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A STUDY OF THE DIFFERENCES IN IMAGE MEMORY AND PREFERENCE BETWEEN MALE AND FEMALE VISUAL COGNITION

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Abstract

Cognition is a critical process for human beings to obtain messages, process messages, and eventually acquire information, in which vision is the most important since it accounts for 65%-70% of the absorbed knowledge and information. Currently, information is so complicated that image messages are full of daily life and thus become interference. The study aimed to understand the difference in visual cognition of images between different genders and investigate three issues, namely (1) the difference between the memory quantities of images, (2) the difference between the better remembered categories of images, and (3) the difference between the more impressive images, in the visual cognitive process of simultaneously watching different categories of images. The study targeted at the general public from 18 to 40 years old, including respectively 30 males and 30 females. The study classified images into five categories: Animal, Plant, Human Figure, Cartoon Character, and Culture and Life. Each category included ten representative images, and these fifty images were played by the speed of one image per second. An entirely black image was played for five seconds respectively before and after the fifty images were played. Therefore, it took one minute in total, and each research object answered the questionnaire after all the images were played.

According to the research result, there was not significant difference between the memory quantities of males and females between 18 and 40 years old ($p=0.738>0.05$). Males remembered best human figures (52%) whereas females remembered best human figures (56%) and second best cartoon characters (46%). In summary, the memory for the images of human figures tended to be more visual cognitive. However, in terms of the preference for images, cartoon characters received the most votes while human figures received the second most votes. In light of the result, suggestions for the application and cognition of images were brought up in order to improve the application of images as well as to be the cognitive theory of images in the following research.

Keywords: Cognition, Vision, Image, Memory

Introduction

Cognition indicates the systematic behavior that human beings process messages after sensing external information, and from which they obtain or learn meaningful knowledge and experience. The progress is composed of receptor, reactor, cognitive processor, and memory (Lin, 2007). Human bodies sense external messages through sense organs, and, by message processing, they generate feelings, including five important feelings, namely vision, hearing, olfaction, taste, and touch.

Vision is one of the crucial senses of human beings. 65%-70% of the knowledge and information of ordinary people are obtained through vision (Chen & Yang, 1998). When looking at images, human beings will also unconsciously focus on a particular subject and remember it. For example, people tend to have different focuses when they look at the same picture with various images, such as pretty women, sport cars, and foods. A lot of research and literature related to vision indicated that the visual cognition of males and females was different.

Nevertheless, if analyses and experiments can be conducted on visual characteristics, the data and results can be applied to relevant fields to further improve the current life of human beings and advance industrial efficiency and values. In terms of practical aspects, such as visual

communication and advertisement design, if the valued object themes and the preferred images in the visual cognition of males and females can be analyzed and applied to message transmission, the attractiveness, values, and meaning of advertisement can be enhanced.

Since vision is indispensable for all the activities of human beings, it is necessary, important, and developmental to explore the influence of the visual cognition of images on human beings. Except being helpful to understand the personality features and psychological aspects of the research objects, data can be employed to strengthen the functionality of visual messages and further improve the problems existing in the modern life, such as overflowed information and malfunctioned images. Consequently, finding differences through image categorization and experiments is helpful for images to increase the influences and purposes in design applications.

The study aimed to comprehend the differences in image memory between the visual cognition of males and females, which could be further classified into the following three items.

(1) The differences in image memory quantities between males and females.

(2) The differences between the better memorized image categories of respectively males and females.

(3) The differences between the impressive image categories of respectively males and females.

Literature Review

Visual Cognitive

Cognitive Procedure

Message processing in the progress of cognition is of systematic stages or steps. The input messages are certain operational behavior conducted in these stages, and the final response is assumed as the result of these stages and operation (Lin, 2007). The simplified cognitive

model brought up by Solso et al. (2007) divides the entire process into three parts, including stimulus detection, stimulus storage and transformation, and reaction. However, the entire cognitive progress can also be regarded as a systematic program. Starting from inputting stimulation, messages are stored in the region called primary memory after being received by sense organs externally and processed by corresponding sense units. If old messages are not repeatedly thought of or applied, they will be replaced by new messages. On the contrary, repeatedly remembered messages will be moved to the region for long-term memory with infinite capacity (Lee, 2000). In light of the aforementioned, when the messages of visual images are extraordinarily complicated, new messages will be continuously replaced by the viewed messages of images, and it is thus difficult for the messages of images to be moved to the long-term memory. Hence, it is meaningful and necessary to investigate the influences of the varieties of images on the visual cognition of human beings. This is helpful to improve the capability of images for conveying messages.

Importance of Visual Cognitive

Vision plays a considerably critical role in our life, and it is the most important one of five senses, namely vision, hearing, olfaction, taste, and touch. Human beings receive 65%-70% of knowledge and information through vision (Chen &Yang, 1998). In addition, other research has also showed that, among all the senses, vision accounts for the most influence (Madanipour, 1996). Visual cognition mainly senses, receives, and processes messages through vision, and it is fairly influential in the research on medical brain coding and cognitive psychology (Tyler & Likova, 2010). Furthermore, national issues related to aesthetic education, cultural promotion, and the cultivation of relevant experts are all closely correlated to visual cognition (Lin &Lo, 2008). Even the messages from the instrument panel of an aircraft are read on the basis of visual

cognition, so it is easy to find that vision is very important for human cognition (Waldron et al., 2008). It can be seen from the aforementioned that the importance of vision for human beings is beyond words, and there has been a great deal of contribution resulted from the research on vision. However, many modern issues about and relationships to vision are still worth discussion and investigation, such as the influence of image varieties on visual cognition.

Memory of Visual Cognitive

Human beings are capable of establishing visual memory for an object or scene in a short time. Melcher (2007) proved by his research that human beings could establish strong visual memory even though they only saw a scene or image briefly. Nevertheless, human beings are in an era flooded by images, and the vision certainly has selective focuses in terms of cognition. However, these decisions are often made unconsciously. For instance, the images of animals tend to be more impressive for some people whereas the images of human figures tend to be more impressive for other people. Complicated information on images is a critical research issue since too many visual images may obstruct the development of pure literature and reduce the desire to learn writing, which may further result in the reduction in writing capability. On the contrary, the importance of image applications is thus revealed. Therefore, for industries relevant to image applications and message transmission, such as advertisement and visual communication, it is worth studying whether or not there are differences in visual memory between genders.

Images

Our life is full of images, which results in that many people gradually view images instead of reading words. Research indicated that the content of media deeply influenced the user behavior of the audience. Since the great number of images and sounds in the electronic media bring the audience more sensory stimulation and thus become popular; the audience used to

electronic media gradually become fond of viewing pictures and images instead of reading words (Guo, 2004). However, issues related to the influence of images on human memory and impression are seldom explored. Consequently, in the study, the images often seen in the daily life were classified into five categories, including Animal, Plant, Cartoon Character, Human Figure, and Culture and Life, for investigation, and the image categorization in the literature was extended for pragmatic investigation.

The Images of Animals

Animal Planet, a famous animal program, is an international animal channel. Animal Planet (2004), the global voting campaign held by this program in 2004, elected the top ten globally popular animals, respectively tiger, dog, dolphin, horse, lion, snake, elephant, ape, whale, and penguin. The aforesaid ten animals were taken as the experimental sources of images in the study.

The Images of Plants

According to the result of street interviews and investigations, it was found that the general public tended to recognize flowers more easily in terms of plants, and females tended to pay attention to the applications and modeling more easily, so they were frequently employed in the applications of visual images. By means of the interviews with several anonymous owners of flower shops, the ten flowers more familiar by Taiwanese currently were sorted out in the study, including rose, lily, chrysanthemum, lotus, sunflower, plum blossom, carnation, cherry blossom, flame tree blossom, and rhododendron, which were taken as the experimental sources of images in the study.

The Images of Cartoon Character

The images of cartoon characters bring people lively and imaginary attraction. They are of considerably visual attraction, and the plentiful character features impress people easily. Ten highly exposed, famous, and representative cartoon characters were selected from the statistics of Yahoo, respectively Rufy (One Peace), Goku (Dragon Ball), Sponge Bob (Sponge Bob), Doraemon (Doraemon), Kiroro (Kiroro), Maruko (Maruko), Batman (Batman), Superman (Superman), Spiderman (Spiderman), and Tinky (Teletubbies), which were employed as the experimental sources of images in the study.

The Images of Human Figures

Human figures are the element most frequently seen in the visual communication and advertisement in daily life, especially the images of celebrities (Lee, 2008), and they are usually influential and easy to be remembered. The celebrities that people know tend to be limited to the figures with salient performances or special contribution in the fields of entertainment, sports, and politics. Therefore, from the media exposure ratio and awareness indexes of many statistics and ranking, such as TIME Magazine, 2010 and Yahoo, 2010, the images of ten celebrities, easy to recognize and remember, were sorted out, including Y. G. Ma, Bruce Lee, Michael Jordan, Tom Cruise, Bill Gates, H. R. Clinton, Sharapova, Oprah Winfrey, Angelina Jolie, and Lady Gaga, in which there were five males and five females. These ten celebrities were also employed as the experimental sources of images in the study.

The Images of Culture and Life

The category of culture and life targeted on the more important or representative images in daily life in Taiwan, such as famous scenery, constructional, and cultural features. In contrast to the aforementioned categories of images, these images tend to be ideological and possess the characteristics of cultures and recognition, so they are still easy to be visually remembered in

certain degree. After investigation, ten images were selected, including Taipei 101, MRT, Chiang Kai-Shek Memorial Hall(Liberty Square), Wii, Lottos, motorcycle, Ice cream, stinky tofu, computer, and perfume, which were used as the experimental sources of images in the study.

Methodology

Experimental Objects

The experimental objects of the study were targeted at the general public between 18 and 40 years old in Taipei. There were not particular constraints on other conditions. Only the experimental objects were proportionally found, including respectively thirty males and thirty females, sixty people in total (N=60), in order to be consistent with the purpose of sexual differences in the research.

The Design of the Experiment

Through the investigation and analysis of literature, the images were classified into five categories in the study, respectively A – Animal, B – Plant, C - Cartoon Character, D - Human Figure, and E - Culture and Life. In each category, ten most representative images were selected, totally fifty images, each of which were titled according to the category for the convenience of the records and coding of the following experiment. By means of Photoshop, all the image samples were modified into the size of 512*512 and the solution of 72dpi, the basic resolution of image display). The images were illustrated by the following five tables.

Table 1. The Images and Codes of Category A - Animal

A-1 Tiger	A-2 Ape	A-3 Lion	A-4 Dolphin	A-5 Snake	A-6 Elephant	A-7 Whale	A-8 Horse	A-9 Dog	A-10 Penguin

Table 2. The images and codes of Category B - Plent

									
B-1 Plum Blossom	B-2 Cherry Blossom	B-3 Lotus	B-4 Chrysanthemum	B-5 Rose	B-6 Flame Tree Blossom	B-7 Lily	B-8 Rhododendron	B-9 Carnation	B-10 Sunflower

Table 3. The images and codes of Category C - Cartoon Character

	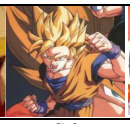					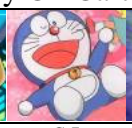			
C-1 Rufy	C-2 Goku	C-3 Maruko	C-4 Batman	C-5 Superman	C-6 Kiroro	C-7 Doraemon	C-8 Sponge Bob	C-9 Spiderman	C-10 Tinky

Table 4. The images and codes of Category D – Human Figure

		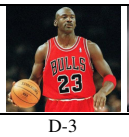							
D-1 Y. G. Ma	D-2 Bruce Lee	D-3 Michael Jordan	D-4 Tom Cruise	D-5 Bill Gates	D-6 H. R. Clinton	D-7 Sharapova	D-8 Angelina Jolie	D-9 Oprah Winfrey	D-10 Lady Gaga

Table 5. The images and codes of Category E - Culture and Life

									
E-1 Stinky Tofu	E-2 Wii	E-3 Computer	E-4 Taipei 101	E-5 Perfume	E-6 MRT	E-7 Liberty Square	E-8 Lottos	E-9 Motorcycle	E-10 Ice cream

According to the design of the experiment, the aforementioned fifty images were edited by a program and showed to the experimental objects in random number. The fifty images were displayed continuously and unrepeatedly by a projector in the speed of one second per image. Before and after displaying these images, a black screen was respectively held for five seconds to avoid deepening the memory of the 1st image and the 50th image which might further influence the result of the experiment. The total time of the experiment was 1 minute. When the experiment was conducted, the experimental objects were brought to the space with a projector installed, namely the experimental venue. The experiment allowed either group measurement or individual measurement since it depended on the convenient time of each experimental object.

However, to take into account the experimental quality, each measurement allowed the

maximum of ten objects to simultaneously conduct the experiment. The experimental objects were not informed of the purpose of the experiment either before or after the images were displayed in order to avoid the objects' intentional attention on certain images which might influence the result.

After the video was accomplished, the objects were provided the questionnaire and informed of the purpose of the experiment. The questionnaire was filled out accordingly by the objects to comprehend the result of the experiment. The experimental objects included respectively thirty males and thirty females, and totally sixty copies of questionnaire were retrieved. The question items in the questionnaire are listed as follows:

(1) Gender

(2) What images did you see? Please specifically list the names (unlimited number).

(3) Which three images are your favorite or most favorable images in terms of the images you remembered? (Please list them in order of preference.)

Research Result

The Differences in Visual Memory Quantities between Males and Females

Statistics were conducted in light of the data resulted from the questionnaire survey. After applying One-Way ANOVA, it was found that there was not differences in image memory quantities between modern males and females ($p=0.738>0.05$). Males could remember 13.8 images in average, 26 images at maximum or 4 images at minimum. Females could remember 14.2333 images in average, 23 images at maximum or 6 images at minimum. The result of the statistics is indicated by Table 6 and 7.

Table 6. Descriptive Statistics (The Comparison Between Male And Female Memory Quantities)

Gender	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower	Upper		

					Bound	Bound		
Man	30	13.8000	5.35885	.97839	11.7990	15.8010	4.00	26.00
Woman	30	14.2333	4.61395	.84239	12.5105	15.9562	7.00	23.00
Total	60	14.0167	4.96254	.64066	12.7347	15.2986	4.00	26.00

Table 7. The analysis of One-Way ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.817	1	2.817	.113	.738
Within Groups	1450.167	58	25.003		
Total	1452.983	59			

p value=0.738>0.05

The Correlation between Image Categories and Memory

The differential comparison between male and female visual cognition is helpful to understand which type of images are easier for respectively males and females to remember when images are not intentionally memorized. Table 8 indicates the image memory distribution and memory rate of males and females. In terms of visual cognition, both males and females could not strongly remember the images in Category A, B, and E, and only the memory rates of A-1 and A-3 reached 40%, which were still not influential. For Category D, both the average memory rates of males and females were over 50%. In particular, 83% of males and 80% of females remembered D-1, and the memory rates of D-6 and D-10 were not bad, either. Males could not significantly remember the images of Categories C except C-2(58%). However, Category C had certain influence on females, especially C-1(60%), C-6(53%), and C-8(53%).

The Differences in Image Preference between Males and Females

The most attractive and impressive images in the visual cognition of males and females could be found by calculating the number of the preference or impressiveness of an image. According to the result of the questionnaire statistics, the favorite image of males was Y. G. Ma, who was elected as the President of Taiwan in 2008, (an image from Human Figure) whereas the favorite images of females were Rufy, the chief male character in One Peace which was the hottest cartoon, (an image from Cartoon Character) and Lady Gaga, a famous singer, (an image from

Human Figure). It was further found by observing Table 9 that the categories of Human Figure and Cartoon Character were highly attractive and impressive for both males and females.

Table 8. The Statistics For The Image Memory Quantities And Memory Rates Of Males And Females.

Image Category	Image	Memory Quantity (Male)	Memory Rate (Male)	Memory Quantity (Female)	Memory Rate (Female)	Memory Rate (Male and Female)
A Animal	A-1 Tiger	14	47%	11	37%	40%
	A-2 Ape	8	27%	8	27%	27%
	A-3 Lion	13	43%	11	37%	40%
	A-4 Dolphin	5	17%	11	37%	27%
	A-5 Snake	6	20%	8	27%	23%
The Mean of Image Memory Male: 24% Female: 25%	A-6 Elephant	4	13%	7	23%	18%
	A-7 Whale	5	17%	2	7%	12%
	A-8 Horse	8	27%	8	27%	27%
	A-9 Dog	2	7%	4	13%	10%
	A-10Penguin	5	17%	3	10%	13%
B Plant	B-1 Plum blossom	4	13%	3	10%	12%
	B-2 Cherry blossom	0	0%	1	3%	2%
	B-3 Lotus	6	20%	6	20%	20%
	B-4Chrysanthemum	4	13%	6	20%	17%
	B-5 Rose	4	13%	6	20%	17%
The Mean of Image Memory Male: 7% Female: 13%	B-6 Flame tree blossom	0	0%	1	3%	2%
	B-7 Lily	0	0%	5	17%	8%
	B-8 Rhododendron	2	7%	4	13%	10%
	B-9 Carnation	1	3%	2	7%	5%
	B-10 Sunflower	12	4%	6	20%	12%
C Cartoon Character	C-1 Rufy	13	43%	18	*60%	52%
	C-2 Goku	18	56%	14	47%	53%
	C-3 Maruko	3	10%	10	33%	22%
	C-4 Batman	14	47%	8	27%	37%
The Mean of Image Memory Male: 27% Female: 42%	C-5 Superman	4	13%	8	27%	20%
	C-6 Kiroro	8	27%	16	53%	40%
	C-7 Doraemon	11	37%	9	30%	33%
	C-8 Sponge Bob	10	33%	16	53%	43%
	C-9 Spiderman	8	27%	14	47%	37%
	C-10 Tinky	6	20%	4	13%	17%
D Human Figure	D-1 Y. G. Ma	25	***83%	24	***80%	***82%
	D-2 Bruce Lee	17	57%	19	*63%	*60%
	D-3 Michael Jordan	8	27%	5	17%	22%
	D-4 Tom Cruise	14	47%	17	57%	52%
	D-5 Bill Gates	15	50%	17	57%	53%
The Mean of Image Memory Male: 52% Female: 56%	D-6 H. R. Clinton	24	***80%	22	**73%	**77%
	D-7 Sharapova	12	40%	17	57%	48%
	D-8 Angelina Jolie	17	57%	19	*63%	*60%
	D-9 Oprah Winfrey	7	23%	10	33%	28%
	D-10 Lady Gaga	13	43%	23	**77%	*60%

E Culture and Life	E-1 Stinky Tofu	4	13%	5	17%	15%
	E-2 Wii	5	17%	3	10%	13%
	E-3 Computer	8	27%	8	27%	27%
	E-4 Taipei 101	8	27%	3	10%	18%
	E-5 Perfume	0	0%	1	3%	2%
	E-6 MRT	9	30%	5	17%	23%
The Mean of Image Memory Male: 16% Female:14%	E-7 Liberty Square	3	10%	0	0%	5%
	E-8 Lottos	3	10%	6	20%	15%
	E-9 Motorcycle	3	10%	6	20%	15%
	E-10 Ice cream	2	7%	3	10%	8%

(* indicates the value is between 60-69%; ** indicates the value is between 70-79%; *** indicates the value is over 80%.)

Table 9. The Quantitative Ranking Of Male And Female Preference For Images

Gender	First	Second	Third
Male	D-1(Y. G. Ma) (10 votes)	C-1(Rufy) (8 votes)	C-2(Goku) (7 votes)
Female	C-1(Rufy), D-10(Lady Gaga) (8 votes)	A-3(Lion), C-8(Sponge Bob), D-4(Tom Cruise), and D-7(Sharapova) (5 votes)	C-6(Kiroro)、C-9(Spiderman), and D-8(Angelina Jolie) (4 votes)
Total	C-1(Rufy) (16 votes)	D-1(Y. G. Ma) (13 votes)	D-7(Sharapova) (11 votes)

Conclusion

According to Table 6 and 7, there was not significant difference in the capability of memory between male and female visual cognition ($p=0.738>0.05$). Moreover, there was not difference in the indexes of mean (13.8 images for male; 14.2333 images for females), maximum memory (26 images for males; 23 images for females), and minimum memory (4 images for males; 6 images for females), which further proved that the gender difference between males and females did not influence the capability to visually cognize images.

In light of Table 8, the memory rates of the images in A-Animal (24% for males; 25% for females), B-Plant (7% for males; 13% for females), and E-Life and Culture (24% for males; 25% for females) were significantly low, which indicated that they tended to be less attractive or more difficult to be remembered in the process of visual cognition. The images in C-Cartoon Character (52% for males; 56% for females) and D-Human Figure (24% for males; 25% for females) had higher visual memory rates, but Category C tended to be easier for females to remember.

According to the above result, the memory rate of the images in the category of human

figure tended to be considerably high. It was thus known that the images of human figures, or celebrities, tended to be remembered easily by males and females between 18 and 40 years old, and they tended to be cognized by vision from many and diverse images, which indicated the great influence. There was not much difference in terms of each single image. However, the difference was significant between images in Cartoon Character, such as C-1, C-6, and C-8, which indicated that the influence of different images in Cartoon Character on males was highly different from that on females. Finally, in terms of preference (Table 9), the preference of males tended to be more concentrated. However, in succession to the previous result, the images from Cartoon Character and Human Figure accounted for the top three places in preference.

In summary, the images of human figures, or celebrities, were generally more attractive to both males and females, and those images were easier for them to remember. In addition, the images of cartoon characters should be employed according to the audience, that is, males or females, in order to develop the characteristics of being highly attractive, being easy to be remembered, and being different. Consequently, when images are applied to the transmission of messages, such as advertisement and visual design, different applications and planning of images can be conducted according to the genders of the audience by referring to the data in the study in order to achieve the goal of effectively applying the images. Furthermore, there are still a lot of interesting and unknown issues relevant to the visual memory of images, and there is thus a lot of space for future investigation.

References

Animal Planet (2004). The Top 10 of Animals. Retrieved November 17, 2009, from: http://animal.discovery.com/

Chen, J. H., & Yang, T. M. (1998). *Introduction to Visual Communication Design*. Taipei: Opentech.

Guo, H. T. (2004). Words to Figures. *Journal of Media Literacy center, 39,* 3.

Lee, Y. S. (2000). Human Factors Implications of Working Memory Limits. *Journal of Research in Applied Psychology, 5,* 55-67.

Lee, Z. C (2008). *Advertising Culture*. Zhengzhou: Zhengzhou University Press.

Lin, J. Y. (2007). *Aged People Life Cognition*. Taipei: Tingmao.

Lin, Y. C., & Lo, M. L. (2008). *Developing concepts of visual art education: From visual perception to aesthetic caring*. The TNUA 2008 Symposium on Culture Resources.

Madanipour, A. (1996). *Design of Urban Space: An Inquiry into a Socio-spatial Process*. London: John Wiley & Son Ltd.

Melcher, D. (2007). Predictive remapping of visual features precedes saccadic eye movements. *Journal of Nature Neuroscience, 10,*903-907.

Solso, R. L., MacLin, M. K., & MacLin, O. H. (2007). *Cognitive Psychology* (8th Edition). Boston: Allyn and Bacon.

TIME Magazine (2010, March). Real Top of 100 People. TIME Magazine. Retrieved from http://www.time.com/time/.

Tyler, C. W., & Likova, T. L. (2010). An Algebra for the Analysis of Object Encoding. Journal of Neuroimage, 50(3), 1243-1250.

Waldron, S. M., Patrick, J., Duggan, G. B., Banbury, S. & Howes, A. (2008). Designing information fusion for the encoding of visual–spatial information. Journal of Ergonomics, 51(6), 775-797.