David Alciatore ("Dr. Dave") **ILLUSTRATED PRINCIPLES**

"Draw Shot Primer – *Part IV: game examples*"

***Note**: Supporting narrated video (NV) demonstrations, high-speed video (HSV) clips, and technical proofs (TP) can be accessed and viewed online at www.engr.colostate.edu/pool. The reference numbers used in the article (e.g., **HSV 3.1**) help you locate the resources on the website. If you have a slow or inconvenient Internet connection, you might want to view the resources offline using a CD-ROM. See the website for details.*

This is the fourth article in a series dealing with draw shot principles. In the last three months, we explored some of the basic physics of draw shots, compared various aiming systems for predicting the path of the cue ball, and looked in detail into the trisect aiming system. This month, we'll look at some real examples where this knowledge can pay off in game situations.

Diagram 1 illustrates the *trisect system* that was described in detail in last month's article. For a "typical" draw shot, with good action, the angle between the final cue ball direction and the impact line (2A) is twice the cut angle (A). Remember from previous months that a "typical" amount of draw is defined as the amount of backspin required to change the cue ball's direction by 90° for a half-ball hit. For a draw shot with less action than "typical," the angle labeled 2A in Diagram 1 will be larger than 2A; and for a draw shot with lots of action, the angle will be smaller than 2A. Please refer to last month's article for all of the details and advice, especially how to use your hand to help measure the cut angle and visualize the final cue ball direction. Note – if you want to refer back to any of my past articles, they are available on my website (www.engr.colostate.edu/pool).

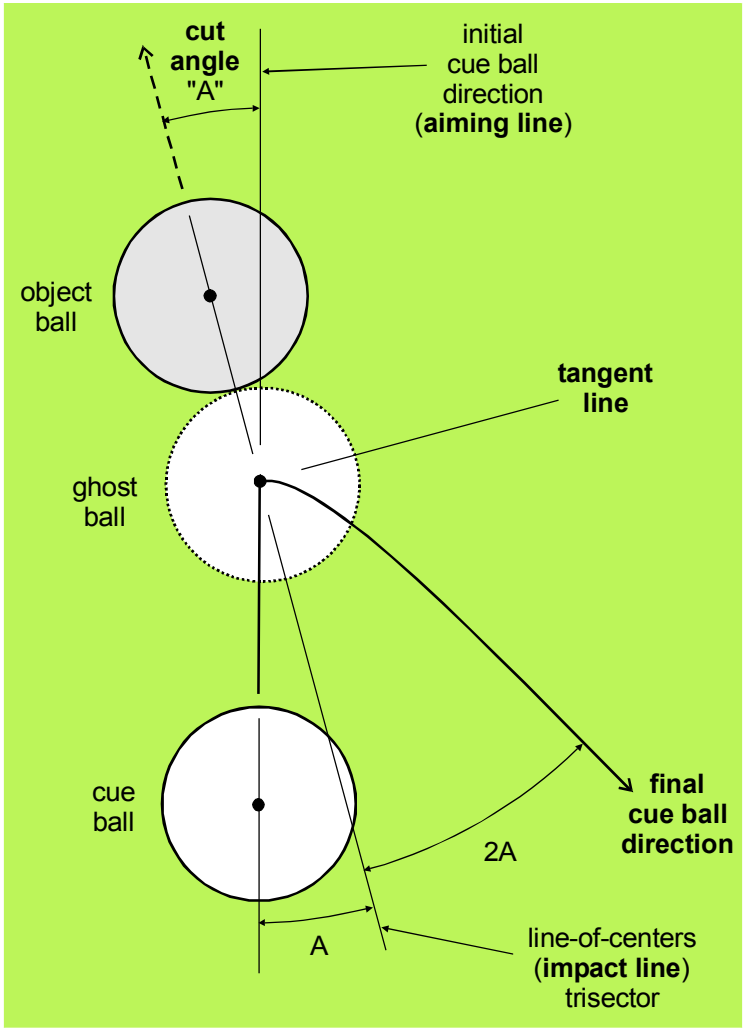

Diagram 1 Draw shot trisect system

When using the trisect system, it is also important to be aware of the effects of shot speed. The cue ball loses backspin with distance (due to friction between the cue ball and the table's cloth), especially at lower speeds (e.g., see **HSV 3.1**). Therefore, to achieve the same amount of draw for a lower speed shot, you need to strike the cue ball lower than with a faster speed shot. Also, shot speed affects the shape of the cue ball path. With more speed, the cue ball travels farther down the tangent line before turning to the final direction (e.g., see **NV 4.21**). Again, see last month's article for more details.

high-speed video

HSV 3.1 – Stop shot showing loss of bottom spin over distance

normal video

NV 4.21 – Delay of draw curve with higher speed

Diagram 2 shows an example where the trisect system can be used to plan a carom draw shot in a game of 9-ball. Before looking at the shot shown in the diagram, first study the table layout. The 3-ball is the lowest numbered ball on the table (so it must be hit first), and the 4-ball

and 5-ball are tied up in a cluster up table. What would you do in this situation? There are several options. You could shoot the 3-ball into top-left corner pocket, but you would likely face the 4-ball-5-ball cluster on your next shot. You could try to break up the cluster with the cue ball while pocketing the 3-ball (e.g., by using top and/or right English, with speed, to have the cue ball travel one or two rails to the cluster), but this might be difficult. And even if you did make contact with the cluster, you might not leave a good shot on the 4-ball after the break out. A second option is to play safe by hitting the 3-ball into the 4-ball-5-ball cluster while leaving the cue ball frozen to (or at least close to) the right side of the 7-ball, blocking a direct path to the new 3-ball location up table. If executed well, all balls would be free and clear, your opponent would likely be unable to play a decent shot (or even make contact) with the 3-ball, and you should have a decent chance to run the table on your next turn. A third option is shown in the diagram. Here, a draw carom is played off the 3-ball to pocket the 9-ball and win the game. This creative offensive shot is probably the best option of the three considered, provided you are comfortable with draw shots and the trisect aiming system. Also, even if you miss the shot, your opponent will still need to deal with the 4-ball-5-ball cluster.

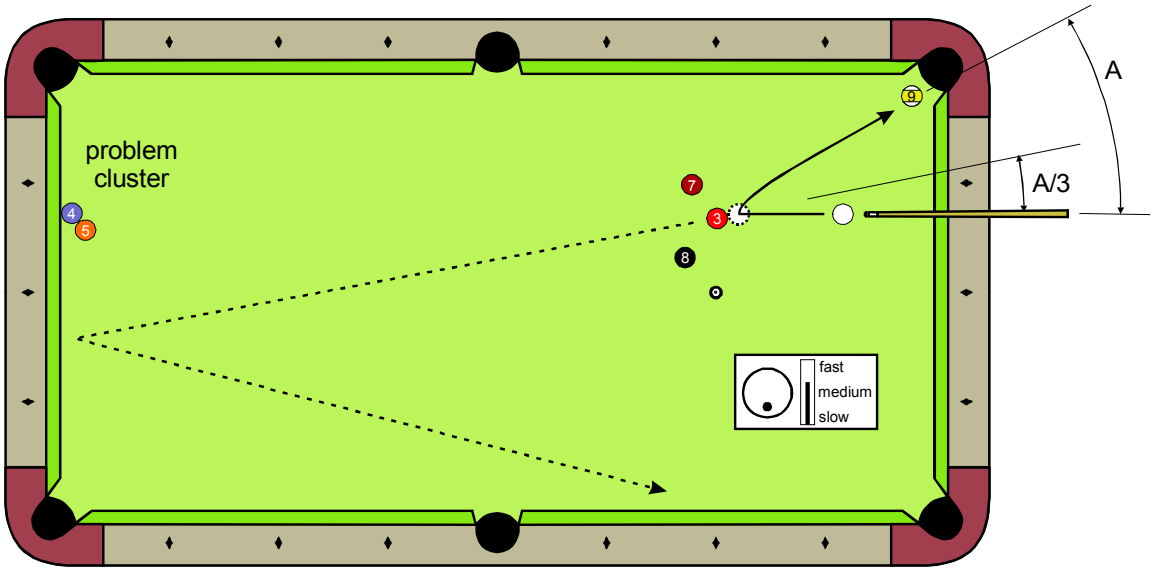

Diagram 2 Example 9-ball trisect carom draw shot

To execute the draw carom shot shown in **Diagram 2**, you need to decide how much to cut the 3-ball to have the cue ball draw back to pocket the 9-ball. You must ensure that the total angle between the aiming line and desired cue ball direction (angle “A” in the diagram) is three times the cut angle (“A/3” in the diagram). It is clear what angle “A” must be in this shot. The tough part is visualizing one third of this angle to define the aiming line. However, once you think you have your aiming line figured out, you can use the hand method I presented last month to check yourself. Then you can make adjustments to your aim if necessary. Also, as mentioned above, the trisect system applies only for a good draw shot with a “typical” amount of draw action. If you don’t have a consistent stroke and/or if you don’t have a good feel for the amount of draw, you might have some difficulty. Also, depending on the exact ball positions and angles on the shot, you might need to be careful with where the 3-ball is headed. You wouldn’t want to pocket the 3-ball by accident while missing the 9-ball. If that were to happen, you would be in a difficult situation facing the 4-ball-5-ball cluster on the next shot, and the cue ball might even be snookered (blocked) by the 7-ball or 8-ball. As with all shots in all articles in this magazine and in any books you might read, you should try the shots yourself (on a real life table). But first make sure you have a good feel for a “typical” amount of draw (see last month’s article for some advice on how to practice this). Also, if you have trouble visualizing one third of the total angle, use the

hand technique to check yourself (see last month's article). Don't feel bad if you have trouble making the shot because it takes lots of practice to develop a consistent draw stroke and to visualize the angles.

Diagram 3 shows another example shot, this time from a game of 8-ball, where knowledge of the trisect system can help you get out of a bind. You are shooting solids and the 2-ball is tied up with the 12-ball on the upper cushion. The diagram shows a desirable option, where you pocket the 5-ball in the bottom left corner pocket while breaking up the cluster with the cue ball. In this example (unlike with the previous example), you are not free to choose the cut angle. The required cut angle is shown as "A" in the diagram. The trisect system would predict a final cue ball path in the direction labeled as "trisect system direction." Notice angle "2A" from the impact line to the predicted direction. Last month, I showed an easy way to use your hand to visualize the cut angle ("A") and reliably predict the expected cue ball direction. As compared to the example above (in Diagram 2), it is much easier to apply the hand method here because the required cut angle is known. Notice that the expected cue ball direction, as predicted by the trisect system, represents too much draw (i.e., the cue ball will miss the cluster to the right). Therefore, you need to use a little less than "typical" draw to accomplish the break out.

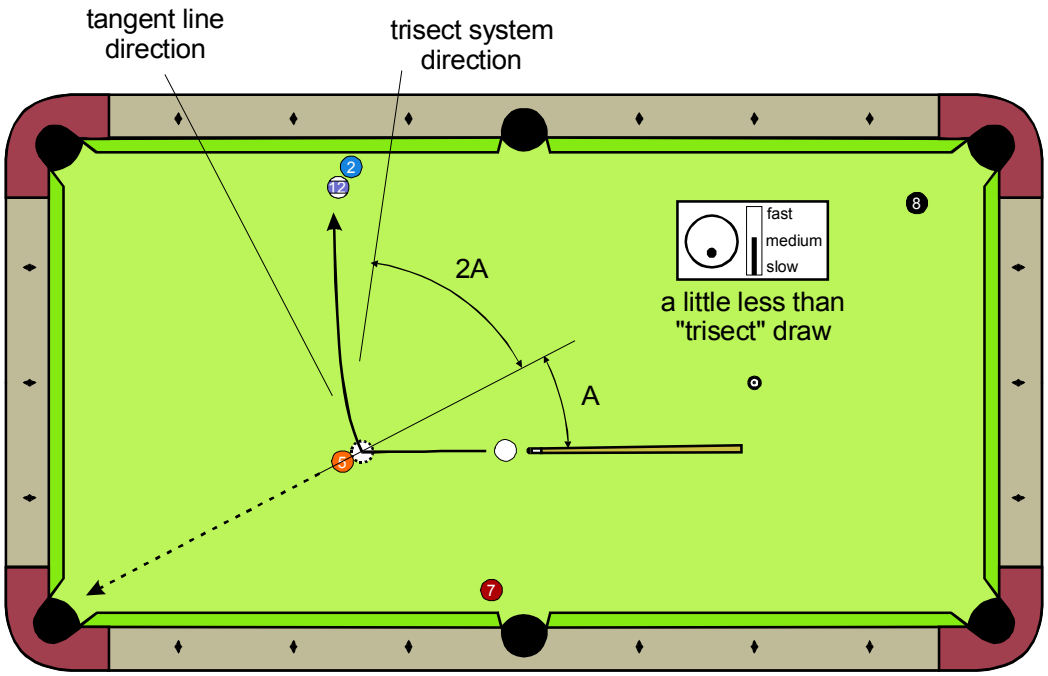

Diagram 3 Example 8-ball "less-than-trisect" draw break-up shot

Another useful reference direction shown in **Diagram 3** is the tangent line. As predicted by the 90º rule, the cue ball would head straight in the tangent line direction for a stun shot, where the cue ball has no bottom spin at object ball impact. Because the desired cue ball direction is closer to the trisect direction than it is to the tangent line, you shouldn't take too much draw action off the cue ball. This is the kind of thing that takes practice ... you need to develop a feel for and control over the amount of draw needed for various paths close to the trisect direction. Ideally, the cue ball would hit the left side of the 12-ball to leave good position for the 7-ball shot in the lower side pocket. **Diagram 4** shows a possible (and desirable) post-5-ball-shot layout and run-out plan for winning the game.

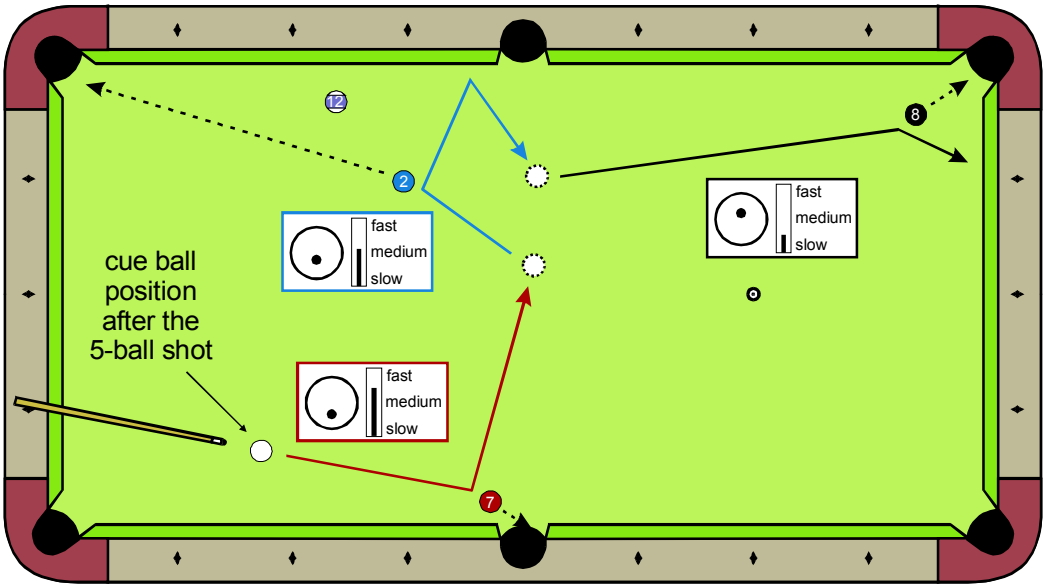

Diagram 4 Table layout and run-out after 5-ball shot in Diagram 3

I hope you are enjoying my series of articles on draw shot physics and aiming. I also hope you see some value in having knowledge and understanding of draw shot physics and the trisect aiming system. Maybe you will be able to put some of the information to good use in future games. Next month, I'll summarize some useful advice on how to improve your draw shot technique and refer you to some drills that might help you in practice.

Good luck with your game,
Dr. Dave

PS:

- If you want to refer back to any of my previous articles and resources, you can access them online at *www.engr.colostate.edu/pool*.

Dr. Dave is a mechanical engineering professor at Colorado State University in Fort Collins, CO. He is also author of the book: "The Illustrated Principles of Pool and Billiards."