Aesthetic Preference in the Composition Ratios of Graphic Designs

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Abstract. For the golden ratio, there has been extensive development in design, aesthetics and fields. What is regarded as the "perfect ratio" is indeed found in many experiments and is not the most preferred ratio. But if you look at it from another point of view, perhaps this is the ratio that people are most accustomed to, because there are many relationships of the golden ratio hidden in nature, so the golden ratio still has its value in use. Therefore, it is assumed that the golden ratio is the favorite ratio of human beings, and by manipulating specific ratios in different presentation methods, the influence of the golden ratio on human preferences is discussed. The experimental design was divided into a two-factor within-subject design of 3 (ratio, 1.25, 1.618, and 2) × 3 (presentation, thumbnails of web pages, figures and backgrounds, and thumbnails of internal scales). It is divided into two stages. In the first stage, the aesthetic preference score of a single image is used as the dependent variable, and the second stage is based on the relative aesthetic preference score as the dependent variable. Experimental results in both stages, the effect of presentation method has a significant impact. While the effect of proportionality had no significant effect in the first stage, it had near-significant results in the second stage. This can indicate that evaluating an image does not seem to have much effect on manipulating proportions. However, if you compare images of different scales at a time, it seems to be better at distinguishing the difference in the degree of preference for different scales. Compared with previous studies, almost all experiments are designed in a similar way to the first stage, so such results have room for discussion. However, the data of this experiment are too small, so the presumption of the results cannot be reliable and valid.

Keywords: Display design · Aesthetic preference · Golden ratio · Composition · Graphic design

1 Introduction

The evolution of aesthetic concepts has been continuously updated with the needs and preferences of the times, and several of the aesthetic concepts that have continued from ancient times to the present seem to have become the "standards" of aesthetics. The principle of composition is an important aesthetic presentation technique. The application of compositional principles in aesthetics has long been quite common, and its application level has extended to many different fields. The most common technique is

to present the main object to be emphasized at a specific position in the picture, and the specific position is based on the composition principle so that the distance and proportion between the main object and the border of the picture can have a more suitable relative relationship.

One of the most famous ratios in the composition principle is the Golden Section, or the Golden Ratio. The golden ratio was originally a proportional relationship from the Fibonacci sequence to the limit value, about 1.618. Then it was discovered that the golden ratio has many beautiful properties in mathematical principles, such as the golden rectangle, infinite series and so on. (Falbo 2005). Then such a ratio was used in the design of artistic aesthetics, and was euphemistically called "the most perfect ratio", thus opening the meaning of the golden ratio being widely used in various fields. Its principles can be seen not only in the aesthetic creation of painting, photography, architecture, etc., but also affect the aesthetics of many fields, such as: medicine, media image design and so on. Even in nature, many relationships that conform to the golden ratio can be found, such as the growth angle of plant stems and leaves, the division relationship of animal cells, or the growth base of spotted animals, etc.

In early psychological experiments, it was confirmed that the compositional ratio of the golden ratio is aesthetically preferred (Benjafield and Adams 1976). But such a result does not prove that the preference for composition is directly influenced by the composition principle of the golden ratio. (Boselie 1997). And when people judge the ratio, there is no special acuity to feel the golden ratio. It seems that the range close to this ratio can be evaluated by similar preferences (Tang Dalun 2004). The Implicit Association Test (IAT) was also used to explore the implicit liking of real works of art, and the results were also insignificant (Stieger and Swami 2015).

Although many studies have pointed out that the golden ratio may not be an absolutely perfect composition principle, but will vary according to individual differences. However, it still has a great influence on the proportion of use in various fields. I divide the possible reasons for this into two. First, it may be the influence of the "glorification of the golden ratio". Because such a ratio has existed in both aesthetics and various fields from ancient times to the present, and it has even been dubbed the "perfect ratio like gold". Because of the reputation of the golden ratio, we naturally associate the concept of the golden ratio with the perfect ratio. Another point of view, perhaps the golden ratio feels more like it, is because of the relationship we are more familiar with such a ratio. In nature, we often come into contact with structures or forms composed of the golden ratio, such as the human body, the proportions of teeth, the golden thread and so on. Therefore, our preference for the golden ratio may come from the fact that we are familiar with such ratios. For these two possible reasons, we believe that the golden ratio is still favored in most cases.

1.1 Purpose

Whether the influence of the golden ratio can really produce a preference for aesthetic feeling is the topic that this research wants to explore. Therefore, different design techniques are used to discuss the presentation of the ratio. This study wondered if the golden ratio could be subject to higher subjective aesthetic preference scores when the golden ratio was used as a benchmark for design ratios. And we use modern elements as the

medium we want to present, which is more in line with the concepts and methods of modern design. For example, the presentation of web design, the design of app thumbnails, and the design of simple icons, etc., let the subjects rate the aesthetic preference of different presentation methods of specific proportions. We also expect designs based on the golden ratio to have higher aesthetic preference scores.

Therefore, this study aims to clarify the relationship between aesthetic preference and composition ratio, especially the golden ratio. It is assumed that the composition ratio of the golden ratio is aesthetically preferred, in advance, through the display of different graphic designs in the 3 composition ratios, it is possible to explore the influence of these ratios on people's preferences.

2   Method

The experimental design is divided into a two-factor within-subject design. It mixed 3 kinds of composition ratios (1.25, 1.618, and 2) with the 3 graphic designs (webpage layout, logo or symbol design using explicit ratios, and logo or symbol design using implicit ratios). There are 5 type graphic design in each condition, totally 45 stimulus materials in this study. It is divided into two stages. It is divided into two stages. The first stage uses the aesthetic preference score of a single picture as the dependent variable, and the second stage uses the relative aesthetic preference score as the dependent variable.

2.1   Participant

A total of 61 subjects (35 males, 26 females) were enrolled in this study, all of whom were students at National Chung Cheng University. Subjects participated in this experiment voluntarily and without any additional fee. Before the experiment, the proportion-related content of this experiment was not mentioned, and the informal research name "the differences in subjective aesthetic feelings of different people to different pictures" was used as the recruitment and explanation before the experiment.

2.2   Material

This experiment was a two-factor within-subject design of 3 (scale, 1.25, 1.618, and 2) × 3 (presentation, thumbnails of web pages, figures and backgrounds, and thumbnails of internal scales). It is divided into two stages. In the first stage, the aesthetic preference score of a single image is used as the dependent variable, and the second stage is based on the relative aesthetic preference score as the dependent variable.

2.3   Research Design

The experimental design is divided into a two-factor within-subject design. It mixed 3 kinds of composition ratios (1.25, 1.618, and 2) with the 3 graphic designs (webpage layout, logo or symbol design using explicit ratios, and logo or symbol design using implicit ratios). There are 5 type graphic design in each condition, totally 45 stimulus materials in this study. It is divided into two stages. It is divided into two stages. The first stage uses the aesthetic preference score of a single picture as the dependent variable, and the second stage uses the relative aesthetic preference score as the dependent variable.

2.4 Stimulus

The design concept of each stimulus: 1. thumbnails of web pages: the ratio between the reading blocks of the web page, or the ratio between the reading blocks and the blank area; 2. figures and backgrounds: the ratio with the background pattern; 3. thumbnails of internal scales: adjust the presentation of the ratio with different design concepts, such as angle ratio, area ratio, length ratio. As can see Fig. 1.
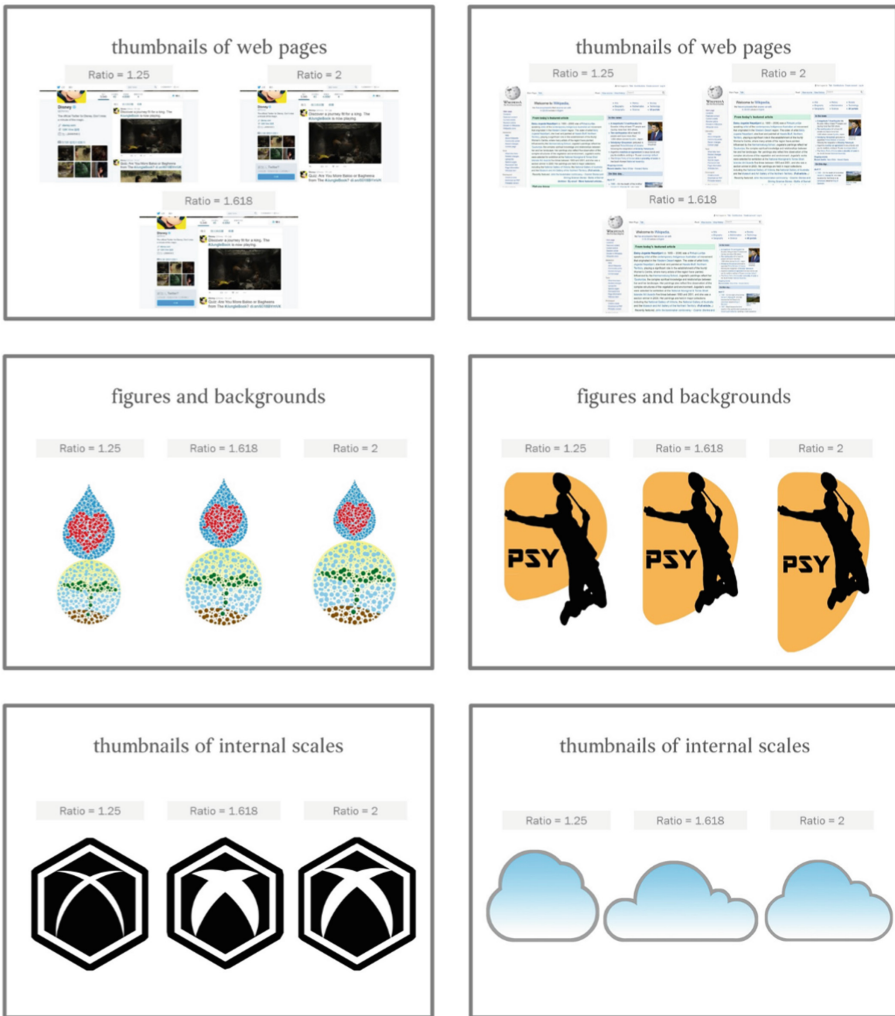

Fig. 1. The stimulus examples by 3 × 3 research design

2.5 Procedure

In these two stages, a "+" symbol is displayed in the center of the screen (presentation time is 400 ms), which is the gaze point of the eyes. Next, in the first stage (Fig. 2), a picture had displayed in the center of the screen, and the participants were asked to drag the bar in response to their aesthetic preference score.

In the second stage (Fig. 3), two pictures randomly selected from 3 composition ratios are displayed on both sides of the screen, and participants are asked to drag the bar according to their relative relationship with aesthetics preference section. ISI = 500 ms. The scoring method is to move the mouse to control the cursor of the number line from 0
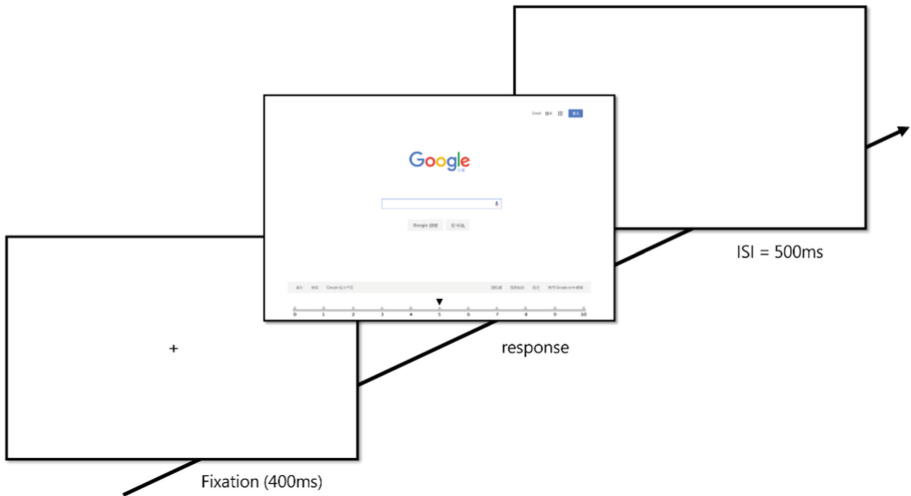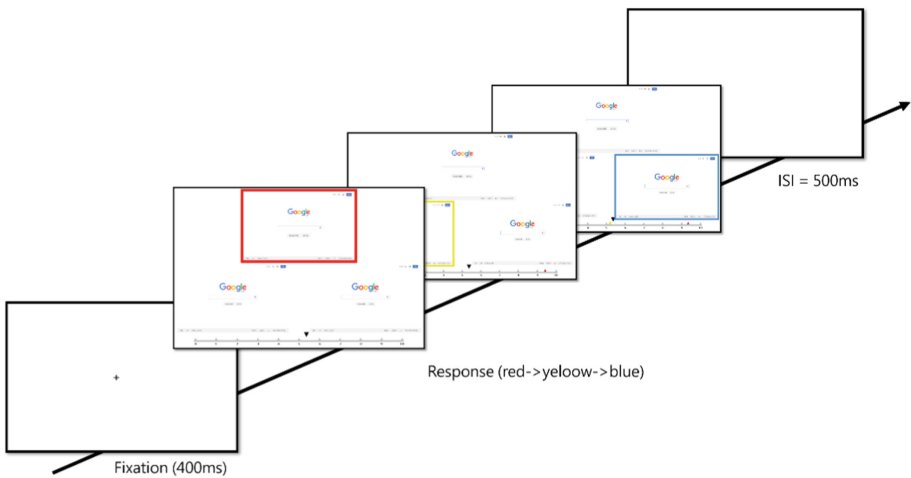
Fig. 2. The procedure of the first stage

Fig. 3. The procedure of the first stage

to 10, and click the left button of the mouse to score the corresponding score. The order of trials was randomly arranged, and there were 12 practice questions before answering the two-stage experiment.

3 Result

After analyzing the obtained results, it was found that the effect of the first stage for each proportion was not significant ($p = 0.970$), but there was a significant difference in aesthetic preference for different presentation methods ($p = 0.002$). The interaction of the two independent variables was also not significant ($p = 0.989$). Such results seem to fall short of the expected assumptions, and the difference in proportions does not seem to have much of an effect when scoring a single image for subjective aesthetic preference. However, there are significant differences in the preferences of presentation methods, which means that different types of presentation methods seem to have higher or lower results due to their preferences for the pictures themselves. However, in the second stage, the effect for each scale was close to a significant effect ($p = 0.063$), and there was still a significant difference in preference ($p = 0.045$) across scale presentations. The interaction effect was also not significant ($p = 0.587$). Different from the first stage, the second stage is a relative aesthetic preference score, so when it can be directly compared with pictures of different scales, the results of the scale can be more obvious. Although the effect of the proportional variable is not significant, if the number of subjects increases and the amount of data is more complete, it may be able to achieve a significant effect. The assumption of homogeneity of variance in both stages was not significant ($p = 0.535$ and $p = 0.938$).
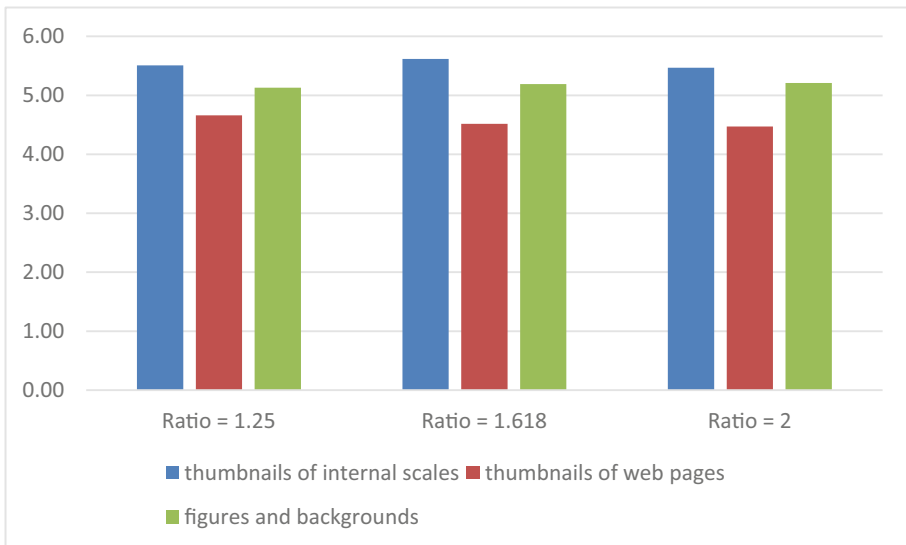

Fig. 4. The influence of proportion and presentation method on preference evaluation in the first stage

The descriptive statistics of each variable, stage 1 and stage 2, are attached to Tables 1 and 2 respectively (Fig. 4).

Table 1. Narrative statistics of the first stage

Ratio	Layout Design	M	SD	N of items
1.25	Thumbnails of web pages	4.65	0.941	5
	Figures and backgrounds	5.55	0.644	5
	Thumbnails of internal scales	5.08	0.508	5
	SUM	5.09	0.767	15
1.618	Thumbnails of web pages	4.51	0.933	5
	Figures and backgrounds	5.56	0.627	5
	Thumbnails of internal scales	5.24	0.391	5
	SUM	5.10	0.781	15
2	Thumbnails of web pages	4.47	0.826	5
	Figures and backgrounds	5.49	0.597	5
	Thumbnails of internal scales	5.18	0.593	5
	SUM	5.04	0.769	15
SUM	Thumbnails of web pages	4.54	0.838	15
	Figures and backgrounds	5.53	0.578	15
	Thumbnails of internal scales	5.16	0.472	15
	SUM	5.08	0.755	45

This result makes us wonder if the golden ratio is the most popular ratio if the manipulation of the ratio is very close to a significant effect in the second stage? We can see from Fig. 1 that the preference for the golden ratio is actually the lowest among the three different presentations. This is the opposite of what we originally expected. The same results can be obtained from descriptive statistics (means of proportions 1.25, 1.618 and 2 are: 5.144, 4.857, 5.203, respectively) (Fig. 5).

4   Discussion

From the results, it seems that the experimental design of the first stage, the same as that of many previous studies, is to score the aesthetic preference for pictures of different scales. And the result seems to be the same as ours, there is no particular aesthetic preference for the golden ratio. However, from the results of the second stage of the experiment, it seems that the experimental method of the first stage has a more relationship with the individual differences in the preference of the experimental method, that is, the manipulation of different presentation methods. Therefore, the results of many previous experiments on the aesthetic feeling of the golden ratio may still have a lot of room for discussion.
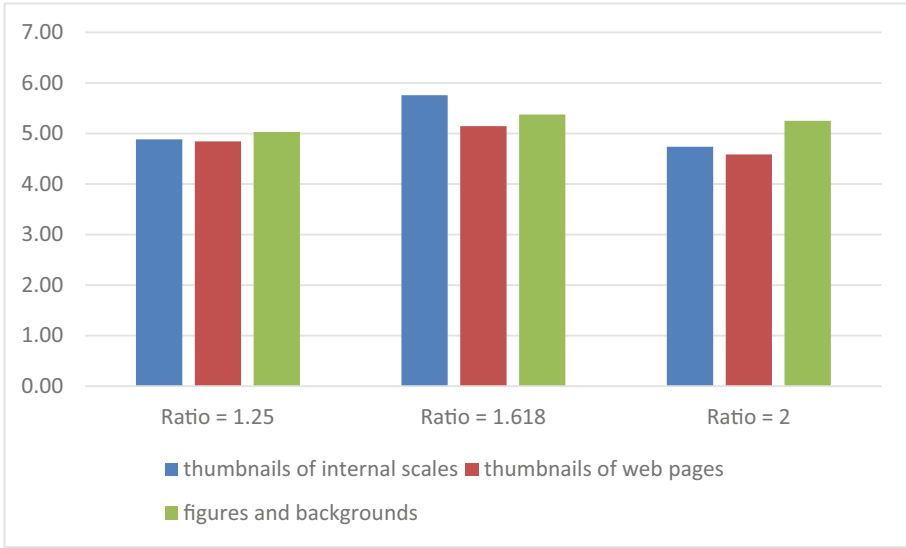
Fig. 5. The influence of proportion and presentation method on preference evaluation in the second stage

Table 2. Narrative statistics of the second stage

Ratio	Layout Design	M	SD	N of items
1.25	Thumbnails of web pages	5.03	0.541	5
	Figures and backgrounds	4.88	0.744	5
	Thumbnails of internal scales	4.84	0.268	5
	SUM	4.92	0.737	15
1.618	Thumbnails of web pages	5.37	0.833	5
	Figures and backgrounds	5.76	0.627	5
	Thumbnails of internal scales	5.15	0.441	5
	SUM	5.43	0.731	15
2	Thumbnails of web pages	5.58	0.846	5
	Figures and backgrounds	5.74	0.567	5
	Thumbnails of internal scales	4.74	0.523	5
	SUM	4.86	0.759	15
SUM	Thumbnails of web pages	4.54	0.838	15
	Figures and backgrounds	5.53	0.568	15
	Thumbnails of internal scales	5.16	0.422	15
	SUM	5.07	0.755	45

In the second stage, the comparison of images with different ratios makes the effect of ratios close to significant. However, the results obtained were the opposite of our expectations, with the lowest score on the golden ratio preference score. There are two possible reasons: First, the experiment stimulates the manipulation of materials in the golden ratio. There is no exquisite design of modern professional designers, so they are not liked. Second, there may be too little experimental data, because individual differences appear that specific data will affect the overall average. However, if the experiment can be made more certain in the future, this is still the result. That can also be explained, either when judging images at different scales individually, or when comparing designs at other scales simultaneously. There is no proof that the golden ratio is people's favorite ratio. Perhaps as long as the ratio is close to the golden ratio, it can still make people have more preferences for beauty. These can be discussed in future research.

In addition, this experiment is controlling the internal validity (internal validity), because the number of data is too small, so the result analysis is easily affected by a small number of extreme quality. And the interview after the experiment also asked about the data of the subjects who responded in line with the experiment. However, since the amount of data is too small, it is still processed with reservations. And in the experimental stage, it is easily affected by the expected effect of the subjects, and the scores made are not really what they like. This would make the results less inferentially valid. In the control of external validity (external validity), because the subjects are all students of the Department of Psychology of Chung Cheng University, there may be biases due to a non-representative sample. In terms of construct validity, perhaps the stimuli pictures we designed cannot represent the golden ratio method used in modern design. Therefore, the experimental manipulation may be very successful, and it cannot be analogized to modern design concepts. These are all areas that need to be noted and improved when conducting this experiment in the future.

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