

Measuring the Subjective Value of Windowscapes: A Novel Method to Evaluate Urban Landscape Preferences

Leila Mirza¹, Michael Linzey², Hugh Byrd³

^{1,2} School of Architecture and Planning, NICA, The University of Auckland, NZ.

³ School of Architecture, University of Lincoln, UK.

¹Imir009@aucklanduni.ac.nz

TOPIC (CONTEMPORARY URBAN CULTURAL LANDSCAPE)

ABSTRACT

Landscape plays a crucial role in modern life for urban dwellers even though the majority of their time is spent indoors [1]. In this context, vision is the dominant sense that connects urban residents to landscapes. The visual quality of urban environments, consequently, can have a great influence on the quality of life. But how can visual quality be assessed? Research into urban landscape preference is relatively limited, and there are significant shortcomings with existing methods. For example, the method of asking people to rate photographs of the scenes cannot capture the subjective value of urban environments as experienced on a daily basis.

This paper presents a novel method, Active Perception Technique (APT), to measure visual preference for everyday urban scenes. Windowscape is used as a convenient, useful tool in this method. In addition to photographic evidence, APT uses graphic responses where participants are asked to draw from memory what they recall seeing of their windowscapes. APT is designed to identify the most and least visually preferred features of urban windowscapes, and hence how to combine common urban features to predict preference for windowscapes.

The method is demonstrated by studying postgraduate students of two Auckland universities. APT produced several original results. As one might expect, natural features of urban windowscapes were preferred over built ones; however, some natural features contributed more strongly to overall preference than others. Preferences for some features were found to differ across home and workplace windowscapes. Personal association with features was also found to impact on visual preferences.

Results obtained from APT can be useful for policy makers, and planners to enhance the visual quality of built environments. APT may also have other uses; including examining the perceived significance of cultural features in everyday urban landscapes. Furthermore, it can show how landscape preferences differ between populations, such as tourists and local residents.

KEYWORDS: Urban Landscape, Preference, Windowscape, Active Perception Technique

1 INTRODUCTION

The landscape contributes an important part to the quality of life for people everywhere: in urban areas as well as for those living out in the countryside [2]. However, the fact that most people are living in cities means that it is more important to focus on how the urban landscape affects the quality of life there. Urban dwellers spend the majority of their time indoors [1]; hence direct contact with the world outside is only a small part of their life. As a result, vision is the dominant sense that connects urban residents to landscapes. From this point of view, the quality of life of urban dwellers is associated with the visual quality of urban landscapes. However, this raises the question 'how do we measure the visual quality of landscape in an urban context'?

Assessing preferences for natural landscapes is an established field of study. It is, however, not clear if findings from these studies are applicable to urban landscapes [3]. Moreover, there is relatively limited research on urban landscape preferences [4]–[8]. Two reasons account for the lack of research in this area. First, urban areas have a highly complex structure, which makes assessing preference determinants difficult. Second, there are significant shortcomings with methods that have been used in studies of natural landscape preferences and hence it is necessary to question their applicability for studying urban landscapes.

Most studies into landscape preference have used experiments in a laboratory setting consisting of showing participants photographic images of scenes. Thus the experimental subjects did not have the holistic experience of the landscape, itself [9], [10]. Stamps [11] has identified over 1300 references that used photographs to evaluate landscape preference. Hence, very little is known on how real places are experienced [12]–[14], [10].

The method of asking people to rate photographs of the scenes cannot capture the subjective value of the urban landscape as experienced on a daily basis. In addition, "a photograph is totally unable to convey the life of the scene; [being] unable to discriminate; it merely records everything at one instant" [15, pp. 360–361]. Dearden [16] and Zube, Pitt, and Anderson [17] warn researchers to be cautious in their use of photographs and emphasise that photographs and actual environments are not completely interchangeable. Uzzell [18, p. 9] adds, "[i]t seems highly likely that the preferences expressed on the basis of two-dimensional photographs are different to those which might be made in situ". As Wohlwill [19] has rightly pointed out, a photograph cannot capture the ambience of an urban environment, which is composed of sonic and dynamic components as well as visual.

Although the results concerning validity of using photographs are inconsistent [11], [12], [20], [21]; much research in landscape preference continues to use static images. Research on urban landscapes has shown that urban images containing natural features (vegetation and water) are liked better than those without [22]–[25]. The presence of water features in urban landscapes is also found to have a positive effect on the economic values of properties [26]–[28]. However, open questions remain as to whether such results hold for actual scenes seen on a daily basis, and whether all natural features are equally preferred. Moreover, it is not yet clear how to combine common natural and built features to predict preference for urban landscapes.

This paper addresses the aforementioned limitations and gaps, with the objective of developing a novel method for measuring the visual quality of an urban landscape in a real context. Hence, the main research questions are:

- 1) How do urban dwellers perceive the visual quality of their everyday landscapes? and,
- 2) How to measure their urban landscape preferences in a real context?

The significance of this research rests on the fact that preferences reflect how well the given environments support well-being (e.g. [29], [30]). Being able to identify environmental characteristics, which can contribute to the enhancement of the visual quality of urban areas, will also be useful to policy makers, architects, urban planners, and environmental experts [31]. The result can help architectural and urban designers to provide urban environments, which promote psychological well-being.

2 ACTIVE PERCEPTION TECHNIQUE: AN OVERVIEW OF THE ORIGINAL METHOD

The central idea of the theoretical framework stems from research in environmental cognition, which claims that the real world is too complex to be processed completely by inhabitants. Hence, people create their own version of reality by selecting only those environmental features that produce affective responses. In this present work, it is similarly argued that viewing an urban landscape on a daily basis makes some features stand out more than others (depending on environmental and personal factors). Preferences held for these prominent perceptual features are proposed to be the determinants of preference for the overall landscape. The Active Perception Technique (APT) aims to capture these features and to explore the relationship between visual-quality values of these features and the overall view. As opposed to using photographs for environmental sampling, APT uses 'windowscapes viewed on a daily basis' as a convenient, useful tool. The main advantage of using window-views is the possibility to study the urban landscape in its real-context from the point of view of a building occupant.

APT originates from Kevin Lynch's [32] seminal work, 'Image of the City', and Nasar's (1990) study, 'The Evaluative Image of the City'. Because he was interested in how people make sense of the vast amount of visual information in a city, Lynch [32] asked research participants to draw a quick sketch of their city as if they were making a rapid description of the city to a stranger. Lynch's analysis predominantly dealt with the effects of physically perceptible objects and the relation between image and physical form. He [32, p. 6] proposed the concept of environmental image, a generalized mental picture of the exterior physical world:

Environmental images are the result of a two-way process between the observer and his environment. The environment suggests the distinctions and relations, and the observer...selects, organizes, and endows with meaning what he sees. The image so developed now limits and emphasizes what is seen, while the image itself is being tested against the filtered perceptual input in a constant interacting process. Thus, the image of a given reality may vary significantly between different observers.

Nasar [33, p. 42] argued "evaluation is central to our perception of and reaction to the environment" and Lynch's theory of the city image can be strengthened by measuring the emotional

meaning that an individual brings to the image. Nasar asked residents of two cities to identify areas that they liked visually and areas they disliked, and to describe the physical features accounting for their evaluation.

Nasar's concept of likability was used to develop the APT. The term likability refers to "the probability that an environment will evoke a strong and favourable evaluative response among the groups or the public experiencing it" [34, p. 3]. Likability derived from what Gibson has labelled affordance—the reciprocal relation between environmental properties of things and the active perceiver [35]. For instance, a road affords (supports) walking or driving. According to Nasar (1990), likability has two components imageability and affect. In other words, "for a favourable image, features must stand out as both memorable and likable" [34, pp. 60–61]. APT, accordingly, is composed of two parts:

- Capturing the imageable features of urban windowscape,
- Determining preferences for those features and their influence on overall windowscape preference.

Research participants were asked to sketch from memory what they could recall of the view from their window. It was stressed to the participants that their sketching technique was not important. They were required to number each feature of the view in the order that they have been drawn, and to express their feelings towards them on a Likert scale by annotating each with a letter: (A) for Strongly like, (B) for Like, (C) Not Sure, (D) for Dislike, and (E) for Strongly Dislike. They were also asked to evaluate the windowscape as a whole based using the same Likert-scale. These sketches were then compared against photos taken from the same view point in order to compare the actual with the perceived view.

2.1 Participants

The method is demonstrated by studying postgraduate students of two Auckland universities. A target population was identified as postgraduate research students, who had been assigned university workplaces in rooms with outdoor views. There is an advantage to using students as they have no vested interest in the workspace as employees might have (their response may impact on their job), and therefore the answers tend to be more objective. It was decided to use postgraduate students because they are the only students who are usually assigned workplaces at universities and spend most of their times within their workplaces.

158 postgraduate research students were interviewed. The gender distribution of the survey was well balanced with 51% female and 49% male. Most of the participants were in the age group of 26-35 (93 students, 59%); followed by the group <26 (48 students, 30%) and 11% were above the age 35. The study participants were ethnically diverse (32% Far East, 43% of European origin, 13% Middle East, 12% other).

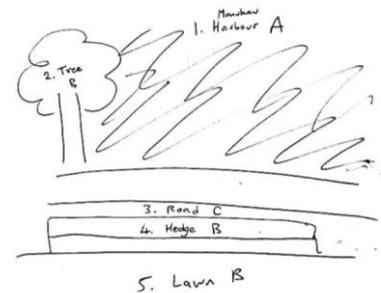


Figure 1 An example of the data obtained from the sketching exercise

2.2 Procedure

Face-to-face questionnaire-based interview sessions were used as a tool for data collection. The participants were self-selected volunteers following advertisement of the aims and objectives of the project. Recruitment was achieved by invitation via fliers, emails, Facebook, and universities' newsletters, or group presentation in the postgraduate student meetings. All those who responded to advertisements or submitted their email addresses were contacted to schedule a date and time for an interview.

Participants were presented with a regular lead pencil, eraser, and a set of coloured pens for the sketching aspect of the survey. No rules or guidance on how to draw mental images were given to the participants. The only restriction was that the image should not be copied from the outdoor view but drawn from memory. Participants were also supervised to ensure that they would not look out of their office window while drawing. If a lack of confidence with drawing skills were observed by the researcher or expressed by participants themselves, writing down the name of features instead of drawing them was allowed. However, only one participant chose to write some of the features names under her sketch without drawing them.

For the office-view sketches, participants were advised to draw the view they could see when they were sitting behind their desks. For the house views the choice of view was more complicated since the variety of participants' living situations meant that several had access to more than one window in their homes. In these cases, participants were advised to choose between their bedroom and living room view, to represent the one in which they spend most of their time. Participants were encouraged to talk freely during sketching. The interview typically took 20 to 30 minutes to complete. Photos were taken of their office window views by the first author, and the participants were requested to email the photos of home views.

2.3 Analysis

Following the data collection, all sketches were scanned and a digital library built by placing sketches and the corresponding photographs next to each other on one page using Adobe Photoshop CS6. To avoid identification, all respondents are referred to by code numbers. The montage collection of sketches and photographs together with participants' socio-demographic data-sheet was then uploaded into NVivo 10 for content analysis. Content analysis is an empirically grounded method, which has been widely used in the studies involving with visual data [36], [37]. The purpose of using content analysis was to identify the most common features within the views (e.g. trees, street, buildings). Frequency data generated by content analysis was analysed using SPSS. Statistical comparison was done by non-parametric methods (Mann Whitney U-test). For the statistical data analysis, responses were recorded as A = 5, B = 4, C = 3, D = 2, and E = 1. A p-value less than 0.05 was considered significant for all tests.

3 RESULTS AND DISCUSSION

The dataset comprises 158 respondents, 153 office-view sketches and 157 home-view ones, and 304 corresponding photos of the views. Missing data is because either a few participants did not have access to windows from their workplaces (n=5) or their places of residence



Figure 1 Word cloud of drawn/labeled features

(n=1), or they did not email their home-view photographs (n=6). On average four features were drawn in each sketch, and the results presented here are obtained from the analysis of more than 1240 drawn features. The collected data covers a variety of Auckland windowscapes. Figure 1 presents the word cloud of common features within the views in which font size is associated with relative frequency.

A summary of the preferences for each windowscape feature is presented in Figure 2. A straightforward result of this analysis revealed that urban natural features were preferred over urban built ones. Large bodies of water and the sky were the most preferred features within urban windowscapes. Similar results were reported by Howley and O'Donoghue [38] who asked their survey respondents to rate a list of 14 landscape elements based on how much they like each of these on a 5-point Likert scale. The researchers found that water bodies were the most liked landscape attribute, followed by hills/mountains.

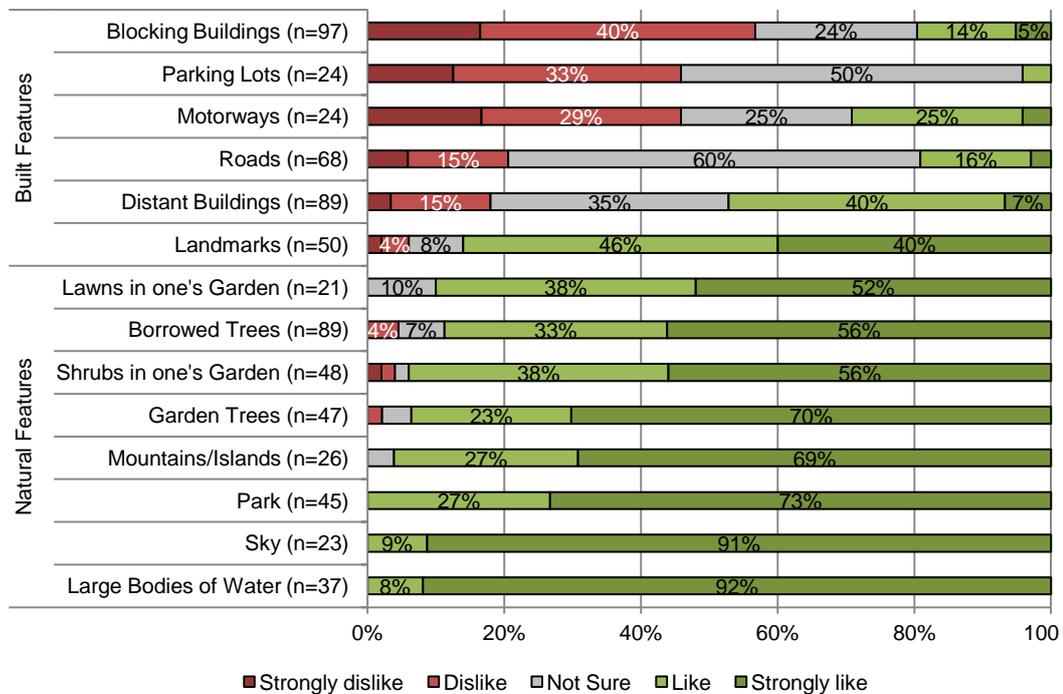


Figure 2 Feelings attached to the most common features of the view

Sky is the most under-researched feature in landscape studies as researchers using photo-protocol usually asked their respondents to rate the scenes without reference the appearance of the sky (e.g. [39]). This is because the presence of sky in landscape photographs is more related to photocomposition, and measuring its significance to landscape preference may not provide useful information using this method. However, APT reveals that the sky is considered as one of the most attractive features of urban landscapes. Preference to see the sky has been previously reported in a few window-scape studies (e.g. [40], [41]) and was linked to the preference to see the weather out of the window [41].

'Park land' was the most-preferred type of greenery rated by 73% as strongly like, followed by garden trees (rated strongly liked by 70%). The respondent's own lawns were the least preferred feature in urban natural category. This finding was in line with the results of a study on workplace window-views which found that flowers, trees, and park-like environment increased the odds of being satisfied with the views, however, no significant relationship was found between view satisfaction and presence of 'mowed lawns' [42]. The difference in preferences of tree and grass might be because the visual effect of trees is three-dimensional [43], and that they are relatively uncontrolled in their form (no straight edges). Instrumental functions of urban trees, shade and shelter, can also explain the reasons why trees are valued more than lawns (Gibson's [35] affordances).

One of the interesting and novel results obtained from the APT application was finding that personal association had an impact on preferences for greenery. For instance, the percentage of The respondent's garden trees rated as 'strongly like' was higher than borrowed (street or neighbour's) trees. Moreover, comparing photographs with sketches, all twenty-six participants, who could also see greenery outside of their garden, omitted it from their sketches (see Figure 3 for example). Street trees were positively preferred; median preference score for views with street trees (Mdn=4) and without trees (Mdn=4) were not statistically different, U-test=11537.5, $z=-.45$, *ns*. This result suggests that although street trees are visually valued, they are not as powerful as photo-protocol studies suggest in affecting preference visual quality of the urban landscape.



Figure 3 Omission of greenery that was located outside one's garden

Landmarks comprise those features in the sketches that were labelled and rated separately from other 'distant buildings' (buildings that were located in the far distance of the views) indicating that, in the eyes of the observer, they stood out from other buildings. These features are namely Auckland War Museum, Sky Tower, Harbour Bridge, Auckland City Hospital. Landmarks were the most preferred built features, rated as 'strongly like' or 'like' by 86% of participants. Landmarks were drawn with clear exaggerations (Figure 4) even when their silhouette was only visible on the horizon, suggesting their significance as an urban feature. Herzog, Kaplan, and Kaplan's [44] study on

familiar urban places revealed that pictures depicting cultural buildings (e.g. churches, an art

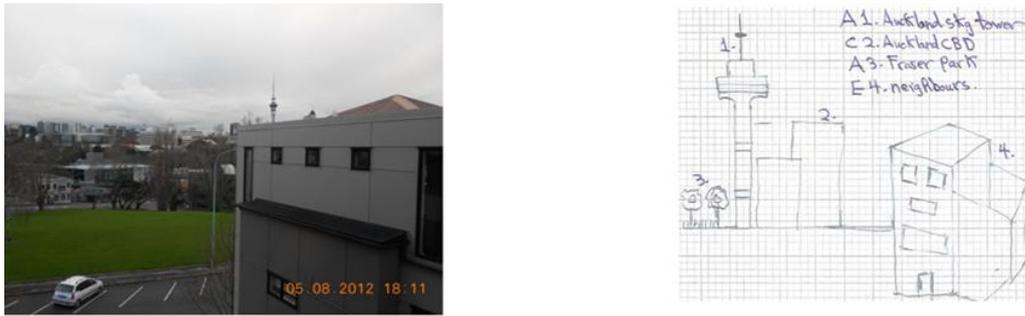


Figure 4 The sky tower has been exaggerated in the drawing. Compare the building in the foreground and the sky tower in the photo and the sketch.

museum) were relatively high in preference.

Parking lots and motorways created negative preferences in 46% of observers. The majority (60%) were indifferent to the presence of roads within their views. However, it was found that the percentage of roads negatively preferred was larger and significantly different in home views (33%) than in office views (9%), $U\text{-test}=390.5$, $z=-2.615$, $p<0.01$, $r=-.22$. Such a result is not surprising as the research conducted in real setting and aural components of the urban landscape can have an impact on visual preferences.

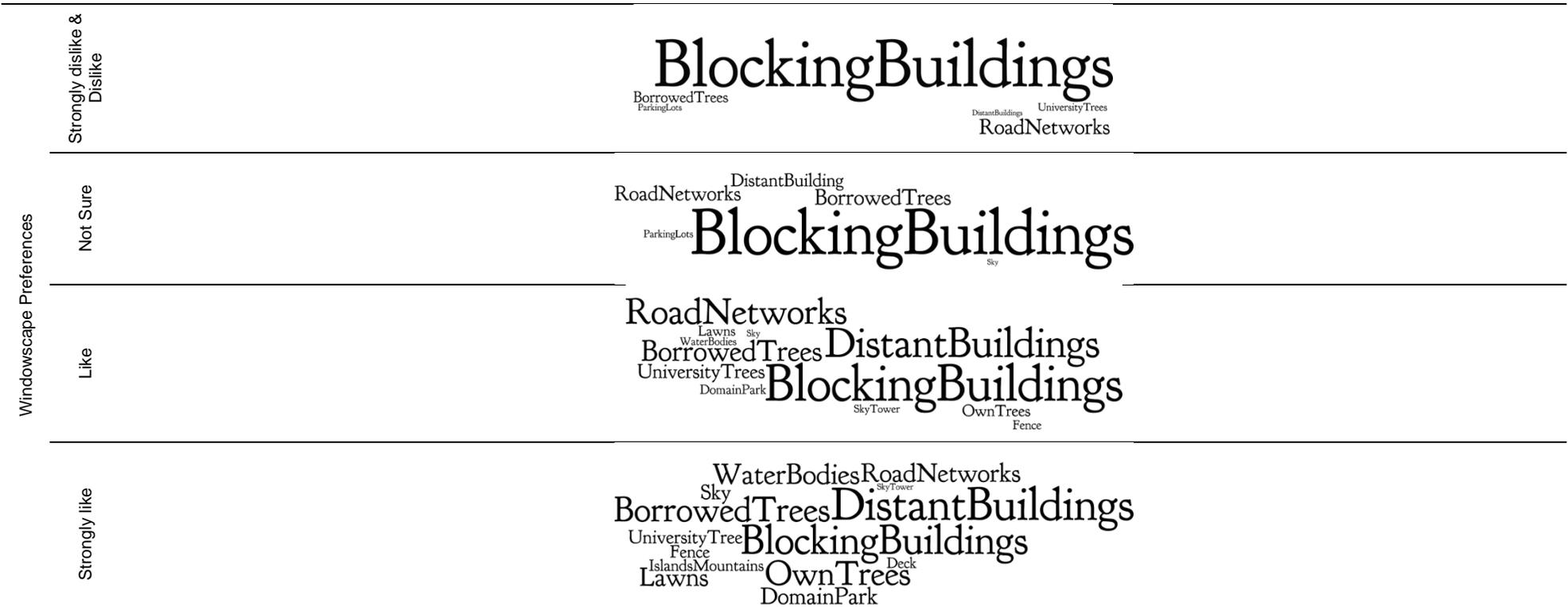
Blocking buildings (that were located in the immediate foreground of the views) were the least preferred feature with 56% rating them as disliked or strongly disliked. Similarly, a study on view preferences on human-made islands reported that the presence of residential buildings at a close distance were the most important determinants of a negative assessment of the view [45]. Herzog found that blocked urban scenes were rated lower in preference than photos depicting well-structured scenes with an intermediate level of openness [46].

3.1 The Effect of Features on Windowscape Preferences

An analysis of the frequency of the appearance of features in each preference group was carried out with the aim of determining if a combination of common urban features can be found for making predictions about windowscape preferences. For this analysis, all the features appeared in windowscapes rated as 'strongly like', for instance, were listed in a spreadsheet, and uploaded into NVivo. The result of this analysis is presented in Table 1. Looking at the word clouds (see Table 1), it is clear there are more features within the word clouds of 'strongly like' window-views compared to the ones in 'strongly dislike' & 'dislike' categories. This difference is because complexity, the average features in the view, has an influential factor on view preferences [40], [47]. As the research was mainly involved an urban situation, the presence of buildings within the views was inevitable. Accordingly, it is not surprising that blocking and distant buildings appeared in all types of windowscape with different preference scores. Blocking building is a prominent feature in strongly disliked and disliked category, while the percentage of the times this feature is mentioned decreases with an increase in positive preferences towards the views. In contrast, the number of times distant buildings are noted in the participants' sketches increases with increased preference for the views. This increase reaches the point where buildings in the far distance were more frequently mentioned in the strongly liked category than buildings in the foreground. This finding should not be taken to

mean that the appearance of distant buildings positively affects preferences for windowscapes. Since this research was conducted in an urban area, the presence of distant buildings merely indicates that these windowscapes were offering long views. The presence of road networks (driveway, road/street, motorway) in the views also seems to be a determining factor in windowscape preferences. Natural features are displayed with green colour in Table 1. As can be seen, there is a correlation between the percentage of the time natural features are mentioned in the views and preferences for the view. However, each natural feature seems to have a different power in affecting the windowscape preferences. For instance, own garden trees or the Park land have only appeared in the word clouds of liked and strongly liked categories, suggesting that their appearance is likely to be associated with positive preferences of the views. Borrowed trees, however, appeared in all the word clouds, which do not seem to be associated with windowscape preference. This finding supports the result (see Figure 2) suggesting that borrowed trees are one of the least preferred features of urban greenery.

Table 1 Word cloud of frequent features appeared in windowscape



Rank	Strongly Disliked & Disliked Views			Indifferent to the Views			Liked Views			Strongly liked Views			
	Features	N	%	Features	N	%	Features	N	%	Features	N	%	
1	Blocking Building	43	31%	Blocking Building	49	27%	Blocking Building	65	11%	Distant Building	37	8%	
2	Road Networks	17	12%	Borrowed Trees	17	9%	Distant Building	53	9%	Blocking Building	33	7%	
3	Borrowed Trees	17	12%	Road Networks	16	9%	Road Networks	46	8%	Borrowed Trees	28	6%	
4	Distant Buildings	5	4%	Distant Building	14	8%	Borrowed Trees	37	6%	Own (Garden) Trees	27	6%	
5	Parking Lot	4	3%	Parking Lots	8	4%	University Owned Tree	25	4%	Harbour	23	5%	
6				Sky	6	3%	Own (Garden) Trees	20	3%	Lawns	21	5%	
7							Cars	18	3%	Road Networks	21	5%	
8							Lawns	18	3%	Park	19	4%	
9							Park	17	3%	Sky	17	4%	
10							Fence	16	3%	University Trees	15	3%	
Total Number of Drawn Features		139	100%			184	100%			601	100%		

4 CONCLUSIONS

This study uses a novel method for measuring urban landscape preferences from the point of view of daily observers. Photographs still play a role as a research instrument in this study, though the use differs from photograph study protocols. Traditional protocols see photographs as a reasonable surrogate of the physical environment. In this research, photographs are considered to be tools, as an objective record of the view outside. Photographs capture exactly what is there to be seen, and a comparison between photographs and sketches indicates how a person perceives the view, which can contrast greatly with the reality documented in the photograph.

Participants in this study had visual contact with a view on a daily basis; therefore, the results reveal the reaction of participants to a three-dimensional, ever-changing environment. Results obtained from APT have a clear potential to be useful for policy makers, and planners to enhance visual quality of built environments and to provide more likable and liveable cities. It may also have an economic impact on the value of buildings. This has already been demonstrated for water views [27], [28]; so why not for preferred landscapes. It can also help to identify particularly influential features of urban landscape preference, and hence aid in the development of guidelines for improving the visual quality of cities. For instance, in this study it was found that trees that were owned by observers evoked a stronger positive effect than street trees. Therefore, it may be a better choice to leave maintenance of street trees in residential areas to the local community. However, it should be mentioned that the results present postgraduate students' preferences and may not be transferred to the general public. The current work would benefit by being repeated in different population groups.

Although this study demonstrated the method in the urban landscape, APT has a great potential to be used as a decision tool in cultural landscape management. For instance, as cities intensify one of the challenges in management of urban cultural landscapes is what to conserve. APT can help to identify significant cultural features in an urban environment; also can justify preserving existing view shafts to these features as the city intensifies. APT could be a tool for evaluating the difference between social and cultural landscapes and showing strengths and weaknesses of the visual quality of each. Such information can be used to improve the appearance of urban areas and make a more pleasant place to live.

In this research, a relatively homogeneous group (postgraduate students) were chosen to demonstrate the method. However, APT could be used to show differences in landscape preferences between differing groups, sub-cultures, and special populations. For instance, APT can compare preferences of tourists and local residents, which can guide urban planners and policy makers when allocating land to residential and touristic uses.

Although preference may compass other visual dimensions of urban cultural landscapes such as tranquillity and security, APT can be modified to measure these aspects too. For instance, APT can provide useful information about tranquillity values of visual contact with some cultural heritage such as mosques or churches.

REFERENCES

- [1] C. A. Shoemaker, Ed., *Interaction by Design: Bringing People and Plants Together for Health and Well-Being*, 1st ed. Wiley-Blackwell, 2002.

- [2] M. Déjeant-Pons, "The European Landscape Convention," *Landsc. Res.*, vol. 31, no. 4, pp. 363–384, 2006.
- [3] R. Home, N. Bauer, and M. Hunziker, "Cultural and Biological Determinants in the Evaluation of Urban Green Spaces," *Environ. Behav.*, vol. 42, no. 4, pp. 494–523, Jul. 2010.
- [4] M. P. Galindo and M. C. Hidalgo, "Aesthetic preferences and the attribution of meaning: Environmental categorization processes in the evaluation of urban scenes," *Int. J. Psychol.*, vol. 40, no. 1, pp. 19–27, 2005.
- [5] M. C. Hidalgo, R. Berto, M. P. Galindo, A. Getrevi, M. Ambiente, and C. Humano, "Identifying attractive and unattractive urban places: categories, restorativeness and aesthetic attributes," *Medio Ambiente Comport. Hum.*, vol. 7, no. 2, pp. 115–133, 2006.
- [6] I. C. Kaymaz, "Chapter 12: Landscape Perception," in *Landscape Planning*, InTech, 2012.
- [7] R. Crane and R. Weber, *The Oxford Handbook of Urban Planning*. Oxford University Press, 2012.
- [8] H. Hellinga, "Daylight and View: The influence of windows on the visual quality of indoor spaces," PhD thesis, Delft University of Technology, 2013.
- [9] M. V. Giuliani and M. Scopelliti, "Empirical research in environmental psychology: Past, present, and future," *J. Environ. Psychol.*, vol. 29, no. 3, pp. 375–386, Sep. 2009.
- [10] C. W. Thompson, "Landscape perception and environmental psychology," in *The Routledge Companion to Landscape Studies*, Routledge, 2013.
- [11] A. E. Stamps, "Use of Photographs to Simulate Environments: A Meta-Analysis," *Percept. Mot. Skills*, vol. 71, no. 3, pp. 907–913, Dec. 1990.
- [12] R. B. Hull IV and W. Stewart, "Validity of photo-based scenic beauty judgments," *J. Environ. Psychol.*, vol. 12, no. 2, pp. 101–114, Jun. 1992.
- [13] P. H. Gobster, "An Ecological Aesthetic for Forest Landscape Management," *Landsc. J.*, vol. 18, no. 1, pp. 54–64, Mar. 1999.
- [14] M. S. Myers and C. W. Thompson, "Chapter 3: Interviews and Questionnaires," in *Crossplan: Integrated, participatory landscape planning as a tool for rural development*, Simon Bell, Ed. Edinburgh: Forestry Commission, 2003, pp. 17–29.
- [15] D. C. D. Pocock, "Valued Landscape in Memory: The View from Prebends' Bridge," *Trans. Inst. Br. Geogr.*, vol. 7, no. 3, pp. 354–364, Jan. 1982.
- [16] P. Dearden, "Landscape Assessment: The Last Decade," *Can. Geogr. Géographe Can.*, vol. 24, no. 3, pp. 316–325, 1980.
- [17] E. H. Zube, D. G. Pitt, and T. W. Anderson, "Perception and prediction of scenic resource values of the Northeast.," 1975.
- [18] D. L. Uzzell, "Environmental psychological perspectives on landscape," *Landsc. Res.*, vol. 16, no. 1, pp. 3–10, Mar. 1991.
- [19] J. F. Wohlwill, "Environmental aesthetics: the environment as source of affect," in *Human Behavior and Environment*, New York: Plenum, 1976, pp. 37–86.
- [20] T. C. Daniel and M. M. Meitner, "Presentational Validity of Landscape Visualizations: The Effects of Graphical Realism on Perceived Scenic Beauty of Forest Vistas," *J. Environ. Psychol.*, vol. 21, no. 1, pp. 61–72, Mar. 2001.
- [21] E. H. Zube and D. G. Pitt, "Cross-cultural perceptions of scenic and heritage landscapes," *Landsc. Plan.*, vol. 8, no. 1, pp. 69–87, Feb. 1981.
- [22] T. R. Herzog, "A cognitive analysis of preference for urban nature," *J. Environ. Psychol.*, vol. 9, no. 1, pp. 27–43, 1989.
- [23] V. L. Sheets and C. D. Manzer, "Affect, Cognition, and Urban Vegetation Some Effects of Adding Trees Along City Streets," *Environ. Behav.*, vol. 23, no. 3, pp. 285–304, May 1991.
- [24] M. White, A. Smith, K. Humphryes, S. Pahl, D. Snelling, and M. Depledge, "Blue space: The importance of water for preference, affect, and restorativeness ratings of natural and built scenes," *J. Environ. Psychol.*, 2010.
- [25] E. V. White and B. Gatersleben, "Greenery on residential buildings: Does it affect preferences and perceptions of beauty?," *J. Environ. Psychol.*, vol. 31, no. 1, pp. 89–98, Mar. 2011.
- [26] J. J. Kim and J. Wineman, "Are windows and views really better? A quantitative analysis of the economic and psychological value of views," *Rep. Univ. Mich.*, 2005.
- [27] O. E. Samarasinghe and B. M. H. Sharp, "The value of a view: A spatial hedonic analysis," *N. Z. Econ. Pap.*, vol. 42, no. 1, pp. 59–78, 2008.
- [28] C. Y. Jim and W. Y. Chen, "Value of scenic views: Hedonic assessment of private housing in Hong Kong," *Landsc. Urban Plan.*, vol. 91, no. 4, pp. 226–234, Jul. 2009.
- [29] T. Hartig and H. Staats, "The need for psychological restoration as a determinant of environmental preferences," *J. Environ. Psychol.*, vol. 26, no. 3, pp. 215–226, Sep. 2006.

- [30] A. E. van den Berg, S. L. Koole, and N. Y. van der Wulp, "Environmental preference and restoration: (How) are they related?," *J. Environ. Psychol.*, vol. 23, no. 2, pp. 135–146, Jun. 2003.
- [31] L. E. Jackson, "The relationship of urban design to human health and condition," *Landsc. Urban Plan.*, vol. 64, no. 4, pp. 191–200, Aug. 2003.
- [32] K. Lynch, *The Image of the City*. Cambridge [Mass.]: Technology Press, 1960.
- [33] J. L. Nasar, "The Evaluative Image of the City," *J. Am. Plann. Assoc.*, vol. 56, no. 1, pp. 41–53, Mar. 1990.
- [34] J. L. Nasar, *The evaluative image of the city*. Sage Publications Thousand Oaks, CA, 1998.
- [35] J. J. Gibson, *The Ecological Approach to Visual Perception*. Routledge, 1986.
- [36] P. Bell, "Content Analysis of Visual Images," in *Handbook of visual analysis*, London; Thousand Oaks [Calif.]: SAGE, 2001, pp. 10–35.
- [37] R. Maggi and C. Scholz, "Finding the Invisible—Quantifying the 'urban beauty' of Dubai via content analysis of photographs," in *Instant Cities: Emergent Trends in Architecture and Urbanism in the Arab World.*, UAE, 2008.
- [38] P. Howley and C. O'Donoghue, "Landscape preferences and residential mobility: Factors influencing individuals' perceptions of the importance of the landscape in choosing where to live," *J. Landsc. Stud.*, vol. 4, no. 1, 2011.
- [39] R. G. Ribe, E. T. Armstrong, and P. H. Gobster, "Scenic Vistas and the Changing Policy Landscape: Visualizing and Testing the Role of Visual Resources in Ecosystem Management," *Landsc. J.*, vol. 21, no. 1, pp. 42–66, Jan. 2002.
- [40] T. A. Markus, "The function of windows— A reappraisal," *Build. Sci.*, vol. 2, no. 2, pp. 97–121, Jun. 1967.
- [41] H. Hellinga and G. de Bruin-Hordijk, "Preferences of office workers regarding the lighting and view out of their office," in *SOLG Symposium Light, Performance and Quality of Life*, 2008, pp. 26–29.
- [42] L. Lottrup, U. K. Stigsdotter, H. Meilby, and A. G. Claudi, "The Workplace Window View: A Determinant of Office Workers' Work Ability and Job Satisfaction," *Landsc. Res.*, vol. 0, no. 0, pp. 1–19, 2013.
- [43] Y. Aoki, Y. Yasuoka, and M. Naito, "Assessing the impression of street-side greenery," *Landsc. Res.*, vol. 10, no. 1, pp. 9–13, 1985.
- [44] T. R. Herzog, S. Kaplan, and R. Kaplan, "The Prediction of Preference for Familiar Urban Places," *Environ. Behav.*, vol. 8, no. 4, pp. 627–645, Dec. 1976.
- [45] I. Z. Kfir, J. Munemoto, O. Sacko, and Y. Kawasaki, "Evaluation of the view from the dwelling units on man made islands in Osaka bay. Multiple regression analysis based on residents' evaluation and image processing of photographs taken from the living room.," *J. Archit. Plan. Environ. Eng.*, no. 554, pp. 357–364, 2002.
- [46] T. R. Herzog, "A cognitive analysis of preference for urban spaces," *J. Environ. Psychol.*, vol. 12, no. 3, pp. 237–248, 1992.
- [47] B. L. Collins, "Windows and people: A literature survey," *NBS Build. Sci. Ser.*, vol. 70, 1975.