

VISUAL SIMULATION AND PSYCHOLOGICAL EXPERIMENT OF MÜLLER LYER VISUAL ILLUSION

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ABSTRACT. The simulator was constructed by using the electric circuit model based on the nerve system structure of the outer retina. The simulation experiment was done by using this constructed simulator. Moreover, we did the experiment on psychological search and we confirmed the validity of the simulation. As a result, our simulator developed in this paper could realize the visual illusion phenomena in Müller Lyer image. Furthermore, it is suggested from our simulator structure that the Müller Lyer visual illusion phenomena are caused by lateral inhibition.

1. Introduction. Processing of the visual information in a vertebrate begins from the retina. Generally, the retina of the vertebrate consists of five kinds of nerve cells, and the cell is located in a line in layers for every kind. The left figure of Figure 1 draws typically the layer called the outer retina. The outer retina consists of the photoreceptor cells (cone) which change light signals into electric signals, the horizontal cells which receive signals from the photoreceptor cells, and the bipolar cells which receive signals from the photoreceptor cells and the horizontal cells. Moreover, signals are spread to lateral projection by the electric relation called a gap junction between the adjoining photoreceptor cells and between horizontal cells. The spread to lateral projection has the important role in visual information processing, and affect the mechanism called lateral inhibition. Such a neural circuit structure can be seen also in a cerebral visual area. In this research, the visual simulator was created for the purpose of modeling neural circuit structure with an important role for this visual information processing as a control system by an electric circuit, and simulating the simplified vision processor. Moreover, the created simulator was applied to reappearance of the visual illusion phenomenon, and the mechanism of visual illusion generating was examined.

2. Visual Simulator. The simulator created by this research was created based on the retinal neural circuit structure of a vertebrate. By the electrical property of a retina cell, since the inside of a cell lets electricity pass, it can be expressed as resistance. Since potential difference has arisen on both sides of the thin insulator, a cell membrane can be expressed as a capacitor. Since a gap junction conducts electricity to lateral projection, it can be constituted as resistance of lateral projection. Since polarity reverses the output from a horizontal cell to the output from visual cells, the output from a bipolar cell serves as difference of the output from a visual cell layer, and the output from a horizontal cell layer [1]. The structure of the outside retina based on these characteristics was shown