Hospital Wayfinding through Directional Sign on Logistics Concept

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Abstract

Logistics is a science of planning, organizing, and managing activities affecting the production and services. Hospitals are public buildings used by people with different ages and education. Signs in the hospital are also important to solve communication problems, and they can reduce work load and time of hospital personnel to help the patients determine the directions. Therefore, they can efficiently perform other duties.

Directional sign can be a device of logistics in reducing wayfinding and service time. The first step of the research is to test and collect the patient's perception time indulged on directional sign based on lettering only. The test result shows that 89 percent of the samples with education level lower than diploma education take the highest average perception time of 12.45 seconds per sign while the samples with higher education level have lesser perception time.

This paper shows the research findings that advance to the second step by associating pictogram and lettering in hospital directional sign though logistics based on timing of perception. The new signs with lettering and pictogram do not only have logistics efficiency at 49.28% but they also help patients who can't read to reach medical services by themselves.

Introduction

In order to communicate well with building users, the elements such as directional sign, floor sign, and directory should help the users to determine locations and to go around the building accessibly. All kinds of signs are also very important in case of fire. In public buildings like hospitals which have large quantity of users, signs are more important in solving communication and wayfinding[1] problems. Statistics across the country (excluding Bangkok) has shown that only hospitals under the Ministry of Public

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[1] Takahashi, K. And Oikawa, S. Editors. 2002. Pictogram & Icon Graphics. P-I-E BOOKS.

Health serve 106,251,652 patients per year[2]. These patients vary in terms of age, education, and language. As observation reveals, the signage to direct users to their destinations are not appropriate and clear.

Most of the patients, both existing and incoming, spend a lot of time on wayfinding. Therefore, a large number of hospital personnel also spend their time to help the patients to go directly to their destinations.

This paper would find out how to reduce patients' wayfinding time for direct destination by their own through the concept of logistics –the science of planning, organizing, and managing activities which affect the production and services[3].

Objectives

- To test patients' perception time on existing sign
- To design new sign combining lettering and pictogram
- To compare perception time on existing sign and new sign to identify logistics efficiency

Research Aspect

Compare the perception time between the directional sign with pictogram and lettering to the sign based on lettering only.

Definition

Wayfinding encompasses all of the ways in which people and animals orient themselves in physical space and navigate from place to place.

Pictogram is an ideogram that conveys its meaning through its pictorial resemblance to a physical object.

Directional sign is a sign containing directional information about public and private attractions of interest to the traveling public and be able to reduce the time employees spend giving directions.

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[2] Anonymous. Statistic of patients in Pan Hospital from 1998-2006. http://cro.moph.go.th/Hosp05/news/2541-2549.htm. 2 December 2007.

[3] Stock, J. R. and Lambert, D. M. 2001. Strategic Logistics Management (4th Edition). McGraw-Hill.

Logistics is the management of the flow of goods and services between the point of origin and the point of use in order to meet the requirements of customers or corporations.

Research benefit

To reduce time of patients and staff in communicating and wayfinding around the hospital

Materials and Methods

- Interview form and oral personal perception test
- Computer
- Microsoft Office Excel to analyze basic statistic and standard test
- Adobe Illustrator

Research Process

The following methods are used:

1. Literature review
2. Interview the key informant of Ban Phaeo Hospital. Several information obtained from this step are general data, statistics of inpatients and outpatients, statistics of personnel, and existing signage.
3. Interview the outpatients and staff who have duties related to sending documents and services around the hospital. To determine problems of existing signage, the interview questions consisted of 3 parts:
   - General data of the samples
   - Existing signs' data and perception
   - Suggestions for new design
4. Pre-test interview questions by test-retest method to determine the stability reliability and Pearson's correlation coefficient. The retest result has indicated that the Pearson's correlation coefficient value is 0.75.
5. Interview planning
6. Interviewer training

7. Interview 13 staff and 121 outpatients. The number of samples was determined at 90% Confidence Level and 5.9% Error Level[4] from the average daily patients of Ban Pheao Hospital.

8. Evaluate all data with Microsoft Office Excel.

9. Test the perception time on each existing sign by 100 people with different ages and education levels.

10. Make another test on each new sign with combined lettering and pictogram by 100 people equivalent to the sample group that has tested the existing sign.

11. Compare the time finding in each sign perception from these two tests.

12. Analysis

13. Redesign pictogram according to sample group's comments and suggestions.

14. Conclusion

Results

1. Literature Review

Directional sign is one of the wayfinding systems in buildings. In Thailand, signage in hospitals is mostly based on a lettering which is not a universal language. Patients who could not read both Thai and English cannot perceive information on signs. Graphics, symbols, and pictograms can ease reading as well as optimal contrast of colors since they are universal. However, the main factors of signage design are font, letter size, and color since most patients are elderly. In addition, patients with vision problems such as nearsightedness, farsightedness, and especially color blindness are the focal point of the research. The color blind people are identified by genes or eye sickness which is mostly red-color blindness. Color blind people can not distinguish the colors especially red, green, yellow, and blue. However, these kinds of people can

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[4] Anonymous. Survey Random Sample Calculator. http://www.custominsight.com/ articles/random-sample-calculator.asp. 10 August 2010.

differentiate blue more than other colors[5]. Other literature reviews have shown that elderly people can clearly read dark blue information on white background[6].

Time to perceive the meaning in sign is also important to define the perfect useful sign. Thus, this research concerns on reducing perception time, making wayfinding easy and avoiding any misunderstanding from diagnostic procedure signs in each department.

2. Ban Phaeo Hospital: Signage development and improvement

By interviewing well educated hospital personnel, existing signs used in hospital were mixed patterns: lettering, pictogram, and number. Thus, the following problems occurred to both new and existing patients:

- Medical OPD instructed the patients about diagnostic process with number and lettering to identify the diagnostic room. However, it caused patients to be confused, for example, a patient who would obtain clinical service at diagnostic Room 1, which was the seventh process, would be confused and would wait at the on-call area in front of diagnostic Room 7 instead.

- Most patients in Eye OPD were elderly having vision problems and not well educated. Thus, they could not read the sign to determine the exact direction or diagnostic process. Eye OPD tried to improve the sign to reduce workload and time to determine directions for patients. By now, this department still cannot solve this problem even though it has tried many strategies as stated herein

  : Variety of small colored flags was used to identify clinical process. Patients responded that they were too small and confusing.

  : Variety of large colored flags was used to identify clinical process. Patients responded that they could see the flags clearly but still confusing.

  : Instruction leaflet replaced the colored flag but due to vision and education problems, the leaflet was ignored and regarded as "another paper work".

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[5] Anonymous. Color Blind: Many aspect that you do not know. http://www.i-medipro.com/index.php?lay= show&ac=article&Id=122653&Ntype=5. 10 August, 2010.

[6] Charutat, T. 2004. Minimum Standard in Resident and Surrounding for Elderly. http://www.thainhf.org/index.php? module=news&page2=detail&id=11. 23 July, 2010.

At present, Eye OPD uses number system but the problem still persists. Some special diagnostic procedure not needed for all general patients is in the numerical order. It stops the patients undergoing the general procedure at that point for quite sometime until the hospital personnel can find them and take them to the correct procedure.

3. Hospital personnel's interview results

The interview was conducted with 13 hospital personnel only involved in public relations, porter jobs, and medical equipment delivery. 61.54% acknowledged that the existing sign shown in Figure 1 helped them get to their destination quickly. In case the hospital signage would be changed, 53.85% of the personnel preferred lettering only as the existing sign.

Figure 1. Existing sign in Ban Phaeo Hospital

4. Patients' interview results

The interview focused on 121 patients at Medical OPD, E.N.T. OPD, and Surgical-Orthopedics OPD. Majority of the patients selected as sample group were classified into the following factors and percentages: education level below diploma - 82.64%, and females - 65.29%. The sample group was distributed through all age groups: under 25 years - 25.26%, 25-35 years - 20.66%, 36-45 years - 17.36%, 46-55 years - 17.36%, and over 56 years - 19.01%.

Patients defined that the existing sign helped them get to their destination at 46.15% while 53.85% indicated that they were confused. In case the hospital signage would be changed, 57.02% of the patients preferred the lettering only as the existing sign.

5. Results of perception time on existing sign

The test on 100 people with different ages and education levels found that the sample group with education level below diploma spent highest average perception time at 12.45 seconds (Table 1). However, 12% of sample group could not read and

their perception time was infinite. This group could simulate patients who could not understand both Thai and English.

Table 1. Relationship of education level and perception time for all existing signs

Education level	Below diploma	Diploma	Bachelor and above
Perception time (second)	12.45	5.07	4.76

The perception time to understand information in the existing sign is associated with education level. This is proven by the result of test using Thai and English medical terms to identify information on sign, causing high perception time. Either Thai or English medical terms of the first to seventh departments in Table 2 are difficult to interpret by all patients; i.e. Obstetrics and Gynecology OPD, Eye OPD, Medical OPD, E.N.T. OPD, Pediatrics OPD, Surgical - Orthopedics OPD, Admission Centre. Thus, the perception time is inversed with the level of education. As the age of patient increases, the perception time also increases (Figure 2).

Table 2. Average perception time of each existing sign

Department	Perception time (seconds)
Obstetrics and Gynecology OPD	23.96
Eye OPD	21.31
Medical OPD	18.61
E.N.T. OPD	16.57
Pediatrics OPD	16.19
Surgical - Orthopedics OPD	15.24
Admission Centre	15.22
Operation Room	13.35
Wellness Centre	12.28
Radiology	11.79
Registration	11.69
IPD Ward	11.05
Dental OPD	9.50
Delivery Room	9.47
Spa	8.51

Cashier	8.51
Laboratory	8.46
Library	8.38
Emergency Room	7.54
Blood test	7.04
Pharmacy	6.30
Canteen	6.07
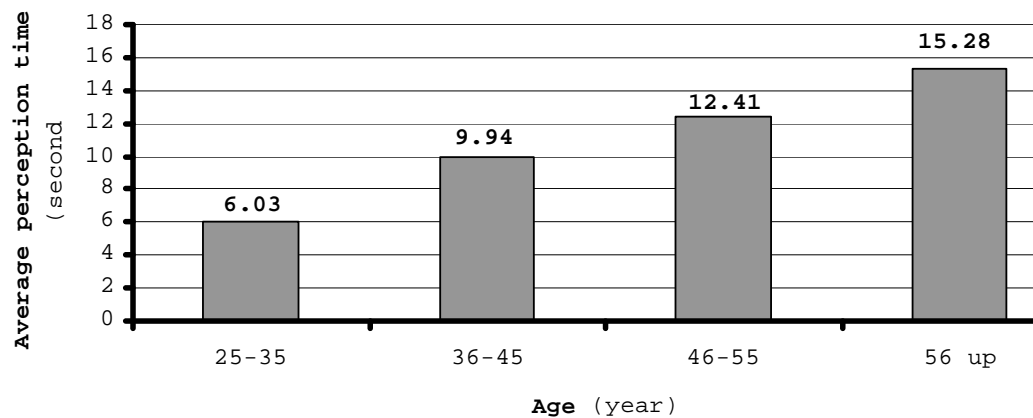
Figure 2.   Relationship between age of the patients and perception time

6.   Results of perception time on new sign

All elements: lettering, color, and pictogram in the new sign- were separately tested[7] before combining them in the new sign for perception time testing. The result about the former tests concluded with Freesia DSE font, Thai letter size at 5 cm. high and 2.8 cm. for English letter[8], and white lettering and arrow on light blue (CMYK value of C=70 M=20) background stood out more clearly due to optimal contrast[9]. The blue tone was selected from Ban Phaeo's corporate identity, but many color tones were tested for ease of reading which is important for wayfinding. Finally white lettering against a colored

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[7] Boonyachut, S. and Sunyavivat, C. Hospital Directional Sign : Color and Font. Journal of the National Research Council of Thailand (Social Science). Vol. 43 No. 1 January-June 2011.

[8] Anonymous. Italia in Miniatura Signage Program, www.saleemkhattak.com/pdfs/ signage% 20manual.pdf. 9 October, 2009.

[9] Uebele, A. 2007. Signage Systems & Information Graphics A Profession Sourcebook. Thames & Hudson. Page 66.

background, light blue, was selected as it always looks best if there is sufficient contrast[10].

Pictograms are designs based on pretest result that suggests large proportion of white color in the pictogram against blue background. Then the test of perception time on new sign was conducted to 100 people who were the same sample group that tested existing sign. The test results are compared as shown in Table 3.

Table 3. Comparison of average perception time of each existing sign and new sign

Department	Perception time (seconds)		Difference
	Existing sign	New sign	(%)
Obstetrics and Gynecology OPD	23.96	8.28	65.44
Eye OPD	21.31	6.21	70.86
Medical OPD	18.61	9.46	49.17
E.N.T. OPD	16.57	6.46	61.01
Pediatrics OPD	16.19	6.52	59.73
Surgical - Orthopedics OPD	15.24	15.30	- 0.39
Admission Centre	15.22	16.22	- 6.57
Operation Room	13.35	7.96	40.37
Wellness Centre	12.28	3.52	71.34
Radiology	11.79	3.38	71.33
Registration	11.69	9.64	17.54
IPD Ward	11.05	1.64	85.16
Dental OPD	9.50	9.69	- 2.00
Delivery Room	9.47	2.41	74.55
Spa	8.51	9.55	- 12.22
Cashier	8.51	2.27	73.33
Laboratory	8.46	2.57	69.62
Library	8.38	2.46	70.64
Emergency Room	7.54	2.03	73.08
Blood test	7.04	1.99	71.73
Pharmacy	6.30	4.50	28.57

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[10] Uebele, A. 2007. Signage Systems & Information Graphics A Profession Sourcebook. Thames & Hudson. Page 67.

Canteen	6.07	3.39	44.15
Average	12.14	6.16	49.28

From Table 3, there are four departments: Surgical - Orthopedics OPD, Admission Centre, Dental OPD, and Spa. The perception time for new sign is higher than that of the existing sign. However, these results are not significant since the perception time for new sign is approximately not more than one second. After the test, researchers interviewed the sample group to get comments about the pictograms and to develop them for use in the research case study at Ban Phaeo Hospital. Comments have stated that pictogram designs in E.N.T. OPD, Radiology, Laboratory, and Surgical - Orthopedics OPD were difficult to perceive. However, only Surgical - Orthopedics OPD pictogram has proven its difficulty in perception time as cited in the comments.

Thus, design development was conducted based on Ban Phaeo's logo and comments from the test as shown in Table 4 in the following categories:

- Consistency is emphasized in the pictogram with white circle, the main composition in Ban Phaeo's logo, instead of either blue or white square around a pictogram. Ban Phaeo logo has a circle shape.
- Line weight
- Composition
- Elements
- Emphasizing pictogram with blue color

Table 4. Comparison of tested pictogram and final design

Department	Pictogram tested	Pictogram revised
Obstetrics and Gynecology OPD		
Eye OPD		
Medical OPD		
E.N.T. OPD		
Pediatrics OPD		
Surgical - Orthopedics OPD		
Admission Centre		
Operation Room		
Wellness Centre		
Radiology		
Registration		
IPD Ward		
Dental OPD		
Delivery Room		
Spa		
Cashier		
Laboratory		
Library		
Emergency Room		
Blood test		
Pharmacy		
Canteen		

Recommendation

All design and arrangement including font, lettering and pictogram should be tested by executive administrators and professionals in hospital in order to make completely fulfillment. The future research should study on indoor and outdoor directory and all signs use in hospital such as infrastructure sign.

Conclusion

The test results of seven departments' existing signs have high perception time, using both Thai and English medical terms to identify information on signs which are difficult to be interpreted by all patients, i.e., Obstetrics and Gynecology OPD, Eye OPD, Medical OPD, E.N.T. OPD, Pediatrics OPD, Surgical - Orthopedics OPD, and Admission Centre. The perception time of five departments' new sign, i.e., Obstetrics and Gynecology OPD, Eye OPD, Medical OPD, E.N.T. OPD, and Pediatrics OPD reduced significantly. Only perception time of Surgical - Orthopedics OPD, and Admission Centre increased approximately not more than one second due to the unclear pictogram design on tested version. The new signs with both lettering and pictogram contain not only logistics efficiency at 49.28% but also they help patients who can not read to reach medical services by themselves.

Discussion

The existing directional sign in the research case study designed regardless of users, corporate identity, and color design standard for signage. The age and education of patients are the most important factors in signage design for hospital. Comparison of clear visibility between existing sign (Figures 1) and new design sign[11] shows that the attraction by bright color - orange - cannot help the patients to direct themselves to the destination. As a result, the main information in white letter on gray background is a great neutral color. Because of the contrast of saturation[12], it is very difficult to be visibly seen by elderly people, the majority group of users in hospitals.

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[11] Boonyachut, S. and Sunyavivat, C. Hospital Directional Sign : Color and Font. Journal of the National Research Council of Thailand (Social Science). Vol. 43 No. 1 January-June 2011.

[12] Marberry, S. and Zagon, L. 1995. The Power of Color. John Wiley & Sons, Inc. New York. Page 8.

In the case of corporate identity, light blue must be use to represent Ban Phaeo hospital. The existing directional sign in Figure 1 was designed to attract user attention by using orange boundary in the sign. But according to the color design standard for signage orange is for warning sign.

Acknowledgement

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