Pay Attention to the Influence of Landmarks and Path Design on the Navigation Effect of Indoor Map

Fang Hao
School of Arts and Communication
China University Of Geosciences，wuhan, CHN
faveric@qq.com

Zhao Ying
School of Arts and Communication
China University Of Geosciences，wuhan, CHN
1015393594@qq.com

Wang Zhong
School of Arts and Communication
China University Of Geosciences，wuhan, CHN
1911671923@qq.com

Dai Qinling
School of Design
Southwest Forestry University,kunming, CHN
daiqinling@126.com

Zhu Yongqiong
Academy of Arts
Wuhan Business University,wuhan, CHN
zyqzhuyongqiong@126.com

ABSTRACT
Indoor maps are the basis and information carrier for indoor location services. With the increasing difficulty of indoor path finding tasks and the continuous development of positioning and navigation technology, indoor maps are widely used. However, the existing indoor map design lacks expressiveness and affinity, which affects the navigation effect of its products. Based on the characteristics of indoor map products and the research status of indoor map design, this paper expounds the practical significance of using quantitative research methods to investigate the influence of landmarks and paths on navigation effects.

Keywords: indoor map; map design; navigation effect

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INTRODUCTION
The increasingly complex indoor business environment has exacerbated the difficulty of people finding tasks. As the basis and information carrier of indoor location service, indoor map can provide users with information such as positioning and navigation route, alleviating the pressure of people's indoor activities, and is widely used with the development of information technology ([1],[2])

Compared with the outdoor environment, the indoor space has the characteristics of small scale, large information density, complicated road structure, obvious space enclosing, segmentation and only human elements ([3]). These environmental characteristics determine the difference between indoor map cognition and outdoor map cognition. The reference frame when people use indoor maps is “front and rear, left and right, up and down”, and the reference frame when people use outdoor maps is “east and west, south and north”. ([4]). Therefore, the difference in cognitive styles has caused traditional map design expressions not to be fully applicable to indoor maps. It is urgent to explore the influence of indoor map design elements on map cognitive effects, and to establish new indoor map design expressions.

RESEARCH STATUS OF INDOOR MAP DESIGN
Some scholars have carried out research on the improvement of the design and expression of indoor maps. Klippel proposed the “you-are-here-maps” indoor emergency map design principle with reference to architectural representations, but this principle is not fully applicable to other forms of indoor maps([5]); Arto Puikkonen found that using a very simplified design can reduce the user's cognitive load([6]); Nossum designed a two-dimensional and three-dimensional simplified “pipeline map” for indoor maps with reference to the subway map representation, but the design has not been empirically evaluated([7]); based on the spatial cognition theory or map perception theory, some scholars also proposed the indoor map design principles and element expression methods, but these design principles are relatively macroscopic, and most of them are speculative research, lacking empirical results support ([1], [3], [4]).

The above research has made a positive exploration for the standardized design of indoor maps from different angles, but the research on the design and expression of existing indoor maps is still at a preliminary stage, and there are some deficiencies in the research results and research methods. As far as the research results are concerned, the existing indoor map design lacks unified design theory and design principles, resulting in uneven quality of indoor map design, which has a certain impact on the user's reading behavior. Among them, low navigation efficiency and high cognitive load are two important issues affecting the use of indoor maps. ([1], [8]).As far as the research method is concerned, most of the research stays in the theoretical explanation and application, lacks the corresponding empirical results support, and few studies start from the specific design elements of indoor maps, and examine their influence on the cognitive effect of the overall map, which brings some troubles to the practice of indoor map design.

According to the above analysis, the author believes that from the specific design elements of indoor maps, to investigate the influence of different expressions on the navigation effect of indoor maps, it can provide new ideas for indoor map design research.

INDOOR MAP QUANTITATIVE RESEARCH MATHODS AND DESIGN FACTORS RESEARCH VALUE

Based on relevant theories and research results, the quantitative research method can mine the important expression elements of indoor maps, and quantify the indoor map navigation effect into specific scores, so as to clarify the influence degree of different design elements expression methods on indoor maps, providing guidance for indoor map design. The existing researches are mostly guided by the relevant theories of cartography, expounding the specific design expression of indoor maps, which has a certain positive impact on the development of indoor maps. However, the introduction of quantitative research can broaden the research object of indoor map design, bring different dimensions of thinking value and research results to indoor map design, and improve the effectiveness of indoor map design expression.

Landmarks are stationary, distinct, salient objects or areas ([9]). As the most important navigation clue in the path of pedestrians, it can help people to understand the environment in a structured way, effectively reduce cognitive load and improve user navigation efficiency ([8]; [10]). However, its information transmission efficiency is affected by its own expression. Excessive landmark information is easy to bring confusion to users, which affects navigation efficiency. Too little information will reduce users' reference goals and reduce user navigation efficiency ([10]; [11]). Therefore, studying the influence mechanism of landmark expression on indoor map cognitive load and navigation efficiency, defining the way in which landmarks affect the cognitive load and navigation efficiency of indoor maps, have important reference value for indoor map design expression.

The path is a topology representation of the user's navigation path, which is beneficial to the user's structured understanding of the navigation path ([12]). Cognitive prominence - graphic/background theory believes that visual or perceptual fields can be divided into two parts: "graphics" and "background". When people observe or perceive surrounding things, they tend to pay attention to visually or perceptually prominent things as "graphics", that is, as the focus of attention. And they use the part of the environment that is not of concern as a "background", that is, as part of the "graphics" ([13]). According to the above theory, the research suggests that the indoor map elements can be highlighted to better conform to the user spatial cognitive model, improve the spatial reasoning efficiency and the rationality of spatial information expression. As an important expression element of indoor maps, there is no indoor map product that guides the path by highlighting important paths. Therefore, examining the effectiveness of indoor maps path highlighting on navigation efficiency and cognitive load can provide a new way of expressing indoor maps.

CONCLUSION

Indoor map is the basis and information carrier of indoor location service. Its element design will affect the transmission efficiency of map information. However, the existing research focuses on the development of positioning and navigation technology, resulting in the lack of expressiveness and affinity of indoor map design,which affects the indoor map cognitive load and navigation efficiency. Through the empirical quantitative research method, the specific relationship between the design elements and the map navigation effect can be clarified, thereby effectively guiding the indoor map design and improving the cognitive effect of the indoor map.

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