Reading the Visual Environment: Wayfinding in healthcare facilities

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Abstract

This paper reports an on-going project that studies how visitors search and use information from the visual environment to guide wayfinding within a healthcare facility. The execution of wayfinding task by ten participants as simulated visitors of a General Hospital in Malang, Indonesia were recorded by video camera and voice recorder. This study revealed that during wayfinding, visitors would focus on the visual environment. Visitors would search, select and use information for wayfinding by reading the environment. These results imply that the arrangement of visual environment is crucial to support wayfinding.

Keywords: wayfinding; healthcare facility;visual environment; visual reading.

1.0 Introduction

Wayfinding in healthcare facilities is commonly difficult for a new patient and visitor. This can be happened not only because the complexity of the environment itself, but also because of the unfamiliarity of the patient and visitor with this new environment. This problem in finding places is not only an uncomfortable experience for a patient and visitor, but being lost or disoriented in a new environment can be time consuming and at worst, create a stressful situation that may give a severe impact, especially on the patient health condition. For this reason, wayfinding is an important aspect in healthcare facilities design and become one of the key parameters of space quality that affect the quality care of the facilities (Samah et.al, 2013). A previous study showed elements that have roles as wayfinding cues within healthcare facilities, (Pati D. et.al, 2015), but there is limited knowledge on how these cues are searched, selected and used.

This paper argues the role of visual environment in giving stimulus for cue-searching while someone navigates in healthcare facilities. Our purpose is to describe the process of visual cue-searching in wayfinding by breaking down the process of wayfinding into steps of actions and identification of visual elements used to guide these actions. By this study we intend to gain understanding on the interaction between visual environment as a stimulus and patient/visitor visual cue-searching in wayfinding as a respond.

2.0 Literature Review

2.1 Wayfinding, Information Processing and Decision Making

Wayfinding can be defined as the ease with which people find their way in a building. Most of discussion about wayfinding see it as a part of environmental learning process that involves the use of information gained from the environment. This process includes environmental perception, cognition and cognitive mapping. During wayfinding, someone develops his cognitive process (Spiers and

Maguire, 2008). That explained why individual familiarity with the environment is one of important factors that affect wayfinding. Someone familiar with the environment usually can do wayfinding with least difficulty by th use of cognitive map, a representation of the environment in the memory. The information in a cognitive map enables someone to recall and make routes selection (Imani and Tabaeian, 2012). The different way works for someone who is unfamiliar and still new with the environment. First time visitor may know nothing about his surrounding environment prior to the visit. Someone unfamiliar with the environment will depend mostly on external aids. He will try to get information from external environment and use his senses to look for something that can guide him to the desired destination. Wayfinding of first time visitor will be explored by this study.

In addition to information processing, Passini (1992) explained that wayfinding also involved decision making process. A decision regarding what direction to take or what action to do has to be planned and executed at every points called decision points (Tzeng and Huang, 2009).The decision plan will be made based on the environmental information. At decision points people need and search an environmental infomation. The kind of information needed is different regarding to the time constraint and the spatial character of the surrounding (Zheng, 2012). How people seek information from their surrounding is the focus of the curent study.

2.2 Wayfinding in Hospital and Healthcare Facilities
Wayfinding is an important aspect in designing healthcare facilities. Considering wayfinding in healthcare design contributes to supportive design by reducing stress experienced by patients, visitors and staff of healthcare facilities (Carpman and Grant, 1993). Wayfinding is also incuded as aspect of design that influence efficiency, effectiveness and patient effectiveness in healthcare facilities (Haron et.al, 2012). Many studies have been conducted regarding to wayfinding within hospital and healthcare facilities setting. Some studies emphasized the importancy of understanding the specific character of the patients such as the visually impaired (Rousek and Hallbeck, 2011) and people with dementia (Passini et.al, 2000; Marquardt and Schmieg, 2009; Marquardt, 2011) and their limited abilities on wayfinding. Regarding to environmental factors, Mollerup (2009) argued that most problems in wayfinding wtihin healthcare facilities arised due to the lack of information, architectural factors and toponomy or room's naming and numbering system. Some of the studies had identified architectural factors that influenced wayfinding performance, such as spatial differentiation (Baskaya et.al, 2004), spatial form and arrangement (Lu and Stamenovic, 2009; Tzeng and Huang, 2009), and architectural elements (Pati et.al, 2015). Study of wayfinding that focused on the process of how patient and visitor seeking information from surrounding environment is still rarely explored. This became the focus of our paper.

2.3 The Issue: Wayfinding and Cue-searching
This study is about the process of wayfinding of hospital patient and visitor as newcomer. It is departed from Lynch (1960) argument that wayfinding could be conducted by the use of sensory element from external environment. This external elements functioned as wayfinding cues. These cues are obtained by the mechanism of perception-action (Heft, 2013). Wayfinding as a process of perception-action means that the sensory cues perceived from external environment then are used to guide action on wayfinding. A person who looks for a destination would search for cues tell him which path to select and direction to move about (Hashim and Said, 2013). This act of searching involves the process of perception. Since people mostly perceive the environment by their eyes, wayfinding cue-searching will involve visual perception. As Gibson (2015) said that locomotion is guided by visual perception, then visual perception in wayfinding has a role to guide the action of moving from one place to another with the objective of reaching the destination. Visual environment become the stimulus and wayfinding behavior is the respond of this stimulus. This paper will argued that wayfinding involves the mechanism of visual cue-searching to guide people movement from place to place to reach a destination.

3.0 Method

3.1 Research Setting
This study included empirical experiments in an outpatient area in a General Hospital located in Malang, Indonesia (see figure 1). The outpatient area is located on the second floor of the main hospital building. The layout of the area consist of three part: center area where the registration booths located; the clinics area in the north and south wings. The two wings are connected by four corridors. Other than clinics that are located on the north and south wings, there is one clinic which is located in different building. This building is located next to the south wing and connected with a bridge.

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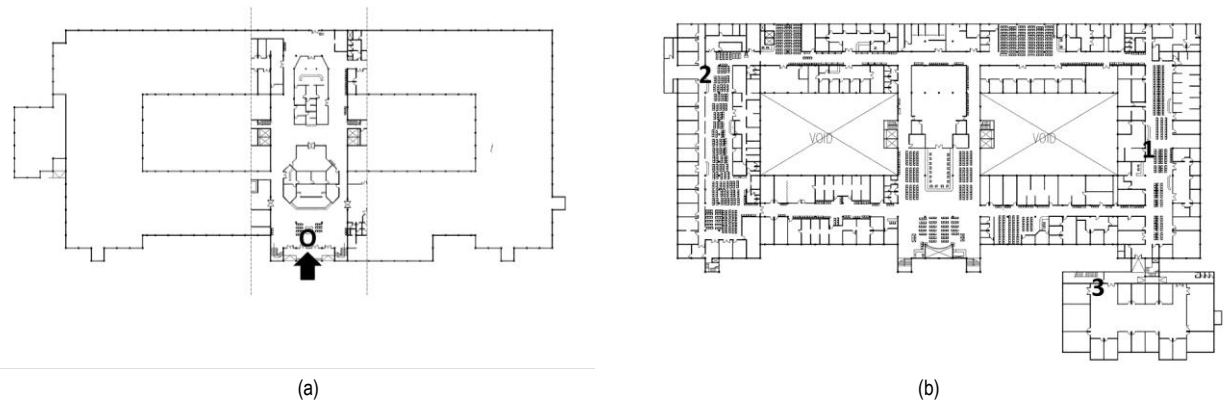<tr><td>(a)</td><td>(b)</td></tr>
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Fig. 1 The layout of setting (a) first floor (b) second floor arrow indicates main entrance as the point of origin numbers indicate the destination's location for each wayfinding task

3.2 Participants

The study involved 10 participants, 4 females and 6 males. This participants were assumed to be new patients who visited this setting for the first time. They were selected so that none of them had visited the hospital more than once in the 12 months prior to this study. The age of the participants were between 23 and 50. All of them had no serious visual impairment.

3.3 Walking-with observation of wayfinding task

In the setting, the participants were asked to carry out wayfinding tasks that simulated an actual jouney of a new patient taking the hospital treatment procedure. Giving a wayfinding task is a method usually used on study about wayfinding process (Tzeng and Huang, 2009; Zeng, 2012). In this study, each participant was asked to go to several destinations in outpatient area. The destination was sequential, started at the main entrance as a place of origin and finished at three different clinic as the final destinations. The purpose in arranging three different journey is to avoid redundancy among participants. During the journey, participants were not allowed to ask direction to other people The execution of wayfinding task were observed by researcher who walked with the participant. This accompanied walk help researcher to conduct in-situ observation that gave more insight of the ongoing journey. All of the journeys carried out by participants were video tapped by a research assistant. The visual data were then analiysed to find out wayfinding visual gesture and movement.
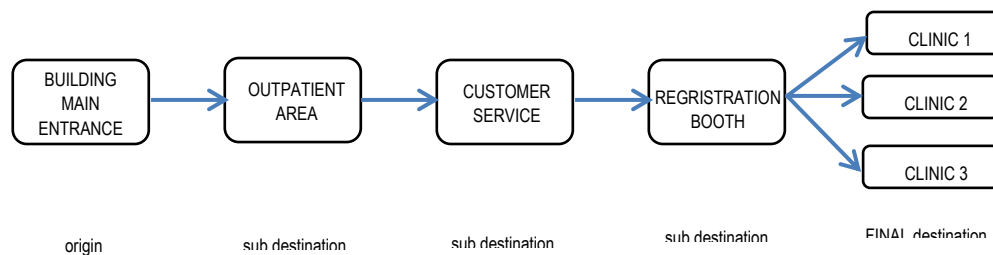

Fig. 2 The wayfinding tasks

3.4 Verbal Protocol

While 'walking-with' observation had advantage in sharing the walking experience of participants, but it was difficult to know exactly the experience in detail. Verbal protocol then were conducted by asking participants to think to say aloud what they see, what they look for, and what action they took while they completed the journey. The verbal protocol is a data gathering method often usen in human factor research in process tracing. The protocols were recorded by a voice recorder then transcribed into written form. The transcripts were coded and categorized into identified wayfinding behavior.

3.5 Limitation acknowledge

Some limitations had been noted from the method used in this study. They were:
- Despite the rich data source gained from the walking-with observation and verbal protocol, the process of data collection can be time consuming, so this method should be applied only to research involving small amount of participant.
- The video tapping is taken from outside view (research assistant). While it documented what action taken and to what direction participants had their view, but it showed very little about what exactly they saw during the journey. For future research, the use of camera from participant's view is suggested.

4.0 Findings

4.1 Time Spend for completing the task

In completing the task, participants were not given a time limit.The average time spend for completing all wayfinding tasks is around 7 minutes. Table 2 resumed the time spend for completing wayfinding task. The highlited number identified time spend by participant who met diffculties in completing the subtask. According to this study, wayfinding difficulties arised when somene could not find any information about the location (where to go) and/or what direction to take. Since the participant were not allowed to ask for verbal help from other person, they were forced to depend only on visual cues.

The time spend did not represent the time of the overall outpatient care service .It only indicated how long hospital visitor will spend in walking and following route of the hospital service procedure. But since wayfinding is one of the space quality parameter that support hospital care quality, the time spend in wayfinding movement can become an indicator to evaluate the effectiveness of wayfinding system within the hospital.

Table 2. Time spend in wayfinding task

Task	Participant	Time Completion of subtask			
		O1-D1	O2-D2	O3-D3	O4-D4
I	P-01	01:54	01:21	00:29	01:34
	P-03	02:28	00:29	00:19	01:52
	P-07	02:00	05:35	00:30	01:20
	P-10	03:31	01:18	00:30	01:39
II	P-04	01:20	00:47	00:16	06:30
	P-06	01:25	00:20	00:16	01:40
	P-08	01:34	00:37	00:14	03:23
III	P-02	02:13	02:07	00:27	03:54
	P-05	04:49	00:31	00:10	03:31
	P-09	04:39	00:49	00:15	02:20

4.2 The wayfinding behavior in a new environment

New visitor generally had no previous knowledge of the spatial layout of the building he visited. In this study, participants were considered as new visitors of the hospital. The analysis of the content of verbal protocol and observation on what participants did during the completion of the task revealed some wayfinding behavior. Those includes 1)Orientation, 2)Wandering behavior 3)Stop and search behavior and 4)turning back to the last decision point.

Orientation.

Orientation includes the process of knowing where we are and knowing where to go. Before taking any action of movement, some participants considered the importancy of knowing the location of the destination. The information of orientation give a glimpse of spatial knowledge of the new environment and enabled he/she to plan the next action such as choosing routes to take. In the study setting, the process of orientation were mostly identified at the first point of origin, which was the main entrance. But although almost all of the participants tried to find out the position of the destination, but not all of them succeeded in gaining the information needed. In that case participant would try to look for directional cues or just wander around. These are some expressions in verbal protocol which indicate the process of orientation:

First, i want to search if there is a plan or layout of the first floor to know the position of the outpatien area...(P-03)

Is there any maps? Oh the outpatient area is located on the second floor. Okay...(P-04)

The sign information said that the outpatient area is on the second floor. So, I have to look for the stair or tools or media to go the second floor.(P-10)

Wandering behavior.

On the contrary to orientation process, wandering behavior was showed by participant who was failed to find information of the destination location, or cues that showed the direction or path leading to the destination. The participant then decided to take attempted action without any information prior to the decision. The participant was not sure whether the direction or route will take him/her to the right destination. If the participant succeeded, he/she would reached the desired destination, but in case the strategy was failed, the participant had to take different action. This was a trial and error strategy and of course would be time consuming. The example of verbal protocols that showed wandering behavior are:

Customer service...keep looking... is it overhere? oh...it is not it...i must be wrong, then a have to turn right. (P-02)

Wait, i will try the rignt corridor....is it on the ssecond floor? I will just try... (P-05)

Just go straight... then where should I go?...(P-09)

I am confused ...mmm... I will just go straight (P-09)

Stop behavior.

In some spots, participants stopped their movement and search for information. It was identified that participant would stop the movement in the point where he/she would look around for cues. Participant would look for cues that might guide his/her next movement. Participant also showed stopping behavior whenever he/she had already found something that can potentially be the cue.

In this type of stop, participant would take some steps to get hear to the cue, stopped his/her step and examine the information by reading the visual content of the cue. it seemed that these two stop behavior are hierarchical, with the first type precedes the second one.

(a)   (b)

Figure 2. The stop and search behavior with two types
(a)Stop to look for cues and (b)Stop to read the cues

The places where participants stopped were identified as decision points. The decision points are the place where cues and information have to be perceived. Figure 3 showed the decision points identified in the study area.
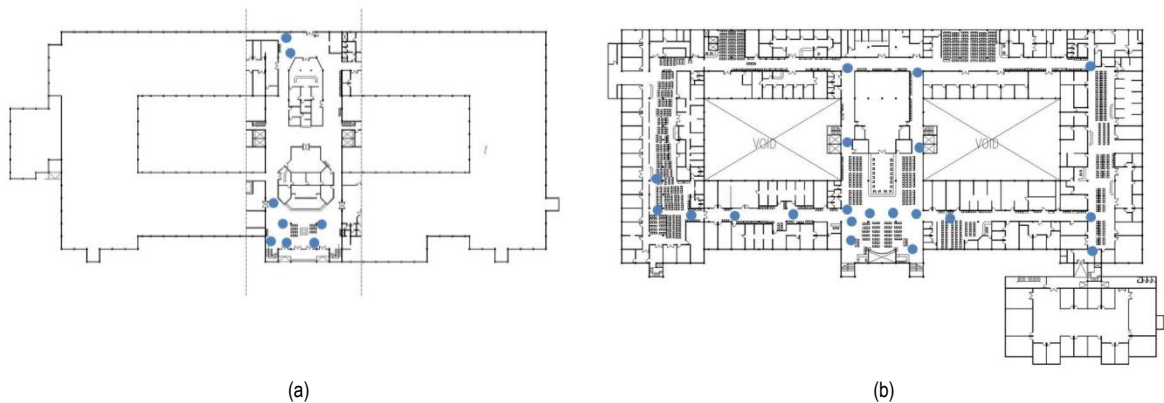

(a)   (b)

Figure 3. Decision points in (a) first floor and (b) second floor

Turning back to the last decision point.
In some cases, participants took steps back to the last destination. They did this behavior if they thought of taking the wrong route or not finding the desired destination. They would walked back through the last route taken to last decision points and confirm the information that they got from this spot. These examples of verbal protocol express turning back behavior:

It seemed that we take the wrong route ..... I will go back (to the previous place) (P-02)

mmm....it seemed that I have to turn back to the last route (P-04)

how if I cannot find the destination....which way to go back? (P-05)

Wayfinding is an act of spatial problem solving. These four behavior, carried out by participant may give insight of what would be done by a new visitor in solving their problems of wayfinding in unfamiliar environment.

4.3 Visual gesture in cue-searching
Visual environment consist of many objects to see. For the purpose of finding a place or destination, people have to select what information to take by seeing and focusing on the elements that can facilitate the process of place searching. The study showed that during wayfinding, participants would focused their view to the textual sign. It also identified that there were some visual gesture showed by participant during the process of wayfinding
- Participant will would focus their view and attention by always looking into forward direction and keeping their head iin upright position.
- While walking, participants would search wayfinding cues and information by controlling their view into distant view and close/nearby view.
- In a narrow sight as in the corridor, participants also looked slightly to the left and right sight but without too much turning the head.

- In a place which gave wider sight, such as hall, lobby or waiting area, participants would show the possibility of turning his head to the left or rignt, look around and turn the head above, to look for information
- Gazing or starring at the sign would be the gesture that indicated the activity of examining the textual content of the information.
- During the journey, participant tended to read the content of sign while walking following a route. This might be also the act of information screening and selection

5.0 Disscussion

This study is about the wayfinding of new visitor in unfamiliar environment. The study concentrates more on how individual read the environment to seek information and doesn't focus on mental representation that created and stored during wayfinding. People read a book to gain information which contained in the text. That mechanism is also occur in wayfinding process. The environment becomes the text that will be read by a visitor.

Wayfindings consist of step of actions. Downs and Stea (1977) divided wayfinding into four sequential steps including knowing where one is, knowing which direction to take, keeping in the right track and knowing that one has reached the destination. Each of the steps would need different information. In this study some identified wayfinding behaviors include orientation, wandering, stop and search and turning back. In relation to the four steps of wayfinding, orientation refers to the first step, stop and search conforms to the second step, whereas turning back became the mechanism of keeping in the right direction. Wandering behavior seem to be able to occur in any of the steps as it become a strategy taken when there is a lack of information in the environment.

Orientation behavior as the first step of wayfinding had been shown by participant of this study at each place of origin. People need to orient themselves to know spatial relation between themselves and the destination. Spatial orientation shown to be easier with a person with spatial memory or knowledge of the place (Lin et.al, 2014), but that cannot be the case for one without prior knowldge of the place as newpatient of hospital. The study showed that new visitor try to orient by looking for orientational information. So they read their surrounding environment to find related cues such as maps or place directories.

Wandering behavior showed by participants when they found no information regarding to location of destination. Wandering could occur in such wayfinding situation which had no time constraint (Zeng, 2012). In this study, all the participants were asked to complete their task without any time limit and not allowed to get verbal information from others . With this condition and while any information had not been obtained, wandering behavior become the probably behavior to occur.

Stop behavior occured in some nodes within the journey. Previous study also identified stop behavior as the most probably produced behavior in wayfinding (Tzeng and Huang, 2009). Tzeng and Huang (2009) differed stop behavior into two kinds namely stop to search for cues and stop to think. In current study, stop behavior that showed by the participant, occured in relation to two aims; the first was stopping to search for cue and the second was stopping to examine the informational content of a cue.

The turning back behavior occured when the participants felt rather lost or not sure about the right direction. It was the mechanism to make they sure that they were on the right track. Instead of making one turns back in his journey, providing nformation that reassure a person about being in the right way would be helpful.

All the behaviors identified in this study seemed to have a relation with what kind of information is need by new visitor. The deeper exploration on where the specific behavior tends to occur should be conducted to find out what information should be provided on specific location within a healthcare environment

The visual gesture or how one would control his visual perception was in accordance with what Gibson (2015) said about the action of '*looking around' and 'looking at'*. In the act of looking, the movements of our head and eyes will influence what to be perceive. Looking around will involve the movement of the head while looking at will mostly the control of eye movement. The result of this study also showed the relation between the spatial form and dimension with probably visual gesture to occures. This also conforms with the concept of *affordance* (Gibson, 2015) that refers to what the particular quality of an environment offers to its users. The implication of this result would be related to exploration of spatial form and dimension of circulation area where wayfinding is mostly carried out.

6.0 Conclusion

Wayfinding is a process of finding place of destination based on environmental information. New building visitor will perform and carry out strategy that will help them in getting information needed. The strategies includes orientation, wandering behavior, stopping and turning back in case of finding difficulties. This study was still in the initial stages. Further exploration should be carried out to draw the relation between each strategy. The specific form of representing wayfinding with these related strategy would also need to be explored. The form of representation should describe wayfinding as a process of movement from place to place that involved specific behavior in specific location.

Cue-searching is the main activity during wayfinding for someone unfamiliar with the surrounding environment. In searching cues, people depend on thier visual senses and will perfom visual gesture regarding to the process of visual perception of searching for cues, selecting them and translating the information into action. Since wayfinding involves visual perception, visual ergonomic will be significant into spatial design concideration. The concept of environmental reading still has to be strengthen by further research. Some question that can be arise include how each cues perceived by the visual mechanism? How each cues be related to one another to develop information needed in wayfinding?

Acknowledgements

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