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修士論文

オブジェクト知覚の解明を目指して：運動錯視の実験的検討

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Abstract

What does it mean to see things in our daily lives? Unlike a camera, in the human visual processing, the pattern of light reflected from an object is not just processed as an array of pixels, but supplimented and inferred from the environmental contexts and our own knowledge. As a result, even the processing of pixelwise “same” stimuli can be different, depending on the context. For example, in a widely known "Rubin's Pot", which is a figure that has two areas colored black and white, different interpretations are made for the same figure depending on which of the two areas is perceived as a “figure” or “ground”. Such figures are a type of illusions called “ambiguous figures”.

Wertheimer sought to provide an explanation for the interpretation of illusions and ambiguous figures in an "experimental study of motion vision" (Wertheimer, 1923). At that time, he attempted to formulate the motion illusions using a rule called the Prägnanz (German word for terseness, or simplicity) rule, but failed to do so (Marr, 2003). In line with the work of Wetheimer, we aim to explain the human visual perception using a motion illusion as our means. As an example of a motion illusion, let us explain a well-known example of an apparent motion. When there are two light spots set apart in the space-time and these two spots blink alternately at different times, people perceive the movement of one dot, by interpreting the two light spots as one (Sato, 1991). In this phenomenon, two light spots are not treated individually, but are perceived as one, by associating the two. In our study, we call things that are not perceived only by partial features but perceived by it’s wholeness as "objects".

In a study on ambiguous figures, Hidaka and Takahashi (2019) gives an explanation of the illusory phenomenon of perceiving the non-existant direction of movement, using an example of an ambiguous figure called “Barberpole (a barber's sign pole)

illusion”. Barberpole illusion is defined by Hidaka and Takahashi (2019) as "the perception of the motion of a straight line that occurs when looking at a straight line moving from a" window "on a two-dimensional plane." As an explanation of the barberpole, these authors claim that translation that associates a certain line in space and time with a line after time change is an interpretation of perception (Hidaka and Takahashi, 2019) . In the case of barberpole, a certain point in a space is associated with the line after the change of the time, but since the line is a set of points, the theory can be applied to the interpretation of other ambiguous figures that are seemingly different from Barberpole illusion.

Based on this observation, we hypothesized that the correspondence of points gives an interpretation of the perceived motion of an ambiguous figure, and made a prediction concerning the perceived motion of an ambiguous figure called "slit illusion". The slit illusion occurs, for example, when observing the sunlight through the background of the tree through a gap with a certain width. In this situation, if you move your neck left and right, the difference in the width of the grid will cause the moving speed of the object consisting of a part of the background to change. It is a phenomenon that is perceived at a speed different from the neck movement speed. To explain this phenomenon, we predicted that in the slit illusion the perceived speed may be different depending on the width of the grid.

We tested this prediction by the experiment that involves the human participants. In the experiment, we investigated the change of perceived speed depending on the width of the grid of the slit illusion, and obtained results consistent with the prediction. In other words, it was suggested that the interpretation of perceived movements of an ambiguous figure is caused by the correspondence of points. The Barberpole illusion introduced earlier was an ambiguous figure that changes perception depending on the direction of movement, but the slit illusion

that we employed is an ambiguous figure that changes the speed of movement. Since motion is determined by speed and direction, it may be possible to use our theory to give explanations to the interpretation of other ambiguous figures.