Using Social Media Data in Understanding Site-Scale Landscape Architecture Design: Taking Seattle Freeway Park as an Example

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Social media is a fast-growing area in built environment studies used to understand public opinions and landscape usage. As most literature focuses on regional topics, this paper marks a pilot effort to study site scale issues using social media data. Taking the Seattle Freeway Park as an example, 3414 Instagram posts from 2035 users for three years (2015-2017) were mined and categorized to answer two research questions: 1) how is Seattle Freeway Park used as a public space? 2) what are the users' emotional or affective ties to the built environment of Seattle Freeway Park? An analytic procedure for analysing and understanding site-scale crowdsourcing data was developed and introduced. The results bring new perspectives and insights about public space design by discussing the associations between park usage in terms of design features, publicity, and climate.

Keywords: social media; Seattle Freeway Park; brutalism; publicity; open space usage

Introduction

Recent decades have produced a boom in social media that enables people to share information and opinions by publicly posting textual (words, tags, and comments) or non-textual (pictures, videos or audio) data online. These supplies of huge, efficient, and ever-growing data has been taken advantage of by researchers to better understand the environment and society (Ratti, Frenchman, Pulselli, & Williams, 2006; Hansen et al., 2012). Since social media data are self-posted and crowdsourced, they are rich and complex in nature. Stories, facts, opinions, emotions, and moments are communicated and recorded, along with geo-locations, timestamp, and account information to the public. The data opens doors for analysis and research on numerous issues, such as socio-spatial inequality (Shelton et al, 2015),cultural ecosystem services (Guerrero, Møller, Olafsson, & Snizek, 2016), transportation patterns (Gal-Tzur et al., 2014), disaster relief (Landwehr & Carley, 2014), urban tourist behaviors (Yang, Wu, Liu, & Kang, 2017) , and human experiences in natural settings (Wood, Guerry, Silver, & Lacayo, 2013). These studies not only offer new understanding and strong empirical evidence of the issues of interest, but also exemplify the analytical procedure of using social media data.

However, the examination of human-scale designed landscapes, which constitutes the works of practicing landscape architects and urban designers, has been largely disregarded. Regional scale research provides understanding of landscapes and cities using a more summative mean (such as the cultural ecosystem services of different landscape types), which greatly benefits landscape planners, managers and policy makers (Chen, Parkins, & Sherren, 2018). But practicing landscape architects are more attuned to site-scale design literacy issues, such as activities, spatial experience, material, composition, etc. Studying people's preferences about natural scenery and

man-made structure could provide detailed design guidelines for design elements such as pathway textures, stair tread height, retaining wall colour, etc., which are more relevant to the realm of landscape architecture practice. Hence, empirical studies using social media data focusing on site-scale landscape designs are urgently needed.

Historically, the understanding of site-scale environment relied on data collected by methods of observation (Whyte, 1980; Zeisel, 2006; Cosco & Moore, 2007) and surveys (Giles-Corti et al, 2005; Schipperijn et al, 2010). Observation data record the visible behaviors of subjects while survey data reveal their invisible memory and opinions. Both methods collect controlled and structured data to describe built environment usage. However, both methods usually collect relatively small amounts of data sampled on-site in a limited time frame which might lead to oversimplification or consistency issues (Scrimshaw & Gleason, 1992).

On the other hand, social media data is made from users' self-motivated postings, with which researchers cannot intervene during the generation process but they can conduct data mining afterwards. The notion of equating big data with big knowledge was warned about by Pauleen & Wang (2017), since social media data only partially reflect the facts, demands, and opinions from the 'real world' (Daume, Albert, & Gadow, 2014). Compared with the traditional method that can provide an assortment of profound information, social media data capture facts but not the context of those facts (Boyd & Crawford, 2012). This information can therefore be too scattered to generate sound conclusions. Other scholars suggest a critical examination of database construction and analysis process to ensure a robust research design (Schofield, 2017).

Given the challenges stated above, the merits of social media are still promising. The high volume, variety and velocity of self-posting data (Holsapple, Hsiao, Pakath, 2014)

provide many opportunities for site level research such as post occupancy evaluation (Zimring & Reizenstein, 1980; Preiser, White, & Rabinowitz, 2015), site programming (Xun &Gao, 2001), and crime monitoring (Crowe & Fennelly, 2013). This study uses the Seattle Freeway Park in Seattle, WA, a well-known landscape architecture project, as the vehicle to explore site-scale landscape design issues with potentially greater accuracy and depth.

The Seattle Freeway Park

Figure 1. Seattle Freeway Park by Bo Zhang

Seattle Freeway Park (or Jim Ellis Freeway Park) is a 5.2-acre public space in downtown Seattle (Figure 1). It was built over Highway Interstate 5 and connects two areas which used to be isolated, downtown Seattle with First Hill. The park was

designed by Lawrence Halprin and Angela Danadjieva from the Lawrence Halprin Associates and opened to the public on July 4th, 1976.

We selected Seattle Freeway Park as a case study for several reasons. First, this park has the suitable size (5 acres) of a typical 'site-scale' designed landscape with simple programs. Second, it is considered a classical example in landscape architecture history. Halprin celebrated his design ideas of promoting 'form-giving potentials and their inherent qualities as works of art in the city' (Halprin, 1966, p. 2). The piled concrete blocks, countless level changes up to as much as 90 feet, zigzagging ramps, and dynamic water features emerged as innovative spatial design literacy at the time. As Hirsch suggested, these spaces 'recalled the history, the prehistory, the native ecology and the essence of the individual place, evoking a sense of *genius loci* and re-establishing a sense of order' (Hirsch, 2006, p.2).

Third, as the first open space to connect the freeway-segregated urban areas, Seattle park's 'experiential quality of landscape' (Hirsch, 2006, p.1) was repeatedly questioned by users, who believed that the design didn't promote outdoor activities but instead 'inspired fear and facilitated crime' (Mudede, 2002). The park was accepted as a premiere piece among landscape architects but this didn't convince the locals to admit it as a Seattle Landmark. The national Cultural Landscape Foundation lists Seattle Freeway Park as a cultural heritage at risk (The Cultural Landscape Foundation, 2006) because it has been challenged and suggested for demolition. However, a limited number of empirical research studies on the use of this park have been conducted. This study sheds light specifically on the contrasting opinions on the design features of Seattle Freeway Park. Two research questions are addressed:

- How is Seattle Freeway Park used as a public space?

- What is the relationship between built environment elements and human behaviours within Seattle Freeway Park?

Methodology

Instagram as a data source

We use Instagram data as the major data source to explore the usage and perception of Seattle Freeway Park. Instagram is by far the most popular free online service that enables users to instantly share photos publicly. Since it was launched on Oct 6th, 2010, Instagram has become the predominant online mobile application that focuses on sharing photographs and social networking, with 813 million active users by March 2018 (Statista, 2018). It is especially popular among younger generations, as 59% of 18-to-29-year-olds in the United States are reported to use Instagram (York, 2017).

Database Construction

In this study, we collected data from the location tag 'freeway park' during a complete three-year period from January 1st, 2015 to December 31st, 2017. We assumed that all data with the location tag 'freeway park' were taken in Seattle Freeway Park. All posts were fetched through the Instagram API and a customized Python program (Giannoulakis & Tsapatsoulis, 2016; García-Pablos, A., Duca, A. Lo, Cuadros, M., Linaza, M. T., & Marchetti, A. 2016). Each retrieved post included the photo and its metadata, such as the user ID, the posting date, the image caption, the hashtags and the post URL link. All this raw information was stored in different CVS files for later analysis.

Then, three data wrangling works were conducted. First, this study only focussed on single photograph posts and excluded those with video and photo album posts. Second,

all the hashtags were standardized by transforming from a string format to a list format that could be used for statistical analysis. Third, we assigned each post and its corresponding image a unique post ID. This post ID is the connection key to join attribute data such as the user ID, the posting date, the hashtags and the post URLlink as one entry list in our database (Figure 2).

postLink	timeImgText	idName	tags	postID
https://www.instagram.com/p/y23YuzR-5n/?taken-at=221935080	8-Feb-15	reed_kelly	['#seattle', '#concrete', '#architecture']	freeway4015

Figure 2. Inclusion of the photo and its metadata for each post.

Finally, there were 3414 Instagram posts from 2035 users included in the database. Most participating users were infrequent posters who made less than five posts. As Table 1 shows, 1535 users, or 75.43% of all users, posted one image; 448 users, 22.01% of total, posted two to five images; 52 users, accounting for 2.56%, posted more than five images with a total of 610 posts.

	Total Posts(3314)		Total Users(2035)	
Images Posts by single user	Number	Percentage	Number	Percentage
1	1535	46.32	1535	75.43
2 to 5	1159	34.97	448	22.01
6 to 10	267	8.06	34	1.67
11 to 20	201	6.07	14	0.69
>20	152	4.59	4	0.20

Table 1. Instagram posts included in the database and their users.

Photo Categorization

One major part of this study was the categorization of photos and hashtags. Instagram photos include those with human beings and with no human beings. The former reflects human activities in Seattle Freeway Park, while the latter records Instagram users' appreciation of park spaces or elements. There are also headshot photos that focus on the facial expressions which present human perceptions at the moment they were taken. Hence, we coded all 3414 photos into three major themes, including (1) activities, (2) objects/scenes, and (3) headshots. These three themes are not necessarily mutually exclusive; one photo can be coded into more than one theme.

A pre-categorization was conducted by two researchers independently going through 200 randomly selected photos using the categorization protocol. An average Cohen's kappa of 0.79 was tested (p-value < 0.001) indicating a significant level of agreement. The final categorization resulted in the following information (as outlined in Table 2).

(1) Activities. This includes photos of human subjects presenting their knees and hands, so we could identify their movements and activities. As shown in Figure 3, these images were further put into categories such as cosplay and imaginative activities (cosplay stand, spitfire), music and party (group dance, music, party), physical activities (jog, run, jump, yoga), and portrait photos (lying down, lean against a wall, sit, standing pose).

Figure 3. Exemplary photo of activity categories. Photographer's Instagram user names in parenthesis: cosplay & imaginative activities (duststormpettigrew); music & party (electromagicforce); physical activities(ryanmcintosh21); portrait (river.alexander).

(2) Objects/scenes. As shown in Figure 4, photos of this theme focus on various environmental elements which are coded into the categories of animals (dog, turtle), concrete structures (concrete scene, concrete and plants), natural scenes (landscape scene, grass, rockery, single plants), water (reflecting water, running water), sky (sky and clouds), entrance sign, details and artefacts (fabric, food, kite, chair), surroundings (highway, surrounding building).

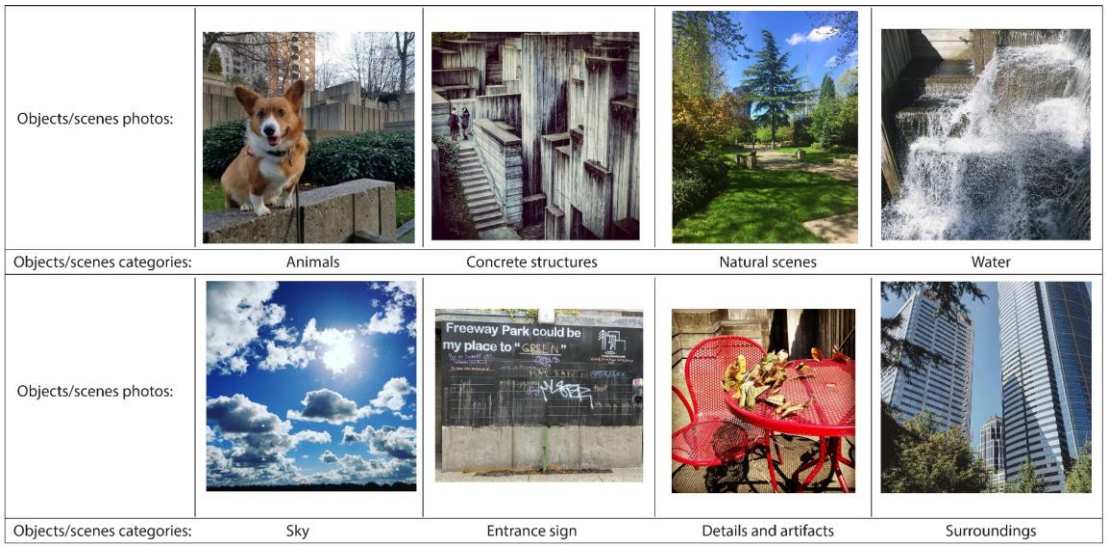

Figure 4. Exemplary photo of objects/scenes categories. Photographer's Instagram user names in parenthesis: animal (mariethecorgi); concrete structures (will.a.lane); natural scenes (sarah990); water (helenshin); sky (cjmooreorless); entrance sign(vasz_difference); details and artefacts (kthaima); surroundings(toekneebroils).

(3) Headshots. This theme focusses on facial expressions with the images having at least 5% of the image area as the human subjects' face. Based on earlier findings in psychological studies of smiling (Duchenne, 1990; Surakka & Hietanen, 1998), the Duchenne smile is a reliable indicator of enjoyment (Jaffe, 2011). As shown

in Figure 5, we categorized headshot images according to facial expressions such as: Duchenne smile (raised both cheeks and corners of mouth), non-Duchenne smile (only raised the corner of mouth), cool/neutral (no significant facial expression), and cosplay (with cosplay masks or makeup). All headshot photos were also coded for their background environments, such as buildings (>50% of background environment being buildings), concrete (>50% of background environment being the concrete scene), plants (>50% of background environment being planting), etc.

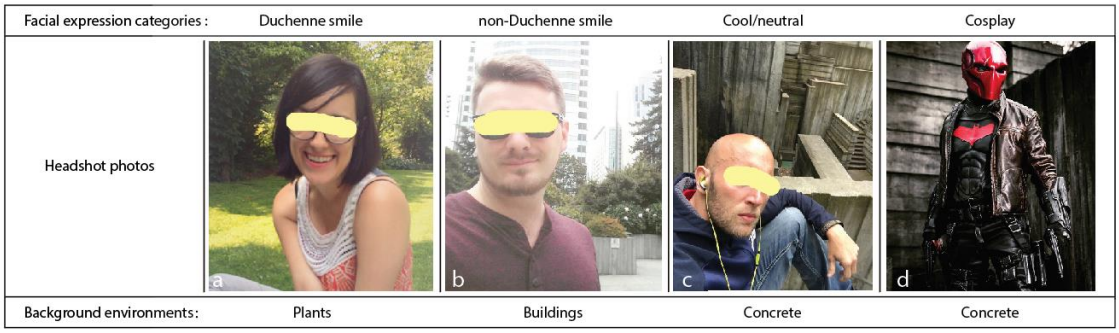

Figure 5. Examples of the categorization of headshot images. Photographer's Instagram user names in parenthesis: a: Duchenne smile (@dlesiak), b: non-Duchenne smile (@buildingwhisperer), c: cool/neutral (@wanderlustwestley) d: cosplay (@jordan.redhood1).

Hashtag Categorization

A total of 5468 hashtags (appearing in 3414 posts) were included in the database by using the data science package Pandas. Hashtag frequency was counted. For example, #happy appeared in 10 posts while #city appeared in 37 posts. In order to make the content more manageable and focused, the irrelevant tags to our research questions were deleted, such as (1) low frequency hashtags (the hashtag items with less than 10 posts are considered unimportant), (2) general location description hashtags (such as #Seattle, #freeway, #freeway_park, #washington, etc, which show little information about park

usage), (3) Instagram promotion hashtags (such as #instagram #instago #igers #igdaily, etc.), and (4) vague experiential description (such as #seattlelife, #citylife, #daily_life, etc.). In the end, 133 hashtag items were included, which appeared 2787 times in 1330 different postings (note that sometimes the same image postings had multiple hashtags).

The two researchers created lists of categories by repeatedly examining and comparing the sematic meanings and corresponding images of each hashtag. Through three rounds of individual works and group discussions,

a total of 2787 hashtags were grouped into three themes including activities, objects/scenes, and experiences. A detailed categorization was presented in Table 2. The theme of activities includes hashtags (e.g. #cosplay, #fitness) that depict human activities taking place in the park. They are coded into categories of cosplay and imaginative activities, music and party, physical activities, and portrait. The theme of objects/scenes includes the hashtags (e.g. #concrete jungle) that depict users' observations of the park space. The hashtags of this theme are further coded into the categories of animals, concrete structures, natural scenes, water, and sky. Different than photos which can only record activities and scenes, hashtags can express emotions and feelings (e.g., #love and #beautiful). Hence, a third theme of experiences included hashtags that reflected users' perceptions of the park. The hashtags under this theme were further coded into the categories of attachment, sense of season, sense of brutalism, sense of discovery, and sense of design.

Theme& Categories	Hashtags	Photo Contents
Activities: represents behaviors and events		

Cosplay&imaginative activities	#cosplay', '#smwaxpublicaspect', '#moodygrams', '#halocosplay','#illgrammers','#sakuracon','#shoot2kill','#cosplayer','#emeraldcity','#halo5','#foamarmor','#evafoam','#cosplayphotography','#halo','#haloreach','#foamsmith','#halo4','#haloarmor','#unsc','#xbox','#xbox360','#343industries','#ECCC','#girlswhocosplay','#halo3','#microsoft', '#teamairassault','#xboxone','#Cosplay','#halo2','#sakuracon2017','#blackrapid','#eccc2017','#foamgun','#fuelrodcannon','#girlswhoweararmor','#halospartan','#spartansneverdie','#RedHood','#foam','#pax','#videogamecosplay'	cosplay stand, spitfire
Music&Party	#music','#blues','#seattlemusic	dance,group dance,music,party
Physical activities	'#fitness','#training','#travel','#GetOutside'	jog run, jump, yoga
Portrait	#portrait','#makeportraits','#fashion','#model','#PursuitOfPortraits','#Portraits','#portraitpage','#ootd','#seattlemodels','#modeling','#portraitphotography','#moodyports','#seattlefashion','#streetwear','#heffnerscoutme','#highsnobiety','#iamsmg','#musemodels','#tcmmodels	foot, lie down, lean wall, sit, stand_pose
Objects/scenes: surrounding environments in beholders' eyes.		
Animals	'#dogsofinstagram', '#dogs', '#k5summer', '#king5seattle'	dog, turtle
Concrete structures	#architecture','#concrete','#skyline','#concretejungle','#sculpture','#archilovers'	concrete scene/concrete and plants
Natural scenes	#leaves', '#green','#flowers','#trees','#fallcolors'	landscapes,grass,rockery, single plants
Water	#fountain','#waterfall','#waterfeature'	standing water,running water
Sky	#sunshine','#sun	sky and clouds
Entrance sign*	none	entrance sign
Details and artifacts*	none	fabric,food,kite,chair
Surroundings*	none	highway, ,surrounding building
Experiences: categories about experiences, emotions or feelings		
Attachment**	'#beautiful','#love','#beauty','#amazing','#inspiration','#happy','#lifeisgood','#loveparks'	none
Seasons**	#spring','#autumn','#fall','#summer','#winter'	none
Brutalism**	#brutalism','#brutalist','#brutalistarchitecture'	none

Discovery**	'#findingfreewaypark','#pnwonderland','#wanderlust','#explore','#adventure','#exploremore','#KeepExploring','#createexplore','#exploreseattle'	none
Design**	#design','#landscapearchitecture','#modernism'	none

* are categories only appeared in Photo categorization, ** are categories only for Hashtag categorization.

Table 2. Categorization of hashtags and photos

Data Analysis

After the data categorization, we further defined our research questions as:

Question 1: How is Seattle Freeway Park used as a public space?

1-1 What are the main build environment elements the users interacted with?
1-2 What activities occurred in Seattle Freeway Park?
1-3 What are the temporal patterns of usage in Seattle Freeway Park?

Question 2: What are the users' emotional or affective ties to the built environment of Seattle Freeway Park?

As Figure 6 shows, our database includes (a) the categorized hashtag data and (b) the categorized photo data which are divided into themes of activities and objects/scenes (b1) and the headshot categorizations (b2). Then we conducted a categorical frequency analysis and a monthly distribution analysis with data a and b1 to answer Questions 1-1, 1-2, and 1-3. And we conducted the analysis of shared hashtag categories using data a, and the correlational analysis using data b.2, to answer Questions 2.

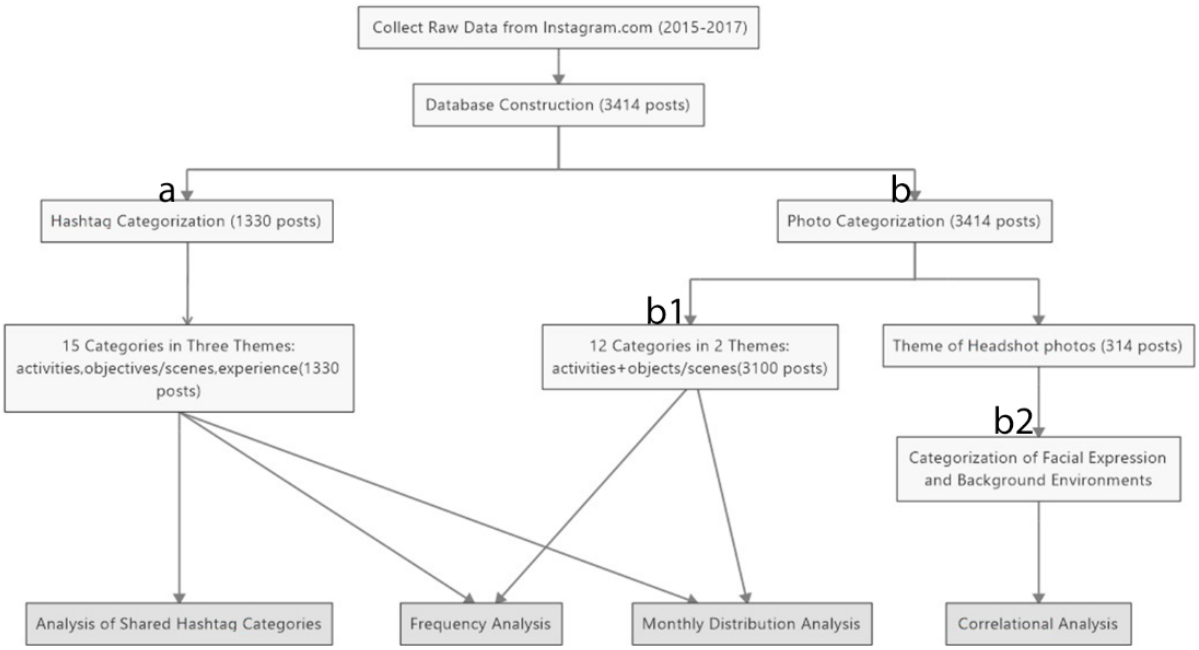

Figure 6. Data collection and analysis flow chart

Results

1. General Categorical Frequencies

The general categorical frequencies analyse the number of photos and hashtags in categories to answer Questions 1-1 and 1-2. Figure 7 shows the results for photo categories. Among the observed objects/scenes, concrete structure was the dominant element, followed by natural scenes and surroundings. Among activities, portraits outnumbered others such as physical activities, music & party, and cosplay & imaginative activities by about five times. Figure 8, showing the result for hashtag categories, presents similar patterns in the themes of objects/scenes and activities, in which concrete structures, natural scenes and portraits are also significant categories. However, cosplay & imaginative activities present stronger weight in hashtags than in photos. For the theme of experiences in hashtag categories, discovery was the major

category. Then, brutalism, seasons, and attachment varied with smaller numbers.

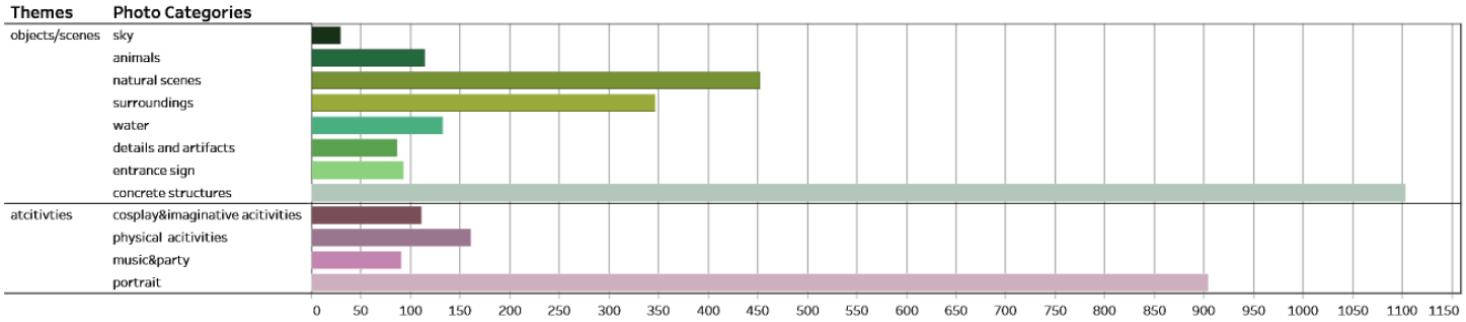

Figure 7. Categorical frequencies in photos

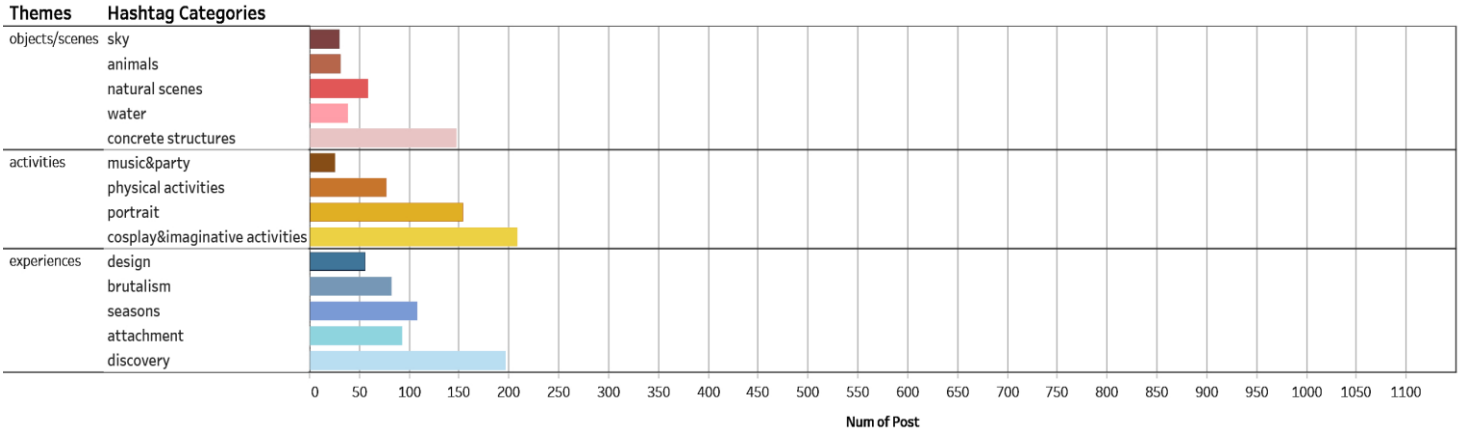

Figure 8. Categorical frequencies in hashtags

2. Monthly Distribution

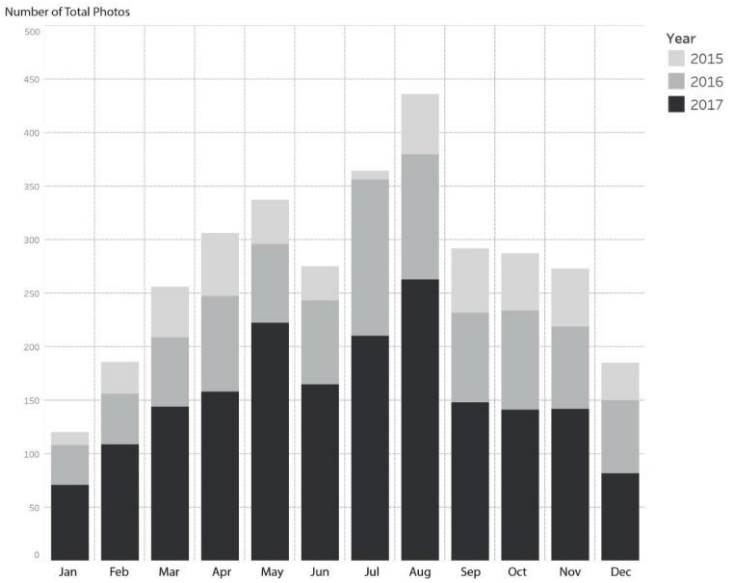

Figure 9. Monthly distribution of all the photos

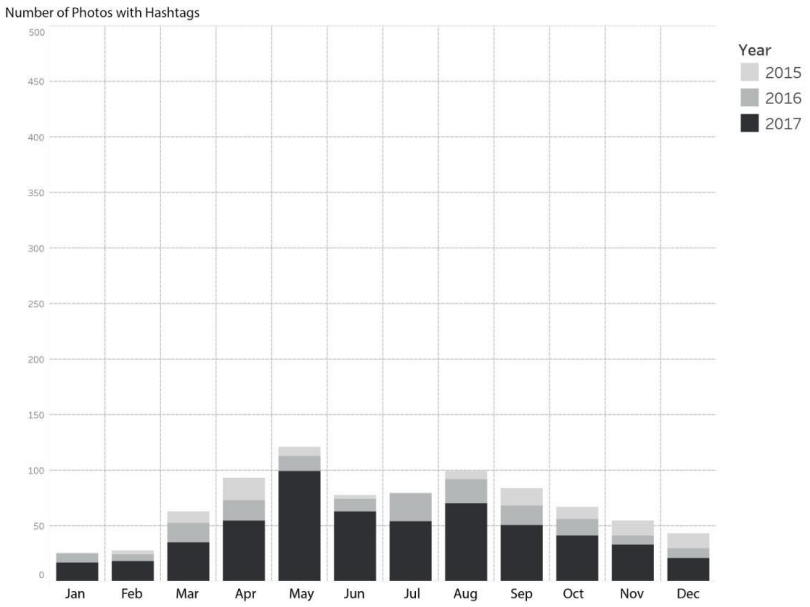

Figure 10. Monthly distribution of hashtags

Figure 9 and Figure 10 present the monthly numerical distribution of hashtags and photos to show seasonal variations, which answers Question 1-3. The results coincide with the weather data for Seattle (Figure 11), as the cold and rainy months are not suitable for outdoor activities. Both figures suggest that May (late spring) and August (late summer) are the two most active months of the year. May is the transition period between spring and summer with less rain and more blooming plants. August is also a transition month between summer and fall with the fewest wet days and optimal temperatures. As for seasons overall, spring and fall were the most active, followed by summer, with winter as the least active.

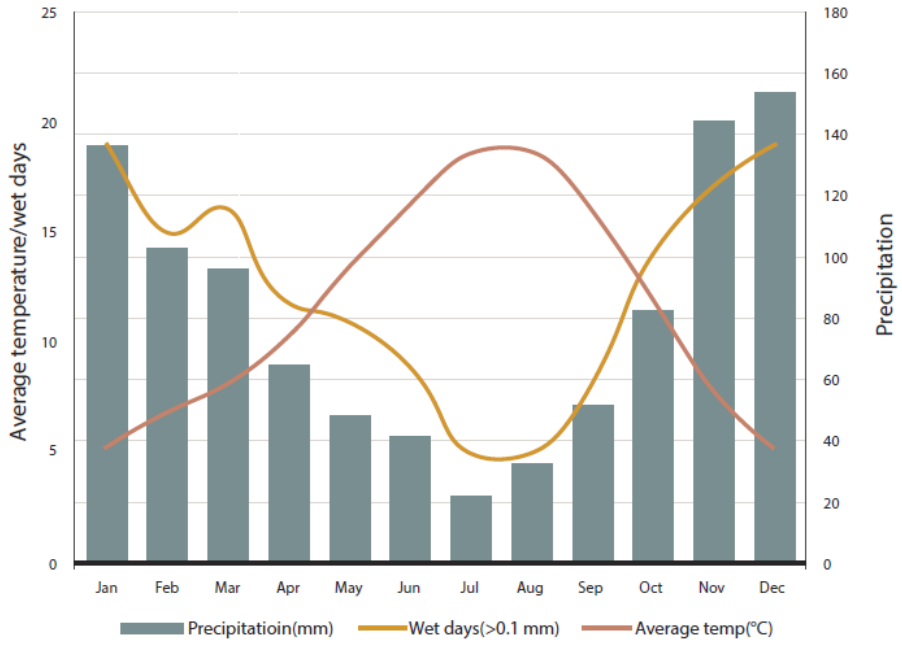

Figure 11. Basic climate summary of Seattle. Seattle, Washington Climate Graphs (n.d.)

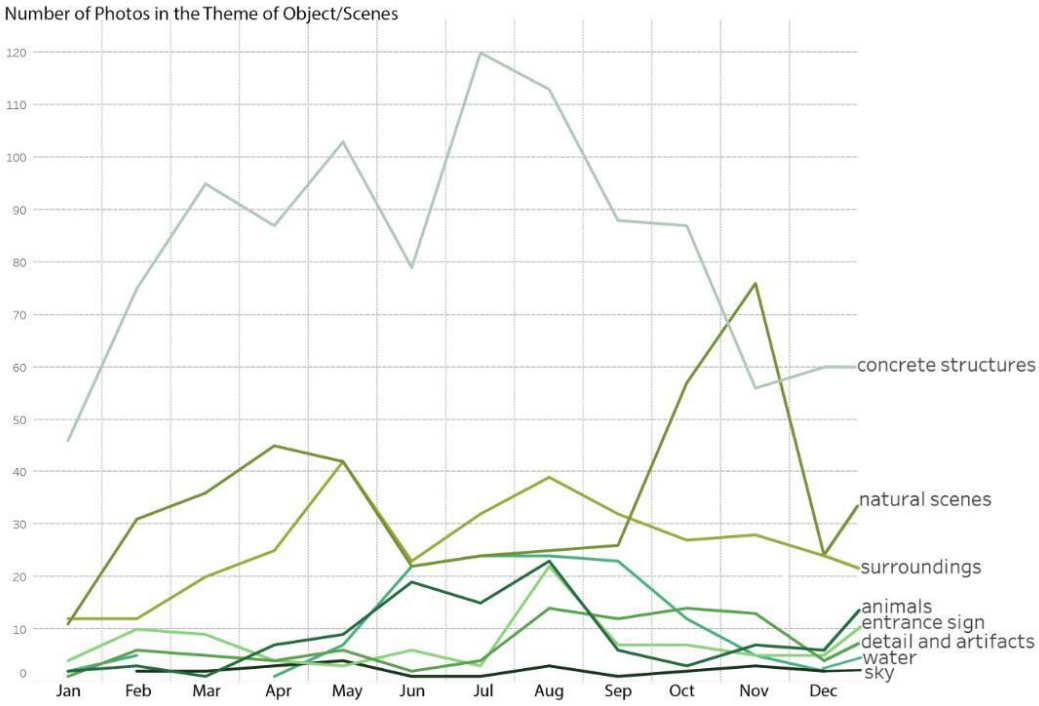

Figure 12. Monthly distribution of scene/object images in categories

Figures 12 and 13 present the monthly distributions of the Scenes/objects theme from

photo categories and hashtag categories respectively. Figure12 shows that concrete structures are the dominant scene of the posted images year-round. The second most significant element was natural scenes. They were mostly captured during spring and fall, with peaks in April and November. Photos reflecting surrounding environments (highway and office buildings) were posted all year round with peaks in May and August. Water features were captured mostly during the period from June to September, when the temperature was high and water features were open. Animal photos were posted mainly in summer, from June to August. Details and artefacts, such as chairs, food, and kites, were mostly posted in fall, from August to November. Sky was the least posted category, which was evenly distributed throughout the year. The entrance sign was also flat throughout the year except for a spike in August.

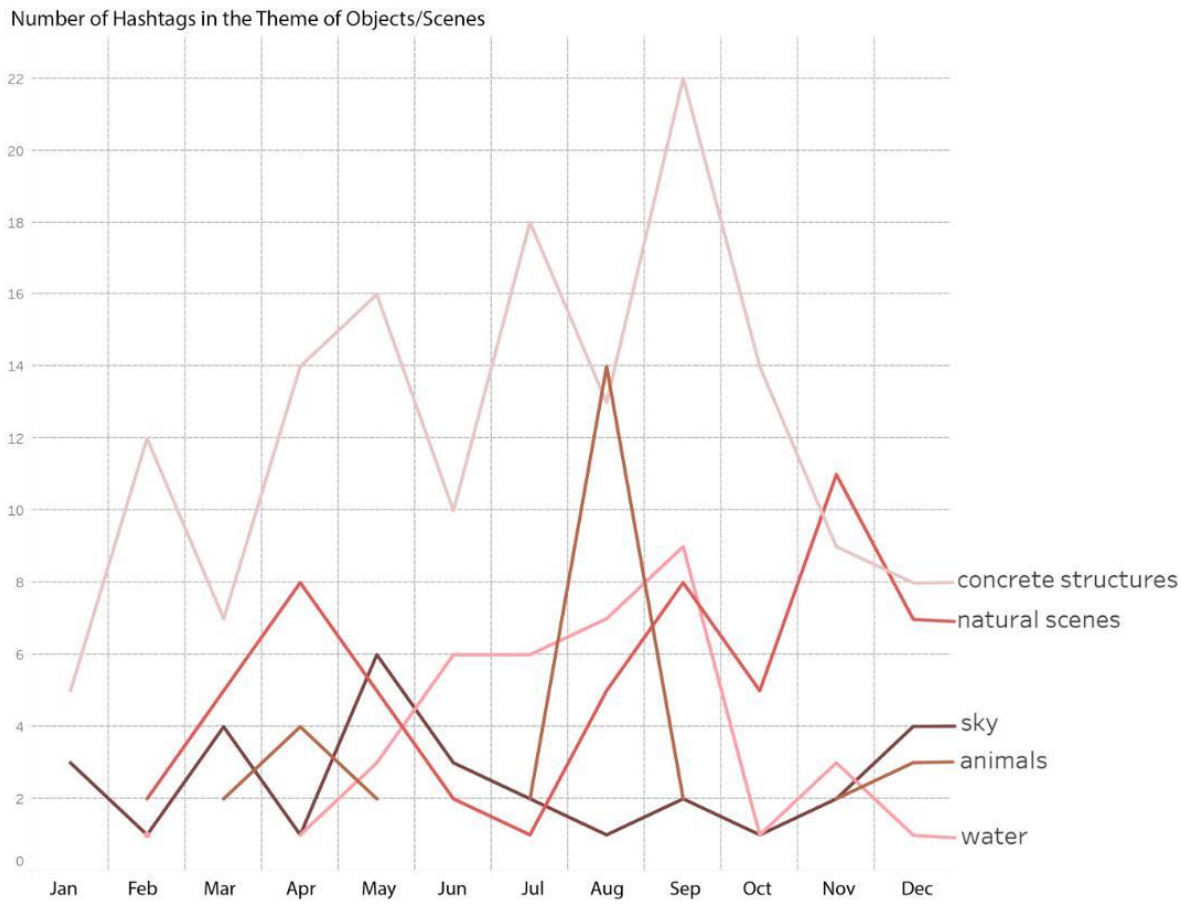

Figure 13. Monthly distribution of scene/object hashtags in categories

From the hashtag distributions of objects/scenes in categories presented in Figure 13, we can tell that concrete structures, water, and natural scenes generally comprised the three major elements that were tagged year-round. Concrete Structures were the dominant hashtag category, except in August and November. Natural Scenes were mostly tagged during spring and fall, with the peaks in April, September, and November. In mid-summer (June and July) while plants are lush but lacking seasonal features, natural scenes were not a noticeable category. It is speculated that natural scenes attract more attention when plants present seasonal changes. Water features present a strong presence during the whole summer season. In those high temperature days, people prefer to appreciate and interact with water more frequently. Sky as a fourth theme is noticed primarily during May and December when sunshine and clear sky are beloved. Then animals were mostly tagged in April and August.

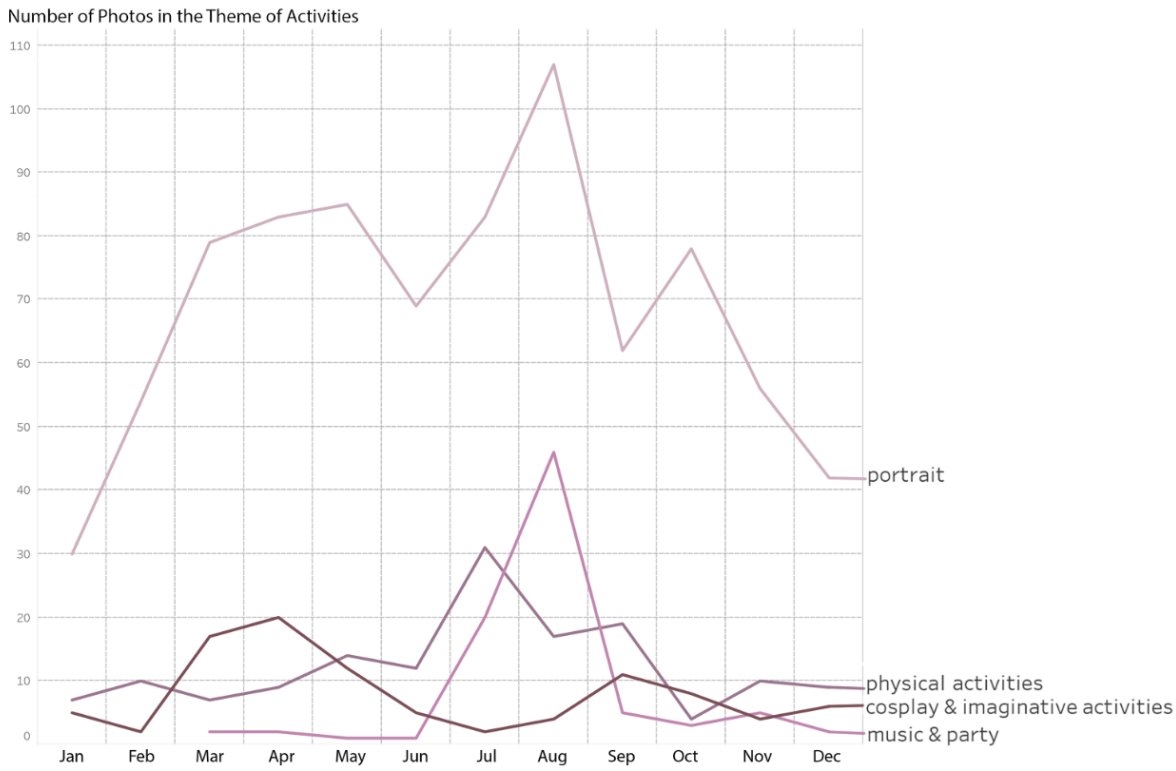

Figure 14. Monthly distribution of activity images in categories

Figure 14 presents the monthly distribution of the activities theme from photo categories. The category of people taking portrait images was the dominant activity, with three major spikes: in spring, August, and October. Physical activities were the second highest category, with higher intensity from May to October. The music & party category is generally inactive throughout the year except for summer, with a huge spike in August. Finally, cosplay & imaginative activities are active in spring and early fall.

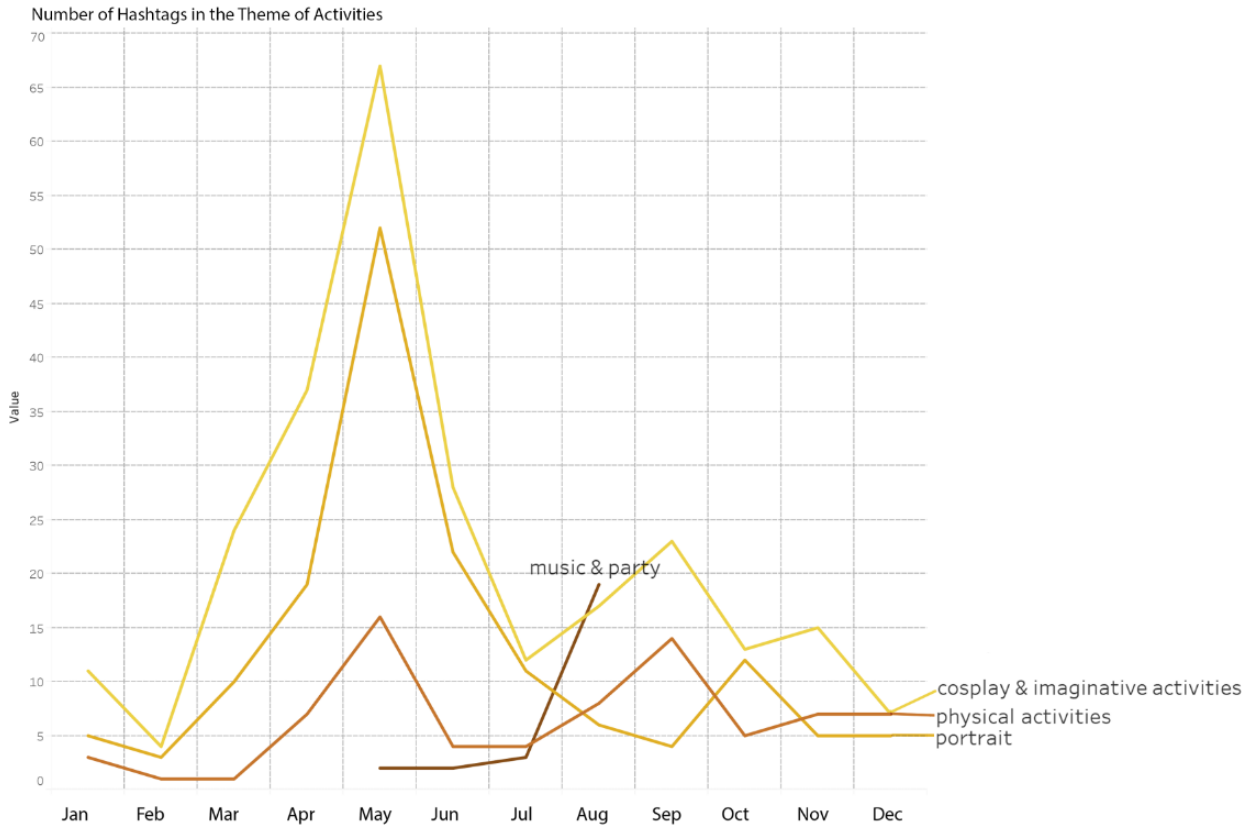

Figure 15. Monthly distribution of activity hashtags in categories

Figure 15 presents the monthly distribution of the activities theme in various hashtag categories. Cosplay is the most popular activity tagged in each month. The popularity increased dramatically from February, climbing to the huge spike in May, and then decreasing to a low level in July. Portrait images, as the second most popular hashtag

activity, almost follow the same pattern as cosplay, with a huge spike in spring. Physical activities also repeated the pattern of cosplay, with their popularity ranked third. In general, spring was the most active season, and in most areas greatly surpassed fall, the second most active season. The music & party category started in spring, with a spike in August. This is because there is a highly popular free concert in that month, which also caused the spike in the theme ‘animals’ in Figure 13.

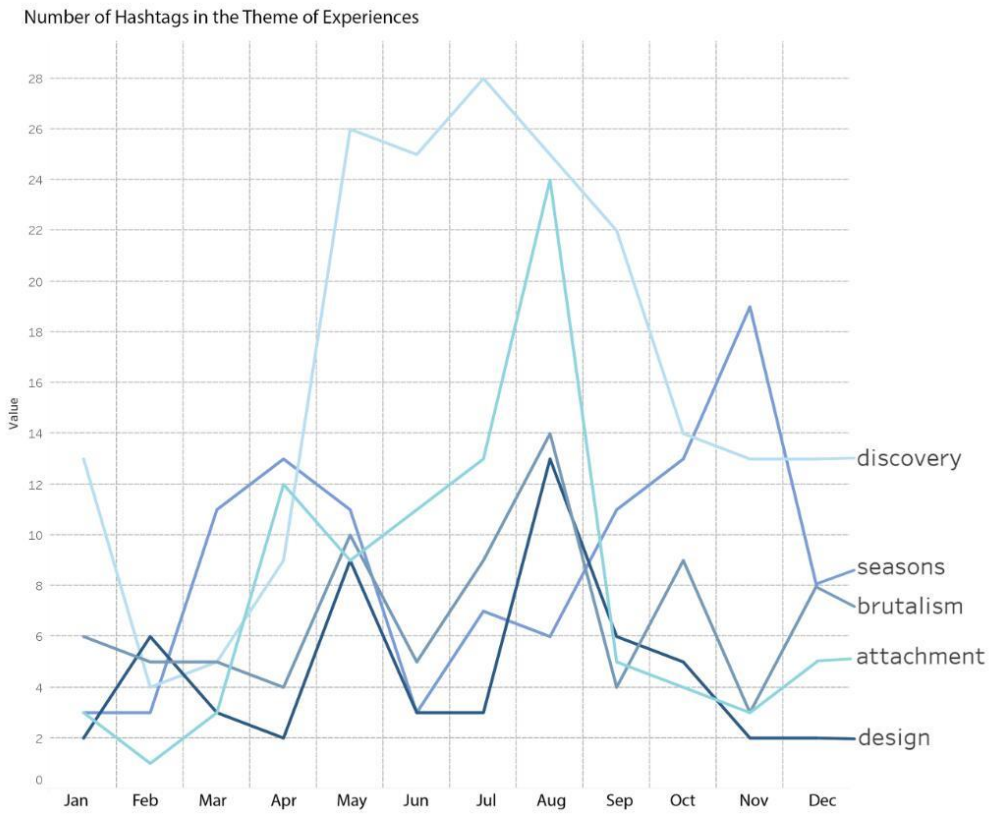

Figure 16. Monthly distribution of experience hashtags in categories

The monthly distribution of hashtags in the experiences theme is shown in Figure 16. This illustrates how users view the spaces in the Freeway Park throughout the year. The discovery category was the most evident experience category, especially during the period from May to September. The attachment category increased after February and peaked in August, which suggests that this is the most pleasing period for park visiting.

Next the season category was tagged most in March, April and November, which are the transition periods from winter to spring and from fall to winter. This pattern echoed the natural scenes category in Figure 13. Brutalism was surprisingly strong throughout the year. This was a category in which users specifically tagged words stemming from 'brutal'.

3. Correlational analysis of headshot images

A correlational analysis was done for the headshot images to identify associations between facial expressions and background(question 2). Since each profile image has been coded at two categorical levels with 0 (not shown) and 1 (shown), we conducted a chi-square test for all category pairs between facial expression (non-Duchenne smile, normal, Duchenne smile, cosplay) and background (buildings, concrete, plants). All the category pairs presented a Chi-square p-value<0.05 which indicates a statistically significant association for each pair. Then we did a Phi correlation analysis (3 x 4 table) for all the pairs to show the strength of association. The Phi coefficients are in Table 3. Based on suggestions by Cohen (1988, p.25 and 79), a Phi coefficient between -0.1 to 0.1 indicates few correlations, a Phi coefficient between -0.1 to -0.3 indicates small negative correlations, and a Phi coefficient between 0.1 to 0.3 indicates small positive correlations. Therefore, we see few correlations for most pairs in Table 3. Plants with Duchenne smile and concrete with cool/neutral showed small positive correlations; plants with cool/neutral and concrete with Duchenne smile showed small negative correlations.

This presents a strong pattern that demonstrates people tend to have a happier mood in the plants scene, while they seem to have a less happy mood in the concrete scene.

	buildings	concrete	plants

non-Duchenne	-0.06	-0.01	0.08
Cool/neutral	-0.03	0.1	-0.13
Duchenne smile	0.08	-0.13	0.12
Cosplay	0.01	0.03	0.03

Table 3. Correlation analysis results

4. shared hashtag category analysis

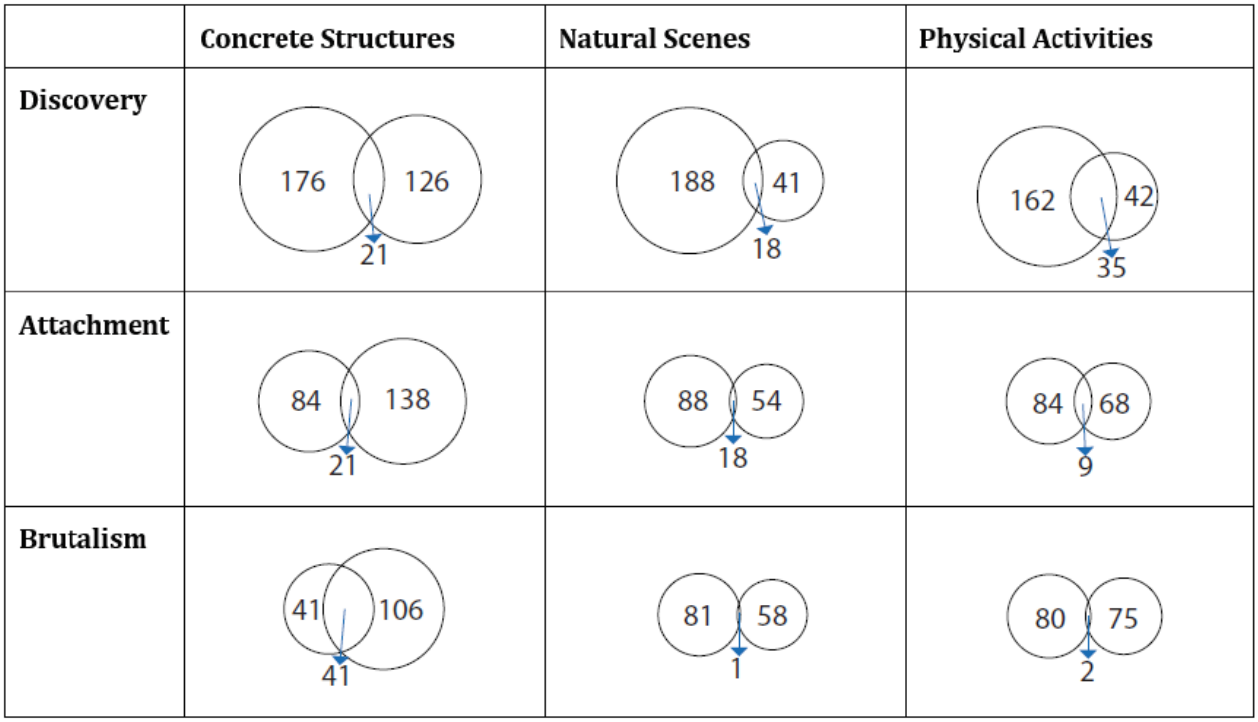

Figure 17 Bubble chart showing how different hashtag categories intersect.

To find out how different hashtag categories intersected with each other, we counted the posting numbers for shared hashtag categories. Specifically, we looked for the relationships between the hashtag categories in the experience theme including discovery, attachment, and brutalism, with the hashtag categories of concrete structures, natural scenes, and physical activities(question 2). Figure 17 uses a bubble chart to illustrate the number and shared portion of each category pair (the horizontal categories on the left, the vertical categories on the right). The overlapped area is the number of postings that included both hashtag categories. We discovered that most of the category

pairs have few overlaps; however, two pairs stood out:

(1) Brutalism vs. concrete structures: With 82 total posting from the category of Brutalism, 41(50%) are shared with concrete structures. This indicates users who hash tagged the brutalism category strongly related this with the concrete structures in Freeway Park.
(2) Physical activities vs. discovery: With 77 total posting from physical activities, 35(46%) are shared with discovery. This indicates that users who hash tagged the physical activities category in Freeway Park strongly related with the experience of discovery.

Discussion

By systematically mining, categorizing, and analysing the Instagram data with the location tag 'Freeway Park' in Seattle, findings of usage, observation, and perception of the public open space at site scale can be reached.

1. Design Features

The design features of Seattle Freeway Park are familiar to landscape architects, particularly for their recessed maze, artistically piled concrete blocks, sharply angled stairways, dynamic water features, and lush green plants (Olin, 2012). According to the result, the concrete maze was the foremost recognized design feature, as the 'concrete structures' surpassed all other designed elements year-round in both photos and hashtags (Figure 12, 13).

Figure 18. Exploration in the concrete maze by gr8hentai.

We think the concrete structures in Seattle Freeway Park as a design language have three characteristics. First, the concrete structures invoke a strong sense of ‘discovery’. The discovery category was the most tagged experience (Figure 16). Many unique spaces such as valleys, cliffs, turnings, and mazes in the park encourage the sense of exploration and curiosity (Figure 18). Physical activities are also a key category in the theme of activities (Figure 14, 15) which indicates that users like to explore the concrete maze. This echo the description in the 1976 Park Brochure, which suggests that the park has ‘many moods and balances the extremes of dynamic motion and peaceful reflection ... [The park] is filled with contrasts and surprises. Sometimes noisy and dramatic, sometimes calm and peaceful’ (Your Seattle Parks and Recreation, 1976).

Second, the term ‘brutalism’ represents the users’ perception of the concrete structures.

According to *The Concise Oxford Dictionary of Art Terms*, brutalism, a term coined to describe the Marseilles and Chandigarh architecture by Le Corbusier, denotes the rough and muscular character of chuck-sculpted concrete projects (Clarke & Clarke, 2010). This concept strongly resonated with the users in Freeway Park where brutalism as a hashtag category dwarfs other perceptions, such as attachment and seasons (Figure 16). A close relationship between brutalism and concrete structures (Figure 17) also confirm this experience.

Third, the 'concrete maze' is often not a pleasing environment (Figure 19). Our correlation analysis indicates that the concrete scene has a positive correlation to cool/neutral facial expression and a negative correlation to Duchenne smile (Table 3). The result calls into question the 'calm and peaceful' environment claimed in the 1976 Park Brochure (Your Seattle Parks and Recreation, 1976). A local writer suggests the concrete components of the park 'does not age gracefully but instead crumbles, stains, and decays' which therefore ends up being 'cold-hearted', 'inhuman', 'hideous', and 'monstrous' (Mudede, 2002). Though a landscape historian denies that there should be a superior alternative style (Hirsch, 2006), the empirical data of this study confirms the concerns about rough brutalist architecture of stains, moss, and coldness issues (Dalrymple, 2009).

Figure 19. Neutral expression in the concrete maze by bumblebeebeth.

The natural scenes in the park were also recognized by park users. The correlation analysis of the users' headshot photos showed that people were happier in the natural scene (Table 3), which confirms the results from previous studies (Ivarsson & Hagerhall, 2008). Moreover, the natural scenes category ranks as the second most popular category in the scenes/objects theme in posts of both photo categories and hashtag categories (Figures 12 and 13). However, we didn't see expressions such as 'peace' or 'harmony' found in the hashtags. It seems that the natural elements of the park don't counteract enough the bold and muscular aesthetics of concrete structures, and the park is perceived as a gigantic environmental art piece rather than a relaxing public place.

Water features are less attractive, and they only gain popularity during the summer (Figures 12 & 13). The limited running season, the closing of several pumps (Hirsch, 2006) as well as the low visibility from the circulation paths constituted the reasons for relatively low posting numbers in this category.

2. Publicity

Our analysis suggests a low degree of publicity for the freeway park. In all the activity categories, portrait images are the most posted category in photos and second in hashtags (Figures 7 & 8). Obviously, taking an individual photo in public spaces is a significant motivation for people who use Instagram. However, it is surprising that the music and party category was not significant in either photo categories (Figure 14) nor in the hashtags categories (Figure 15). Except for those in musicalevents, few photos about group activities were found. Hashtags about families, lovers, friends, kids, children, and elderly were rarely seen either. This reflected a shortage of group activities in the park, which contradicts the initial programming of the park design which claimed to engage diverse human groups.

Cosplay & imaginative activities were the most tagged activity category in the park year-round (Figure 15). Even though this category was overrepresented by cosplay enthusiasts, it still indicates the heavy use of cosplay activities. An online guide stated that the reason to set up the cosplay background was to create a fantasy world, in which the environment should be darkened as much as possible to increase the unnaturalness of the scene (Suna, Yu, Kanata, Genkosha Co. 2017). The deeply-recessed concrete maze of the park fits perfectly in this regard, as the introverted rough concrete maze presents a fantasy-like atmosphere that obscures sunshine (Figure 20).

Figure 20. Cosplay photo in the concrete maze by bats_edits.

The low publicity can also be traced to the park's introverted space characters. The recessed concrete maze has narrow pathways, up and down stairways, angled turns, obstructions, and enclosed retaining walls. These spatial designs encourage discovery (Figure 16), but also jeopardize the qualities of publicity, such as visibility, way-finding, and spatial understanding. Unfortunately, the width of the walkway and stairs, which are suitable for only one person at a time, excludes programs involving group activities (Figure 21). The park lacks a central open area that is easily visible and accessible from other areas in the park. The spaces are divided into segmented pieces by the dent-patterned paths and paved areas, which are difficult to accommodate large public events.

Figure 21. The narrow walkway and Stairs by sweetleaf.pnw.

3.Climate

Not surprisingly, the climatic factors have a decisive impact on the amount of Instagram postings throughout the year. The analysis on both photo categorization and hashtag categorization show that natural scenes are posted in greater amounts in the spring (Figures 12 & 13). Meanwhile cosplayers and portrait photo takers are more active, and the amount of physical activities increase during this same time (Figures 14 and 15).

Compared to the previous winter season, spring has less rain, has more comfortable temperatures, and has new sprouts and blooming plants (Figure 22). This significantly promotes park use.

Figure 22.The spring bloom by geekburger.

Fall is another strong season in tag numbers, but not as great as spring. Moderate temperature and fall color can be major factors that encourage the park usage. From the spikes in November of the natural scenes category (Figure 12) and the seasons category (Figure 16), we see a significant preference for the seasonal changes of vegetation such as the color, texture, scents, or vitality. In contrast, the posts about natural elements in summer were less than those in spring and fall (Figures 12 and 13), largely due to the

lack of seasonal change.

Conclusion

This study marked a pilot effort to use crowdsourcing data to evaluate a site scale landscape design. This expanded the current case study method in landscape research by introducing up-to-date Instagram data at the site scale to assess design programs and spatial qualities. This method can be an alternative way to understand and monitor the use of public spaces. Compared with research methods such as survey and on-site observations, this method has a large amount of data and participants included in the analysis but is also financially economic and less time-consuming. Moreover, the image data and hashtag data from Instagram in this study are actively generated by the participants without the researchers' involvement, so more specific or counterintuitive findings such as the perception of brutalism and the shortage of public usage are presented in this case.

An analytic procedure for Instagram data from 1) data mining and cleaning, 2) coding and categorization, 3) analysis and 4) interpretation was developed. The meanings of each Instagram post were deciphered through piece-by-piece reading and compared following inductive logic. Three themes and 17 categories were created (Table 2) and used for statistical analysis. This bottom-up rationale asks researchers to familiarize the data and is effective in finding graphical and semantic patterns in the data.

This paper has both theoretical and practical values for landscape architects. It not only presents the usage and perceptions of the park in a larger and more systematic manner, but also assists in confirming or disapproving of design claims, evaluating current landscape programs, and rewriting design guidelines. By examining Seattle Freeway Park, public space designers should be cautious when using rough materials, mindful of

too many introverted spaces, and give attention to the right scale for open space programs.

Delimitation

It is also worth noting the limitations of Instagram data. Most Instagram users consist of those in the younger generations. Therefore, other age groups, especially minorities, such as children, the elderly, etc, are less represented in this dataset. However, considering the increasing popularity of social media, more demographic groups will be represented by Instagram data in the future and this method will be more promising.

As Wang et al. (2018) suggests, social media users tend to post more attractive contents rather than contents reflecting daily usage patterns. Regular users may get used to the scenes, and majority contents are posted by one-time visitors. This could pose challenges for using Instagram data to understand public space. Therefore, more studies are needed to evaluate the difference between traditional methods (such as survey and observation) and using crowdsourcing data.

In the future, other individual-designed landscapes, such as parks, gardens, waterfronts, and natural reserve areas, under different cultural and ecological settings can be examined. With more cases accumulated, there will be more reliable findings to evaluate issues of interest in the built environment.

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