

# The rotating Pulfrich illusion



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# The 'rotating' Pulfrich effect<sup>1</sup>

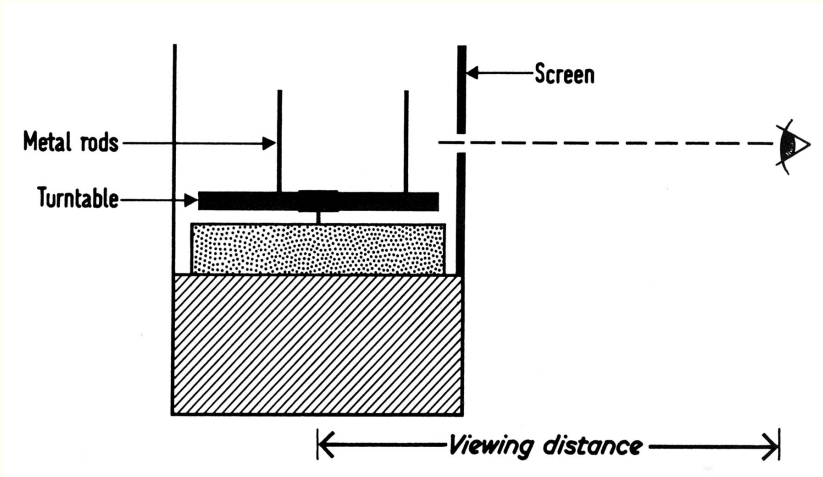
- A remarkable visual illusion
- Easily demonstrated
- Interesting mathematics & geometry & computing
- Physiological research tool – visual latency
- Medical applications – multiple sclerosis, cataracts
- Pulfrich web site <http://www.siu.edu/~pulfrich/>
- Curves web site  
<http://www.2dcurves.com/higher/highern.html>

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<sup>1</sup>Nickalls (1986a): (see *References* on last slide)

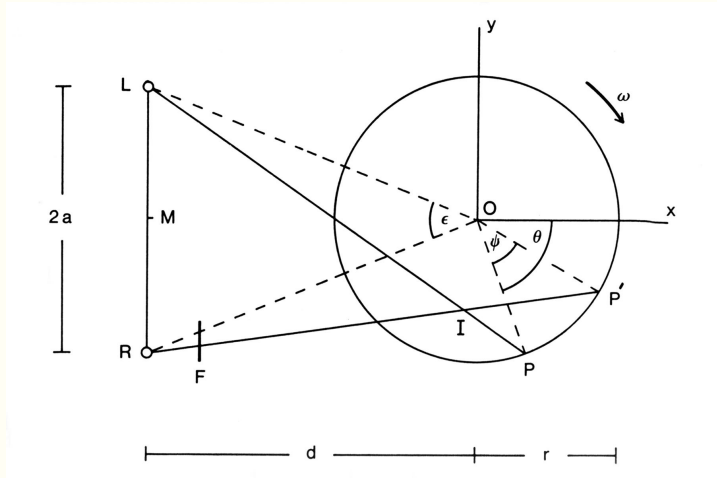
# Rotating Pulfrich effect

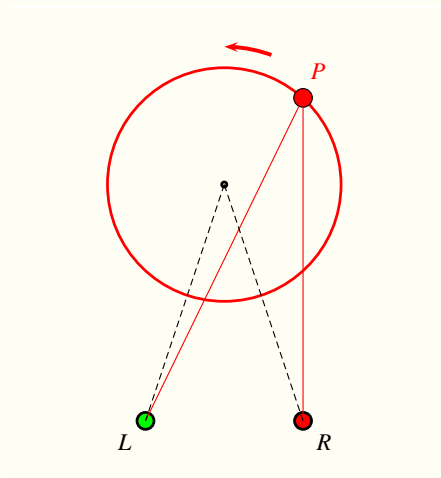
viewing configuration



# Rotating Pulfrich effect

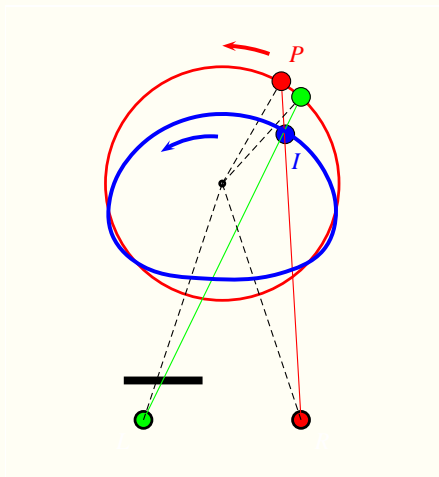
viewing configuration





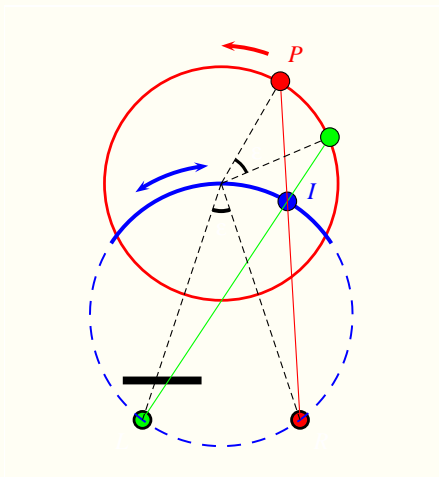
# Rotating Pulfrich effect

image rotates anticlockwise ( $\phi < \varepsilon$ )



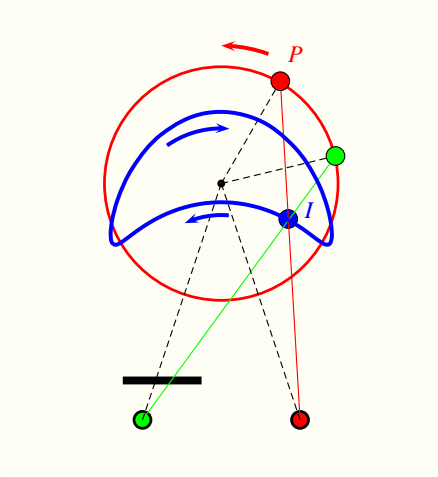
# Rotating Pulfrich effect

$$\Delta t = \frac{1}{3\omega} \tan^{-1} \left( \frac{a}{d_T} \right) \text{ transition configuration } (\phi = \varepsilon)$$

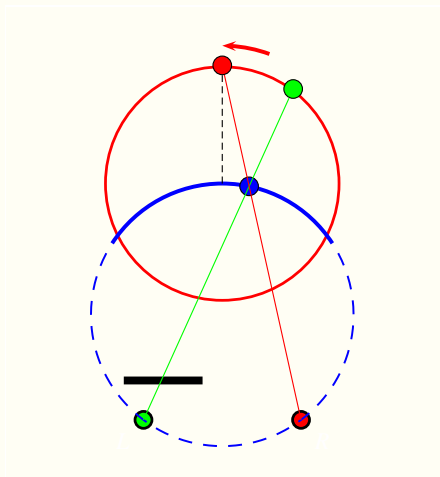


# Rotating Pulfrich effect

image rotates clockwise ( $\phi > \varepsilon$ )

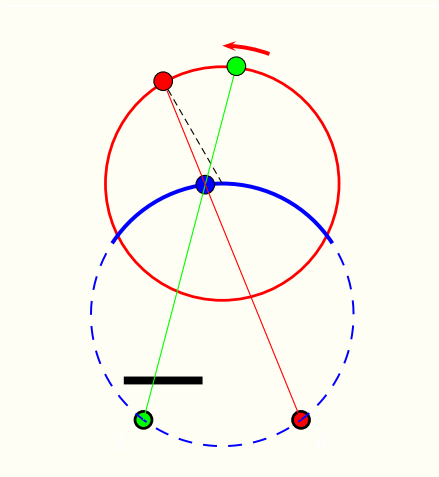






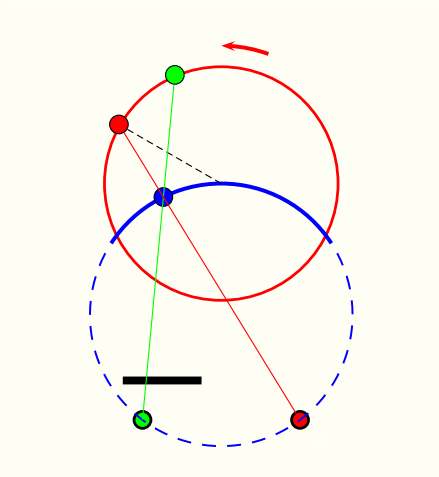
# Rotating Pulfrich effect

transition sequence



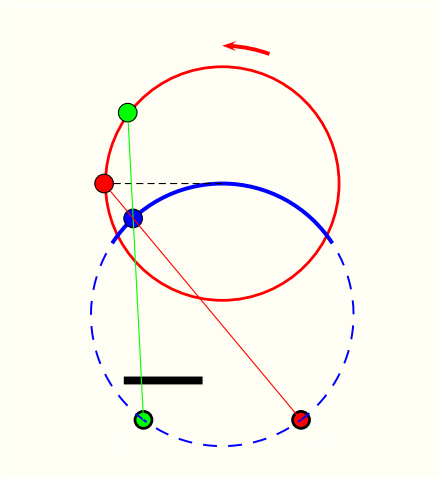
# Rotating Pulfrich effect

transition sequence



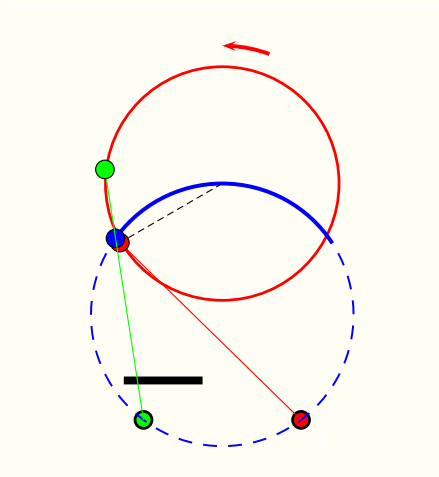
# Rotating Pulfrich effect

transition sequence



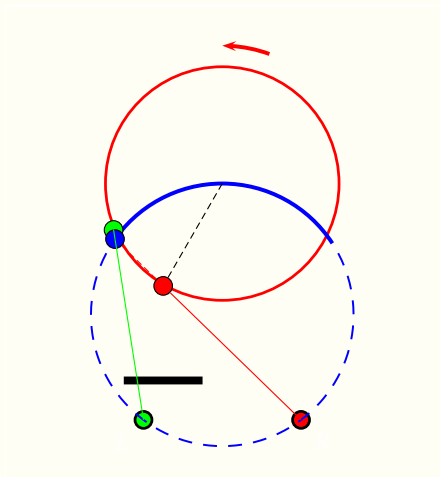
# Rotating Pulfrich effect

transition sequence



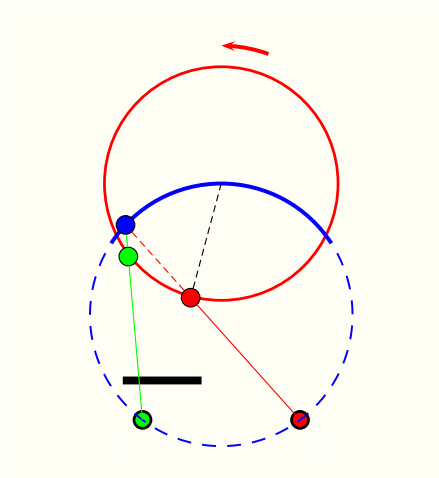
# Rotating Pulfrich effect

transition sequence



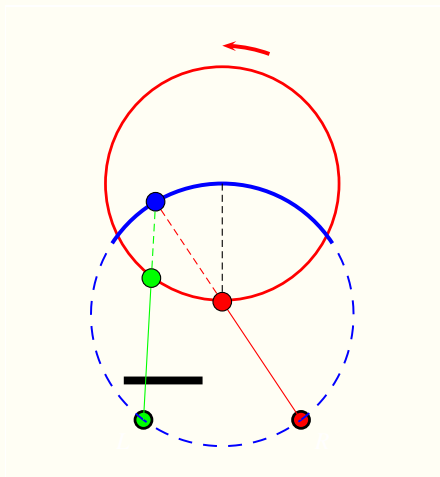
# Rotating Pulfrich effect

transition sequence



# Rotating Pulfrich effect

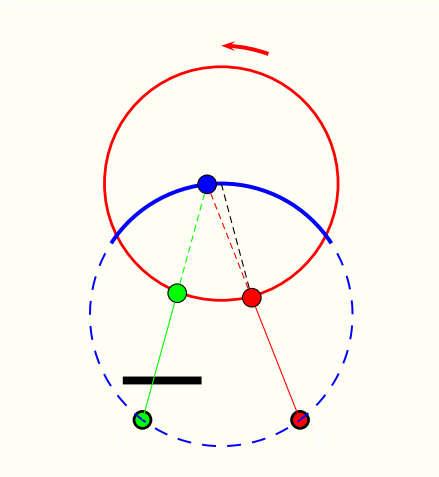
transition sequence





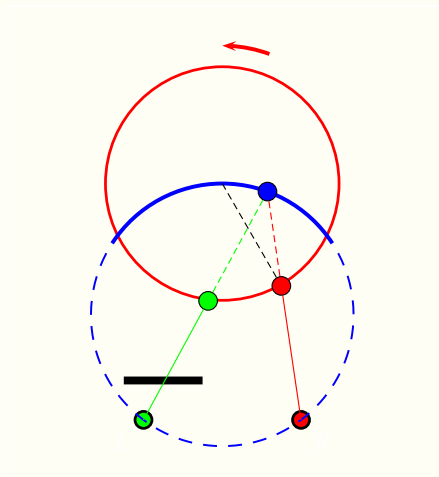
# Rotating Pulfrich effect

transition sequence



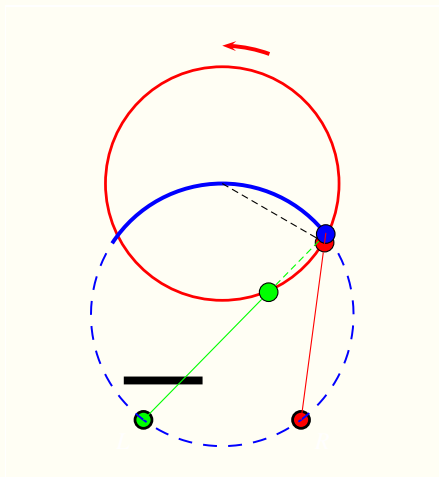
# Rotating Pulfrich effect

transition sequence



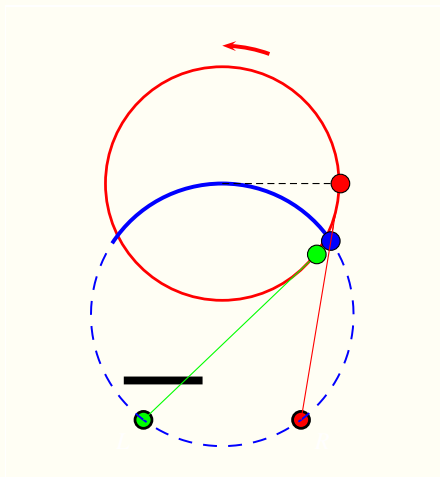
# Rotating Pulfrich effect

transition sequence



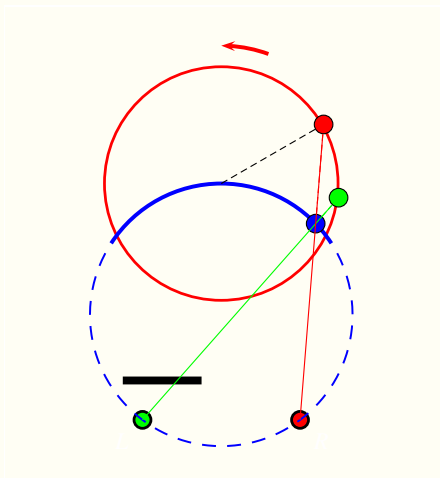
# Rotating Pulfrich effect

transition sequence



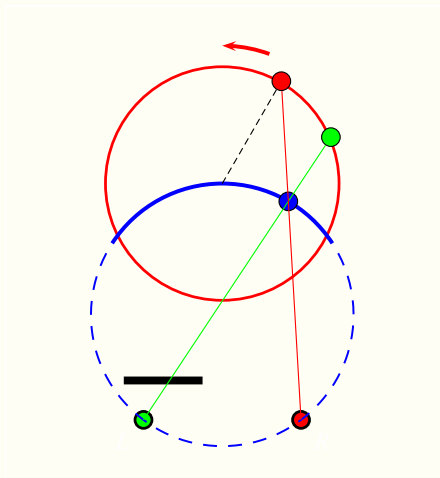
# Rotating Pulfrich effect

transition sequence



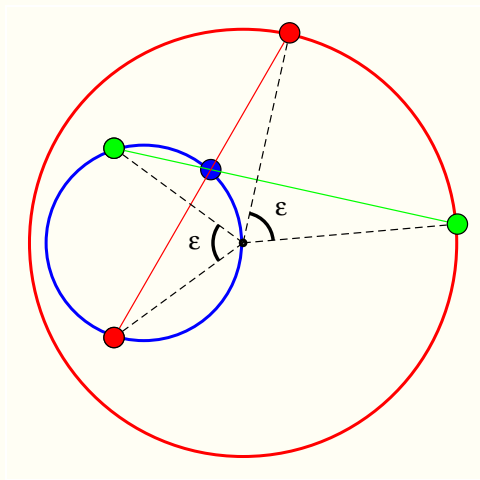
# Rotating Pulfrich effect

transition sequence



Theoretical view from inside<sup>2</sup>

one rotation of  $P \equiv$  two rotations of locus (blue)

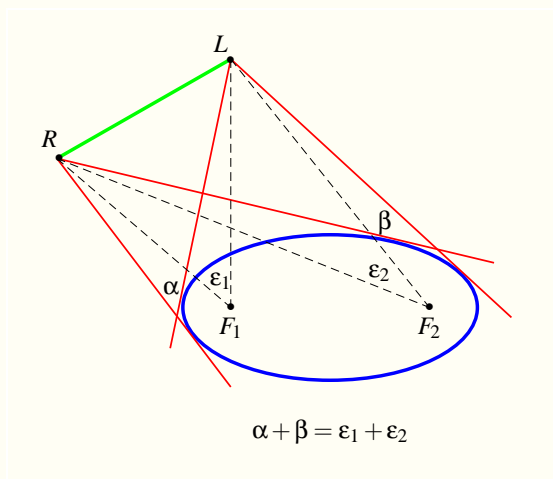


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<sup>2</sup>Nickalls (1986b)

# Line & conic theorem<sup>3</sup>

derived from rotating Pulfrich effect



<sup>3</sup>Nickalls (1986b; 2000)



## References<sup>4</sup>

- Nickalls RWD (1986a). The rotating Pulfrich effect, and a new method of determining visual latency differences. *Vision Research*, 26, 367–372.
- Nickalls RWD (1986b). A line and conic theorem having an interesting visual correlate. *The Mathematical Gazette*, 70, 27–29.
- Nickalls RWD (1996). The influence of target angular velocity on visual latency difference determined using the rotating Pulfrich effect. *Vision Research* (1996); 36, 2865–2872.
- Nickalls RWD (2000). A conic theorem generalised: directed angles and applications. *The Mathematical Gazette*, 84, 232–241.
- Nakamizo S, Nickalls RWD and Nawae H (2004). Visual latency difference determined by two rotating Pulfrich techniques. *Swiss Journal of Psychology*, 63, 201–205.

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<sup>4</sup>downloadable from:

<http://www.nickalls.org/dick/papers/rwdnPapers.html>

END

