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Synesthesia Metaphor in Semantic Processing and Visual Perception

Ai Shinohara[8]

Synesthesia is a rare neurological ability whereby people can interpret one stimulus by using multiple perceptions or cognitions. Synesthesia metaphor, on the other hand, is a synesthesiac feeling which most people have toward a target stimulus. The current study was conducted to determine if there is a synesthesia metaphor between vision and semantic processing. Chinese characters were used as visual stimuli for those unfamiliar with the symbols, and the English words that served as a prompt for the task were used as cognitive or semantic stimuli in this study. Fifty-eight students recruited from the Lindenwood participant Pool (LPP) were presented with an English word prompt and asked to choose one of two Chinese characters, presented as one which they thought matched the meaning of each English word on the computer screen. A chi-squared analysis was used to determine if the participants were able to correctly match the visual stimuli with the English words. The findings revealed that people are more likely to choose the correct Chinese characters than not. Thus, it was concluded that people have a synesthesia metaphor in vision and semantic procession.

Synesthesia, or synaesthesia, is a condition in which people use multiple perceptual or cognitive processing towards the target stimulus (Rogoaska, 2011). Synesthesia is a rare condition, and many experts have been studying synesthesia. For example, people who have an ability of synesthesia can see colors when hearing sounds (Goller, Otten, & Ward, 2009). Although many people do not have an ability of synesthesia, some synesthetic conditions, called synesthesia metaphor, among non- synesthetic people were discovered (Peipei, 2007). "Booba and Kiki effect" is one of the most common examples of synesthesia metaphor (Wolfgang as cited in Jansen, 2007). Wolfgang, the primary researcher of Booba and Kiki effect, asked his participants to choose either "Kiki" or "Booba" as the name for the star-like shape or the rounded shape. He found that 98% of people said the star-like shape was a "Kiki,"and rounded shape was a "Booba," and he concluded that people use two different senses (vision and sound) to

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determine the name of each shape (Wolfgang as cited in Jansen, 2007). This is evidence of synesthesia metaphor in vision (shape) and sound (name).

One of the newest studies reported that babies also have a synesthetic ability in sound and physical property (Marcela, 2011). Most native English speakers instinctively guess that made up words which have the pair of vowel sounds "O" and "A", such as "boaw," as a "bigger" sounding object if it were to exist, whereas words which have "I" or "E", such as "like," as a "smaller" objects. However, Marcela (2011) discovered that individuals, like babies, who did not knew the relation between objects and their names can still recognize there is a relation to the names sound and object' size. It is also considered as one of the examples of the ability of synesthesia.

Shinohara (2012) conducted a study to determine if people showed their synesthetic ability in semantic processing and visual perception toward an unfamiliar stimulus. In the original study, the researcher used Chinese characters as unfamiliar visual stimuli, and the abstract meaning of the words involved semantic processing (cognitive stimuli). Two main surveys were used for the experiment: a Chinese characters survey and a demographic survey. In the previous study by Shinohara (2012), the Chinese characters survey was a paper form which included 10 matching items and 10 open-ended questions (see Appendix A). The first five items were positive words, which were "happy," "beautiful," "bright," "heaven" and "peace." The last five items were "depression," "crying," "bad," "crime" and "hate". Only abstract words were used in this experiment because most Chinese characters which are tangible words are came from drawings of the concept (pictograms). If the Chinese characters which are pictograms are appeared in the experiment, the participants would choose a Chinese character not by synesthesiac feeling; rather, by the participants' schema of the concept. Thus, only abstract

words which were came from logogram in Chinese characters were used in the study. There were two Chinese characters for each item, and participants were asked to choose one of the Chinese characters which they matched the meaning of the English word. Fifty-five undergraduate students at Lindenwood University were asked to choose one of two Chinese characters which matched the meaning provided. In each of the 10 trials, the paired Chinese characters had opposite meanings, whereby one of them matched the meaning of provided, and other was its antonym. Shinohara's (2012) main finding was that participants showed their synesthetic ability (synesthesia metaphor) in semantic processing and visual perception.

Through the experiment, Shinohara (2012) found that there was a time bias in the study. Since there was no time limit in answering the questions, duration to respond to items was significantly different among the individuals. However, because of the concept of synesthesia, which should be unconscious and automatic condition (Cytowic, 1998), participants should not have spent too much time choosing the Chinese characters. Thus, the imposed time limit was necessary for the current study to reduce time bias.

The current study was conducted in order to confirm the conclusion of the original study and to collect less unbiased data. In the present study, the visual stimuli (Chinese characters) were presented by a computer-based task. Each items appeared on the computer screen and participants were given limited time (5 sec) to respond to each item.

Based on the previous study, the hypothesis of this study was that people were more likely to choose a correct Chinese character for each question; people had an ability of synesthesia, or synesthesia metaphor in semantic processing and vision as well as different types of synesthesia.

Method

Participants

Fifty-eight Lindenwood University students (33 women, 25 men), with an age range from 18 to 24 years, participated in the study in exchange for extra course credits as compensation. To obtain participants, the Lindenwood Participant Pool (LPP) was used. The LPP is a convenience sampling technique; all students, who were enrolled in PSY100, PSY101, SOC102, SOC214, SOC318, AT295, EXS250, or ANT295 during the spring semester of 2012, had an opportunity to sign up voluntarily for the experiment on the LPP bulletin board. Forty-nine students spoke English as their first language, whereas nine students spoke different languages, including Spanish, Turkish, Japanese and Chinese. To avoid misleading the outcome of the result, three people were excluded from the data analysis because they were familiar with Chinese characters or took part in the previous study during the fall semester of 2011 (Shinohara, 2012). As per Institutional Review Board (IRB) regulations, although students who were under 18 years old could not participate in the experiment, they still could earn the extra credits for their class. There were no students who were under 18 years-old in the study.

Materials and Procedure

Reflecting on the result of the previous study, an alternative stimulus was created for this study. The same items from the previous survey were used in the present study. That is, the first five words were positive abstract meanings (happy, beautiful, bright, heaven, and peace), and the last five words were negative meanings (depression, crying, bad, crime, and hate). For the current study, the New Chinese characters task was administered through a Microsoft PowerPoint slideshow with a timer to eliminate the time bias. First, participants saw a word in English on the screen, for example, “Happy.” Two Chinese characters then appeared, such as, “嬉” or “悲,” and the participants were asked to choose one of two Chinese characters which

they felt represented the meaning of the English word presented. The timer was set on each of the PowerPoint slides. After 5 sec, the screen was automatically changed to a blank slide. The participants could see each item only for 5 sec, and they were asked to choose one Chinese character by saying "right" or "left" or point out the character on the screen during or right after the 5 sec exposure time (see Appendix B). The researcher recorded the participants' answers onto a response sheet each time they answered the items.

The demographic survey was constructed from five questions in order to obtain general information about the participants. Questions in the demographic survey included age, gender, and participants' first language. Participants were also asked if they were familiar with Chinese characters or not and if they took the previous study (Shinohara, 2012) during the fall semester of 2011or not (see Appendix C).

To obtain participants, a sign-up sheet was posted on the LPP bulletin board with the experiment description form to inform students what kind of research it was. Participants took part in the experiment individually at Young Hall in room 105 at Lindenwood University where there was a computer. After signing the informed consent form, participants were shown a sample question to understand how to answer each question before they started to take the Chinese characters survey. They were then asked to take the Chinese characters survey on the computer screen and to complete the demographic survey. After completing the computer-based task, they were told about the definition of synesthesia and the purpose of the study, and received a feedback letter including more details about the study. The participant received a receipt in order to get extra course credits through the LPP office.

Results

The scores of the computer based task were analyzed to determine if the synesthesia metaphor existed between vision and semantic processing. A chi-squared analysis was conducted in order to compare between the observed frequency and the expected frequency of correct answers. The observed frequency refers to obtained data from the experiment, and the expected frequency refers to a chance response rate (null hypothesis). In this study, I examined to see if the observed frequency, which was how many answers the participants got correct, was different from the expected frequency of 50 % correct. The result showed that the observed data were significantly above the expected frequency, χ^2_{10}= 61.60, p<.05, (observed frequency, M =6.05, SD = 1.43, d=.73).

A paired *t*-test was also used to see if there were any differences in the number of correct responses between word choices (positive words or negative words). The mean number of correct responses of the positive words was 3.16 (*SD*=1.13), and for negative words, it was 2.89 (*SD*=.98). There was no significant difference between the positive and negative words, $t(54) = 1.299$, p=.199.

Discussion

The hypothesis of the study was that people would be able to tell the correct Chinese characters even though they had never seen those Chinese characters, which would show people had an ability of synesthesia metaphor in vision and semantic processing. The results showed that people were more likely to choose the correct Chinese characters than not. Based on the theory of synesthesia, it could be concluded that there was a synesthesia metaphor between visual perception and semantic processing.

Although the current study resulted in the same conclusion as the previous study (Shinohara 2012), the result of the current study (χ^2_{10}= 61.6, p<.05, d=.73) was stronger than the

result of the original study (χ^2_{10}= 24.6, p<.05, d=.54). It could be explained that the material used for collecting data in the original study violated the theory of synesthesia. Because the paper-based Chinese characters survey was used in the previous study, many participants spent a lot of time answering the questions and tried to analyze each Chinese character and the meaning of the question word. Because synesthesia must be more intuitive using visual sensation and semantic processing, participants should not be analyzing their responses. A computer-based task in the current study eliminated the time bias completely, and it brought a more consistent conclusion. Eliminating the time bias could also explain the reason why there was no difference in the number of correct answers between positive and negative words in the current study, even though there was a significant difference among those two in the previous study. Since participants could go back to their answers anytime during the experiment, they may have compared questions to one another in the previous study. However, participants were not able to go back or forth between questions in the computer-based questionnaires. A computer-based task in the current study ensured that the participants could only view each item for 5 sec, and they could not see their responses once they answered the question.

To reduce more confound variables, the study could be further conducted with young children who do not know the alphabet. Through the experiment, I realized that college students may use alphabetic symbols or recognition when they chose a Chinese character. For example, many American students chose "良" as "bad" because they saw "x" in the Chinese character, and "x" symbolizes "bad" for English speakers. Thus, future studies can test children who do not have any preconceived knowledge of symbols for this study in the future. The future methodology of the study would be a little bit different from the current study because those young children will be not able to read English words. A computer-based task will be used again

to show Chinese characters. However, instead of seeing the English words on the screen, drawing task in which the children draw a picture of the abstract word after the experimenter tells the children the word will be added before the Chinese characters task. That is, the experimenter will know if the children really understand the meaning of the word or not.

Most of the publications of synesthesia are only focused on people who have a rare synesthesic condition consistently, such as the study of people who always see colors when they hear the sound. However, this study, synesthesia metaphor in vision and semantics, showed that there are many synesthesic conditions around us, and we all perceive and experience one stimulus by using multiple cognitive abilities.

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Appendix A

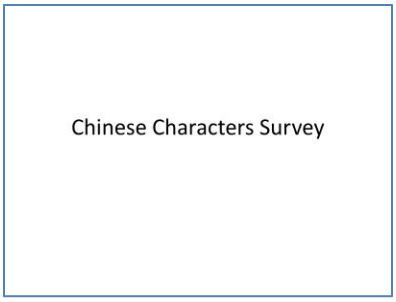
The Chinese Characters Survey Used in the Previous Study

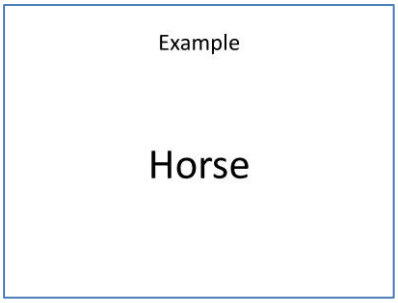
1	Happy	嬉	悲
	Why did you choose the character above?		
2	Beautiful	醜	美
	Why did you choose the character above?		
3	Bright	光	闇
	Why did you choose the character above?		
4	Heaven	獄	天
	Why did you choose the character above?		
5	Peace	和	争
	Why did you choose the character above?		

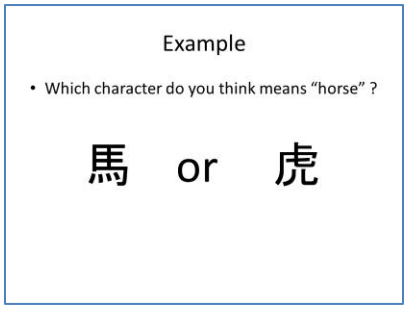
6	Depression	鬱	陽
	Why did you choose the character above?		
7	Crying	泣	笑
	Why did you choose the character above?		
8	Bad	悪	良
	Why did you choose the character above?		
9	Crime	善	罪
	Why did you choose the character above?		
10	Hate	愛	嫌
	Why did you choose the character above?		

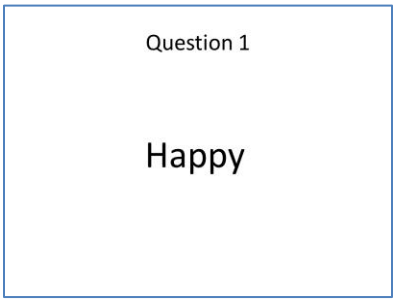
Appendix B

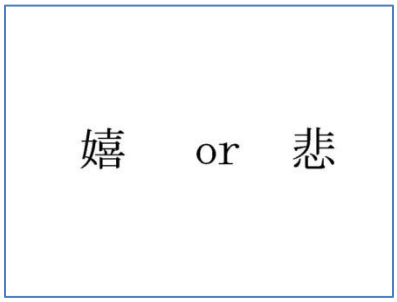
New Computer based Chinese characters questionnaires (PowerPoint Slides)

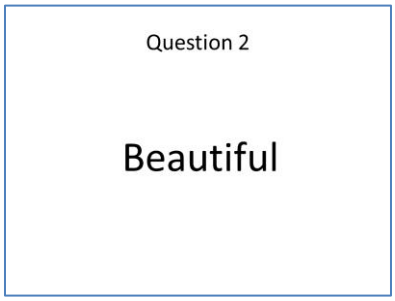


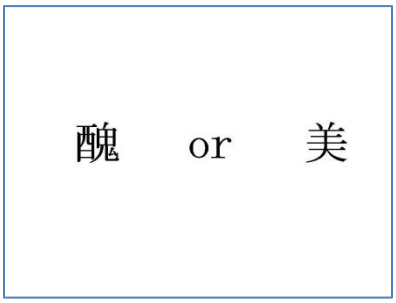


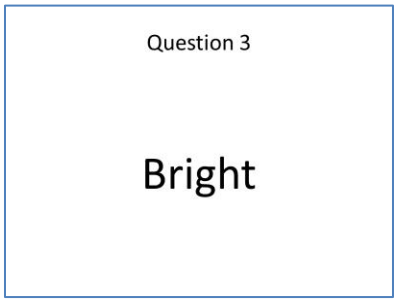


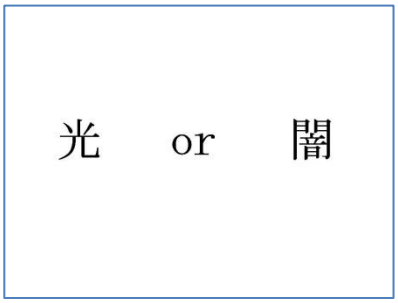


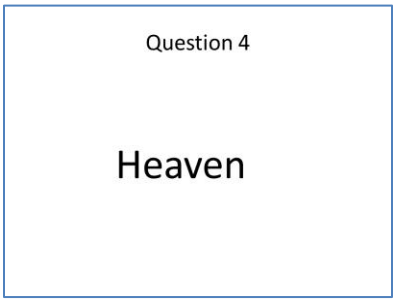


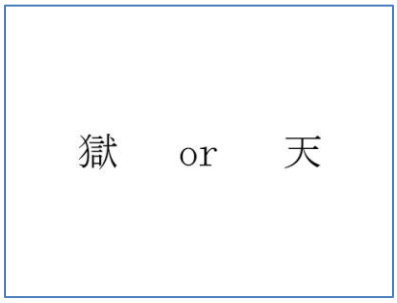


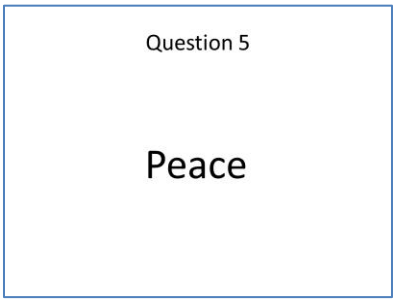


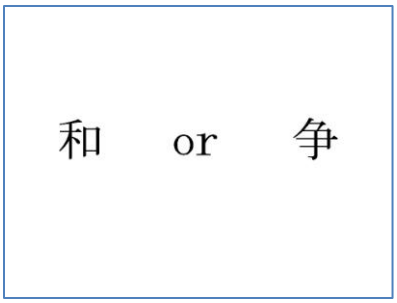


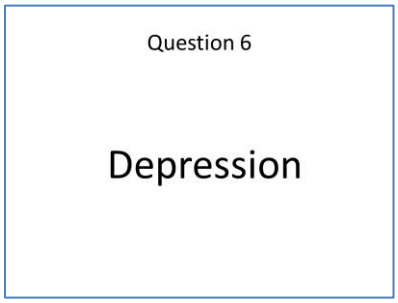


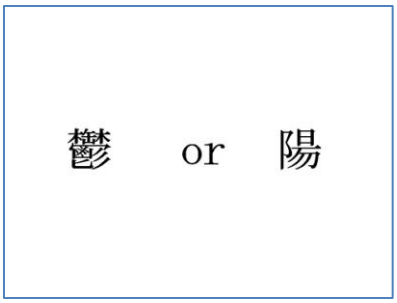












Question 7

Cry

泣 or 笑

Question 8

Bad

悪 or 良

Question 9

Crime

善 or 罪

Question 10

Hate

愛 or 嫌

Appendix C

Demographic Survey

6) Are you MALE FEMALE?

7) How old are you? ( )

8) What is your first language? ( )

9) Have you learned any Chinese characters at some point in your life?

YES NO

10) Did you participate in a similar study with Chinese characters survey during the previous semester?

YES NO