BY David Alciatore Ph.D.

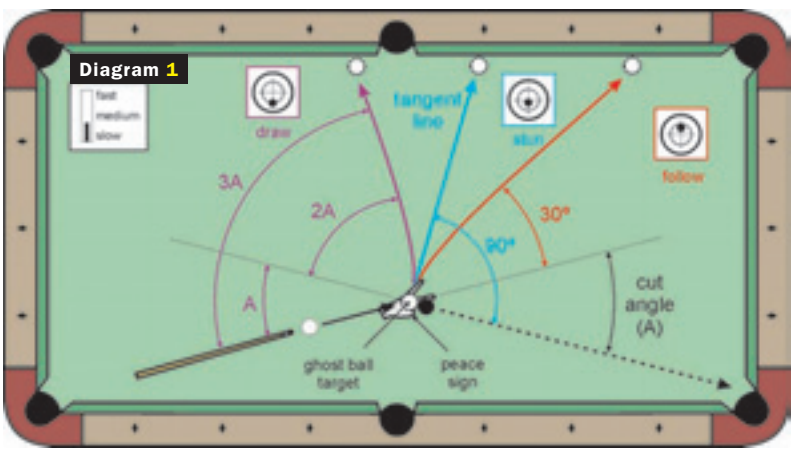
POSITION CONTROL

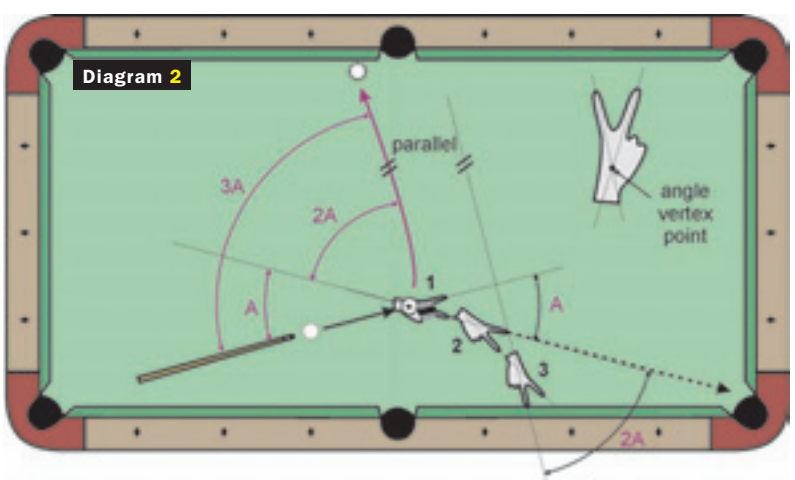
Use the "peace sign" to make the cue ball do your biding.

[Note: Supporting narrated video (NV) demonstrations, high-speed video (HSV) clips, and technical proofs (TP) can be accessed and viewed online at **billiards.colostate.edu.** *The reference numbers used in the article help you locate the resources on the Web site. You might want to view the resources on a CD-ROM or DVD. Details can be found at dr-dave-billiards.com.]*

THIS IS the fifth article in a series on fundamentals. This month we will start looking at important issues related to cue-ball control. An important skill in pool, beyond pocketing balls, is being able to predict fairly accurately where the cue ball will go during a shot. This skill is useful for avoiding scratches (e.g., see **NV 3.7, NV 3.10,** and **NV B.46**), playing position for the next shot (e.g., see **NV 5.1** and **NV 5.2**), and planning and executing carom shots (e.g., see **NV 7.2-7.4** and **NV B.46**) and breakout shots (e.g., see **NV B.46**). **Diagram 1** illustrates several reference lines that are useful in predicting the cue ball's path and direction. The first and most well known reference line is the tangent line predicted by the 90º rule (the blue shot in the diagram). For a stun shot (aka a "stop shot at an angle"), where the cue ball is sliding with no top or bottom spin at object-ball impact, the cue ball will head exactly in the tangent-line direction (assuming perfect balls), which is perpendicular to the object-ball direction. FYI: A convenient one-page summary of the 90º rule can be found in the instructor/student resources section of my Web site under "summaries." In **NV B.43**, I demonstrate several methods for using the cue and your hand to help you visualize the tangent line.

Another useful reference direction is for a rolling cue ball, where the 30º rule applies. The rule predicts that over a wide range of cut angles, between a 1/4-ball and 3/4-ball hit, the cue ball will deflect by very close to 30º from its original direction after hitting the object ball (see the red shot in Diagram 1). Demonstrations can be viewed in **NV 3.8-3.10**, and more information can be found in my April '04 and June '05 articles. If you want to be more precise, the deflection angle is a little more than 30º (about 34º) closer to a 1/2-ball hit and a little less (about 27º) closer to a 1/4-ball or 3/4-ball hit. If you want an easy way to use your hand to accurately visualize the cue-ball direction, use the Dr. Dave peace-sign technique. A firm, but relaxed, "peace sign" is very close to 30º for most people, so if you point one finger in the original direction of the cue ball, the other finger will point in the final direction of the cue ball (see the "peace sign" in Diagram 1 and demonstrations in **NV 3.8** and **NV B.43**). In **NV B.44**, I show how you can use angle templates and your opposite hand to help you calibrate your "peace sign," not only for the average 30º angle, but for other useful references as well (e.g., 27º and 34º). FYI: The angle templates and a convenient one-page summary of the 30º rule can be found in the instructor/student resources section of my Web site.





A third useful reference for cue-ball control is the draw direction predicted by the "trisect system." It applies for a draw shot with good draw action, and for cut angles smaller than about 40º (i.e., ball-hit fraction greater than about 3/8). By "good draw action," I mean you are hitting quite low on the cue ball (near the miscue limit) and with enough speed so that not much bottom-spin wears off (i.e., there is very little "drag") on the way to the object ball. For details on the system, see my March '06 article. It is called the "trisect system," because the cut angle of the shot is 1/3 of the total angle between the original and final cue-ball directions (see the purple shot in Diagram 1 with angles "A"

and "3A"). Again, this applies only for "good action" draw shots where the cut angle is less than about 40º.

You can use a modified version of the Dr. Dave peace-sign technique to predict the cue-ball direction for draw shots also. As shown in **Diagram 2**, you point one finger in the direction of the initial cue-ball direction and you point the other finger in the desired object-ball direction. This defines the cut angle for the shot. Most people can comfortably form angles up to 40º with the index and middle fingers; but if you have trouble, you can use your thumb and index fingers instead. Because most people cannot comfortably form angles much larger than 40º with a stretched peace sign, the technique also ensures you don't apply the trisect system for larger cuts where it doesn't apply. Ideally, the vertex of the angle (i.e., the point where the finger lines meet in the base of the hand, as shown in the top-right portion of Diagram 2) should be centered directly over the center of the ghost-ball target. If you pivot your hand twice, moving the original cue ball-direction finger in the direction of the shot, the original object ball-direction finger will now be three-times the cut angle away from the original cue ball-finger direction. As shown in Diagram 2, with each pivot, one finger should be rotated until it reaches the original direction of the other finger. If you have trouble visualizing where to stop each pivot, use the cue (or your other hand) to mark the second finger direction before pivoting your hand to the new position. Diagram 2 shows the second and third hand positions offset from the first hand position (to prevent clutter in the illustration), but in practice it is better to just pivot the hand in place over the ghost-ball target. See **NV B.43** for a demonstration. For the example shot in Diagram 1 and NV B.43, the cut angle for the shot happens to be 30º (because the shot happens to be a 1/2-ball hit). Therefore, the final cue-ball direction is 90º away from (i.e., perpendicular to) the original cue-ball direction (90º = 3 x 30º). For fuller hits, the angle will be less; and for thinner cuts, the angle will be more.

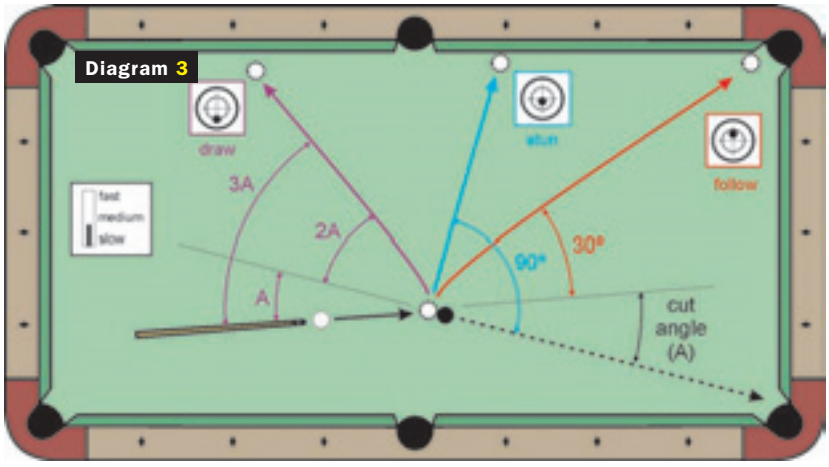


Diagram 3

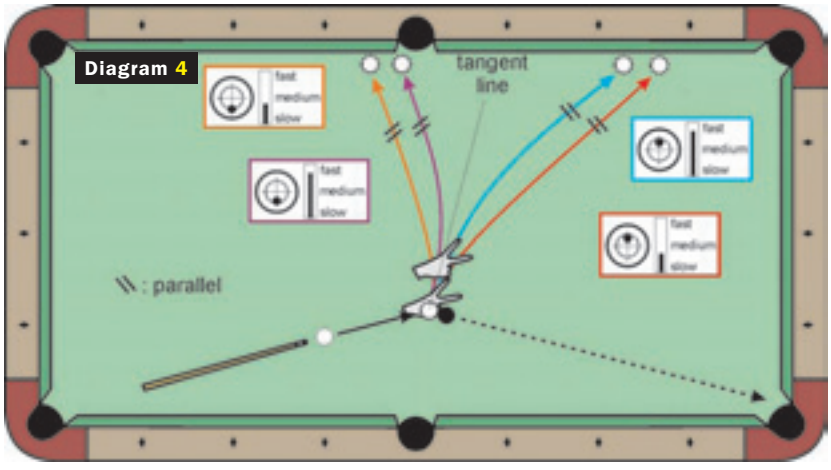


Diagram 4

For shots "in between" all of the cases above, the cue ball will go somewhere between the indicated directions. For example, if you hit the cue ball only slightly above center and it doesn't have full roll at object-ball impact, then the cue ball will head somewhere between the tangent line and the 30º line. With half roll, it would go about halfway in between. The only way to get a feel for how much "in between" the cue ball will go is to practice ... a lot!

For different cut angles, all of the reference lines are different. **Diagram 3** shows where the lines would be for the same object-ball location as in Diagram 1, but with a different cue ball location, creating a fuller hit (smaller cut angle). As you can see, for smaller cut angles, the references lines are farther apart. Likewise, for larger cut angles (thinner hits), the lines get closer, converging on the tangent line (e.g., see HSV B.23).

Diagram 4 illustrates the effects that shot speed has on the exact path of the cue ball. For a stun shot, speed has no effect on the cue-ball path. The cue ball heads and persists along the tangent-line direction, regardless of shot speed. But with draw or follow shots, speed does have an effect on the path of the cue ball. Regardless of the amount of top or bottom spin, the cue ball always starts along the tangent line. With faster speed, the cue ball stays closer to the tangent-line longer before the ball curves to the final direction predicted by the reference lines described above. For slow-speed shots, the cue ball departs away from the tangent line almost immediately, and the curving of the cue ball is almost imperceptible. In these cases, the cue ball heads straight in the reference-line direction almost immediately off the object ball (e.g., see the slower red and orange shots in Diagram 4). The effect of increased speed can easily be visualized by shifting the "peace-sign" hand along the tangent line (see the peace sign shift in the diagram for the blue shot). The faster the shot, the more you shift your hand along the tangent line. The shift offsets the reference line a different amount for each speed, but the final direction of the cue ball is the same (i.e., the lines are parallel) at all speeds.

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