

Landmarks selection in street map design

C J Kao¹

Associate Professor, Department of Geography, Chinese Culture University

E-mail: cjkao@staff.pccu.edu.tw

Abstract. In Taiwan many electrical maps present their landmarks according to the category of the feature, a designer short of knowledge about mental representation of space, can cause the map to lose its communication effects. To resolve this map design problem, in this research through long-term memory recall, navigation and observation, and short-term memory processing 111 participants were asked to select the proper landmark from study area. The results reveal that in Taiwan convenience stores are the most popular local landmark in rural and urban areas. Their commercial signs have a unique design and bright color. Contrasted to their background, this makes the convenience store a salient feature. This study also developed a rule to assess the priority of the landmarks to design them in different scale maps.

1. Introduction

Since 1675 John Ogilby had published his first road map, he put the landmarks to be the clue of important town. After 250 years, when Harry Beck design the London Underground Map he put Times River as the landmark to assisted navigators to find their destination. Landmarks play an important role in navigation. In research field, [1] is the first person to propose his concept of anchor point. He defines landmark can function as a point of reference. He also characterizes landmarks by their singularity, where singularity is bound to contrast to the background, a clear form and a prominent location. His idea inspired multiple research papers.

Over the past decades, there has been a considerable amounts of research conducted on the landmarks. [2] categorize landmarks into visual (visual contrast), structural (prominent location), and cognitive (use, meaning) ones. [3] shown landmark is one of the most common environmental features used in route description. They said that landmarks serve as sub-goals that keep the traveler connected to both the point of origin and the destination along a specified path of environment. [4] measure for the attractiveness of landmarks reveled that façade area, shape, color and visibility may influence the contrast to surrounding objects. [5] addressed the influence of landmarks depends on the stability of the landmarks and the locations of the landmarks. However, [6,7,8] all conclude that landmarks can provide important information to facilitate navigation.

More research on various facets about landmarks had been studied by different fields, but little mention is made in Cartographic design. Nowadays in Taiwan before people are planning to visit a new place they surf the Google Map first. While this electronic map change its contents with the scale, readers could not always depend on the landmarks to find their destination i.e. when the scale is small, the location is clear, but the landmarks are hided. Only when the scale became larger, the landmarks will appear, but the location function is disappeared. This study is trying to extract the appropriate salience feature along the road, and according to their characteristics as well as assessing their priority to develop different forms of representation for the required geographic information.

¹ To whom any correspondence should be addressed.



2. Method

2.1. Basic concept

In this study three experiments are conducted. The first experiment is using long-term memory to recall the landmarks around the familiar environment. The second experiment requires the participants to navigate along the unfamiliar environment, trying to know what kind of feature will attract the participants. The scene of the last experiment is same as the second one, but the participants only sit indoors to watch the film catch from the streetcar. The aim is to choose the landmark from short-term memory. Due to many literatures reveal landmarks have their common characteristics; they also have their local difference. Therefore, this study is trying to combine the results from these three experiments to assess the reputation of all landmarks, and according to their popular degree to set them in different scale layout in Taiwan's electronic street map.

2.2. Study environment

Two study roads are used. The first one is Hwa-kung road which located in Yan Ming Shan near Chinese Culture University. Basically it belongs to rural area, and is the only one road to enter the campus. Along this road many shops established, compare to other lanes, this road looked prosperous. The second road is Chu-lin Road which located in New Taipei City, it belongs to urban region, the land use here is mix residential and commercial, especially the first floor all operating the commercial activities, commercial signs are along all this road. These two roads almost have the same length and same commercial categories.

2.3. Participants

There are 54, 27 and 30 undergraduate students participate the first, second and third experiments respectively.

2.4. Procedure

In the first experiment, participants sit in the classroom and draw their cognitive maps about their routine path to enter the campus. The second experiment, participants are asked to record the appropriate salience feature while navigating. After arrive the destination, they also have to hand in the map make by themselves. In the third experiment, participants sit in the classroom to watch a film lasted about 2 minutes. The content is Chu-lin Road. After the film finish, the participants write down the proper feature as their landmarks.

3. Results

There are more than 14 objects are selected as landmarks in the first experiment. But only 3 objects are mentioned by more than half of the participants. The results are shown in Table1. In the second experiment, the amount of object is up to 6 mentioned by more than half of the participants. One of the reasons is because the environment is belonging to commercial district many fantastic things there, the other is because the participants employ observation will not limited by memory capacity. 100% of the participants support convenient store is a good landmark (Table2), the situation is same as the first experiment. In the third experiment short-term memory is working, the amount of object down to 3 again. Considering the camera angle and very short time's glance, some objects are skipped from the second experiment, the convenient store is no more get all participants' support (Table3), but in this section still gain the most participants' agree. From these experiments reflect the different landmark between rural and urban, the results also decide convenient store as the most proper local landmark in Taiwan.

Table 1. Landmark extracted from long-term memory.

	Convenient store	Bird sign	Road mark
male	38	17	15
female	48	13	14
percentage	100	55.6	53.7

Table 2. Landmark extracted from observation.

	Convenient store	School	City hall	Shaw-bei store	Book store	Bank
male	13	13	13	14	10	11
female	14	8	8	6	5	4
percentage	100	77.8	77.8	74.1	55.6	55.6

Table 3. Landmark extracted from short-term memory

	Convenient store	Tea shop	Bank
male	3	2	3
female	20	14	13
percentage	76.7	53.3	53.3

4. Discussions

In the first experiment the specific object extracted from long-term memory, i.e. prior knowledge are involved. Convenient store sell all kinds of daily necessary, from children to adults know this kind of store in Taiwan indicates people store information about their environment then use to make spatial decision [9]. The commercial sign are unique and colorful, especially 7-11 always located in the street corner. Familiar, bright color of signs and special location attract people's attention make this kind of stores popular. Even in the continue experiments they still occupied the number one interesting. Regardless of rural and urban in this study convenient store is important landmark. Bird sign is the symbol of Chinese Culture University. The sign with white color and irregular bird shape stand in Hwa-kung road entrance, totally different from its background [10], that's why it is selected as salience of object in this experiment. Differ from Taiwan's road marks are hanging high in the pole, the road marks in the campus are only around 1 meter high, standing in the intersection of Hwa-kung road, when a change in direction is require to read them, it is so called decision points, support people confident to navigate of the route [11]. Besides the position characteristic, the road names all named for memorial historical figure such as Confucius Avenue, Jesus Avenue which are unforgettable too. Whereas these two objects focus on this campus will not show up in other places, but their design of contrast to background and intersection position contribute to their salience.

Except the convenient store, the second experiment indicate elementary school and city hall are allow participants to select them as the landmark, because their structure are stand out from a scene. Usually, they have facade area, around their main building always build a small garden, the space is free and not squeeze. It is different from the landscape of urban especially these building is labeled is easy to distinguish. Shaw-bei store is a traditional grocery store. Its unique comes from the decoration. The boss stacking and hanging their products outdoor for the advertising effect, caused the appearance of this store is not as regular as others. More than 70% of the participants select it as salient feature. Book store and bank relatively own bigger area than other stores. Book store decorate glass wall, when people walk down there can see indoors clearly. While bank counter often set in the second floor, but ATM machine stand in the first floor for 24 house service. It is common phenomena for Taiwanese. Structural prominent and people's cognition dominant these two objects to be the landmarks.

Different from the former experiment people keep the visual angle parallel to the street view. In the third experiment, with the camera angle, the street view changed all the time although mainly straightforward. Therefore, in the short-term memory processing procedure the hanging way of commercial sign dominant the visual focus. Convenient store, tea shop and bank come out as the

landmark. Besides they all have their unique and well known commercial sign design, their commercial sign are hanging on the wall not flat against the wall prominent in the background, no wonder they attract the eyes. Echo back to the definition of landmark, they all bound to visual distinction (color, design), contrast to background, and cognition (daily necessary, familiar). These findings all follow previous research.

5. Street map design

There is a rule developed from this study which will enrich the landmarks in the smaller scale electronic street map lead to better guidance. Combining above three approaches, whether in rural or urban the most popular local landmark in Taiwan is convenient store, so 7-11, family mart or OK mart will be the best choice. The other stores will be neglect for they are not existed in everywhere. But their intersection location and big size characteristics will be the factors to influence the landmark selection. In the smaller scale the control factor is the intersection of two main roads, such as in 1:200 (Figure 1). With the scale become larger the control factors change to main road and street intersection (Figure 2), it will increase the landmarks. When the scale is 1:50 (Figure 3), can put a landmarks in the street and street intersection. This procedure is applying Hierarchical Organization concept. Once the amount of landmark is abundant, the size of the landmark i.e. the size of the convenient store can be the criteria, choose the bigger one in smaller scale map first and so forth.

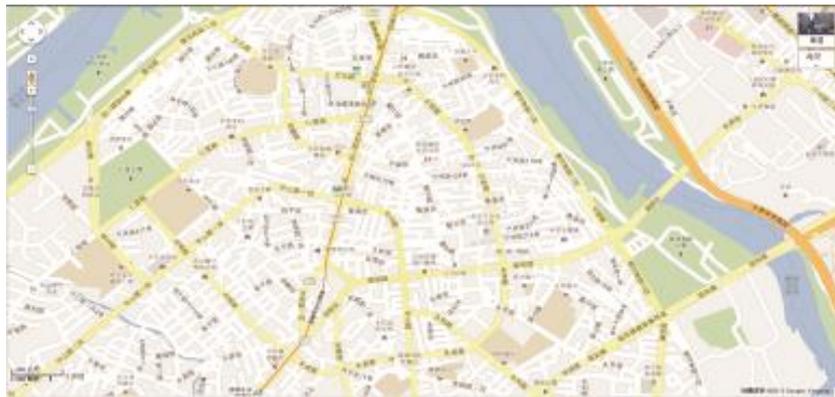


Figure 1. Landmarks selected from the intersection of two main roads

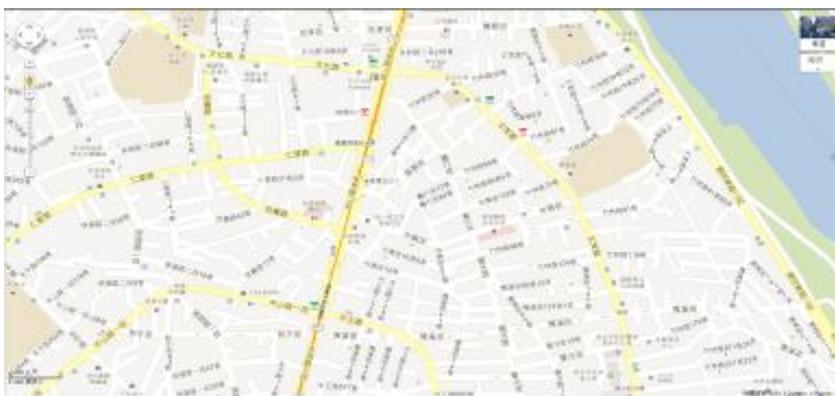


Figure 2. Landmarks selected from the intersection of main roads and streets.



Figure 3. Landmarks selected from the intersection of two streets.

6. Conclusion

This study performed the processing of long-term memory, real-world navigation and observation and virtual-world short-term memory three experimental conditions, conclude that convenient store is the proper local landmark in Taiwan. From the results also developed a rule to select the landmarks in map design. Following the Hierarchical Organization rule developed from this study, it must be more reasonable and have more power to facilitate the map's guidance function in Taiwan.

Reference

- [1] Lynth K 1960 *The Image of the City*, MIT Press Cambridge MA.
- [2] Sorrows M. and Hirtle S 1999 *The Nature of Landmarks for Real and Electronic Spaces*. In Freksa C and Mark D (Eds.) *Spatial Information Theory. Lecture Notes in Computer Science*, 1662. Springer, Berlin 37-50
- [3] Allen G L 2000 *Principles and Practices for Communicating Route Knowledge*, *Applied Cognitive Psychology* **14** 333-359
- [4] Raubal M and S Winter 2002 *Enriching Wayfinding Instructions with Local Landmarks*, in M J Egenhofer and D M Mark (Eds.) *GIScience LNCS2478* 43-259
- [5] Wan X Wang R F Crowell J A 2012 *The Effect of Landmarks in Human Path Integration*, *Acta Psychological*, **140** 7-12
- [6] Roger M N Bonnardel and L L Bigot 2009 *Improving Navigation Messages for Mobile Urban Guides: Effects of the Guide's interlocutor Model, Spatial Abilities and Use of Landmarks on Route Description*, *International Journal of Industrial Ergonomics* **39** 509-515
- [7] Padgitt A J and Hund A M 2012 *How Good Are These Direction? Determining Direction Quality and Wayfinding Efficiency*, *Journal of Environmental Psychology*, **32** 164-172
- [8] Kao C J 2012 *How Landmark Design on Advertising Maps Affect Wayfinding Processes*, *Journal of Cartography*, **22** 31-44
- [9] Schmid F 2008 *Knowledge-based Wayfinding Maps for Small Display Cartography* *Journal of location Based Services* **2** 57-83
- [10] Klippel A and Winter S 2005 *Structural Saliency of Landmarks for Route Directions*, in *Proceedings of the International Conference on Spatial Information Theory (COSIT 2005)* ed. A G Cohn & D M Mark Berlin: Springer 347-362
- [11] Srinivas S and Hirtle S C 2007 *Knowledge Based Schematization of Route Directions*, in Barkowsky T et al. (Eds.): *Spatial Cognition V*, LNAI 4387, Spring-Verlag Berlin Heidelberg 346-364
- [12] Roger M. Bonnardel N and Bigot L L 2011 *Landmarks' Use in Speech Map Navigation Tasks*, *Journal of Environmental Psychology*, **2** 192-199