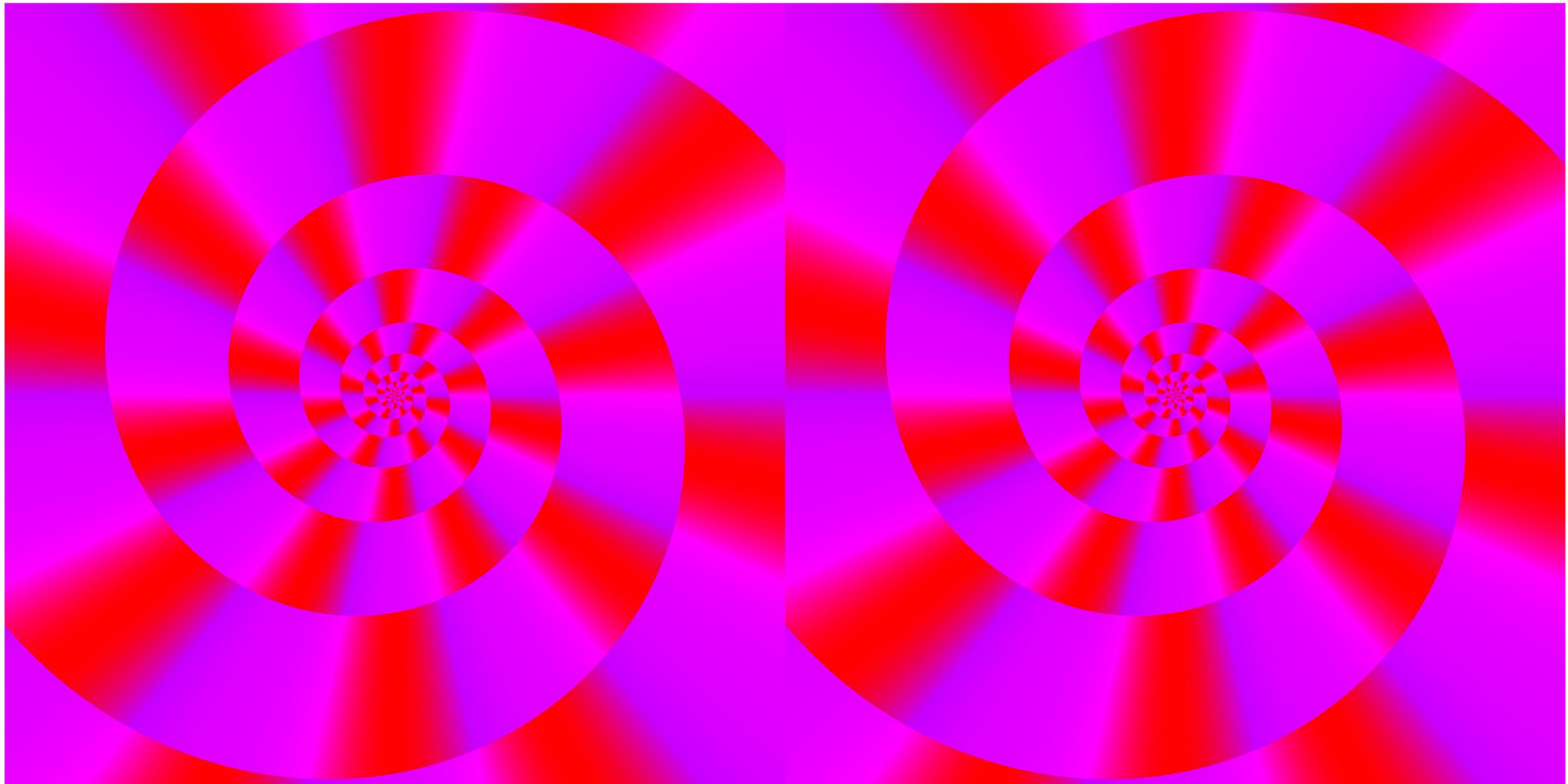


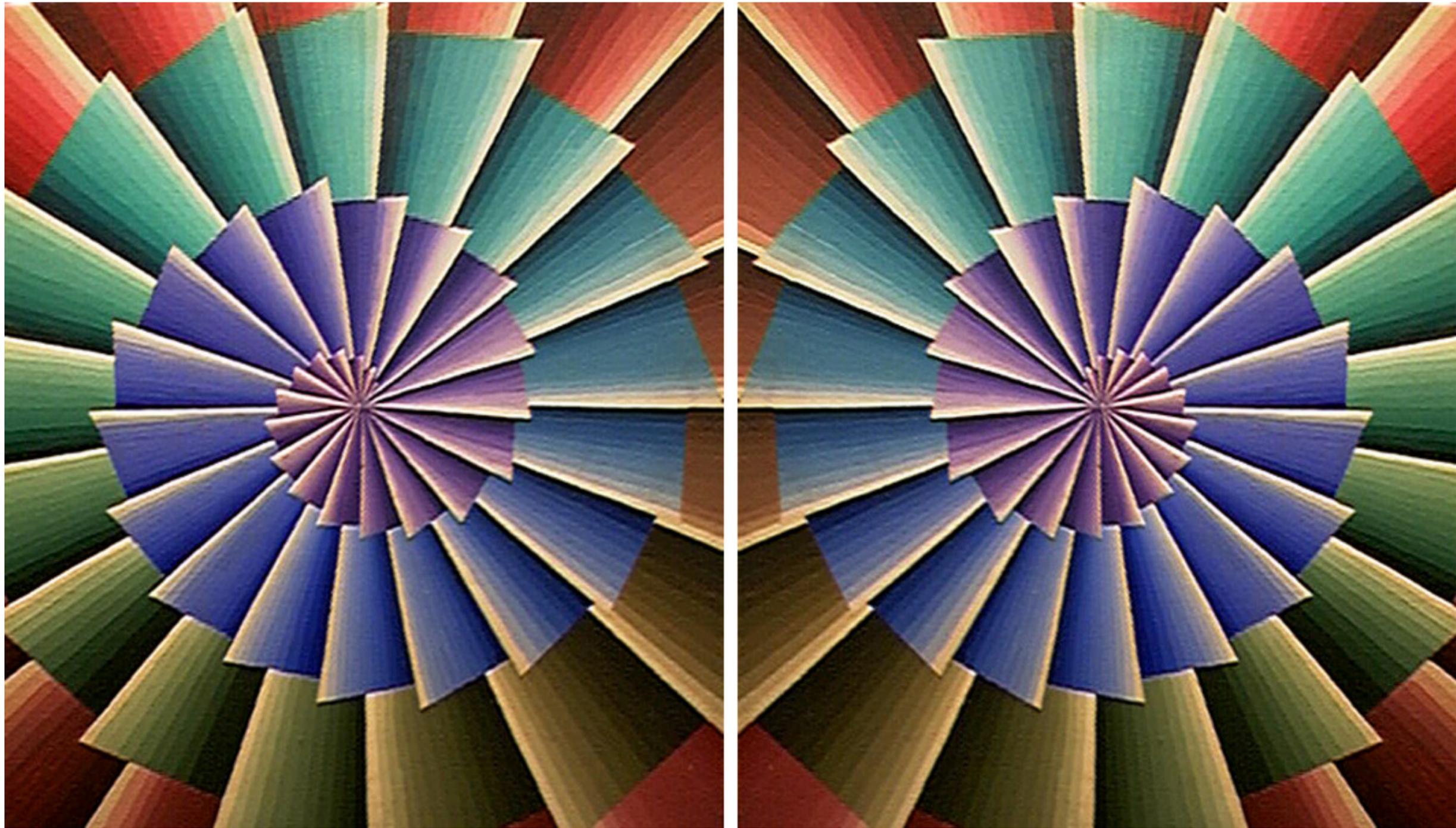
Reversal of the color-dependent Fraser-Wilcox illusion under a dark condition

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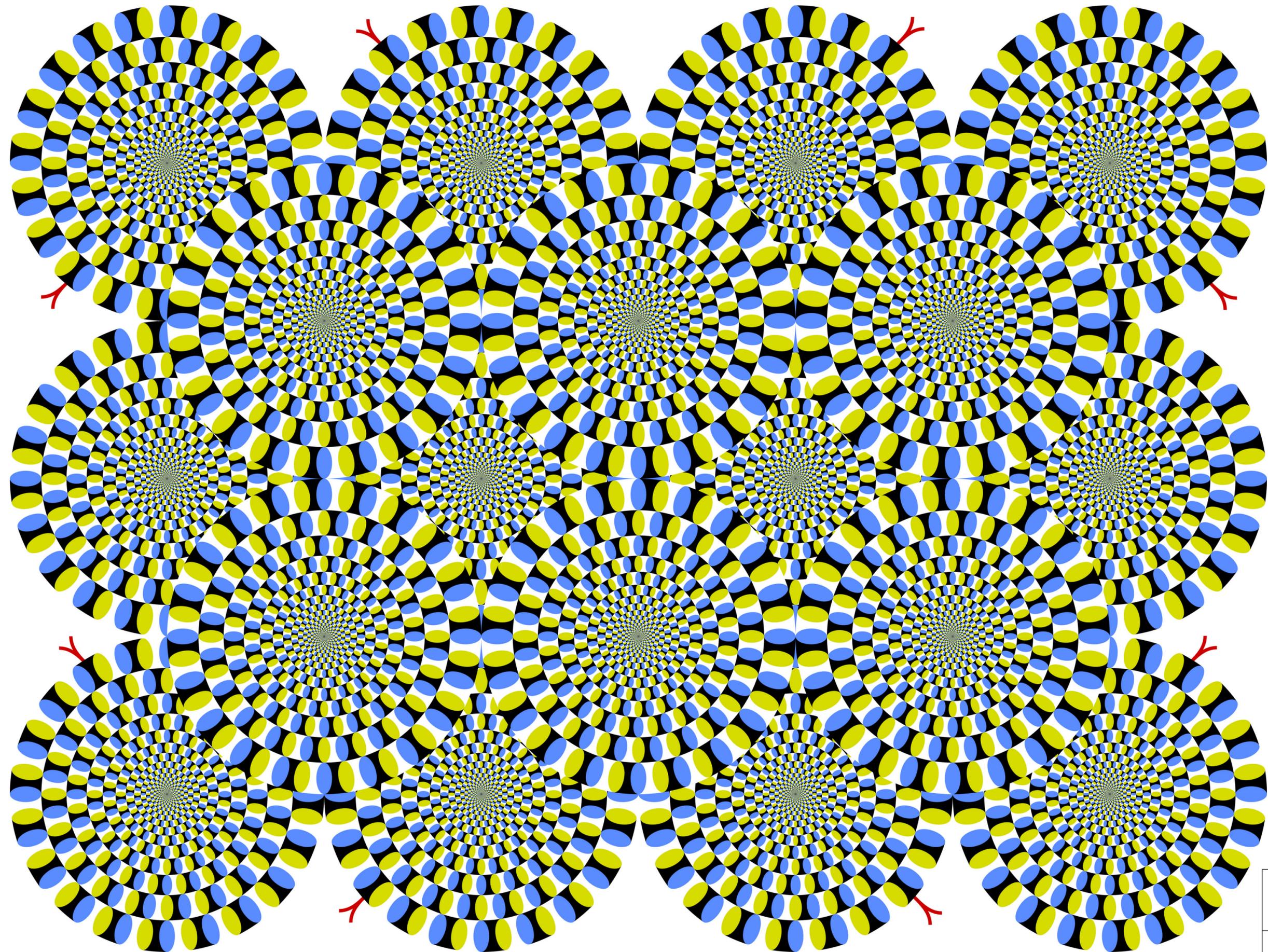
1. Fraser-Wilcox illusion group



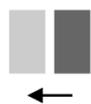
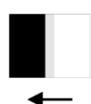
Alex Fraser's original (Adopted from 'Alex Fraser, Geneticist and Painter' (<http://doctorexfraser.blogspot.jp/p/spirals.html>) with permission from Alan Fraser (access August 25, 2012). Alex Fraser (1923-2002) was a geneticist and a painter.

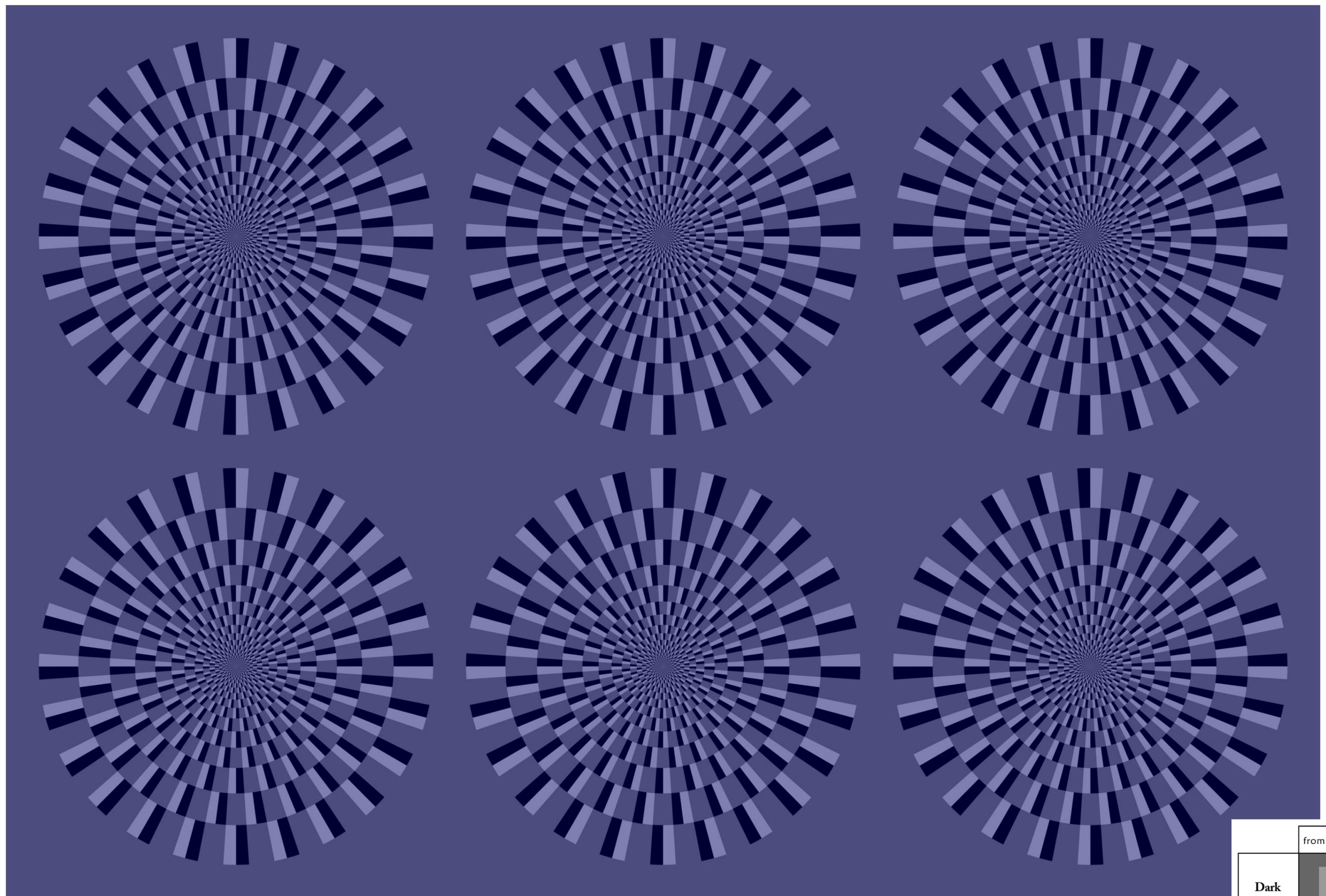
Fraser, A. and Wilcox, K. J. (1979). Perception of illusory movement. *Nature*, 281, 565-566.

Observers saw illusory motion in a stationary image which consists of repeated luminance gradient in a saw-tooth wave form. Some reported illusory motion from dark to light along a luminance gradient, while others saw the reversal. The illusion is strong in the peripheral viewing. Fraser and Wilcox (1979) claimed that this individual difference depends on some genetic properties.

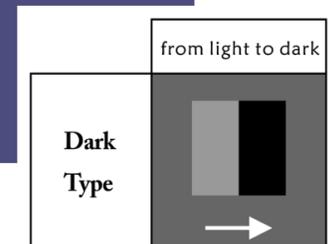


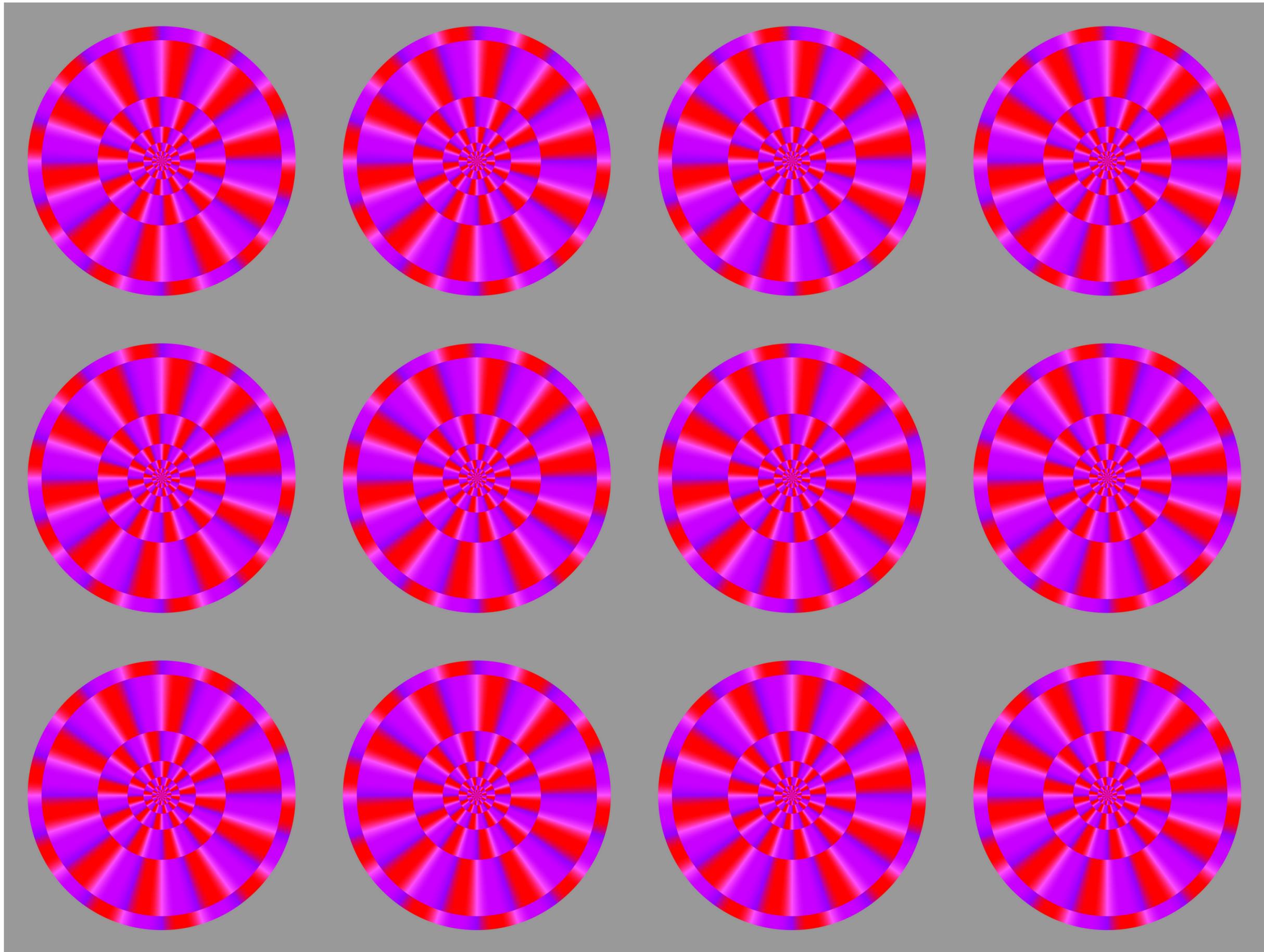
“Rotating snakes” (Kitaoka, 2003), a work of the ‘optimized’ Fraser-Wilcox illusion

	from dark to light	from light to dark
Type IIa		
Type IIb		



Dark type of the Fraser-Wilcox illusion (Kitaoka, 2012, ECVF)

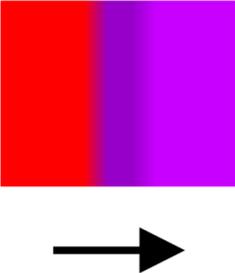
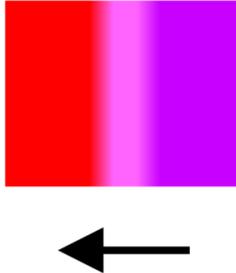




Color-dependent Fraser-Wilcox illusion (Kitaoka, 2008, 2012)

2. Properties of the color-dependent Fraser-Wilcox illusion

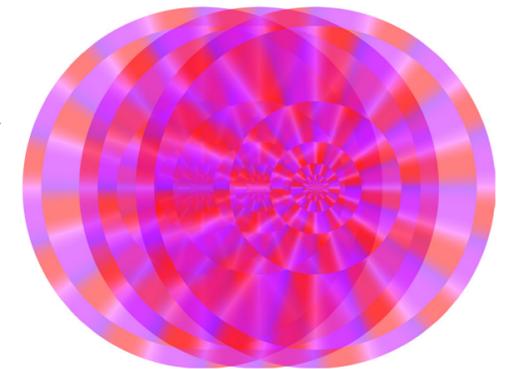
(1) In 2008, Kitaoka found that the direction of illusory motion is “red → dark purple → purple → magenta (light red-purple) → red”, and that the illusion magnitude is strong when overall luminance contrast is low. Images of high luminance make a strong effect.

	from dark to purple	from light to red
Color-dependent Type		

(2) In 2011, Kitaoka found that flickering the image increases the illusion magnitude. Blinks also work.

(3) Yanaka and Hilano (2011) reported that this illusion is enhanced by mechanical shaking.

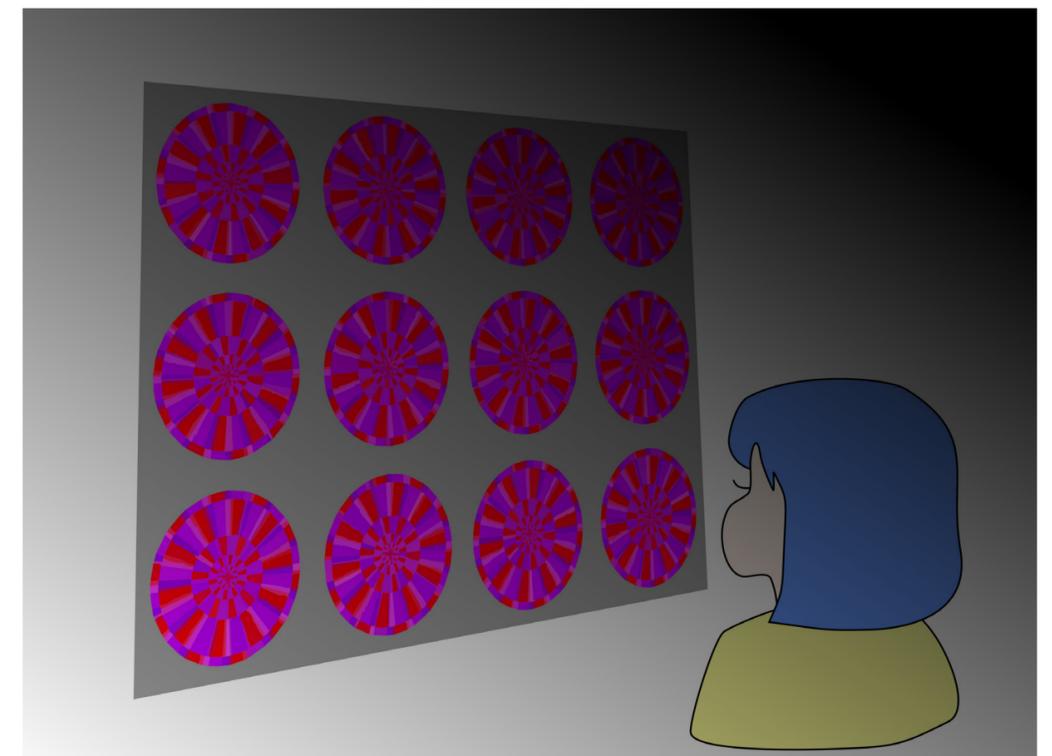
Yanaka, K. and Hilano, T. (2011). Mechanical shaking system to enhance "Optimized Fraser-Wilcox Illusion Type V". Perception, 40, ECVF Abstract Supplement, page 171.



(4) Yanaka (2012) reported that this illusion is enhanced by viewing images under dark illumination.

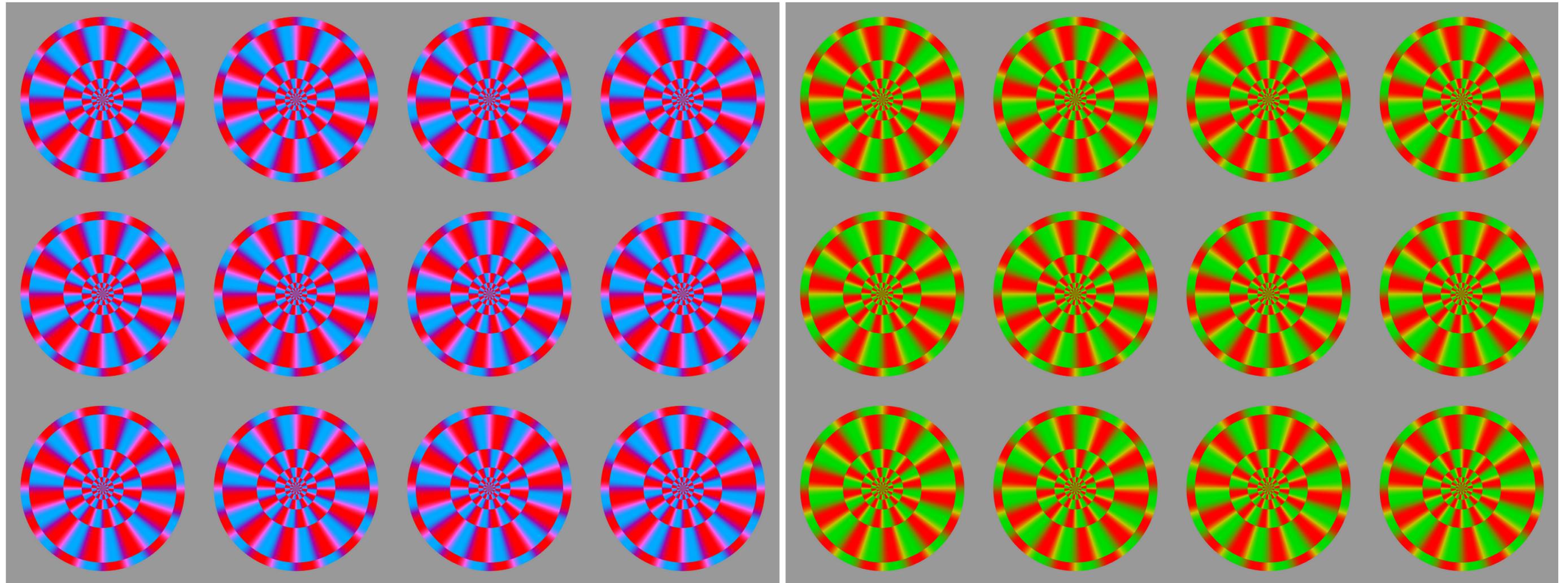
Yanaka, K. (2012). Enhancement of the optimized Fraser-Wilcox illusion Type V by swinging the image. Talk in the 5th Illusion Workshop, Meiji University, Tokyo, Japan, September 18, 2012.

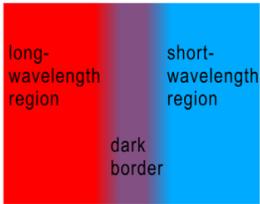
(5) In 2013, Kitaoka (this report) found that Yanaka’s darkening enhancement is accompanied by a reversal of illusion: i.e., the direction under dark condition is “red → magenta (light red-purple) → purple → dark purple → red”.



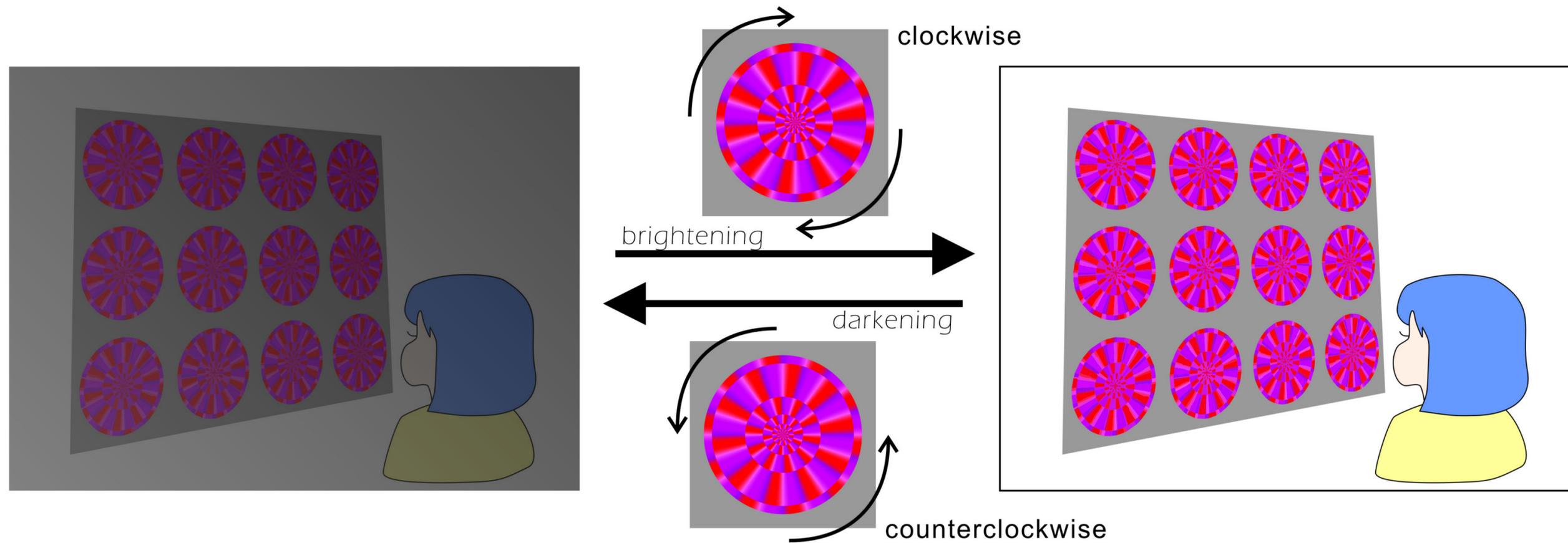
3. Further findings and a possible explanation

(1) Combination of a long wavelength color and a short one makes the illusions.



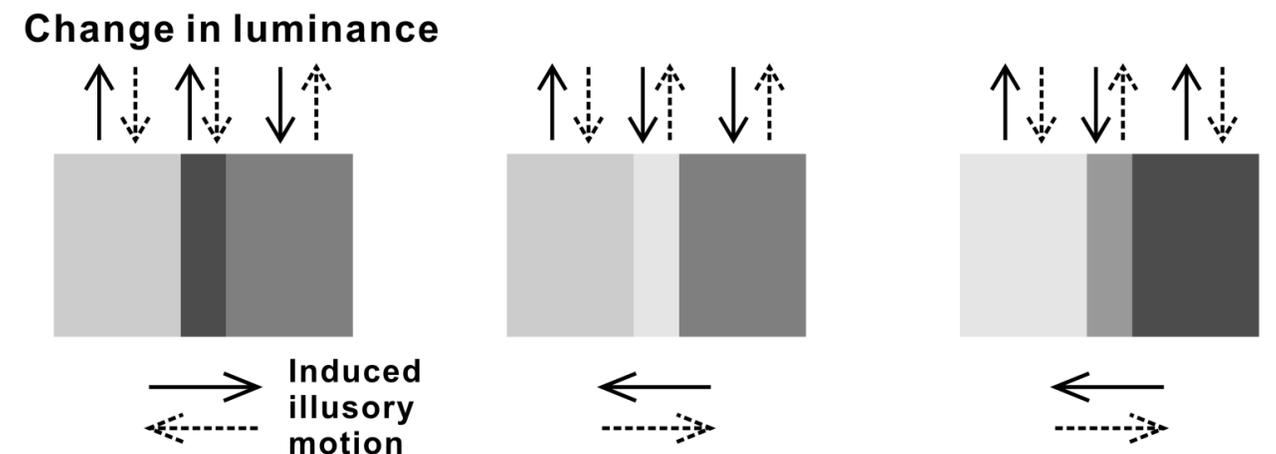
COLOR-DEPENDENT TYPE	Over a dark border	Over a light border
In a bright condition or when illumination goes brighter	illusory motion → 	← 
In a dark condition or when illumination goes darker	← 	→ 

(2) Increasing or decreasing illumination induces motion illusion.



(3) It is suggested that this ‘luminance change-induced’ motion* might generate the color-dependent Fraser-Wilcox illusion through a rod-and-cone interaction, being triggered by saccades, blinks, flickering or shaking the images.

*The ‘luminance change-induced’ motion includes the reverse phi phenomenon (Anstis, 1970) and the phenomenal phenomena (Gregory and Heard, 1983). Directions of illusory motion depending on the changes of luminance are shown in the right (Kitaoka, 2006).



Anstis, S. M. (1970) Phi movement as a subtraction process. *Vision Research*, 10, 1411-1430.

Gregory, R. L. and Heard, P. F. (1983). Visual dissociations of movement, position, and stereo depth: Some phenomenal phenomena. *Quarterly Journal of Experimental Psychology*, 35A, 217-237.

Kitaoka, A. (2006). Configurational coincidence among six phenomena: A comment on van Lier and Csathó (2006). *Perception*, 35, 799-806.