $k = 90$ presents where the distance of points sharply increases and the corresponding KNN-distance value is Eps threshold.

Source: by author

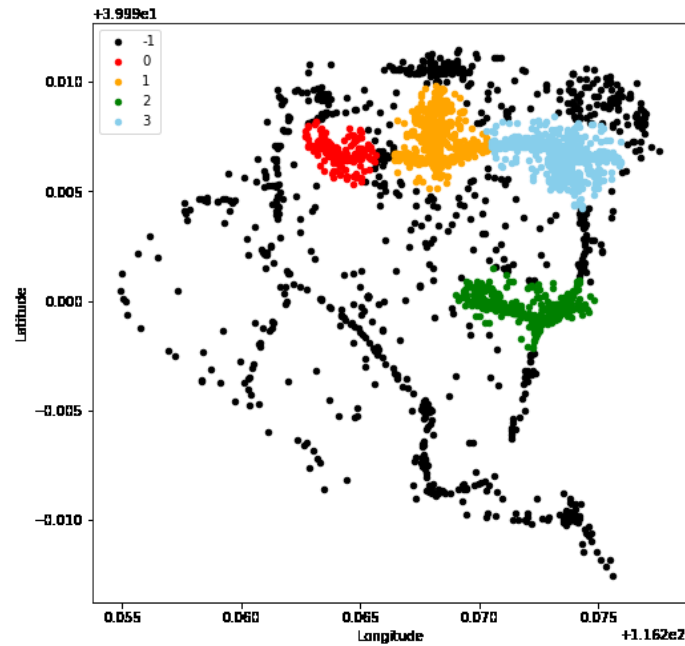


Figure 3.30 Clustering hotspots on the Summer Place with $MinPts = 50$ and $Eps = 0.0005$

TRACCLUS analysis

Trajectory instances were analysed by TRACCLUS algorithm to reveal the most representative trajectories of visitors' photo-taking activities across the study sites (see 3.3.2.1), by grouping the trajectories that only share a similarity in a short duration of the trajectory. Visitors' photographing trajectories were densely nested making finding patterns nearly impossible. Therefore, trajectory clustering was applied to find groups of trajectories that were similar to each other. TRACCLUS analysis was performed via adapting a public GitHub python project (https://github.com/apolcyn/traclus_impl), which was created based on the study of Lee et al. (2007). It was implemented to cluster trajectories of pedestrians on a school campus by the creator and had a decent performance.

Parameter setting is very important in calculating representative trajectories, as TRACCLUS is sensitive to input parameters. There are two key parameters to be predetermined: $MinLns$, which means the minimum number of objects in neighbourhood, and ϵ (hereinafter Eps), which refers to radius of neighbourhood. In laboratory studies (Kashyap et al., 2009; Tao & Pi, 2008),

different thresholds are tested based on parameter estimation method provided by Lee et al. (2007). Accordingly, as suggested, optimal parameters were calculated through using a simulated annealing technique(Kirkpatrick et al., 1983) based on entropy theory (Shannon, 1948). The first step was to find the value of Epsilon that minimizes $H(X)$ obtained by:

$$H(x) = \sum_{i=1}^n p(x_i) \log_2 \frac{1}{p(x_i)} = - \sum_{i=1}^n p(x_i) \log_2 p(x_i),$$

$$\text{Where } p(x_i) = \frac{|N_\varepsilon(x_i)|}{\sum_{j=1}^n |N_\varepsilon(x_j)|} \text{ and } n = num_{ln}$$

Where num_{ln} is the total number of line segments, $|N_\varepsilon(x_i)|$ is the number of line segments in the cluster of an ε -neighbourhood. Then the optimal $MinLns$ is determined as $(avg|N_\varepsilon(L)| + 1 \sim 3)$ in as $MinLns$ should be greater than $avg|N_\varepsilon(L)|$ to discover meaningful clusters. The first step was to determine an optimal Eps. An ideal value of Eps makes the entropy minimal. Then average $avg|N_\varepsilon(L)|$ can be done while computing $H(X)$. The clustering result is sensitive to parameter values, as noticed in Lee's study (2007), a smaller Eps or a larger $MinLns$ results in larger number of clusters, while larger Eps or smaller $MinLns$ discovers a smaller number of larger clusters. There is no fixed method to determine reasonable clustering. Researchers' experience in the study field is required to select parameter values derived from experiments.

Based on this, experiments were conducted to find the optimal value of Epsilon in every selected park. For example, A total of 556 trajectories collected in The Summer Palace were used as input data. Figure 3.31 shows that the entropy varies as Epsilon changes. The minimum achieved at $Eps = 0.000116$. Here, $avg|N_\varepsilon(L)| = 3$. Figure 3.32 shows the detected representative trajectories with Eps thresholds of 0.0001, 0.001, and 0.01 respectively. The number of representative trajectories corresponds to how many clusters are identified (Lee et al., 2007). Accordingly, only one large cluster was identified when Eps

was larger than 0.001, which does not correspond to the actual situation. Therefore, Eps values were tried between 0.0001 to 0.0009 and the one which has a reasonably small $H(X)$ was selected. Figure 3.33 illustrates the effects of $MinLns$ values on the clustering result. The larger $MinLns$ is, the smaller number of clusters and representative trajectories are. Thus, three $MinLns$ values: 2, 3, 5, 7, 9 were tried for all cases in order to identify reasonably number of clusters and representative trajectories.

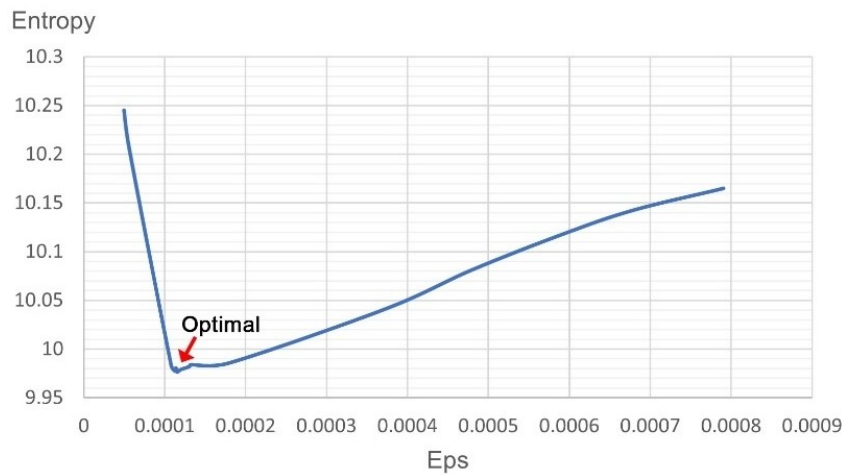


Figure 3.31 Entropy for the photographing trajectory data
 Note: data was collected in The Summer Palace.
 Source: by author

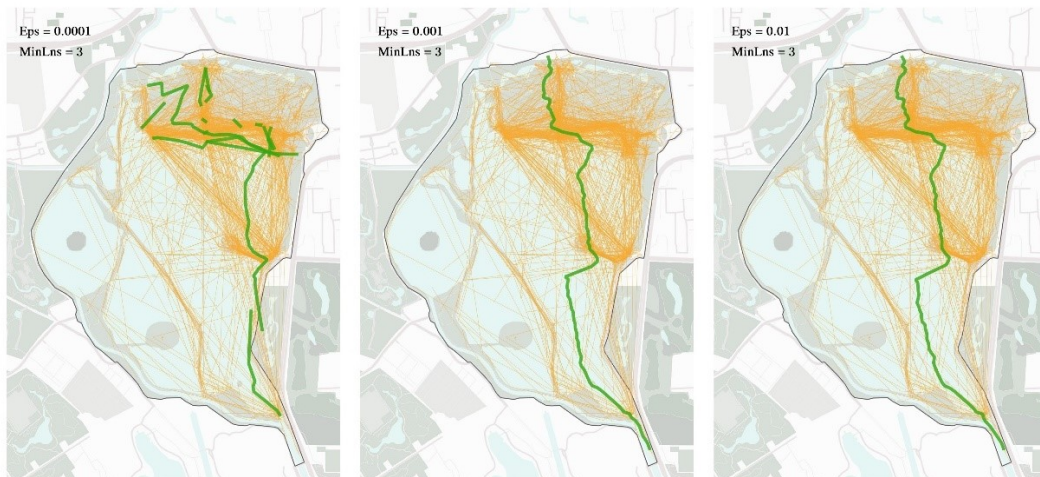


Figure 3.32 Comparison of representative trajectories by adopting TRACLUS algorithm with different Eps values
 Note: $MinLns = 0.0001, 0.001, 0.01$ respectively; thin orange lines display trajectories, and thick green lines display representative trajectories.

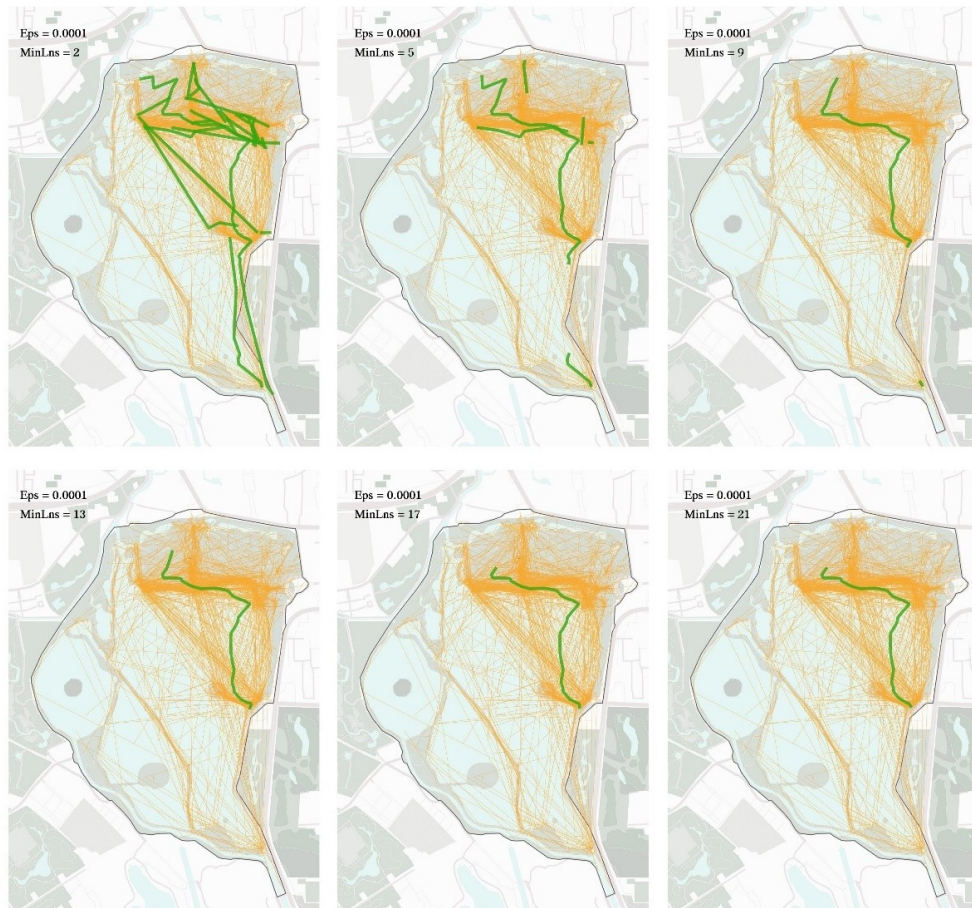


Figure 3.33 Comparison of representative trajectories by adopting TRACCLUS algorithm with different *MinLns* values

Note: *MinLns* = 2, 5, 9, 13, 17, 21 respectively; thin orange lines display trajectories, and thick green lines display representative trajectories.

3.6.2.3 Content analysis

Automated image recognition

This study explored the content of geo-tagged photos in the six parks selected for further investigating photographing preference. Google Cloud Vision (henceforth 'Google') service was selected, as discussed in section 3.3.2.3, to extract up to ten labels for each uploaded photo. Photo size is in a large class and its longest edge is 1024 pixels, which is the highest resolution that can be harvested without restriction. In this regard, content is clear and recognisable for label detection by the pre-trained machine learning model. Table 3.10 shows a sample of statistical summary of the top 5 labels in selected six parks (N/A label was excluded).

Table 3.10 Sample: top 5 labels in selected six parks

Traditional Chinese Gardens						Public Parks					
The Summer Palace		Beihai Park		Jingshan Park		Chaoyang Park		Olympic Forest Park		Olympic Park	
Labels	Count	Labels	Count	Labels	Count	Labels	Count	Labels	Count	Labels	Count
Temple	3634	Sky	1913	Sky	1598	Tree	343	Sky	482	Architecture	1640
Sky	3385	Tree	1729	Tree	1517	Sky	334	Plant	423	Sky	1635
Tree	3270	Temple	1445	Plant	1069	Plant	289	Tree	398	Building	1042
Water	2710	Plant	1315	Temple	1047	Leisure	277	Natural landscape	215	City	926
Architecture	2594	Leisure	977	Building	850	Event	159	Grass	171	Tree	699

Latent Semantic Indexing (LSI)

Through clustering process, space-related and time-related dots were grouped for potential hierarchical cluster analysis based on the content labels of each photo. As discussed in section 3.3.2, labels that were generated through Google Cloud Vision were diverse. Label classification was seemingly a straightforward solution for massive and detailed descriptions. However, it suggested either an arbitrary recognition or a literature-based definition of environmental scenarios before exploring the research question: (1) Are different integrations of environmental elements important to photographing behaviour? and (2) Can affordance of picturing practice be created through arranging related environmental settings? In short, since computer-aided content analysis contributed to identifying elements in photographs, examining relations between these elements and photo-taking behaviour might shed light on factors, that might be ignored or not carefully studied, with respect to landscape preference.

To start with, it is posited that the frequent presence of environmental elements in photos indicates a statistical significance of the elements. To reduce the massiveness of labels and the influence of noise information, which embodies personalised bias of photos or bias of Online Cloud Services, Latent Semantic Indexing (LSI), as introduced in 3.3.2.4, was applied to generate representative terms and topics of photos taken by residents and tourists.

3.6.3 Qualitative analysis of interview

A thematic analysis was conducted for open-ended interviews with the guidance of Braun and Clarke's six phases of analysis (Braun & Clarke, 2006). In the first phase, the text data were reorganised and translated into English, while the verbal data, which were recorded by the author were transcribed into written form and then translated into English. The transcription and translation process are practically suited to familiarization of the data and another two times of rereading the data facilitate a thorough understanding of the transcript. Phase two to phase five are guided by the results of questionnaires and the literature review of landscape perception and preference. These coding and theme-searching processes are both data-driven and theory-driven as the exploration of discrepancies between photo-taking preference and real on-site preference is not theoretically established, whereas a richness of natural landscape perception and preference models are proposed and developed to date. Coding and finding themes in the materials are not linear but a recursive process and stopped when there are little overlaps among themes and "internal homogeneity" in all themes are fulfilled. To capture the hidden information and meanings in the transcript, themes are not determined at the beginning but developed through the recoding processes and the findings of social media data are used in exploring the nuance and detailed people's landscape preferences. As a result, a refined thematic map containing several themes and sub-themes was generated in phase 5.

3.7 Research ethics

The research has ethical approval from the University of Edinburgh (number: 193402-193395-52914057). However, some ethical issues need extended discussion due to the nature of visual research methods. Rose (2016, p. 358) points out that visual materials, such as video, film, and specifically photographs, which is being collected and analysed in this study, may inevitably

contain location identifier and the individual may be identifiable. The metadata of collected photographs from social media platforms in this research include their locations, geotags of latitude and longitude (if users have turned on the *Add Geo Information* option to the uploaded images), taken-time, photo hyperlinks and owner ID. Rose (2016, p. 301) suggests consent and anonymity are the most challenging issues for researchers using visual methods.

Informed written consent forms are expected from all the research participants, however, when thousands of images and their relevant information are collected online, these consent forms are difficult to achieve and are not provided and collected by researchers (Ghermandi et al., 2022; Gosal & Ziv, 2020; Oteros-Rozas et al., 2018; Richards & Tunçer, 2018; Song et al., 2020). Rose explains that this may also be because the data is accessible and available to anyone by definition (2016, p. 302), and in most circumstances, once images are uploaded online and made 'public', they are technically visible for anyone although the data is not explicitly agreed to be used for research purpose (2016, p. 365). The International Visual Society Association (IVSA) states that consent is not required if the research is conducted in public places and the data is collected from public records (Papademas & Association, 2009). Therefore, only public online photographs are collected in this study and is achieved by setting query parameters. Flickr API (<https://www.flickr.com/services/api/>) developed query rules for each API method for data collection. For example, only users who are permitted to view the photo can call method *flickr.photos.getInfo*; the method *flickr.photos.search* is explained by developers as follows:

“Return a list of photos matching some criteria. Only photos visible to the calling user will be returned. To return private or semi-private photos, the caller must be authenticated with 'read' permissions and have permission to view the photos. Unauthenticated calls will only return public photos.” Researchers can use unauthenticated calls to only harvest public photos uploaded by users.

When uploading an image to Flickr, users are asked to choose from a drop-down list: public, friends, family, friends & family and private. Except for the public, other options either belong to private or semi-private types.

Although the IVSA suggests that “similarly, confidentiality is not required in the case of information available from public records” (Papademas & Association, 2009), it is necessary to remove or hide identifiable information, for example, Google blurs any face that appears on street photographs of Google Map Street View; and hiding identifiers (e.g. users’ real names, faces on images) should be conducted according to the objectives of research and the anonymity requirement. However, Wiles et al. (2012) suggest three aspects to consider here: respondents’ status and vulnerability, the nature of the research, and the ways that visual (and other) data are used and presented’ when making decisions about anonymity. Thus, efforts are made to de-identify dataset as followings:

- All participants (image owners) have been allocated a random number identifier instead of owner id provided by Flickr.
- Only photos that were taken outdoors have been collected by setting relevant query parameters.
- Only photos on which the main objectives were not people ‘selfies’ were selected by online image content recognition service.
- All collected data were aggregated in a database and stored on a local hard disk.

It is recognised that the discussion of consent is not a one-off event. Ethical research requires consent throughout the whole process, thus, if more online information is required according to the research questions, a consistent awareness of research questions and possible consequences of collecting and analysing data should be put in the first place.

3.8 Conclusion

This chapter first introduced formulated research objectives and questions. A mixed method and a case study research framework were implemented. Then different technical approaches were combined for exploring landscape preference. Specifically, corresponding to the first research objective, an online survey was applied to explore correlation of sociodemographic characteristics, social media use, subjective well-being and green space use. For the second and third research objectives, Python programming language and Flickr API were used to harvest and filter geo-tagged photos and their attached information at data collection and pre-processing stage. In order to understand the nuance of landscape preference, social media big data analytics were introduced in the data analysis stage. In this, clustering methods were used toward points and trajectories data to reveal spatio-temporal patterns of photographing practices. Content analysis, consisting of labelling images and text mining of these labels, was implemented to understand characteristics of places that attracted people. A qualitative interview approach was used to help further understand landscape preference and learn stories that big data cannot tell. Thirdly, research ethics was discussed in terms of social media data harvesting and analysing.

Chapter 4 Investigating the Correlations of Visual Social Media Use, Green Space Use and Subjective Well-being

4.1 Introduction

This chapter posits a potential correlation between visual social media use and urban green space use and thus affects people's subjective well-being in China's cities. A 24-item GSU&SMU questionnaire including the three dimensions is formulated using adapted items from existing surveys, international surveys or related studies (see 3.3.3.1). Online survey approach and random sampling are applied to administer questionnaires via WeChat, which is a prevalent social communication tool in China. A total of 355 questionnaires were collected from 28 August 2020 to 29 September 2020, with 347 determined valid.

Data analysis was performed using SPSS Statistics 26 and Excel. Firstly, descriptive analysis was conducted to generate summary statistics of demographic characteristics, subjective well-being, visual social media use and urban green space use (section 4.1). Secondly, an ANOVA test and a t-test were performed on the SPSS platform to investigate the impact of demographic characteristics on subjective well-being scores, visual social media use and urban green space use dimension, respectively. Lastly, a fixed-effect model regression analysis was applied to investigate correlations between subjective well-being, visual social media use and green space use. The sociodemographic factors identified as potential unobserved variables were used as control variables in this process. Moreover, relationships between the frequency of urban green space use and social media use were explored.

In doing so, the chapter aims to investigate (1) correlations between visual social media use and outdoor activity in urban green spaces; (2) the impact of different natural factors, park types and facilities on people's visit experience; and (3) experience of using visual social media platforms and urban green space that related to subjective well-being. Moreover, given the effects on people's outdoor activities and subjective well-being, the situation of COVID-19 is worthy of further discussion due to the concerns for infection and strict regulations in place. Finally, this chapter presents a detailed and critical understanding of visual social media platforms, urban green space use, and their hidden relationships associated with well-being.

4.2 Results of preliminary analysis

This section shows the results of descriptive analysis applied to four parts of the UGS&SMU questionnaire. The skewness and kurtosis of all variables (except for multiple-choice items) fell within ± 2 , which was an acceptable range for deviation from normality according to George and Mallery (2019). In each part, the ANOVA test and t-test are combined to find out (1) the impact of different demographic characteristics on other dimensions; and (2) the impact of different levels of social media use on green space use. Moreover, Features of urban green space are discussed related to respondents' evaluation of the most recent visit.

4.2.1 Sociodemographic characteristics

Table 4.1 shows a summary of the collected data. 40.63% and 41.5% of participants were in the age groups of 18-24 and 24-34, respectively. The dominant groups in this study were employees and students (93.08% of the total samples), which were proportionally similar to each other (40.63% of the participants aged 18-24 and 41.5% of the participants aged 25-34). More than half of the respondents' residency length was more than ten years. Only 21

participants reported less than one year. 51.3% of participants do not have access to a private garden or outdoor space regarding the living environment. 34.5% out of all respondents have access to a private outdoor space but not a garden (e.g., balcony). In comparison, the percentage of respondents with access to a private garden is the lowest at 14.12%. The number of females (n=234) is higher than that of males (n=113) due to the bias of online random sampling. The ANOVA test and t-test were performed to examine whether gender affects the individual items and scales.

Table 4.1 Summary statistics for demographics (n=347)

Demographic characteristics		Variables	n	%
A	Gender	Male	113	32.56
		Female	234	67.44
		Total	347	100
B	Age group	18-24	141	40.63
		25-34	144	41.5
		35-44	21	6.05
		45-54	24	6.92
		55-64	17	4.9
		Above 65	0	0
		Total	347	100
C	Work status	Employee	169	48.7
		Student	154	44.38
		Retire	10	2.88
		Others	14	4.03
		Total	347	100
D	Residency lengths	Less than one year	21	6.05
		1-3 years	67	19.31
		3-5 years	42	12.1
		5-10 years	38	10.95
		More than ten years	179	51.59
		Total	347	100
E	Living environment	I have access to a private garden.	49	14.12
		I have access to a private outdoor space, but not a garden (e.g., balcony).	120	34.5
		I don't have access to a private garden or outdoor space.	178	51.3
		Total	347	100

This online survey is distributed through the most widely used communication application (WeChat) in China. The demographics of the respondents reflect its prevalence. Respondents' age ranges from 18 to 64 years old. With over 1 billion monthly active users²⁰, WeChat is of importance for Chinese to share and collect information on a daily basis, evidenced by the even distribution in different age groups of WeChat users (Figure 4.1). Therefore, utilizing WeChat

²⁰ Wikipedia contributors. "WeChat." Wikipedia, The Free Encyclopedia, <https://en.wikipedia.org/wiki/WeChat> (accessed June 20, 2022).

as an online survey tool has advantages of inviting wider age groups of respondents in China. Only 6.05 % of the respondents report their residency lengths are less than one year, while 83.64 % have more than three years residency lengths. It can be posited that most of respondents are generally familiar with the place they live in so that their reports reflect their daily routines and outdoor activities. Moreover, 85.8% do not or have limited opportunities to contact greenery, indicating the need for public parks in Chinese cities.

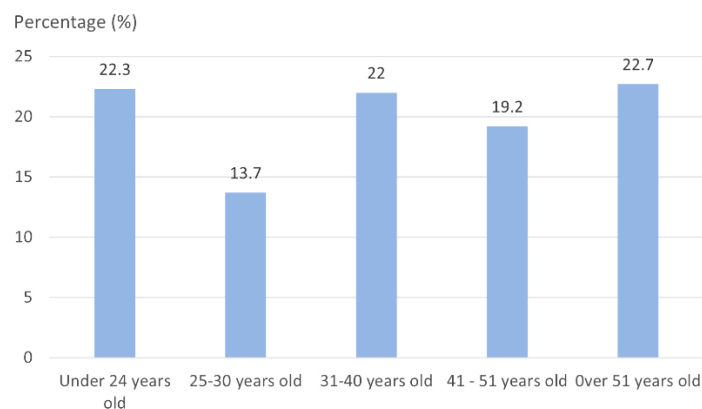


Figure 4.1 Distribution of WeChat users in China as of March 2022, by age
 Source: <https://www.statista.com/statistics/387658/wechat-china-user-age/>
 (accessed June 20.2022)

4.2.2 Visual social media use

A 6-point Likert scale was applied to measure social media functionality dimension and attitudinal dimensions of visual social media use, including visual social median intensity, visual social media influence. As Table 4.2 presents, respondents report spending between 1 and 2 hours on average using social media each day. In visual social media intensity dimension, participants reported significantly more visual social media use for browsing online photos (mean = 3.74) than sharing online photos (mean = 2.10). In terms of the impact of visual social media, respondents report an effect on the intention to visit a place with a mean score of 3.76 and 3.80, respectively. Participants report a high probability of searching for destination information on social media before the visit (mean = 4.76). As shown in Table 4.3, different genders, age groups and work statuses significantly influence participants'

social media intensity ($p < 0.01$). Social media functionality is affected by different gender groups ($p < 0.01$).

Table 4.2 Summary statistics for visual social media use (n = 347)

Visual social media use (Cronbach's alpha = 0.754)		Individual Items	Variables	n	%	Mean	S.D.
A	Social media intensity	In the past week, on average, approximately how many minutes per day have you spent on social media?	1 = Less than 10 minutes	16	4.61	4.01	1.292
			2 = 10-30 minutes	35	10.09		
			3 = 31-60 minutes	65	18.73		
			4 = 1-2 hours	65	18.73		
			5 = 2-3 hours	145	41.79		
			6 = More than 3 hours	21	6.05		
			Total	347	100		
B	Visual social media intensity	Sharing photos to social media has become part of daily routine.	1 = Strongly disagree	154	44.38	2.10	1.273
			2 = Disagree	76	21.9		
			3 = Slightly disagree	73	21.04		
			4 = Slightly agree	23	6.63		
			5 = Agree	13	3.75		
			6 = Strongly agree	8	2.31		
			Total	347	100		
		Browsing online photos from social media is part of my every activity.	1 = Strongly disagree	38	10.95	3.74	1.612
			2 = Disagree	52	14.99		
			3 = Slightly disagree	60	17.29		
			4 = Slightly agree	71	20.46		
			5 = Agree	64	18.44		
			6 = Strongly agree	62	17.87		
			Total	347	100		
<i>Please recall the experience that you were viewing a scenic photo from social media.</i>							
C	Visual social media influence	I desired to visit the places in online photos for several times.	1 = Strongly disagree	37	10.66	3.76	1.582
			2 = Disagree	43	12.39		
			3 = Slightly disagree	73	21.04		
			4 = Slightly agree	71	20.46		
			5 = Agree	61	17.58		
			6 = Strongly agree	62	17.87		
			Total	347	100		
		I have had strong desire to visit the places in online photos.	1 = Strongly disagree	32	9.22	3.80	1.604
			2 = Disagree	55	15.85		
			3 = Slightly disagree	63	18.16		
			4 = Slightly agree	67	19.31		
			5 = Agree	62	17.87		
			6 = Strongly agree	68	19.6		
			Total	347	100		
D	Social media functionality	I frequently gather information from social media before I decide to visit a certain destination.	1 = Strongly disagree	10	2.88	4.76	1.342
			2 = Disagree	21	6.05		
			3 = Slightly disagree	27	7.78		
			4 = Slightly agree	56	16.14		
			5 = Agree	103	29.68		
			6 = Strongly agree	130	37.46		
			Total	347	100		

Table 4.3 Analysing factors of demographic characteristics that affect visual social media use via t-test and one-way ANOVA approach

Demographic characteristics	Visual social media use			
	Social media intensity	Visual social media intensity	Visual social media influence	Social media functionality
	p-value	p-value	p-value	p-value
Gender	0.000**	0.372	0.054	0.006**
Age group	0.000**	0.804	0.557	0.166
Work status	0.000**	0.389	0.927	0.739
Residency lengths	0.098	0.349	0.356	0.843
Living environment	0.174	0.616	0.572	0.686

Notes: * $P < 0.05$ (2-tailed) in t-test or one-way ANOVA. ** $p < 0.01$ (2-tailed) in t-test or one-way ANOVA.

According to the results presented in Table 4.3, Table 4.4 and Table 4.5, there

are significant variances between four groups of work status and five age groups with respect to social media intensity, respectively. As shown in Table 4.4, we can see that students spent more time than employees did, while other pairs are not statistically different from each other with respect to social media intensity. Table 4.5 illustrates those respondents aged 18-24 spend more time using social media than those of 25 to 44 and 55 to 64. Respondents of the 45 to 54 age group have statistically higher social media intensity than those aged 55 to 64, indicating that participants aged between 55 to 64 have the lowest social media intensity in general.

Table 4.4 Result of one-way ANOVA analysis for work status and social media intensity

Explanatory variable	Employee	Student	Retire	Others
Employee	1**			
Student	-.739*	1**		
Retire	0.416	1.155	1**	
Others	0.502	1.240	0.086	1**

Dependent variable: social media intensity

Notes: * P < 0.05 (2-tailed) in one-way ANOVA. ** p < 0.01 (2-tailed) in one-way ANOVA.

Table 4.5 Result of one-way ANOVA analysis for age group and social media intensity

Explanatory variable	18-24	25-34	35-44	45-54	55-64
18-24	1**				
25-34	.558*	1**			
35-44	1.263*	0.705	1**		
45-54	0.787	0.229	-0.476	1**	
55-64	1.630*	1.072*	0.367	0.843	1**

Dependent variable: social media intensity

Notes: * P < 0.05 (2-tailed) in one-way ANOVA. ** p < 0.01 (2-tailed) in one-way ANOVA.

4.2.3 Urban green space use

Table 4.6 shows summary statistics for items measured in the dimension of urban green space, including the frequency of two types of urban green space use and evaluation of respondents' most recent visit to a park. The park visiting experience contains a series of 5-point Likert-scale attitudinal questions. The visit frequency to urban green space was reported as generally low (mean =

2.76 and mean = 2.29). Therein, participants reported slightly greater usage of neighbourhood parks (mean = 2.76) than that of destination parks (mean = 2.27). In terms of the most recent park visit experience, respondents reported spending an average of 31 minutes to 60 minutes in the urban park. Grove or forest was mentioned the most regarding features of the park, while the least participants mentioned hill or mountain. Participants mentioned more about neighbourhood parks than destination parks (not including neighbourhood parks). Features of children's playgrounds and green spaces with exercise facilities were less mentioned (n = 44 and n = 65, respectively). Potential well-being outcomes (satisfaction of the visiting experience) were generally at a higher level (mean = 3.56). Participants reported higher scores for the visits in terms of being emotionally connected to nature (mean = 3.39), free from litter/vandalism (mean = 3.52), and having good facilities (mean = 3.24). From Table 4.7, we could see that both work status and living environment had impacts on respondents' visit frequency to neighbourhood parks ($p < 0.05$), while different gender and age groups influenced the visit frequency to destination parks ($p < 0.01$ and $p < 0.05$, respectively). Concerning the most recent visit, work status affects visit duration, while nature connectedness is significantly influenced by different age groups.

Table 4.6 Summary statistics for urban green space use (n=347)

	Urban green space use	Individual Items	Variables	n	%	Mean	S.D.
A	Frequency of neighbourhood park use	How often have you used neighbourhood parks in the last six months?	7 = Several times a day	11	3.17	2.76	2.235
			6 = Once a day	34	9.8		
			5 = Several times a week	53	15.27		
			4 = Once a week	49	14.12		
			3 = Once or twice a month	37	10.66		
			2 = Once every two or three months	29	8.36		
			1 = Once or twice in the last 6 months	46	13.26		
			0 = Not in the last 6 months	88	25.36		
			Total	347	100		
			B	Frequency of destination park use	How often have you used destination parks (not including neighbourhood parks) in the last six months?		
6 = Once a day	14	4.03					
5 = Several times a week	38	10.95					
4 = Once a week	36	10.37					
3 = Once or twice a month	52	14.99					
2 = Once every two or three months	50	14.41					
1 = Once or twice in the last 6 months	73	21.04					
0 = Not in the last 6 months	77	22.19					
Total	347	100					
<i>Details about the park you most recently visited.</i>							
C	Visit duration	Approximately how much time did you	1 = less than 30 minutes	113	32.56	2.15	1.111
			2 = 31-60 minutes	126	36.31		

		spend at the park LAST time?	3 = 1-2 hours 4 = 2-3 hours 5 = more than 3 hours Total	70 18 20 347	20.17 5.19 5.76 100		
D	Park features	Which of the following types best describes the park you visited LAST time? (Multiple choice)	Grove or forest Hill or mountain River or lake Neighbourhood park Destination park (neighbourhood parks are not included) Children's playground Green space with exercise facilities Total	127 75 110 163 136 44 65 720	17.64 10.42 15.28 22.64 18.89 6.11 9.03 100	-	-
		<i>How much do you agree with the statements below about your LAST visit?</i> (Cronbach's alpha = 0.855)					
E	Well-being outcome related to the visit	I was satisfied with the visit.	1 = Strongly disagree 2 = Disagree 3 = Neutral 4 = Agree 5 = Strongly agree Total	7 12 141 153 34 347	2.02 3.46 40.63 44.09 9.8 100	3.56	0.796
F	Nature connectedness	I felt part of nature.	1 = Strongly disagree 2 = Disagree 3 = Neutral 4 = Agree 5 = Strongly agree Total	14 30 144 124 35 347	4.03 8.65 41.5 35.73 10.09 100	3.39	0.926
G	Quality of natural environment	The area was free from litter/vandalism.	1 = Strongly disagree 2 = Disagree 3 = Neutral 4 = Agree 5 = Strongly agree Total	8 24 126 156 33 347	2.31 6.92 36.31 44.96 9.51 100	3.52	0.848
		There were good facilities (e.g., parking, footpaths, toilets).	1 = Strongly disagree 2 = Disagree 3 = Neutral 4 = Agree 5 = Strongly agree Total	13 45 154 114 21 347	3.75 12.97 44.38 32.85 6.05 100	3.24	0.890

Table 4.7 Analysing factors of demographic characteristics that affect urban green space use via t-test and one-way ANOVA approach

Demographic characteristics	Urban green space use					
	Frequency of neighbourhood park use	Frequency of destination park use	<i>Details about the park you most recently visited.</i>			
	p-value	p-value	Visit duration p-value	Well-being outcome p-value	Nature connectedness p-value	Quality of natural environment p-value
Gender	0.418	0.009**	0.555	0.615	0.514	0.715
Age group	0.000	0.042*	0.052	0.159	0.007**	0.219
Work status	0.019*	0.066	0.032*	0.328	0.227	0.572
Residency lengths	0.269	0.135	0.359	0.229	0.873	0.776
Living environment	0.019*	0.464	0.106	0.676	0.495	0.267

Notes: * P < 0.05 (2-tailed) in t-test or one-way ANOVA. ** p < 0.01 (2-tailed) in t-test or one-way ANOVA.

T-test is applied to compare means between two groups. If the calculated means of this pair are statistically different ($p < 0.05$), this indicates a potential influence that the criteria (explanatory variable) have on testing variable. Table 4.8 shows the results of t-test analysis for the multiple-choice question to investigate whether different features of parks influence respondents' subjective well-being, visit duration, well-being outcome of the visit, nature connectedness and quality of natural environment. In this, grove/forest and

neighbourhood park have an impact on overall subjective well-being, while grove/forest has an impact on visit duration ($p < 0.05$), connectedness ($p < 0.01$) and quality of natural environment ($p < 0.01$) at the same time. Hill/mountain feature influence visit duration ($p < 0.01$), nature connectedness ($p < 0.01$) and respondents' evaluation of natural environment quality ($p < 0.05$). The influence of lake/river is only significant on well-being outcome, while destination park only affects visit duration ($p < 0.05$). Features of children's playgrounds and green spaces with exercise facilities have no evident impact on measured items.

Table 4.8 T-test analysis results for exploring differences between park characteristics and self-reported well-being, visit duration, well-being outcome, nature connectedness and quality of natural environment

Descriptions of the most recent visit (Paired comparison: with/without measured features)	Subjective well-being		Visit duration		Well-being outcome		Nature connectedness		Quality of natural environment	
	t	p	t	p	t	p	t	p	t	p
Grove/Forest	-2.031	0.034*	-2.281	0.023*	-1.915	0.056	-3.45	0.001*	-3.23	0.001*
Hill/Mountain	-1.367	0.172	-2.791	0.006*	-1.96	0.052	-2.788	0.006*	-2.009	0.045*
Lake/River	0.725	0.469	-1.477	0.141	-2.212	0.028*	-1.735	0.084	-1.78	0.076
Neighbourhood park	-2.052	0.041*	1.542	0.124	-1.407	0.16	-2.233	0.026*	-1.811	0.071
Destination park (not including neighbourhood park)	0.921	0.358	-2.314	0.021*	-1.741	0.083	-0.676	0.499	-1.416	0.158
Children's playground	-0.496	0.622	-0.476	0.635	-1.476	0.141	-1.881	0.061	-0.829	0.407
Green space with exercise facilities	-0.145	0.885	1.48	0.14	0.091	0.928	0.071	0.944	0.783	0.434

Notes: * $P < 0.05$, ** $p < 0.01$

4.2.4 Visual social media use and urban green space use

Table 4.9 shows the comparison of means between items of visual social media use and urban green space use. Social media intensity has neither a significant impact on visit frequency to urban parks nor on respondents' experience of the most recent visit to urban parks. Visual social media intensity significantly connects with visit frequency to neighbourhood parks ($p < 0.01$) and destination parks ($p < 0.05$), well-being outcome of visit ($p < 0.01$), nature connectedness ($p < 0.01$), and quality of natural environment ($p < 0.01$). The extent of influence caused by visual social media has a significant variance with respect to frequency of neighbourhood use ($p < 0.05$) and destination park use ($p < 0.05$),

nature connectedness ($p < 0.05$) and natural environment quality ($p < 0.01$). In contrast, different levels of social media functionality have significant impacts on park visiting experience, including well-being outcome ($p < 0.01$), nature connectedness ($p < 0.01$) and quality of natural environment ($p < 0.05$).

Table 4.9 One-way ANOVA analysis for different visual social media use groups

Explanatory variable	Social media intensity	Social media intensity ^a			Visual social media intensity	Visual social media intensity ^a		
		High	Medium	Low		High	Medium	Low
Frequency of neighbourhood park use	High	1**			High	1**		
	Medium	0.297	1**		Medium	0.598	1**	
	Low	-0.751	-1.048*	1**	Low	1.316**	0.717*	1**
Frequency of destination park use	High	1**			High	1**		
	Medium	-0.206	1**		Medium	-0.030	1**	
	Low	-0.573	-0.367	1**	Low	0.586	.616*	1**
Well-being outcome	High	1**			High	1**		
	Medium	-0.048	1**		Medium	0.103	1**	
	Low	-0.052	-0.004	1**	Low	.513**	.409**	1**
Nature connectedness	High	1**			High	1**		
	Medium	0.049	1**		Medium	0.220	1**	
	Low	-0.209	-0.257	1**	Low	.686**	.466**	1**
Quality of natural environment	High	1**			High	1**		
	Medium	-0.001	1**		Medium	0.252	1**	
	Low	-0.136	-0.135	1**	Low	.6473**	0.395**	1**

Notes: * $P < 0.05$ (2-tailed) in t-test or one-way ANOVA. ** $p < 0.01$ (2-tailed) in t-test or one-way ANOVA. Bonferroni is selected for post hoc comparison. a. data is presented using mean difference; scores of social media intensity and visual social media intensity are grouped into high level, medium level and low level with equal interval approach.

Table 4.9 One-way ANOVA analysis for different visual social media use groups (continued)

Explanatory variable	Visual social media influence	Visual social media influence ^a			Social media functionality	Social media functionality ^a		
		High	Medium	Low		High	Medium	Low
Frequency of neighbourhood park use	High	1**			High	1**		
	Medium	-0.302	1**		Medium	0.109	1**	
	Low	0.633	0.934*	1**	Low	0.400	0.291	1**
Frequency of destination park use	High	1**			High	1**		
	Medium	-0.239	1**		Medium	0.623	1**	
	Low	0.549	.788*	1**	Low	-0.206	0.829	1**
Well-being outcome	High	1**			High	1**		
	Medium	0.176	1**		Medium	0.239	1**	
	Low	0.258	0.082	1**	Low	0.467**	0.228	1**

	High	1**			High	1**		
Nature connectedness	Medium	0.231	1**		Medium	0.155	1**	
	Low	.396*	0.164	1	Low	0.577**	0.422	1**
	High	1**			High	1**		
Quality of natural environment	Medium	0.160	1**		Medium	0.029*	1**	
	Low	0.466**	0.306*	1**	Low	0.410*	0.118	1**

Notes: * $P < 0.05$ (2-tailed) in t-test or one-way ANOVA. ** $p < 0.01$ (2-tailed) in t-test or one-way ANOVA. Bonferroni is selected for post hoc comparison. a. data is presented using mean difference; a score of visual social media influence and social media functionality are grouped into high level, medium level and low level with equal intervals, respectively.

4.2.5 Subjective well-being

Subjective well-being is measured by applying WHO-5 Well-being Index (Topp et al., 2015). Table 4.10 shows a statistical summary of all respondents' WHO-5 Well-being Index in a two-week timeframe. Participants' subjective well-being is generally in a medium level (mean = 52.25), but the discrepancy is large (S.D.), ranging from the worst 0 to the best 100. Table 4.11 presents the result of comparing means among items of sociodemographic characteristics, visual social media use and urban green space use. Age group, work status and living environment significantly influence respondents' subjective well-being ($p < 0.05$) with respect to sociodemographic characteristics. Visual social media intensity and social media functionality are significantly related to respondents' subjective well-being ($p < 0.01$). Moreover, there are significant differences in participants' subjective well-being corresponding to different frequencies of neighbourhood park use. In contrast, the frequency of destination park use has no evident impact on participants' subjective well-being. In terms of the park visiting experience, visit duration did not significantly influence subjective well-being, while well-being outcome of the visit, nature connectedness, and quality of natural environment impact subjective well-being ($p < 0.01$).

Table 4.10 Summary statistics for WHO-5 Well-being Index (n=347)

	N	Minimum	Maximum	Mean	S.D.
WHO-5 Well-being Index	347	0	100	52.25	22.253

Notes: The raw score is calculated by totalling the figures of the five answers. A percentage score of 0 represents the worst possible, whereas a score of 100 represents the best possible quality of life. S.D. denotes standard deviation.

Table 4.11 Analysing factors that affect subjective well-being between demographic characteristics, visual social media use and urban green space use dimension

Sociodemographic characteristics	WHO-5 Well-being Index p-value	Visual social media use	WHO-5 Well-being Index p-value	Urban green space use	WHO-5 Well-being Index p-value
Gender	0.421	Social media intensity	0.415	Frequency of neighbourhood park use	0.023*
Age group	0.018*	Visual social media intensity	0.001**	Frequency of destination park use	0.084
Work status	0.022*	Visual social media influence	0.262	<i>Details about the park you most recently visited.</i>	
Residency lengths	0.146	Social media functionality	0.005**	Visit duration	0.481
Living environment	0.011*			Well-being outcome	0.000**
				Nature connectedness	0.000**
				Quality of natural environment	0.001**

Notes: * P < 0.05 (2-tailed) in t-test or one-way ANOVA. ** p < 0.01 (2-tailed) in t-test or one-way ANOVA.

4.3 Results of correlation analysis

Pearson correlation analysis generates a statistical metric that measures the linear association between two variables, including the strength and direction of the relationship (Lee Rodgers & Nicewander, 1988). It is an explorative step for generating a comprehensive understanding of relations among pairs of measured variables in this study.

Table 4.12 shows the correlation among items of subjective well-being, social media use and urban green space use. Items of social media use dimension and urban green space use dimension significantly correlate with the measure of subjective well-being, except social media intensity and duration of the most recent visit. The results suggest that the connection between subjective well-being and social media is complex and thus requires further classifications for the intensity of different social media platforms. The duration of the most recent

visit to urban green space does not significantly influence the status of subjective well-being. However, satisfaction (well-being outcome) of the visit, nature connectedness, and natural environment quality significantly correlate with the two-week status of subjective well-being, indicating that the quality of park visiting experience appears more important than visit duration when accounting for subjective well-being. However, it is worth noting that a high frequency of visits to urban green spaces is significantly related to a higher score of subjective well-being, while the frequency of neighbourhood use ($p < 0.01$) is more significant than that of destination parks ($p < 0.05$).

There are significantly positive interactions among all items of social media use ($p < 0.05$ or $p < 0.01$). There is a positive connection between visual social media use and the frequency of neighbourhood park use ($p < 0.01$). Social media use items relating to visuality (i.e., visual social media intensity, visual social media influence and social media functionality) significantly correlate with the experience of visiting a park, except for social media intensity. None of the interactions is significant between social media intensity and individual items of urban green space use, indicating that only certain types of social media are useful in this case.

In terms of urban green space use, there is a statistically positive interaction between the frequency of visiting neighbourhood parks and destination parks ($p < 0.01$), suggesting that respondents who visit a neighbourhood park a lot, incline to visit a destination park more frequently and vice versa. Respondents reporting higher frequencies of visiting to a destination park appear to have a longer visit duration of the most recent visit ($p < 0.01$), whereas the visit frequency to neighbourhood parks does not associate to visit duration. This phenomenon corresponds to the result presented in Table 4.8, which shows that those visiting a destination park tend to spend more time in the park. However, there is no significant variance in visit duration, indicating that

whether the destination is a destination park or not is a potential predictor of visit duration. Among attitudinal questions of an urban green space visit, there are positive interactions in relation to well-being outcomes, nature connectedness and quality of natural environment.

Table 4.12 Correlation analysis results for items of demographic characteristics, social media use and urban green space use dimension via applying Pearson approach

	W	S1	S2	S3	S4	U1	U2	U3-1	U3-2	U3-3	U3-4
Subjective well-being	1										
Social media intensity	.045	1									
Visual social media intensity	.232**	.216**	1								
Visual social media influence	.125*	.131*	.468**	1							
Social media functionality	.156**	.215**	.353**	.482**	1						
Frequency of neighbourhood park use	.158**	-0.063	.178**	0.085	.041	1					
Frequency of destination park use	.135*	-0.105	.100	0.081	.034	.525**	1				
Visit duration	-0.002	.027	.011	0.013	.048	.102	.180**	1			
Well-being outcome	.278**	-0.023	.239**	.153**	.218**	.168**	.253**	.278**	1		
Nature connectedness	.283**	-0.04	.276**	.189**	.190**	.207**	.201**	.158**	.618**	1	
Quality of natural environment	.198**	-0.030	.263**	.210**	.226**	.206**	.190**	.271**	.676**	.596**	1

Notes: W = Subjective well-being (WHO-5 Well-being Index); S1 = Social media intensity; S2 = Visual social media intensity; S3 = Visual social media influence; S4 = Social media functionality; U1 = Frequency of neighbourhood park use; U2 = Frequency of destination park use; U3 denotes the question "Details about the park you most recently visited.", Therein, U3-1 = Visit duration; U3-2 = Well-being outcome U3-3 = Nature connectedness; U3-4 = Quality of natural environment.

4.4 Results of regression analysis

In order to explore research hypotheses regarding the correlation between visual social media use and subjective well-being, as well as the correlation between visual social media use and urban green space use, regression analysis is conducted. In each regression analysis, sociodemographic characteristics are controlled to investigate if the use of visual social media accounts for variance in subjective well-being and urban green space use over other explanatory variables.

For starters, a fixed effect model (Allison, 2009) was applied for linear regression analysis to estimate the relationship among subjective well-being, visual social media use and urban green space use. In a fixed effect model, the potential influence of unobserved covariates on the dependent variable is controlled. Table 4.13 illustrates that adjusted R^2 for urban green space use model was 0.154 (Model 1 in Table 4.13). After the use of social media variable was entered, it raised the adjusted R^2 to 0.162 (Model 2 in Table 4.12). The same variables were still significant when entering the social media use dimension.

In order to examine the performance of this model, as discussed in 4.1.5, work status and living environment variables are included as dummy variables in the fixed effect regression Model 1, as illustrated in Table 4.14, while Model 2 includes all variables of sociodemographic characteristics. Table 4.14 shows the results of linear regression analysis for subjective well-being with items of visual social media use and urban green space use. A total of 347 respondents are included. R^2 is stable at 0.16 when comparing Model 1 and Model 2. Two models revealed a stable positive connection to visual social media intensity (Beta = 0.136, $p < 0.05$ in Model 1 and Beta = 0.133, $p < 0.05$ in Model 2). Interestingly, general social media intensity has no significant connection with subjective well-being, but it negatively correlates with subjective well-being (Beta = -0.026 in Model 1 and Beta = -0.036 in Model 2).

There is no statistical significance between subjective well-being and frequency of neighbourhood park use, nor the frequency of destination park use in Model 1 and Model 2 (Table 4.14), which is inconsistent with the results of correlation analysis in section 4.2. These results suggest various extents to which different individual items of urban green space use influence subjective well-being, namely, when compared to the visit frequency to urban green space, experience of the most recent visit (well-being outcome and nature

connectedness) accounts more for variance in the subjective well-being in Model 2 (Table 4.14), thus there is no significant connection between frequency of urban green space use and subjective well-being with the presence of experience variables. Results presented in Table 4.15 support this explanation. In this, after adding more explanatory variables of urban green space use, the significance of the visit frequency to neighbourhood parks decreased (p-value changes from 0.004 to 0.148). Besides, there is no significant association between subjective well-being and frequency of destination park use. In terms of the experience of visiting a park (Table 4.14), well-being outcome has a strong connection with subjective well-being (Beta = 0.204, $p < 0.01$ in Model 1 and Beta = 0.206, $p < 0.01$ in Model 2), even after control gender, age group, work status, residency lengths and living environment. Nature connectedness is another significant variable in this regression ($p < 0.05$) and has a positive correlation with subjective well-being (Beta = 0.139 in Model 1 and Beta = 0.145 in Model 2).

Table 4.13 Fixed effect regression analysis results for subjective well-being with urban green space use dimension and entered visual social media use dimension

Dependent variable: Subjective well-being (WHO-5 Well-being Index)			Model 1		Model 2		
			Urban Green Space Use		Urban Green Space Use, Visual Social Media Use		
			(Std.) Beta	p	(Std.) Beta	p	
Explanatory variables	Visual social media use	Social media intensity	-	-	-0.036	0.530	
		Visual social media intensity	-	-	0.133	0.028*	
		Visual social media influence	-	-	-0.034	0.586	
		Social media functionality	-	-	0.060	0.322	
	Urban green space use	Frequency of neighbourhood park use	0.088	0.148	0.069	0.258	
		Frequency of destination park use	0.045	0.465	0.045	0.455	
	<i>Details about the park you most recently visited.</i>						
		Visit duration	-0.089	0.100	-0.079	0.140	
		Well-being outcome	0.221	0.003**	0.206	0.006**	
		Nature connectedness	0.166	0.015*	0.145	0.034*	
	Quality of natural environment	-0.040	0.587	-0.060	0.415		
Control variables	Sociodemographic characteristics		YES		YES		
	N = 347		Adj. R ² = 0.154; F = 4.151		Adj. R ² = 0.162; F = 3.789		

Notes: "Yes" denotes the control variables are included; * $P < 0.05$, ** $p < 0.01$

Table 4.14 Fixed effect regression analysis results for subjective well-being with visual social media use and urban green space use dimension

Dependent variable: Subjective well-being (WHO-5 Well-being Index)			Model 1		Model 2		
			Control Factors: Age Group, Work Status, and Living Environment		Control Factors: Gender, Age Group, Work Status, Residency Lengths, and Living Environment		
			(Std.) Beta	p	(Std.) Beta	p	
Explanatory variables	Visual social media use	Social media intensity	-0.026	0.645	-0.036	0.530	
		Visual social media intensity	0.136	0.024*	0.133	0.028*	
		Visual social media influence	-0.019	0.754	-0.034	0.586	
		Social media functionality	0.058	0.334	0.060	0.322	
	Urban green space use	Frequency of neighbourhood park use	0.055	0.372	0.069	0.258	
		Frequency of destination park use	0.046	0.444	0.045	0.455	
	Details about the park you most recently visited.						
		Visit duration	-0.081	0.132	-0.079	0.140	
		Well-being outcome	0.204	0.006**	0.206	0.006**	
		Nature connectedness	0.139	0.043*	0.145	0.034*	
	Quality of natural environment	-0.065	0.376	-0.060	0.415		
Control variables	Gender	NO		YES			
	Age group	YES		YES			
	Work status	YES		YES			
	Residency lengths	NO		YES			
	Living environment	YES		YES			
	N = 347	Adj. R ² = 0.16; F = 4.445		Adj. R ² = 0.162; F = 3.789			

Notes: "Yes" denotes the control variables are included and "No" denotes the control variables are excluded; * P < 0.05, ** p < 0.01

Table 4.15 Fixed effect regression analysis results for subjective well-being with individual items of urban green space use (control variables included)

Dependent variable: Subjective well-being (WHO-5 Well-being Index)			Model 1		Model 2		Model 3	
			(Std.) Beta	p	(Std.) Beta	p	(Std.) Beta	p
Explanatory variables	Urban green space use	Frequency of neighbourhood park use	0.159	0.004**	0.110	0.084	0.088	0.148
		Frequency of destination park use	-	-	0.096	0.125	0.045	0.465
Details about the park you most recently visited.								
		Visit duration	-	-	-	-	-0.089	0.100
		Well-being outcome	-	-	-	-	0.221	0.003**
		Nature connectedness	-	-	-	-	0.166	0.015*
		Quality of natural environment	-	-	-	-	-0.040	0.587
Control variables	Sociodemographic characteristics		Yes		Yes		Yes	
	N = 347		Adj. R ² = 0.066		Adj. R ² = 0.069		Adj. R ² = 0.154	

Notes: "Yes" denotes the control variables are included; * P < 0.05, ** p < 0.01

4.5 Conclusion

This chapter focused on the influence of visual social media use on subjective well-being, urban green space, and relationships between visual social media use and urban green space use in the context of China's post-Covid. It sought to understand the complexity of perceptions towards different landscape factors in urban green space. To this end, it presented online survey data and results of quantitative analysis regarding the statistical difference between categorical groups via t-test and ANOVA approach and correlations between subjective well-being and explanatory variables via fixed effect regression analysis.

The empirical results showed a significant linkage between visual social media use and subjective well-being, and a strong association between visual social media use and neighbourhood park, contrasting with some dominant evidence. Although the use of social media elicits concerns about social comparison, feelings of low self-worth, and other related negative emotional outcomes, visual social media use contributes to maintaining relations, recording experiences, sharing meaningful moments and facilitating aesthetic appreciation of place. Understanding how interactions from visual social media influence offline behaviours and its consequences on subjective well-being is beyond the discussion of the pros and cons of visual social media. The overarching aim is to examine how visual social media integrates into the flows of visual information from online to offline and the hidden perception of the environment. Based on the findings of this chapter, visual representations derived from visual social media are further explored in the next chapter to uncover experience, perception and personal preference reflected by photography practices.

Chapter 5 Visual Social Media Data Mining: Spatio-temporal Patterns of Photography Practice and Representation of Nature Experience

5.1 Introduction

As discussed in 3.3.1, a total of 22760 geo-tagged photos and a total of 2056 unique users with affiliated information in ten urban parks of Beijing were harvested. Photos were taken by Flickr users from 2005.1.1 to 2019.12.31. With geographic information (latitude and longitude of a photo) and temporal information (timestamps of when the photo was taken, including years, months, days, hours and minutes), hotspots and trajectories of photo-taking behaviour were generated to explore distinct patterns between advertised attractions and the places beyond advertised (discussed in 5.2) and discrepancies between residents and tourists (discussed in 5.3). Hotspots referred to clustering phenomenon in space, while trajectories were a sequence of locations visited and marked by visitors. Accordingly, a hotspot-trajectory pattern was established to explore the spatio-temporal behaviour of photographing. With harvested photos shared by visitors, content analysis was performed via a computer-aided coding approach and Latent Semantic Indexing (LSI) to explore different topics embedded in advertised attractions and unadvertised ones (see 5.2.3); photos taken by residents and tourists (see 5.3.5).

Drawing on the concept of “tourist gaze”, this chapter concentrated on two research objectives: (1) exploration of landscape preferences between advertised attractions and unadvertised attractions in urban parks; and (2) investigation of landscape preferences between residents and tourists in urban

parks. This section analysed visitors' photo-taking behaviour and the content of photos taken in urban parks. For the former objective, ten urban parks with considerable variation in popularity and cultural context (see 3.4.2 for more details) were included in section 5.2. For the latter objective, data harvested from the previous ten urban parks were included for statistical analysis (5.3.1 and 5.3.2) regarding revisit behaviour between residents and tourists and the impact of seasonality on the activeness of taking photos (see 5.3.3), while six out of the ten urban parks were retained for spatio-temporal behaviour analysis and content analysis to guarantee residents and tourists were statistically comparable (see 5.3.4 and 5.3.5).

5.2 Advertised attractions and visitors' photo-taking behaviour in ten urban parks

In order to explore the impact of place popularity on visitors' photo-taking behaviour, advertised attractions were identified in each urban park by examining popular online platforms, in which travel information is provided by websites' ranking systems and visitors' reviews (see 5.2.1). For the places where geo-tagged photos spatially clustered but were not advertised by online travel websites (the unadvertised attractions), thus it was worth investigating visitors' representations towards advertised attractions and unadvertised ones and if there were distinct visual representations among advertised attractions and the unadvertised, unprompted attractions. In 5.2.2, hotspots and representative trajectories were generated and compared with identified attractions. Then photos were grouped based on the attached geographical information: (1) those belonging to hotspot areas related to advertised attractions; and (2) those related to unadvertised attractions. Content analysis was performed on these two groups of photos in each urban park in 5.2.3.

5.2.1 Statistical characteristics of visitors' photo-taking behaviour in ten urban parks

As chapter 4 has discussed, the online search was pervasively part of routines for respondents in planning to visit a place (H. A. Lee et al., 2011) and forming an image of the destinations (Kladou & Mavragani, 2015). In order to understand the popularity of selected urban parks, TripAdvisor (www.tripadvisor.com), which was a widely used online travel website for people to collect information about destinations from its ranking systems (Jeacle & Carter, 2011) and user-generated content (Miguéns et al., 2008; O'connor, 2008), were utilized as the main source to classify the parks into three levels of popularity: top choice, alternative choice and not recommended for visitors, corresponding to top 20, top 40 and not included in top 40 places to visit in Beijing respectively (see more details in Table 3.10 and Table 3.11). Specifically, Traditional Chinese Gardens were generally in higher levels of popularity, while Public Parks were at lower levels of popularity. Traditional Chinese Gardens referred to the historical gardens that were built in ancient era (BC 221-1840) of China (Zhu, 2012), while Public Parks in this study referred to the parks characterised with contemporary green spaces and were built in contemporary era of China (1949 to present) (Zhu, 2012), when People's Republic of China was established.

Table 5.1 presents advertised attractions and statistical characteristics of photos and visitors harvested from Flickr. Advertised attractions in each park were identified based on the place page of TripAdvisor (www.tripadvisor.com) and the place description on Lonely Planet (<https://www.lonelyplanet.com>). Thereinto, The Summer Place (P1) have the most advertised attractions, while Olympic Forest Park (P8) and Purple Bamboo Park (P9) have no specific attractions mentioned by any of the travel websites. Identified attractions

advertised by online travel platforms can be landmarks (e.g., Tower of Buddhist Incense for The Summer Palace, White Dagoba for Beihai Park and Wanchun Pavilion for Jingshan Park) and areas of the park (e.g., Wester Mansions Area for Yuanmingyuan Park, Cherry Blossom Garden for Yuyuantan Park). The Summer Palace has the most photos and visitors compared with other urban parks, and Olympic Park has the second largest number of photos and visitors. Traditional Chinese Gardens had more visitors and a higher average number of photos taken per person, except for those of Jingshan Park. However, the average number of photos taken per person in Public Parks was more consistent (varied between 2 to 3) than that of photos taken in Traditional Chinese Gardens (varied from 1 to 5), although fewer photos and visitors were harvested in Public Parks.

Table 5.1 Park popularity and statistical characteristics of photo-taking behaviour

ID	Type	Park	Popularity level	Advertised attractions ^[1]	Photo count	Visitor count	Mean ^[2] (C.V.)
P1	Traditional Chinese Gardens (Imperial Gardens)	The Summer Palace	★★★ ^[3]	<ul style="list-style-type: none"> • Tower of Buddhist Incense • Long Corridor • Qingyan Stone Boat • Seventeen Arches Bridge • Suzhou Street • West Dyke 	3049	772	3.95(0.77)
P2		Yuanmingyuan	★★	<ul style="list-style-type: none"> • Wester Mansions Area 	695	168	4.14(0.69)
P3		Yuyuantan Park	★★	<ul style="list-style-type: none"> • Cherry Blossom Garden 	244	98	2.49(0.69)
P4		Beihai Park	★★★	<ul style="list-style-type: none"> • White Dagoba 	1070	341	3.14(0.77)
P5		Jingshan Park	★★★	<ul style="list-style-type: none"> • Wanchun Pavilion (Panoramic view of the Forbidden City) 	924	489	1.89(1.09)
P6	Public Parks	Yuan Dadu City Wall Ruins Park	★	<ul style="list-style-type: none"> • Haitang Huaxi (Flowering Arabapple Creek) 	199	72	2.76(0.47)
P7		Olympic Park	★★★	<ul style="list-style-type: none"> • Beijing National Aquatics Centre (Water Cube) • Niaochao (Bird's Nest) • National Stadium • Olympic Park Observation Tower 	1765	665	2.65(0.79)
P8		Olympic Forest Park	★★	<ul style="list-style-type: none"> • - 	294	137	2.15(0.58)
P9	Purple Bamboo Park	★	<ul style="list-style-type: none"> • - 	180	63	2.86(0.69)	
P10	Chaoyang Park	★	<ul style="list-style-type: none"> • Amusement Area 	268	132	2.03(1.05)	

Notes: [1] Advertised attractions were based on three sources: a. "attractions" in the park page of TripAdvisor website (<https://www.tripadvisor.co.uk>); b. the image of them were recommended by the park page of TripAdvisor website (<https://www.tripadvisor.co.uk>); c. mentioned by the descriptions in the park page of Lonely Planet website (<https://www.lonelyplanet.com>). [2] Mean denotes average number of photos taken per user; C.V. denotes the coefficient of variance.

[3] ★★★ = Top choice; ★★ = Alternative choice; ★ = Not recommended; for details about classification criteria see Table 3.10 and Table 3.11 in section 3.4.2.

5.2.2 Hotspot-trajectory patterns of photo-taking behaviour

To explore patterns of visitors' photo-taking behaviour, hotspot areas and representative trajectories were identified by taking temporal and spatial information of geo-tagged photos into account. Then overlays of hotspot areas and representative trajectories of urban parks, as discussed in 3.6.2, were superimposed over the base map. The hotspot layer presents identified clusters or groups of photos that were taken geographically related, while the representative trajectories layer reflects the overall movement of the trajectory groups that share similarity in a short duration of the trajectory so that visitors' movement is legible. Geo-tagged photos identified as noise and trajectories of all photos were excluded when mapping a hotspot-trajectory pattern. Only the geo-tagged Flickr photos in clusters (identified hotspot areas) and representative trajectories were retained (Figure 5.1).



Figure 5.1 Hotspot-trajectory pattern of The Summer Palace

Note: Three maps are the result of hotspot analysis (left top), the result of TRACLUS analysis (left bottom) and the hotspot-trajectory pattern (right).



5.2.2.1 Hotspot-trajectory patterns and advertised attractions

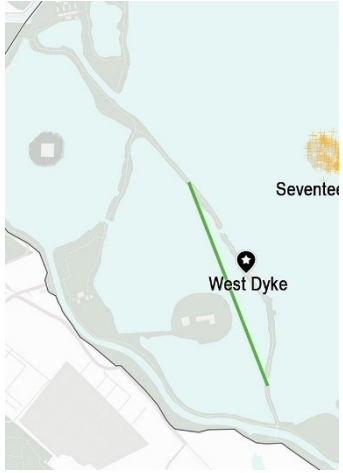



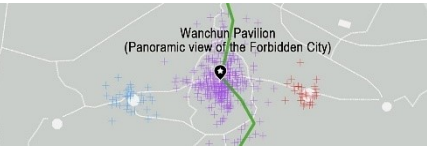
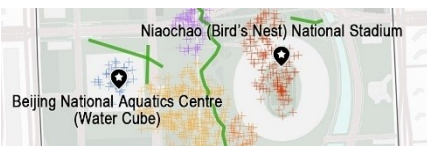
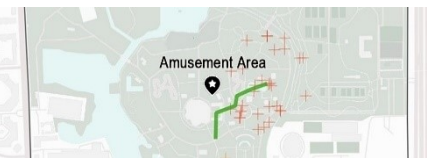
Table 5.2 presents the hotspot-trajectory patterns that were in accordance with advertised attractions (see Appendix E for complete maps of each park). Therein, attractions of The Summer Palace were mostly predicted by hotspot areas generated from geo-tagged photos and representative trajectories also predicted a popular walking route – West Dyke, which was not a typical destination but was promoted by the stunning scenes visitors would experience when moving through. Hotspot areas also validated the presence of all advertised attractions in other urban parks. The advertised attractions were areas within some parks, such as Cherry Blossom Garden in Yuyuantan Park (P3), Western Mansion Area in Yuanmingyuan Park (P2) and Amusement Area in Chaoyang Park (P10). The advertised attractions were landmarks in some parks, such as White Dagoba in Beihai Park (P4) and Wanchun Pavilion in Jingshan Park (P5).

In terms of representative trajectories, which presented a sequence of important locations but not the real routes for visitors to take photos, they indicated a popular visiting sequence yielded by most visitors, since TRACCLUS algorithm aimed at generating similarity among a group of trajectories (Lee et al., 2007). As for The Summer Palace, the sequence of Suzhou Street, Tower of Buddhist Incense, Long Corridor and Seventeen Arches Bridge were frequently chosen by visitors to take photos. Both endpoints of the sequence could be the first location of visitors' trip in the park. Qingyan Stone Boat, in this sense, is relatively isolated from other attractions, while West Dyke was not recognised as a hotspot but a representative trajectory, suggesting a considerable number of visitors took photos along it. For those parks which have one to two advertised attractions (from P2 to P10), representative trajectories inclined to either connect the park entrance and the attraction (i.e.,

P2, P4, P5 and P7) or be extracted a short distance within the hotspot areas (P2 and P10). The former phenomenon indicated that visitors had more consistent visiting trajectories from the park entrance to the attraction, compared with trajectories around or within the hotspot areas. Similarly, the latter phenomenon suggested that visitors had more diverse trajectories in another part of the park than in hotspot areas. It is worth noting that parks with longer and entrance-to-attraction trajectories (i.e., P2, P4, P5, P7) were generally more popular than parks with shorter and within-hotspot trajectories (P3 and P10).

Table 5.2 Hotspot-trajectory patterns corresponding to advertised attractions

ID	Park	Popularity level ^[1]	Place feature	Hotspot-trajectory patterns corresponding to advertised attractions ^[2]
P1	The Summer Palace	★★★	<ul style="list-style-type: none"> Suzhou Street: it was an imitation of famous Jiangsu canal town along the Back Lake, containing waterways and shops with ancient style on the banks. Tower of Buddhist Incense: symbolic and majestic building in the centre of Longevity Hill; an outstanding focus point; a spot for a wider perspective of Kunming Lake. Qingyan Stone Boat: a ship-like building made carved out of marble on waterfront; an outstanding and exquisitely ornate landmark. Long Corridor: also called Long Gallery; a covered walkway on the transitional zone between the northern shore of Kunming Lake and the foot of Longevity Hill, leading from east to west; is famous for its total length (728 meters) and paintings on beams and ceiling. 	
			<ul style="list-style-type: none"> Seventeen Arches Bridge: a classic structure connecting the easter shore of Kunming Lake and Nanhu Island; the largest bridge with a length of 150 meters in the Summer Palace; constructing a unique and symbolic scenery of the Summer Palace. 	

			<ul style="list-style-type: none"> The representative trajectory on the west in line with the West Dyke, where ancient willows and peach trees were lined with the walkway. There are six bridges of different styles placed along the causeway, forming iconic images of Kunming Lake. 	
P2	Yuanmingyuan Park	★★	<ul style="list-style-type: none"> Western Mansions Area: ruins of 18th-century European-style imperial buildings; located in the northern part of Garden of Eternal Spring, covering an area of around 7 hectares; western-style constructions in an Imperial Garden make them iconic scenes of Yuanmingyuan (the Old Summer Palace). 	
P3	Yuyuantan Park	★★	<ul style="list-style-type: none"> Cherry Blossom Garden: Yuyuantan park is famous for Cheery Blossom Fair in spring and Cheery Blossom Garden located to the northwest of Yuyuantan park, is the best place for visitors to see more than 2000 cherry trees in Beijing. 	
P4	Beihai Park	★★★	<ul style="list-style-type: none"> White Dagoba: a religious landmark placed on the highest point on Jade Flower Island; a 36m-high Tibetan-style construction forming a representative scenery for Beihai Park. 	
P5	Jingshan Park	★★★	<ul style="list-style-type: none"> Wanchun Pavilion: located on the top of Prospect Hill in Jingshan (Prospect Hill) Park; the highest lookout point and the best spot to see the Central Axis of Beijing, panoramic view of the Forbidden City and other historical landmarks such as the Drum Tower, the Bell Tower, White Dagoba of Beihai Park. 	
P7	Olympic Park	★★★	<ul style="list-style-type: none"> Bird's Nest: a symbolic building constructed for the 2008 Beijing Olympic Games. Water Cube: a symbolic building, coupled with Bird's Nest, for the 2008 Beijing Olympic Games. 	
P10	Chaoyang Park	★	<ul style="list-style-type: none"> Amusement Area: located in the central area of Chaoyang Park and is famous for the kids' playground and recreational facilities. 	

[1] ★★★ = Top choice; ★★ = Alternative choice; ★ = Not recommended.

[2] Popular attractions were based on the summary of Table 5.1.

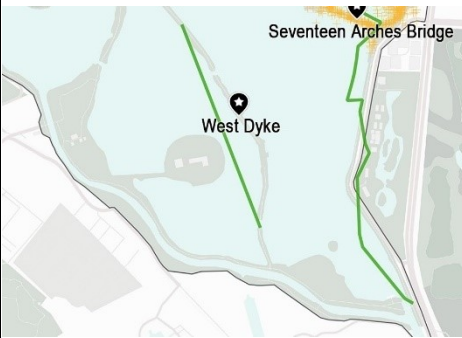

5.2.2.2 Hotspot-trajectory patterns and beyond popular attractions

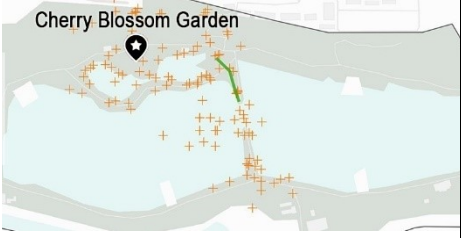
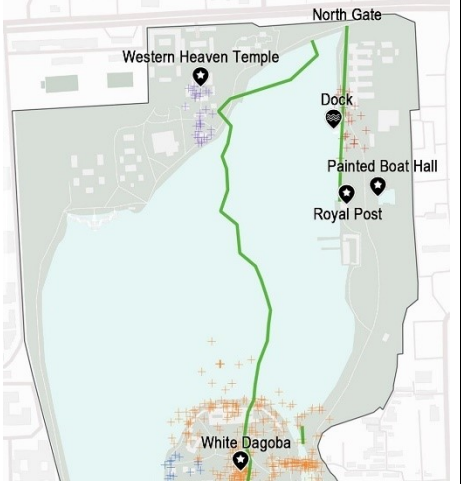

Table 5.3 shows a summary of hotspot areas and representative trajectories that were not in accordance with advertised attractions. In terms of The Summer Palace (P1), visitors walked along the lakeshore after visiting Seventeen Arches Bridges to the southmost of the park. However, no additional hotspot areas were detected beyond trendy ones. According to representative trajectory together with detected hotspots, visitors also visited other unadvertised attractions except for the popular ones in P2, P3, P4, P5, P7 and P10. These attractions could be places near lakes and bridges (P2, P3, P4 and P7), or corresponding to other places of interest (P4, P5 and P10). Interestingly, bridges were attractive for visitors, especially in Traditional Chinese Gardens such as P1, P2, P3 and P4. Besides, clusters were found on the way to advertised attractions. P5 was the only urban park without a lake or other aquatic landscape among the selected sites. Visitors were not only interested in photographing on top of the hill but also the pavilions halfway up the hill. This was also observed in P2 and P4, where the clustering phenomenon happened on the way heading to advertised attractions. One of the unadvertised attractions in P4 was Western Heaven Temple, which was located on the north shore of the central lake and characterised by a magnificent four-pillared memorial arch in front of the temple. Another unadvertised attraction in P4 was in line with a dock and on the way from North Gate to White Dagoba (the advertised attraction).

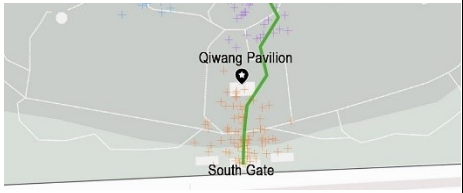
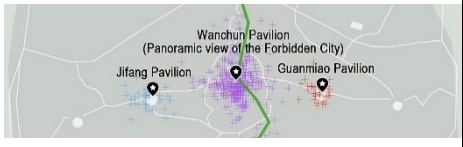
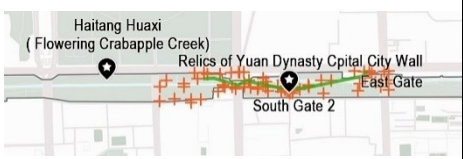

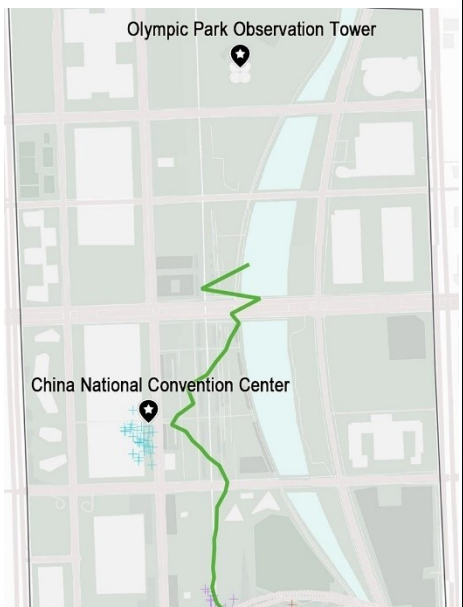
There was another type of urban park that had no specific attractions being advertised (P8, P9). In this, hotspot areas were close to waterbody as a whole, though P6 was a linear urban park built along the Moon River. P6 was a unique type of urban park, where the hotspot area only partially corresponded to the

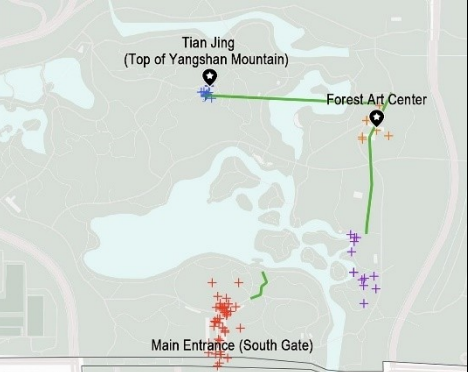

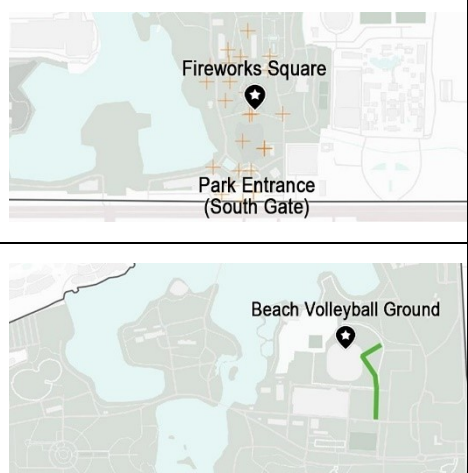
Crabapple flowering area (advertised attraction) but mainly corresponded to the park entrances. There were similarities shared by these parks with different levels of popularity: (1) park entrance was detected as one of the hotspot areas in every park except for P3; (2) sightseeing platforms on top of the hill attracted visitors to take photos whether or not they were being advertised (i.e., Wanchun Pavilion in P5 and Tian Jing in P8); (3) waterfront or surrounding area of waterbody was favoured by visitors to take photos, except for P5, which had no waterbody and was famous for having a panoramic view of the Forbidden City in its sightseeing pavilion.

Table 5.3 Hotspot-trajectory patterns corresponding to unadvertised attractions

ID	Park	Popularity level ^[1]	Place feature	Hotspot-trajectory patterns NOT corresponding to popular attractions ^[2]
P1	The Summer Palace	★★★	<ul style="list-style-type: none"> There is a representative trajectory of photo-taking behaviour on the eastern shore of Kunming Lake (the right green line on map), linking the southmost end with Seventeen Arches Bridge in the Summer Palace. 	
P2	Yuanmingyuan	★★	<ul style="list-style-type: none"> Two hotspots were detected and were not in accordance with any recommended attractions ^[2]. One was near the park entrance (orange signs on map) and along the waterfront of main road heading to Changchun Garden (the northern one of the three gardens consisting of Yuanmingyuan); the other hotspot (purple signs on map) was also on the main road to Changchun Garden but mainly distributed near the bridge of connecting two islands. The representative trajectories were generally leading toward recommended attractions located to the north of Changchun Garden. Most part of the trajectories were either in line with lake shores or across the lakes of Qichun Garden and Changchun Garden. 	

P3	Yuyuantan Park	★★	<ul style="list-style-type: none"> Identified hotspots also covered mid-causeway starting from Yuyuan Pavilion on the south shore of the middle lake to Cherry Blossom Garden on the northwest shore of the middle lake. The representative trajectory was detected in the transitional zone between mid-causeway and Cherry Blossom Garden. 	
P4	Beihai Park	★★★	<ul style="list-style-type: none"> Two hotspots that did not correspond to popular attractions were identified: one is geographically related to Western Heaven Temple and the other is on the northeast shore of the central lake, where a dock was placed. There were two obvious representative trajectories: for the longer trajectory (left green line on the map), most of it was across the centre lake, suggesting visitors visited White Dagoba after visiting the Western Heaven Temple by boating or walking; the shorter one (right green line on the map) linked the north entrance of Beihai Park and Royal Post and Painted Boat Hall. Another hotspot area was close to advertised attraction – White Dagoba (blue cluster on the map). Identified trajectories were in line with lakeshore and the right one linked two clusters. 	
P5	Jingshan Park	★★★	<ul style="list-style-type: none"> A representative trajectory was generated in the northern zone, corresponding to Xingqing Pavilion and Shouhuang Hall, to the top of Prospect Hill. 	

			<ul style="list-style-type: none"> The detected hotspot was in accordance with main entrance (South Gate) of Jingshan Park and Qiwang Pavilion, together with a spacious square in front of this building. 	
			<ul style="list-style-type: none"> Two pavilions were detected as hotspots on the middle way to Wanchun Pavilion (the top of Prospect Hill): Jifang Pavilion and Guanmiao Pavilion. 	
P6	Yuan Dadu City Wall Ruins Park	★	<ul style="list-style-type: none"> Hotspot area was mainly distributed in Flowering Crabapple Creek zone and near the entrance square, a notable spot of sculptures and relics of ancient city wall. A representative trajectory linked East Gate to the Flowering Crabapple Creek zone. 	
			<ul style="list-style-type: none"> Another representative trajectory was identified in the western area of the sculpted parkland, near the West Gate and North Gate. 	
P7	Olympic Park	★★★	<ul style="list-style-type: none"> A hotspot was detected at China National Convention Center. A representative trajectory started from landmarks of this zone: Bird's Nest and Water Cube to the northern area of Olympic Park, heading to the waterfront. The Olympic Park Observation Tower was an absolute landmark in this area with a height of 258 metres. 	

P8	Olympic Forest Park	★★	<ul style="list-style-type: none"> Four hotspot areas were identified in Olympic Forest Park: one hotspot area was in accordance with Main Entrance of Olympic Forest Park, with a large lawn in front of the central lake (Aohai Sea); the hotspot of Tian Jing is a viewing platform on the top of Yangshan Mountain to the north of central lake; Forest Art Center is another hotspot; an exception that did not correspond to any labelled attraction, is the one near several islands of the central lake. Three representative trajectories were identified: firstly, one linked the entrance square to the lake shore; secondly, the islands zone and Forest Art Center were connected; lastly, Forest Art Center and Tian Jing viewing platform were linked. 	
P9	Purple Bamboo Park	★	<ul style="list-style-type: none"> Four hotspot areas were detected: firstly, East Gate was identified as a hotspot area while South Gate was only related to representative trajectory; secondly, the other three hotspot areas were mainly distributed at islands and lake shore. Representative trajectories linked South Gate, a hotspot area near East Gate, two islands in the central lake and Zizhuyuan Temple. 	
P10	Chaoyang Park	★	<ul style="list-style-type: none"> Identified hotspot area was mainly distributed at South Gate and Fireworks Square. The representative trajectory was in accordance with the presence of a Beach Volleyball Ground. 	

[1] ★★★ = Top choice; ★★ = Alternative choice; ★ = Not recommended.

[2] Refers to the hotspot areas or trajectories that did not include any advertised attractions that have been advertised in each park.

5.2.3 Content analysis of photographs taken in advertised and unadvertised attractions

According to results presented in Table 5.2 and Table 5.3, identified clusters were classified as two groups for each park: clusters of geo-tagged photos in close proximity of advertised attractions (or geographically overlapped) were designated to the advertised group; those had no advertised attractions were designated to the unadvertised group. Then content analysis was performed on the image data of each group per urban park. Specifically, as discussed in 3.3.2, Google Cloud Vision was first implemented for coding the content of each photo in the dataset. Textual descriptions were generated for each photo. Then Latent Semantic Indexing (LSI) approach was conducted to extract topics of these textual data, namely, retrieving appropriate representations of the document. In LSI method, the weight of an individual word was set as the corresponding term frequency in that document. Then k topics of the document were generated. Individual terms of the document had different values in each topic, suggesting how much each term contributes to each topic. The higher the value is, the greater the contribution term has.

LSI dimensionality (the number of topics included in the textual material) requires to be determined before information retrieval. Naturally, the k dimensions of a collection depend on its breadth of conceptual content (Bradford, 2008). There is no obvious approach to choose the number of dimensions. As for contents analysis of park photos, k value for each park was determined as 7 in this study due to three reasons: (1) the presence of objects in photos taken in urban parks is relatively limited compared to those taken in the whole city; (2) optimum value for k ranged from 6 to 80 for textual documents, the size of which was between 667 (articles) to 2000 (articles) (Elsas, 2005; Haley et al., 2007; Lerman, 1999; Wu et al., 1998); while the size of textual descriptions was between 180 to 1000 (contents of each photo was determined as one “article”) for each urban park in this study; and (3) factor

analysis and scree plots were performed following the method of another study (Shahid et al., 2017) to determine k value. Looking at the scree plots, the first few components' eigenvalues sharply decreased. After that, the curve became flattened, with which we could deduce that there were a few important topics that were significant to explain the whole materials. The results suggested that appropriate k value was between 7 to 11. Lastly, top ten terms with highest values of each topic were extracted. Accordingly, proposed topic labels were presented (Appendix G).

As presented in Table 5.4, unique topics for both advertised and unadvertised attractions were identified (see details in Appendix G). Figure 5.3 shows photography samples assigned to eight themes. More unique topics were identified in unadvertised attractions than the topics identified in advertised attractions. Figure 5.2 illustrates the visualization of networked relations between topics of advertised and unadvertised attractions according to their descriptions' similarities through Python package NetworkX (Hagberg et al., 2008). The network consists of nodes and edges. Nodes denote unique topics identified from textual descriptions of photos, while edges linking two or more nodes suggests a similarity between these topics.

In terms of similarities shared by photos taken at advertised and unadvertised attractions, eight descriptive themes of topics were identified (Figure 5.2). Social features group contains most of the topics related to documenting travel experiences in photos. The items that best described these topics were "leisure", "event", "travel", "recreation", and those described environment settings, such as "temple", "building", "sky", "plant", "flower" and "water". This theme encapsulates visitors' photos without avoiding crowds when they take photos of interesting objects in parks, The theme also contains candid photos of locals or other visitors, which concentrate on crowds per se. Selfies are also included in this theme for their social nature of self-representation and self-exposure.

Interaction with nature theme presents photographers' selfies in natural environments and other visitors' contact with nature. The moment when people are in natural environment is recorded in this scenario. Thus, green space is as important as people in photos, in which artificial objects are excluded in most cases. The image of place encompasses all general images of parks perceived by visitors. No single items of this category are representative, but a combination of diverse environmental factors that counts. Thus, these topics consist of architectural elements (e.g., "temple", "architecture" and "tower"), water elements (e.g., "water" and "lake"), greenery elements (e.g., "plant", "tree" and "grass") and those indicating a panoramic view, such as "sky", "landscape" and "atmospheric". In terms of Landmark features, key items of the topics associated with landmarks are "landmark", "monument", "tower", and "skyscraper", and those related to the panoramic view, such as "sky", "cloud", and "atmosphere". Water features include the top one items such as "water", "lake", and "watercourse". If most of the ten items for each topic are relevant to water (e.g., "boating"), the topic is identified as waterscape. Greenery features consist of vegetation-related topics, of which items are either present natural environment, such as "natural", "landscape", "botany", and "vegetation", or close-ups of trees and flowers, such as "leaf", "petal", "trunk", and "twig". As for the theme of light and shadow features, key items are "light", "shade", "afterglow", "tints", "sunset", and "sunrise".

From the topic similarities between advertised and unadvertised attractions, it can be observed that, firstly, the general image of Traditional Chinese Garden was perceived at these two types of locations, including factors of traditional Chinese architecture, temples, pagodas, plants, trees, water, lake and sky. Secondly, landmark topic was of significance in both advertised and unadvertised groups, though there was the nuance of co-occurrent elements. Specifically, the landmark was photographed with plants and with visitors posing in front of the lens at advertised places, and crowds (e.g., tour groups)

were inevitably included in most cases, while for unadvertised places, flowering plants were commonly included in landmark photos, and gradations of light and shade at different times of a day was the key context for taking landmark photos. Thirdly, greenery was an important topic for both advertised and unadvertised places. These photos either were mainly relevant to flowers, trees, grass, and other plants, or mainly about recording the moment when visitors relaxed themselves in nature. Similarly, the image of place, water features and light and shadow features are perceived by visitors at both advertised and unadvertised places.

There are more unique topics identified at unadvertised places than those identified at advertised places (Figure 5.2). More specifically, the seasonality of nature is perceived at unadvertised places based on identified topics, namely “cold weather and winter photographing” and “tree seasonality”. Trees are significant objects in these places according to the topic “trees in natural environment”. Activities in a public park (i.e., “cycling in a public park”), photographic apparatus and the process of taking photos (i.e., “camera and shooting nature” and “camera in nature”), and park signage are another three distinct topics of unadvertised places. As to advertised attractions, cityscape and art photography (i.e., “black and white photography”) are identified unique topics.

Table 5.4 Summary of unique topics identified from photos taken at advertised and unadvertised attractions

Clusters of advertised attractions (n = 12) Identified unique topics	Clusters of unadvertised attractions (n = 20) Identified unique topics
<ul style="list-style-type: none"> • Architectural details • Art of architecture and street scene • Architectural details of Traditional Chinese Garden • Architectural details and contrast of light • Traditional Chinese architecture and travel record • Atmospheric perspective and selfie • Black and white photography • Contrast of light and sky • Cityscape • Event record • Event and trip records • Event record and night scene • Facilities • General image of the garden 	<ul style="list-style-type: none"> • Atmospheric perspective of landscape • Camera and shooting nature • Camera in nature • Close-ups of flower • Cold weather and winter photographing • Contrast of lights and parkway landscape • Cycling in public park • Event and trip records • Event record • Facilities • Flower and traditional Chinese architecture • General image of the garden • General image of the garden and travel record • Landmark and close-ups of flower

<ul style="list-style-type: none"> • General image of Traditional Chinese Garden • Landmark and plant • Landmark and travel record • Leisure in nature • Natural landscape and close-ups of flower • Natural landscape and close-ups of plant • Night scene and street scene • People in nature • Recreation • Recreation and event record • Selfie in nature • Sculpture and monument • Travel record • Travel record and selfie • Water activities • Waterscape • Waterscape and flower • Waterscape and sky 	<ul style="list-style-type: none"> • Landmark at different times of the day • Leisure record • Natural landscape and close-ups of plant • Park signage • People in nature • Plant and traditional Chinese architecture • Recreation and travel record • Recreation in public space • Recreation in nature • Selfie on grass • Street scene • Sculpture and monument • Travel record and park signage • Travel record • Tree and grass and people in nature • Trees in natural environment • Tree seasonality • Water activities • Waterscape • Waterscape and tower • Waterscape and flower • Waterscape and plant
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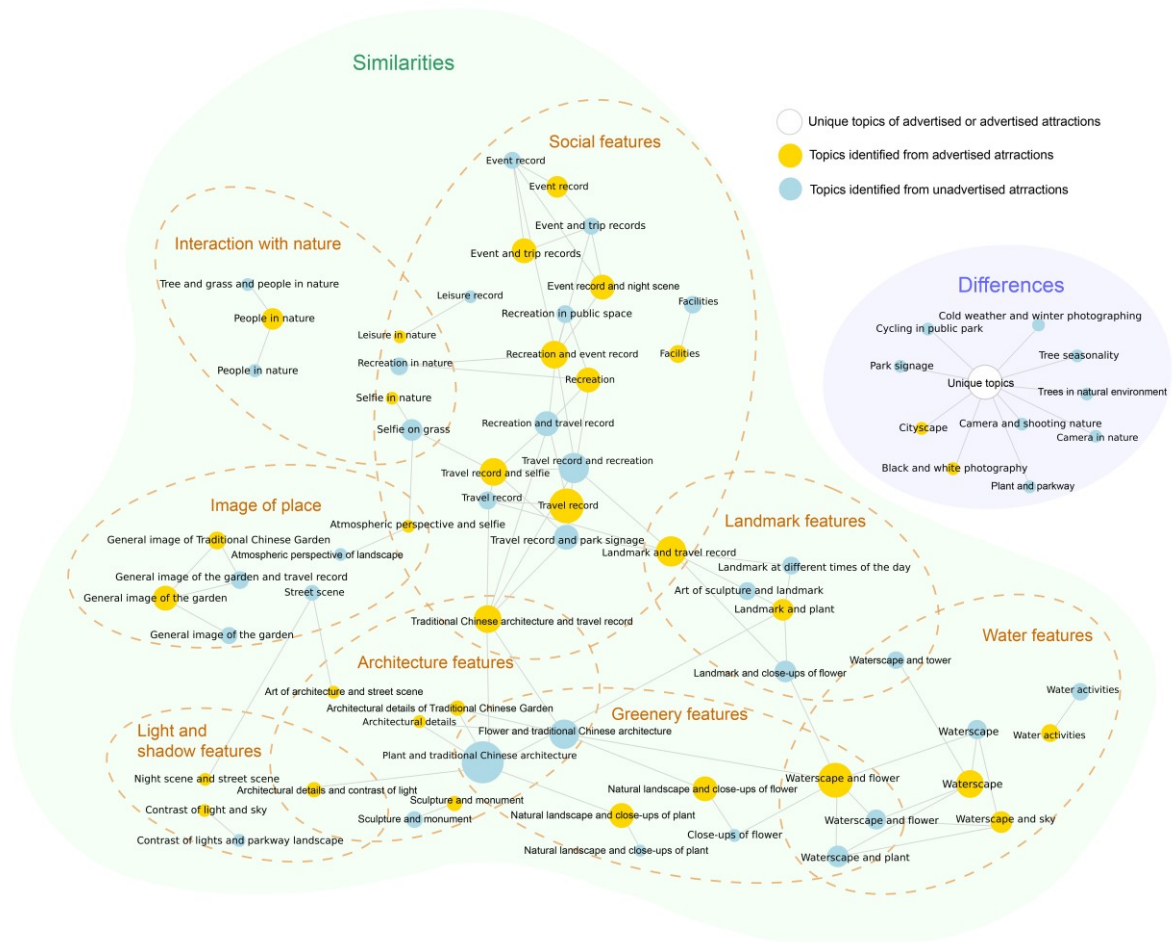


Figure 5.2 Visualization of identified unique topics from photos taken at advertised and unadvertised attractions based on similarities and differences of their topic descriptions

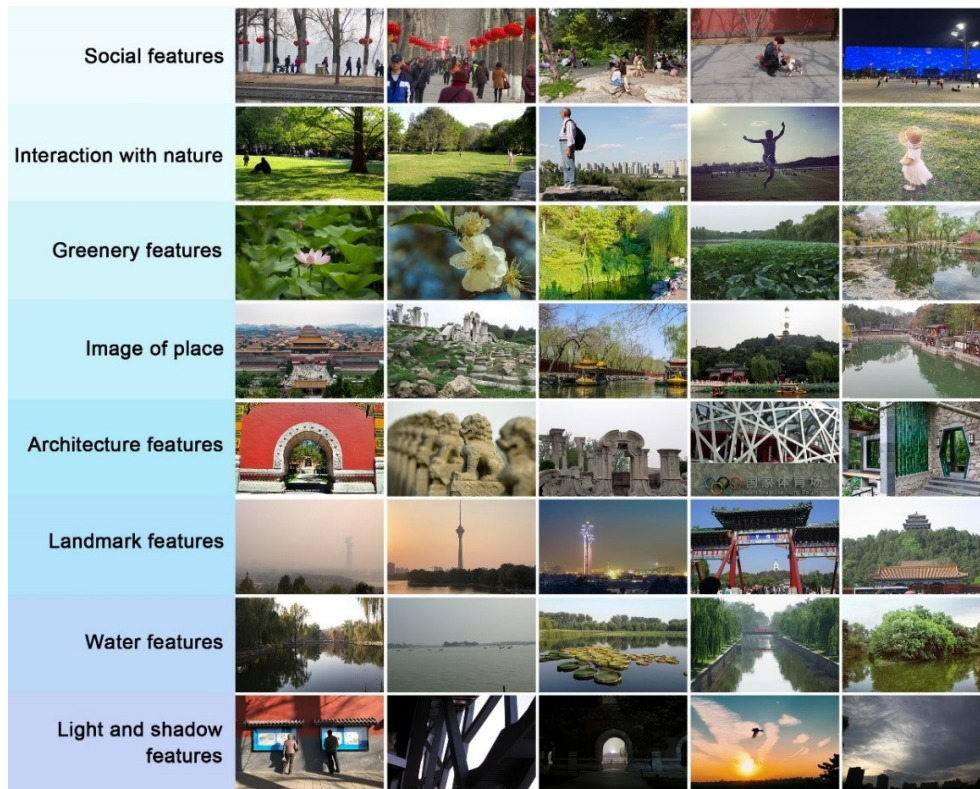


Figure 5.3 Samples of Flickr photos corresponding to identified themes of topics based on similarities of photo contents

5.3 Two visitor groups' photo-taking behaviour in urban parks

Section 3.3.1.4 has discussed the strategy of tourist classification according to self-reported home locations, hometowns and characteristics of spatial-temporal behaviours. For starters, all identified residents and tourists of ten selected urban parks were included in 5.3.1 to improve the quality of representativeness of data. A comparison between residents and tourists was presented via ratios with little impact on their absolute quantity. This subsection helps to understand revisit behaviour and the influence of seasonality on residents and tourists respectively. It is of significance for the following interpretative analysis of the contents of photos taken by residents and tourists. In terms of mapping two groups' trajectories (section 5.3.3) and content analysis of photos (section 5.3.4), the top 50 identified residents with the most photos, as discussed in 3.6.2, were selected in each of the selected six urban parks. To make two groups of visitors comparable in each park, the top 50 tourists with

the most photos were also selected. Therefore, a total number of 300 tourists and 293 residents were included to explore hotspot-trajectory patterns and landscape preferences reflected via online photos. In short, this section focuses on (1) statistical characteristics of two visitor groups' photo-taking behaviour from the perspective of revisit and seasonality by analysing all data harvested from ten urban parks; (2) hotspot-trajectory patterns of two groups' photo-taking behaviour in six sampled urban parks; (3) content analysis of online photos taken by residents and tourists in six sampled urban parks, respectively.

5.3.1 Statistical analysis of visit characteristics

A total of 8689 geo-tagged photos with affiliated information were retained via the filtering strategy used in 3.4.2 to avoid bias caused by extremely active users, and the photos were taken by 2059 unique users in study sites. In this, 217 residents with 1363 photos and 1839 tourists with 7326 photos are identified. As presented in Table 5.5, each resident takes around 6 photos on average, while every tourist takes around 4 photos on average, suggesting that residents tend to take much more photos than tourists with lower statistical variation ($0.59 < 0.60$), although the range of photos taken by residents is greater than that taken by tourists.

Table 5.6 shows a statistical description of photos taken by residents and tourists corresponding to each park. Tourists took significantly fewer photos than residents did in Public Parks, while there was no noticeable quantitative difference between Traditional Chinese Gardens regarding the average number of photos taken by residents and tourists. P10 (Chaoyang Park) had the least photos taken by unique residents on average and tourists took the smallest number of photos in P8 (Olympic Forest Park) on average. Among all Traditional Chinese Gardens, P5 (Jingshan Park) had the least number of photos taken by both residents and tourists on average, and these two groups, on average, took the most photos in P1 (The Summer Palace). As for Public

Parks, P9 (Purple Bamboo Park) had the most photos taken by residents on average. P7 (Olympic Park) ranked top one for the average number of photos taken by tourists, although the average number of photos taken in P9 was very close to P7.

Table 5.5 Statistical sum description of photos taken by two visit groups in ten urban parks, Beijing

Visit groups	Max	Min	Mean	Range	CV
Resident (n=217)	111	1	6.28	110	0.59
Tourist (n=1839)	78	1	3.98	77	0.60

Note: *Max* and *Min* denote the maximum photos and minimum photos taken by a visitor; *CV* denotes “Coefficient of Variation”; *Std* denotes “Standard Deviation”.

Table 5.6 Statistical description of photos taken by two visit groups in ten urban parks, Beijing

ID	Category	Park	Photo count of resident				Photo count of tourist			
			Max	Min	Mean	CV	Max	Min	Mean	CV
P1	Traditional Chinese Gardens	The Summer Palace	26	1	4.62	0.77	42	1	3.9	0.77
P2		Yuanmingyuan Park	14	1	3.08	0.99	31	1	4.42	0.68
P3		Yuyuantan Park	18	1	2.53	0.66	18	1	2.47	0.71
P4		Beihai Park	15	1	3.19	0.95	39	1	3.13	0.74
P5		Jingshan Park	15	1	2.31	0.84	13	1	1.84	1.17
P6	Public Parks	Yuan Dadu City Wall Ruins Park	47	1	4	0.47	15	1	1.83	0.8
P7		Olympic Park	24	1	2.82	0.9	32	1	2.63	0.77
P8		Olympic Forest Park	35	1	2.94	0.58	20	1	1.72	0.66
P9		Purple Bamboo Park	23	1	4.15	0.72	21	1	2.54	0.72
P10		Chaoyang Park	8	1	2.13	1.17	10	1	1.96	0.98

Note: *Max* and *Min* denote the maximum photos and minimum photos taken by an unique visitor; *CV* denotes Coefficient of Variation.

5.3.2 Statistical analysis of revisit behaviour

A statistical summary of two groups of visitors’ revisit behaviour is presented in Table 5.7. There are significant discrepancies between residents’ and tourists’ revisits in the ten urban parks. Residents had generally higher revisit ratios than tourists in Traditional Chinese Gardens and Public Parks. Exceptions are P3 (Yuyuantan Park) and P9 (Purple Bamboo Park), which has small differences between locals and tourists, while P5 (Jingshan Park) has pronounced variance between residents and tourists. Among all Traditional Chinese Gardens (from

P1 to P5), most residents revisited and took photos in P5 (Jingshan Park), and P1 (The Summer Palace) and P4 (Beihai Park) were among the top 3 highest revisit ratios, while P3 (Yuyuantan Park) has the least revisit ratio. Contrary to residents, the least ratio of tourists revisited P1 (The Summer Palace) and P5 (Jingshan Park), while P3 (Yuyuantan Park) was revisited the most among tourists. As for Public Parks (from P6 to P10), P7, P8 and P10 (denote Olympic Park, Olympic Forest Park and Chaoyang Park, respectively) have the top 3 highest revisit rates except for P9 (Purple Bamboo Park), which has the lowest revisit rate for residents, compared with overall ten urban parks. Therein, P7 (Olympic Park) had the highest revisit variation among residents, followed by P8 (Olympic Forest Park) and P10 (Chaoyang Park).

Table 5.7 Statistical summary of revisit behaviour between residents and tourists based on count of unique visitor in ten urban parks

ID	Park	Resident				Tourist			
		Revisit (N>1)		Sum of unique resident count	Mean (C.V.)	Revisit (N>1)		Sum of unique resident count	Mean (C.V.)
		Unique resident count	Ratio			Unique resident count	Ratio		
P1	The Summer Palace	18	0.34	53	1.89 (1.01)	53	0.07	721	1.08 (0.27)
P2	Yuanmingyuan Park	8	0.22	36	1.28 (0.44)	13	0.1	132	1.13 (0.38)
P3	Yuyuantan Park	7	0.19	36	1.42 (0.96)	9	0.15	62	1.6 (1.99)
P4	Beihai Park	16	0.34	47	1.77 (1.02)	25	0.09	294	1.14 (0.58)
P5	Jingshan Park	19	0.4	47	2.15 (1.28)	33	0.07	441	1.12 (0.58)
P6	Yuan Dadu City Wall Ruins Park	10	0.32	31	2.06 (0.92)	6	0.15	41	1.34 (0.8)
P7	Olympic Park	36	0.46	79	2.11 (0.91)	70	0.12	586	1.21 (0.64)
P8	Olympic Forest Park	20	0.42	48	2.56 (2.01)	10	0.11	89	1.2 (0.57)
P9	Purple Bamboo Park	2	0.15	13	1.38 (0.78)	6	0.12	50	1.22 (0.64)
P10	Chaoyang Park	23	0.43	53	2.13 (0.79)	12	0.15	80	1.42 (0.89)

Note: Revisit is defined as “visit a park more than once”; Ration denotes ratio of revisit user counts to the total number of users; Mean denotes the average number of users who revisited a park; C.V. denotes Coefficient of Variation.

5.3.3 Statistical analysis of visit seasonality

Table 5.8 shows the statistical characteristics of residents’ seasonal visiting behaviour in ten urban parks. P3 (Yuyuantan Park) has a pronounced

proportion of visit count in spring than those in other seasons, which is more than 60%. It also has the smallest proportion of visit count in winter than other urban parks, where only one user visited and took photos in winter. Similarly, P6 (Yuan Dadu City Wall Ruins Park) has a remarkably high proportion of visit count in spring (nearly half of the total visit count) than that in other seasons. P8 (Olympic Forest Park) has the highest ratio of visit count in autumn than other seasons of the same park and P2 (Yuanmingyuan Park). Winter is, unsurprisingly, the season when the least residents will visit an urban park in Beijing. However, the visit count of P1 (The Summer Palace), P7 (Olympic Park) and P5 (Jingshan Park) are much more evenly distributed in each season than that of other urban parks.

Table 5.9 illustrates the statistical characteristics of tourists' visiting behaviour in ten urban parks influenced by seasonality. P3 (Yuyuantan Park) has the highest proportion of visit count in spring, which is in accordance with that of residents. P6 (Yuan Dadu City Wall Ruins Park) has the highest proportion in summer than in other seasons, while P8 (Olympic Forest Park) has the highest proportion in autumn than in other seasons. Tourists have higher rates of visiting an urban park in winter, no matter what type it belongs to (i.e., Traditional Chinese Garden or Public Park). Except for P3 (Yuyuantan Park), tourists' visit to urban parks is more evenly distributed in each season than residents. For example, the visit count of P6 (Yuan Dadu City Wall Ruins Park) in winter was almost the same as its autumn visit count. In general, significantly more residents visited urban parks in spring and summer time than in autumn and winter. The ratio of visits in autumn was also significantly higher than the ratio of visits in winter (Table 5.10). As for tourists, there were no significant differences in the ratio of visit count in spring, summer and autumn, though the ratio of visit count in winter was still the lowest (Table 5.11). Accordingly, it can be concluded that tourists' visits to urban parks are more evenly distributed in each season than residents.

Table 5.8 Seasonal distribution of residents' visiting behaviour based on visit count in each of the ten urban parks, Beijing

ID	Parks	Spring (Mar., Apr., May)		Summer (Jun., Jul., Aug.)		Autumn (Sep., Oct., Dec.)		Winter (Nov., Jan., Feb.)		SUM	
		Count	Ratio	Count	Ratio	Count	Ratio	Count	Ratio	Count	Ratio
P1	The Summer Palace	22	0.22	29	0.29	29	0.29	20	0.2	100	1
P2	Yuanmingyuan Park	17	0.37	8	0.17	17	0.37	4	0.09	46	1
P3	Yuyuantan Park	33	0.65	8	0.16	9	0.18	1	0.02	51	1
P4	Beihai Park	30	0.36	26	0.31	22	0.27	5	0.06	83	1
P5	Jingshan Park	39	0.38	28	0.27	18	0.17	18	0.17	103	1
P6	Yuan Dadu City Wall Ruins Park	31	0.48	8	0.12	16	0.25	9	0.14	64	1
P7	Olympic Park	44	0.26	55	0.33	39	0.23	29	0.17	167	1
P8	Olympic Forest Park	34	0.28	33	0.27	39	0.32	17	0.14	123	1
P9	Purple Bamboo Park	6	0.33	7	0.39	1	0.06	4	0.22	18	1
P10	Chaoyang Park	44	0.39	31	0.27	26	0.23	12	0.11	113	1

Note: visit count is calculated according to timestamps affiliated with harvested photos. Those photos taken on the same day by a unique user are decided as one visit to a park.

Table 5.9 Seasonal distribution of tourists' visiting behaviour based on visit count in each of ten urban parks, Beijing

ID	Parks	Spring (Mar., Apr., May)		Summer (Jun., Jul., Aug.)		Autumn (Sep., Oct., Dec.)		Winter (Nov., Jan., Feb.)		SUM	
		Count	Ratio	Count	Ratio	Count	Ratio	Count	Ratio	Count	Ratio
P1	The Summer Palace	172	0.22	227	0.29	290	0.37	90	0.12	779	1
P2	Yuanmingyuan Park	42	0.28	47	0.32	39	0.26	21	0.14	149	1
P3	Yuyuantan Park	55	0.56	13	0.13	21	0.21	10	0.1	99	1
P4	Beihai Park	92	0.27	97	0.29	98	0.29	49	0.15	336	1
P5	Jingshan Park	138	0.28	134	0.27	154	0.31	70	0.14	496	1
P6	Yuan Dadu City Wall Ruins Park	11	0.2	19	0.35	12	0.22	13	0.24	55	1
P7	Olympic Park	198	0.28	207	0.29	216	0.31	87	0.12	708	1
P8	Olympic Forest Park	33	0.31	25	0.23	35	0.33	14	0.13	107	1
P9	Purple Bamboo Park	24	0.39	17	0.28	11	0.18	9	0.15	61	1
P10	Chaoyang Park	39	0.34	24	0.21	32	0.28	19	0.17	114	1

Note: visit count is calculated according to timestamps affiliated with harvested photos. Those photos taken on the same day by a unique user are decided as one visit to a park.

Table 5.10 Result of one-way ANOVA analysis for the ratio of resident visit count in each park grouped by each season

Explanatory variable	Spring	Summer	Autumn	Winter
Spring	1**			
Summer	0.114	1**		
Autumn	0.135*	0.021	1**	
Winter	0.240*	0.126*	0.105	1**

Dependent variable: ratio of visit count in each park

Notes: * $P < 0.05$ (2-tailed) in one-way ANOVA. ** $p < 0.01$ in one-way ANOVA.

Table 5.11 Result of one-way ANOVA analysis for ratio of tourist visit count in each park grouped by each season

Explanatory variable	Spring	Summer	Autumn	Winter
Spring	1**			
Summer	0.047	1**		
Autumn	0.037	-0.010	1**	
Winter	0.167*	0.120*	0.130*	1**

Dependent variable: ratio of visit count in each park

Notes: * $P < 0.05$ (2-tailed) in one-way ANOVA. ** $p < 0.01$ (2-tailed) in one-way ANOVA.

5.3.4 Comparison of hotspot-trajectory patterns between sampled residents and tourists

Table 5.12 presents residents' and tourists' hotspot-trajectory patterns (for complete maps, see Appendix F). Both residents' and tourists' patterns share several similarities though they may have different expectations and strategies for visiting a park. Firstly, spatial overlaps of detected hotspot areas occurred at advertised places, and representative trajectories shared similar patterns linking these overlapped places, such as P1 (The Summer Palace), P4 (Beihai Park) and P7 (Olympic Park), indicating a similar tour sequence for both residents and tourists. Secondly, the park entrance elicited photo-taking behaviour from both residents and tourists (see hotspot areas near the park entrance in P1, P4, P8, P7 and P10), while no cluster was identified near the entrance of P5 (Jingshan Park), where the pavilion for overlooking Beijing cityscape was the only one advertised attraction. Thirdly, sightseeing platforms attracted both residents and tourists to visit and take photos, such as sightseeing spots in P8 (Olympic Forest Park) and the pavilion on top of the hill in P5 (Jingshan Park).

It is worth noting that residents and tourists have different hotspot-trajectory patterns in sampled urban parks. Firstly, new clusters emerged in residents' hotspot-trajectory patterns, which were inconsistent with identified attractions. For example, three hotspot areas were detected along the causeways of

Kunming Lake in the western zone of P1 (The Summer Palace). A similar phenomenon happened in P7 (Olympic Park), where new clusters of residents emerged along the waterfront and the central parkway, except for those corresponding to a meeting venue and a museum, suggesting that photos were used to record events and experiences in residents' everyday life. Similarly, a hotspot area was formed by residents at a civic sports ground in P10 (Chaoyang Park). In contrast, tourists gathered at a Beach Volleyball Ground, which was not available to citizens and was built for the Beijing 2008 Olympic Games. Thus, the merged tourists cluster was likely related to a sports event, which was confirmed by carefully looking at the contents of photos harvested there. Accordingly, residents' daily activities in urban parks were reflected, if not all, by geo-tagged photos and tourists also recorded events through visual social media like residents did.

Secondly, residents' hotspot areas were consistent with advertised attractions, while tourists' hotspot areas emerged at other attractions that were not the most popular. P5 (Jingshan Park) was a pertinent case, where tourists' cluster was identified at Jifang Pavilion, the first pavilion halfway up to the Wanchun Pavilion (advertised attraction in P5). Tourists' geo-tagged photos also gathered at the entrance adjacent to Western Heaven Temple in P4 (Beihai Park), but residents' clusters only formed at advertised places and the roads (or bridges) leading to the place. Although P8 (Olympic Forest Park) had no advertised attractions, it still had a similar phenomenon, namely, residents' hotspot areas were only identified at two places – the main entrance with its surrounding area and Tian Jing sightseeing platform on the top of Yangshan Mountain. However, tourists' hotspot areas emerged in the eastern zone of the park and close to the main entrance, specifically, the photos were either positioned along the main parkway (or on a bridge), or close to the lake. It could be posited that residents were focused on the most symbolic and popular places in terms of all advertised attractions, while tourists inclined to record as much as attractions by cameras

when heading to the advertised one.

Lastly, representative trajectories depicted different visit strategies between residents and tourists beyond advertised attractions. More specifically, residents' representative trajectory emerged and linked new hotspot areas in the west zone of P1 (The Summer Palace), whereas tourists' representative trajectory was only in line with West Dyke and another one emerged at the southern end of a main parkway. This suggests tourists tend to head toward advertised attractions directly, while residents incline not only to choose the popular path along West Dyke, but also to go around the park along its boundary, if not all, and then walk to West Dyke via a causeway. Similarly, P5 (Jingshan Park) had distinct patterns of representative trajectories between residents and tourists: residents more likely took photos on the west and east foothills and then took photos at the top of the hill, suggesting that they more likely took the west and east routes up the hill, while tourists inclined to take photos at the entrance square and west foothill, then took photos in the top sightseeing pavilion, suggesting that tourists tended to take the central routes as well as the west one up the hill.


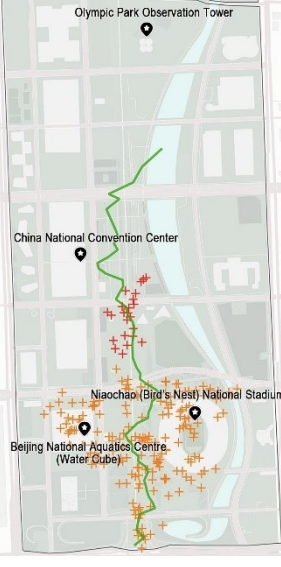
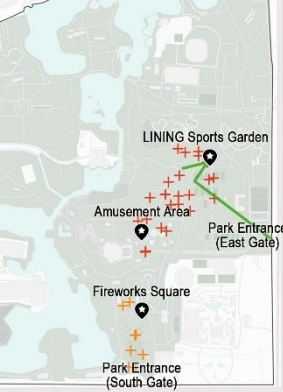

Moreover, Residents had a broader range of excursions reflected by photos' geographical information, such as the case in P1 (The Summer Palace), P7 (Olympic Park) and P8 (Olympic Forest Park), excluding the impact of events, for example, tourists' representative trajectory extended to Beach Volleyball Ground in the northern zone of P10 (Chaoyang Park), but residents' representative trajectory only linked the Sports Garden with the nearest park entrance. It is worth noting that those parks where residents had a broader range of representative trajectories were greater than 3 square kilometres (P1, P7 and P8), while the urban parks where there were no significant differences between residents and tourists regarding the range of representative trajectories, were less than 1 square kilometres (P4 and P5), indicating that

both two groups of visitors were able to explore the park with less time thoroughly.

Table 5.12 Comparison of Hotspot-trajectory patterns between residents and tourists

ID	Parks	Features	Residents' hotspot-trajectory pattern	Tourists' hotspot-trajectory pattern
P1	The Summer Palace	<ul style="list-style-type: none"> For residents, the distribution of hotspot areas was mainly in line with four advertised attractions, while Qingyan Stone Boat and West Dyke were not as popular as other attractions. Three clusters in the western zones were detected as unadvertised attractions that interested residents. For tourists, the distribution of hotspot areas and representative trajectories were almost consistent with advertised attractions. More representative trajectories of tourists were identified than that of residents, suggesting that tourists' trajectories had a greater consistency than residents'. Besides, a representative trajectory linked unadvertised attractions to residents' photo-taking behaviour. Tourists and residents were both regularly boating photographing or taking photos at the Seventeen Arches Bridge after visiting the Long Corridor. 		
P4	Beihai Park	<ul style="list-style-type: none"> For residents, the distribution of hotspot areas was in accordance with the advertised attraction – White Dagoba and the trajectory overlapped with the detected hotspot area from the park entrance (South Gate) to White Dagoba. They took photos on the bridges or waterfront that were heading toward White Dagoba. Tourists were not only interested in White Dagoba but also Western Heaven Temple. They also took photos on the bridges or waterfront that were heading toward White Dagoba. The representative trajectories of both residents and tourists were across the central lake, suggesting that visitors (1) regularly boating while photographing, (2) taking photos at the dock (located at north of the central lake and 		

		<p>near Western Heaven Temple) and the destination dock (on the island of White Dagoba).</p>		
P5	Jingshan Park	<ul style="list-style-type: none"> For residents, the only hotspot was in accordance with the advertised attraction – Wanchun Pavilion Tourists were not only interested in taking photos at the top of Prospect Hill, where advertised attraction was located, but also interested in photographing on the way (i.e., Jifang Pavilion) to the advertised location. Representative trajectories of both residents and tourists linked the foot of the hill to the top, while identified tourists' trajectory was longer than residents', suggesting a consistency of tourists' routes compared with that of residents. 		
P8	Olympic Forest Park	<ul style="list-style-type: none"> For residents, the top of Yangshan Mountain and Main Entrance of the park interested them most. They were inclined to head toward the mountaintop and take photos according to the representative trajectories, which almost linked the park entrance to the Tian Jing attraction. For tourists, the distribution of hotspot areas was in accordance with Main Entrance, top of Yangshan Mountain and eastern zone between central lake and main road of the park. Detected tourists' representative trajectory was mainly in north zone of the park, while residents' trajectories were sparsely distributed in the north and central zones of the park. 		

P7	Olympic Park	<ul style="list-style-type: none"> The distribution of residents' hotspot areas was not only spatially related to advertised attractions (Water Cube and Bird's Nest) but also other places of interest, i.e., China National Convention Center and China Science and Technology Museum, as well as the waterfront zone between these two buildings. Tourists were mainly interested in the advertised landmarks (i.e., Water Cube and Bird's Nest) and the green space adjacent to these attractions. Residents' representative trajectories ran north for a longer distance than tourists', and overlapped with the river after visiting the convention centre, while tourists headed to the waterfront after walking across the bridge north of the convention centre. 		
P10	Chaoyang Park	<ul style="list-style-type: none"> Residents' hotspot areas were in accordance with the park entrance (South Gate), Fireworks Square, Amusement Area (advertised attraction) and LINING Sports Garden. Tourists' hotspot areas contain a park entrance (South Gate), Amusement Area (advertised attraction) and Beach Volleyball Ground. Residents' trajectory directly linked East Gate with LINING Sports Garden, while tourists' trajectory headed from the south to Beach Volleyball Ground. 		

5.3.5 Content analysis of photographs taken by different visitor groups

A total of 2506 geo-tagged photos taken by 300 tourists and 930 geo-tagged photos taken by 292 residents were included for content analysis via computer-aided coding. Then LSI algorithm, as discussed in 5.2.2, was performed using sample data from selected six urban parks (the same dataset as 5.3.3). K value in this section was decided as 10 according to the scree plot of residents and tourists. Table 5.13 presents identified ten topics and their ten descriptive terms with the highest values calculated by LSI. By using NetworkX, Figure 5.4 illustrates similarities and differences of topics identified from photos taken by residents and tourists respectively.

As Figure 5.4 shows, only four distinct topics were identified. More specifically, the general image of Traditional Chinese Garden and leisure record, arch bridge and waterscape, and parkway landscape were detected in the tourist group, while the topic of happy emotion and sunlight in nature was detected in the resident group.

Both residents and tourists shared similarities in six major themes:

- Image of place
- Light and shadow features
- Greenery features/Interaction with nature
- Architecture features/Landmark features
- Water features
- Social features

While there were substantial similar topics shared by both tourists and residents, between which nuances of topics covered by the same major theme was uncovered. Firstly, both residents and tourists were interested in photographing close-up nature, yet residents were fond of picturing the moment when people interact with nature. Secondly, the image of street scene was identified as main topic in both the resident and tourist groups, while tourists regularly took pictures of general image of Traditional Chinese Garden. Then Traditional Chinese Architecture seemed a popular topic both for residents and tourists. Moreover, residents chose to shoot a holistic picture of the waterscape in Traditional Chinese Garden, while tourists were more interested in the image of arch bridge and waterscape in the Traditional Chinese Garden. Lastly, tourists had a particular interest in photographing parkway landscapes, conversely, no path-related images were significantly detected in resident groups.

Table 5.13 Top ten items best describing each topic and proposed topic labels

between residents and tourists in ten urban parks

Resident			Tourist		
Topics	Top ten terms	Identified topic	Topics	Top ten terms	Identified topic
1	plant; sky; tree; water; landscape; natural; cloud; lake; building; leisure	Waterscape and leisure record	1	sky; tree; water; plant; temple; architecture; leisure; building; Chinese; lake	General image of Traditional Chinese Garden and leisure record
2	plant; flower; petal; terrestrial; flowering; lotus; grass; botany; aquatic; twig	Close-ups of plant and flower	2	temple; architecture; Chinese; leisure; facade; travel; pagoda; building; landmark; roof	Travel record and traditional Chinese architecture
3	temple; architecture; leisure; building; Chinese; travel; sky; facade; tree; city	Traditional Chinese architecture	3	plant; grass; landscape; tree; road; natural; surface; wood; flower; terrestrial	Natural landscape, close-ups of plant and flower
4	water; lake; architecture; temple; resources; plant; Chinese; watercourse; lotus; bank	Waterscape of Traditional Chinese Gardens	4	building; city; sky; design; urban; light; tower; art; street; road	Landmark and art of architecture
5	vehicle; automotive; light; building; tire; wheel; sky; water; design; street	Street scene and night scene	5	architecture; building; facade; symmetry; wood; shades; tints; natural; landscape; art	Architectural details and contrast of light
6	vehicle; automotive; tire; wheel; architecture; temple; motor; natural; landscape; car	Vehicle in natural environment	6	plant; water; boat; vehicle; watercraft; art; lake; building; leisure; bridge	Waterscape and leisure record
7	tints; shades; architecture; rectangle; building; font; facade; landscape; symmetry; blue	Architectural details and contrast of light	7	wood; art; shades; tints; symmetry; leisure; road; pattern; font; surface	Architectural details and parkway
8	shades; tints; leisure; nature; people; rectangle; blue; art; happy; wood	People in nature, happy emotion and contrast of light	8	road; surface; tree; asphalt; vehicle; architecture; tints; shades; boat; watercraft	Parkway landscape
9	nature; cloud; atmosphere; sky; people; dusk; afterglow; sunset; happy; branch	Happy emotion and sunlight in nature	9	road; light; architecture; surface; water; city; street; asphalt; resources; leisure	Night scene and street scene
10	nature; building; people; tower; tree; branch; wood; leaf; botany; grass	Landmarks and people in nature	10	bridge; tree; watercourse; bank; arch; leisure; girder; water; building; city	Arch bridge and waterscape

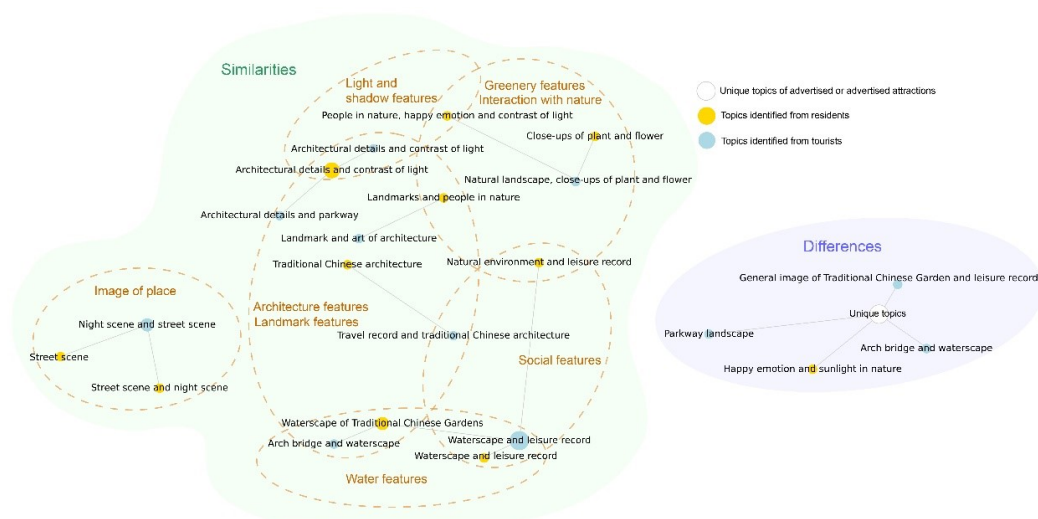


Figure 5.4 Visualization of identified unique topics from photos taken by residents and tourists

5.4 Conclusion

This chapter presents the findings of geo-tagged photos harvested from visual social media to investigate landscape preference revealed by spatio-temporal patterns of photo-taking behaviour and contents of photos at two levels: (1) selected ten cases responding to the hotspots of Beijing city as a whole (areas within the 5th Ring, see details in 3.4.2) and (2) selected six cases from the ten cases studied in the prior level. At the former level, the second research objective is explored. It first compares visitors' hotspot-trajectory patterns between advertised attractions and unadvertised attractions. Then it compares the contents of photos extracted from advertised attractions and unadvertised attractions. The latter level is to investigate the third research objective. Similarly, it compares patterns of hotspot-trajectory patterns and contents of photos extracted from resident group and tourist group. Finally, an understanding of how place popularity and social groups influence landscape preference was developed. Key findings emerge from the data mining in visual social media can be generally concluded that (1) place popularity has a strong connection with spatio-temporal patterns of picturing practice and diversity of photo topics in urban parks; (2) different social groups – residents and tourists – have showed similar preference for nature but have distinct visit strategies in urban parks.

Chapter 6 Landscape Preference Embedded in Everyday Living: Affordance, Social Media and Biophilia

6.1 Introduction

This chapter focuses on qualitative analysis of interview data by applying a thematic analysis approach (Braun & Clarke, 2006). Chapter 5 presents spatio-temporal patterns of visitors' photo-taking behaviour and finds impacts of place popularity and social groups on landscape preference reflected from topics of geo-tagged photos. Landscape preference is further explored in this chapter via interview and observation approach to explore the nuance of individuals' perceived quality of a place and how the landscape preference is constructed by everyday practice. Five open-ended questions are included in the interviews, namely:

- What do you like/dislike of this park?
- Why do you come to this park?
- Are there any other parks you like in this city, if there are, why do you like them?
- What kinds of activities you will have in parks and how often do you visit a park?
- Do you think social media influence your outdoor activities?

Section 6.2 starts by describing three types of environment-behaviour interactions within urban green space embedded in individuals' everyday living, namely interactions of the passer-by, sightseers and public open space seekers, who differ in terms of expectations, motivations and perceived affordance of urban green space. Section 6.3 then concentrates on the roles of social media in promoting outdoor activities in urban green spaces. Section 6.4 presents two

identified sub-themes in relation with perceived imagery of nature, which contains respondents' favourite features. Further, it showcases an understanding of landscape preference shaped by individuals' everyday lives, the prevalence of social media, and perceived biophilic images.

6.2 Affordance of urban green space

An affordance is the functional possibilities that the environment affords organisms in environmental psychology (Gibson, 2014). Visual perception is the centre to this person-environment reciprocity according to Gibson's description that perceiving affordance is a process of identifying structures and relations of things, which are carried by ambient lights. This notion implies that the physical properties of environment are meaningful to living of organisms once they perceive possible actions in the environment. It sheds light on substantial studies about landscape preference (Falk & Balling, 2010; Hadavi et al., 2015; Menatti & Casado da Rocha, 2016), including aesthetic preference (Grahn & Stigsdotter, 2010). However, social engagement and sociocultural factors are key aspects of people's daily life, and thus separating physical and socio-cultural aspects likely lead to a superficial understanding of human behaviour (Gibson, 2014; Heft, 1989, 2001).

Drawing on Gibson's affordance theory, three kinds of interactions with urban green space were revealed corresponding to different groups. Both environmental and socio-cultural contexts jointly influence the affordance of urban green space for individuals. Thus, with diverse routines of everyday living, urban green space affords different possibilities and values to its users. Accordingly, three groups are identified from interview data and on-site observation, namely passers-by, sightseers and public open space seekers.

6.2.1 Passer-by and lived experience

Some participants reported that urban green space had provided a distinct place for the passer-by to walk through or stop off. They integrate walking through green space as a part of everyday urban life, incorporating in their lived experience (Elliott & Wattanasuwan, 1998). These urban green spaces were characterised by their proximity to residential areas, destinations (e.g., shopping mall, schools and supermarkets) and is connected by several city sidewalks with a higher level of accessibility, such as site 2 and site 4. For this group, individuals' practical activity was ongoing but they could have a "half-time break" in the hustle of urban life. It was argued that the encounter of otherness functions as a sign of slow-paced resting time. Accordingly, urban green space (including neighbourhood parks and highly accessible destination parks) is perceived as a walk-able and rest-able place, which is the "other" scene different from urban scene. Collectively, participants stated a multitude of reasons that drove them to choose paths or benches in urban green spaces, suggesting the dynamic nature of affordance influenced by socio-cultural factors.

I came after dropping off the kids and there weren't many people this year. (...) I don't have anything to do now, so I take a stroll and walk home. It's very nice here, I like it very much and I often come here. (...) I'm just passing through, and the air is fresh in the morning [right now], although it doesn't get that hot in the afternoon. (DP 33 interviewed at site 2)

DP33 reported impressive fresh air in the morning and cool air temperatures in the afternoon when walking through the green space in the city. This reveals both environmental and social context for walking: on the one hand, commuting for taking children to school sets the routines and makes encounter of urban green space along the route a commonplace; on the other hand, fresh air and

sunshine are less tangible factors related to green space but are prominent motivators for park users (Irvine et al., 2013).

Another participant reported how destinations, daily needs and urban green space are incorporated into the everyday activities:

(...) When I came here in 2014, I wasn't familiar with this area, but I knew there was a supermarket and a square [situated in a neighbourhood park], so I came out to buy food and sat in the park and then went back. I usually stayed in this park for one to two hours, or longer if I knew someone, so I would talk with them.

(...) My children attended the primary school in proximity to this park, and every morning I would take them to school, and afterwards, I would come to the park and stroll for a couple of laps. (NP34 interviewed at site 4)

Visiting urban green space is not on the daily agenda of passers-by, but it serves as a flexible and comfortable activity that occupies the temporal and spatial interval between scheduled commitments. Similarly, urban green space was recognised as a place that was sit-able and rest-able in terms of waiting to pick up kids from school.

I came here to wait for my kid(s). (...) (NP24 interviewed at site 4)

At least there's a place to sit and rest while I wait for the kids and they're in their after-school classes. I do this once a week and it's just a happy place, I guess, it feels like a particularly peaceful atmosphere, it feels like a particularly laid-back place, it's just that although it's a bit noisy [there are a lot of people

practising their instruments], everyone doesn't disturb each other. (...) (NP33 interviewed at site 4)

Parents wait to pick up their children at the gate of school on a daily basis in China. There are too many parents so they have to line up in most cases due to a large number of students and limited education resources. The “waiting areas” in front of the school gate are often crowded and lack benches for rest. Thus, instead of waiting at the school gate, some parents choose the closest urban green space as a “waiting area”, where there are plenty of benches. Parents also chose the nearest green space as “waiting areas”. NP33 reported the kids went for a cram class on the weekend and there were fewer students and not so crowded than public schools. NP33 concentrated on the perceived happy and relaxed atmosphere created by diverse outdoor activities in the park. Even noise is not only acceptable but contributes to forming a pleasing aura. It is the lived experience of encountering social events and physical activities that count in the park. This type of encountering is situated in a natural context and, as Peters et al. (2010) point out, is a typical function of urban parks for social interaction. Yet, the study finds that meeting and chatting with friends, acquaintances or strangers is not the whole story with respect to encountering in China’s context. Gazing at diverse activities can positively impact the subjective well-being of the passer-by.

Urban green space was, for another passer-by, a transitional space from one working scenario to another, namely between shopping for necessities in groceries (or supermarket) and taking care of elderly dependents at the employer’s home. It is characterised by the state of everyday work.

I am a domestic helper; I usually have little time to come to the park because I have to take care of the elderly at home. I have just returned to Beijing from my hometown and I only get 20

days off a year, so I don't have any days off during the week. I only have the chance to come out when I'm shopping for groceries at the supermarket in proximity to this park, then I walk through this side of the park and stroll for a couple of laps and then go back to work. I do not have much time to stay in this park. (...) (NP32 interviewed at sit 4)

Recruiting domestic helpers is common to ease couple's burden in China's megacities, such as Beijing and Shanghai, due to high-paced city life, long working time and commuting time. Couples have to take care of their elderly parents and children after China's government officially ended its one-child policy in late 2015. Chinese couples were encouraged to have two children thereafter, and then up to three children were legally allowed for each family in 2021.

Lefebvrian notion of space (1991) provides a framework to understand how this transitional space is socially constructed via three aspects and based on Ateljevic's (2000) application: (1) representations of space – a perceived sign of “being outdoor”; (2) material space – the presence of green space and practical experience of being in it; and (3) spaces of representations – the imagined leisure place. These three aspects suggest that material foundation comes with symbolised outdoor space and the perceived meaning of space constructing domestic helper's transitional space. Domestic helper, as NP32 reported, was “in service” all day and had no guaranteed holiday except for 20-day annual leave. Walking in urban green space, for NP32, was more of “being outdoor” during the transient “off-duty” time, whereas no specific features of natural environment and quality of green space related to neighbourhood parks were mentioned throughout the interview. In this regard, the totality of neighbourhood parks is perceived as a place for leisure.

6.2.2 Sightseer and perceived restorativeness

Urban green space had become a sightseeing resource in some participants' outdoor practice. Most participants who were motivated by aesthetic appreciation expressed the connection between sightseeing behaviour and destination park, which is characterised by its larger area, better maintenance, more facilities, diverse recreational activities, rich biodiversity and landscape elements (Henderson, 2013; Ode & Miller, 2011). Besides, urban scenes were mentioned as contrast objects when participants talked about their favourite landscape and the distinctiveness of natural environment. Moreover, participants reported similar perceived restorativeness implicitly or explicitly when gazing at greenery. First, participants reported an association between destination parks and the provision of immersive experiences in natural environment.

(...) although the larger park, such as Olympic Forest Park and Chaoyang Park, is farther away from my apartment, it can fulfil my aesthetic needs because it is very big and placed a lake, diverse trees, flowers and mountains, which give me a sense of immersion, I mean, there is greenery as far as you can see, unlike neighbourhood parks, which are smaller and you cannot avoid seeing tall buildings that I am familiar with [in city]. And this [seeing tall buildings] makes me feel tired. But I am completely surrounded by the natural environment like Olympic Forest Park or Chaoyang Park, so there is a sense of immersion.
(...) (NP14 interviewed at site 3)

A larger area of green space in city, especially the destination park, as NP14 pointed out, was not only recognised as a place that afforded a break for individuals from everyday routine and functioned better than small green space, such as a neighbourhood park. Another participant stressed the importance of

seeking a unique scene that is different from the typical green space found in city. The desire to explore an alluring park was also mentioned as a driving motivator.

I come here more often after the COVID-19 epidemic because there is no other place to go, and the air is better and I feel safer here. The landscape I like is taller trees, a secluded, serene and a bit of sublime landscape, I mean, the type of landscape elicits exploratory activity or vegetation that is completely different from the urban scene, where willows are prevalent along the road. There are a lot of tall trees [in Olympic Forest Park] and I feel relaxed. (DP13 interviewed at site 1)

This suggests that for some participants, sightseeing was not just about enjoying the aesthetic quality of natural environment, but more of a process of seeking the constructed scenes before actually seeing them. Participants were inclined to visit the green space that afforded exploratory practice, indicating that the quality of green space had a significant influence on sightseers' choices. This consideration was clearly shown in respondents' detailed descriptions of favourite parts of the park.

(...) Let's see these flowers [Sunflower], a single one is nothing special, but a group of flowers makes the scene different. (...) I also like another garden [Big Tree Garden] where there is a lake with a wooden pavilion on it, next to a lotus pond, and when the fog rises in the early morning, there is a large bamboo forest with winding paths, that scene is particularly poetic. In winter, when the lake is all frozen, you can go up and walk, or you can walk up to the big lawn, which feels completely different from watching the water. I think trees are most beautiful in spring

here, because the appearance is very similar to winter, like the branches, but there seems an inner power, is about to burst into life. (DP8 interviewed at site 1)



Figure 6.1 Sightseeing (left) and picturing practice (right) in an urban park in Beijing
Note: photos were taken in Olympic Forest Park
Source: by author

No single natural element is superior to others when participants talked about their preferences. Rather, a combination of diverse natural settings was repeatedly mentioned. Some participants expressed actual features in a detailed manner, for example, the central lake and its natural surroundings in Olympic Forest Park (DP17), while others emphasized the perceived image of the sight, such as “poetic place” (DP8) and mysterious landscape invoking exploration (DP13). Apart from visual features, a participant mentioned the smell of plants contributing to perceived restorativeness in a destination park.

(...) I think that there is water and greenery, which is very good. This garden is very big. There are places I haven't visit in this park [Olympic Forest Park]. You see, there is a fountain and a big lake in the southern zone, in front of which there is a big lawn, and I am particularly relaxed being there. It was impressed by the smell of grass was particularly fresh after mowing the lawn, I was happy and comfortable both physically

and mentally in that scenario. (...) (DP17 interviewed at site 1)

One participant mentioned that childhood experience trigger aesthetic awareness of the scenery in front of her, suggesting that perceived aesthetic sight did not simply result from the feeling of nature connectedness or an innate preference for natural elements from an evolutionary perspective, but could be constructed by acquired memory.

I like the field of reeds, I like this landscape in all seasons, especially in winter, when the reeds turn golden and harvested in patches, which reminds me of my childhood, the landscape of the fields and river running through my hometown. There are also plank roads and paths that curve through the trees, which I like the most! And when I climb that hill and look down, the sight is also very enchanting. I often come to this park [Olympic Forest Park], I feel particularly relaxed and the air is so fresh here. I usually finish cleaning, finish my work, then come here at about 7 or 8 o'clock in the evening almost every day. (...) I feel that life gets better with a park. (DP14 interviewed in site 1)

Together, participants motivated by sightseeing to visit urban green spaces reported positive effects of being connected to nature, such as stress reduction and mood improvement. As Seresinhe et al. (2019) pointed out, a more scenic environment elicits a better mood. Whilst participants described personal landscape preference for sightseeing, it suggests that the presence of natural elements does not warrant well-being benefits derived from sightseeing practice. This was also noted by participants that poor maintenance and uncivil behaviours impeded the experience. They also noted different expectations for destination parks and neighbourhood parks. Seeking scenic green was related to visiting destination parks. In contrast, the neighbourhood park was more of

a public space for social practice and outdoor activities of daily life. This consideration is discussed in 6.2.3.

6.2.3 Public open space seeker and “publicness” of urban green space

Urban green space has been integrated into all participants' everyday lives. But for some of them, it is the public nature of urban green space that counts. They were motivated to find a public open space with multiple possibilities for actions that are meaningful and important to individuals. First, parks were important for those seeking social encounters: a participant reported how a destination park functioned as a quiet place to practice the accordion without disturbing others in neighbourhood parks. It was emphasized that the scenic view, fresh air and quiet atmosphere enabled her to settle down and learn something. More importantly, it was a public open space where active social contacts would occur. As DP22 described, it provided a context for meeting others who also practice instruments and evoking spontaneous chatting with them.

(...) The neighbourhood park is too noisy for me to practice accordion here alone, but I need a peaceful and quiet place, and it's quiet here. And it's also a place for communication (...) it's a 20-minute walk to get here from my residence, so I'd like to come here. It's a place where I can meet other people who play instruments and have a chat, so It's a place for me to learn and exchange ideas. (...) (DP22 interviewed at site 2)

This suggests the type of contested practice in urban green space in the process of seeking public open space. Neighbourhood parks had to cater for highly mixed function requirements, such as the need for connecting with nature, children's daily activities, the elderly's daily outdoor activities, traffic and parking car. Ephemeral self-organised outdoor activities were observed at fixed spots in neighbourhood parks: Tai Chi, dance, callisthenics and aerobic exercise at

the central square (see Figure 6.2). A participant (NP20) mentioned that *“although these clubs have regulars, everyone is free to join as long as you arrive at the fixed spots at their gathering time”*. It was worth noting that middle-aged and old-aged residents also engaged in playful games such as Mah-jong, Poker or Chess within a neighbourhood park backdrop by utilising benches, pavilions, and fitness equipment (see Figure 6.2). When bystanders gathered and there were no sit-able places, residents sometimes fetched folding stools and joined the games. Neighbourhood park was important for children. Participants mentioned diverse activities for children, such as bike riding, exploratory activities and being with friends. However, they generally played within an enclosed square for safety concerns.



Figure 6.2 Everyday leisure – residents were playing Poker (left) and dancing (right) in a neighbourhood park in Beijing
Source: by author

For some of our participants, it was not easy to find a suitable place for dance rehearsal in a neighbourhood park. On the one hand, the routinized activities and regular participants appropriated the same position, leaving a fragmented space to choose from. On the other hand, they were concerned that music would disturb others due to the proximity of the residence. Then they found another appropriate public open space within a destination park temporarily occupied for rehearsal:

(...) This area is closer to our residence and another group of people had a rehearsal for a chorus competition here previously. (...) we do not practise in the neighbourhood park because it will disturb others. We all come up here to practise. We are rehearsing for a CCTV dance event. (...) (DP21 interviewed at site 2)

(...) We will participate in a competition on the 24th of this month, so we need to practice [instruments] at this time. After the competition, we won't be here next week. The air is especially fresh here. It's not disturbing, there are many elderly people and children in the neighbourhood park, so we can't practise. (DP23, interviewed at site 2)

However, another group of residents had regular public performances – choral singing, dancing and instrument playing in the same destination park. Some of the regular members were retired instrumentalists, singers and dancers. There were no rigid rules or policies for joining the group and attending the activities. Thus, more and more residents participated in their group. They had a leader responsible for organizing regular activities and events. Apart from the regular public performance, as one of the performers mentioned, group leaders had planned an excursion and dinner for group members, which was also at their free will to attend.

(...) We live in the neighbourhood and come here to perform choral singing and dancing every weekend. There are many programmes [held in this park], from 9 am to 11 am (...) we have a leader (...) We are all retired and have much leisure time, so we joined this performance club. (...) (DP 32 interviewed at site 2)



Figure 6.3 Public performance in urban parks of Beijing
Note: photos were taken in Yuan Dadu Ruins Wall Park
Source: by author

Other participants regarded urban green space as “a place to go” – an outdoor place which is accessible to the public. Its public nature, was meaningful for individuals to escape from the workplace and the burdens of housework at home for a while. Seeking public open space was, as DP18 noted, motivated by the desire of being in “other” open space with quality natural elements in contrast with city streets, where it was nearly unbearable for residents to, for example, be exposed to smelly automobile exhaust.

(...) I think park greenery is very important because we need a place to go. If there are no neighbourhood parks and other green spaces, people have to go to the street and in exposure to automobile exhaust. (...) (NP3 interviewed at site 3)

(...) I need a place to go, otherwise, if I only commute between my residence and workplace on a daily basis, it would be so frustrating. (...) (DP18 interviewed at site 2)

To summarize, the overarching aim of some participants was to find a public open space for collective activities or a pleasing outdoor place differentiated from the workplace or home. Crucially, urban green space characterised by its

natural elements is defined by individuals who use it. In this sense, urban green space is endowed with publicity via residents' unplanned and creative use of it. Interestingly, those participants who expressed their pursuit of public open space were aged 40 to 60, which aligns with other studies (Qian & Lu, 2019; Richaud, 2018; Xie et al., 2021). As Richaud (2018) argued: "Parks have become meaningful sites in the everyday experience of middle-aged and older residents. They lie at the nexus of 'place-making processes' ...".

6.3 Social media as a catalyst for outdoor activity

Social media have received considerable attention because of their potential for users to share visual and textual information. As Molz (2012) notes, individuals' social life is inevitably wrapped up in information and communication technologies, such as the Internet, mobile phones and social media. Diverse online communities are formed based either on some offline relationships, such as relatives, schoolmates and colleagues or on some shared interests or common attributes beyond the confines of geographical location. In light of the substantial interaction among users via social media platforms, participants reported that social media not only functioned as an information source and also evoked offline activities. In this sense, it is argued that social media is a catalyst for individuals' outdoor activities for those who actively use it.

6.3.1 Information source: arranging the outdoor activities

It was repeatedly mentioned that social media platforms served as an activity-related information source, but participants also considered the missions of different platforms, which reflexively influenced social media use. For example, WeChat is a multipurpose application that fulfils users' need for social interaction, such as messaging, sharing content (i.e., photos/videos) with other users/within selected groups via the *moments* function, giving comments and

“likes” to posts, free video and voice call (Montag et al., 2018). Therefore, for some participants, it was convenient to use the “all-in-one” social media platform in their everyday lives regarding relationship maintenance and information acquirement. They could easily establish *groups* by including the “right” kind of individuals based on shared interests. There was another type of social media platform noted by participants – Dazhongdianping (review by the public, hereafter Dianping) – a business review platform where consumers could rank the destinations and share travel experiences. It has similar functionalities to TripAdvisor, such as ranking and recommendation systems.

Most participants mentioned a self-built online community (the function of *groups*) via WeChat, whereby they acquired information from community members about where to play and to take scenic photos. However, the community might not be for sharing outdoor activities but for communication among parents, for example.

(...) [For example] I would go to that park because someone posted a photo I liked on WeChat. We had a parents' WeChat group. When the parents posted where to play and send pictures, then we would go if we liked. (NP2 interviewed at site 3)

One participant had more than one app to search for customer-generated content of specific parks. The quality of natural environment, recreation facilities, activities or events will be checked by browsing previous reviews posted by those who have already visited the park to arrange personal visits. This suggests a mediating role of social media platforms in outdoor activities planning, thus constructing expectations, forming a prior image and giving meaning through both visual and textual representations. Moreover, participants noted that *WeChat-Public-Account* functioned as an information

resource. Users acquired specific information, such as events and activities information, when they followed public accounts (e.g., the official account of Beijing Municipal Management Centre of Parks). Participants also used WeChat as a booking website when the park restricted the number of visitors due to the COVID-19 pandemic.

(...) I always use apps on my mobile phone, for example, the Dianping, because it presents reviews about the park, including what recreational facilities are available, the overall environment and what activities it affords. So, when I go to a park I don't know about, I will first open a website like Dianping and check out the environment, how is it, are there any entertainment facilities that are worth playing. I can say that 99% of the time this is the way works for me. (...) (NP14 interviewed at site 3)

(...) I usually use the WeChat official accounts or booking app to get information about arranging the visit, because reservation is required to visit large parks [destination parks] during and after the epidemic. (DP24 interviewed at site 4)

Most participants emphasized the credibility of photos posted by users in terms of the authenticity of the visual representations because images were more reliable about what can be seen. In contrast, personal ranking criteria were subjective. Moreover, comments presented users' feelings about the visit, which were also helpful for reference.

(...) Actually, I am most concerned about the photos and the reviews, because I don't have any idea about the rating criteria

and they are not very credible, I mean because you don't know how the ratings are made, who makes them and for what reasons. But when I look at the reviews and the photos, I know that the reviewer has been to the park, a reviewer has taken these photos, how the park looks like, and personal feelings about the park, whether it is good or bad, I think the photos are more reliable, (...) if there are a lot of very good photos, I will regard the park as a very attracting one. (...) (NP14 interviewed at site 3)

I often use the Dianping app when I want to visit a park that I haven't been to. I'll look at the cover photos, reviews and popularity. But if I have a targeted destination, I'd go for other people's reviews, more detailed reviews. Photos, in this case, of course, are more important than textual information, I think. (...) (NP13 interviewed at site 3)

Yet, other participants would not concentrate on reviews or other information presented on social media if they were familiar with the park. Social media was still the primary source of acquiring information, such as changes in a park, events and activities, which had a strong connection with participants' revisit behaviour.

(...) Basically, if I know the park, I don't search for it on social media or online comments. But if the park is doing something new, I will still check on social media to see what people think about the new facilities, let's say, events, and activities and if they are interesting. If people are talking about it online or it is a trending topic, I might revisit the park because of those comments. (...) (NP14 interviewed at site 3)

One participant reported a passive way of getting information about parks and leisure activities, in which word-of-mouth communication worked. Social media was more of a communication tool, whereby her friends filter and pass on messages about where to go. Similarly, she noted that a new park elicited her visit motivation, suggesting the park affords users' exploration and curiosity and thus facilitates the willingness to visit.

(...) I think it was probably just friends who would tell me about it. Some of them would post in WeChat groups about what flower exhibition was going on and then I might want to go and see it. But I didn't follow any official WeChat account, I was more passive in getting information. If the park was a new one, I would desire to visit it, but of course, I have to consider whether I had time or whether it was convenient on that day. (NP11 interviewed at site 3)

Users had different strategies for acquiring information from social media to arrange outdoor activities. This showed that users did not simply rely on content posted by official accounts, but valued electronic "word-of-mouth" from diverse social media platforms. Among different types of user-generated content, photos of the park were first considered, Comments would be checked thereafter if audiences wanted to know more about others' feelings and attitudes toward the park. Personal ratings of a park conveyed a vague message about users' judgement from the viewpoint of audiences, while the popularity generated by the ranking algorithm on the platform was taken into account by users.

6.3.2 Online-to-offline interaction

The majority of participants emphasized the importance of photos posted on social media in relation to visit motivation of urban green space. As discussed

in 6.3.1, online information, including images and comments, can influence participants' plans for outdoor activities. This suggests that online interactions reflexively influence offline activities, apart from the influence of actual experience on how users' online representations are formed. On the one hand, representations, especially visual representations of lived experience, have profoundly constructed participants' expectations of a park and its perceived affordance. On the other hand, participants continually engage in producing representations or signs of the landscape in visual culture through, as Urry and Larsen (2011) highlight, "gaze upon" and photograph the actual scenes when they visit the park. These considerations are shown by some participants' responses:

On a scale of one to ten, I will probably give a seven or eight in terms of how photos posted by others influence my willingness to visit a local park. (DP1 interviewed at site 1)

(...) I came here once in April this year and now I am revisiting it. I especially like this park [Olympic Forest Park]. I am going to take some photos of this park and send them to my family. (DP2 interviewed at site 1)

(...) My sister-in-law and her family, the elders would often post photos about the parks they went to in WeChat *moment*, and that was a source of information for me to consider which park to go to. I would also take photos and share them on social media when I visit a park. (DP20 interviewed at site 2)

Online interactions might occur among users in a passive manner, namely gaining information or looking at posted photos without direct exchange with others. Yet, some participants actively seek information about the park they are

interested in by communicating with others and gaining feedback on their visit.

(...) The park is promoted by a WeChat post, they say, "Go to the country park this weekend," and then it recommends some country parks, and that has an impact on my outdoor activity plan. (NP9 interviewed at site 3)

(...) I would go to that park just because of the photos on social media, I mean, when I saw the fascinating photos posted by my friends on WeChat *moment* or by WeChat official accounts. (NP27 interviewed at site 4)

(...) [Social media] It is not just about reading public reviews, but if I have a friend who has posted a particularly good photo of the park via WeChat *moment*, I could ask where you took the photo. In fact, if I get feedback of a park, I am more likely to go to that place. (NP15 interviewed at site 3)

It was recognised that scenic photos would not guarantee a satisfying offline visit due to concerns about overcrowded destinations and other conditions, such as uncomfortable temperatures. Participants also reflected on the aestheticization of online photos.

(...) I decide whether to go to a park by gathering as much information as I can from the Internet, so I will not just go to a "trending attraction" because of a nice photo posted by others. (DP10 interviewed at site 1)

(...) I will look at the photos that others post on social media, but I am especially concerned about too many people, so I will

also take it into consideration. (DP11 interviewed at site 1)

(...) the last time I went to a country park, because it was recommended by an official WeChat account, and then I went but it was an extremely hot day, I never wanted to pay another visit. If someone posts some great photos of a park, I will desire to go there, for example, I've always wanted to go to a place that is more than an hour away from my home by car, designed by a famous design company (...) (NP 9 interviewed at site 3)

Online interaction was not merely information-oriented, it was for communication with like-minded friends in an online community for some participants. In this sense, online interaction was incorporated into their routines of offline activities, such as square dancing, singing and playing instruments in parks. Collective performances in public spaces, such as “square dance” in parks, are regarded as typical physical activities to improve subjective and physical health in China (Xie et al., 2021). From the very beginning, in “square dance”, for example, people spontaneously stand in line and dance for fun in a public space with a music background. With more and more people participating in the square-dancing activity, as it is easy to join and learn, square-dancing groups were formed to fulfil participants’ social needs. In this regard, group members formulate a community, which usually has a designated leader responsible for organising activities on a regular basis. Social media is naturally the best platform for interactions and activity organization within the community. As DP 28 and DP 32 mentioned:

(...) We have a WeChat group. My home is in proximity to this park. It only takes less than ten minutes for all eight of us in the WeChat group to come and practice dancing together. (...) (DP 28 interviewed at site 2)

(...) There are many programs [held in this park], from 9 a.m to 11 a.m. Everyone has a distinct programme, we have a leader and a WeChat group for connection. We are all retired and have leisure time, so we join this performance club. We come here to perform every Saturday and Sunday. (...) (DP 32 interviewed at site 2)

Overall, the findings reveal evidence that social media catalyses easy and quick information acquisition, social connection, offline activity arrangement, and offline social gathering centred on a common interest. Social networking sites and visual media technologies motivate users to engage in outdoor activities, such as walking, sightseeing, and “square dancing” in parks. However, it is worth noting that social media can evoke both negative and positive experiences of outdoor activities. Participants are more likely motivated by Internet-mediated outdoor experience, while they may encounter overcrowding problems or unexpected factors in actual visit, such as high temperature and the place is not as scenic as the photo presents.

6.4 Biophilic mental image

Given the burgeoning study of the relationship between nature-based experience and well-being, the biophilia hypothesis is a key one from an evolutionary perspective. According to Kellert and Wilson (1993), humans have largely relied on natural resources for survival and finding “liveable” habitats. Thus, there is an innate tendency to emotionally connect with nature and a preference for being close to the natural environment. In terms of exploring an individual’s nature experience, as discussed in 6.2, participants reported a positive impact on subjective well-being when being in urban green space. However, the preference for certain types of landscape, or aesthetic criteria, is

to be uncovered.

Participants had to recall experiences related to park visit when they were asked if there are any other parks that they like in Beijing and the reason why they like them. It means that the most impressive mental images embedded in the perception of certain urban parks will be described. Apart from the innate appreciation of the natural environment, perception of the place is constructed by interrelated factors, including individuals' symbolic experience, memory and sensory (Gregory, 1994). Schwartz and Ryan (2003) emphasize the appreciation of meanings of space created by others, indicating that an individual's choice of views to be presented can be constructed and modified via lived experience and enculturation (Falk & Balling, 2010). Accordingly, participants' verbal descriptions of their ideal mental image were analysed based on what was mentioned and what was not. As such, two subthemes were identified regarding the third main theme of biophilic mental image: (1) detailed and clear descriptions of a biophilic mental image – the “close-up nature”; and (2) element-based descriptions of biophilic mental image – the blurry scene.

6.4.1 The “close-up nature”

Some participants mentioned the ideal mental image of natural environment by focusing on the most symbolic/impressive elements derived from their previous experience in urban green space, obscuring environmental surroundings of the targeted elements, namely a “close-up” presentation of nature. While participants mentioned the multitude of elements, in which two motifs were repeatedly noted: flowers and trees, while fewer participants mentioned water features independent of other natural elements.

In terms of flowers, participants perceived the most valuable scene to see in different urban parks. Seasonal flowers were recognised as “markers” contributing to different urban parks' distinctiveness. The flower markers

included peonies, lotus, cherry blossoms and begonias, which required careful maintenance in Beijing and thus are not common in urban scenes. The seasonal flowers were utilized to promote urban parks by park managers. For example, Cherry Blossom Fair is annually held in accordance with the florescence in Yuyuantan Park and was advertised on multiple social media platforms. Themed souvenirs are made to keep up with the latest trend and needs, such as cherry blossom-shaped ice cream and cherry blossom biscuits, which facilitate the flower marker being represented in different forms, promoting destination image and attracting more tourists. In this regard, flower-viewing tourism is increasingly regarded as an engine for the growth of the mass tourism industry in China (Lu et al., 2022). Interestingly, most participants did not mention buildings or any architectural features.

(...) I go to Jingshan to see peonies, to Beihai Park to see lotus flowers, and to Yuyuantan Park to see cherry blossoms. (...)
(NP6 interviewed at site 3)

(...) I usually go to Jingshan Park, and the cherry blossoms in Yuyuantan Park are also very good, I would recommend you have a look. (...) (NP7 interviewed at site 3)

(...) When the begonias are in bloom in April, I came several times a day or stayed here for a whole day. Besides the begonias here, I also love to go to Beihai Park to see lotus flowers and peonies. (...) (DP12 interviewed at site 2)

A participant desired to see more seasonal flowers in a neighbourhood park, where foliage plants were dominant biomes.

(...) I think we should add some seasonal flowers to the park,

not too many, like peonies, tulips and so on. By the way, I really like “velvet flowers” [flower of acacia], and it would be nice to have some. (NP27 interviewed at site 3)

Trees were mentioned with respect to their features, such as seasonality. Additionally, leisure activities and photography practices afforded and evoked by trees were also highlighted in forming an ideal image of trees.

(...) The cherry blossoms at Yuyuantan Park and the ginkgo forest in Olympic Forest Park are also impressive. (...) (NP9 interviewed at site 3)

(...) There are two rows of big ginkgo trees next to the Diaoyutai State Guesthouse, and I always go there with my friends to take photos. (...) (NP29 interviewed at site 3)

(...) I especially like tall trees, I can imagine in the woods, there are suspension bridges, tree houses, and more facilities for outdoor activities (...) (DP16 interviewed at site 1)

Another participant mentioned water features as the most attractive characteristic of an urban park because it was not a common scene in cities.

(...) I think parks with lakes are particularly attractive to me, for example, Chaoyang Park has a lake and some rivers for boating, which is more attractive to me. Because lakes like this are something you don't see much in everyday life, especially in a city like Beijing. (...) If this park had a lake, I would just think it was better than other parks. (...) (NP 14 interviewed at site 3)

She then reported her favourite water feature in urban parks by comparing the waterfront between the lake in Chaoyang Park and that in Beihai Park. It was noted that whether the waterfront was sit-able and afforded proximity to water influenced her preference for the water feature.

(...) Beihai Park is good because I am attracted to places that have a lake. But I don't think the lake is that attractive to me, unlike the lakefront in Chaoyang Park, which is next to the grass, so I can sit there. [In Beihai Park] I can not get closer to the water, but I like to see it and it's nice to look at it, but I like the type of lakefront in Chaoyang Park better. (...) (NP 14 interviewed at site 3)

Another participant described water features in certain weather conditions. It was emphasized that the sound of raindrops and the misty lake on a rainy day engendered aesthetic feelings toward water features of an urban park.

(...) I've been to Yuan Dadu City Wall Ruins Park, Madianqiao Park, Jingshan Park and Tiananmen Square. My favourite is still the Summer Palace because of the big lake [Kunming Lake], especially when it rains, [I remember] the rhythm of falling rain and the lake is particularly beautiful in the rain (...) (DP39 interviewed at site 1)

Other participants reported concerns about bugs and mosquitoes that often come with water features in urban parks:

(...) it would be fine if there was some water, and it would be good if it was the kind of meandering one, but there are too many bugs. (...) (NP11 interviewed at site 1)

(...) If there is a lake, there will be a lot of mosquitoes, I think,
I'm worried about that. (...) (NP27 interviewed at site 4)

In short, while it is nearly impossible for participants to separate natural elements and elucidate which one elicited the most positive affective response in the actual experience of nature, some of their responses showed a general level of consensus on the preference for certain natural elements – flowers, trees, and water– which were used as markers for different urban parks.

Moreover, individuals' landscape preference, as Falk and Balling (2010) point out, is “best understood as a continuous progression of aesthetic ideals, tempered by social convention, passed on from one generation to the next through human culture”. Similarly, sight-viewing practice was also continuously promoted by using markers and cumulating collective memory for a specific urban park.

6.4.2 Three natural scenes

The subtheme was generated by examining the co-occurrence of natural elements when asked the participants about their favourite urban parks in Beijing and explained why. Instead of expressing personal landscape preference as specific natural elements in urban parks, some participants presented a holistic description of an ideal urban park image, including vegetation, water, architecture, hill, and recreation facilities. Accordingly, three natural scenes were identified based on the co-occurrence of natural elements and context of participants' descriptions.

Hill and water (*Shan-shui*) landscape

Hill and water were repeatedly mentioned for an ideal urban park, corresponding to traditional Chinese perspectives on nature (Yang & Hu, 2016),

as most participants described the Traditional Chinese Gardens they visited. Hill and water (*Shan-shui landscape*) are symbolic elements in Traditional Chinese Gardens and embody Chinese subliminal understanding of nature (Han, 2006; Keswick et al., 2003). The appreciation of *Shan-shui landscape* is culturally constructed into an aesthetic judgment about the authenticity of nature. Thus, hill and water elements were more likely to form an imagination of “real” nature, in which the scene was radically different from urban scenes.

(...) The scenery with hills and water attracts me, for example, the Summer Palace. (...) (DP18 interviewed at site 3)

(...) I used to take the bus to Beihai Park and Jingshan Park, where there are hills and water, so the scenery is especially good. (...) (NP5 interviewed at site 3)

Most participants’ stories showed that they had to take a bus and spend around 30 to 60 minutes to get to the park with hills and water, which were destination parks and had good maintenance. On the one hand, participants could not visit these parks daily, so they likely had a surprisingness or feelings that were different from that of seeing green space on the sidewalk or in neighbourhood parks. On the other hand, the Chinese culture of “real” nature, along with the boredom of the urban scene, contributes to making the hill and water elements function as visual stimuli that contrast with the mundane. These considerations were clearly expressed by NP8:

(...) This year I went to Beihai Park, I felt especially good, a brand-new happy feeling, because it was especially clean, looking at the White Tower, the lake and the hill. (...) maybe it was because I had not been there for a long time, I felt especially different at that time compared with the prior

experience. (NP8 interviewed at site 3)

Those who did not mention their experience in Traditional Chinese Gardens also expressed the imagination of having hills and water in an urban park:

(...) I think the most important thing for a park is to have water and hills. Although this park doesn't have water, there is a small hill and a "trail for health", which is good. (...) (NP18 interviewed at site 3)

(...) A park should have hill and water and I think this park needs some hills. (...) (DP24 interviewed at site 2)

(...) I actually have no requirement for scenic landscape, a bit of water is good, but it is best if there are hills and water. (NP23 interviewed at site 3)

Savanna-like landscape

Fewer participants mentioned another natural scene, but it was worth noting that the type of landscape – broad lawn with sparsely scattered trees – was still preferred with the prevalence of biomes containing grassland and trees in roadside green space. One participant mentioned trees, flowers, and a big lawn, constructing a savanna-like landscape that afforded an open view and activities, such as sunbathing.

(...) [because] I was attracted by the view, the trees, the flowers, and the big lawn, which is very open and you can go up there to sunbathe. I really like that. (...) (DP36 interviewed at site 1)

This suggests that the affordance dimensions of the savanna-like landscape

are important factors for landscape preference. Specifically, it enables participants to have a feeling of openness (a wide view) and step on and sit or lie on the grass for sunbathing. Spending leisure time on the lawn is commonplace in western cities, yet it is rare in the Chinese context, where people are commonly not allowed to step on lawns due to their ornamental role in Chinese urban greening and costly maintenance (F. Yang et al., 2019). In this regard, it can be posited that the affordance of a savanna-like landscape is more influential than aesthetic feeling on individuals' preference judgement.



Figure 6.4 Public lawn not allowing users to step on in China's urban park
Note: photos were taken in Olympic Forest Park
Source: by author

Waterscape and trees

Other participants noted that water and trees (shady places) were attractive scenes in urban parks. The affordances of waterscape and trees were noted by participants. Thereinto, for example, it is both a walk-able and sit-able scene. DP20 showed the experience of walking along the lakeshore and DP38 mentioned a shady place with a view of water and recreation facilities for her kids. Prior experience concerning positive interactions with green space attunes individuals to a specific combination of outdoor settings over others.

(...) I like to go to Chaoyang Park, it's divided into two areas, one is for children, an amusement zone, and the other is the lake area, I like to go to the lake area for walking, I especially

like the water and the trees. (...) (DP20 interviewed at site 2)

(...) I like the place where there is water, a shady place, so I can relax, and preferably there are sandpits and playgrounds for children. (...) (DP38 interviewed at site 1)

Whilst the same natural elements were emphasized, participants enjoyed the scene in different fashions, namely walking and sitting. In other words, trees provided a shady place to sit or stroll, while the combination of trees and water offer objects to see.

In short, inspired by findings in 5.3.4, the third theme was identified to uncover how the co-occurrence of natural elements constructs participants' ideal mental image of urban green space. The results showed that three recurring subthemes embodied participants' imagination of nature and affordance in urban green space. Specifically, three mental images were uncovered: (1) Hill and water (*Shan-shui*) landscape subtheme indicated that socio-cultural factors and prior experience are more likely to influence individual judgement of a scenic landscape; (2) Savanna-like landscape subtheme revealed that imagination of affordance might impact perceived aesthetic appreciation of specific landscape; and (3) Waterscape and trees subtheme suggested the previous pleasing experience of contacting with nature contributed to form a preferred scenario related to urban green space.

6.5 Conclusion

This chapter has sought to understand the complexity of everyday relationships between landscape preference and the use of urban green space in the context of social media age through presenting data from interviews with residents and observation in neighbourhood parks and destination parks in Chaoyang district of Beijing. In doing so, natural elements are neither explored separately nor discussed to reach a consensus on individuals' preferred landscape. Rather, the overarching aim has been to look at landscape preference revealed in a sociocultural context. This chapter highlights the entanglements between green space features, individuals' aims, and sociocultural interactions that reinforce the perceived aesthetics of nature. It shows the need to understand social media use and its relationships with everyday living. The chapter argues that technology is intertwined with everyday life, and it influences the way people interact with and experience urban green spaces.

Chapter 7 Discussion and Conclusions

7.1 Introduction

The previous three substantive chapters have shown findings from empirical work conducted online and in Beijing parks. This final chapter presents the discussion and conclusions of this thesis. It draws together key arguments and discusses how the research objectives were achieved using a mixed method to explore relationships between human, technology and nature in the previous three chapters. The chapter starts with a discussion and conclusions of how the research design was developed in response to the research questions. Then it outlines the contribution to the knowledge of this research, key implications and limitations. Lastly, this chapter explores directions for future research.

This chapter has linked and discussed the key findings of an online survey, visual social media data mining, and a semi-structured interview. It addresses the three research objectives by synthesising the findings of both quantitative and qualitative methods. The findings lie three-fold. First, visual social media is actively involved in many individuals' everyday use of green space. Then, user-generated images are in accordance with the preference for natural elements, while place branding causes homogeneity of visual representations on social media. Lastly, the perceived affordance of green space differs in relation to different social practices. Diverse combinations of natural elements demonstrate how affordance and experience influence landscape preference, while different natural elements elicit different perceptions and subjective well-being consequences.

7.2 Summary of research

7.2.1 Literature review

This research set out to review key theoretical debates and previous empirical studies, whereby two theoretical perspectives are identified in explaining the perception of landscape. The extent to which the physical environment or individuals' cognitive processes (e.g., memory, experience, and stimuli) determine their perception of the environment remains debatable. This divide between ecological and cognitive stances sheds light on the prospects of exploring landscape preference by focusing on the physical environment, sociocultural factors, and the relationship between the environment and active individuals.

Chapter 2 discussed how mobile media technology, especially visual social media, shape sightseeing practice through photo-taking and photo-sharing practice. Crucially, the concept of "tourist gaze" proposed by Urry (2011), along with the technology-driven context, tremendously influences perceptions and preferences of landscape. Moreover, it was identified that visual social media increasingly intertwine and shape everyday practice. The huge amount of user-generated content (UGC) from social media emerges as a valid repository of data to explore landscape preference.

Given that landscape preference is determined not only by an innate tendency to react positively to nature, but is also moderated by sociocultural factors that evolve in a continuous fashion. Yet, little is known about the interaction between visual social media use and landscape preference from the perspective of social practice and perceived environmental properties. In addition, while a growing number of studies have investigated visual representations of the living environment on social media, fewer studies have explored landscape preference by combining spatio-temporal photo-taking behaviour and the

content of photos derived from visual social media.

Finally, the literature suggests that the formation of urban green space has occurred in tandem with the overarching forces of urbanization in Chinese cities due to the prevailing system of top-down planning. It shows that the everyday landscapes of Chinese cities have been shifted significantly in past decades and innovative planning initiatives for urban green space are still in continuous progression. However, few studies have investigated landscape preference under this shifting urban landscape context.

7.2.2 Research objectives and methodology

This thesis originated from research in the field of landscape perception. It initially aimed to investigate physical and social factors related to landscape preference. Then it is noticed that the ubiquitous presence of social media has profoundly shaped everyday practice due to the rapid development of mobile technology and the vast growth in the number of social media users in China. Therefore, the primary research question which emerged was:

What characterizes landscape preferences which are embedded in the everyday use of green space in the age of social media?

This question was addressed by studying social media data, which offers evidence to understand landscape perceptions and preferences. Social media is deeply involved in human-nature interactions. Firstly, the relationships between social media use, urban green space use, and perceived subjective well-being were examined to obtain outlines of this phenomenon. Then, following Urry's theory of tourist gaze, two sociocultural factors – place popularity and social groups – were examined in response to landscape preference. Lastly, it explores a wider range of sociocultural factors associated with landscape preference reflected in the everyday use of urban green space.

Accordingly, the research objectives were as follows:

- To explore the correlation between social media use, green space use, and subjective well-being.
- To investigate landscape preference reflected by visual social media, with respect to place popularity and social group.
- To understand landscape preference embedded in the everyday use of urban green space and the role of social media in shaping it.

The research methodology was developed in chapter 3 to address the research objectives with a robust and detailed dataset in case study areas of Beijing. It explained the case study research used in this study and then adopted a mixed method approach, to explore what social media reveal about users' landscape preference, how social media is integrated into individuals' everyday use of urban green space, and what this conveys about landscape preference. It then outlined technical strategies, including an online questionnaire survey with social media users, social media analytics with geo-tagged data harvested from visual social media, and semi-structured interviews with residents in parks.

Case study parks were selected via a top-down method with data harvested from social media: first, hotspots were identified across the 5th Ring of Beijing city; second, ten case study parks were selected based on those places identified as hotspot areas to explore place popularity and social group in relation to landscape preference; lastly, four sites are selected to conduct semi-structured interviews according to these hotspot areas.

Lastly, this chapter described techniques and algorithms used in data analysis. These methods include statistical analysis with questionnaire answers, cluster analysis and content analysis with geotagged data yielded from visual social media and thematic analysis with semi-structured interview data.

7.2.3 Green space use, social media use and subjective well-being – the GSU&SMU survey

Following the research framework, chapter 4 presented the findings of the online questionnaire survey, which was conducted to understand the role of social media in participants' everyday routines and to explore associations between urban green space use, visual social media use, and subjective well-being. Given that the use of green space evokes positive responses by the users, which are expressed through a preference for natural environment, social media use, especially visual social media use, appeared to mediate the experience of nature and thus affected subjective well-being. Three sub-questions were asked in this chapter:

- Is the use of visual social media associated with use of urban green space?
- Is the use of social media, especially visual social media, connected to subjective well-being?
- How does the experience of nature affect subjective well-being?

The results corresponding to the questions from the survey are as follows:

- **Association between visual social media use and urban green space use**

A connection between visual social media intensity and urban green space use was identified, including the frequency of visiting neighbourhood parks and of destination parks. Visual social media intensity was also significantly associated with three factors in relation to respondents' most recent nature experience: well-being outcome, nature connectedness, and quality of the natural environment.

The extent of influence of photos posted on social media is positively associated with the frequency of urban green space use (i.e., the use of neighbourhood parks and destination parks). The level of social media function

as an information resource was significantly related to respondents' most recent nature experience. Specifically, respondents of a medium perceived social media influence reported a higher frequency of visiting urban green space, a higher degree of perceived connectedness with nature, and a higher quality of natural environment, compared with those within the low influence group. However, the high-influence group had no significant association with the frequency of visiting urban green spaces.

Participants overwhelmingly utilized social media as an information resource for planning their trips and constructing an image of what the destination is like. Participants who reported a higher chance of gathering information from social media before visiting a place also reported a better experience after visiting an urban green space. Furthermore, they reported above-average scores for visual social media influence. One possible explanation is the ubiquity of attractive images shared by friends, official accounts, celebrities, or acquaintances. Audiences of online images can interact with the image owners, such as by giving a "like", a comment, or by reposting the image on their social media account. In these circumstances, users were more likely to plan a visit to the place presented on social media.

Conversely, respondents reporting higher intensity of social media use reported a lower frequency of visiting green space. This finding suggests, unlike general social media use, image-based social media use appears to be beneficial for encouraging offline activities. Specifically, there was a significant difference between the two respondent groups regarding visiting offline places. Findings partially support an movement from online to offline, as a positive connection was identified between moderate visual social media use and engaging in outdoor activities reflected by the frequency of green space use.

- **Association between visual social media use and subjective well-being**

Visual social media intensity was positively connected with participants' subjective well-being, although it is unclear which precedes the other, while other factors of visual social media use have no significant connection with subjective well-being. Among the dimension of visual social media use, the findings suggest that social media intensity appears to associate negatively with participants' subjective well-being, although the association is not statistically significant even after adding control variables, indicating a complex mechanism of this pair.

- **Association between nature experience and subjective well-being**

Both well-being outcomes and feelings of connectedness with nature that the participants gain from the most recent nature experience are positively connected with subjective well-being. Whilst the use of urban green space was significantly associated with subjective well-being, different features of natural environment elicited different outcomes: the presence of water features predicted well-being outcome in the visit, while greenery features (i.e., grove or forest) and greenery with topographic features (i.e., hills or mountains) had a positive connection with a perceived connection with nature.

- **Unexpected findings**

Unexpected findings emerged in a two-fold aspect. For one, whilst the representation of males is relatively lower than females in the sample, there was no significant variance between males and females with respect to visual social media intensity. This is most likely due to the prevalence of visual social media. As reported by China Internet Network Information Centre, China had 989 million netizens. The per capita weekly online use of China's internet users was 26.2 hours by December 2020 and 99.7% of the Chinese internet users using mobile phones to access the internet (Center, 2014). Visual social media

(such as Instagram, Snapshot and Flickr, and WeChat moment module, Xiaohongshu and Sina Weibo in China) saturate everyday life in China, as Ibrahim (2015) puts :

“... while the popularity of video/photo-sharing sites is facilitated by the technological convergence, on a more integral level it reveals the pull towards the visual in our human makeup; the role of the visual in memory and recall, as well as its vital role in representing the real or in authenticating and chronicling events in our everyday lives, in forming connections with others, ...”

The findings also indicate that different landscape factors play different roles in participants' experiences in visiting urban parks. In order to understand the experiential differences associated with different landscape features comprehensively, potential explanations are identified based on previous studies. Firstly, many studies have focused on preference of forest landscape (Balling & Falk, 1982; Ruddell & Hammitt, 1987; Ulrich, 1986). Laaksoharju and Rappe (2017) demonstrate that children show obvious preferences for trees when engaging in outdoor activities because trees function as a source for place-connected play, supplying materials, space, and the content of the actual play. Similarly, Harris et al. (2018) observe that individuals' landscape preferences are positively associated with the increasing proportion of woody plants, as opposed to the proportion of lawns. This is possible because preference is primarily influenced by the structural complexity of vegetation. The greater complexity perceived in natural environments the greater the visual elements encouraging people to concentrate on “how much is going on in the scene” with effortless attention. It enhances viewers' involvement with natural environments (Pazhouhanfar & Kamal, 2014), as people are able to perceive species richness in urban green space (Qiu et al., 2013). Thus, it can be posited that, forest landscape commonly includes more diverse species, which stimulates more cognitive engagement than open landscapes (e.g., a large lawn) (Burgess et al., 1988; Harris et al., 2018; Kaplan et al., 1989), or

landscapes with tidy “least natural” planting structure (Hoyle et al., 2017). Moreover, forest atmosphere stimulates beneficial engagement, such as forest bathing (Park et al., 2010), which facilitates human psychological well-being (Bell & Thompson, 2014).

Interestingly, participants who reported mountainous landscape were also significantly related to perceived connectedness with nature. A possible explanation is that the presence of forest landscape and mountain-related activities, such as mountain climbing, viewing, and the experience of nature (Knez & Eliasson, 2017), contribute to a different level of engagement with the natural environment (Pretty et al., 2005). This argument is also supported by the finding that the presence of hills/mountains and groves/forest features had a significant association with longer visit duration, indicating that respondents appeared to be interested in these environments.

Lastly, water features correlated with a significant well-being outcome, while other features did not. This finding is in line with Ulrich’s (1981) findings that views of water are especially effective in maintaining attention and interest, leading to a more beneficial influence on psychological states, over and above the general benefits to well-being offered by viewing nature scenes. Wilkie and Stavridou (2013) also concluded that pleasant waterscapes are more restorative than those without water. In an investigation of waterscapes, mountain waterscape is preferred among other types of waterscapes (Herzog, 1985). Therefore, it can be argued that the presence of waterscape is probably the most directly beneficial feature affecting well-being outcomes (e.g., attention restoration and stress reduction) in a visit to a park, while forests and mountains play a key role in perceived nature connectedness.

7.2.4 Concept of “Tourist Gaze”, photography practice and representation of nature experience

Given the results presented in Chapter 4, the environment-behaviour interaction regarding visual social media use remained unknown. While empirical evidence shows that visual social media use is positively associated with the use of urban green space, the actual experience mediated by visual social media requires further examination. Drawing on the influential concept of “tourist gaze” (Urry & Larsen, 2011), two sociocultural factors are examined concerning landscape preference: place popularity and social group (i.e., resident vs tourist). Four sub-questions were asked in chapter 5:

- How do spatio-temporal patterns of photo-taking behaviour correspond to advertised attractions and unadvertised attractions in urban parks?
- How do the contents of photos differ between advertised attractions and unadvertised attractions in urban parks?
- How do spatio-temporal patterns of photo-taking behaviour differ between residents and tourists in urban parks?
- How do the contents differ between the photos taken by residents and tourists?

By analysing geo-tagged data harvested from visual social media, Chapter 5 first compared photography practice and representations of nature experience between advertised attractions and unadvertised attractions; and then compares those of residents and tourists. The key findings were as follows:

- **Comparison of photo-taking behaviours between advertised places and unadvertised places**

Spatio-temporal patterns of photo-taking behaviour generated by visitors were largely clustered around locations of advertised attractions and iconic sights that were promoted via social media. Indeed, this is not a new insight derived from research into geo-tagged images (Liu et al., 2012; Sun et al., 2015). The

relationship between the content of these visual representations and whether the place was advertised were explored in this thesis. According to the results, advertised attractions were connected in sequence by representative trajectories. Visitors inclined to be driven by the desire to see all advertised attractions and naturally followed guidance gathered from social media, which was taken to be the shortest route to capture all attractions.

All advertised attractions corresponded to hotspot areas, where most visitors were inclined to take photos and posted on social media. Yet visitors also regularly took photos at the entrances of urban parks, the start point of a visit, which were not commonly advertised. Moreover, certain features were attractive for visitors to take photos of: sightseeing platforms, waterfronts, and places in proximity to water. Visitors' photography practice did not always predict an advertised attraction. Thus, visitors not only followed practices surrounding the popular attractions but also create "hotspots" based on their on-site feelings. It can be stated that visitors did not always follow an online guidance related to urban parks but were also influenced by other factors when deciding whether the moment were meaningful to record. This phenomenon was more pronounced in some of the Public Parks, which had no advertised or promoted attractions. Visitors generated more distinct topics in unadvertised places compared with topics identified in advertised places. This is elaborated further in the following findings.

- **Comparison of photo contents between advertised places and unadvertised places**

It can be argued that place branding influences people's representations of nature experiences on social media. Whilst visitors may have an ideal mental image of the parks throughout their visits, they were inclined to photograph diverse topics, such as trees in natural environment, parkways, and activities. Visitors captured more nature-centred scenes (e.g., tree seasonality and trees

in natural environments), activities, and parkway scenes (e.g., cycling and parkway landscapes) in unadvertised clusters, which were not identified in advertised clusters. Therefore, visitors are inclined to focus on natural environments and scenery along roads when they are in unadvertised places rather than in advertised places. In Traditional Chinese Gardens (i.e., P2, P4 and P5) containing advertised attractions and unadvertised attractions, natural landscapes, close-ups of plants, and vegetation were commonly identified as the main themes in unadvertised places. By contrast, architectural features, events, and recreation records were most often identified at advertised places. P3 is an exceptional Traditional Chinese Garden because it is not advertised for its exquisitely detailed architecture but is well-known for its annual cherry blossom festival in April. Residents reported that the main specialty of Yuyuantan Park (P3) is the flower. However, flower-related themes not only appeared at the advertised place (the cherry blossom garden) but at unadvertised places. The compositions varies, though they often contained close-ups of flowers and combinations of waterscapes and cherry trees.

Among the public parks that contained no advertised attractions (i.e., P6, P8, and P9), image themes reflected the characteristics of each park. First, the linear park was formed around Little Moon River and passing through densely populated residences (P6), where visitors focused on capturing everyday activities, street scenes, waterscapes and monuments on public squares. Second, Olympic Forest Park (P8) served as the place of contacting with nature, as photographic themes related to interaction with nature and recreation in the natural environment. Waterscapes and landmarks were also impressive scenes captured by visitors. Lastly, Purple Bamboo Park (P9) was built in Traditional Chinese Garden style – a mountain-water landscaped garden, consisting of bridges, lakes, isles and a large variety of bamboo. The perceived features were mostly in accordance with that of other Traditional Chinese Gardens, such as the Summer Palace (P1) and Yuanmingyuan Park (P2). Yet, plants were the

dominant content presented in the images, combined with other factors, such as selfies, architecture, waterbody, and paths. Compared with the semi-structured interview, waterscapes, trees and flowers were the most mentioned factors that attract respondents in urban parks. There is consistency between self-reported landscape preferences and user-generated images related to natural environment. Moreover, these representations of nature experience were mostly unprompted and bottom-up in urban parks, implying that the distinctiveness of places was manifested and shaped by social media.

Compared to Instagram, where people are inclined to be visible and become influencers, Flickr is more record-oriented and acts as a virtual photo album for individuals. Visitors identified from Flickr were more likely to record based on personal judgement and preference in natural environment (Hausmann et al., 2018). Therefore, it can be posited that visitors' preferences change to some degree when they are out of advertised places in urban parks. The record of the parkway (a linear element in urban parks) is consistent with the element of path from Kevin Lynch's (1964) mental map of city. This observation is also supported by a recent study of city images using geo-tagged photos (Liu et al., 2016), in which paths in the real world are detected from linear clustered dots. This suggests that visitors not only perceive the path element of an urban park but also show a preference for it without the presence of advertised attractions. A possible explanation is that visitors have borrowed views at unadvertised places along park roads, especially for landmarks, indicating that landmarks are also appreciated from long distances (Huang et al., 2021).

- **Comparison of photo-taking behaviours between residents and tourists**

Residents and tourists had different landscape expectations and preferences which were reflected by different revisit ratios to the same destination and different proportions of the visit to different urban parks in the same season.

Compared with tourists, residents focused on the most popular and symbolic attractions in smaller urban parks (less than 1 square kilometre in this study). Aside from the interest in advertised attractions, they also presented a distinct preference for some unadvertised places in larger urban parks (larger than 3 square kilometres in this study). Tourists were inclined to visit more attractions when heading for the advertised attractions in parks of different sizes. Events are important motivations for tourists to explore urban parks.

The distinctness of visit sequence between residents and tourists was assessed by comparing their hotspot-trajectory patterns. By contrast, content analysis of photos implied a degree of similarity between tourists and residents, suggesting the complex nature of visitors' landscape perception and preference.

- **Comparison of photo contents between residents and tourists**

The results of content analysis generally support the assumption that residents and tourists share many similarities, while few distinct topics were identified. This statement is in accordance with Hunziker (1995), who finds that landscape evaluation patterns are difficult to differentiate according to social groups, namely residents and tourists. The finding shows that both residents and tourists were interested in photographing water features, social features, architecture and landmark features, greenery and interaction with nature, and contrasts in light and shadow features. It is worth noting that tourists showed a pronounced preference for photographing natural elements instead of architecture or any artificial markers, which is also the case among photos taken by residents. This suggests a homogeneity of nature appreciation between different social groups.

In terms of image of place, street scenes were attractive for both residents and tourists, while general images of Traditional Chinese Garden and leisure records were only identified in the tourist group. This finding is in accordance

with the observation of Larsen and Urry (2011): “Gazing at particular sights is framed by rules and styles as well as by circulating images and texts of this and other places.” The garden of Chinese style functioned as a “particular sight” that had saturated visual social media, adverts, guidebooks etc. Similarly, another distinct topic of tourist photos is the scene of an arch bridge and waterscape, which is a typical scene in Traditional Chinese Gardens (Cheng, 2012; Han, 2006; Keswick et al., 2003).

In addition, tourists in particular concentrated on park road landscapes, evidenced by an active photography practice throughout the visit. Although posting, selecting and managing photos online based on certain themes were more of an afterthought. The thought of taking photos partially, if not entirely, affects visitors’ walking rhythm: when they would stop for a photo (Arts et al., 2021b; Campbell et al., 2022). Moreover, topics identified in photos were proportional to the count of detected descriptions, thus a distinct topic of tourist photos meant that photos with the same topic taken by residents were not statistically significant. Those tourists who revisited a park, demonstrated a strong willingness to revisit after exploring the park for the first time. Lee et al. (2014) find that the intention for eco-tourists to revisit parks is significantly associated with an appreciation of nature and being close to nature along a natural tracking route. The motivations align with the results of substantial studies, which uncover residents’ motivations for visiting local urban parks (Burgess et al., 1988; Irvine et al., 2013; Larson et al., 2016). Although motivations of revisit are complex, it can be posited that tourists who revisit the same urban park share similarities with residents in terms of their appreciation of natural environment.

Together, considering the common representations shared by tourists and residents, the concern that the “tourist gaze” may jeopardize visitors’ experiences is reductive. The dichotomy between residents and tourists is more

likely blurred regarding nature-related activities, such as picnicking, boating, mountaineering and walking. It can be posited that, instead of collecting popular signs of places, which are socially constructed via visual media before individuals see them in real life, both residents and tourists are actively engaged with the environment in green space.

- **Unexpected findings**

Major themes identified in photos taken at advertised places consist of expected features for an urban park, such as water features and greenery features, and distinct features that are expected in a Traditional Chinese Garden; such as architectural features (e.g., pagoda, arch bridge and pavilion). In this regard, the destination becomes a collection of signs. As Crang (1997) points out:

“A world of multiple fragments, where each site becomes a point in an endless signifying chain of sights... rather than the global village of organic wholeness, the global media produce a sense of the serial distance of each sight from the next.”

Homogeneity was observed between advertised and unadvertised attractions in this case study. A total of eight major themes in photo clusters were identified through content analysis (see 5.2.2 and 5.3.4). The themes identified are supported by other studies (Clemente et al., 2019; Ghermandi et al., 2022; Liu et al., 2016; Richards & Tunçer, 2018; Tieskens et al., 2018), in which greenery features (e.g., flowers, forests and individual plants), water features (e.g., rivers and the sea), architecture and landmark features (e.g., monuments, churches and towers), interactions with nature (e.g., family in nature), social features (recreational activities and recreational equipment) and weather phenomena (e.g., significant sky, sunset and sunbeams) are detected from visitors' Flickr photos. The theme “light and shadow features” is partially associated with weather phenomena identified in these studies. More importantly, it contains

environmental settings that embody light and shadow effects, suggesting that the contrast of light is aesthetically perceived with co-occurrence of other elements, such as architectural structures, parkways, plants and water features. This observation is consistent with the findings of Edensor and Hughes (2021) in perception of shadow and light in people's everyday lives. They argue that light and shadow elicit aesthetic responses when combined with peoples' movement through streets, high-rise buildings, and trees. This quality of contrast is studied in another research (Tinio et al., 2011), finding that contrast has the greatest influence on aesthetic judgement over grain and sharpness qualities of photos. Another distinct theme that had not been identified in previous studies is the "image of place". Interestingly, a co-occurrence of water features, architecture features and greenery features (the major theme "image of place"), was extracted from photos in both advertised attraction clusters as well as in unadvertised attraction clusters, suggesting that there likely exists an imagined picture of urban green space among visitors. This imagined scenario appears to be expected and recorded throughout the visits in advertised places and unadvertised places. One explanation is that visitors seek to, as Urry and Larsen (2011) argue, "view a set of different scenes, of landscapes or townscape which are out of the ordinary". Parks are certainly distinct places for visitors, compared with other spaces pervaded with human-made scenes in cities.

7.2.5 Landscape preference embedded in everyday practice

Following the findings of chapter 5, place popularity evidently impacts representations of activities and landscapes, while representations of nature experiences made by residents and tourists have blurring distinctions. These findings call into question the meaning of the "popularity" of landscape from a wider sociocultural perspective, namely, the consensus in landscape preference embedded in the everyday use of urban green space. This consideration leads to the initial question:

- How are landscape preference embodied in everyday use of urban green space in the age of social media?

Chapter 6 discussed the findings of semi-structured interviews conducted in four selected urban parks, including destination parks and neighbourhood parks. It aims to reveal the interactions between the use of social media and everyday use of urban green space, thereby shaping landscape preference. Three major themes and seven subthemes were identified by applying thematic analysis of the interview data. Key findings were as follows:

- **Shaping the preference: perceived affordance in everyday use of green space**

The affordance of urban green space is perceived differently by three groups of participants identified in the survey: the passer-by, sightseer, and public open space seeker. Urban green space afforded different functions to these groups and thus evoke distinct environment-behaviour interactions. For passers-by, urban green space was the preferred space when it was in proximity to their destinations. Urban green space is more of a sit-able or walk-able for transient use. This group sensed less tangible properties of urban green space, such as fresh air, cool temperature and sunshine. Short breaks or a slow-paced walk that were not part of a personal daily to-do list, and these activities contributed to forming a transitional space for passers-by who were moving between two destinations. Among sightseers, urban green space affords aesthetic appreciation and gazing at scenic landscapes can be restorative. Thus, sightseers concentrate on the interactions with nature, such as a sense of immersion, a feeling of poetic atmosphere, and picturing practice. Yet for public open space seekers, it is the publicness of urban green space that is most important. In other words, a preferred urban green space affords activities to the public. The urban green space could be as simple as the setting: a shady tree, an accessible square, and a couple of benches.

- **The role of social media in everyday use of green space**

Social media is identified as a catalyst for outdoor activities and functions as an information source for outdoor activities, promoting online-to-offline interaction in urban parks. Regarding its role as an information source, the results showed that participants particularly focused on user-generated content from social media and that images were preferred in the decision-making process. Further, there was a reflexive influence between online and offline interactions. Participants were likely motivated by the posts of like-minded friends in arranging offline activities in urban parks. It is worth noting that the online survey (see chapter 4) presents a positive association between visual social media use and the frequency of green space use, which can mostly be explained by the active role of social media use in promoting offline use of urban parks.

- **Landscape preference as an embodiment of biophilia, experience and cultural context**

The third major theme summarises two types of ideal mental images in relation to nature: the “close-up nature” and three natural scenes. The former depicts the ideal mental image of an urban park through a symbolic element (cherry blossoms and begonias), whereby the local government advertises these “markers” for tourism. The image of urban green space, along with symbolic elements, are constructed through marketing and scenic landscaping. The subtheme of three natural scenes shows that the preferences for a combination of natural elements likely result from respondents’ cultural context, their expected affordance, and past experiences.

7.2.6 The role of visual social media in characterizing attractive landscapes

According to the participants of the online survey, visual media, specifically digital images, saturate everyday life and the use of social media is normalized in visiting a place. Participants were accustomed to watching flows of

photographs from social media and to collecting information from social media before visiting a place (see section 4.2.2). More than half of the participants reported a positive influence of digital images on the desire to visit places. These influences were confirmed and further detailed in semi-structured interviews. Participants sought to construct expectations of places via digital information created by other users or official accounts on various social media platforms. Among the information, images were considered the most direct and reliable media in terms of figuring out places. Comments are useful when considering subjective feelings about places. A study finds that digital images facilitate higher social media engagement due to eye-catching colourfulness (Li & Xie, 2020).

Sundar (2008) has established a model, via a heuristic approach, to understand individuals' credibility judgements of digital information, or sources of information in the digital age. The model posits that our brains are more likely to consider audio-visual modality as "real" than textual communication because of the "realism heuristic" that is cued by photographs and videos. The interactions with visual social media, such as scrolling imagery, commenting, and giving "likes" to content generated by users, virtually shape (re)imagination and understanding of places (Liu, 2022). Participants stressed that seeking authenticity of experience online is fundamental to arrange their outdoor activities as visual social media may present "filtered" or modified images of destinations. Personal ratings were also too subjective to form the basis of a choice because of the uncertainty of personal rating criteria. Therefore, respondents reported that it was important for them to distinguish the credibility of different information sources in digital spaces. The responses showed that the accounts of close friends, family and official accounts were trusted the most in participants' decision-making processes.

By combining the findings of the visual social media analysis and online survey, it can be concluded that visual social media is increasingly involved in constructing nature experiences. Participants in the online survey reported a positive correlation between intensity of visual social media use and urban green space use, including their most recent experience in urban green space and frequencies of urban park use (see section 4.2.4). This observation elicited another series of questions, namely: what do people document with visual social media? Do they incorporate natural landscape into visual conversations on social media platforms? According to content analysis of photographs shared on visual social media, identified nature-dominated photos, including themes of water features, greenery features and interaction with nature (Figure 5.3), showcased personal expressions of urban nature, implying the visibility of personal landscape preference to audiences in “cyberspace”. It can be argued that participants not only enjoy being in green spaces but also enjoy representing the spaces via digital photography practices. The findings are consistent with previous studies arguing that people show a significant preference for natural environments when compared with built environments (Falk & Balling, 2010; Ulrich, 1981).

As shown in the results of the online survey, vegetation and water elements are significantly correlated with perceived nature connectedness and well-being outcome of nature experience, respectively (see section 4.2.3 and Table 4.8). This finding is confirmed by content analysis of photos, in which greenery features and water features are among the main themes detected by the image recognition algorithm. Thus, representations of nature in “cyberspace” may reflect the perceived benefits of some, if not all, natural landscapes through visual social media. However, the findings also evidence the influence of digital technology in human-nature interactions, which are driven by a “neoliberal logic of economic growth” (Arts et al., 2021a; Stinson, 2017). Stinson (2017) proposes the phenomenon of Wildness 2.0, which emphasizes the use of digital

technology in human-nature interactions. It makes virtualized nature not only a new route whereby people can connect or disconnect with “real” nature. Instead, digital devices and social media networks facilitate and orient online content for the purpose of branding and marketing. The results of spatio-temporal analysis of geo-tagged photos suggest similar observations to Stinson’s: photos were densely clustered around promoted and iconic attractions in most of the urban parks. This phenomenon is also confirmed in the semi-structured interviews, in which participants noted they were motivated by the most representative scenes in visiting different urban parks in Beijing. It is natural for visitors to take photos of these scenes and show them off via social media. Therefore, internet-famous characteristics of places are more likely captured and shared by users in social media ecosystem. One needs to be cautious when discussing attractive features of landscapes using social media data as a proxy of landscape preference because human perceptions of the “actual” world can be mediated by online representations of places.

7.3 Contribution to knowledge

This thesis’ contribution to knowledge is its thorough understanding of the rich meaning of landscape preference in a changing world context, where technology and individuals’ everyday practices are intertwined. Ubiquitous engagement with digital technologies and data has radically transformed practices of everyday life (Ash et al., 2018). Given that China’s capital and other Chinese cities have witnessed rapid landscape shifts due to the continuous changes wrought by urbanization, the appearance of urban green space has dramatically changed over the past decades. Urban parks are especially significant because they mark cases of expectation for liveable environments and intersecting spatial practices in the urbanization process in China (Morgan, 2009; Zhan et al., 2018). Against this backdrop, this study has explored landscape preference through the lens of technology and the everyday use of

urban green space in Chinese cities. The final findings are rewarding.

To illustrate and investigate the role of social media that intervenes in human-nature interactions and thus characterizes landscape preference of everyday urban life, this study explored the effects of social media, specifically practices of taking and sharing photos on social media, which strongly feature a new digital engagement with nature. An online survey is firstly utilized to examine the effects of visual social media use in human-nature interactions and ten case studies of Internet-famous urban parks with different popularities were selected to further explore the role of social media and digital images that reflexively (re)framing landscape preference. The present research recognises the need for integrating technology and everyday practice to rethink landscape preference in its diverse manifestation: from technology-elicited phenomenon (i.e., photo-taking behaviour, digital image, social media photo-sharing) to everyday use of urban green space (i.e., routinised activities, transient appropriation of space and positive personal experience).

To start with, the first research objective was revealed through a convenience-sampled online survey in China, that is the existence of possible connections between visual social media use and actual experience of nature, and thus their impact on subjective well-being. The findings showed that the participants who had a higher intensity of watching or sharing photos through social media daily also visit urban parks with a higher frequency (specifically neighbourhood parks), a higher perceived satisfaction (well-being outcome of the visit), higher connectedness to nature and quality of natural environment (see section 4.2.4). Those who were habituated to retrieving visit information from social media had overall better urban park visiting experiences, evidenced by higher scores of visit satisfaction (well-being outcome of the visit), feelings of nature connectedness and quality of natural environment. Notwithstanding the associations between visual social media use and urban green space use,

positive consequences of subjective well-being were only related to visual social media intensity, the level of well-being outcomes and perceived natural connectedness in relation to the most recent visit to urban parks. The results also illustrate that the quality of experience was more significant than the quantity of visits to urban parks in terms of positive influence on subjective well-being. The reason may lie in the fact that the functionality of visual social media affords the formation of online communities as well as image-centred communication, which incorporate individuals' lives in the highly connected and visual contemporary world. Participating in visual social media was beneficial in encouraging offline activities and gaining social rewards. However, we cannot positively conclude that visual social media use results in a better experience of nature as participants who are active on visual social media platforms may also have an active lifestyle in terms of outdoor activities. Therefore, the possible relationships, such as causality, between visual social media use and subjective well-being in relation to the experience of nature merit further research.

The second research objective was to examine digital expressions and factors that influence these expressions of landscape preference by analysing the content (image data) and structure (spatio-temporal patterns) of geo-tagged photos harvested from visual social media. The present research has made sense of digital photography practice and visual representations of nature experiences in urban parks. The results show that place popularity is more influential than social group (residents or tourists) in terms of the diversity of photo topics. Furthermore, residents and tourists have distinct visit strategies, as evidenced in spatio-temporal patterns of digital photography practice: (1) photos of residents were spatially dispersed while photos of tourists were spatially clustered; (2) residents focus on the most symbolic attractions in smaller urban parks (less than 1 square kilometre), while they found some preferred places that were not advertised in larger urban parks (larger than 3

square kilometres); (3) tourists were disposed to view as many attractions as they could when heading for popular attractions.

Whilst Urry has argued that tourism and tourist behaviours are opposite to everyday practices in *The Tourist Gaze* (Urry, 1990), implying a dualism between common (everyday life) and uncommon (tourism experience), the boundaries between everyday space and tourism consumption are often blurred (Haldrup & Larsen, 2009; Liu, 2022). As the findings of content analysis have emphasized, it is difficult to differentiate visitors' social groups, namely tourists or residents, in relation to the categorised contents of photos taken in nature, as both residents and tourists were interested in taking photos of greenery features, water features, and human-nature interactions in urban parks. This study provides empirical evidence that no rigid boundary exists between residents and tourists with respect to perceived scenic scenes in urban parks. To summarize, place popularity has strongly oriented where and what participants take photos of, which guides and shapes digital expressions of landscape preference in urban parks. Thus, place branding may lead to the homogeneity of stories presented on visual social media. Although different social groups (residents and tourists) have distinguished visit strategies, the hot spots of photo-taking behaviour still overlap to some extent: photos of residents and tourists are clustered around iconic places, while the photos taken by residents also form new clusters not in proximity to popular attractions in some urban parks. According to the findings, different social groups (residents and tourists) have shown similar preference, generally, toward natural landscapes, as shown in digital expressions on social media.

The final research objective was to work with Gibson's conception of affordance and Wilson's hypothesis of biophilia to link participants' everyday experiences of nature to digital technologies. To further answer the question of how social media and digital information intervene in human-nature interactions in

everyday life, a qualitative analysis of semi-structured interviews was conducted. The study emphasized affordance as a key concept to understand the role of social media in shaping participants' everyday use of green space. According to the findings, social media platforms embedded in portable smartphones with higher-resolution cameras and screens, have afforded retrieval of information, communication and watching flows of place images. This feedback on urban parks can easily construct participants' expectations and perceived affordances, which has been differentiated from the affordance of physical properties by Norman (1999). On the one hand, participants have shown appreciation of vegetation and natural landscapes due to the diverse affordances of urban green space in everyday life, which is in line with biophilia hypothesis from an evolutionary standpoint. On the other hand, perceptions of urban parks are also culturally constructed: (1) digital information has reflexively influenced who uses spaces (through affordance of communication) and what is experienced in parks (through digital representations of places); (2) different urban parks are symbolised by "markers" (popular scenic landscape) that relate to the uniqueness of the place, which is strengthened via circulation of place-based representations. To summarize, everyday use of social media has delivered perceived affordances of urban parks to participants, such as a photogenic place or a square suitable for "square dancing". These "learned" affordances, together with the innate affinity for natural landscape, are incorporated into characterizing participants' expectations for ideal urban green spaces. In addition, affordances induce reflection on the relationship between a "place-making" process embedded in everyday living and landscape preference. As Feuchtwang (2004) stresses, place-making is the "centring and marking of a place" via people's everyday practice. The actions and constructions of people define the preferred features of space and thus show rich explicit or implicit explanations, of what an ideal urban park looks like.

7.4 Key Implications and Limitations

7.4.1 Potentials to promote green space use in the age of social media

The main recommendation for planners is that social media offers promising directions for green space branding and thus facilitates people's outdoor activities in green space. The finding underpins that social media use is integrated into people's social practice as it intertwines with everyday life in relation to planning, storing, and sharing outdoor activities, mutual connections, and self-representations. People use social media as an information source before embarking on an outdoor activity, to locate, plan, and communicate. During and after the activities they may use social media as a "stage" to record and share experiences. Using social media is routinized into people's everyday life such that digital information and online interactions are likely to forge specific expectations and attitudes associated with a place.

Planners, managers, and visitors, including tourists and residents co-create their representations and form expectations of green spaces. For managers, digital images shared for place branding should be carefully considered, as they can motivate audiences to engage with the promised aesthetic images of the park, while jeopardizing satisfaction if visitors find that their expectations are over-aestheticized. Green space is no exception as it promises to promote public well-being in the urban environment. There are two phenomena that shape natural experience in the age of social media: the involvement of digital technology in social practice and the representation of green space via digital screens. Subjective well-being is identified as the potential consequence of the complex interlacing of technologies and green space use.

To facilitate positive responses and well-being outcomes of nature experience in cities, practitioners should recognise how green space is integrated into everyday living and thus make wise interventions. It can be a transient

appropriate of green space embedded in daily practice: from a walk-able and sit-able space to a perform-able space (e.g., square dancing) with distinct rhythms and atmospheres. Moreover, the unplanned use of green space is in accordance with park-users' need for physical exercise, entertainment, and socializing. Thus, practitioners should be aware that green space is not, and should not be, only decorative landscapes but mundane places that afford contexts for vivid parts of residents' everyday life.

7.4.2 Implications of COVID-19

Whilst visual social media data mining relies upon online work, behaviours on social media use, and green space use, in China these remain influenced by the pandemic. The first peak of COVID-19 occurred in Wuhan, China, where a lockdown occurred from January 23, 2020, to April 8, 2020. Strict travelling rules and quarantine policies were implemented in China after Wuhan's lockdown was lifted. Other guidelines such as social distancing, mask-wearing, mass testing and limited access to public space including urban parks, have profoundly changed people's behaviour and attitudes (Jia, 2021; Liu et al., 2022; Si et al., 2021).

This thesis shows that the frequency of visits to neighbourhood parks has a significant association with subjective well-being, while interestingly, destination parks did not strongly relate to subjective well-being. Destination parks commonly have better facilities, management, and biodiversity than neighbourhood parks, where greenery is limited due to cost and space. One explanation consistent with this result was that there was limited access to destination parks in China's post-COVID period when this survey was conducted. This assumption was confirmed in the semi-structured interviews with park visitors and residents. Participants reported that an online reservation via social media platforms or official websites was necessary to visit a destination park after COVID-19, which prevented them from using big public

parks as often as before. Those who failed to make reservations had to change their plans and seek out nearby green spaces that did not require reservations. Thus, respondents were less likely to use destination parks as much as neighbourhood parks. Although destination parks are characterized by their large size, more amenities, affordance for diverse physical activities, and provision of more areas to explore, neighbourhood parks appear to be alternatives for big ones in the post-COVID context.

7.4.3 Specialties of social media platforms

This thesis draws on image posts from Flickr, whereby users can store, organize, and share photos. Other popular platforms provide photo-sharing services, such as Instagram, Weibo, and WeChat. Although a significant number of studies analyse various aspects of image datasets from social media, the specialities of social media platforms differ in terms of how people understand and use them. For example, suppose professional or amateur photographers use Flickr as an online archive for their photos. In that case, normal people are inclined to use social-oriented platforms, such as Instagram and Weibo, to share images with wider audiences. Instagram users may take casual photography in everyday practice and the overall purpose is to capture moments and share experiences, events, or situations. By contrast to Instagram, Flickr is primarily for documenting experiences with high-quality pictures. Therefore, users are likely to post different photos and show different perceptions of nature on different visual social media. Further, social media data mining largely relies on official API provided by social media platforms, thus researchers are likely to have no access to these online datasets once APIs are closed.

7.4.4 Changing accessibility of social media platforms

This study adopted Flickr and TripAdvisor as data sources to explore landscape preference. Whilst the strengths of Flickr is that it provides geo-tagged photos

and contains a wider range of photo content than Chinese route websites (i.e., foouoot.com and 2bulu.com), which are primarily used by outdoor activity enthusiasts, Flickr was blocked in mainland China in 2007 and this study found that annual photo counts shared through Flickr in Beijing central area dropped radically in 2014. To date people in Beijing can share photographs on Flickr via a personal Virtual Private Network (VPN), however, it considerably decreases the availability of this platform in China. Although a certain number of users are identified as residents and geo-tagged photos were collected in a 15-year period starting in 2005 when Flickr was not blocked in China, its data representativeness is still weaker than Chinese mainstream social media platforms in terms of the diversity of demographic background. TripAdvisor is the most popular trip website in the world and is also used by foreign tourists and large numbers of Chinese residents due to the release of a Chinese version. Although the study uses TripAdvisor as a reference for identifying park popularities and their tourism attractions, its mobile application was blocked in mainland China in 2020 and this may have affected its influence among Chinese users. Setting against this backdrop, there is no perfectly representative crowdsourcing platform. A multisource study can decrease bias within user sampling but bias can not be eliminated as non-social media users may only be reached using traditional survey method.

7.4.5 Photography practice, image-based social media and everyday life

Taking digital images as proxies of landscape preference, the study is attentive to the production and expression of place-based photography in everyday life. Photography practice has been examined by a wealth of previous tourism studies (Conti & Heldt Cassel, 2020; Crang, 1997; Lo & McKercher, 2015; Urry, 1990; Zhang et al., 2019). Currently, with the proliferation of digital cameras and smartphones, taking and sharing photos is an increasingly popular activity in people's everyday lives (Shove et al., 2007). Some researchers have foregrounded the penetration of digital technology in everyday practices (e.g.,

photographing, communication and wayfinding) and thus their influence on the lived experience of places (Arts et al., 2021a; Liu, 2022). Leszczynski (2020) proposed a focus on “digital mundane” to examine interactions between digital technology and daily routines, ordinary sites in quotidian spaces. Given that photography is trusted as more “real” than text (Pittman & Reich, 2016; Sundar, 2008), photo taking and sharing form part of the imaginary of places (Degen & Rose, 2022).

Inspired by Urry’s theory of the tourist gaze, which depicts tourists’ pursuits as extraordinary, exotic experiences in opposition to everyday life, the study examined differences of landscape preference between tourists and residents by including a comparable number of tourists and residents in six case studies (section 5.3). The findings show that whilst residents and tourists had different visit strategies in urban parks, both were interested in taking photos of greenery features, water features and human-nature interactions, suggesting that the appreciation of natural landscape may be less influenced by a “tourist gaze” in comparison with iconic artificial structures (e.g., temples and arch bridges). This finding was also confirmed in the following semi-structured interview, in which residents stated that their preferred features of urban parks were related to vegetation and waterscapes.

However, it was natural that tourists took photos of symbolic objects in much larger numbers than residents, especially artificial structures. Therefore, hotspots of overall geo-tagged photos merely reflect visitation and space appropriation for photography practice, which was significantly influenced by place popularity. It is worth noting that photography practice and photo contents are only valid when examining landscape preference of visual social media users. Those who are not amateur photographers and sharers will be excluded in the research. Photographs are also influenced by standardized aesthetics and social norms regarding a beautiful landscape or a meaningful moment in

the processes of editing, applying filters and seeking for internet-famous places/spots (Arts et al., 2021b; Liu, 2022). These circulating visual contents may in turn reframe landscape preference and photography practice in everyday life.

7.5 Directions for future research

This research explores landscape preference through the lens of relationships between the everyday use of urban green space and the use of social media. In doing so, it reviews existing theoretical debates and empirical studies in landscape preference research, providing insights on landscape from the perspective of evolutionary theories and cultural preference theories. The rapid changes in urban landscape and shifting planning initiatives for liveability in Chinese cities means that there is more important work to be conducted to comprehensively understand landscape preference.

This work has investigated the relationship between visual social media use and urban green space use. Therefore, research could be done to further validate the interactions of this pair by considering other factors, such as gender, proximity to residences and types of urban green space. The thesis is particularly attentive to visual representations of nature experiences from Flickr. Due to the multitude of visual social media platforms, the representation of nature experience may be further examined by harvesting multi-sourced data, such as datasets from Instagram and Weibo. Given that Chinese people primarily use local social media platforms, such as Weibo (the Chinese version of twitter) and Dazhong Dianping (the Chinese version of Yelp), Chinese urban parks deserve a comparative study in terms of how nature experience is presented differently between social media platforms. Fewer investigations have related different affordances of these platforms with the representation of nature experience, and this could be expanded in further research. Moreover,

photo-taking behaviour is a way of interacting with natural environment but few studies have explored whether photo-taking behaviour causes negative outcomes among visitors who do not take photos. Lastly, only a few studies include everyday practice in examining the aesthetic appreciation of landscape. Thus, further research could gather more empirical evidence in different cultural contexts to this end.

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Appendices (another supplementary volume)

Appendix A: Explanation of Flickr API Method

Appendix B: Parameters of TRACCLUS

Appendix C: Popularity of parks

Appendix D: Online Questionnaire

Appendix E: General Spatio-temporal Patterns of Photo-taking Behaviour

Appendix F: Comparisons of Spatio-temporal Patterns of Photo-taking Behaviour Between Residents and Tourists

Appendix G: Top ten items of best describing each topic and proposed topic labels between advertised attractions and unadvertised attractions in ten urban parks