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Phenomenal Characteristics of the Peripheral Drift Illusion

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The peripheral drift illusion refers to an anomalous motion illusion that can be observed in peripheral vision [1-3] (Fig. 1). Although this illusion has been characterized by gratings that have sawtooth luminance profiles, we demonstrate that ones with stepwise profiles are more effective. Moreover, the order of four regions of different luminances is critical, i.e. the combination of black and dark-gray or the combination of white and light-gray. Specifically, illusory motion tends to appear in the direction from a black region to an adjacent dark-gray region or in the direction from a white region to an adjacent light-gray region (Fig. 2). This order enhances the peripheral drift illusion as shown in Fig. 3.

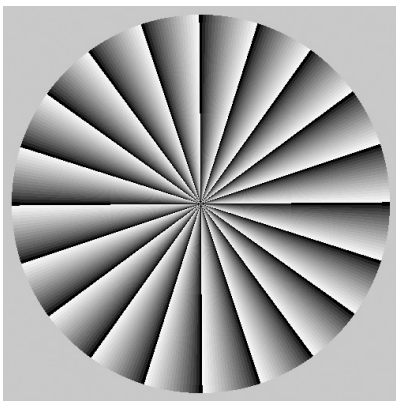

Fig.1 The peripheral drift illusion. When observers see this figure in the peripheral vision, the circle appears to rotate slowly. Although Fraser and Wilcox [1] reported that the direction of illusory rotation was clockwise or counterclockwise depending on individuals, recent studies [2,3] mentioned only clockwise rotation in this case.

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We point out two novel factors that affect the strength of illusory motion. (1) The peripheral drift illusion is enhanced by stepwise luminance profiles, as mentioned above. Stimuli with smooth luminance profiles, like Fig. 1, give weaker illusion. (2) The peripheral drift illusion is enhanced by fragmented or curved edges. Stimuli made up of long edges give weaker illusion. Fig. 4 is produced

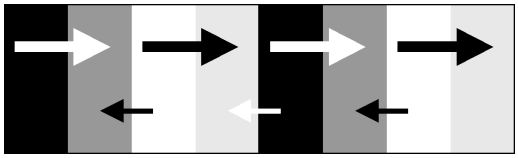

Fig.2 The phenomenal rules of the peripheral drift illusion we here propose, i.e. black to dark-gray and white to light-gray. Arrows indicate assumed local motion signals and their strengths, which originate from black or white areas.

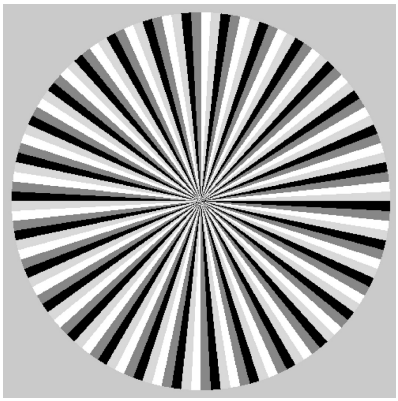

Fig.3 Enhancement of the peripheral drift illusion by our new rules. When observers see this figure in the peripheral vision, the circle appears to rotate clockwise. This illusory rotation is stronger than that in Fig. 1.

according to these rules and shows illusory rotation even stronger than that in Fig. 3. There are a variety of applied figures of the peripheral drift illusion on the first author's webpage: http://www.ritsumei.ac.jp/~akitaoka/index-e.html.

Although this study only reveals phenomenological or design rules to obtain the peripheral drift illusion with large illusion magnitude, we are seeking an explanation on the basis of motion detector models[4]. It is also expected that these rules can contribute to the study of motion perception to elucidate anomalous motion illusions[5-11] such as the Ouchi illusion (Fig. 5).

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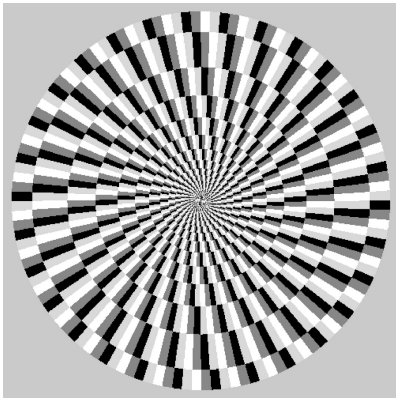

Fig.4 Further enhancement of the peripheral drift illusion by our further rules. When observers see this figure in the peripheral vision, the circle appears to rotate clockwise. This illusory rotation is even stronger than that in Fig. 3.

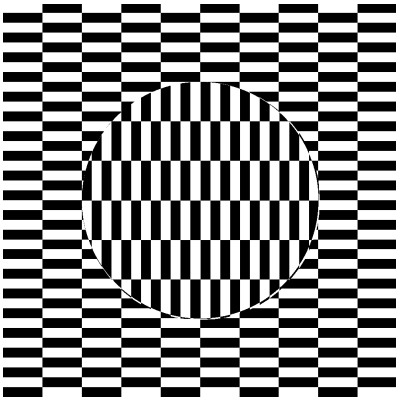

Fig.5 The Ouchi illusion, the most typical among anomalous motion illusions. The inset appears to move while the surround does not.

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