The Effect of the Combination of Familiarity and Novelty on Preference

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Abstract

This study investigates whether the combination of novelty and familiarity in a stimulus increases the preference of the stimulus. Specifically, we compare people's preference ratings and BOLD signal changes at specific brain regions when they perceive a mix of familiar stimulus and novel stimulus with those when they perceive only familiar stimulus or novel stimulus. In the study, undergraduates (*N=200*) will be randomly assigned into 2 mixed groups, 1 novel group, 1 familiar group, and 1 control group. The experiment will be conducted in two different phases. In the first phase, each group will perceive a set of polygons. In the second phase, with the exception of the familiar group, who will see the same set of polygons, each group will perceive a different set of stimuli while undergoing fMRI scanning and rating another set of polygons. For the mixed group, the polygons in the second phase are similar but not the same as the polygons in the first phase. We anticipate the mixed group will have significantly higher rating and signal changes at anterior cingulate and left parietal than other groups ($p < .05$). The result will suggest the combination of novelty and familiarity increases the preference. This study can lead to further investigations of our understanding in aesthetic perceptions.

Keywords: novelty, familiarity, combination, preference

The Effect of Combination of the Familiarity and Novelty on Preference

Beauty has been a significant concept in our history and the subject of many modern science literature. However, we have yet to fully discover the neuroscientific and cognitive base of how the perception of beauty works and why it exists. Scientifically, we can study the concept of beauty by measuring perceivers' responses based on their preferences. In this experiment, we are going to investigate whether the combination of familiarity and novelty in a stimulus can affect people's preference for it. By definition, familiarity indicates a condition that exists if and only if after people have been exposed to a stimulus for multiple times. Novelty, on the contrary, indicates a condition when people are exposed to a stimulus that has never been exposed to them before.

Evidence has been found to suggest that mere repeated exposures can lead to an increase in perceivers' preferences and attitudes toward the stimuli (Maslow, 1937; Zajonc, 1968). Maslow discovered that participants preferred the tools they had repeatedly used in the past even when there were more convenient new tools available and preferred the paintings they had seen before. Zajonc found that people would rate the nonsense words or characters higher after they saw them multiple times. On the other hand, some researches about novelty preference showed that the perceivers would prefer novel stimuli more than familiar stimuli (Berlyne, 1970). Berlyne's study showed people preferred novel painting, and the people' preferences reduced as they had been exposed to the same painting multiple times. The study also showed the subjective complexity - which is the level of complexity of paintings rated by participants - of visual stimuli was a factor of preference. The participants performed highest preference of the simple novel and complex familiar paintings while performed relatively lower preference of the simple familiar and complex novel paintings. To solve such contradictions, researchers started separate stimuli

into more detailed categories (Park et al., 2010). This suggestion was accepted in research by Liao, Yeh, and Shimojo in 2011(Liao, Yeh, Shimojo, 2011). In the research, that familiarity preference was observed on human face visual stimuli but not on natural scene visual stimuli (Liao et al., 2011). Moreover, the way that researchers measure participants' preferences can also affect the result of the experiments (Liao et al., 2011). In 2004, Kawabata and Zeki conducted a study that demonstrated neural correlates of beauty. They found out that people would obtain higher signal changes in a few brain areas when they see the paintings categorized as beautiful by themselves, even for the abstract paintings (Kawabata & Zeki, 2004).

Based on the information above, we know that the exposure frequency of stimuli, complexity of stimuli, and category of stimuli are all factors of preference. Although many studies have been conducted to assess the perception process with familiarity and perception process with novelty preference, few studies look at the perception process including both familiarity and novelty. The microcosmic of the process and the interaction between familiarity and novelty should be studied. A between subject posttest only experiment will be conducted, this experiment would like to separate the process of perception into small pieces including percept familiar elements and percept novel elements by building visual stimuli via smaller visual stimuli. This can lead us to understand the microcosmic perception process more.

The purpose of this experiment is to explore whether the combination of novelty and familiarity increases the preference on stimulus. In other words, we want to find out the complexity of cognitive process level's effect on preference. Our conceptual independent variable will be the level of combination of novelty and familiarity and conceptual dependent variable will be the preference of the stimulus. The level of combination of novelty and familiarity will be operationalized into five conditions of stimulus: pure novel condition, novel-

familiar condition, familiar-novel condition, pure familiar condition, and control condition. We assume that the process of perceiving novel-familiar condition and familiar-novel condition stimulus will be more complex than the process of perceiving pure novel condition and pure familiar condition stimulus. The preference of the stimulus will be operationalized by self-reporting on preference rating of the stimulus and fMRI scanning. We hypothesize the participants under the novel-familiar and familiar-novel condition have higher preference rating and exhibit more activities in anterior cingulate and left parietal cortex (Kawabata & Zeki, 2004) than those under pure familiar and pure novel condition. The pure familiar and pure novel will have higher preference than those under the control condition, since these former two conditions provide more complex cognitive experience to the participants.

Method

Participants

Totally 200 participants will be needed for the experiment, and 100 of them are female and 100 of them are male. The participants will be recruited from undergraduate students of non-psychology departments of University of Wisconsin, Madison, aged between 18 to 23. Each participant will get 5 dollars after the experiment as compensation.

Apparatus

Five 2T Magnetom Vision fMRI scanners with a head-volume coil will be used to record the brain images. 30 black and white slides will be used as stimulus, and each one contains a random polygon with random shape and less than 10 black edges (see figure 2 for example). Ten slides of the 20 slides have 20 different specific shapes, and each of the 10 slides has one corresponding slide with similar shape but with a new small polygon connected to form a new

polygon. There are 10 other slides with different shapes. The shapes in the slides are not symmetric and don't look like any object in the real world.

Procedure

Before the experiment starts, the experimenters will ask the participants to carefully read and sign a consent form. The form informs the participants that the experiment is about the effects of geometrical shapes on emotion (see Appendix A). The form also notifies participants that they will be in an fMRI machine and advises participants with claustrophobia to proceed with cautions. Then the participants will be randomly assigned into five groups by computer program, which are, pure novel group, pure familiar group, familiar-novel group, novel-familiar group, and control group. There are two phases of the experiment, familiarizing phase and the rating phase (see figure 1). The participants will complete the two phases in the fMRI machine with a small screen in front of their eyes and a touch pad near their dominant hands to operate the pointer on the screen. Instructions that the participants hear in the scanner are recorded previously, so all participants will hear the same instructions. In the familiarizing phase, the participants in the pure novel group will watch the 10 slides with shapes without corresponding similar shapes in the rating phase. The familiar, familiar-novel, and novel-familiar groups will watch through 10 slides of specific shapes (see figure 2 for instance), where each slide plays 10 seconds, with a 5-seconds gap between each slide. The participants in the control group will do nothing during the familiarizing phase.

In the rating phase, all groups except for the familiar-novel group and novel-familiar group will watch the 10 slides with specific shapes on the screen in the fMRI scanner, no brain images will be obtained in this phase. Each slide will be presented for 5 seconds and then a 5-seconds gap for participants to rate their preference of the slide between 0 to 5, where 0 indicates

least favorite and 5 indicates most favorite. The familiar-novel group will watch 10 slides with similar shape of the previous slides but with a small new polygon connected to it (see figure 2 for example) and rate their preference of each stimuli with the same scale as other groups. The novel-familiar group will watch 10 slides of rotated specific shapes and rate their preference of each stimuli with the same scale as other groups (see figure 2 for example). Every time a participant sees a slide, a scanning of brain is done with a gradient echo planar-imaging (EPI) sequence, which is selected to maximize the blood oxygen level-dependent (BOLD) (Kawabata, H., & Zeki, S., 2004). In the end of the experiment, the participants will be debriefed by debriefing form (see Appendix B).

Data analysis

The independent variable, the combination of familiarity and novelty of the corresponding stimulus will be manipulated by the slides presented in the rating phase in constructing novel group, familiar group, familiar-novel group, novel-familiar group, and control group. The dependent variable, preference rating of the stimulus and the images of the brain, will be measured by self-reports on preference of each stimulus. Another dependent variable, the active level at anterior cingulate and left parietal cortex, will be measured by the average BOLD signal changes. A t-test will be conducted to calculate the relationship between the combination of familiarity and novelty of a stimulus and the preference rating of it. Another t-test will be conducted to determine the relationship between the combination of familiarity and novelty of a stimulus and participants' active level at anterior cingulate and left parietal cortex.

Results

T-tests will be conducted to assess the relationship between the independent variable and the dependent variable. We anticipate the novel-familiar group will have a higher preference

rating and signal change at cingulate and left parietal cortex compared to the novel group, The results of the t-test will be considered statistically significant with a p value of less than 0.05. Similarly, we expect the novel-familiar group to have a significantly higher rating of preference and brain active level than the familiar group with p values of less than 0.05. The result of the familiar-novel group should show a similar pattern, with a higher preference rating and signal change at cingulate and left parietal cortex compared to the novel and familiar group. Moreover, we expect to see familiar group with a significantly higher mean value of rating of preference and brain active level at anterior cingulate and left parietal cortex from the control group, the results of the t-tests will have p values of less than 0.05, while novel group might not have significant different on the value of the independent variables from the control group. The anticipated result of preference rating is shown in figure 3, the anticipated result of signal change of anterior cingulate is shown in figure 4, and the anticipated result of signal change of left parietal cortex is in figure 5.

Discussion

Based on the studies about novelty preference and familiarity preference in the past, we assume that higher complexity of people's cognitive process for perceiving a stimulus causes higher preference on the stimulus perceived. Our result supported our hypothesis. Thus, we claim that the stimulus with the combination of novelty and familiarity or a higher complexity of cognitive process increases people's preference for it. Moreover, the significant familiar preference has been found, this result is consistent with the past experiences. The data of two dependent variables are consistent with each other, indicating that our measurement is reliable.

In comparison to the experiment in the past, we consider the integration of novel preference and familiar preference. This can lead us to a new topic of cognitive science. The experiment design can be improved, and more study should be done on this topic.

Our study was designed with good internal validity. We prevent possible affections from researchers by setting the participants in the fMRI scanner for most of the time during the experiment. We will use recorded instructions to prevent demand characteristics. To avoid observer bias, the interaction between researchers and participants will be minimized, and the measurement of dependent variables involves only computers and participants. There are no explicit systematic varies and design confound can affect our result. We use random assignment to prevent selection effects. We have good construct validity because the measurement we used for dependent variables have been used by experiments in the past and have shown consistent results. The way we are manipulating the independent variable is still improvable since the experiments in the past have shown the novel preference and familiar preference have different effects on different categories of stimulus and we only use one category of visual stimulus (Liao et al., 2011). Our external validity is relatively low since the participants of the experiment are all selected in the same location with many similar characters.

The future studies should involve more participants with diversity in characters and more categories of visual stimulus, or even other types of stimulus. Also, more methods of measurement can be applied to obtain more details about the process of stimulus perceiving.

References

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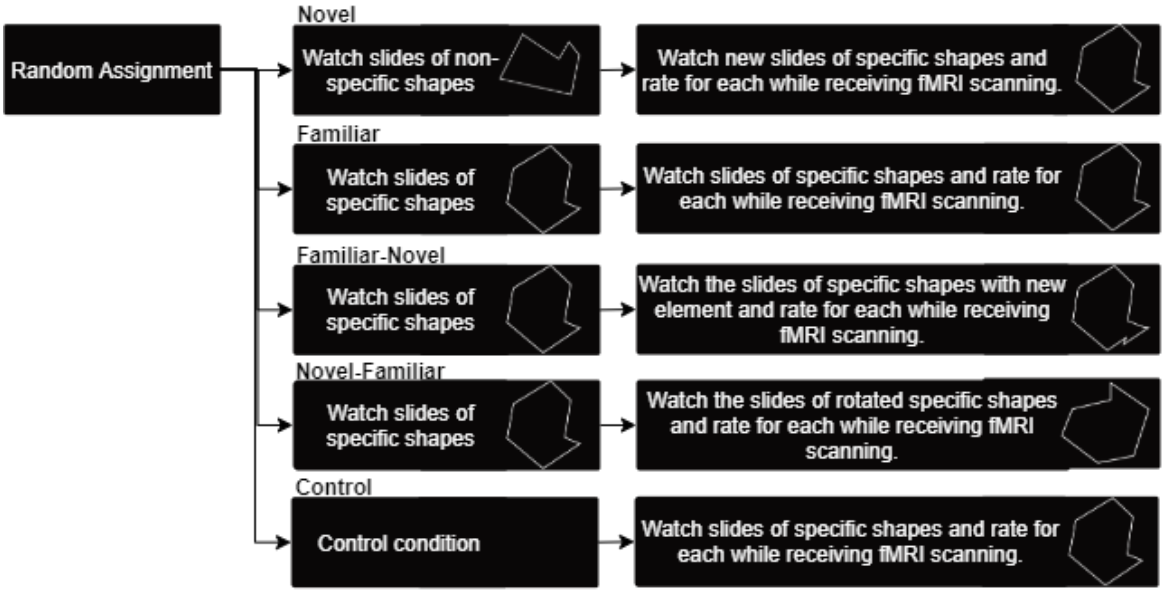

Figure 1. The experiment procedure.

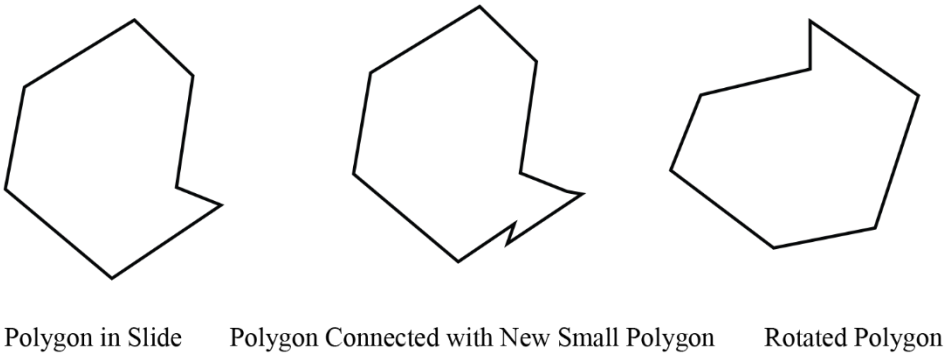

Figure 2. Example of polygon in the slides.

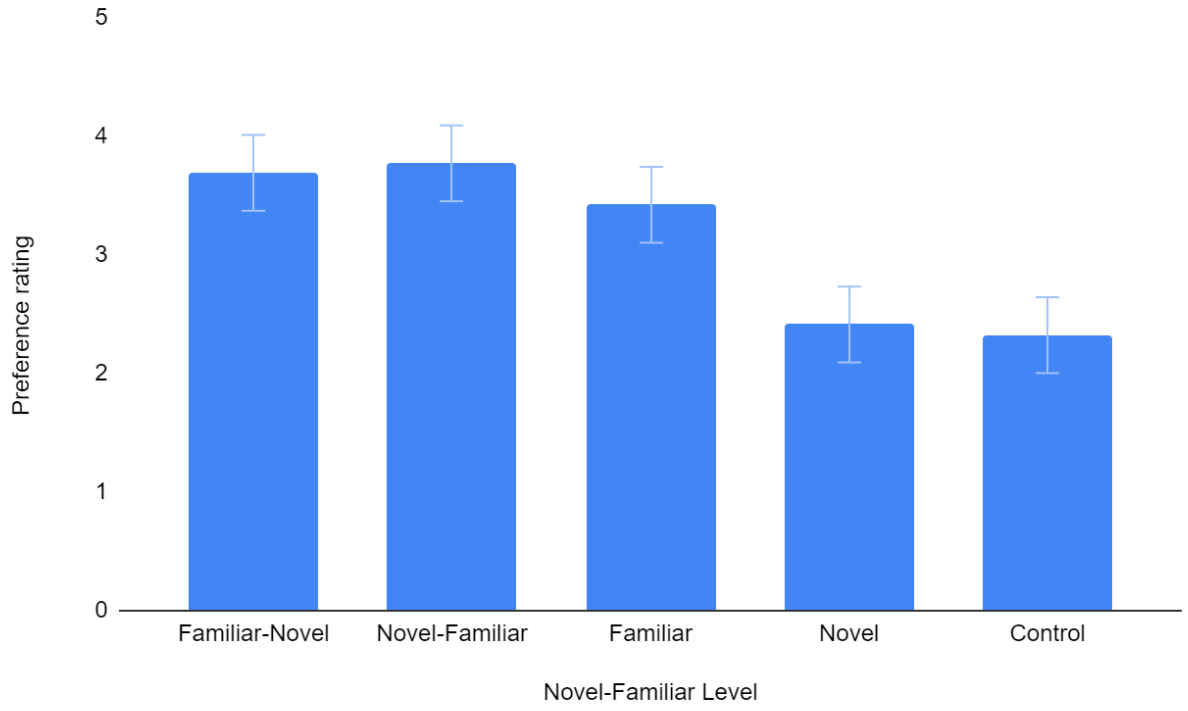

Figure 3. The anticipated result of preference rating.

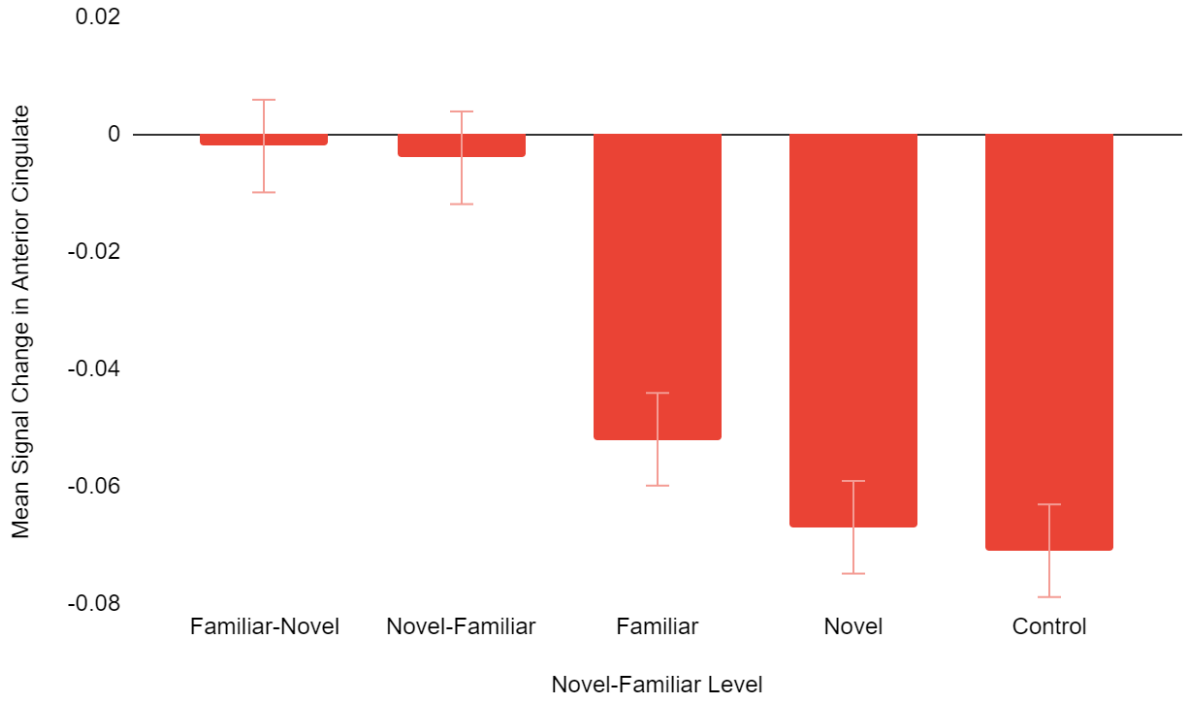

Figure 4. The anticipated result of signal change at cingulate.

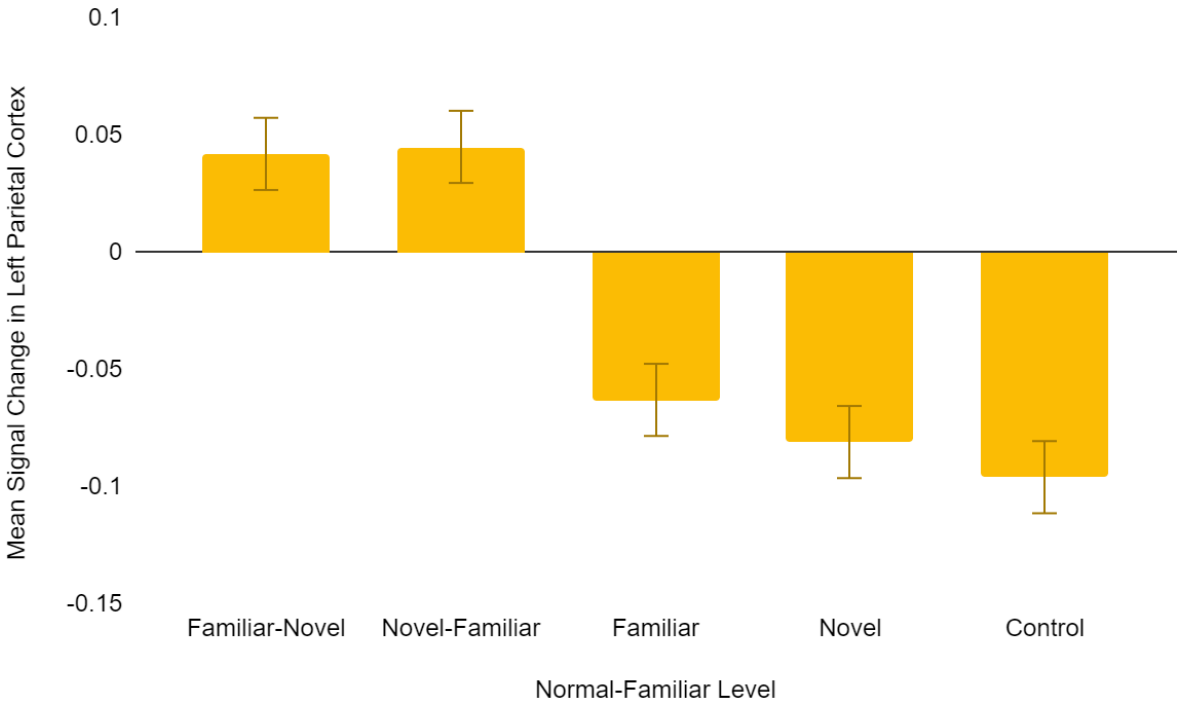

Figure 5. The anticipated result of signal change at left parietal.

Appendix A

Consent Form

This research project explores how human emotion is affected by geometric shapes. In this experiment you will watch a series of polygons on a screen in the fMRI machine and rate another series of polygons later. Participation is expected to take approximately 10 minutes.

All of your responses will be completely confidential. In all probability research papers will be written about the results of the study, but they will not contain any identifying material. While there are no individual benefits, your participation in this experiment will help us better understand the functional effects of divided attention. Risks in this procedure are considered very minimal. Notice that if you have experienced claustrophobia before, please be careful to proceed and let the researchers know.

Your experimenter will be pleased to answer any questions you have now, or you may contact the principal investigator of this project, Dr. Allyson Bennett, by email (Allyson.j.benneg@wisc.edu).

Your participation is completely voluntary. You may stop at any time prior to the completion of the project without any penalty.

I have read and understood the above statement. I am at least 18 years of age and give my consent to participate in this study.

_____

Signature

_____

Printed name

_____

Date

Appendix B

Debriefing Form

Thank you for your participation in our study! Your participation is greatly appreciated.

Purpose of the Study:

We previously informed you that the purpose of the study was to explores how human emotion is affected by geometric shapes. The goal of the research is to find the affection of novel-familiar level on preference of visual stimulus.

Please do not disclose research procedures and/or hypotheses to anyone who might participate in this study in the future as this could affect the results of the study.

Confidentiality:

You may decide that you do not want your data used in this research. If you would like your data removed from the study and permanently deleted, please contact the principal investigator: Dr. Allyson Bennett (Allyson.j.bennett@wisc.edu).

Final Report:

If you would like to receive a copy of the final report of this study (or a summary of the findings) when it is completed, please feel free to contact us.

Useful Contact Information:

If you have any questions or concerns regarding this study, its purpose or procedures, or if you have a research-related problem, please feel free to contact the principal investigator, Dr. Allyson Bennett, by email (Allyson.j.bennett@wisc.edu).

If you feel upset after having completed the study or find that some questions or aspects of the study triggered distress, talking with a qualified clinician may help. If you feel you would like

assistance please contact University Health Services: Mental Health and Counseling, 608-265-5600, or visit http://www.uhs.wisc.edu/services/counseling/. In the case of an emergency please call 911.