

# The theoretical framework of consumer service APP on mobilephone affecting urban commercial space

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**Abstract.** The purpose of this paper is to study consumer service-oriented APP and try to build a theoretical framework of its impact on urban space. The Physical space space when consumers use APP is defined as "window space". Based on constructing the dynamic mechanism for the reorganization and diffusion of consumer service-oriented APP, this paper puts forward the hypothesis that "window space" gathers the physical space of service industry. Focusing on the spatial development in the Internet era, this paper predicts the transformation of urban space from "business center" to "crowd center".

**Keywords:** Mobile phone APP, Urban commercial space, Theoretical framework, Function mechanism, Window space.

## 1 Introduction

APP (short for "Application") is a kind of Application software installed in smartphones. The portability of APP and its carrier improves the efficiency of urban life. From the perspective of "behavior-space" theory, the change of living behaviors will promote the change of urban space, and urban planning should also respond to such spatial changes. This paper tries to judge the mechanism and effect of the influence, so as to think about the ideas and methods of urban commercial space planning in the information age.

## 2 Research review

APP and its carrier smartphone are typical products of the development of information communication technology (the following referred to as "ICT" use Information Communications Technology) to mobile information and communication technology (the following referred to as "MICT" use Mobile Information and Communication Technology). From the early classic utility framework of collaboration, substitution, derivation and enhancement [1] to a series of empirical studies with different results. Realistic

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spatiotemporal constraints can affect human network usage behavior, and website use will have special time distribution characteristics, while website use will affect travel behavior [2].

At the stage of MICT's influence on urban space, mobilephones become an important object of this kind of research. In order to arrange activities in a relatively free way, it is necessary to make the behavior time-selective and malleable [3]. How to use mobile phone data in building design and urban planning to fully understanding and analysis of real space, the change of the design process, or specific to the virtual space form and special environment is worth thinking about [4]. In the existing research on urban planning response in the information age, systematic research has emerged in the aspects of public participation in planning compilation brought by new media, construction of urban planning management system driven by geographic information [5], and cultivation of special functional areas of high-tech industry. The spatial changes of urban residents' behavior, urban economic activities and urban spatial morphology are all worthy of attention.

To sum up: Firstly, urban space research in the era of mobile information should be at the forefront, but there are few spatial studies on consumer service APP with certain particularity and wide use. Secondly, predecessors and colleagues have laid a strong theoretical foundation on the impact of ICT on urban space, and the strong informatization wave and the development of complex cities in China provide a wealth of cases worth exploring. Thirdly, the research on the correlation between mobile phone and urban space involves the use of mobile phone and its software to complete the dialogue and echo with urban real space, as well as its impact on urban real space, but there are gaps in the specific spatial action mechanism. Fourthly, responding to the urban planning in the information age is a very important new proposition.

## **2 Theoretical basis**

Consumer service APP carry significant spatial characteristics, and its spatial action of this type of APP are as follows: I. Spatial information transmission, that is, APP allows consumers and service providers to know each other's spatial location information; II. The space limitation, that is, the APP background usually choose only within A certain distance of services to consumers, push ("food and beverage", "leisure and entertainment") III. Space order reorganization, namely the APP background when push to consumers on the basis of popularity, reputation, price, open time and consumer requirement for the above services within the scope of sorting, the sorting of the different situations will bring service space location of the reorganization, can also lead to the weakening of geographical proximity advantage. IV. Instant reserve space, namely the service provider through the APP for consumer choice and complete the online trading, there will be a certain amount of time to preparation of the reality space consumer services, the similar production "instant" ("Just in Time") concept of "at the time of need, according to the need of production quantity needed products" advocated toughness production space.

## **3 Framework building**

### **3.1 Mechanism construction and influence effect hypothesis**

Based on the above principle of spatial action, the mechanism of consumer service APP affecting urban commercial space is further studied. At a certain distance critical point, the consumer's choice probability appears maximum. The formula is as follows:

$$P = e^V / (1 + e^V) \tag{1}$$

$$V = -x(s - kX)^2 + X^2k^2x \tag{2}$$

Use P for probability of individual using APP. Use x for consumer social attribute index, judging its value according to different social attributes; Uses for distance between consumers and merchants; Use k for a constant;  $X = Cq1$ , use X for attraction index,  $C = C1 - C2$ , use C for price variable. Use C1 for offline commodity price, use C2 for online commodity price. Use q1 for praise rate. When  $P \geq K1$ , consumers will choose to consume, when  $P < k1$ , consumers will choose to give up consumption.

Based on spatial aggregation and diffusion mechanism, consumer service APP urban commercial spatial effect hypothesis include: one, the APP services to APP consumer gathered in the locality of the reality space, form the APP consumer community centered, APP services around the circle around the urban space structure (different from commercial center as the center of the city space structure). Second, the mobility of mobile APPs promotes the diversification of consumers' use space and the randomness of spatial distribution of APP service providers. Thirdly, the diffusion mechanism formed by the spatial reorganization function of APP causes the mismatch between commercial centers in virtual space and real space to a certain extent.

### 3.2 “Window space” for consumers to use APP

The real space where consumers use APP to search for service providers is a “window space” that connects virtual space. This kind of space has the characteristic of time space double dimension. Consumers a certain number of cases in some area, the “window space” growth rate and using the consumer number, unused APP is directly proportional to the product of the number of consumers, according to the growth curve model is derived: In a certain period of time, the “window space” in different distances will appear in different states of slow growth, rapid growth or saturation. The formula is as follows:

$$N(S) = L / (e^{-bSM}(L/N_0 - 1) + 1) \tag{3}$$

Use N for window space scale;  $L = k'h$ , use L for living demand (i.e., the limit value of  $N(S)$ , determined by the population of the research area), use  $k'$  for a constant. Use h for total number of people living in (employment) center; Use b for adjustment coefficient; Use S for distance between the consumer group and the residence (employment) center (point of departure),  $0 < S \leq S_0$ , use  $S_0$  for distance between the residence (employment) center and the business center;  $M = h / \pi r^2$ , use M for quotient circle size index. Use h for total number of users in the quotient circle, use r for quotient circle radius; Use  $N_0$  for number of consumers using APP in the distance from the residence (employment) center at a certain time.

### 3.3 Correlation between consumer “window space” and location evolution of service providers

By collecting consumer location data and service provider location in orders of “Meituan” and “Dianping”, the spatial and spatio-temporal change of density and location is quantitatively analyzed respectively. The multi-distance clustering analysis method is adopted to calculate the spatial correlation between APP service provider location and consumer use by their household ratio, area ratio and their associated spatial weight (within a certain period of time). The formula is as follows:

$$L = \frac{\frac{s_1 \times h_1}{s_2 \times h_2} \sum_{ij}^n k}{\pi n (n-1)} \quad (4)$$

Use L for spatial correlation intensity between service area and consumer area; Use S for area of research area, Use S1 for area of consumer area, use S2 for the area of service area, S = s1 + s2; Use h1 for number of business households in the research area, use h2 for number of consumer households in the research area; use i for the consumers in the research area in a certain period of time, use j for merchants consumed in the research area in a certain period of time. Use ij for distance between i and j. Use k for distance weighting. When  $ij \leq d_1$ , the distance weighting k is 0. When  $ij \leq d_2$ , the distance weighting k is 1. The distance weight is 2 when  $ij \leq d_3$ , and the distance weight k is 3 when  $ij \leq d_4$ . Use n for number of consumers calling the online service in a certain period of time.

On this basis can study service provider cluster with high density “window space” relationship, to verify the assumption 1 of a spatial effect. By comparing location selection characteristics of APP service providers with those of similar grade but not included in APP service providers, hypothesis 2 of spatial effect can be verified. Study APP in word of mouth, the location of the popularity of the top service providers, which are not located in the center of the city commercial APP for service providers to investigate and induction, to validate the hypothesis 3 spatial effect.

## 4 Planning and response

This paper presents a planning idea to control the development of urban commercial space based on the control of relevant time relations. In the case of geographical proximity, this is no different from the traditional spatial trend. However, if it can be verified that consumption service APP leads to the transformation of urban commercial spatial structure connotation, it is necessary to establish a new urban commercial spatial structure based on information and communication technology -- APP service providers focus on the “window space” of APP users. This spatial structure represents a shift from “business center as the center” to “crowd center as the center”. To further expand, we can combine the needs of planning and management to conceive a life service facility configuration system or activity space system that contains more facilities.

Supported by the Natural Science Foundation of Shandong (ZR2021ME076), Major R & D Plan (Soft Science) Project of Shandong (2021RKY04066), Humanities and Social Sciences Research Project of the Ministry of Education (21YJCZH024).

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