CITIES / Access to nature

Restorative values and cognition ability improvement effects of man-made park in Hong Kong downtown area

By Luyao XIANG (/profile/luyao-xiang) and Edward Ng
07 Jan 2020
0

This study sought to test two questions on man-made parks located in downtown areas: whether they're more restorative than built environments; and whether they're more helpful in improving cognition ability than built environments.

Authors of scientific paper:

LUYAO XIANG
PhD candidate, Chinese University of Hong Kong

(/profile/luyao-xiang)

EDWARD NG
Associate director, Institute of Future Cities, Chinese University of Hong Kong

(javascript:void(0))

Abstract

A well-designed outdoor environment gives people opportunities to enjoy spending time outside for stress relief and restoration. In this study, which took place in Hong Kong, a typical high-density city, participants (n=62, aged 21-34, m=27) were asked to walk two pre-defined routes – one through a man-made park, the other through a commercial/residential district – with measurements taken pre-test, mid-test and post-test. During the walking process, they stopped, observed and responded to the restorative scale. The results show the man-made park had a significant effect on restoring attention and improving cognition ability. Landscape type and arrangement are the dominant factors. The implications for urban design is to insert some small man-made parks into high-density urban contexts. The arrangement of landscapes and the sequence of nodes should be carefully considered.

Keywords

RESTORATIVE VALUE MAN-MADE PARK HONG KONG

Nowadays, the features of city living – high complexity, high heterogeneity and high rate of change – result in a higher prevalence of mental illness compared with rural areas.[1] We know, too, that the natural landscape plays an important role in the process of attention restoration and recovery from stress.[2–7]

This study sought to test two questions in relation to man-made parks located in downtown areas: whether they're more restorative than built environments; and whether they're more helpful in improving cognitive ability than built environments. To achieve this aim, 52 young adults in good health condition and living in Hong Kong were asked to walk two pre-defined routes: Tsim Sha Tsui (commercial area) – Kowloon Park Route; and Hung Hom (residential area) – Hutchison Park Route. Both routes feature two parts of built environment and man-made park. The participants were divided into two groups: group A walked the sequence of man-made park to the built environment; group B walked the opposite sequence. The two man-made parks include diverse landscape features: fountain, pool, shrub maze, tree array, falling water, sculpture square, Chinese classical pavilion, corridor and memorial building.

During the walking process, subjects stopped at predefined points and assessed the restorative value of the scenes using the Restorative Component Scale,[8] on which the restorative score of the scenes would be based. Attention ability and response time were used to measure cognitive ability. Pre-test, mid-test and post-test analysis were conducted to compare the cognition ability improvement effects from the built environment and man-made park.

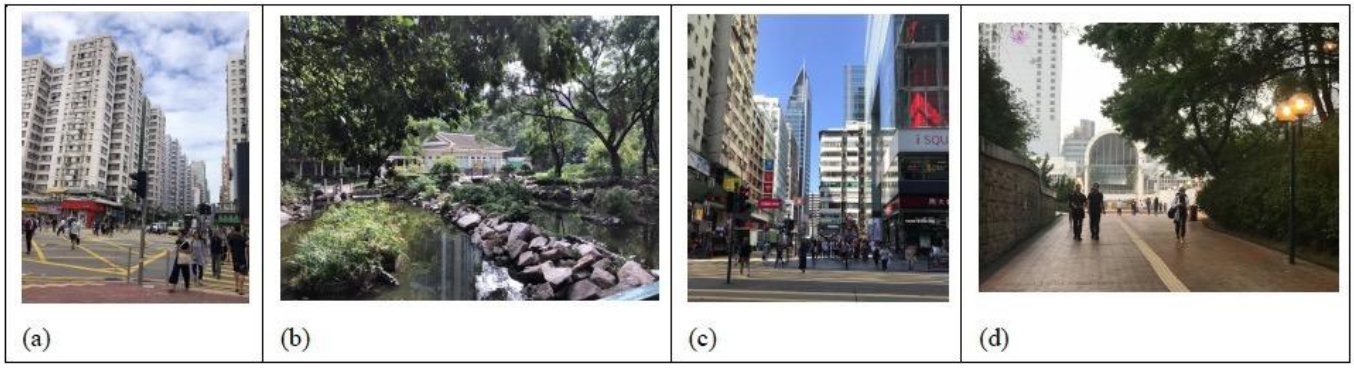
The results of the study have important practical implications for urban design. The current Hong Kong Planning Standard and Guidelines (HKPSG) state that urban design should "try to create, as much as possible, pedestrian-oriented and pedestrian-interested space in core areas"[9] but there are few detailed strategies on building an environment that can help people recover from daily stress. This study will not only enhance the current HKPSG but also encourage good design practice of psychological-friendly environments. Last but not least, Hong Kong is famous as a high-density city worldwide, so what can be applied here could also be replicated by other cities undergoing high-speed development.

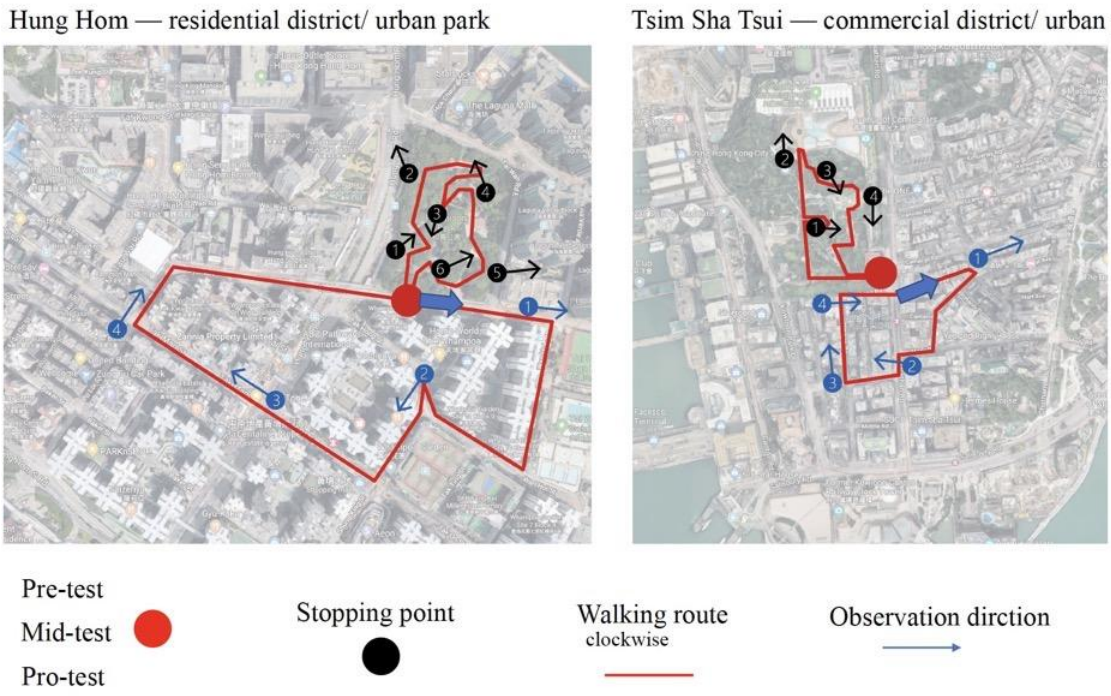
Materials and methods

Case study areas

The project involves two typical high-density blocks located in downtown Hong Kong as case study areas (Figure 1). Tsim Sha Tsui (TST) is famous as a commercial hub and attracts a huge volume of visitors every day. Hong Hum (HH) is a residential district, with a rich living atmosphere.

The TST route has two parts to it: one in a commercial area, the other in Kowloon Park. The HH route also consists of two parts: one in a residential area, the other in Hutchison Park. The length of the two routes is about 1.8km, and participants took about one hour to complete the experiment (walk, experience and answer the questionnaire).


(a) (b) (c) (d)



The two man-made urban parks are different in scale and style. Kowloon Park is the largest man-made park in Kowloon island and contains various types of landscape, including a square, large fountain, tree array, tree maze, pavilion, pond and rockery. In addition to the natural scenery, there are some exhibition areas inside the park. As the park is located in the commercial centre of Hong Kong, people visit the park for different reasons and conduct different activities. Much smaller than Kowloon Park, Hutchison Park is a typical Chinese traditional garden. Users of the park mainly come from the residential district nearby and conducted daily exercises in the park.

Participants

The participants (n=62, aged 21-34, m=27) were all young adults living in Hong Kong, with the mean length of their residency at 2.65 years. Most of them are familiar with the local environment but less so with the test areas. Some 32 participants took part in the experiment and followed the TST route, with 30 participants following the HH path.

Measurement tools

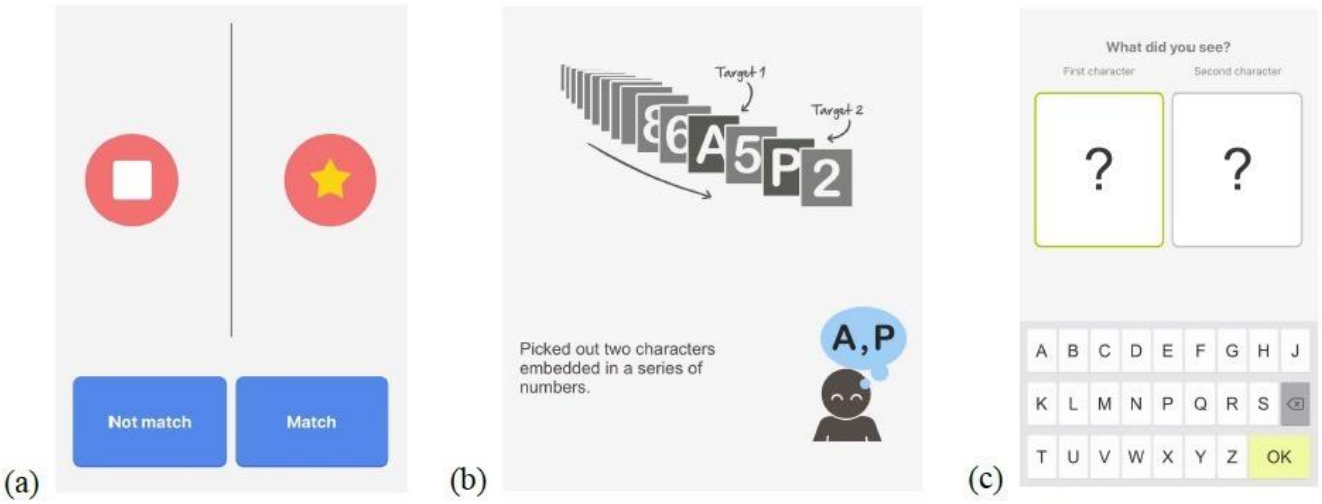
The Restorative Component Scale (RCS) is a five-pointer scale used to measure the restorative effects from the landscapes. The scale contains 18 items that can be ranked from completely agree (+2) to complete disagree (-2).

For this project, two perspectives of cognitive ability were tested (Figure 3): the cognitive reaction test (CRT) and attention blink test (AB). Each participant was asked to download a Boost Brain Power app on their own mobile phones several days before measurements were taken. The app offers three cognition tests: speed match (CRT), attention blink, and memorise cards (not applied in this project).

CRT is administered using a mobile screen with millisecond accuracy. Two images were shown on screen at the same time, and the participants are asked to decide if their contents are the same. The total assessment takes just 45 seconds to complete. If participants make the wrong decision during the test, the test will stop automatically and record the number of correct decisions as the CRT score.

The AB is defined as having occurred when T1 (target one) is reported correctly but T2 (target two) is inaccurate at short intervals, typically between ~100ms to 500ms. In the attention blink test, a series of images of numbers are shown on the screen at a very quick speed. Among the images, there are two letters. Participants are asked to remember the two letters and write them in the correct sequence. There are 10 subtests in AB. When people are under stress, they have difficulties to report T2 correctly.

The place make me far away from pressure in daily life.			
I feel I belong to the place.			
I can temporarily out of the daily routines.			
I can do what I like here.			
I am out of people's expectation here.			
The place make me far away from my responsibility.			
I want to stay here longer.			
The place recall me memory.			
The place is memorable significance.			
I am attracted by a lot of things without any effort.			
I have unexpected discoveries here.			
I feel the environment is boring.			
I feel the environment is monotonous.			
I can watch, listen, feel and think a lot here.			
The place brings freshness to me.			
I feel very annoying here.			
I feel the place is messy.			
The place consists excessive information.			
completely agree (+2)	Agree (+1)	Disagree (-1)	completely disagree (-2)

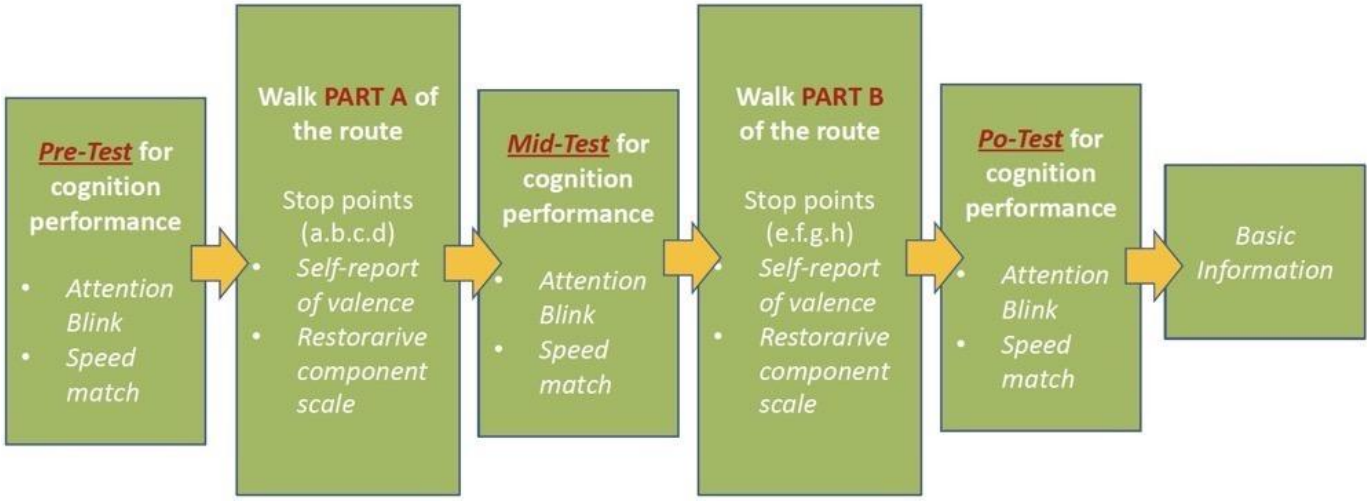


Experimental procedure

The experiment was conducted from October to December 2018. On each test day, two to four subjects were asked to walk the predefined route (TST/HH) in daytime. The instructor presented a basic introduction of the experiment to the subjects at a designated meeting place. The participants did the same test three times: pre-test before walking part A, mid-test after finishing part A, and post-test after finishing part B.

To exclude any influence from repeat practice, group one walked the sequence of urban–park, while group two walked the opposite sequence of park–urban. The route is designed as two loops, with participants carrying out the test at the same place. During their walks the participants were asked to stop at the predefined stop points (eight points for TS, 10 for HH) to experience the scenery for 10 seconds, and answer the RCS.

Once complete the participants provided their basic information (ie, gender, age, period of stay in Hong Kong, and familiarity with tested area).



Results and discussion

The average restorative effect score of all the urban points in TST is -7.1.

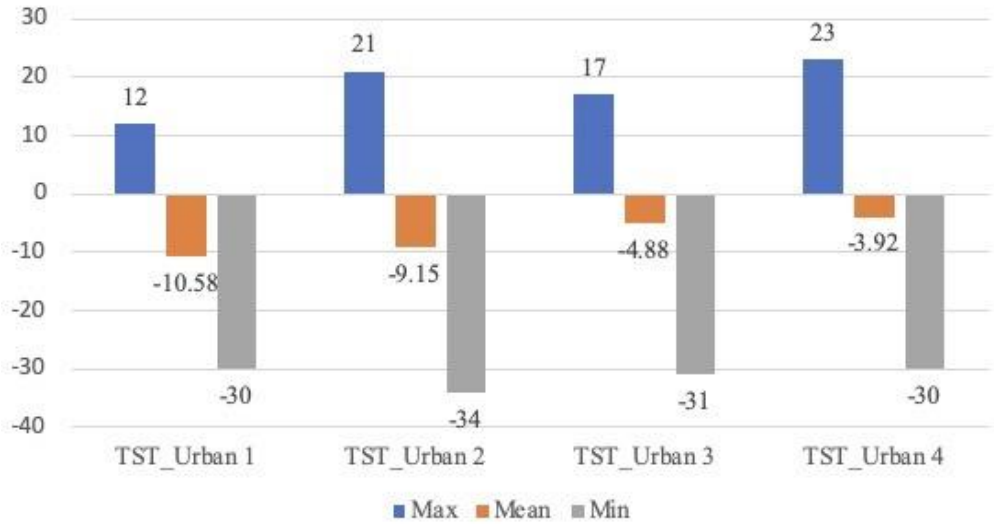
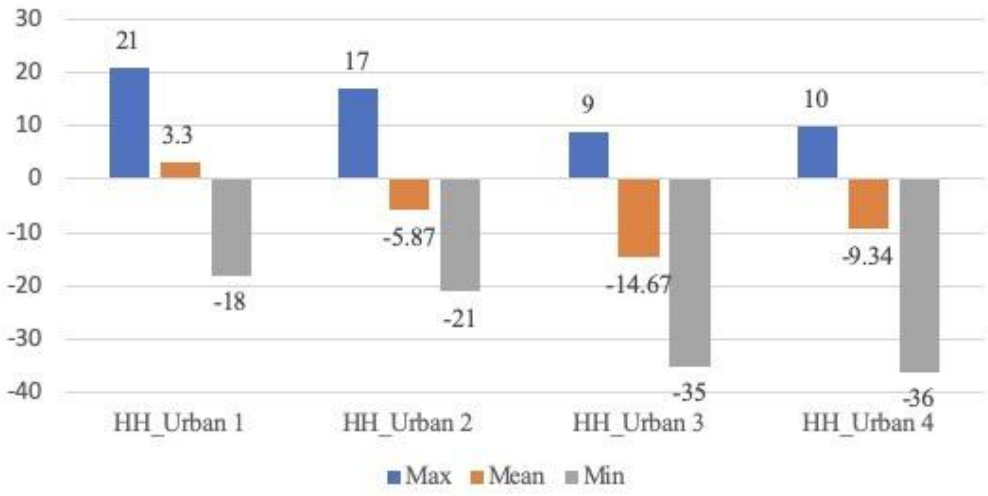


Table 1 indicates that TST Urban 1 has the lowest score (Re = -10.58) while Urban 4 has the highest one (Re = -3.92). Urban 3 and 4 have relatively higher scores than the other two points, owing mainly to the trees on one side of the street. In addition, when people have a visual target at a distance, they're more likely to experience positive emotion[10] and obtain more restorative resources to relieve their stress. The target distance in Urban 1 is the shortest and the building in front of the participants offers no traits of being a landmark.

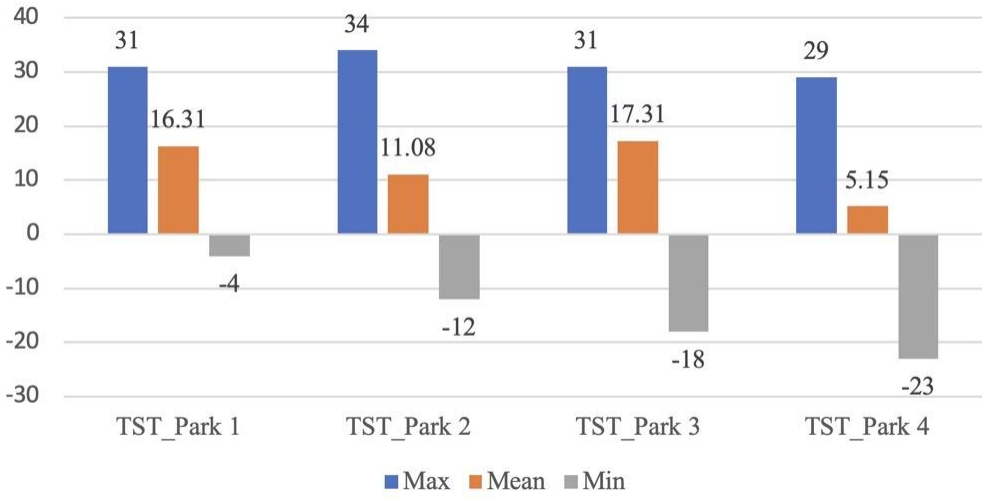
			
Urban 1	Urban 2	Urban 3	Urban 4

For the HH route, the average restorative effect score of all the urban points is 6.65, and the four points scores vary more widely than on the TST route. Urban 1 has the highest score (Re = 3.3) and is the only positive one among all the points. When people walked towards point one, people could see the sea at the end of the street. The score for HH Urban 3 (Re = -14.67) is the lowest for both routes. It's a large crossing with a lot of traffic and crowding. Urban 4, located near a busy market, has the second lowest score.

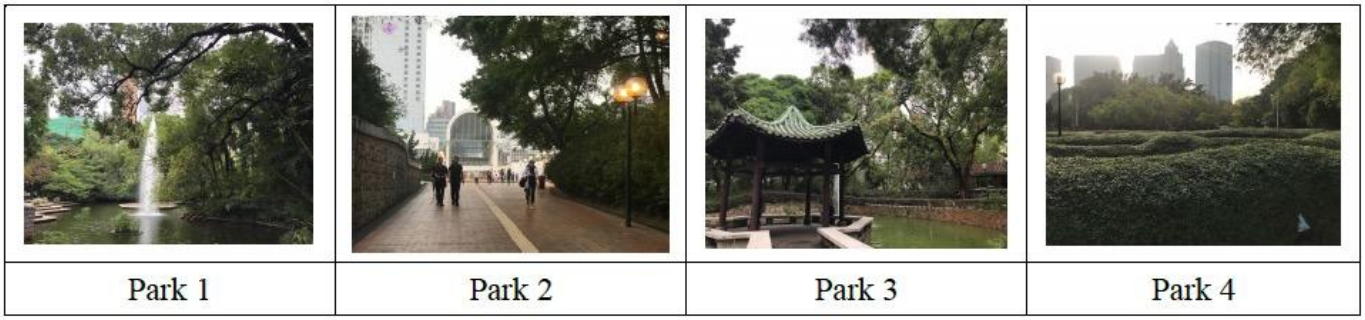


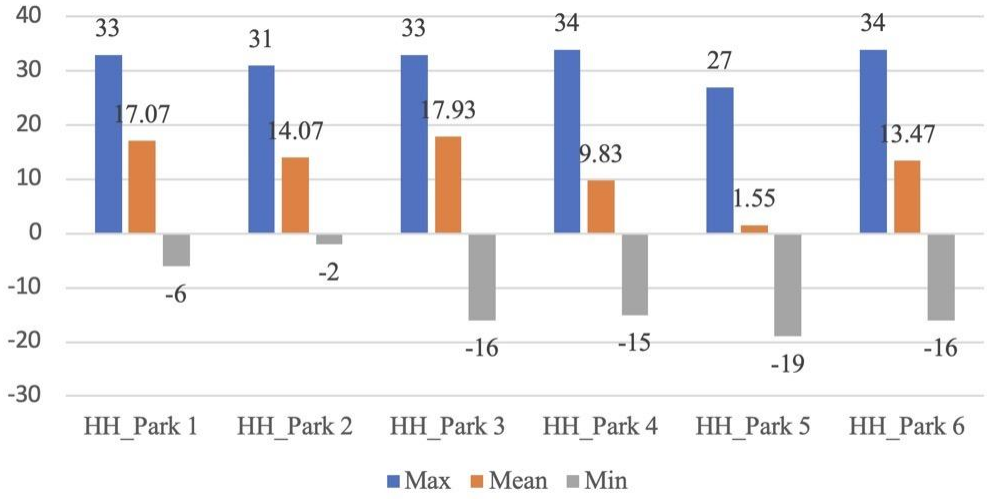
Results from man-made park

Kowloon Park is the largest in Kowloon Island, with a varied landscape. The average value of the points is 12.46. Park 3 (Re = 17.31) and Park 1 (Re = 16.31) have relatively higher mean values than others, and the presence of water is the common characteristic of the two points. Park 2 is higher than Park 4. Although there is no water landscape in Park 2, there is a special vision target – a building with a vaulted roof.



There are six testing points in the HH park (Re mean value = 12.32). Table 4 indicates the scores of Park 1 (Re = 17.07) and Park 3 (Re = 17.93) are significantly higher than others. Based on the experience from the TST route, water plays an important role in increasing the restorative effect score. The lowest score occurred at Park 5 (Re = 1.55), as the test point was located at the boundary of the park, and the noise from outside influenced participants' sense of restoration.





		
Park 1	Park 2	Park 3
		
Park 4	Park 5	Park 6

Comparison of the results from built environment and man-made park

Data from HH and TST show that people would have a greater restorative experience by walking through a park than an urban environment.

Although Kowloon Park in TST is much larger than Hutchison Park in HH, the former's restorative scores are lower than the latter's. This indicates that the size of the park is not the dominant factor of restorative effect; a bigger park doesn't necessarily provide more attention restorative resources than a smaller one, particularly if the arrangement and choice of landscapes aren't well designed and considered.

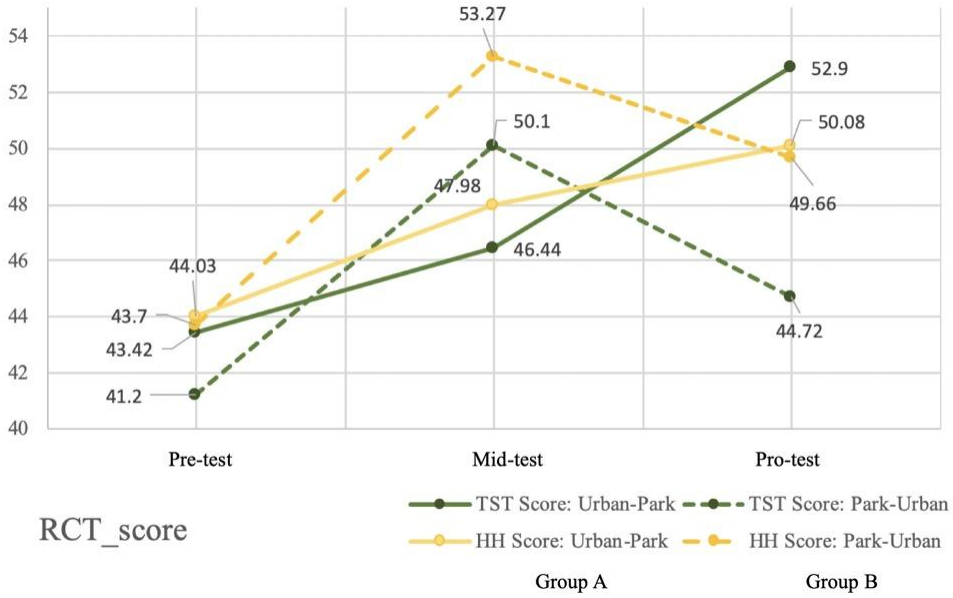
The urban part in the TST route has relatively lower restorative scores than the HH route. This is partly because the crowding density and noise in the commercial area are significantly larger than in the residential area. In addition, the appearances of the buildings in the TST vary across a wide range, with the facades much more complicated than the buildings in HH. The outlooks of residential buildings in HH are similar and the elements on the facade are uniformed. Lederbogen et al pointed out that the complexity of information within the built environment is a key reason why city living is stressful.

Cognition ability

The reaction cognitive test

A large number of studies[11-16] has shown that the natural landscape could improve people's cognitive function, such as capability of reasoning, problem solving, planning, abstract thinking, and so on. This project applies a cognitive reaction test (CRT) and attention blink (AB) test to explore the cognitive effects from experiencing different urban contexts.

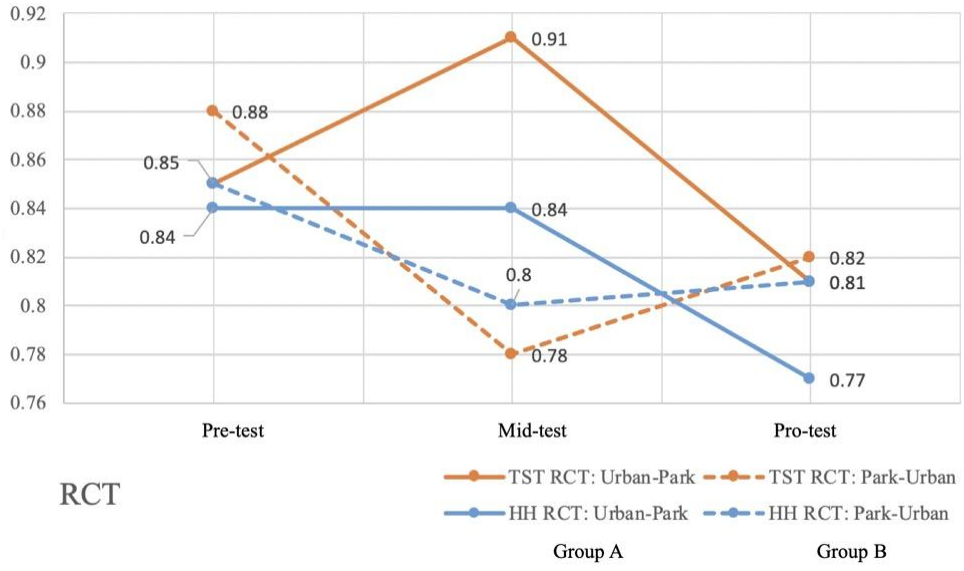
Reaction time refers to the amount of time that takes places between when we perceive something to when we respond to it. Therefore, quicker reaction times mean people perceive, process and respond to the information more efficiently and have better cognition ability.



RCT_score

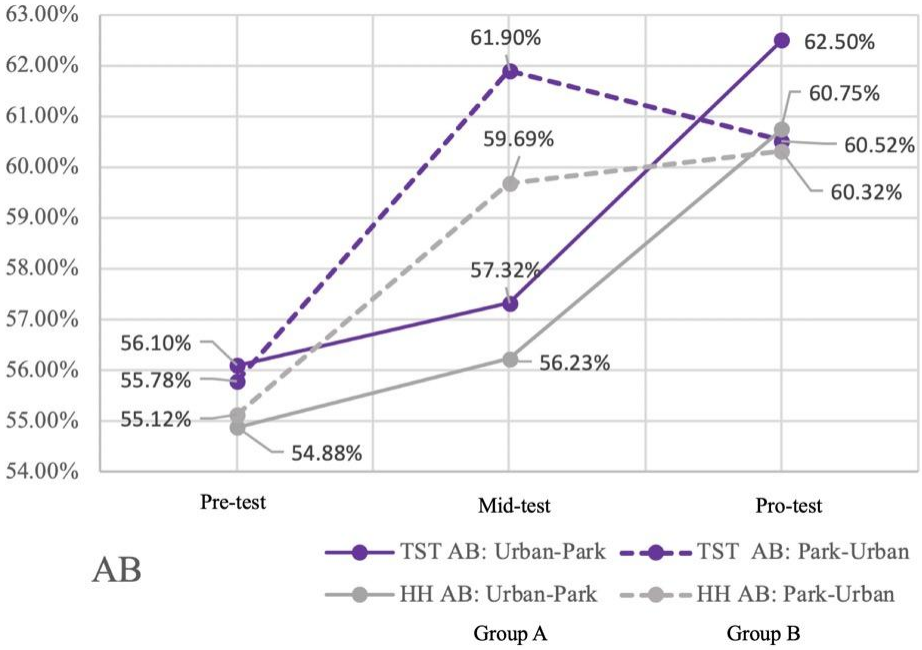
The data (Figure 5) from both routes shows that group A (urban–park) and group B (park–urban) perform better in the mid-test than the pre-test, and the improvement is more significant in group B. This might be caused by repeat exercise or restoration from the environment. But the influence from repeat exercise could be excluded when we look to the post-test result of group B, which shows participants' reaction cognitive scores as much lower after walking the urban parts. The participants in group A who walked the TST route gained a higher score in the post-test than the mid-test, while the post-test score of the HH route is slightly lower than the mid-test. The cognitive improvement effect from the park is more significant in the TST.

In relation to reaction time (Figure 6), the mid-test is when group B's RCT is the smallest and for group A the largest. This indicates that people become slower at processing information if they walk the urban part after the park. Conversely, when following the opposite walking sequence, they recover from brain fatigue and perform much better than during the pre-test.



RCT

In summary, passing a man-made park in the centre of a crowded built-up area will be of benefit to people in recovering from mental fatigue and performing better in a cognitive test. The benefit effect partly depends on the contrast between the contexts.



The project tests the attention blink with a series of numbers and letters. The accuracy of reporting the second target letter is shown in Figure 7. The four pre-test results remain at a similar level (54.88-56.1 per cent), and all of them rise during the mid-test – sharply among group B participants, and slightly among group A. From mid-test to post-test, accuracy in group A sharply increased to more than 60 per cent from around 56 per cent. For group B, accuracy diminished about 2 per cent after walking the urban part on the TST route, while on the HH route, accuracy remained steady at around 60 per cent.

For the period between pre-test and post-test, the accuracy of the AB test showed an upward trend from around 55 per cent to more than 60 per cent. Group A peaked during the mid-test, while group B's peak came during the post-test. For either group A or B, participants gained a higher accuracy after experiencing the man-made park. The landscapes in the man-made park help people save their attention resource and improve their capability to focus on daily working.

Conclusions and further study

This study aims to explore whether man-made parks have restorative values and can improve cognition ability. Most previous studies have taken place in a laboratory, with subjects normally exposed to stimuli in the form of videos or pictures shown on a computer screen.

This project, however, conducted an experiment in a real outdoor environment, with participants asked to provide timely feedback on how they were feeling rather than relying on memory, as most previous studies have done. The feedback consists of two aspects of restorative value: self-perceived emotion from viewing landscapes, and cognition ability before and after periods of walking.

Three main conclusions could be drawn from the restorative value results:

- the restorative score of the man-made park (mean value: 12.4, Std: 12.9) is significantly higher than the built environment (mean value: -6.86, Std: 12.9);
- people feel more stress in a commercial area than in a residential area; and
- dynamic water is the dominant element to increase landscape's restorative value.

In regard to cognitive ability, the results imply that the man-made park located downtown could help pedestrians restore attention, recover from stress and improve cognitive ability. The arrangement of landscape is also much more important than the size of the park. In addition, through comparing the results of two routes, it's found that the man-made park could perform better on restoring attention resource and improving cognitive ability when the urban contexts around it are extremely different.

There are several implications in respect of urban design based on these findings. Firstly, inserting a man-made park in a downtown area would help people experience a restorative effect from stress. Secondly, designed rich water scenes and the arrangement of landscapes are the dominant methods to improve the restorative value of a man-made park.

A future study will focus on the sequence of experiencing different landscape to help designers better arrange the landscape node in the park.

Author

Luyao Xiang is a PhD candidate at the Chinese University of Hong Kong. Edward Ng is associate director of the Institute of Future Cities, at the Chinese University of Hong Kong.

Acknowledgements

The opinions, findings, conclusions and recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the sponsoring agencies.

Funding

The study is supported by the Post Graduate Scholarship grant from the Chinese University of Hong Kong.

References

1. Lederbogen, F, Kirsch, P, Haddad, L, Streit, F, Tost, H, Schuch, P, et al. City living and urban upbringing affect neural social stress processing in humans. *Nature*, 474(7352); 498–501; 2011. doi:10.1038/nature10190
2. Evans, GW. *The Built Environment and Mental Health Journal of Urban Health*, 80(4); 2003.
3. Herzog, TR, Colleen, Maguire, P, and Nebel, MB. Assessing the restorative components of environments. *Journal of Environmental Psychology*, 23(2), 159–170; 2003. doi:10.1016/s0272-4944(02)00113-5
4. Kaplan, S. A model of person-environment compatibility. *Environment and Behavior*, 15(3), 22; 1983.
5. Kaplan, S. The restorative benefits of nature: toward an integrative framework. *Journal of Environmental Psychology*, 15(3), 14; 1995.
6. Ulrich, RS, Simons, RF, Losito, BD, Fiorito, E, Mile, MA and Zelson, M. (1991). Stress recovery during exposure to natural and urban environments. *Journal of Environmental Psychology*, 11.
7. Ulrich, RS. Visual landscapes and psychological wellbeing. *Landscape Research*, 4(1), 17–23; 1979. doi:10.1080/01426397908705892
8. Laumann, K, Gärling, T and Stormark, KM. Rating scale measures of restorative components of environments. *Journal of Environmental Psychology*, 21(1), 31–44; 2001.
9. Hong Kong Planning Department. Hong Kong Planning Standards and Guidelines. Chapter 11: Urban Design Guidelines; 2015.
10. Xiang, L and Papastefanou, G. Isovist and psycho-physiological stress at the pedestrian level: a real-time meausurement case study in a high-density city. Paper presented at the REALCORP 2019; 2019.
11. Abraham, A, Sommerhalder, K, and Abel, T. Landscape and wellbeing: a scoping study on the health-promoting impact of outdoor environments. Int J Public Health, 55(1), 59–69; 2010. doi:10.1007/s00038-009-0069-z

12. Bowler, DE, Buyung-Ali, LM, Knight, TM and Pullin, AS. A systematic review of evidence for the added benefits to health of exposure to natural environments. BMC public health, 10(1), 10; 2010.
13. Hansmann, R, Hug, S-M, and Seeland, K. Restoration and stress relief through physical activities in forests and parks. *Urban Forestry & Urban Greening*, 6(4), 213-225; 2007. doi:10.1016/j.ufug.2007.08.004
14. Hartig, T, Mitchell, R, de Vries, S, and Frumkin, H. Nature and health. *Annual Review of Public Health*, 35(1), 207–228; 2014. doi:10.1146/annurev-publhealth-032013-182443
15. Parry Jones, WLI. Natural landscape, psychological wellbeing and mental health. *Landscape Research*, 15(2), 7–11; 1990. doi:10.1080/01426399008706309
16. Tyrväinen, L, Ojala, A, Korpela, K, Lanki, T, Tsunetsugu, Y, and Kagawa, T. The influence of urban green environments on stress relief measures: a field experiment. J*ournal of Environmental Psychology*, 38, 1–9; 2014. doi:10.1016/j.jenvp.2013.12.005

Organisations involved

CHINESE UNIVERSITY OF HONG KONG

(javascript:void(0))