

Comparison of the Environmental Graphic Design and the Travelers' Perception on the Exit Route of Subway Stations in Bangkok

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Abstract: The Purpose of this study is to compare environmental graphic designs and exit route awareness of passengers traveling on the Chaloe M Ratchamongkhon Line of the Metropolitan Rapid Transit (MRT) subway system to identify the connection between route awareness and graphic designs on signs pointing passengers to each of the exits, aiding in their decisions. The results show different personal and behavioral factors in route awareness and memorization of the passengers, which differ or are similar depending on familiarity and experience, thereby affecting environmental graphic designs. The elements and positions of signs may confuse passengers and affect their information awareness or the clarity of the information. Therefore they have to be used appropriately to support the wayfinding system.

Keywords: Environmental Graphic Design, Signage, Wayfinding, Mass Transit Station, Subway

1. INTRODUCTION

Signs can be grouped according to usage in four aspects: (1) directional, to tell directions; (2) identifying, to identify places; (3) informational, to give information; and (4) restrictive or prohibitive, to restrict or prohibit in public or private area. For these reasons, directional signs are important and designing them adequately and appropriately is necessary as a self-guiding system for passengers. Therefore, designing is an important factor in a mass transit system.

Signs are part of the environmental design that guides a person in a large and complex area to his or her destination using a directional graphic system (Bohari, Bachok, Osman, 2014). This is based on a comparative study between travelling on the ground train and subway systems, which are different in the elements of the environment (Lynch. 1960) and affect the mental picture of the passengers in memorizing the environment. Furthermore, without the elements of the environment, subway passengers will have difficulty in remembering the routes because they cannot take advantage of the directions of things in the environment around them. Therefore, it is imperative for passengers to rely on the directional or informational signs to confirm the routes and guide them to their destination throughout the journey (Zheng. 2012; Pei-Ying Li, Hibino, Koyama, Zheng. 2012). Passengers also tend to stop in subway stations more than above ground train stations, where the trains only stop when changing routes, which affect traffic flow during a journey. Additionally, different areas in different environments have different signs affecting the behavior of passengers, which consequently affect the travel in a wider area and the overall traffic in the stations.

Therefore, a well-integrated design of signs and appropriate placement according to specific environments can aid passengers in finding routes on their own. The efficient system of signs and their proper usage will be helpful in finding routes and act as cues for passengers to

easily get to their destination. Excellent communication of the navigation system will prevent confusion, and ensure accuracy when passengers look up the routes.

The objective of this study is to compare environmental graphic designs and exit route awareness of passengers travelling on the Chaloem Ratchamongkhon Line of the Metropolitan Rapid Transit (MRT) subway system, which is 20 kilometers long with 18 stations (the whole line is a subway line). This study aimed to find the connection between route awareness and graphic designs of signs that help passengers to decide on the routes to their desired exits.

1.1 Wayfinding System

The process that results in a cognitive map consists of elements of the path-finding process, which includes environmental information, decision, and behavioral action, with a decision being imperative in making connections of the information in mind, leading to an expression in behavior.

The process of finding directions can be explained regarding spatial problem solving, which involves several processes as follow (Arthur, Passini. 1992):

- 1) Decision Making: This includes action planning, which helps to plan the actions and understand the overall structure of the environment.
- 2) Decision Executing: This includes applying the plan into an action and translating the decision into an expression in behavior. In this process, one of the information sources aiding in the decision comes from a cognitive map.
- 3) Information Processing: This includes understanding the information from the two processes earlier regarding environmental perception and cognition.

Wayfinding involves making connections based on experience, reading, evaluating the environment, and the perception of signs and indicators by considering factors regarding time and the degree of interest and safety while using the route.

Recognizing various information from the environment involves planning before taking action, including planning about where to go, how to go and when to go. This affects the decision-making process because its hierarchical structure requires information from the environment, starting from setting a destination first and going on until reaching the destination. Furthermore, the familiarity of the environment also affects the decision to go to the destination because past experience can be relied on when deciding to go to a destination in a familiar environment (Arthur, Passini. 1992; Koseoglua, Onder, 2011).

The process of wayfinding is a psychological process or involves environment psychology. This involves a cognitive mapping process that affects the cognitive mapping or image, which makes the mental structure and is a part of environmental perception and cognition. The result of this process is the cognitive map, which is an overall view of the mental picture or a representation of the overall space and plan in that environment (Passini. 1984).

1.2 Graphic Design

Designing means fixing a problem (Arntson. 1998) and graphic means colors, images, or characters that are used to represent the details of an idea (Cowie. 1994) and convey specific information (Livingston. 1992). Therefore, graphic designing means fixing a problem using images, colors, and characters to convey complex information so that it can be quickly and easily understood in the same way and to convey the information to a large target group by reading.

An excellent graphic designing process that creates a good graphic must be able to do the following (Jewler. 1998):

- attract the attention of the target group;
- convey the information that can be easily understood in a short period of time;
- help the target group memorize the information well; and,
- persuade the target group to feel that the information is useful and valuable.

1) Images for conveying meanings

Visual perception is the result of an attempt to understand images and shapes in the brain's memory and the familiarity related to past experience. Therefore, an image to convey information is chosen not just for its external appearance but also mainly for its abstract meaning. The skill required to interpret the meaning of the image and creating an image is called "visual literacy", which requires experience that is mainly based on the society and culture. This can vary depending on other factors and variables that are involved in conveying and interpreting information. Berger (1998) has recommended principles for choosing images to convey the information as follow:

- a Metronymic Code, by using images to convey meaning based on the target group's ability to receive and understand the information;
- an Analogical Code, by using images to indirectly convey the information with analogies, which can be easily understood by the target group due to their familiarity in that specific society;
- Displaced Codes, by using a representative image to convey another meaning that cannot be directly presented. Therefore, using an image to indirectly convey a meaning can help to convey a meaning in a way that is acceptable to a society; and,
- Condensed Codes, by using several images together to create a new image and meaning that depend on the interpretation of the target group. If they understand the meaning, they will feel impressed and remember the image. However, if they cannot interpret the meaning of the image, they may never be interested in it again (Lester, Paul. 2000).

2) Characters for conveying meanings

Characters have an important role in designing graphics for information announcement because they can convey information and details through the title, subtitles and the main text. Designing distinct letters and emphasizing the text help to attract the attention of the readers and help them understand the meaning more clearly. Therefore, there are three things to consider when designing graphical letters: (1) the objective for conveying the meaning, (2) the target group to convey the meaning, and (3) the media type for presenting the graphics using the primary principles.

Primary principles are applied when designing graphical letters (Carter. 1997). These include emphasis, difference, balance, placement, repetition, reading direction and color as detailed below.

- Emphasizing letters is very important for the presented text to convey a meaning because emphasizing helps to make important information become the first spot of interest that can be easily seen by the target group. However, it is not recommended to emphasize every word so the emphasized text must be the most important.
- The difference in letters can be regarded as the easiest way to attract the attention of the target group to an important text, which corresponds to the perception theory (Gestalt) (Crooks, Stein. 1988). regarding the rule of similarity to create a difference

that helps to make the letters more distinctive. This attracts the attention of the target group and makes them want to read.

- The balance of letter placement does not only mean placing the letters on the same line on both sides. It also means arranging elements of the letters and others in a uniform way.
- The placement of letters affects the interpretation. By presenting the information in an easy to read format and by using grids to help to arrange the elements, designers can control the overall balance of the elements and create visual aids that match the reading principles. Grids can also help designers to quickly arrange the elements because they can control the continuity of their designs.
- Repetition is the use of letters with the same style, placed in a repetitive manner to create an image or pattern, unifying the work. This is done by using the Law of Continuity and the Law of Proximity to help to make the work become distinguished (Gestalt) (Crooks, Stein. 1988).
- Arranging letters by following a reading direction is very important when designing graphics to convey a meaning because the reading direction helps to set the importance of the elements. Therefore, notable features and text arrangement that match the reading direction help to make the design become unique and easy to remember.
- Arranging letters to create an image according to a design idea will help the image to easily convey the meaning, which helps the reader to interpret the meaning of the image quickly.
- Colors are important when designing letters to be easily readable and memorized because they can help the letters convey the meaning more clearly with the following principles:
 - The main objective for using colors is to attract attention, focusing on the main text or image.
 - Colors are related to the story that needs to be conveyed by clarifying the story and aiding reading.
 - Excessive use of colors will be distracting to readers.
 - Colors are symbols that represent various things well, such as the color of a department or organization.
 - Colors can relate to the pre-existing experience of the target group during interpretation.

3) Symbols for conveying meaning

Morris (1992) said that the study about a symbolic theory could be compared to a scientific study because, in science, various phenomena are related. Therefore, designing symbols is related to other things as well.

The Symbol Theory can be divided into 3 big areas of study (Morris. 1992):

1) The study of symbols and graphical structures (syntactic). When designing the symbols in this regard, the size and area for graphic representation must be considered. Additionally, graphic size and position on the structure must also be appropriate to the viewing distance of the overall graphic.

2) The study of symbols and their meaning (semantic). When designing the symbols in this regard, the meaning and the connection between the symbols must be considered so that they can be understood by most people in the same way.

3) The study of symbols and the target group's ability to interpret them (pragmatic). When designing symbols in this regard, the target group's ability to interpret them must be

considered. This depends on their nationality, education, society, culture, and language. Therefore, symbols can be clearly and quickly interpreted if they are related to the target group’s ability to interpret them.

It can be concluded that to effectively design a symbol, the connections of the whole structure for the symbol must be studied by mainly focusing on the meaning of the symbol and the target group’s ability to interpret the symbol.

3. METHODOLOGY

3.1 Participants

Population in this study included the citizens living in Bangkok and its surrounding areas who traveled on the ChaloeM Ratchamongkhon Line of the Metropolitan Rapid Transit (MRT) subway system, which is 20 kilometers long with 18 stations (the whole line is a subway line). The data was collected from the citizens (passengers) who have used the service with different personal and behavioral factors by using an online research questionnaire form (Google Forms) for 2 weeks. The ages of the sample group are between 16 to 60 years (M = 32.6, SD = 9.02), with 85 males and 115 females, totaling 200 people.

3.2 Study Area

Metropolitan Rapid Transit ChaloeM Ratchamongkhon Line (MRT) has a total route distance of 20 kilometers and is an underground project containing all the routes of 18 total stations, starting from the front of Bang Sue railway station and ending at Hua Lamphong electric train station. The 18 stations are Bang Sue, Kamphaeng Phet, Chatuchak Park, Phahon Yothin, Ratchadaphisek, Lat Phrao, Huai Khwang, Sutthisan, Thailand Cultural Centre, Phra Ram 9, Sukhumvit, Phetchaburi, Queen Sirikit National Convention Centre, Khlong Toei, Si Lom, Lumpini, Sam Yan, and Hua Lamphong.

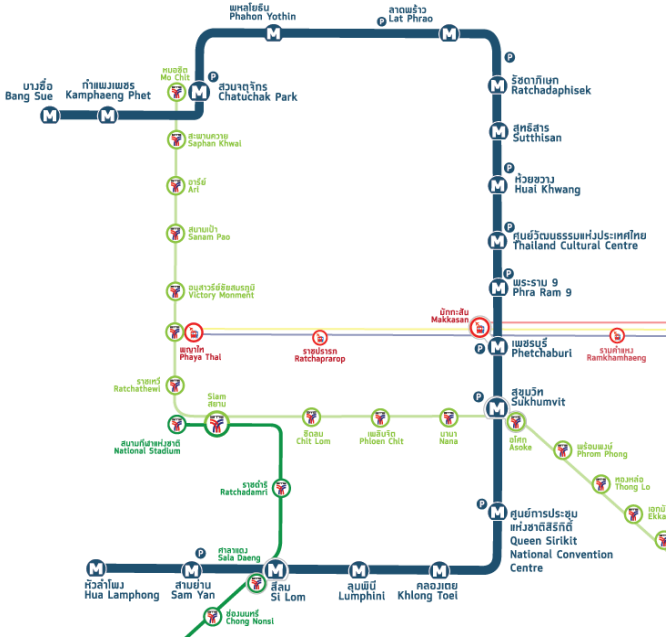


Figure 1. Route diagram of Metropolitan Rapid Transit ChaloeM Ratchamongkhon Line

3.2 Research Framework

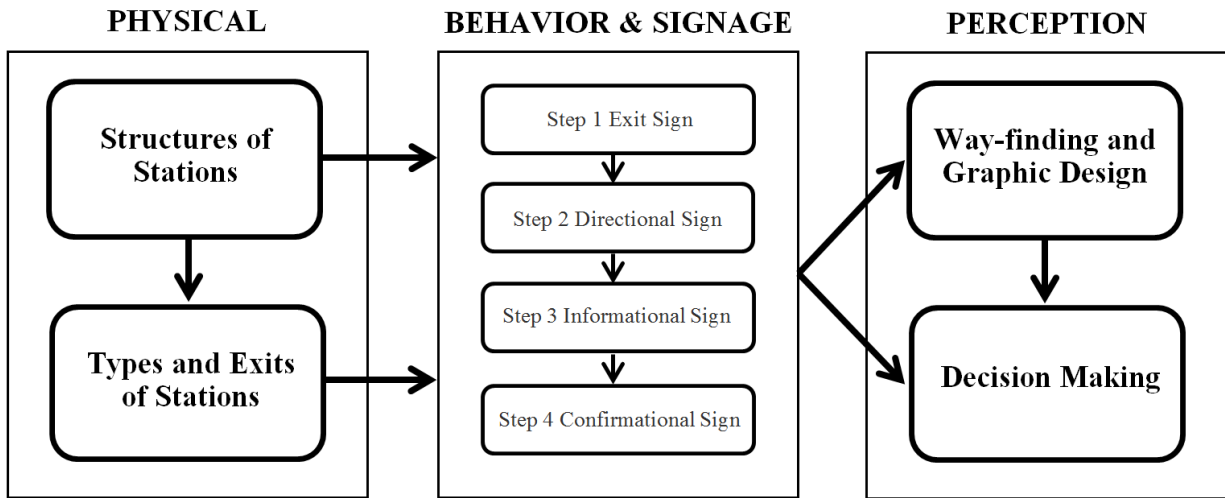


Figure 2. The diagram showing the relationship of variables in the study.

3.3. Behavior and Signage

Signs and pictorial symbols have the purpose of being used and being part of the wayfinding system. The signage system is a part of the environmental design which is a system that helps to guide people in large and complex areas to reach their destination using the directional graphic system.

Beneficial use can divide signage into 4 types which are Directional, Identifying, Informational, and Restrictive or Prohibitive, which facilitate the travel of passengers to their destinations quickly and more efficiently. From the traveling behavior of passengers, 4 steps can be identified according to the behavioral characteristics and the relationships between signage as follows.

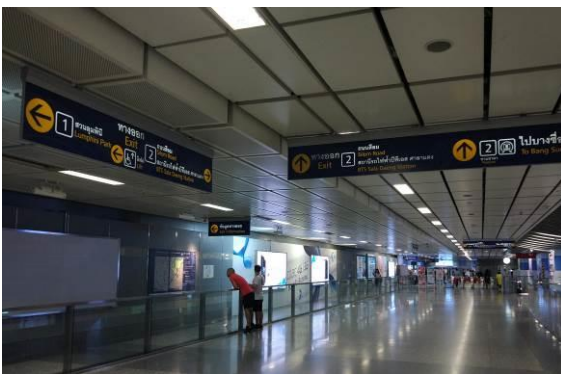


Figure 3. The diagram steps of behavior and the relationships between signage.

Step 1 - Exit Sign - Passengers exit from the subway to the escalators.



Step 2 - Directional Sign - Passengers choose numbers of exit gates from the escalators.



Step 3 - Informational Sign - In case passengers cannot choose their direction or require more information to choose a number of exit gates from the escalators.



Step 4 - Confirmational Sign - Confirms the way and guides passengers to the correct exits.



4. RESULT AND DISCUSSION

4.1 Questionnaire Participants

Participants' general information is divided into 115 females (57.5%) and 85 males (42.5%) aging between 16 to 60 years ($M = 32.6$, $SD = 9.02$) and education dividing into 12 people with a doctorate degree (6%), 50 people with a master's degree (25%), 125 people with a bachelor's degree (62.5%), and 13 people with education lower than a bachelor's degree (6.5%).

As for information about travel behavior, 79 people traveled to attend to a business (39.5%), 63 people traveled to work (31.5%), 39 people traveled for leisure (19.5%), 14 people traveled to do some shopping (7%), and 5 people traveled to school (2.5%).

The frequency of travel on the subway system (traveling from the origin to the destination station counts as 1 time) can be divided into 2 groups: those traveling less than 2 times/week totaling 148 people (74%) and those traveling more than 2 times/week totaling 52 people (26%).

The usage time on the subway system can be divided into rush hours (6.00 - 9.00 and 16.30 - 19.30) at 28.5% and normal hours (9.00 - 16.30 and 19.30 - 24.00) at 71.5%. Travelers can be grouped into those who traveled less than 2 times/week totaling 148 people (53 during rush hours and 95 during normal hours) and those who traveled more than 2 times/week totaling 52 people (33 during rush hours and 19 during normal hours)

The following examples present some of the most typical cases of references at the end of the paper; please follow them as strictly as possible.

Table 1. The group of passengers used less than 2 times/week.

Question	Less than 2 times/week			
	Step 1	Step 2	Step 3	Step 4
	Mean / S.D.	Mean / S.D.	Mean / S.D.	Mean / S.D.
Wayfinding				
1. Signs have clear route information.	3.43 / 0.90	3.51 / 0.96	3.49 / 0.97	3.46 / 0.95
2. Signs have route information that can be easily understood.	3.43 / 0.88	3.40 / 0.96	3.47 / 0.96	3.39 / 0.94
3. Signs have route information that can be memorized well.	3.20 / 0.89	3.28 / 0.55	3.26 / 1.00	3.29 / 0.96
4. Signs have adequate route data for making a decision.	3.23 / 0.96	3.31 / 0.91	3.37 / 0.93	3.30 / 0.96
Graphic Design				
5. Signs have clearly visible and prominent graphics.	3.25 / 0.94	3.29 / 0.92	3.14 / 0.97	3.32 / 0.94
6. Signs have graphics that connect composition together.	3.00 / 0.99	3.27 / 0.91	3.30 / 0.94	3.32 / 0.94
7. Signs have images, symbols and letters that are beautifully placed.	3.00 / 0.92	3.24 / 0.92	3.27 / 0.92	3.22 / 0.94
8. Graphics designing that matches the route information.	3.31 / 0.91	3.29 / 0.83	3.34 / 0.96	3.29 / 0.97
Total	3.27 / 0.09	3.31 / 0.08	3.32 / 0.11	3.31 / 0.08

Table 2. The group of passengers used more than 2 times/week.

Question	More than 2 times/week			
	Step 1	Step 2	Step 3	Step 4
	Mean / S.D.	Mean / S.D.	Mean / S.D.	Mean / S.D.
Wayfinding				
1. Signs have clear route information.	3.67 / 0.75	3.63 / 1.06	3.51 / 0.95	3.53 / 0.99
2. Signs have route information that can be easily understood.	3.73 / 0.90	3.53 / 1.11	3.51 / 1.01	3.51 / 0.99
3. Signs have route information that can be memorized well.	3.48 / 0.85	3.46 / 0.97	3.38 / 1.01	3.50 / 1.03
4. Signs have adequate route data for making a decision.	3.53 / 0.91	3.53 / 1.01	3.25 / 1.08	3.53 / 0.99
Graphic Design				
5. Signs have clearly visible and prominent graphics.	3.36 / 1.02	3.48 / 1.05	3.17 / 0.87	3.51 / 0.93
6. Signs have graphics that connect composition together.	3.48 / 1.01	3.34 / 0.96	3.36 / 0.95	3.51 / 0.95
7. Signs have images, symbols and letters that are beautifully placed.	3.42 / 0.89	3.34 / 0.96	3.34 / 0.98	3.44 / 0.87
8. Graphics designing that matches the route information.	3.44 / 0.99	3.32 / 1.02	3.28 / 1.03	3.51 / 0.95
Total	3.49 / 0.13	3.44 / 0.10	3.35 / 0.11	3.49 / 0.05

4.2 Behavior and Signage

Step 1: Exit sign

When a subway train arrives at a station and the passengers step out of the train, the first important sign that shows route information is the exit sign, which is on the lowermost level of the subway station. The study compared the passengers who used the service more than 2 times/week with those who used the service less than 2 times/week in terms of wayfinding and found the highest values, for clear signs, are at 3.73 (SD = 0.90) and 3.43 (SD = 0.90) while the lowest values, for signs showing information that cannot be clearly memorized, are at 3.48 (SD = 0.85) and 3.20 (SD = 0.89). Therefore, it can be concluded that exit signs are meant to tell a single direction instead of to provide information or show places to be memorized.

For graphic designs, the group of passengers who used the service more than 2 times/week has the highest value of 3.48 (SD = 1.01) for signs that have related images, symbols and letters, and the lowest value for signs with graphics that are not clearly readable or noticeable. As for the group of passengers who used the service less than 2 times/week, the highest value is 3.31 (SD = 0.91) for graphical designs that are related to the routes, while the lowest value is 3.00 (SD = 0.99) for signs with somewhat not beautifully placed images and 3.00 (SD = 0.92) for symbols and letters, as shown in Figure 4.

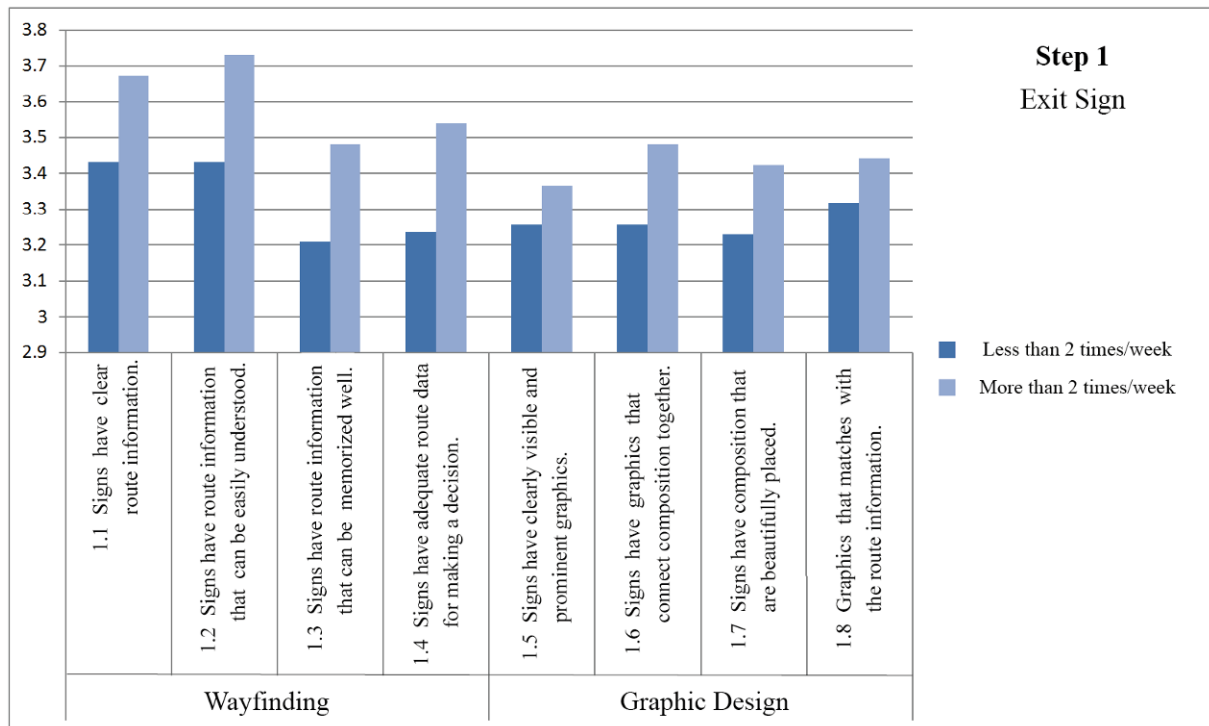


Figure 4. The diagram of behavior and exit sign comparison between groups.

Step 2: Directional sign

After the passengers leave the underground platform of the station, from the escalator to the hall, the second important sign is the directional sign because it is where passengers decide which way to go and what route information to use to find each of the exits. The study compared the passengers who used the service more than 2 times/week with those who used the service less than 2 times/week in terms of wayfinding and found equally highest values for signs with clear route information at 3.63 (SD = 1.06) and 3.51 (SD = 0.96), while the lowest value for signs with route information that is insufficient or difficult to understand is at 3.46 (SD = 0.97). As for passengers who used the service less than 2 times/week, the highest value is at 3.28 (SD = 0.92) for signs with route information that can be somewhat poorly memorized (Morris. 1992).

In terms of graphic design, passengers who used the service more than 2 times/week and those who used the service less than 2 times/week all have equally highest values for signs with clear and noticeable graphics at 3.48 (SD = 1.05) and 3.29 (SD = 0.92), while the lowest value is at 3.32 (SD = 1.02) for graphic designs that are rather poorly related to route information. As for the passengers who used the service less than 2 times/week, the lowest value is at 3.24 (0.92) for signs that have rather poorly arranged images, symbols, and letters. This is due to experience and route familiarity which helps the passengers to recognize the graphics that are poorly related to the route (Carter. 1997), rather than due to those unfamiliar with the route caring about beautiful but unfamiliar things that, as shown in Figure 5.

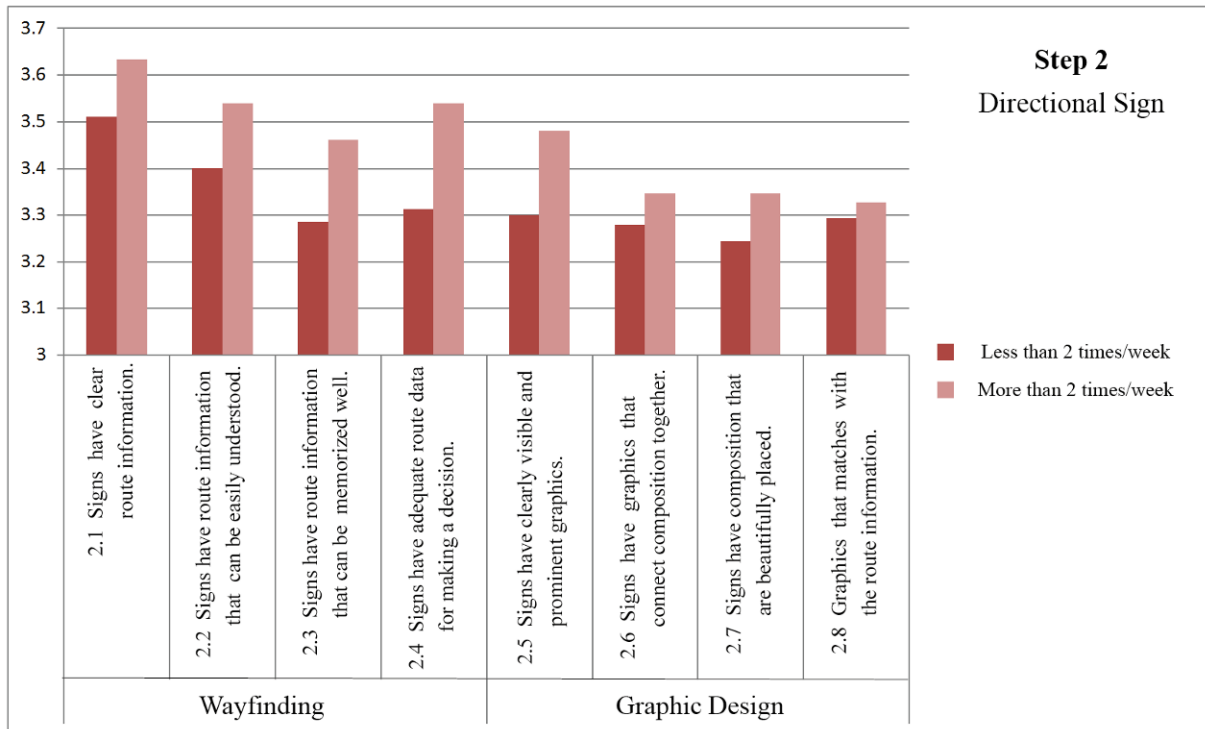


Figure 5. The diagram of behavior and directional sign comparison between groups.

Step 3: Informational sign

Information signs are the third important sign because they can provide information about the routes and important places in the event where passengers are unsure or unable to decide on a place or an exit route from the station (Arthur, Passini, 1992). This study compared the passengers who used the service more than 2 times/week with those who used the service less than 2 times/week in terms of wayfinding and found that both groups have equally highest values at 3.51 (SD = 0.95) and 3.49 (SD = 0.97) for signs that have clear route information, while the lowest value is at 3.25 (SD = 1.08) for signs with insufficient information. This is lower than the value for signs with information that can be somewhat poorly memorized at 3.26 (SD = 1.00) by the passengers who used the service less than 2 times/week.

In terms of graphics, the group of passengers who used the service more than 2 times/week and the group of passengers who used the service less than 2 times/week have the highest value at 3.36 (SD = 0.95) for signs that have related images, symbols and letters, while the highest value for graphic designs that are related to route information is 3.34 (SD = 0.96). However, the lowest value is at 3.17 (SD = 0.87) and 3.14 (SD = 0.97) for signs with graphics that are rather poorly readable because the graphics have a lot of information and letters which are difficult to emphasize as shown in Figure 6.

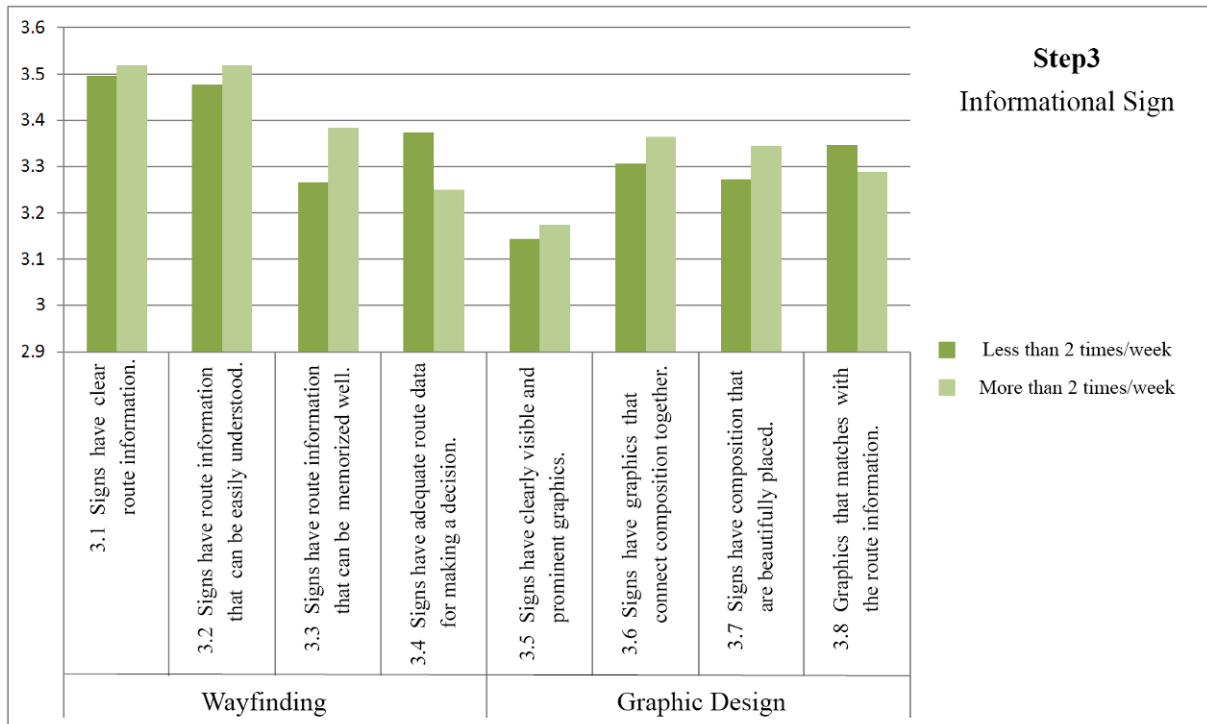


Figure 6. The diagram of behavior and informational sign comparison between groups.

Step 4: Confirmational sign

The fourth important sign is the confirmation sign after the passengers have received additional location information and decided on an exit route from the station. This helps to inform the passengers and confirm the route during their journey to each of the exit (Arthur, Passini. 1992). This study compared the group of passengers who used the service more than 2 times/week with the group of passengers who used the service less than 2 times/week in terms of wayfinding and found equally highest values at 3.53 (SD = 0.99) while the lowest values, for signs with information that can be poorly memorized at 3.50 (SD = 1.03) and 3.29 (SD = 0.96). Therefore, these signs are similar to the exit signs, which are specifically for telling a particular route rather than for providing information or indicating places to be memorized.

In terms of graphic design, the group of passengers who used the service more than 2 times/week and the group of passengers who used the service less than 2 times/week both have equally highest values at 3.51 (SD = 0.93) and 3.32 (SD = 0.94) for signs with clearly visible and noticeable graphics and for signs with graphics that are related to the images, symbols, and letters. However, there was no difference between these values, with the lowest values at 3.44 (SD = 0.87) and 3.22 (SD = 0.94) for signs that include graphics with somewhat poorly arranged images, signs and letters, as shown in Figure 7.

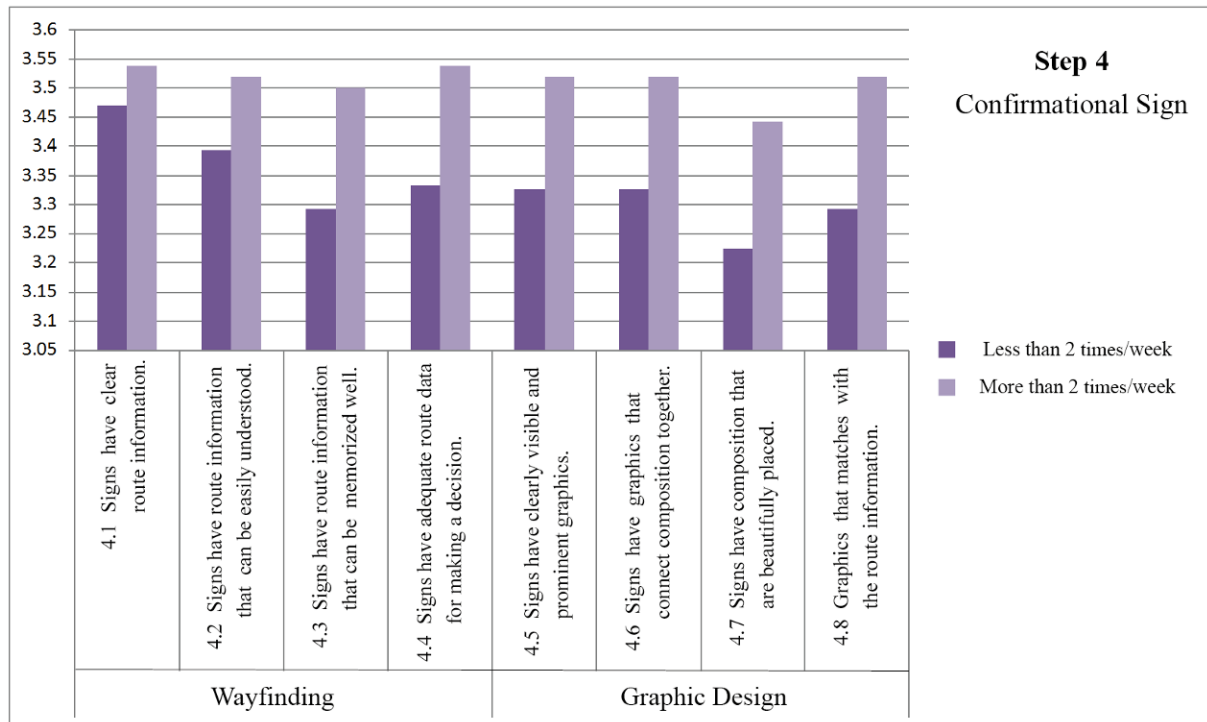


Figure 7. The diagram of behavior and confirmational sign comparison between groups.

The results of the comparison of environmental graphic designs and exit route awareness of passengers traveling on the Chloem Ratchamongkhon Line of Metropolitan Rapid Transit (MRT) show different of personal attribute and behavioral perception. The group of passengers who used the service less than 2 times/week with those who used the service more than 2 times/week were opposite direction of behavioral perception about wayfinding and graphic design in route awareness and memorization. The important signage to passenger behavior were step 2: Directional sign and Step 3: Informational sign (in the case that passengers cannot choose their direction or require more information) because the signage those were used by passengers to make decisions on choosing the correct path and they display behavioral actions which were important decisions for connecting mental information which leads to behavioral action (Arthur, Passini. 1992). From the traveling behavior of passengers, 4 steps can be identified according to the behavioral characteristics and relationships between signage and sort descending which the groups of passengers who used the service less than 2 times/week were Step 3: Information sign, Step 2: Directional sign, Step 4: Comfirmational sign and Step 1: Exit sign with the group of passengers who used the service more than 2 times/week and sort descending which are Step 1: Exit sign, Step 4: Comfirmational sign, Step 2: Directional sign and Step 3: Information sign those differences and show opposite direction, as shown in Figure 8.

The results indicated that the step of decision point and the amount of information of wayfinding on signage has probably affected to the travelers' perception. Additionally, the familiarity with particular environment affects the decision to go to the destination. The destination under an environment that is familiar will be decided by referring to a plan from experience (Arthur and Passini, 1992), as shown in Figure 9.

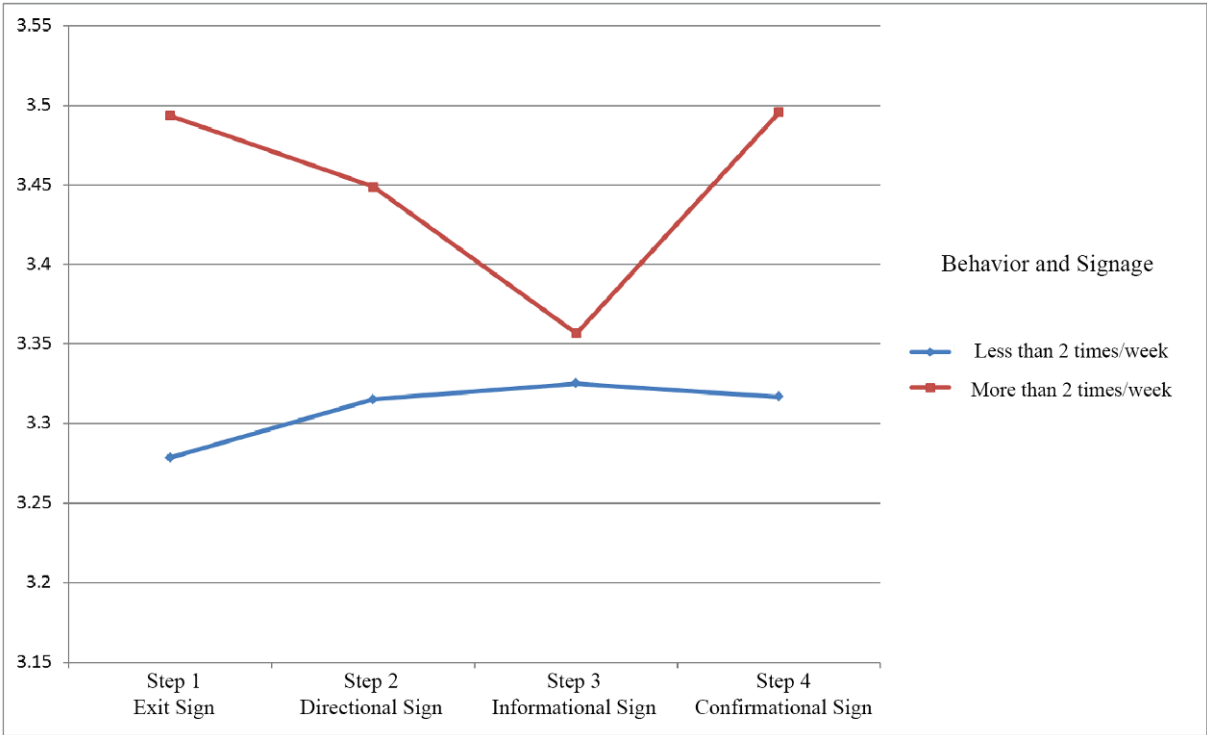


Figure 8. The diagram showing the steps of comparison between groups.

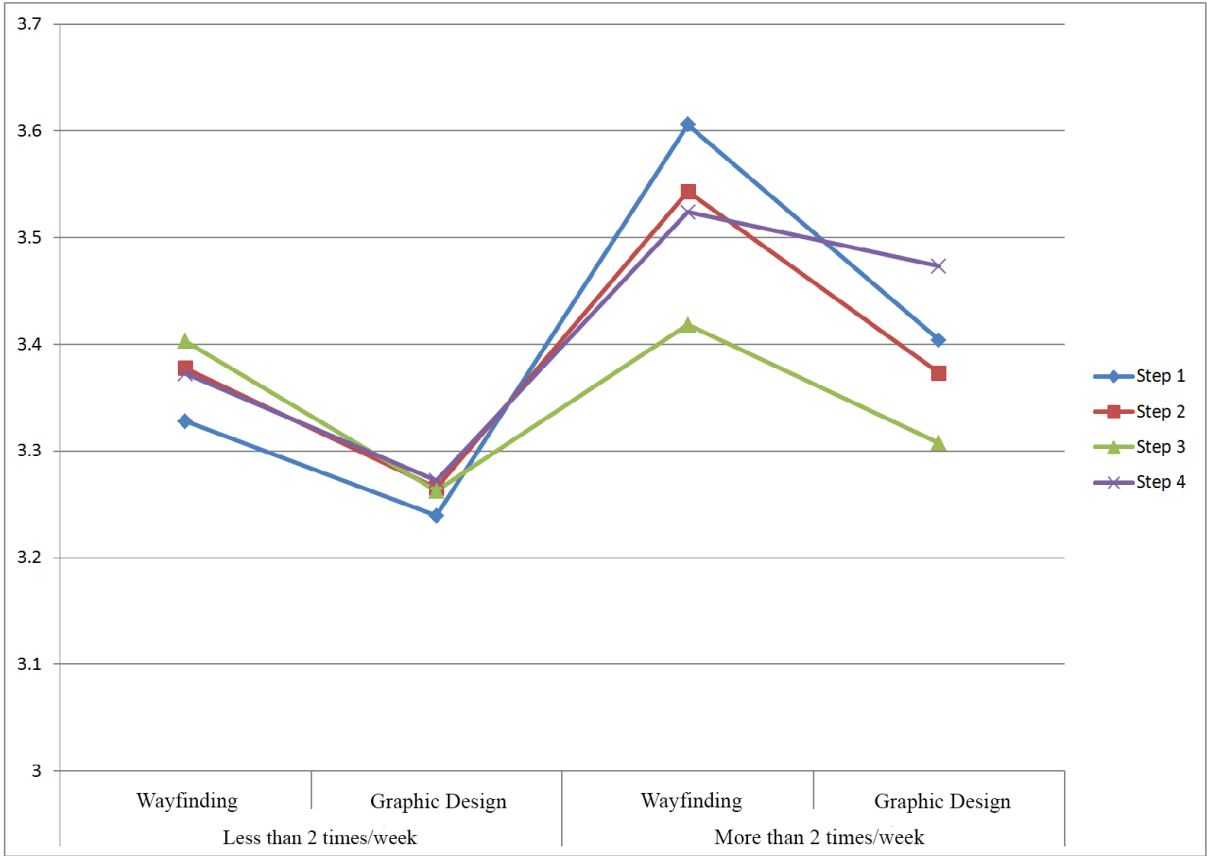


Figure 9. The diagram showing the comparison between signage.

5. CONCLUSION

In this study, data was collected from citizens (passengers) with different behavioral factors travelling on the Chaloem Ratchamongkhon Line of the Metropolitan Rapid Transit (MRT), which is 20 kilometers long with 18 stations (the whole line is a subway line) and an average distance of 1 kilometer between each station (from Hua Lamphong Station to Bang Sue Station).

By comparing two groups of passengers, those using the service less than 2 times/week and those using the service more than 2 times/week (Berger. 1998), it can be concluded that the specific environment of the subway stations including their types and exits were factors that specific route information and graphic designs on signs and affect the travel behavior of subway passengers. Moreover, the directional signs and the information signs can provide more information needed by the passengers who cannot make the decision in choosing the route. These are the important things that link to the information in their mind, leading to an outward behavior.

Furthermore, the group of passengers who have more experiences using the subway and those who are more familiar with the places were more likely to realize better route information and environmental graphic awareness than the group of passengers who are unfamiliar with the first step (exit signs) and the fourth step (confirmation signs). These signs can be grouped together because they provide the specific direction instead of giving information or indicating places for memorization.

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REFERENCES

- Arntson, E. (1998). *Graphic Design Basics*. 3rd ed. Texas: College Publishers.
- Arthur, P., Passini, R. (1992). *Wayfinding: People, Signs, and Architecture*. Mc Graw-Hill Ryerson, New York.
- Berger, Arthur Asa. (1998). *Signs in Contemporary Culture: An introduction to semiotics*. (2nd ed.). Salem, WI: Sheffield.
- Carter, R. (1997). *Working with Computer Type 4 Experimental Typography*. Switzerland: Roto Vision.
- Charles Wallschlaeger, C. B.-S. (1992). *Basic Visual Concepts and Principles for Artists, Architects and Designers*. Iowa: Wm. C. Brown.
- Cowie, P. A. (1994). *Oxford Advanced Learner's Dictionary of Current English*. 4th ed. England: Clays.
- Crooks, R. L., & Stein, J. (1988). *Psychology: Science, Behavior and Life*. Newyork: Rinehart and Winston. einhold, New York.
- Jewler, A. J. (1998). *Creative Strategy in Advertising*. 6th ed. California: Wadsworth.
- Lester, Martin Paul. (2000). *Visual Communication Images with Messages*. 2nd ed. California: Wadsworth: Thomson Learning.
- Livingston, a. a. (1992). *Dictionary of Graphic Design and Graphic Designers*. Singapore: Thames and Hudson.
- Lynch, K. (1960). *The Image of the City*. Cambridge, Mass. : M.I.T. Press.
- Meng-Cong Zheng. (2012).“ Time Constraints in Emergencies Affecting the Use of Information Signs in Wayfinding Behavior”. *Social and Behavioral Sciences*, 35: 440-448.
- Passini, R. (1984). *Wayfinding in Architecture*. Van Nostrand R.
- Pei-Ying Li, Haruo Hibino, Shinichi Koyama, Meng-Cong Zheng (2012). Tailoring Map Design Based on Map-Reading and Wayfinding Behaviour in Subway Stations. *Procedia-Social and Behavioral Sciences*, 42: 466-476
- Wells, William, Burnett, J., & Moriarty, S. (1998). *Advertising Principles & Practice*. 4th ed. New Jersey: Prentice-Hall International.
- Zulfadly Azizi Bohari, Syahriah Bachok, Mariana Mohamed Osman (2014). Improving the Quality of Public Transportation System: Application of simulation model for passenger movement. *Social and Behavioral Sciences*, 153: 542 – 552