



TP A.12

The relationship between cue ball spin and cue tip offset

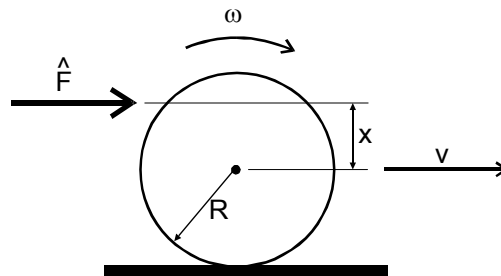
supporting:

“The Illustrated Principles of Pool and Billiards”

<http://billiards.colostate.edu>

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originally posted: 3/1/05 last revision: 8/5/05



Linear impulse results in linear momentum:

$$\hat{F} = mV \quad (1)$$

The offset (x) of the impulse about the ball center results in angular momentum:

$$x\hat{F} = I\omega = \frac{2}{5}mR^2\omega \quad (2)$$

Solving for and equating the impulse from Equations 1 and 2 yields:

$$\left(\frac{\omega}{v/R}\right) = \frac{5}{2}\left(\frac{x}{R}\right) \quad (3)$$

The term on the left side of Equation 3 is the spin rate factor (SRF), expressed as a percentage of the natural roll rate of the ball (v/R). The x/R term is the offset factor, expressed as a percentage of the ball radius.

The typical maximum recommended offset to not risk miscues is approximately:

$$x_{\max} := \frac{9}{16} \cdot \text{in} \quad \text{with} \quad R := 1.125 \cdot \text{in}$$

which corresponds to an offset factor of:

$$\frac{x_{\max}}{R} = 0.5$$

The spin rate factors for various offsets are:

$$\text{SRF}(x) := \frac{5}{2} \cdot \frac{x}{R} \quad \text{SRF}(0\text{-in}) = 0 \quad \text{SRF}\left(\frac{x_{\max}}{2}\right) = 0.625 \quad \text{SRF}\left(\frac{2}{5} \cdot R\right) = 1 \quad \text{SRF}(x_{\max}) = 1.25$$

stun shot 62.5% of natural roll natural roll 25% more than natural roll

The maximum spin rate factor observed in HSV A.98-A.109 (in A.106) was:

$$\text{SPR}_{\max} := 1.37$$

which, from Equation 3, corresponds to an offset factor (x/R) of:

$$\frac{2}{5} \cdot \text{SPR}_{\max} = 0.55$$