

# Research on Recognition of Graphic Symbols in Amusement Park : A Case Study of Taiwan's Theme Amusement Park

Yao-Wen Hsu<sup>1</sup>, Yi-Chan Chung<sup>1</sup>, Ching-Piao Chen<sup>1</sup> and Chih-Hung Tsai<sup>1†</sup>

<sup>1</sup>Department of Industrial Engineering and Management  
Ta-Hwa Institute of Technology  
1 Ta-Hwa Road, Chung-Lin  
Hsin-Chu, Taiwan, ROC  
Tel: +886-3-5927700~2953  
E-mail: ietch@thit.edu.tw

## Abstract

Each amusement park has a wayfinding system, while symbols are important mediums to guide tourists to find their destinations. It is very important that whether the meanings of symbols recognized by tourists immediately. This paper mainly discusses the recognition of graphic symbols in amusement park, and proposes the improvement suggestions. Materials for this study were drawn from 20 different graphic symbols of a theme amusement park in Taiwan. The testees were required to evaluate the design of graphic symbols based on symbolic meaning and graphics recognition to summarize the confusion matrix. The results show that there are three groups of graphic symbols easy to be confused, and five symbols not meeting a criterion of 67% correct responses. The reasons were discussed, and improvement and relevant suggestions have been proposed, which may be helpful to redesign of symbols.

**Key Words:** Graphic symbol, Recognition, Amusement park

## 1. Introduction

The earliest form of amusement park was entertainment park or amusement garden, a conception of outdoor entertainment in 17th century. When it was evolved to the Vienna World's Fair Period in 1837, there were ride and many mechanical recreation facilities introduced for the first time, which made world tourists amazed and curious. Therefore the amusement park was transformed from a gentle and comfortable place to a roaring and exciting place, which indicated that people began to need adventure and excitation, and not satisfied with peaceful and comfortable recreational activities. From then on, the amusement park entered an epoch of mechanical amusement, varieties of recreation facilities were designed, and the territory of

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† Corresponding Author

amusement park was changed in a wider range. Hence the coexistence of multiple forms was produced both in visual sense and acoustic sense. Amusement park needs a large floor space, and recreation facilities to attract people only by keeping them fresh. However, when tourists enter the strange and large amusement park, they may don't know which they should begin or where are they. The first reaction is to find out the thing they are familiar with or some marks and contexts (generally are direction signs) to determine the current position or direction of the place to go. Patterns of many symbols however are similar or have obscure meanings, leading to confusion, and making tourists feel puzzled. Therefore it is very important for graphic symbols to be recognized easily by tourists, especially for the international tourists. A good design of graphic symbol can be used to overcome the language barrier.

The society is developed continuously, symbols representing miscellaneous meanings also develop fast and in more varieties, therefore the design of symbols is extremely important. Symbols are usually transmitted by combined presentation of graphics and contexts. This is effective for improving tourists' comprehension in meanings, graphic presentation in symbols on transmission of information. A group of excellent image design is a chain of complicated process, which at least covers the researches on human factors engineering, plan design, man machine interface, information science and etc. (Barthelemy *et al.*, 1990; Boersema and Zwaga, 1989; Brainard *et al.*, 1961; Easterby, 1967). Good graphics design is helpful for transmitting meanings of amusement park, and attaining the object of advocating at the tourists' first glance. In reverse, confused symbols cannot reach to expected effect at all, but even may result in tourists lost, waste their time, and affect tourists' interest. Especially that old people tend to be troubled since they show poorer perceptivity to symbols than young people (Lesch, 2003; Hancock *et al.*, 2004).

The amusement park can be classified as several types according to different services, but also become complex increasingly due to expansion and increase of its scale and function. Taking the case of this study as an example, in early stage it only has a safari park, now it has five villages of different themes. The demand for services and service space also increase, hence some information and tools are needed to help tourists to be familiar with the environment. In other words, early function of wayfinding system is to make up services of service personnel, so as to enable tourists to reach to recreation facilities easily; moreover the wayfinding system can make up some careless mistakes and faults in space arrangement in amusement park. Degree of complexity of amusement park plane and existence of wayfinding system will affect tourists' wayfinding in amusement areas (Claus and Claus, 1974); thus the importance of wayfinding system in amusement park is obvious. With respect to the quality of graphic symbol, good wayfinding system design must be visible, legible, noticeable and readable; while comprehension and aesthetic feeling are also important (Yang and Chuang, 2005). Sanders and McCormick (1993) also indicated that the criteria for selecting symbols generally include degree of recognition, matching degree and subjective preference and opinions. Therefore comprehension on graphic symbol (including degree of recognition,

visibility, legibility, matching degree and readability etc.) is very important. While subjective preference, aesthetic feeling or noticeable property are different with people and hard to be evaluated. Thus this study considers comprehension as the main index for evaluation. The matching test is a method to measure the usefulness of graphic symbols. The test is that a respondent asked to choose a given referent one symbol from a serial of symbols. The score of a symbol is based on the number of times it is chosen correctly from the group of symbols presented to the respondents (Zwaga and Boersema, 1983). There were many researches using the matching test type of procedure to evaluate the graphic symbols (Howell and Fuchs, 1968; Heard, 1974; Green and Pew, 1978; Easterby and Zwaga, 1976).

In the past, there were seldom researches to investigate about the design of graphic symbol in amusement park. This study uses the matching method to evaluate and analyze 200 tourists' recognition in graphic symbols of a theme amusement park in Taiwan, and proposes to redesign the symbols based on the results.

## 2. Methods

This study mainly quotes graphic graphics in the amusement park to identify, determine the comprehension degree, and judge the quality of graphic symbol by the testees, and then propose improvement for the symbols with lower comprehension degree.

### 2.1 Materials

This study picked out 20 graphic symbols from this amusement park (see Figure 1), amplified each graphic symbol, and printed them respectively on A4 paper with each graphic sized 14×14cm. Then numbered them, and bound them into a brochure for the convenience of follow steps.

### 2.2 Questionnaire design

Questionnaires used in this study mainly aim at investigating the situation of people's recognition of graphic symbols in amusement park. Each 20 amusement park symbols (see Figure 1) has 20 optional answers, and among them there is only one correct answer. In this study, the matching method is used, testees must find out the most appropriate answer for each graphic symbol from the 20 contexts meanings. The comprehension rate of each graphic symbol can be determined by testees' answers. If a certain graphic can match with more than two different context meanings, it indicates that there may be confusion (Zwaga and Boersema, 1983). Therefore we can summarize the matrix table of confusion (see Table 1) to find out symbols easy to be confused, discuss the reason and propose improvement. And then conduct the second questionnaire investigation after improvement to judge the effect of improvement by checking the comprehension rate for obvious effect.

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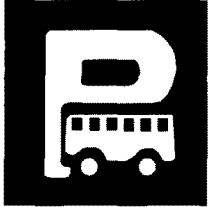



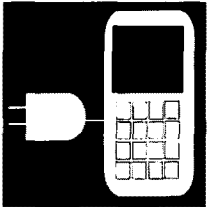
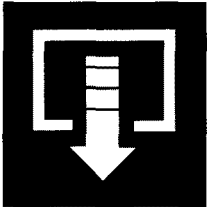


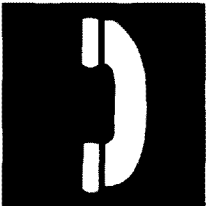



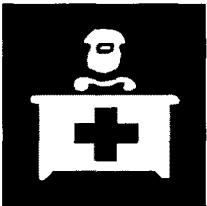






















			
Coach Park	ATM	Lost Children Room	Ticket Office
			
Mobile Phone Charging Station	Exit	Lost and Found	Car Park
			
Card Public Telephone	Passenger Transport Request Stop	Toilet	Entrance Ticket Check In
			
Tourists Consulting Center	Feed Vending Machine	Motor Vehicle Park	Baby Carriage Rental
			
Pets' Family	Nursing Liaison Station	Self Locker	Wheelchair Rental

Figure 1. The 20 graphic symbols in the amusement park

Table 1. Graphic symbols confusion matrix

	Lost Children Room	Mobile Phone Charging Station	Coach Park	Nursing Liaison Station	Motor Vehicle Park	Car Park	ATM	Toilet	Lost and Found	Self Locker	Feed Vending Machine	Tourists Consulting Center	Pets / Family	Entrance Ticket Check In	Ticket Office	Exit	Wheelchair Rental	Baby Carriage Rental	Card Public Telephone	Passenger Transport Request Stop
	6				1	4		1		2		2		3					1	165
		1								1			1	1	1	2			175	
	3	1						1			1						2	174	2	
					1											174				
	1			5						2	5	1		16	4	143		1		
	4	2	1						2	5	3	2	19	51	39	10			1	
	2	1						1	1	7	9	2	2	47	76	19			3	
					1					1	2	21	134	17	1	1	6	1		
	8	2			1			1	11	5	8	81	6	13	7	3			7	
	1						1		2	3	138	12	8	9	5					
	2	2		1					55	121	5	7	3	1	10					
	4	4			2			104	4	18	6	24	6	11	15					
	1				1			178			1				1		1			
										4	1	2	2	2	5					
					2										1	1			3	
					172	2		1		1			2				1			
	4			170					1	7		11	1		7	1				
											1			2		1			2	
	1	164							5	3	1	1		3	9			3		
	145								1	2	17	1		6	1	1		5	1	

### 2.3 Procedure

In order to adapt to general situation, conduct random sampling to achieve normal distribution. Therefore during questionnaire investigation, we draw out a tourist to receive the investigation every 15 minutes at the gate of the Theme Park in Taiwan. Total of 200 tourists, among which 182 are effective samples. First, give a sheet of questionnaire to each testee, tell them the method of investigation. Then research personnel will hold the graphic symbols randomly about 5 meters away, ask testee to identify and select a most appropriate answer for the symbol from the options. In this way, the 20 graphic symbols are shown in turns, and the whole process can be finished within 10~30 minutes.

## 3. Results Analysis

After collate the testees' answers into the matrix of confusion, then evaluate on comprehension degree, and finally discuss on the bad symbols.

### 3.1 Analysis on confusion matrix

In this study, the situation of testees' recognition to the 20 graphic symbols and their context meanings is collated into a matrix of confusion as shown in Table 1. Table 1 provides much useful information, which is helpful to discuss the reason of graphic symbols and their context meanings being correctly identified and mutually confused. In the graphic symbol confusion matrix, figure in the diagonal line indicates the time of graphic symbol correctly identified. While figure beyond the diagonal line indicates the time of graphic symbols and their context meanings being confused or mistaken. Numbers in row indicate the time of the same graphic symbol mistaken as other context meanings. While numbers in column indicate the time of the same context meaning mistaken as different graphic symbols. For example, the graphic symbol "Feed Vending Machine" in Table 1 is correctly identified by 138 testees of in total 182 testees. However there are 12 testees mistaking it as the "Tourists Consulting Center", 9 as the "Entrance Ticket Check In", 8 as the "Pets' Family", 5 as the "Ticket Office", 3 testees as the "Self Locker", 2 as the "Lost and Found", and one as the "ATM" and another one as the "Lost Children Room."
















Confusion among graphic symbols can be classified as symmetrical confusion and asymmetrical confusion. The so called symmetrical confusion refers to that the graphic symbol A is misunderstood as the context meaning of B, meanwhile graphic symbol B is also mistaken as the context meaning of A. For example, in the Table 1, "Ticket Office", "Entrance Ticket Check In" and "Exit"; "Pets' Family", "Tourists Consulting Center" and "Feed Vending Machine"; as well as "Self Locker" and "Lost and Found" indicate that they are easy

to be misunderstood to each other. Asymmetrical confusion is one sided, i.e., A is mistaken as B, but B will not be mistaken as A. For example, “Lost Children Room” and “Baby Carriage Rental”, “Card Public Telephone” and “Mobile Phone Charging Station”, and the like belong to one-sided confusion.

### 3.2 Analysis on comprehension rate

In this study, the 20 graphic symbols are graded according to their comprehension rate; Zwaga and Boersema (1982) consider that the qualified comprehension rate should be above 67%. Based on this standard, we classify these symbols into two grades: good (rate of correct answer is above 67%) and bad (rate of correct answer is below 67%). According to this, this study gets 15 good symbols (see Table 2), which have higher comprehension rate and can be used as good graphic symbols in amusement park. We conclude the characteristics of these symbols as follows:

**Table 2.** Symbols with comprehension rate above 67%

Graphics in daily life			Common things			Graphics simple and clear		
Graphics	Contexts meaning	Comprehension rate	Graphics	Contexts meaning	Comprehension rate	Graphics	Contexts meaning	Comprehension rate
	Toilet	97.8%		Wheelchair Rental	95.6%		Card Public Telephone	96.2%
	Coach Park	94.5%		Baby Carriage Rental	93.4%		Nursing Liaison Station	93.4%
	Car Park	93.4%		Mobile Phone Charging Station	90.1%		Passenger Transport Request Stop	90.7%
	Motor Vehicle Park	92.3%		ATM	82.4%		Exit	78.6%
				Pets' Family	73.6%		Feed Vending Machine	75.8%
				Lost Children Room	79.7%			

- (1) Express by daily graphics: a clear symbol graphic make the symbol easy to be understood, if it is also the graphic common in daily life, the comprehension rate will further increase. For example: there is a "P" in Coach Park, Car Park and Motor Vehicle Park respectively, which is similar to daily life practice, thus meanings to these symbols are easy to be expressed specifically. The Toilet is expressed by the graphic of a man and woman, generally in public place the Toilet is expressed by graphic of the like to tell the meaning of its symbol.
- (2) Express by common things: to design symbols with common things will make them easy to be read and understood, but also may make meanings of these symbols understood in a more rapid way. For example: Wheelchair Rental is expressed by the graphic of a wheelchair, while the Baby Carriage Rental is expressed by the graphic of a baby handcart, and Mobile Phone Charging Station is indicated by a mobile phone with a plug beside, which makes people think of its meaning immediately, in addition there are ATM, Pets' Family, and etc.
- (3) Graphics simple and clear: for example: Card Public Telephone, Nursing Liaison Station and the like are expressed by simple and clear structure.

There are 5 bad symbols (see Table 3) with rate of correct answer lower than 67%. Various reasons may lead to low comprehension rate, we may conclude them as follows:






- (1) Bad symbols design that cannot express the original meaning: for example: the rate of correct answer to the symbol of Ticket Office is only 21.4%, 41.8% people mistake it as "Entrance Ticket Check In". It is possible the improper indicatory direction problem, which makes testees think that a tourist is presenting the ticket for accepting inspection.
- (2) Ambiguous graphics lead to misunderstanding: for example: the mid lower part of the Lost and Found symbol is indicated with a portfolio graphic, and the top part indicated with a interrogation mark, which may be mistaken as that "where the things carried should be placed", therefore 30.2% testees choose the Self Locker.

### 3.3 Improvement and evaluation











As for the above mentioned 5 bad indicators with comprehension rate lower than 67%, this study used the perception principle of designing visual symbols (Easterby, 1970) to make all-round consideration and improvement, including figure/ground, figure boundary, closure, simplicity and unity. The key points for improvement are shown in Table 4. After improvement, the second questionnaire investigation is executed as the same as the first time. There are also 20 graphics and corresponding options for testees to choose, but only 50 samples are collected (in which 47 are effective samples), Table 4 also shows the collation of the comprehension rate got in the second investigation. From the table, we can see that the comprehension rate after improvement is up to standard and greatly increase by 85% above.



**Table 3.** Symbols with comprehension rate below 67%

Graphics	Comprehension rate	Original meaning	Incorrect definition	Possible reasons for mistake
	66.5%	Self Locker	Lost and Found	There is a key and a portfolio in the graphic, which are the articles usually carried but also easy to be lost.
	57.1%	Lost and Found	Self Locker	There is a interrogation mark in the graphic, and in the lower part there is a portfolio, which may be mistaken as that "where the things carried should be placed."
	44.5%	Tourists Consulting Center	Pets' Family Lost and Found	In the middle of the graphic there is an object similar to an animal, and there is an interrogation mark.
	25.8%	Entrance Ticket Check In	Ticket Office	May be mistaken as that the booking clerk is giving ticket to tourist after selling.
	21.4%	Ticket Office	Entrance Ticket Check In	Indicating direction problem may be mistaken as that a tourist is presenting the ticket for accepting inspection.

**Table 4.** Improvement of graphic symbols with bad comprehension rate and evaluation

Original meaning	Symbols graphics		Key points for improvement	Comprehension rate
	Before improvement	After improvement		
Self Locker			There is a portfolio and a key in original graphic, which may be considered as costly articles, and mistaken as "Lost and Found", enclose the portfolio in a frame to indicate that there is a cabinet.	91.5%
Lost and Found			In the original graphic, it seems that there is a portfolio placed in a cabinet, which makes tourists mistake it as "Self Locker". Add lines beside the portfolio to indicate that the portfolio is about to be disappeared.	93.6%
Tourists Consulting Center			In the original graphic the animal is redundant, it may lead to misunderstanding, therefore remove the animal.	95.7%
Entrance Ticket Check In			The meaning expressed in the original graphic is similar to "Ticket Office", which leads to low comprehension rate, therefore remove the hand, and replaced with a ticket that has been torn.	87.2%
Ticket Office			In the original graphic, a ticket is held in a hand, which may be understood as showing the stub, and mistaken as the Ticket Check In, to make the different obvious, add coins in the graphics to indicate buying.	89.4%

## 4. Conclusions

From the matrix of confusion, we can see that there are three groups of symbols that may produce confusion in perception: (1) "Ticket Office", "Entrance Ticket Check In" and "Exit"; (2) "Pets' Family", "Tourists Consulting Center" and "Feed Vending Machine"; and (3) "Self Locker" and "Lost and Found". The three groups of graphic symbol are similar in nature, graphics or some unnecessary graphic elements, which tend to be confused. Therefore it is necessary to clearly define and be improved to avoid puzzling tourists. In addition the comprehension rates of "Ticket Office", "Entrance Ticket Check In", "Tourists Consulting Center", "Self Locker" and "Lost and Found" are lower than 67%, not reaching to ISO standard, which need urgent improvement. Therefore in this study, make improvement as per the perception principle of designing visual symbols, and conduct the second questionnaire investigation. After that, comprehension rate is up to standard and is greatly increased. It is found in this study that graphic symbols with good comprehension generally use some graphics ordinary in daily life, and graphics of common things, which can be used as reference for symbols design. Since the perception quality is different with people, if a graphic symbol can make tourists feel familiar, simple and clear, it is believed that it will be easy to be understood to many tourists, and there may not be misunderstanding. On the other hand, graphic symbols with bad comprehension cannot clearly express their original meanings and tend to be misunderstood, which should be prevented and improved. The purpose of graphic symbol is to help tourists understand its meaning. If it produces misleading or has ambiguous meaning, make tourists feel puzzled, it would be better not to design it.

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