To Understand How Visitors Are Influenced by Emerging Technologies and Policies in Parks During COVID-19 In Southern China

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Abstract: Parks are indispensable urban spaces where residents and visitors spend leisure time to relish. Almost two years after the outbreaks of the pandemic, this tiny invisible creature has caused gargantuan changes to the patterns of people's lives and daily behaviors, including an impact on the visiting experience of park visitors. Decision-makers have employed corresponding technologies and policies, following local and national guidelines in dealing with this world-challenging public health crisis. However, these technologies and regulations vary, depending on location, local context, financial conditions, etc. To understand how communities and visitors are influenced by those emerging technologies and policies, specific urban spaces were studied, examining four urban cores in southern China, using ethnographic observation and semi-structured interviews. The findings of this study suggests that there are still gaps and challenges between technology users and purveyors in terms of users' experience and regulation implementation. Given the results of this study, decision-makers should employ various technologies that consider these gaps and adopt a pragmatic approach in implementing corresponding policies.

1. Introduction

It is well established by many scholars that COVID-19, as a world-wide public health crisis, has resulted in humongous impacts on the economy and social stability [1] [2] [3]. With the lasting of the pandemic, a sharp increase in social instability should be expected [4]. In the context of such an unprecedented global crisis, individuals and communities living in different urban spaces have been socially affected by this instability. As one of the essential urban spaces, urban green space, such as parks, playgrounds and residential greenery, provides a large number of social benefits to residents, communities, and cities [5]. Parks, where visitors and residents spend their leisure time relaxing and appreciating nature, is an indispensable element of urban green space in cities. Indeed, visiting urban parks is conducive to improving overall health and social interaction [6]. However, pandemic-related policies and restrictions have resulted in less use of public parks [7]. On a global scale, many parks and recreational places faced partial or total shut down to the public, in order to control the situation in the middle of the pandemic, which impacts the life patterns and daily routines of humans.

The overall pandemic situation was nearly under control in China two years after the outbreaks of the pandemic; parks as well as other public resources were reopened to the public in order to revitalize the urban life and to meet the public's needs. Nevertheless, several technologies and their corresponding policies in parks were implemented and established, aiming to manage the potential risks from the public health crisis and to prevent another domestic COVID-19 outbreak. The pandemic has not only been deemed as a public health problem, but also a public policy problem [8]. Decision-makers should consider how parks can be used safely and appropriately given communicable diseases such as COVID-19 threatening public health [9]. Understanding how park users are influenced by various emerging technologies and the effects of the corresponding policies is important for reconciling the social instability caused by the pandemic, and for the improvement of park users' experience.

This research studied different anti-pandemic related technologies and policies in parks, observed interactions between park users and purveyors, and users to understand their attitude and expectations about those technologies and policies. The results of this study will help the decision-makers and practitioners identify the current technical issues and users' concerns. The findings will also provide insights with regards to addressing these problems and will help to facilitate the future implementation of related technologies and policies.

2. Methods

2.1 Research Location and High-tech and Low-tech Definition

Figure 1. Research locations

In order to understand how communities and visitors are influenced by emerging technologies and policies, the research design was developed to use four cities (Shanghai, Hangzhou, Shenzhen, and Hong Kong as representative samples to examine the implementation of technology and regulations in Southern China. Preliminary site visits were undertaken, exploring the existing technologies and skills which developed and implemented under the milieu affected by COVID-19.

Technologies were observed and then classified into high-tech and low-tech categories. Technologies with artifacts or skills that autonomously work without manipulation were defined as high-tech (e.g., digital parking permission, autonomous disinfection machines, mask-vending machines, etc.), whereas those technologies that operate manually were classified as low tech (e.g., paper registration, manual disinfection, etc.). Therefore, it was hypothesized that dichotomous levels of technologies would influence users' experience to different degrees. The reasons for this classification were to support deeper observation and semi-structure interviews that were to follow, in order to understand how this different experience would influence visitors' behaviors and what their attitudes toward two levels were.

2.2 Detailed Observation

Observation, as one of the qualitative research methods, was important in order to be able to understand visitors' using experience and attitudes. Subjects and factors needed to be defined before

the commencement of the observation. Therefore, the following two questions were developed to facilitate our observation process.

First, what and who should be observed? To be sure, visitors' interaction with high-tech and low-tech was deemed important. However, park staff and volunteers, as technology purveyors, who implement related regulations and assist visitors to take advantage of various resources, should not be underrated. Hence, observing the interactions between visitors, park staff and volunteers, and high-tech and low-tech technology, was significant for our research. Additionally, visitors' classification is also paramount since the activities and purposes are different for regular visitors who periodically visit parks, and irregular visitors who sporadically or only occasionally visit parks. Therefore, through observing visitors' behaviors, attire, the items they carry with them, and their companions, there can be a better understanding of visitors' identification of technologies.

Second, when and how often should subjects be observed? Time consistency of the observation should be in accordance with the fidelity of the results. Meanwhile, a large population and high density at parks would provide a great vantage point to observe diverse activities. The population and circulation in parks during weekends or festivals is usually at a higher volume than any time during weekdays. Casual conversations with park staff and volunteers during the preliminary site visits also coincide with the assumption that more visitors would arrive at parks in the morning than in the afternoon. Hence, the planned observation was to start at 7am and continue until 12am during the weekend of September 19, 2021, which was the Chinese Mid-Autumn Festival.

Additionally, in terms of technology, it is important that interactions between visitors and high-tech and low-tech mirror visitors using experience and attitudes. Therefore, it is essential to understanding the interaction stories by observing visitors' unconscious behaviors (i.e., visitors' facial expression, mood, and gestures) and core functions of high-to-low techs (i.e., the operation of high-tech machines, the skills of low-tech providers, etc.)

2.3 Semi-structured Interview

To understand how key terms are interpreted by participants, qualitative interviews have been recommended [10]. Semi-structured interviews (SSIs) are suited for valuable tasks, especially when open-ended questions are designed to require follow-up queries [11]. We used SSIs as a qualitative interview method with open-ended questions to understand how participants interpret technologies in parks, and how they approach their interpretations. We interviewed four groups with eight participants in total in the sample cities, and each group consisted of two participants who had been to the park we studied in their city.

Interviewees' basic information, such as gender and age, were documented before each interview. The questions used in the interview included three general questions with regards to the interpretation of technology in parks (i.e., Could you describe any experiences you have had with digital technologies in the park?), whereby we are able to understand an individual's perception, experience, and attitudes toward the concept of technology. The participants then were presented pictures of three different technologies or skills implemented in parks. Then, three to four questions considering perception, experience, and attitudes toward these three technologies were discussed with participants (e.g., What's your opinion on machines (robots, drones, etc.) disinfecting the park?). Depending on the individual's experience during the interview, further questions were developed or generated about participants' spontaneous opinions or personal stories on technology and policy in parks.

3. Results and Discussion

3.1 Observation in Shanghai Gongqing Forest Park

Figure 2. Sequential picture of park gate: comparison between 7am and 9 am., Shanghai Gongqing Forest Park

Before 7 am, people who visit the park are typically visitors with consistent purposes such as chorus, birdwatching, working out, etc. It is observed that these visitors' outfits are usually more causal, and they often walk or bike to the park. They often live nearby and visit the park more frequently and their causal outfits are more convenient for regular visitors to participate their periodic activities. These visitors are considered to be regular visitors who use the parks frequently, tend to live closer to the parks, and they arrive earlier. Around 9 am., the number of visitors increases, with the peak time being approximately at 10 am. It is observed that visitors arriving after 10am., are often accompanied by families, couples, and friends and usually bring food, beverage, a cart, and other recreational equipment. They often use public transportation or drive to the park. This group of visitors are considered to be irregular visitors. Irregular visitors do not go to the park all the time. Since irregular visitors came to the park less often, driving to the park indicates that they live farther than regular visitors.

Both low and high technology are observed at all gates of the park. Firstly, the park accepts digital (high-tech) and paper tickets (low-tech) as permission to enter through the gate. Park staff and volunteers help with the gate entering process. Visitors entering the park in groups are more likely to inquire about staff and volunteers. Staff and volunteers, far from acting passively, proactively observe visitors' behavior and facial expression in case visitors need any help. A wider special corridor, which remains open during the operational time, is left for seniors, low tech users, those with disabilities, and staff and volunteers, while high-tech users utilize narrower gates with turnstiles. Second, emergency buttons and cameras (high-tech) are set at high density locations for any possible health and safe contingencies. In contrast, peripatetic volunteers (low tech) are sitting and walking along main roads for lost visitors or to monitor for emergencies.

Additionally, most visitors, either regular or recreational, indoor or outdoor, do not wear masks in the park. Visiting without masks in this park likely enhances the sense of gratification, therefore, allows visitors to relish and immerse themselves deeply in the natural environment. This can be further supported by observations at the park entrance, where visitors waiting at the entrance or passing infrared thermometer machines were more inclined to wear masks. Given the stringent entrance rule and the location of the gate, no visitors had any chance to appreciate the real nature before entering the park.

3.2 Observation in Shenzhen Talent Park

Shenzhen Talent Park does not offer paper tickets or digital tickets. After the pandemic outbreak, the only way to enter the park was to scan a QR health code and register contact information such as name, phone number, and the time when entering the park. One humanized regulation is that one family member can scan the code and register the information on behalf of their family. As we observed a middle-aged woman fill out the form for her parents, the elder couple had the same access to service and facilities as everyone else in the park. Family-based regulation is a smart and convenient way to trace and notify people in an emergency, while minimally disrupting the visitor experience. This approach offers convenience for people who do not have smartphones, such as the elderly and children, while saving time for park staff and other visitors.

Figure 3. High-pressure cleaning car, Shenzhen Talent Park

Disinfecting work is done by both labor and intelligent machines. Indoor spaces such as visitor centers and restrooms are cleaned and disinfected by janitors. The high-pressure cleaning car sprays the disinfectant on outdoor green spaces. However, this car is driven by a janitor and a park safety guard. They remind people nearby when the car passes by. Under the general condition that the pandemic is under control in China, especially since have been no reported COVID-19 cases in Shenzhen for months, the strength and severity of disinfecting work has been relatively less than in 2020 when the pandemic was spreading throughout the province.

3.3 Observation in Jao Tsung-I Academy

Figure 4. Park entrance at 9 am, Jao Tsung-I Academy

The opening time of the park should be 8 am, and it was unattended at 9 am. Perhaps because of the minimal human traffic, this time is based on machine operation to register visitor information. To enter the park, one needs to complete the registration of 'leave-home-safe', a mini-program and a visitor registration certificate. For tourists with different levels of trust, the park undertakes different measures for different types of visitors, regular visitors or irregular visitors. Regular visitors only

need to complete an online registration, while irregular visitors need to complete online and offline registrations. The implementation of a mask-mandate policy is comparatively strict as we have observed that visitors who did not wear masks were warned by park staff and volunteers. The touchless door opening switches are located near every door in the park's indoor venues. These machines truly achieve the touchless opening and closing of doors. The green sign indicates that visitors are allowed to pass through while the red one indicates that visitors need to have it sense their hands.

3.4 Observation in Hangzhou Xiasha University Park

Figure 5. One-meter space signs at the entance, Hangzhou Xiasha University Park

Manual temperature measurement is implemented at the entrance in Xiasha University Park in Hangzhou to document visitors' temperature and health condition. 'One-meter space' signs at the park entrance were observed, reminding visitors to keep social distance. There is no high-tech technology related to pandemic prevention being observed, while the traditional methods (low-tech) are implemented, probably due to the scale of the park, as the overall pandemic situation in Hangzhou is relatively good, some small and medium-sized parks are starting to relax their protection measures. Manual disinfection by park staff and volunteers was observed. Less frequency of the manual park disinfection also indicates a loose policy implementation due to the fact that the outbreak of the pandemic is under control.

This park uses mainly low-tech prevention and the implementation of its policy and regulation gradually became loose. It might suggest that the level of technology and the strength of the park's precautions are related to the park's scale, the volume of visitors, and the severity of the pandemic in the city. Additionally, high-tech technologies, such as mask-vending machines, have been put in place at the nearby university, but there are no similar anti-pandemic facilities in this park. This may be related to the different functions of park type and intensity of visitors in the space, since small to medium-sized parks with a good urban pandemic situation and dispersed crowds have little demand for mask-vending machines.

3.5 Findings and discussion from the observation

Based on our findings through additional site observation, we hypothesized that decisions to wear masks in parks are dependent upon 4 factors: visitors' preference, park type, management policy, and the situation of the pandemic control, as shown in Figure 6.
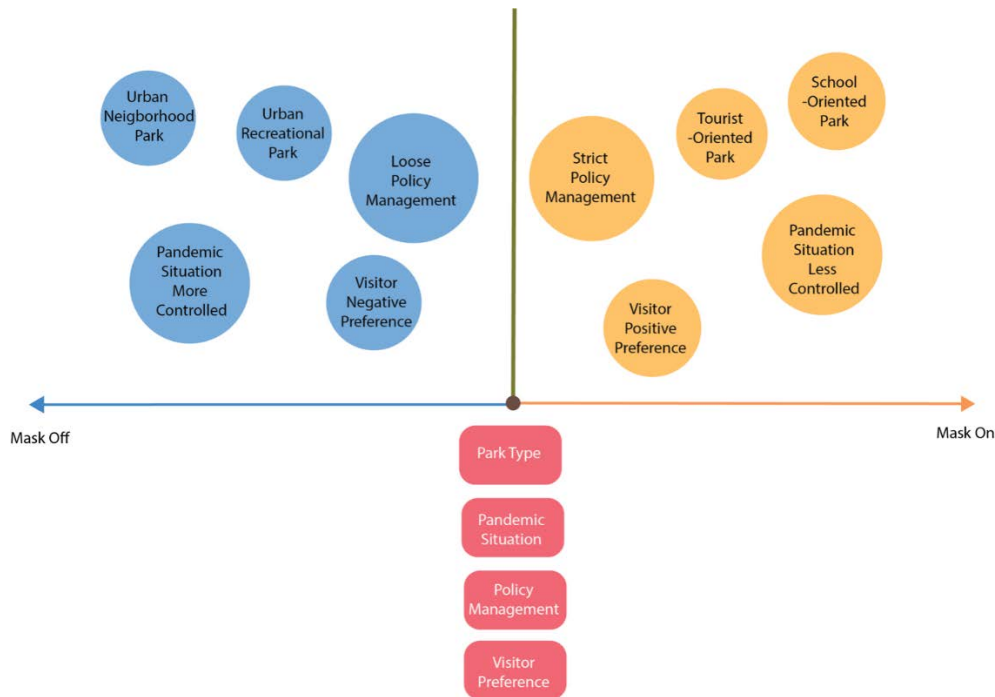
Figure 6. Mask-wearing decision model

Both masks-on and masks-off were observed in different parks. However, visitors who hold positive preference to wearing masks are more likely to wear masks whereas, those who hold negative preference are less likely to put masks on unless the mask mandate is required; policy management in parks also affects visitors' decisions. In our observation at four parks, mask-mandate-related policies with a loose implementation are more likely to cause visitors to keep their masks off. In contrast, wearing masks are more likely to occur at parks where regulations are more stringently implemented; park types also attribute to the mask-decision. It is observed that there are a higher proportion of masks-on visitors at tourist-oriented parks (parks serving for the most wide radius of visitors potentially coming from every city corner) and school-oriented parks (parks located inside or near schools) than that of visitors at urban recreational parks (parks serving for a wider radius area and attracting not only surrounding communities but also visitors living far away) and urban neighborhood parks (parks mainly serving surrounding neighborhoods with a smaller service radius for potential visitors). The pandemic situation in each of the cities was also considered to influence visitors' decisions about adhering to pandemic-related regulations [12]. In Hong Kong, the general public are motivated to wear masks and believe in the effectiveness of face masks against disease spread [13]. With new cases reported daily in Hong Kong, visitors are observed wearing masks commonly in the park.

Despite the hypothesized factors grounded by the findings in contributing to the decision, the correlations about these four factors are not indicated. For instance, whether policy management outweighs visitors' preference o ark type is not discussed in this analysis. Therefore, future research could focus on the study of the interrelation between these four and other potential factors.

Moreover, through the observations, it was concluded that high-tech is still not able to totally displace low-tech in the context of the current pandemic situation. For instance, our observation parks in Shanghai and Shenzhen have provided both digital tickets and paper tickets, whereas the park in Hong Kong only provides digital tickets and the park in Hangzhou only provides paper tickets. In parks where high digital tickets systems were implemented, there were observed anxieties from low-tech visitors' users, which indicates that despite advanced technology being developed, there are gaps between low-tech users and high-tech suppliers. We recommend that for future implementation, city planners and policy makers should consider this gap and communicate and understand the low-tech user's preferences.

Furthermore, the disposition towards trust between park and its visitors plays an important role in the stringency of park entrance policy and regulation. It was hypothesized that parks that serve more regular visitors were more likely to implement loose entering regulation. This was observed in two instances.   In the urban neighborhood park, Shenzhen, visitors can enter the park with no permission or mask-mandate, and visitors only entering its visitor center are required to follow related rules.   In the second example, the urban recreational park in Shanghai, implementation of the entrance regulations is less strict before 7 am, when most regular visitors came to the park for exercise. By contrast, in Hong Kong's Park, where most visitors are irregular visitors, it is observed that even within the park, park staff would strictly observe visitors' faces to make sure their masks are put on and warn visitors who didn't wear masks.

Finally, pictograms are more comprehensible than putting in black and white to park visitors for their understanding of the regulation and policy. We have noted in parks where instructions of entering parks or using certain functions high-tech (such as books sterilizer in the visitor center in Shenzhen's example), visitors would spend much time understanding the instruction. Based on what we have learned, we believe, and therefore, suggest that simple and clear pictograms should be created and illustrated for victors to better understand the policy and regulations.

3.6 Findings and discussion from the semi-structured interviews

Tab. 1 Key words about attitudes toward high-tech and low-tech

	positive keywords from older generation	negative keywords from older generation	positive keywords from younger generation	negative keywords from younger generation
permission high-tech	convenient, easy to learn	inconvenient	convenient, efficient	
permission low-tech	helpful			
disinfection high-tech		aloof	manageable, reliable, efficient	doubts about maturity
disinfection low-tech	friendly, affable, comprehensive			inefficient
mask-selling high-tech	convenient		convenient	
mask-selling low-tech	friendly, able to communicate		cheaper	

Participants' basic personal information were documented. Participants' age ranged from 22 years old to 67 years old. Participants whose ages ranging from 20 to 50 are classified as the younger generation, while those ages ranging from 51 to 70 are identified as the older generation, for the purposes of this study. Keywords are summarized from the semi-structured interviews. Participants' attitudes toward technology related to park permission indicates that older generation participants still have concerns about high-tech implementation in parks. As one participant stated: "'it is inconvenient and difficult for me to use digital codes because I am not good at using smartphones, and my children are not patient enough to explain how I can use the digital codes as permission. Surprisingly, there are older generation participants who express that as long as they learned how to apply for digital permission by scanning a QR code, they felt that digital permission is more convenient than the paper permission process." This might indicate that learning how to use high-tech is important for older

generation users. Therefore, instruction plays a vital role in using high-tech. Despite different opinions among older generation participants, the research indicates that there is still a gap between high-tech and low-tech for older generation users. To be sure, family members and friends who are proficient using high-tech could be one recourse for older generation users. Park staff and volunteers who are trained to help park users with instructions on high-tech are important resources since they are the direct resource in response to issues that visitors encounter. We, therefore, encourage decision-makers and practitioners to be aware of the gap and to employ pragmatic approaches when implementing related technologies and policies.

Opinions on technologies related to disinfection in parks varied among younger generation users. Key words of positive attitude toward high-tech include manageable, reliable, and efficient. However, doubts on the maturity of the high-tech are also raised. This might be related to the fact that these kinds of emerging high-tech, which are specifically tailored in response to the pandemic, developed so fast that users are not able to trust the application of such technologies. On the other hand, most older generation users consider that low-tech (i.e., to disinfect the park manually) is friendlier toward them since they pose that park staff and visitors are friendlier than machines. One participant stated that "having conversation with park staff who manually disinfect the park makes me feel that the park is safer. And they are very affable. I often talked to them when I was in the park." This might indicate that sometimes low-tech serves more than its application function. Some participants consider that high-tech are cold and aloof machines which cannot meet their needs for the establishment of conversation. If high-tech represents a total sense of rational and low-tech represents a total sense of emotional, a conflation of the two might compensate for each other. Therefore, a combination of high-tech and low-tech for implementation is encouraged.

Positive perceptions on both high-tech and low-tech related to mask selling might be an auspicious sign of conflation of high-tech and low-tech for implementation. Indeed, both older and younger generation users express promising key words to both high-tech and low-tech. High-tech, such as mask-vending machines are deemed as convenient tools, while low-tech such as retail store selling are considered as friendly. Additionally, costs are one factor that participants indicate to be considered when they compare low-tech and high-tech related masks selling. This is reasonable in that mask-selling technology involves price factors that directly influence users' decision on purchasing and experience. Future research might examine the relation between cost factors and similar commercial-related high-to-low technologies.

4. Conclusion

Human factors take precedence over technological factors. It can be said that there is no technology without humanity. Technology and humanity must complement each other to maximize people's value. Therefore, caring for human nature and making good use of technology are issues that must be faced at the same time. We must believe that we will have more humane technology products in the future, whether in terms of the epidemic or in terms of national development.

As Jane Jacobs emphasized in her book, "but lively, diverse, intense cities contain the seeds of their own regeneration, with energy enough to carry over for problems and needs outside themselves" [14], we believe that good urban planning should work with all kinds of technologies in order to serve people better. However, a prescribed technology that only defines how people should live makes cities unbalanced in divorcing functioning from questioning, while using technology to coordinate rather than control activities develop human intelligence [15]. Based on the findings of this research, we encourage decision-makers to be more pragmatic when they implement technologies and related policies, in other words, to pay more attention to the transition between low and high technology in public space because people are diverse, and the implementation of high technology does not automatically make the city more advanced and livable to all groups of people. When implementing technologies and policies, decision makers and practitioners should take a pragmatic approach considering the context of the pandemic. To conclude, this research briefly studied how material arrangements and technology infrastructure facilitates specific actions and behaviors between people

during the pandemic. COVID-19 related arrangements did have a significant impact on people's daily activities in parks. Furthermore, some technologies are expected to stay in use in the post-pandemic world. Therefore, there is potential application of these findings, between urban infrastructure and people, to more broad aspects of the urban planning field, such as urban planning and the smart city, sustainable urban development, modern technology, and urban management.

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