

# Simulation of Changsha-Zhuzhou-Xiangtan Public Transport Flow Culture Based on GIS

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## Abstract

As a theoretical concept, the introduction of local mobile culture is very helpful to the study of Changsha-Zhuzhou-Xiangtan public transport. In this paper, GIS public transport policy is used as the carrier of Changsha-Zhuzhou-Xiangtan mobile culture to explore the regional differences of local mobile cultures. The measure of local mobility culture proposed in this paper is composed of the difference of road distance between regions and the efficiency of mobility, which reflects the influence of these two potential factors. In addition, the results also support the prediction of Changsha-Zhuzhou-Xiangtan public transport, and the latitude of local mobile culture has a substantial relationship with transportation distance and tool use.

**Keywords:** mobile culture, Changsha-Zhuzhou-Xiangtan Public Transport, GIS, distance

## 1. Introduction

In China, transportation is the second largest greenhouse gas emission factor affecting low-carbon efficiency. Transportation strategies to reduce these emissions over the past few decades (Ren, J., Jing, Z., Pu, J., et al., 2006) have focused on improving engine technology and, to some extent, encouraging a shift to electrification. However, the emission reduction effect of (Park, J., Lee, J., Lee, T., Kim, J., & Kil, J., 2012) these policies is offset by the increase in the number of vehicles, the weight of vehicles, the size of engines and the frequency of driving. Therefore, the emissions from the transport (Zhuang, Y., & Xia, B., 2017) sector increased further over the same period. On the other hand, with the proposal of three tire policies, my country's cities, especially the population like the Yangtze River, will climb the traversal pressure brought by the population, and will directly reflect the transportation tools that are carriers in personal cars. A large amount of increase, resulting in further deterioration of urban environments. The role of transport planning, in urban settings, where public transport bicycle walking will be better than car use. Car users must pay the environmental costs associated with their transport choice (Fan, Y.-J., 2020). This far-reaching foundation involves infrastructure and spiritual change, and it needs more people's support in society. Although people have become more and more profound about the environmental and health-related costs of automobile-oriented transportation systems, most people are not ready for the necessary fundamental systematic transformation. The absence of public support may be one reason why transportation researchers and urban planners are increasingly interested in the concept of traffic mobility culture. In public discourse, the culture of mobility can only be used to explain that neighboring cities can have different transportation systems and modes (Yang, B.-Q., 2020). If different local cultures of mobility do indeed result in different patterns of mobility, then this has important practical consequences. In this case, better understanding of traffic cultures affects the use of vehicles in the use of vehicles, which can provide a beneficial starting point for the design implementation of the system and assess sustainable transportation policies accepted by the public.

## 2. A Sociological and Geographic Approach to Mobile Culture

Cultures blend modes of transportation, infrastructure, architecture, urban and natural environments as well as

individual modes of transportation and local discourse. Moving culture is an entity related to the practice of physical properties and symbolic emotional activities, which describes the interaction of participant stakeholders, infrastructure and methods as a social technology system. Wu di and etc. in the transportation geographic field propose a more empiric transportation, including urban form, social population (Wu, D., Li, X., & Zhou, Y.-J., 2020). Hu hao has studied an empirically available measure of local traffic mobility that is useful for researchers interested in a predominantly mobile culture, traffic infrastructure, travel behavior and transportation-related cultural cognition, because they used mobile culture as an explanatory independent variable (Hu, H., 2019). However, this method lacks the needs for geographical research for urban agglomerations, because geographical research of urban agglomerations is mainly carried out at the coordinates of GIS. Furthermore, this approach does not provide a theoretical view of the cause-and-effect relationships between indicators that affect the culture of mobility and how changes in one indicator affect other indicators.

### 3. The Research Method of Mobile Culture in Changsha-Zhuzhou-Xiangtan Public Transport Based on GIS

For a long time, the mobile culture of public transport has been mostly supported by subjective means such as social surveys. This research method is mainly based on personal experience. The empirical path suggests that people observe the behavior of their peers on social networks and infer what people usually do. This conceptual path suggests that people learn about their community norms from what their peers say people generally do. However, some scholars have described a situation in which most members of a group privately reject a so-called social norm, but drift along because they mistakenly believe that most others accept it (Ma, X.-Z., 2009). Therefore, this paper takes Chang-Zhu-Tan as the research object and puts forward a new scale of theoretical method, urban agglomeration based on GIS simulation, to study the flow culture of public transport (Shan, B., 2015). There are two Enlightenments to construct the measurement of local mobile culture based on the GIS simulation research method: 1) We highlight the local transportation culture as a geographic space, that is, what priorities should guide the design and further development of local transportation systems; 2) Since GIS simulation is established and maintained in a network of geographical coordinates, time or the number of vehicles can be used as a unit to assess the local mobile culture. Firstly, the geographic environment space of Changsha-Zhuzhou-Xiangtan GIS is constructed in software Anylogic. Five vehicle distribution centers have been established in Changsha Railway Station, Changsha Municipal Government, Zhuzhou Lusong District Government, Xiangtan Municipal Government and Shaoshan. These five vehicle distribution centers represent the mobile stations of Changsha-Zhuzhou-Xiangtan public transport (Jiang, W., Chen, Z., Lei, X., et al., 2016). (Figure 1).

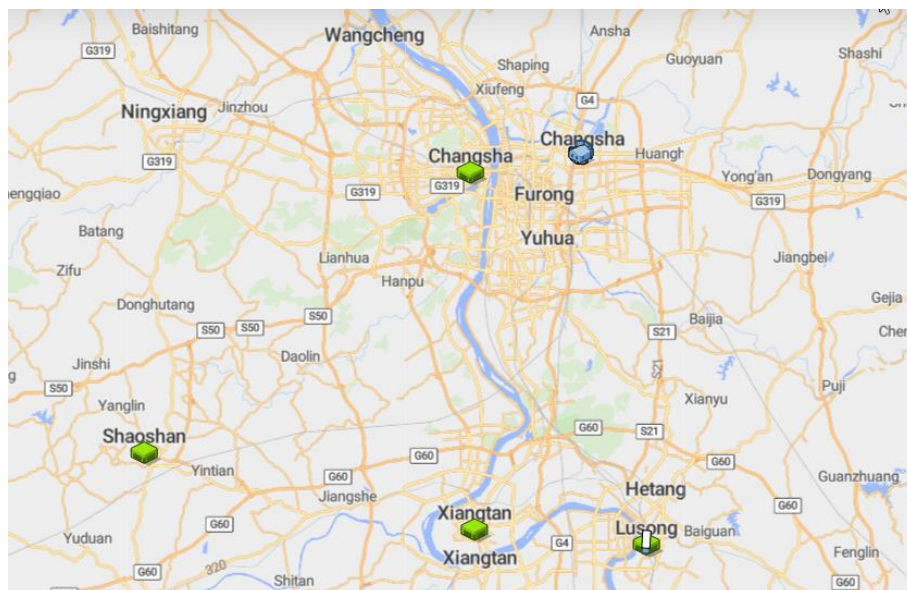


Figure 1. Five mobile stations of public transport simulation in Changsha-Zhuzhou-Xiangtan urban agglomeration

Secondly, the vehicle circulation behavior model of Changsha-Zhuzhou-Xiangtan public transport is established (Figure 2).

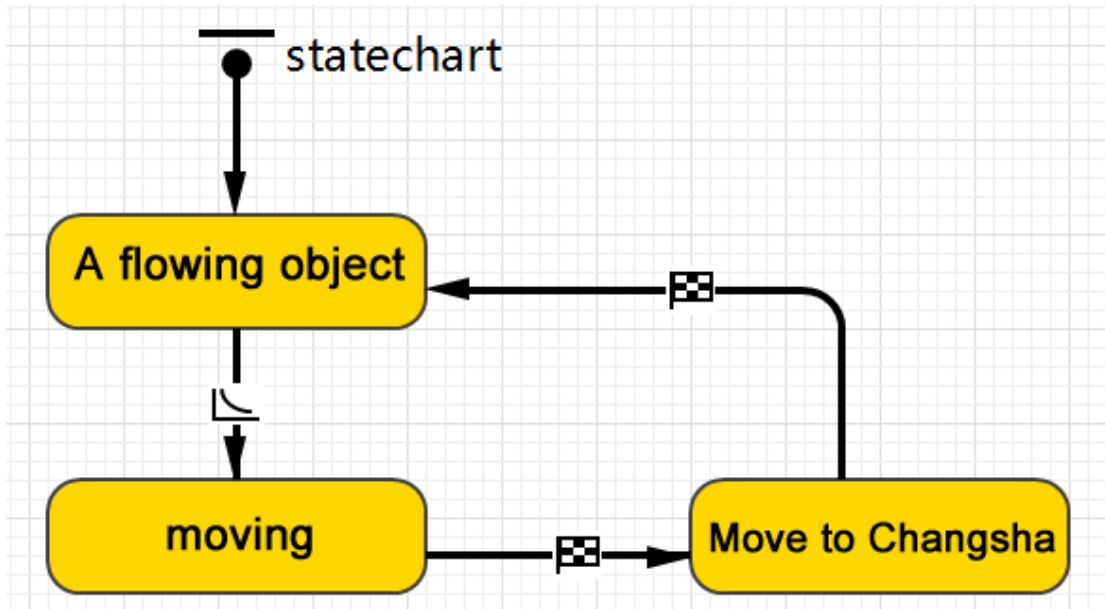


Figure 2. Vehicle circulation behavior model of Changsha-Zhuzhou-Xiangtan public transport

With Changsha Railway Station as the starting point, the other four vehicle distribution centers are mobile stations. When public transport starts from the blue railway station, the GIS road moves to a station, and then returns to the railway station in turn. In this way, a circular flow mode is designed to observe the time consumption of vehicles and the number of departures, which can be used as the basis for quantifying the cultural units of regional public transport. The simulation results are shown in Figure 3. Changsha-Zhuzhou-Xiangtan vehicle-mounted mobile culture is the closest and most efficient between Changsha Railway Station and the municipal government; The vehicle-borne mobile culture between Changsha and Shaoshan has become the most distant because of the long distance between the two places and the long round-trip time; The road gap between Changsha to Zhuzhou and Changsha to Xiangtan is small, and the car flow culture, the similarity is large. The only difference is that Changsha to Xiangtan road is relatively smooth, and Changsha to Zhuzhou's road requires turning.

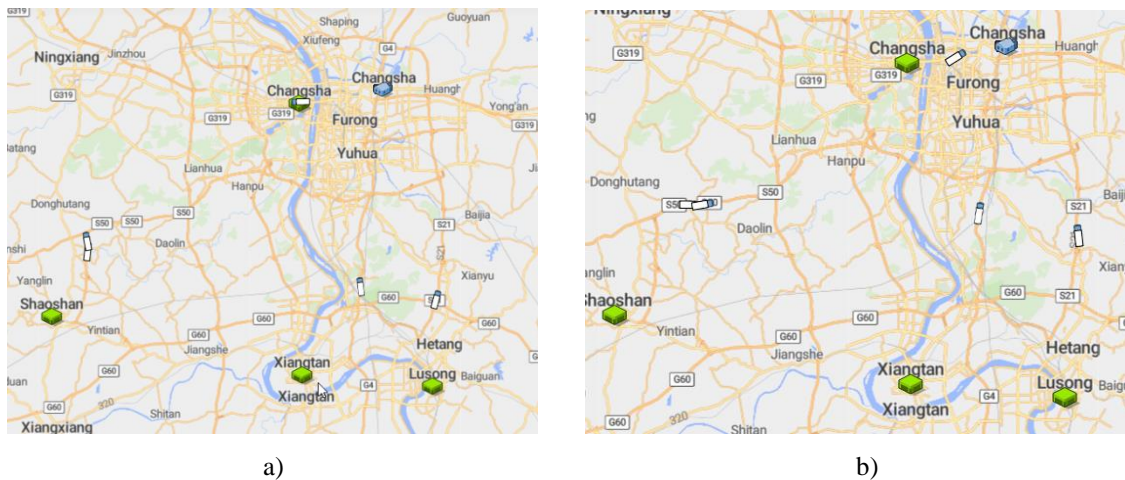


Figure 3. Simulation of Changsha-Zhuzhou-Xiangtan public transport vehicle mobile culture under GIS (a,b)

From the simulation results, it can't be found that the mobile culture of Changsha-Zhuzhou-Xiangtan public transport is closely related to its road distance, public transport infrastructure and means of transport. Among them, the distance between Changsha Railway Station and the municipal government should be the shortest and the effect is the best, which shows that the communication between Changsha-Zhuzhou-Xiangtan public transport and regional culture is the most ideal. However, Shaoshan is the farthest from Changsha because of its geographical location (Nguinbe, B., Tchuidjan, R., Mbinkar, E., et al., 2021), and its cultural exchange is the most difficult. With the continuous improvement of transportation, the commuting time between cities should be shorter because of faster and better modes of transportation. Therefore, between Changsha and Shaoshan, not only the traffic like the inter-city high-speed railway, but also the problem of mobile culture between Changsha and Shaoshan can be effectively solved. Because of the similar road distance from Changsha to Zhuzhou and Xiangtan, there are many similar mobile cultures. This is also an important condition for Changsha, Zhuzhou and Xiangtan to move towards integration.

#### 4. Conclusion

Greenhouse gas emissions from the urban transport sector have continued to rise in recent years. Calls for a focus on technological innovation and changes in the use of personal transport modes are not sufficient to achieve the required reductions in associated greenhouse gas emissions. Therefore, it is increasingly recognized that creating a sustainable transportation system requires a new transportation culture in addition to the basic configuration of vehicle technology and physical transportation structures.

Based on the theory of GIS, this paper takes the visual quantification of local transportation culture as an understanding of regional mobile culture to guide the design and further development of local transportation systems.

For this reason, this paper develops a new method to measure the public transport culture of Changsha-Zhuzhou-Xiangtan. The method consists of geospatial GIS simulation and two factors that reflect the support of Changsha-Zhuzhou-Xiangtan public transport vehicle flow guidance and multimodal transport needs. It reflected the consensus of Changsha-Zhuzhou-Xiangtan public transport on the implementation of policies and measures to promote and stimulate the construction of road facilities, and promote different local needs.

Under the descriptive influence of Changsha-Zhuzhou-Xiangtan public transport GIS simulation, this study finds that there is a direct correlation between two potential cultural factors of mobility and public transport use in Changsha-Zhuzhou-Xiangtan. Two potential flow culture factors show impressive predictive power.

The most realistic finding is that road distance and transport efficiency should be favorable evidence for the use of public transport in Changsha-Zhuzhou-Xiangtan. This finding contrasts with the traditional economic approach. Traditional economic approaches primarily conceptualize the use of transportation as a desirable selection process. This selection process is driven by the calculation of individual monetary and time-dependent costs. In contrast, our results describe vehicle use as a function of road distance and transport efficiency. Its driving force comes from the process of Changsha-Zhuzhou-Xiangtan public transport vehicle mobile culture. This finding reveals the importance of a shift in cultural thinking as a prerequisite for successful transportation policy transformation. At the same time, he also provides hope for changing the way of participation in local transportation culture.

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