

Association Between Emotional Reaction and Visual Symbols

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Abstract:- There are a series of biological change when people have emotions. However, due to limited knowledge of biological mechanism and too many areas involved, only facial expressions were investigated in this study. Four groups of college students from different professional backgrounds and gender were recruited in this study to compare different professional backgrounds in cognition of emotional reaction to facial expressions and symbolic figures. The results showed that people from different professional backgrounds and different genders would perform differently in processing facial expressions. In addition, the difference between facial expressions and symbolical facial expression is that realistic facial expressions are more active and are easier to perceive than are the symbolical facial expressions.

Key-Words: - Emotional reaction, Scared, Visual symbols

1 Rationale

1.1 Research Motivation

Emotion exists everywhere. An expression of eyes, motion, words could be emotional reactions or seducing emotions. They control viewers' emotion to reach what is so-called resonance. For example, abstract art, artists use figure (point, line and face), color, and texture to express emotions. Their purposes are nothing but to obtain viewers' resonance.

Recently, some researchers tried to use visual symbols to represent facial expressions. For example, the symbol "☺" represents happiness, and "☹" represents sadness. The same arc with different direction represents different expressions. Various visual symbols could induce different emotional reactions due to the time and space variation. Some symbols are more abstract, such as the cross on the top of churches, the image on a flag, the totem for a tribe are examples to represent a

specific abstract and deep meaning. Some symbols are easy to understand, but some are accompanied with specific knowledge and social culture.

Reviewing literatures, most researchers have done studies about association between line symbols and emotions. Not many researchers have investigated why people have reaction to symbols. Additionally, whether people with different gender, age or educational backgrounds would have different association to the same symbols has not been demonstrated.

1.2 Research Aims

- (1) To investigate how people interpret emotional reactions
- (2) To investigate how people interpret visual symbols
- (3) To compare cognition between emotional reactions and visual symbols

2 Literature Review

Based on literature review, two theoretical hypotheses were addressed. One was that visual symbols could deliver different emotional reactions, the other one was different people interpret visual symbols differently. Two hypotheses were described below:

2.1 Visual Symbols Could Deliver Different Emotional Reactions

The reason why symbols could represent some specific meanings is that they induce some specific meaning to people. The meanings from symbols could be from learning, habits, and life experiences. Some representations of symbolic images could be nature to people. Most of images are modified including structure (lines, dots, and surfaces), color, and materials. These three materials represent a specific beauty, and one of each changed could represent different meaning.

All elements are full of different characteristics and representations. For example, 'horizontal line' may represent 'peace and calm'; 'diagonal line from left to right' may represent 'movement and speed'; 'incised line' may represent 'nerve, bear and tremble'; 'waved line' may represent 'feminine, soft and smooth'; 'bold line' may represent 'power and active'; 'thin line' may represent 'elegance and precision'; 'continuous line' may represent 'certainty and affirmation'; 'intermittent line' may represent 'uncertainty and hesitance'; 'dotted line' may represent 'animation and interference' (Victor & Buchanan, 1996) [1]. In addition, Bates (1991) [2] suggested that a line could not only induce our eye movement, but also may induce our inner emotions. Because our eyes are sensitive, and even could detect a small change of a moving line. Furthermore, Ione (1989) also suggested that a straight line could indicate the relationship between objects, namely, a straight line could indicate the moving direction and emotions (e.g., happy, sorrow or miserable) [3].

The impact of people's emotions from color is faster and stronger compared to from an object pattern (e.g., shape). Wang (2005) [4] investigated the association between color and adjectives of emotion used in life by testing college students. She found that bright yellow represents excitement and happiness; bright red represents excitement and wrath; grey represents sadness; dark red represents pain and fidget; pink represents shame; white represents peace; dark represents fear; olive represents

disgust and pain. In addition, the quality of each element could give people different impression, such as a steel wire represents cold and hard-hearted, but wool and wood represent warmth and simplicity.

2.2 Different People Interpret Visual Symbols Variously

When people see a particular color, they may think of something relevant, such as past experience and living environment. This association was influenced by past experience, knowledge and memory, and also affected by ages, educational backgrounds, environments, careers and nationalities (Lin, 1992) [5].

Liu (2007) [6] investigated in students from different educational backgrounds and found that the emotions 'scare and horrify' in quality-photographic facial expression, and the emotion 'scare' in geometric image was different between students with different expert education. Besides educational backgrounds, age was also a factor which influences emotional cognition. Shaffer (1999) [7] found that 2.5 year-old infant has already had stereotype impression to different genders and suggested that stereotypical impression could have been developed during infant. In addition, Mead (1934) [8] suggested that people who are masculine or feminine made by the society. Sternberg (2002) [9] suggested that males have better spatial cognition than do females. In addition, Tang (1996) [10] compared difference of gender effect in expressing emotions. He found that males are easier and more specific to express their excitement; however, females are more sensitive to inner sorrow and sadness.

3 Research Design

3.1 Participants

400 students, 100 in each (age range from 20-25 years old) from four departments (College of Literature, Science, Management and Design) were recruited. Each participant has been received professional training for at least two years before participating in this study. All students were in their junior or senior year.

3.2 Research Variables

3.2.1 Facial Expressions

Facial expressions are one directly emotional reaction that can be recognized. In addition, children judge people's emotional reactions by processing changes of facial expressions (Durand & Gallay et al., 2007) [11]. Izard (1977) [12] and Ekman (1972) [13] suggested that facial expressions are the formula of each original emotion. Therefore, the author developed a questionnaire 'A survey in facial expressions and emotional reactions' which contained twenty four variables of emotional adjectives (e.g., scared, and horrified and etc.). Participants had more than one choice in each question.

3.2.2 Abstract Geometric Figures

Geometric symbols include various elements, such as dots, lines and surfaces. Each element may represent various expressions and meanings. However, these meanings and expressions are given by people. Horton (1994) [14] suggested that people may connect some images with specific experiences and then give images specific representation. The questionnaire produced by the author contained twenty four variables of emotional adjectives (e.g., scared, and horrified and etc.). Participants had more than one choice in each question for each geometric image.

3.3.3 Research Limitation

Because there were many variables in this study, some controls should be addressed.

- (1) It is hard to catch a proper picture of facial emotions, because facial expression could be shown fast. In addition, actors and actresses have been trained professionally, and they can express a specific emotion more livingly than other people. Therefore, all photographs were selected from films with black and white and other interference removed (e.g., tears, glasses, gestures, and body gestures).
- (2) Because of wide range of symbolic images, images depicting facial expressions were selected.
- (3) Because this study proposed to investigate the difference of emotional reaction between facial expression and geometric images, the adjectives, 'astonished, scared, panic, frightened and terrified' were used.

3.4 Research Materials

3.4.1 Facial Expressions

Totally sixteen photographs of facial expressions were selected from foreign movies. Each

photograph was modified with black and white and measured 5 x 5 cm (Figure 1)

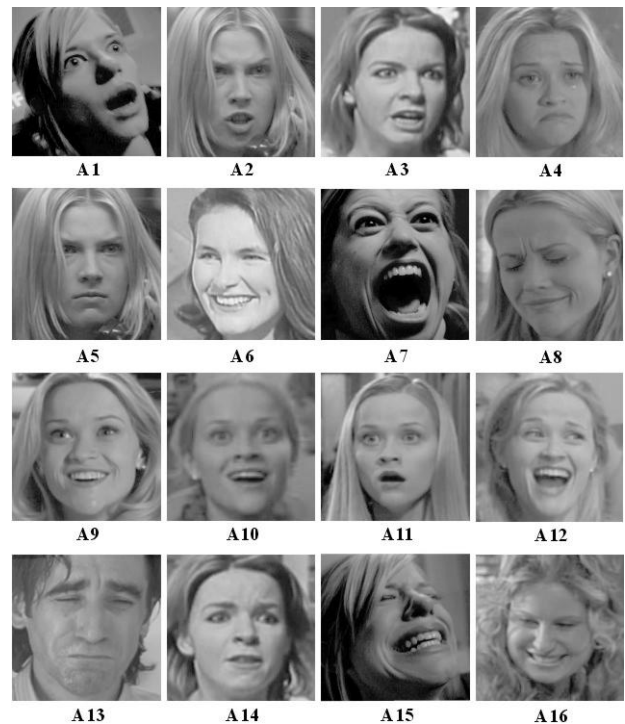


Figure 1. Sixteen facial expressions

3.4.2 Geometric Images

All symbolic facial expressions were drawn from Internet and the author. Eleven images were then selected in this study and each image was measured 1.5 x 1.5 cm (Figure 2).

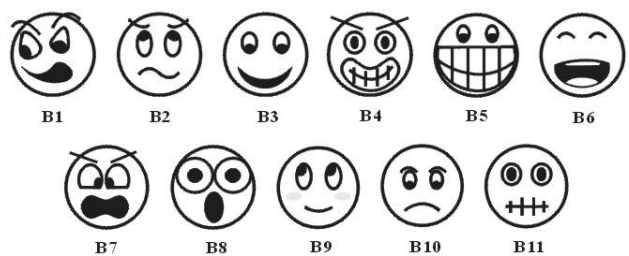


Figure 2. Eleven symbolic facial expressions

3.4.3 Variables of Emotional Adjectives

120 undergraduates were recruited to find and categorize emotional adjectives which are used mostly in daily life. Each student was assigned to one group according to KJ group method, and was required to write three commonly used emotional adjectives on a card. Totally, 360 cards were collected. Subsequently, four researchers reviewed all cards and categorized all adjectives into some categories based on word meaning and similarities. The researchers gave a name for each category. For those adjectives could not be categorized were excluded. Finally, twenty four adjectives were selected as follow: astonished, fearful, cheerful,

scared, joyful, excited, wrathful, inspired, hateful, nervous, frightened, disgusted, happy, panic, surprised, upset, and terrified.

3.5 Data Collection

All students participating in this study were recruited from four colleges in south of Taiwan. All students were randomly assigned a copy of questionnaire and also given instruction by the researcher. All students were required to give their first impression of each image.

3.6 Data Analyses

Descriptive statistics: proportion of each variable (facial expressions, geometric images and emotional adjectives) between different gender and educations was conducted.

Chi-square test: chi-square tests were conducted to investigate the difference between different genders and education in the cognition of each image.

4. Results

Totally 400 students from different colleges (100 in each college) were recruited in this study to investigate the influence of gender and educational backgrounds in processing facial expressions. Each college student has been given professional training for at least 2 years. All participants were on their junior or senior of college when they were drawn. The demographic data of different gender in each college are shown in Table 1.

Table 1. The numbers in each college group for each gender group

College	Gender			Total
	%	M	F	
Literature	f	32	68	100
	%	8	17	25
Science	f	74	26	100
	%	18.5	6.5	25
Management	f	40	60	100
	%	10	15	25
Design	f	31	69	100
	%	7.8	17.3	25
Total	f	177	223	400
	%	44.3	55.8	100

Keywords: ‘M’: male; ‘F’: female; ‘f’: frequency; ‘%’ percentage of each gender in total

In this study, in each question, there were 24 choices of emotional adjectives. The most three adjectives which received higher proportion were analyzed and compared further. In addition, gender and educational backgrounds were used as other independent variables to investigate whether

judgments of emotions would be affected. The results showed a significant association between gender and educational backgrounds ($\chi^2 = 49.8, p < .01$). Consequently, chi-square tests were carried out to explore the association between gender and educational backgrounds in the following analyses.

4.1 Cognition of Emotional Reaction to Facial Expressions

The results showed that the most chosen adjectives for the photograph labeled A1 (Figure 3), A7 (Figure 4), and A11 (Figure 5) were similar. This showed that students had similar emotional cognition to these three facial expressions. In addition, the data shown in Table 2, 3, and 4, the adjectives, ‘scared, astonished and terrified’ were chosen by most of students, indicating that these three adjectives better to describe the emotion of A1, A7 and A11. Moreover, we analyzed the characters of image A1, A7 and A11 and found that there is an obvious character on both images which is that both images contain opened-eyes and slightly opened-mouth (did not consider whether the emotion is positive or negative). This character is sometimes used to describe a surprised face. In addition, image A7 does not only contain that character mentioned above, but also contains more exaggerative expression. Therefore, the facial expression of image A7 could be more salient than others. The ranking order of cognition of emotional reaction are shown in Table 3, showing that the emotional adjective ‘scared’ was ranked as the first, and ‘astonished’ as the second compared with the other two images.

In addition, chi-square tests were further carried to investigate in which image, the association between gender and educational backgrounds could be found. The results showed that for image A1, significant differences for the adjectives, ‘scared’ ($\chi^2 = 35.6, p < .01$) were found. However, these significances were not found for image A7 and A11. In table 2, the proportion in each adjective showed that for ‘scared’, 105 males and 191 females; for ‘terrified’, 79 males and 143 females. The data showed a significant difference that cognition of facial expression was affected by genders.

Moreover, the analyses between different educational backgrounds were carried. The results showed that for image A1 and A7, the adjective, ‘scared’ ($\chi^2 = 24.1, p < .01$; $\chi^2 = 27.1, p < .01$), and ‘terrified’ ($\chi^2 = 16.2, p < .01$; $\chi^2 = 26.3, p < .01$) were significantly different. For image A11, the significant differences were found as follow: for

‘scared’, $\chi^2 = 14.3$, $p < .01$; for ‘astonished’, $\chi^2 = 13.7$, $p < .01$. The results showed that the adjective ‘scared’ was found for three images, suggesting that the cognition of the expression ‘scared’ might be affected by different education. Furthermore, the highest difference was found within the students from College of Science.



figure 3.A1

figure 4.A7

figure 5.A11

Table2. The numbers and percentage of judgments on each adjective, and chi-square results for each gender and educational background for image A1

Adjectives	scared (1)			astonished(2)			terrified (3)		
	M	F	T%	M	F	T%	M	F	T%
College									
Literature	21	55	5.3	23	38	4.2	17	42	4.1
Science	35	21	3.9	44	13	4.0	23	16	2.7
Management	26	54	5.6	32	38	4.9	22	36	4.0
Design	23	61	5.8	20	46	4.6	17	49	4.6
Total%	105	191	20.5	119	135	17.6	79	143	15.4
Gender χ^2	35.6**			1.9			15.2**		
Education χ^2	24.1**			4.2			16.2**		

Keynote: ‘M’: male; ‘F’, female, (number): the rank of the top three choices; ‘T’: total percentage

Table3. The numbers and percentage of judgments on each adjective, and chi-square results for each gender and educational background for image A7

Adjectives	scared(1)			terrified(2)			excited (3)		
	M	F	T%	M	F	T%	M	F	T%
College									
Literature	0	18	1.7	7	22	2.8	11	16	2.6
Science	31	5	3.4	4	3	0.7	14	9	2.2
Management	18	28	4.4	22	14	3.4	4	22	2.5
Design	11	40	4.8	11	21	3.0	12	11	2.2
Total%	60	91	14.3	44	60	9.9	41	58	9.4
Gender χ^2	2.0			.2			.4		
Education χ^2	27.1**			26.3**			.7		

Keynote: ‘M’: male; ‘F’, female, (number): the rank of the top three choices; ‘T’: total percentage

Table4. The numbers and percentage of judgments on each adjective, and chi-square results for each gender and educational background for image A11

Adjectives	astonished(1)			scared(2)			nervous (3)		
	M	F	T%	M	F	T%	M	F	T%
College									
Literature	18	42	8.2	9	12	2.9	11	14	3.4
Science	15	47	8.5	15	2	2.3	5	7	1.6
Management	30	52	11.3	14	20	4.7	6	14	2.7
Design	20	49	9.5	11	26	5.1	4	13	2.3
Total%	113	160	37.5	49	60	15.0	26	48	10.2
Gender χ^2	2.9			.0			3.1		
Education χ^2	13.7**			14.3**			5.9		

Keynote: ‘M’: male; ‘F’, female, (number): the rank of the top three choices; ‘T’: total percentage

4.2 Cognition of Emotional Reaction to Geometric Facial Expressions

The data for geometric images showed that image B8 and B11 received similar judgment adjectives. For image B8, the rank order of most chosen adjectives was ‘astonished, terrified, and surprised’ showing that image B8 was tended to be induced by accidental stimuli. For image B11, the rank order was ‘nervous, fearful and terrified’, showing that B11 was tended to induce emotions, panic and horrified. In image B8 and B11, both images had opened-eyes; however, image B8 had an opened-mouth, and image B11 had a closed-mouth. Thus, image B8 had more similarities as did image A1 and A11, namely, more surprised. Nevertheless, image B11 did not have this characteristic.

Furthermore, chi-square tests were carried out to investigate that whether gender was a factor which influenced judgments of adjectives. The significant differences were found as follow: for image B8, gender significance was found for the adjective ‘scared’ ($\chi^2 = 5.0$, $p < .05$); for image B11, gender difference was found for the adjectives, ‘nervous’ ($\chi^2=7.4$, $p < .01$), ‘frightened’ ($\chi^2 = 5.3$, $p < .05$), and ‘panic’ ($\chi^2 = 14.8$, $p < .01$). For the analysis of educational differences, the significant differences were found as follow: for image B8, ‘scared’, $\chi^2 = 1.7$, $p < .01$; for image B11, ‘nervous’, $\chi^2 = 8.1$, $p < .05$; ‘frightened’, $\chi^2 = 22.9$, $p < .01$. The results showed that the cognition of adjectives, ‘scared, nervous, and frightened’ was different between different groups of educational backgrounds.

The data in Table 6 showed that the adjective, ‘surprise’ was different from other adjectives (e.g., scared, nervous, terrified and panic), because surprise is on the positive dimension of emotions. However, the adjectives, scared, terrified and panic are on the negative dimension of emotions. In addition, it was limited to gain other information about why participants had similar or different emotional reactions to the same/different images, because participants were only required to see those images, In addition, geometric images were too simple to represent more animate expressions. The adjectives, ‘surprised, astonished and panic’ could be used in some other circumstances. Therefore, the results were limited to distinguish the stimuli.



figure 4. B8



figure 4. B11

Table5. The numbers and percentage of judgments on each adjective, and chi-square results for each gender and educational background for image B8

Adjectives College	astonished (1)			scared (2)			surprised (3)		
	M	F	T%	M	F	T%	M	F	T%
Literature	27	49	10.3	7	23	4.0	6	10	2.2
Science	51	17	9.2	16	3	2.6	13	9	3.0
Management	30	48	10.5	16	28	5.9	6	18	3.2
Design	17	58	10.1	6	26	4.3	10	19	3.9
Total%	125	172	40.1	45	80	16.9	35	56	12.3
Gender χ^2	2.2			5.0 [*]			1.6		
Education χ^2	3.0			1.7 ^{**}			4.9		

Keynote: ‘M’ : male; ‘F’ , female, (number): the rank of the top three choices; ‘T’ : total percentage

Table6. The numbers and percentage of judgments on each adjective, and chi-square results for each gender and educational background for image B11

Adjectives College	nervous (1)			frightened(2)			panic (3)		
	M	F	T%	M	F	T%	M	F	T%
Literature	10	20	3.8	2	20	2.8	6	20	3.3
Science	16	6	2.8	13	7	2.6	6	12	2.3
Management	12	26	4.9	6	12	2.3	8	12	2.6
Design	6	32	4.9	15	29	5.6	2	19	2.7
Total%	44	84	16.4	36	68	13.3	22	63	10.9
Gender χ^2	7.4 ^{**}			5.3 [*]			14.8 ^{**}		
Education χ^2	8.1 [*]			22.9 ^{**}			2.1		

Keynote: ‘M’ : male; ‘F’ , female, (number): the rank of the top three choices; ‘T’ : total percentage

5 Conclusion & Discussion

Four groups from different professional backgrounds were recruited to investigate the influence of education in judging facial expressions with different types of images. In each group, 100 students were recruited, and females were more than males, except for students from College of Science (74 males, 18.5%, 26 females, 6.5%). The results in this study showed that students studying in College of Science were conservative than students in other colleges. In addition, the difference between males and females was more significant than in other groups.

In conclusion, the differences between photographs of facial expressions and geometric facial expressions is that in real faces, the expression is more animate and contain more details (e.g., eye contact, tense on the face) which can deliver more accurate emotions than in symbolic images. However, in symbolic facial expressions

(geometric images), the expression may be too stiff to express more detailed emotions. Thus, people only could get surface information from symbols.

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