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RESEARCH ARTICLE

Influence of geometry on legibility: An explanatory design study of visitors at the Kuala Lumpur City Center

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Abstract

Legibility is based on landmarks and geometry. Visitors in a space learn to “read” an area by using three- and two-dimensional cues. This research aimed to determine the responses of visitors to the influence of geometry on the legibility at Kuala Lumpur City Center (KLCC). The relationship between geometry and space legibility can affect visitors' wayfinding. In this study, visitors, including 86 respondents and 8 individuals who participated in a focus group, were surveyed through questionnaires and interviews during daytime. Results show that legibility was moderately and positively correlated with regular geometry, but legibility was negligibly affected by existing geometry. Regression analysis, *t*-test, ANOVA, and scheme coding of qualitative data suggested that regular geometry used in urban spaces might strongly improve legibility. For urban designers, regular geometry associated with landmarks enhances legibility. © 2016 The Authors. Production and hosting by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

Geometry is associated with legibility (Critchlow, 1987, 1976; Hecht, 1988). Regular geometry applied to new tangible products has been widely explored, but the intricacies of the perception on legibility relative to space have yet to be described (Stanford, 2007; Walsh and Cummins, 1976). In most cases, visitors are exposed to irregular geometries utilized for

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urban spaces, where an increasing number of skyscrapers destroy landmarks (Etienne, 2003; Etienne et al., 1998). Geometric designs may also differ from urban designs used for city development (Lee et al., 2012).

Landmarks or geometry is used as a basis for legibility. For example, visitors in a space learn to “read” an area by using two- and three-dimensional cues (Fig. 1) (Sheynikhovich and Arleo, 2010). When finding their way, visitors likely apply landmarks as visual cues in a three-dimensional spatial configuration (Raubal and Winter, 2002). In geometry, human spatial navigation is incorporated in the second dimension (Kelly and Bischof, 2008). Thus, landmarks and geometry can affect a visitor's orientation and navigation (Sovrano et al., 2005). With the development of skyscrapers, regular geometric design may be more reliable than landmarks alone during landscape reading and wayfinding (Sheynikhovich and Arleo, 2010).

Animals and young children, their perception on legibility based on geometry, and the association of legibility with landmarks have been widely considered in legibility-related studies. However, spaces and their relationship with visitors have yet to be fully explored. As such, legibility in spaces should be further investigated to describe their relationship comprehensively. Although legibility in general has been extensively investigated, the legibility of spaces from a visitor's viewpoint has been rarely determined (Dalton and Bafna, 2003; Golledge, 1999; Lynch, 1960). Information on the effects of landmarks on legibility is also limited (Darken and Sibert, 1996; Hartley et al., 2004; Lynch, 1960; Magliano et al., 1995; Ruddle et al., 1999).

This study generally aimed to investigate the visitors' attitudes toward Kuala Lumpur City Center (KLCC) by using an explanatory design method and to determine the visitors' views on the geometry and legibility of KLCC.

This study specifically aimed to achieve the following objectives:

- To describe the explanatory design method for the validation of the process used in our study;
- To investigate the visitors' views on the relationship between legibility and geometry in urban spaces.

KLCC was selected as the study area because it boasts of historical buildings and Malaysian heritage. For instance, Jalan Ampang Street passes through this area. To determine the visitors' perceptions and space-related problems in this area, we conducted a literature review and distributed a questionnaire. We then considered the obtained data to provide recommendations for the improvement of KLCC.

In previous studies, geometry is applied to experiments involving rats to determine the effect of geometry on

wayfinding (Yaski and Eilam, 2007; Yaski et al., 2011a, 2012). In our study, geometry was defined in terms of its effect on legibility and visitors' wayfinding in urban spaces. Difficulties in pedestrian's wayfinding through KLCC were also determined by performing observations during daytime. Significant differences in the perception between genders were not evaluated. Visitors who traveled by car or public vehicles and navigation via computer, robot, or other independent or mechanical tools were also excluded.

The remaining parts of this paper are structured as follows: Studies on legibility, landmarks, and geometry are reviewed. The research methods and procedures used in our study are then described. Our results are subsequently discussed. Implications, limitations, and directions for future research are presented in the last section.

2. Legibility perception of urban space

People understand and recognize urban spaces. Individual features are affected by the cognitive processes of recognition (Koseoglu and Onder, 2011). A cognitive map can be described as the image of spaces recognized by the human mind (MacInnis and Price, 1987). The ability to recognize urban spaces is reduced by vague and complex data (Fig. 1) (Cangoz, 2005).

The mechanism used by humans is similar to that used by computers (Cangoz, 2005). However, the treatment of keywords and the diagram of the human mind is composed of an emotional element (Sacks, 2007). Emotions run deeper than recognition (Cangoz, 2005) and attitudes (Sacks, 2007). The human mind is also adaptive to the level of accessible perceptual data (Hölscher et al., 2011).

The shortest path is not always chosen when people travel. Instead, visitors may refer to landmarks (Graham et al., 2003), follow the geometry of a space (Avni and Eilam, 2008; Dussutour et al., 2005; Hoffmann, 1983; Jeanson et al., 2003; Pratt et al., 2001; Vasquez et al., 2002), focus on gathering data, or visit familiar places (Alstott, 2007). For these purposes, visitors rely on exterior and interior cues incorporated in their representation of an urban space (Etienne, 2003; Etienne et al., 1998; Shettleworth and Sutton, 2005; Sovrano et al., 2005). This spatial image enables route configuration between an origin and destination and between distance and direction determination (Golledge, 1999). These processes have been shown in various investigational environments, such as urban space (Gould et al., 2009; Walsh and Cummins, 1976).

Different types of urban spaces, including squares and streets, have been established. Our study aimed to determine urban space geometry and its effects on legibility.

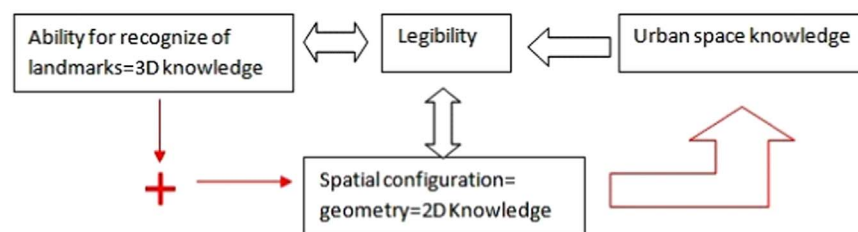


Fig. 1 Mechanism of legibility.

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