ORIGINAL ARTICLE

# DEVELOPMENT OF EFFECTIVE DISPLAYS DESIGN FOR TOURISM PARK

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## ABSTRACT

*Display is the most important things to get information in particularly for Tourism Park. A good display will increase effectiveness and efficiency in reading as well as alleviate uncertainty on information. Thus the design should be clear and able to identify easily about the real environment. This paper develop design of display which can result in expeditious response in human information processing. Empirical study was conducted to determine reaction time as the physiological parameter of human respond by using a software developed with Java. Two categories of information used were accessibilities and public facilities. A case study is Pindul Cave Tourism where 12 male and 8 female was participated in this experiment. The result shows that response time to process the information of alternative design was 1.16 second to 1.30 second. Furthermore, design by using combination of text and symbol was easier to understand than text or symbol with 0.2 second of lapse time. There were significant differences in reaction time among colour combinations which white for background and black for object with 91% of contras value has longer time then with 74% of contras value of green for background and red for object. While the design by using large size was not more effective than other size for information display.*

***Keywords:*** Display, Human Information Processing, Reaction Time, Tourism Park

## INTRODUCTION

Tourism Park was a place to spend leisure time for refresh human activity. *Pindul* Cave is one of the favourite tourism park where it was located in southern part of Yogyakarta. Development of tourism-park was important to improve tourist satisfaction. Tourist satisfaction was affected by easiness to get an information about the fact[1]. Tourism Act No 10 year 2009 article 23 mention that the Government should provide a clear information of the tourism in order to enhance safety and comfort for tourist/visitor activities[2]. Display is an instrument to convey such information[3]. If it is difficult to be understood, so the visitors will be failed to get some information[4]. Therefore, a good display is needed in the tourism park to allow an information conveyed easy to identify effectively.

To address the question on why the display should be effective and efficient to be read, previous study declare that 90% of the receptors in human brain are visual which its work mechanism based on graphic symbol on the display[3,5-6,]. In consequence, display should be quickly legible and understood at least from normal visual distance[7]. Reaction time test is one of the methods to assess speed of response of the human cognitive system. It is suited to find out the human information process since it offer a high sensitivity to detect the information effectively and efficiently[8]. Some existing displays is not fully legible from normal visual distance. So the visitor cannot quickly to respond an information about fact in Tourism Park. It due to the display does not meet the visitor criteria. Therefore, aim of this study is to develop displays for tourism-park to satisfy user criteria such that they are more effective and efficient in making decision.

## RESEARCH METHODS

### Information Process and Reaction Time

Information is a symbol or a set of symbol which use to identify the object[9] and could be conveyed by a display where the decision-making process is based on the amount of information presented[10]. Human information processing is a theory that explore on information process, retention, and knowledge retrieval in the human brain[11]. Human behaviour in information processing is a mental process that obtained from foretime knowledge to making decision in uncertainty condition[12]. Decision-making are the essence of information processing, in which individuals evaluate alternatives and choose the appropriate response[13].

There are three stage of human information process to make a decision. They are sensation, perception, and action[14]. Sensation is a period to detect stimuli from an object by human sense as a receptors (eyes, ears, and nose) and transferred to human brain for producing a perception[13]. Perception is the meaning of a sensation which it is affected by short-term memory and long-term memory to make a decision. The decision is transferred to motor processor for action. A period of human information process to make a respond is called

reaction time[15]. Hick-Hyman Law formulates the reaction time as follows[15-17]:

Reaction Time (RT) = a + bH (1)

H is the amount of information and formulated as follows:

$H = Log_2 n$ or $H = \Sigma p_i \times \log_2 (1/p)_I$ (2)

Where:

| | |
|---|---|
| H | : The amount of information (bits) |
| n | : The number of equally likely alternatives |
| Pi | : The probability of the $i_{th}$ event |
| i | : Alternative from 1 to n |
| a | : Intercept |
| b | : Slope |

**Survey**

Paper based on survey and interview was conducted to identify display criteria by deploying questionnaire to more than a hundred respondents which consists of visitors, tourism park management, local government, designed, and ergonomist. But only 105 questionnaire was valid for continuing stage.

**Apparatus**

**Questionnaire**

The questionnaire was developed consist of three parts. The first part was to identify personal background. Second part describes the information type and the last was to identify display criteria such as interface, background colour, and size of symbol and text. The questions are based on Likert scale (1-Extremely Unimportant; 2-Unimportant; 3-Rather Important; 4-Important; 5-Extremely Important).

**Reaction Time Software**

Software was developed by using java codes in windows 8 (x64 bit). These software were used to generate visual stimuli and to capture reaction time. The visual stimuli appeared is an information on symbol, text, and combination of symbol and text with different size as well as background and object colour which the resolution setting is 800 x 600 pixels. The interface of display contains two toolbars that are setting and play menu. Information display is uploaded in image format (.jpg or .png) and divided into four categories where each categories represent a number button (1, 2, 3, or 4) on a keyboard. In play menu, the visual stimuli are arise at centre of screen. Reaction time are captured if the user pressing the corresponding number on the keyboard. The data will saved in php MySQL database that activated with XAMPP software.

**Experimental Study**

**Design of Experiment**

Type of the choice-reaction time was used in these experiment. This type drives to user for selecting a number that corresponds to the appeared information. Experiment was conducted by using notebook computer (ASUS A51LB) work station, Projector (Ben Q Series), and Screen where the distance between projectors to screen is 300 centimetre and high of screen is 210 cm. Preliminary tests was used for calibrate the display size to achieve 1: 1 ratio so the size on the notebook computer will be equal on the screen. Empirical study was conducted against each information type and criteria such as display content with different sizes and contras colour between background and object colour. Colour contras become a factor to decide the appropriate colour between background and object where it can be measured by using formulas as follows:

$$\frac{Rmax - Rmin}{Rmax} X100\% \quad (3)$$

Where:
R = Contras
Contras value of each colour combination should be attain 70%[18]. It mean when the contras rate was lower than 70%, these combination was not used for experiment study. Different sizes on each content such as symbol, text, and combination text and symbol was divided into four type (small, medium, large, extra-large). Figure 1 shows the experimental set-up for studying the reaction time.

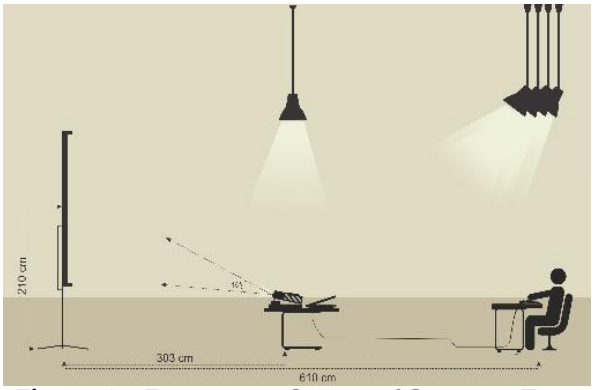


***Figure 1** - Experiment Design of Reaction Time*

**Procedure**

Twenty users (12 male and 8 female) participated in these experiment where they was instructed to sit comfortably in 20 feet distance from screen. Users were informed about the objective and procedure of the experiment. Pilot test and exercise were conducted for 10 minutes respectively to test the experiment setting and make user familiar to the task. Subsequently the

real experiment was conducted to collect the data by using the reaction time software as a visual stimuli. User was instructed to press the corresponding number (1, 2, 3, or 4) on the keyboard with the information appeared in screen.

**Method of Analysis**

Statistical analysis was done to analyse the result of survey. Descriptive analysis was conducted to analyse the reaction time identified based on result of experimental study.

**Result and Discussion**

**Survey**

**Information Type**

The result of first part is information type based on survey. One hundred and five respondents as a sample size from 150 respondents are valid with code. Table 1 describes percentage of each information criteria from 105 respondents. Table 2 shows that colour background for accessibility categories are blue (R:0, G:0, B:255), green (R:0, G:168, B:89), brown (R:165, G:42, B:42),

**Table 1 - Result of Customer Survey**

| Categories | Information Type | Sym. | % | Mean | St. Dev | N |
|---|---|---|---|---|---|---|
| Accessibilities | Direction Sign | a | 95,2 | 4,53 | 5,89 | 105 |
| | Entrance-Exit Sign | b | 64,8 | 3,87 | 1,07 | 105 |
| | Emergency Exit Sign | c | 48,6 | 3,53 | 1,13 | 105 |
| | Geographic Road Sign | d | 74,3 | 4,07 | 0,94 | 105 |
| Public Facilities | Security Service Sign | e | 87,6 | 4,33 | 0,69 | 105 |
| | Healthcare Sign | f | 81,9 | 4,3 | 0,92 | 105 |
| | Outbound Area Sign | g | 44,8 | 3,47 | 1,14 | 105 |
| | Praying Area Sign | h | 90,5 | 4,5 | 0,67 | 105 |
| | Parking Area Sign | i | 66,7 | 4,1 | 0,85 | 105 |
| | Public Toilets Sign | j | 75,2 | 4,13 | 0,81 | 105 |
| | Playground Sign | k | 56,2 | 3,72 | 1 | 105 |
| | Restaurant Area Sign | l | 62,9 | 0,39 | 0,87 | 105 |

5% of significant level. The respondent are used to complete the information type survey, and twenty users are used for experiment. It due to others respondents were not completely fill the field. Table 1 shows the information required at *Pindul* cave Tourism Park. The information that is shown in Table 1 were divided into two categories i.e. Accessibilities and Public Facilities[3].The first four information type; Direction, Entrance-Exit, Emergency Exit, and Geographic Road Sign are the most important information for visitors to be able to access the location easily. While security service, healthcare, outbound area, praying place *(mushola)*, parking area, public toilets, playground, and restaurant area are the most required information for visitors to satisfy the personal needs. Thus, those facilities should be available in the tourism park and designed more attractive, clear, and comfortable.

**Information Criteria**

The information criteria that was used on experimental study are symbol, text, and combination symbol-text with different size as well as background and object colour with RGB code. Table 1 describes percentage of each information criteria from 105 respondents. Table 2 shows that colour background for accessibility categories are blue (R:0, G:0, B:255), green (R:0, G:168, B:89), brown (R:165, G:42, B:42), yellow (R:255, G:255, B:0), and white (R:254, G:254, B:254) where green colour is the yellow (R:255, G:255, B:0), and white (R:254, G:254, B:254) where green colour is the most favourite colour for costumers. It cause green is a clear colour and accordance to International Sign Association[19]. In additional, green is an attractive colour affecting human attention. Meanwhile, colour background for public facilities are blue, yellow, brown, red (R: 255, G: 0, B: 0), and white where brown had highest percentage than others. It causes brown colour give a calm feel than others and comfort to be seen. Furthermore, colour object for symbol, text, and combination symbol-text are red, white, black (R:52, G:52, B:53), brown, yellow, green, violet (R:128, G:0, B:128), orange (R:255, G:165, B:0), and grey (R:128, G:128, B:128) where black colour is the most preferred colour for object. For size object include symbol and text, there was 21.56% of respondents choose extra-large size for combinations of symbol-text design. Moreover, only medium and large size were chosen for text and symbol. It because of the combination of symbol-text need more space to bring it an information in two alternatives. While 50% of d,

**Table 2 - Percentage of Information Criteria**

| Criteria | Type | % | N | Criteria | Type | % | N |
|---|---|---|---|---|---|---|---|
| Background Color of Accessibilities Category | Blue | 8,57 | 105 | Color of Text | Red | 9,52 | 105 |
| | Green | 33,33 | 105 | | White | 15,24 | 105 |
| | Brown | 12,38 | 105 | | Black | 36,19 | 105 |
| | Yellow | 11,43 | 105 | | Brown | 23,18 | 105 |
| | White | 22,86 | 105 | | | | |
| | | | | | Green | 5,71 | 105 |
| Background Color of Public Facilities Category | Blue | 24,76 | 105 | Color of Symbol | Yellow | 15,24 | 105 |
| | Brown | 27,62 | 105 | | Red | 19,05 | 105 |
| | Yellow | 9,52 | 105 | | White | 18,19 | 105 |
| | Red | 8,57 | 105 | | Black | 24,76 | 105 |
| | White | 19,05 | 105 | | | | |
| | | | | | Brown | 8,3 | 105 |
| Text Size | Medium | 55,47 | 105 | Color of Combination Text and Symbol | Yellow | 9,43 | 105 |
| | Large | 40 | 105 | | Red | 12,54 | 105 |
| | | | | | White | 29,44 | 105 |
| Symbol Size | Medium | 40,86 | 105 | | Black | 10,54 | 105 |
| | Large | 54,84 | 105 | | Violet | 8,53 | 105 |
| | | | | | Orange | 6,50 | 105 |
| Combination of Text and Symbol Size | Medium | 31,21 | 105 | | Grey | 6,43 | 105 |
| | Large | 42,67 | 105 | | | | |
| | Extra Large | 21,56 | 105 | Object Design of Symbol | | 21,4 | 105 |
| | | | | Object Design of Combination of Both | | 28,6 | 105 |

Customers' prefers text for interface design to others. It was desired that the design was easy to understand.

**Experimental study of reaction time**

Figure 2 shows the result of experimental study of visual reaction time for each alternatives design which it was in ranges between 1.16 second to 1.30 second and mean was 1.23 second. Reaction time by using combination of text and symbol (Fig. 2(a), (d), (h), (i), (l)) has a lower time than using text or symbol. It was 1.2 s in average. It described that the design were easier to understand, clear, and comfort than others because it provide clear information. On the others hand the reaction time by using only symbol or text requires a little longer time to understand. However with support a good contrast (76%), the visitors can understand the information easily in the appropriate time Colour combination for direction sign (a) and entrance-exit sign (b) were green for background and white for object which average of reaction time of them were 1.24 second with the design size is 450 x 900 mm and 580 x 400 mm. Information display for emergency exit sign (c), praying place sign (h), parking area sign (i), and playground sign (k) used blue colour for background and white colour for object with size is 270 mm, 350 x 750 mm, 580 x 400 mm, and 240 mm in high respectively. Combinations white colour for background and red colour for object was used for geographic road sign (d) and security service sign (e) with size is 300 x 600 mm and 270 in high. Combination red colour for background and white colour for object was used for healthcare sign (f) with size is 240 in high. Combination yellow colour for background and black colour for object used for outbound area sign (g) where size of the design is 240 mm in high. And combination white colour for background and black colour for object is used for public toilet sign (j) with size is 580 x 400 mm. It shows that this size and colour combination was enough to help the visitors to understand a condition of the tourism park.

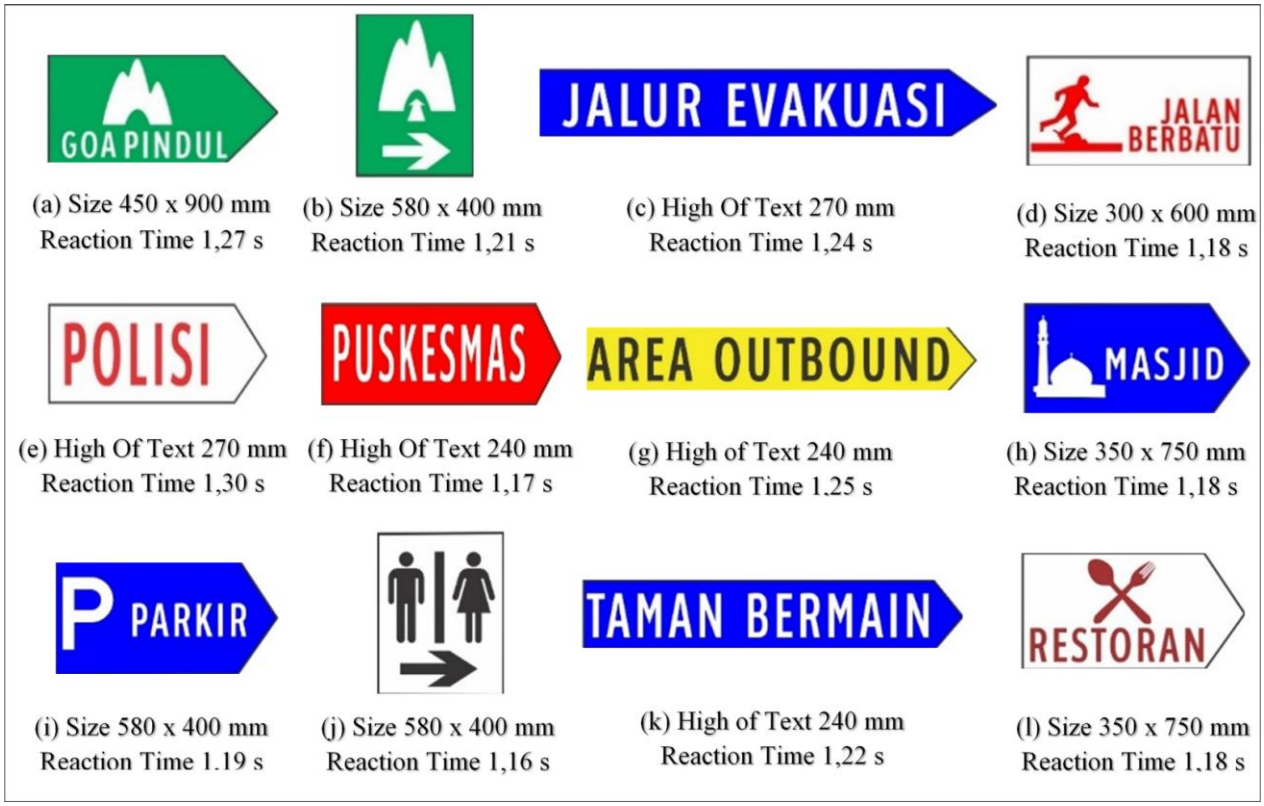


***Figure 2** - Design of Information Display*

## CONCLUSION

The Information type required by visitors encompasses two categories. They are Accessibility; direction, entrance-exit, emergency exit, geographic road display and public facilities; security service, healthcare, outbound area, praying place, parking area, public toilets, playground area, restaurant area display. Information criteria satisfying visitor requirements for background colour are blue, green, brown, yellow, red, and white. While for symbol, text, and combination (symbol and text) are red, white, black, brown, yellow, green, violet, orange, and grey with size is extra-large (450 x 900mm), large (350 x 750 mm), small (300 x 600 mm) for interface design of combination symbol and text. Large size (580 x 400 mm) used in interface design of combination symbol and also interface design of text with the height of text is 270 mm and 240 mm. Based on description analysis, Visual reaction time for each alternatives display design which it was in ranges between 1.16 second to 1.30 seconds.

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