

# Quantitative Estimation of Illusionary Band on the Muller-Lyer Illusion

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## Introduction

Muller-Lyer figure was well known as the illusionary figure and it has frequently used with various variations on the studies investigating human visual perception process and mechanisms (e.g., Franz et al., 2001). But few studies attempt to estimate quantitatively how much the difference in size between real and perceptual objects and/or how much the properties of the figure, such as the angle of arrows, affects on such illusionary perception. In this study, the blender-type Muller-Lyer figures were repetitively tested to subjects with changing its figure properties, and the amount of subjective illusionary perception was estimated statistically.

## Experiments

We introduced the blender-type Muller-Lyer figures as shown in Figure 1. Subjects (Ten healthy students, ages from 21 to 31) were required repetitively adjusting a set of Muller-Lyer figures shown on the PC screen to the level in which both centerlines (denoted as “L1” and “L2” in Figure 1) of the figures were perceptually the same size. The set of the presented Muller-Lyer figures consisted of the 72 of figures in different angles of the arrows ranges from 20 to 180 degrees (denoted as theta in Figure 1) and the length of the centerline. Adjusting was easily handled by changing the L2 with the mouse device (L1 was fixed). In the experiment, the two way of adjusting direction were tested, one was the figures which L2 was perceptually clearly shorter than L1 (named as “PS”), thus subjects had to make L2 longer, and the other was the figure with perceptually longer L2 (named as “PL”). Then 144 types of the Muller-Lyer figures were randomly and repetitively presented on the PC's 17 inches liquid crystal display placed 50 cm from subjects. The figures were shown in the area of 600 × 600 within 1028 × 768 pixels of the display.

## Result and Discussion

Although the large difference within individual, the amount of estimated illusionary difference between real and perceptual figures clearly shows parameters' dependent feature. Figure 2 shows the relation of the arrow angles and the amount of illusion. By statistical analysis like as ANOVA, we could assume that the amount of illusion was greater when the angle is smaller. That result is consistent with past

studies though few studies assessed such a detailed-change of parameters.

On the other hand, the result focused on the adjusting direction was interesting. As Figure 2 shows, the PS experiments marked greater illusionary effect than PL ( $p < .05$  by t-test). This result suggests that some illusionary band could exist in the human perception of the Muller-Lyer illusion (as shown in Figure 3) and such an illusionary band changes accompanying with the arrow angle as shown in the difference in PS and PL score in Figure 2. This results might reflects some differences in the physiological process of recognition of illusionary figures, such as possible feedback in adjusting process, but much more systematic experiment would need for further discussion.

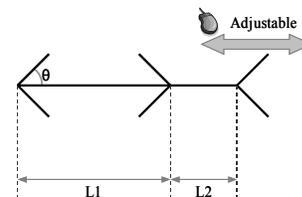


Figure 1: A set of Muller-Lyer figure.

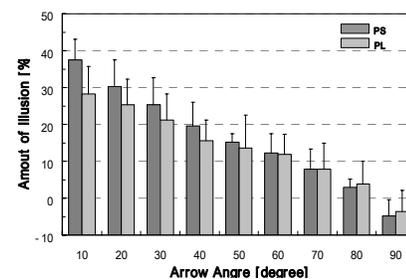


Figure 2: The arrow angle and the amount of illusion.

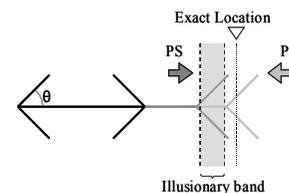


Figure 3: Possible illusionary band of Muller-Lyer figure.

## References

- Franz, V. H., Fahle, M., Bulthoff H. H., & Gegenfurtner, K. R. (2001). Effects of visual illusions on grasping. *Journal of Experimental Psychology. Human Perception and Performance*, 27(5), 1122-1144.