Study on Public Participation of Urban Planning in the Age of Big Data

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*Abstract: Along with the development and popularity of the information technology, the concept of big data has gradually come to public attention. A variety of new data types and new data sources have greatly expanded the data view of urban planning. On the one hand, it has formed a new method of public participation in urban planning, on the other hand, it has also provided a new analysis tool for the research of urban planning. This study, taking big data, urban planning and public participation as the starting point, tried to seek the best combination and establish a potential bridge among them. In this way, planners can not only apply the new technology into urban planning, but also deeply understand the urban planning during the technology development. As a result, a visual, dynamic and interactive smart city platform will be built to improve the ability of information exchange and the level of public participation. As a reaction, public participation, with the mining of diverse knowledge and the participation of multiple thinking, can also ref*ine planners understanding of urban planning, *is favorable to their policy behavior. Therefore, in the stage of practical application, with the new technology such as big data, planners can transport and release information, citizens can sharing experiences and present opinions, decision-makers can absorb suggestions as references for urban planning.*

Keywords: public participation, urban planning, big data

1 Introduction

Along with the development and popularity of the information technology, the concept of big data has gradually come to public attention. A variety of new data types and new data sources have not only greatly expanded the data view of urban planning, but also quickly promoted the innovation of thinking mode, value guidance and technical method in urban planning. Through the transition of urban planning, which is form simple observations, fragmented statistics and rough sets to complex simulation, dynamic evolution and subtle individual, big data will provide infinite possibility for urban informationization construction and management.

Since the Urban and Rural Planning Law firstly established the mechanism of public participation in urban planning on January 1, 2008, public participation has become the impetus for the further development of urban planning. The core value of public participation is to encourage people to actively participate in urban planning and explore various knowledge sources with the aid of technology. Through the participation and integration of multidimensional thinking, designers and decision-makers can refine the understanding of city and improve the precision of policy.

So we can say that big data and public participation are the two significant trends of urban planning transformation. However, in practice, we find that the basic data needed for urban planning are collected, processed and used by different functional departments separately, thus information isolated island will be formed and cannot support the rational analysis and scientific research. Moreover, obstructed channels and the imperfect mechanisms of public participation also restrict the public demands expression for urban planning, construction and management.

Therefore, this study tried to seek the best combination and establish a potential bridge among big data, urban planning and public participation, aiming at providing technical support and decision basis for scientific and rational urban planning.

2 Connotation of big data

Big data is a huge set of concepts, referring to the vast, diversified and rapidly increasing information property, which has the stronger power of decision-making, insight and optimization due to the new processing mode. Michael Batty, a British scholar, has pointed out: Big data i fit into an Excel spreadsheet. (Batty, 2012) He revealed the double connotation of big data. Firstly, the data sample size of big data is large enough. Secondly, big data is not a new concept, but a sample quantity expansion of traditional small sample data analysis. That means the analysis space can be fully covered only based on the sample data, and then the analysis result will be displayed intuitively.

Volume , velocity, variety and value, as the 4V advantages of big data, provi platform between users (Philip Chen and Zhang, 2014). However, These advantages also result in several problems, such as available data explosion and public demand diversification. The generation of SoLoMo precisely makes it possible to obtain extensive data and promote public participation. Social, Local and Mobile are the most representative technological concept of SoLoMo, which brings Social Networks Service, Location Based Service and Mobile Terminal together. It is this immediate information interaction and transmission that meets the needs of public participation in urban planning to a great extent.

2.1 Social Networking Service (SNS)

Social means an online community created by individuals having the same interests based on social networking service (SNS). This kind of service always bases on internet and provides various interactive platforms for user connection and communication. It gives data specific social attribute, and makes the process of data propagation predictable and traceable. At the same time, This kind of platform generally extends and spreads by the realistic social relations, so it is able to provide indirect description of the individual information source to a certain extent. The vast amount of users with specific social attribute are the objective foundation of directive data collection and broad public participation.

Sina Weibo, as a SNS platform for information sharing, spreading and obtaining based on user

relationship, can accomplish text update, information publish and instant share. The basic characteristic of Sina Weibo is to encourage the target audiences to pass message to others, forming a new dissemination mode that the exposure and influence grow at a geometric rate. Relying on the social networking tools represented by Sina Weibo, on the one hand, planners can spread urban planning knowledge more effectively, on the other hand, public can express their appeals and maintain their rights with the help of network platform.

2.2 Location Based Service (LBS)

Local, as the core of SoLoMo, is the mapping of the individual users of network virtual world in the real physical space. Through the location based service (LBS), it can record the geographical location and give data spatial attribute. The main functions include localization (individual position orientation), guidance (path navigation), query (query somebody or something), recognition (recognize human or object), event trigger (send a message to the individual in a particular situation). Data generated in these function processes precisely can provide objectively true individual behavior records for urban planners.

LBS focus on obtaining the spatial position and behavior of individuals. However, spatial resources allocation, as the most central question of urban planning, involves a large number of the spatial, social and economic information which is always difficulty to obtain. GIS technology can provide the perfect database organization, lively visual interface and 3D real feelings. What s more, WebGIS, the internet platform and getting rid of GIS tool software, enable public to easily obtain the comprehensive information by web browser and even directly present their opinion on planning scheme. That is called the PPGIS, which is internationally popular in recent years. It can provide spatially-related information service for LBS with the support of GIS.

2.3 Mobile Terminal

Mobile terminal is a terminal that with which individual can produce and receive data. It mainly includes smart phones, tablet computers and various application programs based on them. Related technologies involve global position system (GPS), gyroscope, acceleration transducer, augmented reality (AR), two-dimensional code or other things networking technology such as NFC. Mobile terminal, with perfect multi-media capability and a large number of interactive technology integrated in small devices which are easy to carry and hold, has already become the substantial platform that recording specific individual behavior, raising public planning awareness and expressing public subjective willingness. Along with the growing popularity of different kinds of mobile terminals, they are gradually taking the place of desktop PCs and becoming the main medium of SNS and LBS.

For different events or locations, developers can develop specific mobile terminal applications to popularize urban planning knowledge and encourage public participation. However, the technical threshold of native APP development is relatively higher. Therefore, in the public participation, developers can make an easy secondary development relying on the social platforms, so that users can

interact information with PPGIS server and query content in the social platform interface. Through uploading photos and comments with location information, which can be viewed and analyzed by planners and public, the traditional working mode of urban planning will be changed. So, we can expect that using mobile terminals and application programs to encourage public participation in PPGIS will quickly gain in popularity as an easier and better way.

3 Public participation mechanism in urban planning

SoLoMo, as an integrative concept generated in the age of big data, corresponds to the public thinking mode in today's society and integrates into life in all aspects. SoLoMo application can effectively protect the informed right of public, widely collect and analysis data produced by public, promptly provide various expression ways for public. Thus, it can improve the public participation mechanism in urban planning and guide the design effort to proceed in an orderly way.

3.1 Extend the ways for public understanding

SoLoMo, with its unique attributes, fills in the blanks of information dissemination and presentation media of traditional urban planning at different aspects and levels, and gradually becomes an important way for public to understand urban planning. With the portability of mobile terminals and the transmissibility of social networks, SoLoMo provides a professional and dynamic display platform of urban planning for public.

Take the application of AR technology in dynamic presentation as an example. AR technology, applies the virtual information to the real world and overlays virtual objects, scenes and system prompts generated by computer onto the real scenario, thus achieves the aim of reality augmentation. Relaying on LBS, the individual geographical location can be positioned accurately. Thereout, applying AR technology to mobile terminals can provide specific scene information and real tour experience. In the meantime, using the angular sensor technology can accurately analysis the individual orientation and angle, which contributes to provides the appropriate visual angel pointedly. What s more, SNS also provides convenient transmission ways and wide user base for this platform, which enables AR technology to apply to the scheme demonstration phase of urban planning through SoLoMo. This dynamic and vivid demonstration, low requirements on professional knowledge and rich in interesting, is very applicable to public-facing planning scheme notification.

3.2 gather the data generated by the public

In the context of big data, urban planning pays great attention to public participation, and emphasizes to introduce public city image into planning and design. City image, drawing from the traditional ways such as questionnaire survey, still has deficiencies in sampling quantity, manifestation mode and so on. However, SoLoMo can not only enlarging the sample size, but also embody the abstract conception in the geographic space accurately. As for the data produced by public, it has the advantages of immediacy,

dynamism, universality and convenience. Therefore, it can promote the dynamic recording of city image in urban planning and the interaction between them, making it possible for the city image to guide the planning and design.

Take the area boundary definition by Flickr as an example. Flickr, composed of mobile terminals, application programs and websites, is a platform that provides storage and sharing service for digital photos. Based on the support of social network and GPS, The core characteristics of Flickr include enlarging and reorganizing the data uploaded by users, giving images attributes such as longitude and latitude described by users. Livia Hollenstein and Ross S. Purves reanalyzed the boundary of the city center of London with Flickr data. Through filtering the labels of the images uploaded by users, they collected the image data with labels of Northlondon, Innercity, Eastlondon and Camden, Mayfair, Soho, thus they analyzed the spatial data distribution and obtained the density gradient variation.

3.3 Enrich the public feedback means

SoLoMo can spread messages efficiently and rapidly between mobile terminals with the support of social network. Its feedback mechanism follows the laws that from point to surface and from bottom to top. In the field of urban planning, it is always from practitioners including planners and designers to public, then to more practitioners, finally to decision-makers. With the guidance of practitioners, on the one hand, public interest is widely attracted, leaving the specific incidents as society hot spots, on the other hand, a large section of public opinion will draw the attention of more practitioners. Therefore, the discussion environment, integrating social public and professional planners, is mutual complementation and mutual benefit.

Take the reconstruction project for Enning Road as an example. Enning Road is the most complete and the longest arcade-house street in the city of Guangzhou. From the year of 2007, Liwan District Government began the large-scale old city reconstruction for this road. In the process of multilateral game, the scheme has been changed multiple times and the reconstruction has come to a deadlock. The academic concern group of Enning road reconstruction was founded in March 2010. Its members include undergraduates and volunteers, and their majors involve urban planning, architecture, sociology, economic, geography, journalism, etc. Through the further study and accurate evaluation of the situation of Enning road reconstruction project, The group, as a third party different from governments and residents, provides professional advices for the old city planning and development. It devotes itself to improving the government consulting process, rationalizing the resident compensation plan and building the discuss platform for all relevant stakeholders. At present, this group are gradually integrated into the residents of Enning road. They jointly drive the implementation of the organic renovation way, whose core ideas are government leading, public participation, gradual treatment and incremental improvement (Zhou Kai, Yan Yan and Song Bin, 2012).

4 Realization of public participation in the urban planning of big data era

In the age of big data, a platform is needed to realize the public participation of urban planning. This platform, is not a graphics design platform such as CAD, but a broader platform which provides public participation and use based on GIS technology (Batty, 2013).

4.1 Involuntary participation: public participation of urban planning

Public participation in traditional urban planning is voluntary. That means participators provide information for urban planning consciously. However, participators involved in this public participation form are restricted, and the information provided by participators is mainly limited by their spirit of dedication and degree of participation.

Urban planning in the age of big data places more emphasis on involuntary public participation. Nowadays, urban residents are in numerous digital networks, such as mobile communication, bank, GPS, etc. Public will inconsciently leave their daily digital paths, while they are getting benefit from the web service. These digital paths can fully reflect the real life of urban residents. The data, as the product of urban residents daily digital paths, will be more helpful in promoting urban op if it is once associated with data from other sources. Thus, it can guide the environment-adapted and futurity-oriented planning decisions.

4.2 Induced using: construction of public participation platform

Based on the principle of involuntary public participation, induced using has already become the basic principle for constructing public participation platform in the age of big data. Induced using, including benefit-induced using and interest-induced using, can construct the public participation platform of urban planning with the help of corresponding forms such as services, games and forums.

Take the icity program in England as an example. With the help of infrastructure constructions such as wireless networks and sensors, it have already established a service platform, which includes climate information release and public facility use, etc. Through inducing residents and encouraging the third parties such as developers, small and medium enterprises, neighborhood associations to use the data produced during the use phase of icity, decision-makers can discovery the public interest, improve the service strategies and increase the service content. As another example, the students from HafenCity University Hamburg designed a game named B3 (Murgante, Gervasi, Iglesias, et al., 2011), when they were designing the market update in the district of Billstedt. This game makes residents to design the infrastructure constructions in their heart such as squares, seats, trees and children playgrounds, and induces the data reflecting the habit and willingness of residents to generate. In addition, Brain McGrath, an American scholar, established the virtual space platform and the on-line forum system about urban evolution in the urban design of Roman with the spatial data of archaeology and the temporal data of systematology. Through inspiring the passion of public participation, urban design will become the city image advocated by most residents rather than the city simulation created by few experts.

4.3 Data visualization: construction of urban planning platform

Traditional urban planning, only relying on the point-line-surface cartography mode, can t fully expression the complex information which implies non-space data. The design platform of traditional urban planning can boil down to the mapping platform of design achievements, while that of the urban planning in big data era is not only the expression platform of design achievements, but also the exchange platform which provides data analysis with abundant visual representation.

Data visualization technology developed in recent years will efficiently solve the problem of urban planning platform construction in the age of big data. Data visualization can realize the data analysis and communication with the application of tables, diagrams, pictures and other intuitive data visualization mode. Accordingly, it can inspire the public participation. The theory comes from the perception study of brain science. When all sense organs of human are perceiving things, 70% information is obtain by eyes. What s more, eye is the sensory organ whose perce (Long and Dhillon, 2014). On the one hand, the visualization function of human eyes can analyze a mass of abstract data, and the new data analysis technique can amplify and expand the human eye vision. On the other hand, the creative nature of human is benefit from the mutual action of the logical thinking and imagery thinking, therefore, massive amounts of spatial data and non-space data can inspire the imagery thinking and creativity of human only through the data visualization technology (Post, Nielson and Bonneau, 2003).

Data visualization technology will encourage designers, managers and public to understand and participate in the whole process of urban planning. Moreover, in the circulatory design flows, public can constantly feedback information and designers can accordingly modified result. Therefore, it is necessary to construct the data analysis platform and the design communication platform in the urban planning platform of big data era. The data analysis platform synthetically integrating the machine learning algorithm, can capture the corresponding social-networking data. With the correlative thinking of big data and knowledge discovery, the visual interface whose data updated automatically and timely will be established to induce more public to focus on and participate in data feedback. The design communication platform, based on the visual interface of data analysis platform, builds the visual interface for design scheme and the feedback environment for plan implementation and public participation. It can provide instant feedback on the dynamic data of public participation and plan implementation and timely correct the design scheme.

5 Conclusion

Big data can provide the ideal public participation platform for urban planning and realize the long-distance communication. With the help of the platform such as e-government and SNS, which play an important role in information disclosure and positive interaction, a new paradigm of public participation in urban planning will be created to change the traditional urban management pattern and the urban planning process.

The appearance of big data realizes the real-time dynamic interaction and communication of government, planners and public in the process of planning investigation, scheme development, planning evaluation, plan implementation, etc. It is conducive to promoting the scientification and humanization of planning process and advancing the democratization process of urban planning. Moreover, with the big data analysis of urban planning, construction and management expressed by public through e-government and SNS, government and planners can promptly adjust the urban spatial layout, optimize the public service facilities allocation and innovate the urban management pattern.

However, big data only provides the tools and methods. To realize the real public participation and scientific planning still need the unremitting efforts of planners. With the open attitude and scientific spirit, planners can really exert the advantage of big data to provide a key support for urban planning under the background of new urbanization.

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