

Study of the Influence of the Two Typical Lines of the Müller-Lyer Illusion

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Abstract

A lot of psychologists have been studied at the Müller-Lyer illusion including which visual illusion it belongs to, what kind of neural mechanism involves in it, how to apply it to the real life and so on. However, the influence of each type of tails in terms of the Müller-Lyer illusion is still unknown. By comparing the mean PSE of each experiment sessions, the tails which is the head of arrow has more impact on participants' perception of length.

Keywords

The Müller-Lyer Illusion; Point of Subjective Equality; JND; Psychometric Function.

1. Introduction

In the Müller-Lyer illusion, the vertical line with the tails which is the head of arrow ($><$) appears to be longer than the vertical line with the tails which is the end of arrow ($<>$) [1]. This type of visual illusion not only influence people's perception of architectures but also plays a role on the perception of the interpersonal distance [2]. For example, the interpersonal distance between two people standing face-to-face is perceived farther than it between two people standing back-to-back, although the physical distance is the same between them. Some of psychologists interpreted the neural mechanism underlying the Müller-Lyer illusion and some of others verified the application of the Müller-Lyer illusion in daily lives. However, the influence of each type of tails in terms of the Müller-Lyer illusion still need to be clarified. In this work, which type of tails has more influence on the Müller-Lyer illusion was clarified by comparing the mean PSE of each experiment sessions.

2. The Experiment

2.1 Method

2.1.1 Participants

A total of 37 undergraduate students from Korea University. At the time of the experiment all of them were second year at the School of Psychology.

2.1.2 Material and Design

The experiment was based on one kind of psychophysical method called method of constant stimuli in which the experimenter presents five to nine stimuli with different intensities in random order and the difference of each stimulus is consistent. Therefore, there was one standard and nine stimuli. Three sessions were conducted during the whole experiment. In each session, there were 225 trials, and a pair of lines was presented per session. The upper line as the standard in the experiment was always fixed as 450 pixel and without tails that seem like arrow during the total experiment, but the length of the bottom line is varied and may with or without tails in different sessions.

2.1.3 Procedure

In each session, each participant was asked to compare the length of the two lines. If the bottom line was longer than the upper line then pressed the “L” key, otherwise, pressed the “A” key. First, the upper line was compared with the bottom line without tails in the Session1. After the Session1, the bottom line was varied to have the tails. Both ends of the bottom line were connected with the end of arrow during the Session2. Then in the Session3, the bottom line still had the tails, but both ends of the bottom line were connected with the head of arrow.

2.2 Results

The psychometric functions were drawn based on the results of each session. In addition, the PSE (Point of Subjective Equality) and the JND (Just Noticeable Difference) were also be figured out according to the psychometric functions. In psychophysics, the point of subjective equality (PSE) refers to any of points within a stimulus dimension at which a variable stimulus is perceived by the observer to be equal to the standard one [3].

According to the Figure.1, this psychometric function was drawn on the base of the results of the Session1 and it was likely to be a classic “S”-shaped curve. The proportion of pressing “L” key increased gradually as the length of the bottom line’s growing. The fact presented in this graph was that it was easy to distinguish which line was longer than the other when the length of the bottom line was far away from the standard. In other words, closer the length of the bottom line to the standard was, more difficult to distinguish. As show in Figure.1, the PSE in Session1 was close to 475 pixel and the JND was between 475 pixel to 495 pixel.

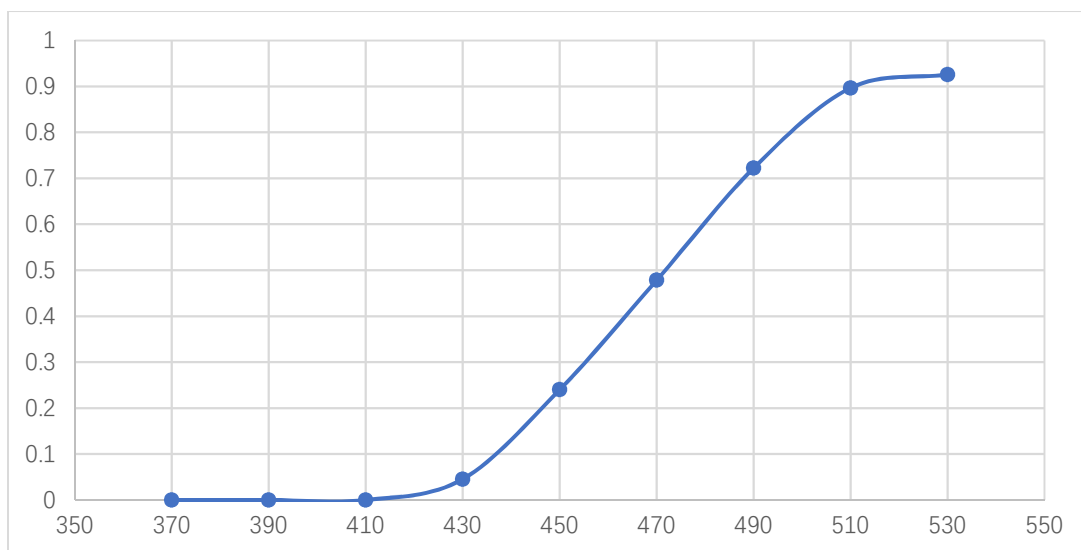


Figure 1. Proportion of pressing “L” key in Session1

As mentioned before, both ends of the bottom line were connected with the end of arrow during the Session2. Compared with the result of the Session1, the psychometric function of the Session2 was not as the same as the classic psychometric function curve. On the whole, although the proportion of pressing “L” key increased, specifically, there was a brief increase at 450 pixel to 470 pixel and after that the curve increased rapidly until the length achieved at 510 pixel and then shown a decrease trend. As shown in Figure.2, the PSE in Session2 was close to 485 pixel and the JND was between 485 pixel to 495 pixel. Therefore, it demonstrated not only the existence of the tails can vary our perception of the length but also both the PSE and the JND became bigger than both of them in the Session1. With this variation, it presented that the existence of the tails which was the end of arrow can influence participants’ PSE.

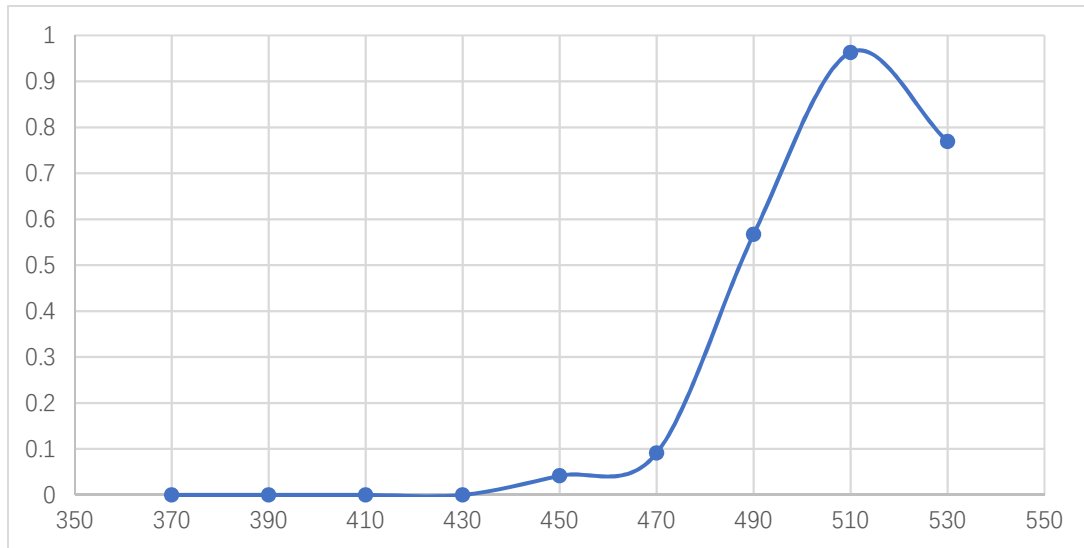


Figure 2. Proportion of pressing “L” key in Session2

In the Session3, both ends of the bottom line were connected with the head of arrow and it was also not a classic psychometric function like Session1. The proportion of pressing “L” key increases slowly overall. Nevertheless, there was a brief decrease between 470 pixel to 490 pixel. As shown in Figure.3, the PSE in Session3 was close to 510 pixel and the JND was between 510 pixel to 530 pixel. Even if the length of the bottom line achieved at 530 pixel which was the longest one of all stimuli, the proportion of pressing “L” key just over 0.6. Therefore, this graph indicated not only this type of tails also can vary participants’ perception of the length but also the PSE and the JND became bigger than both in the Session1. Due to this reason, it also inferred that this type of tails had influence on participants’ PSE.

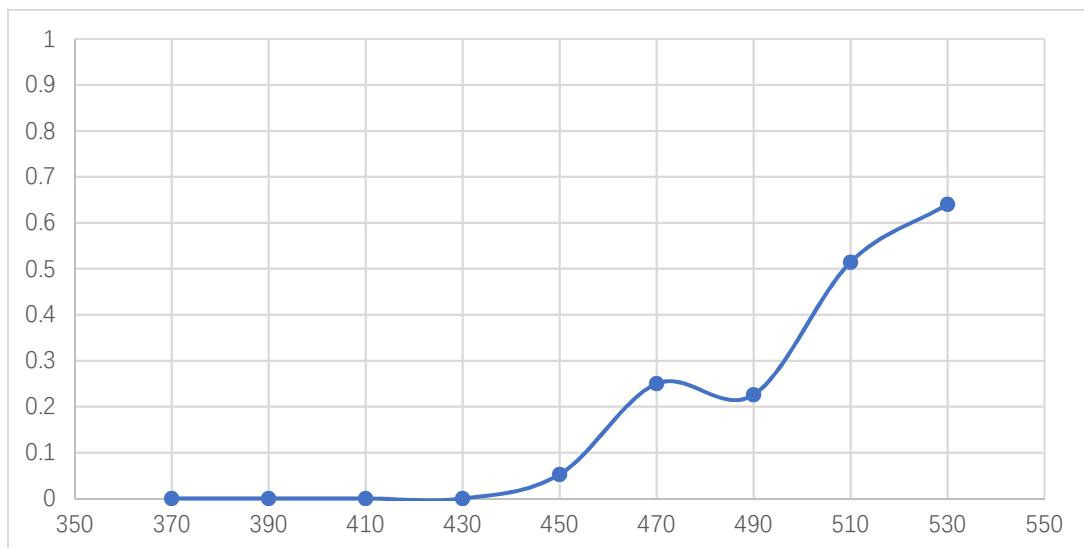


Figure 3. Proportion of pressing “L” key in Session3

2.3 Discussion

These results shown that the difference of the two lines became more and more ambiguous to be figured out when the length of the bottom line was closer to the standard. From the perspective that both types of the bottom line in Session2 and Session3 influenced participants on perceiving length of the bottom line, the existence of the tails which was the head of arrow has more impact on participants’ perception of length, since the PSE in Session3 was bigger than it in Session2.

3. Conclusion

In sum, the existence of the tails can influence people on perceiving the length of the vertical line. In addition, the tails which is the head of arrow has more impact on people's perception of length, compared to the other tails which is the end of arrow. In this work, there is some puzzling results which has a slight conflict with the Müller-Lyer illusion. As mentioned before, the vertical line with the tails which is the head of arrow ($> <$) appears to be longer than the vertical line with the tails which is the end of arrow ($< >$). Based on this, it should be more easily to press the "L" Key in Session3 than in Session2, since the length of the bottom line in Session3 seems longer than the length in Session2 in general. This unexpected result may be due to the small number of the participants. Therefore, a large number of participants should be considered in the further study in order to obtain more precise results.

References

- [1] Goldstein, E.B., Brockmole, J.R (2017). Perceiving Depth and Size. In: Tropp, M. (Eds), Sensation and Perception (Asian Edition). Cengage, Singapore. pp.248-250.
- [2] Carl, B., Katie, L.H., Richard, C (2011). The perception of the interpersonal distance is distorted by the Müller-Lyer illusion. Nature Research., 11:494.
- [3] Guilio, V., Pasquale, A., Egidio, R. (2019). New Perspectives in Computing the Point of Subjective Equality Using Rasch Models. Frontiers in Psychology, vol.10, doi: 10.3389/fpsyg.2019.02793.