Possibilities for Tourism Services & Management Using Data from Architectural & Urban Perspectives

By Yuji Yoshimura

Author Yuji Yoshimura

Points

- Urban design and urban management utilizing big data and artificial intelligence (AI) are required in the fields of architecture, urban planning, and urban development, and in this context, Barcelona (Spain) is an advanced smart city.
- Barcelona is currently implementing a large-scale pedestrianization project (Superblock Project, hereafter referred to as Superblock) as a concrete urban policy to improve the quality of life for its citizens. This policy aims to improve the quality of life for citizens by rezoning more than 60% of the city's streets to pedestrian priority streets.
- Barcelona has succeeded in ensuring the quality of life for its citizens by wisely using data to address the problem of overtourism and excessive concentration of tourists.
- These examples are also useful for Japanese cities that are likely to face similar problems in the future.

Introduction

This article discusses the potential of tourism services and management from the perspective of architecture, urban planning, and city planning in the age of AI and big data. For many years, I have been exploring architecture, urban planning, and urban development using AI and big data from both an academic and practical perspective.[1] Starting with the development and implementation of sensors to measure traffic and human flow,[2,3] urban analysis using credit card payment information and various open data,[4,5,6,7] the development of AI-based architectural and urban design classification methods,[8,9] and the implementation of overtourism at the Louvre Museum in Paris and pedestrian space planning in Barcelona's Gràcia district.[10,11,12,13,14] I have been involved in this field, which is called "Urban Sciences" or "city planning with data", for almost 20 years now and I feel that Barcelona's efforts are instructive for Japanese society in the future. In this article, I would like to discuss these points by taking up two specific examples.

Conversion of the "Request Base" into a Large-Scale Pedestrian Space

The Superblock implemented by Barcelona City Hall has already been introduced in various media, so this article will only give an overview *(Note 1)*. Basically, the project is expected to expand public space and reduce air pollution and noise by converting more than 60% of all streets in the city into pedestrian space. Originally conceived by Salvador Rueda in the 1990s, the Agència d'Ecologia Urbana de Barcelona (Barcelona Urban Ecology Agency), of which he was the director, has steadily implemented the project since the

2000s. The first pilot project was in the Gràcia district. The first pilot project, the Gràcia pedestrian space plan, was undertaken by me.[15] A phased measure was taken to improve the quality of public transportation services, such as bus routes and shared bikes, before introducing pedestrian spaces, with the ultimate goal of encouraging citizens to change their behavior, moving away from a car-centered lifestyle.

I believe that the following two points are behind this large-scale pedestrianization: first, the development and scientific analysis of data that can serve as urban infrastructure, such as a (Geographic Information System (GIS) and traffic data, and the recruitment and securing of human resources through collaboration with academics. Since the Barcelona Urban Expansion Plan (1859) by Ildefonso Cerdà, Barcelona has continued to collect data on various aspects of the city and analyze them scientifically to apply them to the next plan.[16] One example is traffic simulation. I saw a traffic simulation for the first time when I joined the Barcelona Urban Ecology Agency, and I still remember the shock I felt when I saw it. The simulation faithfully reproduced the movement of each individual car, and the results of the traffic flow around the entire city of Barcelona were used as evidence for the creation of pedestrian spaces. I later learned that the simulation was developed on the basis of the accumulated research of Dr. Jaume Barceló, now professor emeritus at the Polytechnic University of Catalonia, who taught at a local university (AIMSUM). It was significant that Dr. Barceló, a physics graduate specializing in traffic engineering and a leading authority on urban planning using data, was from Barcelona, and while teaching at a local university, had founded his own startup company and collaborated with the Barcelona City Hall. In addition, Dr. Carlos F. Daganzo, a world-renowned transportation engineer and professor at

the University of California, Berkeley, was invited to participate in the bus route change project, in which I also participated.

To begin with, streets do not exist in isolation, nor are they complete within an area. Streets are connected to each other and function as a network as a whole. This is why it is important to have a broad and objective viewpoint on the impact of changing the use of one street on the network, and which streets should or should not be turned into pedestrian space. This is where the overwhelming amount of data and computing power should be devoted. Looking a little further ahead, it will be necessary to create rules, mechanisms, and flexibility for residents to discuss together based on such objective data and analysis results.

Thus, the conversion of Barcelona into a pedestrian space has a scientific analysis behind it that skillfully uses data. The design is not based solely on the intuition of architects and planners who say, "It looks pleasant, so we will make it a pedestrian space."[6] The planning and management using data is very different from that of other cities.

What Is "Request Base"?

The second point is the true value of Barcelona's Superblock: the "request base". When one thinks of pedestrianization, the methodology of banning vehicular traffic comes to mind. In fact, this approach is probably the most commonly seen when looking around at pedestrian space policies planned by municipalities around the world. However, Barcelona did not adopt a policy of simply banning vehicular traffic. Rather than prohibiting vehicles from entering the target area, it adopted a policy based on a "request" to prevent vehicles from entering the area as much as possible. So vehicles can enter and pass through the target area if they want to. In fact, if you observe inside the Superblock, you sometimes see vehicles entering. In reality, however, it takes a lot of courage to pass through the Superblock at speed. In the first place, children playing on the street in the Superblock is becoming a common sight, and since there are trees, benches, and other urban furniture in the area, it is difficult to go as quickly as one would like. The design of the urban furniture limits the speed of cars and their intrusion into the area. That is why no one would bother to enter this area just to pass through it. This can be seen as a clever use of design to induce behavior. On the other hand, vehicles that carry goods to the retail stores and restaurants in this area can of course enter. This is because the passage of vehicles is not prohibited.

Children play on the streets, mothers pushing bicycles and strollers come and go, and sometimes cars move slowly, reducing their speed. A space where various modes of traffic coexist slowly: this is the kind of landscape that our cities should aspire to.

Such urban policies have existed for a long time, of course. Examples include the case of Delft in the Netherlands where streets were not straightened by separating passing streets from living streets and by placing flower pots, and "Zone 30" which was introduced throughout Europe in the 1990s. The concept of "rooms in the city" is sometimes referred to as "community zones". There is also an argument that the concept of streets as such public spaces traditionally existed in Japan in the first place. These include earthen floors where the street intruded into the house, and alleys where the streets were used as playgrounds for children. In Japan in particular, there is a tendency to cast a nostalgic gaze toward the pre-modern era and to reminisce about the good old days. However, with capitalism at a standstill, it is not realistic to return to a pre-modern lifestyle. It would be more realistic to think about what is possible within the current system while holding such a vision. In the age of big data and AI, the question is, "What is possible for the streets?"

Overtourism

Now, there are issues that always accompany the implementation of public space development and pedestrianization. These are gentrification[17] and overtourism. A public space that is open to all means that it includes not only residents of the neighborhood and other districts, but also tourists. It also means that it can be easily connected to overtourism, which has become a major problem in recent years.

It is not the success stories of increased human flow that we need to watch out for in future pedestrianization. It is the management of the area by being too successful. As a result of investment in the urban landscape, gentrification will occur where the value of the area (mainly land prices) will increase rapidly. There is no end to the number of cases where the residents who originally lived there are forced to leave. There are many areas where unique stores have been driven out and replaced by globally competitive tenants found everywhere.[18,19]

I have been observing the design of Starbucks, a global chain of cafes, and believe that the way it blends into the local area can be an indicator of the degree to which an area pays attention to its landscape. The Starbucks in front of the Shinshu Zenkoji Temple gate in Nagano city, Nagano Prefecture, and in front of Izumo Taisha Shrine in Izumo city, Shimane Prefecture, have both been modified to blend in with the historical cityscape, rather than the standard design of green. That is how much they care about the surrounding landscape.

"Quantity Changes Quality" – Management of Noise

So how can we stop the harmful effects of an overabundance of tourists? Can big data and AI be useful in this regard? Barcelona's efforts provide hints for data-based management in this regard as

well.

European cities are connected in every direction by budget airlines. Because of the unbelievably low fares between Barcelona and London, many young people from London go to Barcelona on night flights, and instead of staying in hotels, they drink until morning in public spaces – barbaric behavior that has become a daily scene – probably due to Barcelona's warm climate. The next day, they go to the beach. This phenomenon began to occur in the early 2000s, with young people going to the beach the next day and returning home on that day's late-night flight. While these young people may enjoy drinking in public spaces, the residents who live there are not so happy. The fact that they could not sleep because of the noise until the wee hours of the morning was beginning to become a social problem.

A newspaper then told us that "in 2007, 65% of visitors to Valencia spent less than one euro for their stay. Low-cost airlines are causing a subsidence of the product. That is, tourists no longer consume products, but instead occupy beaches, consume water and electricity, and produce garbage. They disrupt the living infrastructure of various cities." (*El Pais*, p. 31, May 3, 2009, my translation)

What made the situation even more serious was that when they went to the local government to discuss how to deal with such behavior, they were not taken seriously at all due to lack of evidence. So the residents decided to work with Fablab to create noise sensors.[20] They attached these sensors to their balconies and began collecting data, which they analyzed and visualized with local researchers and brought to the municipality. Data could be evidence. The visualization of the data, which was easy to understand even for the general public who did not know how to look at the data, convinced the local government officials, and they began to deal with the situation. The sensors, now called Smart Citizen Kits, have open data blueprints and can be created by Fablab in any city in the world. In Barcelona, they are being distributed to citizens to help them measure their own environment. The goal is to supplement the highly accurate but small number of large sensors installed at great expense by the government with the overwhelming power of numbers. Quantity indeed changes quality.

This can also serve the purpose of informal education, whereby people actually measure their environment to learn about what kind of environment they live in. Even if you normally don't notice things at all, when you see them numerically, it gives you a chance to realize what kind of place you are living in and what you can do as an individual. It is inexpensive although inaccurate, but there is a benefit to having a large number of them.

Elimination of Bus Routes

The impact of overtourism is perhaps most apparent among residents living near tourist attractions. The Parc Güell, built along the mountainside of Barcelona and known for its Gaudi design, is one of the city's most popular tourist attractions, visited by 4 million people annually. It is located to the north of the Gràcia district, where the first demonstration of the aforementioned Superblock took place. It is located in a residential area about a 20-minute walk from the nearest train station, but the slope is a bit steep to walk up to it, and the streets running through the area were not designed for automobile traffic, as the area was formed around a church built in the 17th century. That is why the area was known as an area where community buses run to serve as a means of transportation for the local residents living in the area, and the buses work very well.

Some years ago, the local residents were unable to use those community buses at all. Tourists started flooding into the area, as it was just the right way to get from the nearest train station to Parque Güell. The small buses were filled to capacity with as many as 20 passengers, and there were long lines at the small bus stops. For a long time, the Barcelona City Hall could do nothing about this situation. Since it is a public transportation system, even tourists cannot be denied boarding, and the strategy of changing the fare between tourists and locals was only an idea and had not been implemented. This situation changed in the spring of 2024. The Barcelona City Hall approached Google and Apple to have the information on this route erased from Google Maps.

For a tourist who is new to a place, what does not exist on the Internet is synonymous with not existing. The effect of this measure taken by the Barcelona City Hall was tremendous. The number of tourists using the community buses to Parc Güell was drastically reduced, and the buses are now available to local residents as they were before.

This case provides one insight into the overtourism that cities will face in the future. The problem of overtourism is particularly troublesome in cities like Barcelona, where tourism income accounts for a large percentage of GDP. To begin with, when a city is considered a public space, it is impossible to tell tourists not to come. And if it is a tourist city, this is even more so. On the other hand, cities also belong to the citizens who live there. Therefore, by observing how a city deals with the overtourism problem, we can see what it values and where it is trying to go. Barcelona is clearly a city that aims to put its citizens first. And it is using digital technology to protect their lives.

Conclusion: What to Expect from the Government in DXing

The reason Barcelona has been able to be so proactive and successful in using data and digital technology in city planning is largely due to the availability of budgets *(Note 2)*. The current Barcelona City Hall has a department called the Barcelona

Comparison Between ICT departments (information bureaus) of New York City Hall & Barcelona City Hall

	New York City Hall	Barcelona City Hall
Population	About 8.4million people	About 1.6 million people
ICT sector	Department of Information Technology and Telecommunications (DoITT)	Municipal Institute of Information Technology (IMI)
Number of staff	About 1,800 people	About 260 people
Annual budget	About 78 billion yen	About 10 billion yen
Year established	1994	1967
ICT sector budget as % of total municipal annual budget	0.74%	3.41%

Source: Compiled by the author based on interviews and other data[7]

Information Department, which is responsible for the DX (Digital Transformation) and data management of the Barcelona City Hall. This department was established in 1967, some 57 years ago. Even more astonishingly, the use of digital technology to improve the quality of life for citizens began in 1929, during the second Barcelona Expo. Expositions at the beginning of the 20th century focused on the latest technology to enable people to experience and imagine a bright, technology-enhanced future society. The Eiffel Tower was built for the Paris Exposition in 1889, and the Crystal Palace, a huge iron and plate-glass building, was constructed for London's Great Exhibition in 1851.

Only Barcelona strategically used such a large Expo to improve the city's infrastructure: the first Expo in Barcelona (1888) was for the streets, and the second Expo (1929) was for the Montjuïc hill and the city's parks. It was at the second Expo that the architect Mies van der Rohe created the Barcelona Pavilion. Although it is often assumed that the 1992 Barcelona Olympic Games were the catalyst for the city's regeneration and urban development through large-scale events, in fact, this strategy has been passed down through the generations in Barcelona since the early 20th century. And one of the exhibits at the second Expo was the unit record equipment purchased from Powers-Samas (a British company). It was then the most advanced technology in the world and intended for use in enhancing the quality of administrative work and citizens' quality of life. Since then, Barcelona has continued to focus on how digital technology can be used to improve the quality of life for its citizens, and has been moving steadily toward achieving this goal.

The *Table* compares the ICT departments (information bureaus) of New York City Hall and Barcelona City Hall. It was in the 1990s that many municipalities around the world established digital bureaus and information bureaus. In contrast, Barcelona's of 1967 is by far the earliest. Although the budget of the Barcelona Information Bureau is about one-eighth that of the New York City Information Bureau, it represents 3.41% of the total budget of the Barcelona City

Hall for one year. This is a very large percentage even by global standards, and I believe that this 3% figure is indicative of the expectations of Barcelona City Hall with regard to digital technology.

Notes

1) This paragraph is based on Reference 16 with modifications. See References 15 & 21 and others for more information on the Superblock project.
2) This paragraph is based on Reference 21 with modifications.

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Dr. Yuji Yoshimura gained his PhD in Information, Communication and Audiovisual Media Technology at Universitat Pompeu Fabra, and was a postdoctoral fellow/associate at the Massachusetts Institute of Technology before assuming his current position as a project associate professor at the Research Center for Advanced Science and Technology, University of Tokyo, in 2019. He has lived in Spain since 2001, and has served as advisor to the Information Department of Barcelona City Hall, as well as to the Louvre Museum in Paris. In Japan, he has served as a member of the Ministry of Land, Infrastructure, Transport and Tourism's Council for the Realization of Digital Transformation of Urban Planning.