

Using ‘Chorèmes’ style diagram to promote positive cognition of spatial planning concepts: A case from Laogang, Shanghai

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Abstract:

Maps have traditionally been used as auxiliary tools by planners to illustrate spatial concepts and development strategies of multiple stakeholders (Healey, 2006). A conceptual planning map must balance real-world conditions, investment potential, social justice, and spatial power (Doling et al, 2016). Driven by data, traditional conceptual planning maps prioritize the accuracy of feature locations and boundaries. However, such maps may need to be more persuasive when considering the conflicting needs and cognitive uncertainty of map users. Moreover, representing multi-layered information that captures both the spatial and socio-economic aspects of cities is challenging due to their complexity.

To optimize strategic spatial mapping, we propose revisiting the 'chorèmes'-style diagram, which has two primary advantages (Brunet, 1987). (i) The process generalizes and reshapes the morphology and structure of the region by transforming and mapping spatial relations. (ii) It enhances concept understanding and guides consensus by allowing flexible adjustment of map symbolization (Dühr, 2007). The design of the 'chorèmes'-style diagram balances positive cognitive accommodation and planning stakeholders' demands. Using the 'Conceptual Plan for Urban Agricultural Development in Laogang Town of Shanghai City' as an example, we developed two maps: a traditional map based on a remote sensing image and a corresponding 'chorèmes'-style map (Figure 1).

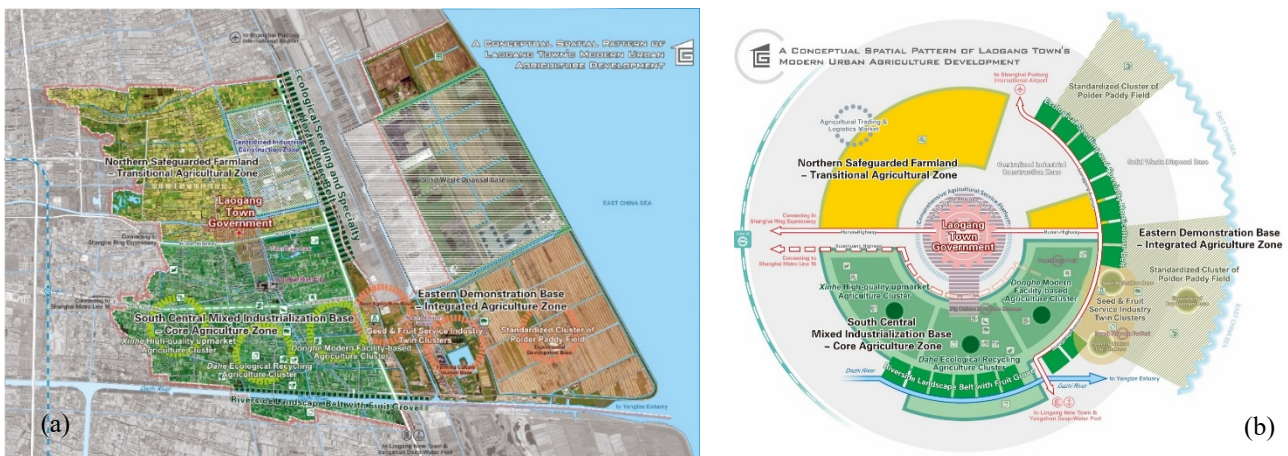


Figure 1. A conceptual spatial pattern of Laogang Town's modern urban agriculture development (a. the remote sensing image map; b. the optimized 'chorèmes' style diagram)

Laogang is situated in the coastal area of Pudong New Area in eastern Shanghai. The town is known as a core demonstration site for urban agriculture, with a focus on enhancing the local agricultural economy through green and ecological planting, as well as developing a leisure service industry. The spatial pattern of the conceptual plan is described as 'three districts - two belts - six clusters.' As shown in Figure 1, the traditional map has three deficiencies: (i) The complex background weakens the intrinsic correlation among functional units. (ii) Although the solid waste disposal base is environmentally friendly, it covers a large area of 15.3 km² and is susceptible to inertia cognitive bias. (iii) The effectiveness of the shuttle buses for transporting tourists is questionable due to a visual distance barrier to the extra-territorial rail transportation facilities.

To tackle these concerns, we designed a 'chorèmes'-style diagram (see Figure.2). We replaced the remote-sensing image with semi-open concentric rings to minimize background interference. The ring pattern corresponds to the spatial configuration of 'three districts - two belts - six clusters.' The gray ring represents the town. The fan-shaped rings filled with yellow, green, and olive lines represent the three main functional areas: the *Transitional Agriculture Zone of Safeguarded Farmland*, the *Core Agriculture Zone of Mixed Industrialization Base*, and the *Integrated Agriculture Zone of Demonstration Base*. Additionally, round symbols denote six industrial clusters. The green dotted arcs in the east and south correspond to the two ecological belts of horticulture and fruit forest. The main roads, rivers, and coastlines are marked with red and blue double lines and an outermost wavy line, respectively. The topological structure is a metaphor for the circle plan, encompassing the local government area, centralized residential zone, and peripheral comprehensive agricultural service platform. We made the northeastern solid waste disposal base colorless to reduce the visual impact and address potential investor concerns regarding the risk of developing green agricultural projects. We also changed the shape of the railroad line 16 in the neighboring town to a circular arc near the western side of the town, making it visually more accessible for residents and tourists.

To verify whether the above methods achieve the design expectations, we adopted eye-tracking technique to compare the difference in attention level between two groups of participants, which respectively focused on the chorèmes-style diagram and the remote sensing image maps, and completed six thematic elements search tasks. The fixation heat maps show (Figure. 2) that the distribution of projected attention to the metro line 16 in the chorèmes-style diagram is enhanced, and the attention to the solid waste disposal base is significantly reduced. The level of participants' awareness of potential spatial structure and relationship was also further evaluated with a six-question questionnaire. The results indicates that users had a higher ability to understand the overall spatial concept in the chorèmes-style map.

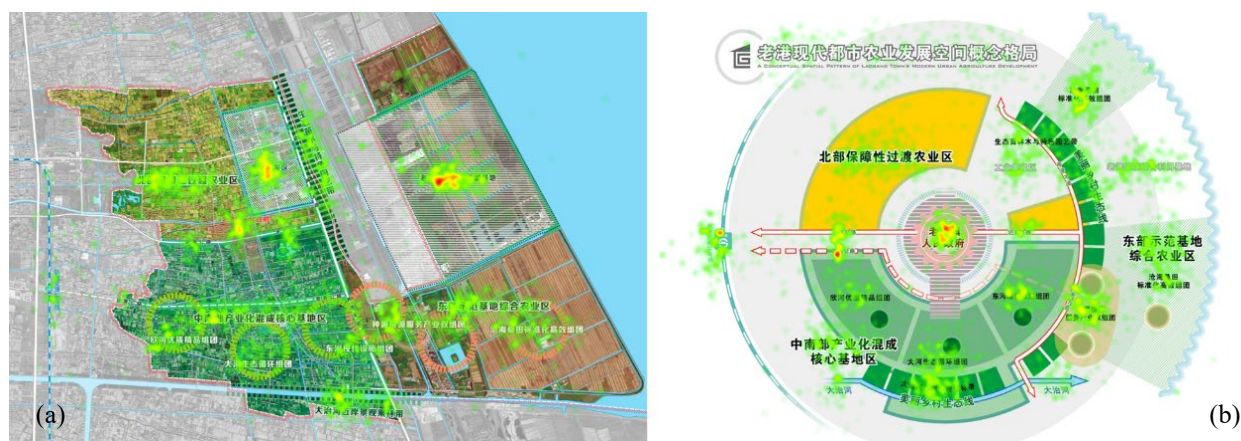


Figure 2. Fixation heat maps of (a) the remote sensing image map and (b) the optimized 'chorèmes' style diagram: Dark red represents high fixation duration; light green represents low fixation duration

According to the above evaluation, we believe that the "chorèmes" style of planning maps is quite advantageous in terms of information searching efficiency, attentional projection control and comprehension, thus is more readable and efficient than a traditional planning map. This is due to three reasons: (i) the 'chorèmes'-style diagram prioritizes visual simplicity by utilizing schematic map generalization techniques, such as selecting, simplifying, displacing, exaggerating, and deforming. (ii) It ensures spatial conceptual consistency by maintaining spatial patterns. (iii) It can visualize multi-objective optimization by adjusting feature weights or eliminating interferences and contradictions. It has the potential for strategic planning scenarios while provides an effective means of information communication to gain the trust, understanding and support.

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