

# Use of Periodic Shift and Color Combinations to Enhance Illusory Motion

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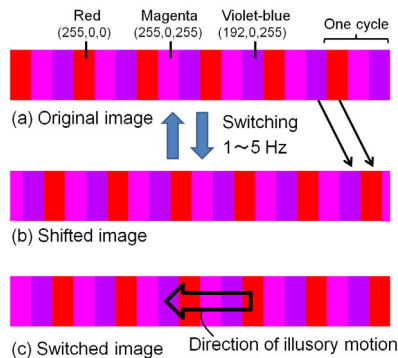


Figure 1: Illusory motion of simple color stripe.

## Abstract

A new illusory motion which is so strong that almost everyone can easily perceive it has been created by using two techniques. One is to shift the image periodically, and the other is to create a still image which causes the illusion by blending only two primary colors such as red and blue.

## 1 Motivation

The basis of movies and computer animations is apparent motion, which is perceived when a series of still images is shown successively for a short duration. On the other hand, illusory motion is both unique and interesting because, in spite of the fact that the image is perfectly stationary, the cognitive effect makes it appear to be moving. Frazer and Wilcox reported this type of illusion in 1979. Faubert and Herbert called a similar effect the *peripheral drift illusion* (PDI) in 1999 because it occurs in the visual periphery. Chi et al. [2008] presented a method for generating such a ‘self-animating image’ from a copy of a piece of art by, for example, van Gogh.

Kitaoka published various beautiful original PDIs including famous ‘rotating snakes’. Kitaoka [2008] also classified this kind of illusion into several types based on the arrangement of gray levels and colors. Among them the ‘Type V’ illusion, in which the color combination of red and blue is essential, is one of the strongest illusions. However, even in this case, the illusory motion was so faint that not everyone perceived it. There seems to be another reason: viewers must not stare at it as the illusion is a PDI. The viewer needs to glance but not everyone can do this.

Therefore, we propose a very simple method to make the illusion strong enough for almost everyone to perceive it [Yanaka et al., 2011]. The method was to shake a still image, electronically or mechanically, at about five to ten Hz. However, the method was not very effective for types other than the Type V. Another issue is that too many parameters might be related because the motion is not digital but analog if it is continuously shaken.

## 2 Method

We used simple cyclic switching between two images, one of which is the original and the other is a horizontally shifted image of it. No intermediate positions were allowed. In addition, we used only a small number of colors without using gradation. Even on this condition strong illusory motion can be created.

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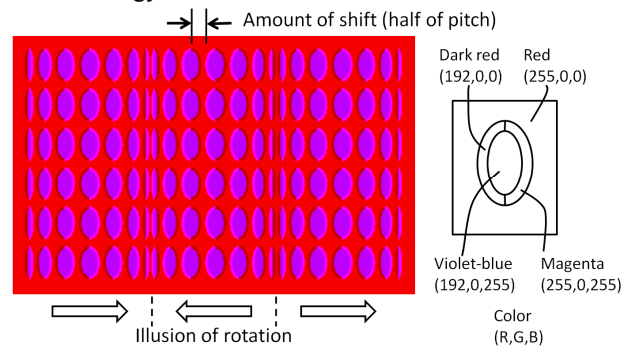


Figure 2: Illusory motion based on Kitaoka's ‘Rollers’.

## 3 Experiments

A simple case in which a stripe consisting of three colors of red, magenta, and violet-blue was used as shown in Fig.1 (a). A horizontally shifted image of Fig. 1 (a) to a half cycle is shown in Fig. 1 (b). When the two still images above were displayed in turn and the duration was about 100 ~ 500 ms each, a strong illusion that stripes are moving to the left is obtained as shown in Fig.1 (c). Although green can be used instead of red, the illusion becomes a little weak.

An illusory motion based on ‘Rollers’ [Kitaoka, 2004] is shown in Fig. 2. His original image can be observed without color because only the gradation of brightness is needed. However, using opposing colors is known to strengthen the effect of the illusion. In his original version, two almost complementary colors are used. Namely, there are several cyan ellipsoidal patterns on a yellow background. Although this color combination is suitable for a conventional illusory motion in which it looks as if three rollers are slowly rotating, little enhancement is expected when the image is switched periodically using our way. We changed the color combination as shown in Fig. 2. Here, only two primary colors of red and blue are blended to produce four colors. No green component is included. When a horizontally shifted image is produced and the image and the original image was displayed alternatively at a frequency of 1 ~ 5 Hz, a very strong illusory motion in which rollers are perceived to be rotating was obtained.

## 4 Conclusion

We created a new illusion in which strong unidirectional motion is perceived in spite of the fact that only two images, the original and the shifted one, are displayed alternatively. Once the detailed mechanism is clarified, we will apply it to computer animation.

## References

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