"The Lag Shot"

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*Supporting narrated video (NV) demonstrations, high-speed video (HSV) clips, and technical proofs (TP), and all of my past articles, can be accessed and viewed online at **billiards.colostate.edu**. The reference numbers used in my articles will help you locate the resources on the website. If you have a slow or inconvenient Internet connection, you might want to view the resources from a CD-ROM or DVD. Details can be found online at: **dr-dave-billiards.com**.*

The topic for this article is the lag shot, which is used to determine who breaks first. Lag shots aren't typically used in league play; but they are often used in tournaments. The winner of the lag has a big advantage in being awarded the first break, especially in a winner-breaks event. Even in alternating-break format, the lag shot can be the determining factor of the match if it goes hill-hill and the winner of the lag gets to break for the deciding game.

Last month, we looked at recommended tip contact-point heights for different situations and indicated that the optimal height for consistent speed/distance control is 0.2R, as illustrated in **Diagram 1**. This is the best tip height to target when shooting a lag shot. **Diagram 2** shows why. The graph, which is from the math and physics analysis in **TP B.12**, shows how cue ball (CB) travel distance varies with tip height, for a given cue speed. With a center-ball hit (point "A"), the cue moves the CB forward initially with the most speed, but the CB slows as it slides (drags) across the cloth and develops forward roll. With a maximum above-center hit (point "C"), at the miscue limit (0.5R), the CB doesn't require drag to develop roll, but the forward speed of the ball is much less due to the off-center hit, thus the CB travels a much shorter distance with the same cue speed as with the center-ball hit. At close to 0.2R (point "B"), the CB starts with slightly less speed than a center-ball hit, but also starts with some topspin, so not as much speed is lost as forward roll develops. As a result, the CB travels farther (about 11 feet for point "B" compared to about 9.5 feet for point "A" and about 7 feet for point "C") Therefore, for the longest CB travel distance with a given cue speed, make contact at the 0.2R height.

Not only does the 0.2R tip height result in the maximum CB travel distance, more importantly for the subject of this article, it also provides the best distance consistency given unintended variances in tip height. This is illustrated by the green and purple range bars in the diagram. The horizontal (green) bars show identical tip height changes at each target height, and the vertical (purple) bars show the resulting changes in CB travel distances. At 0.2R (point "B"), the tip height change makes very little difference in the travel distance (see the short purple bar), but at 0.0R (point "A") and 0.5R (point "C"), the change in CB travel distance is about a foot! The obvious moral of this story is: if you aim the tip at the 0.2R height with a given cue speed, even if actual contact is a little lower or higher than intended, its travel distance will not be much different than expected. Aiming at other heights will result in less consistency.

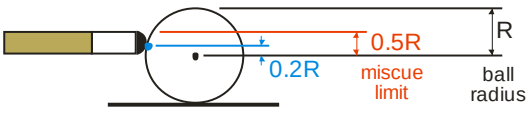

Diagram 1 Optimal lag tip height

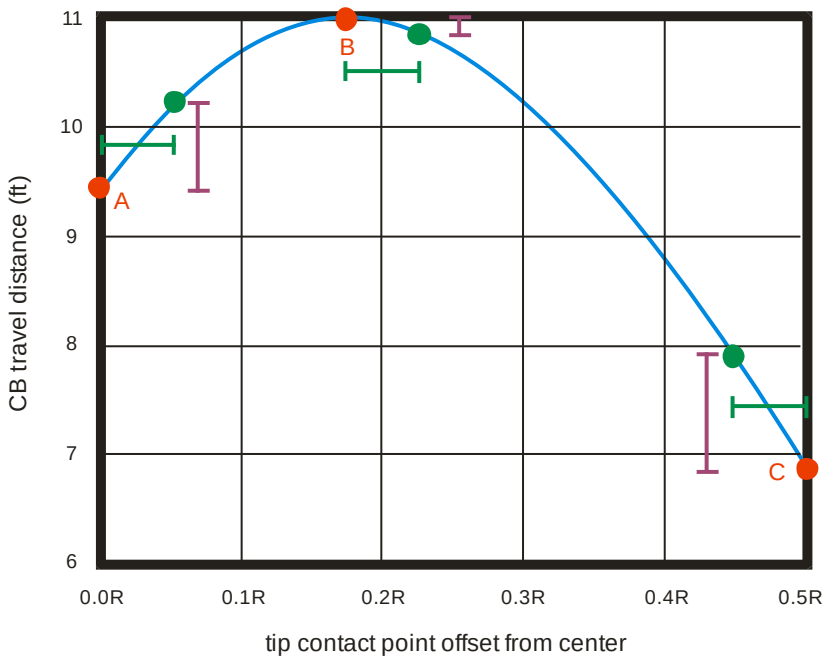

Diagram 2 CB travel distance vs. tip height for a given cue speed

Diagram 3 illustrates some additional advice concerning the lag shot. Diagram 1a shows the range of lag shot positions you might expect if you attempt to leave the CB just short of the cushion. Sometimes, you will reach the cushion (see the red position marked “long”), and sometimes you will come up well short (see the blue position). Most times, you will fall somewhere else in the “expected range” (see the purple bar). The average of all these possible outcomes is shown as the ghost ball in the center of the range. Compare this with Diagram 1b, which shows what happens if your average position is against the cushion instead. With speed inconsistencies similar to that in Diagram 1a, the shortest position will be short by the same amount. However, the distance to the long position will be less because, as demonstrated in **HSV B.15**, when the CB rebounds off a cushion, it typically loses about half of its speed. Therefore, a ball going long off the cushion will come out about half as far as a ball left short with a comparable speed difference from the average. Thus, the expected range of positions will be smaller. Diagram 1c shows an even better situation. If your average speed has the CB rebounding off the cushion by a small amount, both the shortest and longest positions will then be closer to the cushion as a result of the rebound speed-loss effect. The moral of this story is also apparent: you should always strive to try to bounce the CB off the cushion. On average, your final position will be better than if you didn’t.

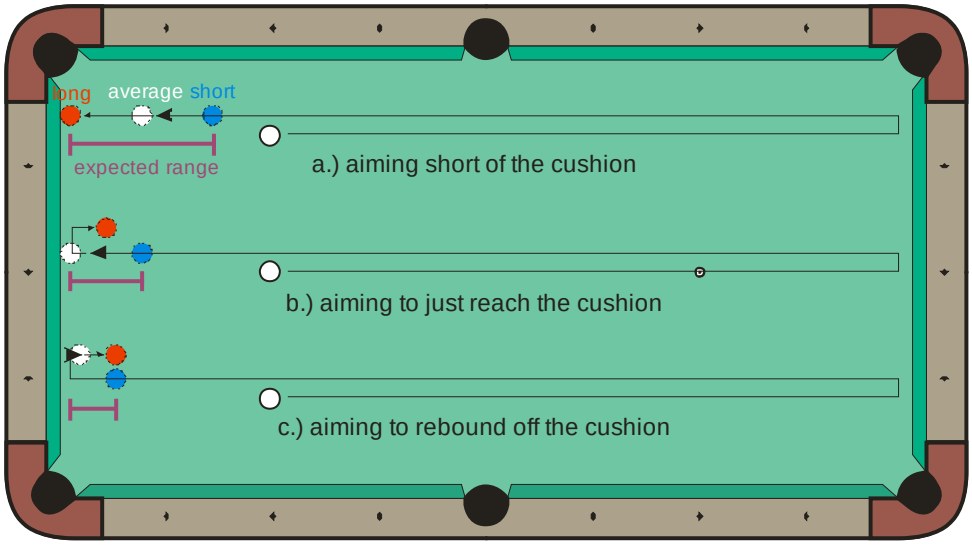

Diagram 3 Lag cushion effect

technical proof

TP B.12 - Optimal tip height for speed/distance control

high-speed video

HSV B.15 – Straight-on kick shot rebound losses and spin changes for roll, stun, and draw shots

I hope this article gives you a new appreciation for the lag shot. In summary, the recommendations are: hit the CB slightly above center (at 0.2R), and use enough speed to rebound off the cushion. If you aren't doing this already, try it out and see if your results improve. As mentioned at the beginning of the article, even a slight edge with the lag shot can make a big difference, possibly being the deciding factor in the outcome of a match or tournament.

Good luck with your game,
Dr. Dave

PS:

- I know other authors and I tend to use lots of terminology, and I know not all readers are totally familiar with these terms. If you ever come across a word or phrase you don't fully understand, please refer to the online glossary on my website.
- I want to thank Jim Valasina. He graciously proof-reads my articles every month to help find errors and make suggestions. My article quality is better as a result of his efforts. Thanks again Jim!

Dr. Dave is author of the book, DVD, and CD-ROM: "The Illustrated Principles of Pool and Billiards," the DVD Series: "The Video Encyclopedia of Pool Shots," and the DVD: "High-speed Video Magic."