
Note: 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 the article 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.

This is the fifth article in a series on fundamentals. In the last four months, I've covered the stroke, the basics of aiming, issues involved with cut-shot aiming systems, and the effects of bridge length. This month we will start looking at important issues related to cue ball (CB) control. An important skill in pool, beyond pocketing balls, is being able to predict fairly accurately where the CB 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 break-out shots (e.g., see **NV B.46**). **Diagram 1** illustrates several reference lines that are useful in predicting the CB's path and direction. The first and most well known reference line is the *tangent line* predicted by the 90° rule (the blue shot in the diagram). For a stun shot (AKA a “stop shot at an angle”), where the CB is sliding with no top or bottom spin at object ball (OB) impact, the CB will head exactly in the tangent-line direction (assuming perfect balls), which is perpendicular to the OB direction. For more information, see my [January '04](#) and [March-June '05](#) articles. FYI, a convenient [one-page summary of the 90° rule](#) can be found in the instructor/student resources section of my website under “summaries.” In **NV B.43**, I demonstrate several methods for using the cue and your hand to help you visualize the tangent line.

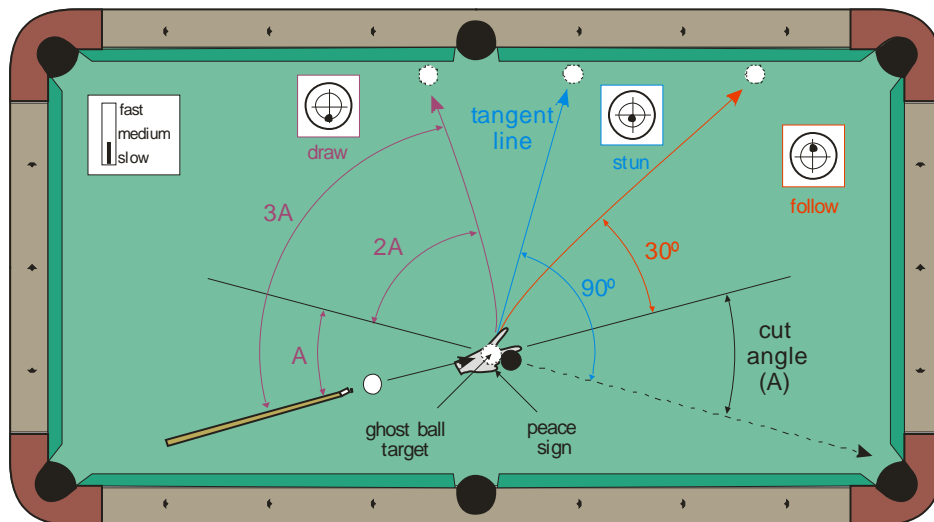


Diagram 1 Useful CB reference lines



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- [NV 3.7](#) – Using the 90° rule to check for and prevent a scratch
- [NV 3.10](#) – Using the 30° rule to check for and prevent a scratch
- [NV 5.1](#) – Using speed and angle-control to pocket a three-ball sequence
- [NV 5.2](#) – Using speed and angle-control to pocket another three-ball sequence
- [NV 7.2](#) – Cue ball billiard shot
- [NV 7.3](#) – Object ball carom shot
- [NV 7.4](#) – 30° rule billiard shot
- [NV B.43](#) – CB position control stun, roll, and draw reference lines
- [NV B.46](#) – CB path scratch avoid, cluster break-out, and carom examples

Another useful reference direction is for a rolling CB, where the 30° rule applies. The rule predicts that over a wide range of cut angles, between a 1/4-ball and 3/4-ball hit, the CB will deflect by very close to 30° from its original direction after hitting the OB (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 30° (about 34°) closer to a 1/2-ball hit and a little less (about 27°) 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 CB direction, use the Dr. Dave peace-sign technique. A firm, but relaxed, “peace sign” is very close to 30 for most people, so if you point one finger in the original direction of the CB, the other finger will point in the final direction of the CB (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 30° angle, but for other useful references as well (e.g., 27° and 34°). FYI, the [angle templates](#) and a convenient [one-page summary of the 30° rule](#) can be found in the instructor/student resources section of my website.



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- [NV 3.8](#) – Using your hand to visualize the 30° rule
- [NV 3.9](#) – 30° rule example
- [NV 3.10](#) – Using the 30° rule to check for and prevent a scratch
- [NV B.44](#) – Dr. Dave 30° rule peace-sign hand calibration

A third useful reference for CB 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 40° (i.e., ball-hit fraction greater than about 3/8). By “good draw action,” I mean you are hitting quite low on the CB (near the miscue limit) and with enough speed so not much bottom-spin wears off (i.e., there is very little “drag”) on the way to the OB. 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 CB 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 40°.

You can use a modified version of the Dr. Dave peace-sign technique to predict the CB direction for draw shots also. As shown in **Diagram 2**, you point one finger in the direction of the initial CB direction and you point the other finger in the desired OB direction. This defines the cut angle for the shot. Most people can comfortably form angles up to 40° 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 40° with a stretched peace sign, the hand technique also ensures you don't use 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 CB-direction finger in the direction of the shot, the original OB-direction finger will now be three-times the cut angle away from the original CB-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 GB 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 30° (because the shot happens to be a 1/2-ball hit). Therefore, the final CB direction is 90° away from (i.e., perpendicular to) the original CB direction ($90^\circ = 3 \times 30^\circ$). For fuller hits, the angle will be less, and for thinner cuts; the angle will be more. Again, for more information, refer back to my [March '06 article](#).

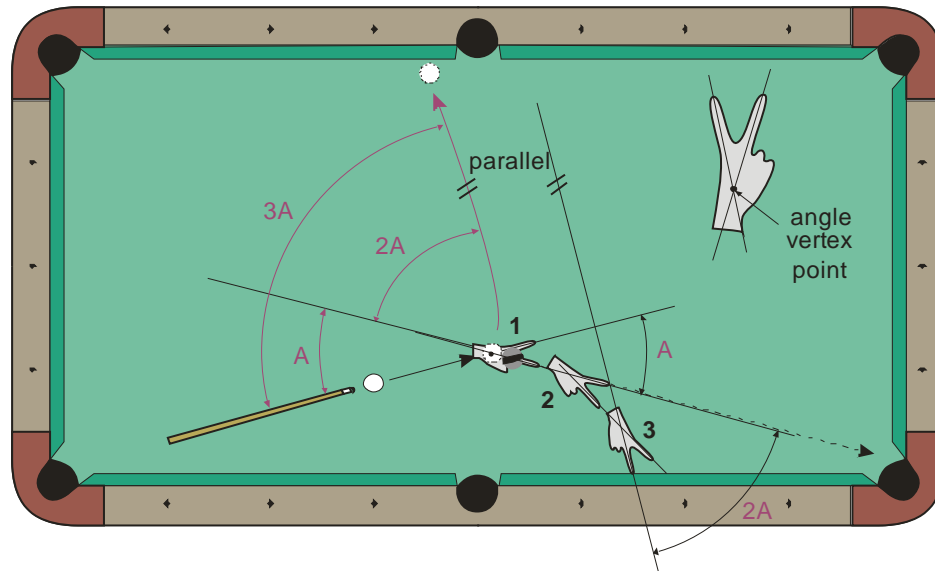


Diagram 2 Trisect system peace-sign technique

For shots "in between" all of the cases above, the CB will go somewhere in between the indicated directions. For example, if you hit the CB only slightly above center and CB doesn't have full roll at OB impact, then the CB will head somewhere in between the tangent line and the 30 line. With half roll, it would go about halfway in between. The only way to get a feel for how much "in between" the CB will go is to practice ... a lot! **NV B.46** shows how judgment and small adjustment come into play. The video also provides good examples of how all of the principles in this article are applied in shot examples.

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

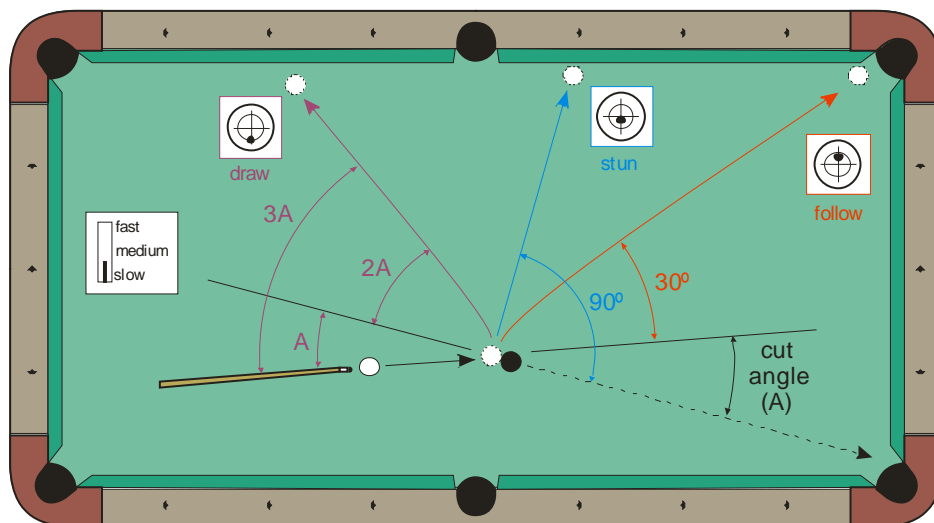
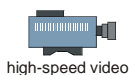


Diagram 3 Reference lines for a different cut angle



HSV B.23 – Cue ball path speed, spin, and cue elevation effects

Diagram 4 illustrates the effects shot speed has on the exact path of the CB. For a stun shot, speed has no effect on the CB path. The CB 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 CB. Regardless of the amount of top or bottom spin, the CB always starts along the tangent line. With faster speed, the CB 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 CB departs away from the tangent line almost immediately, and the curving of the CB is almost imperceptible. In these cases, the CB heads straight in the reference-line direction almost immediately off the OB (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 CB is the same (i.e., the lines are parallel) at all speeds. My [June '05 article](#), **NV B.45**, and **HSV B.23** offer good illustrations, explanations, and demonstrations of this effect.

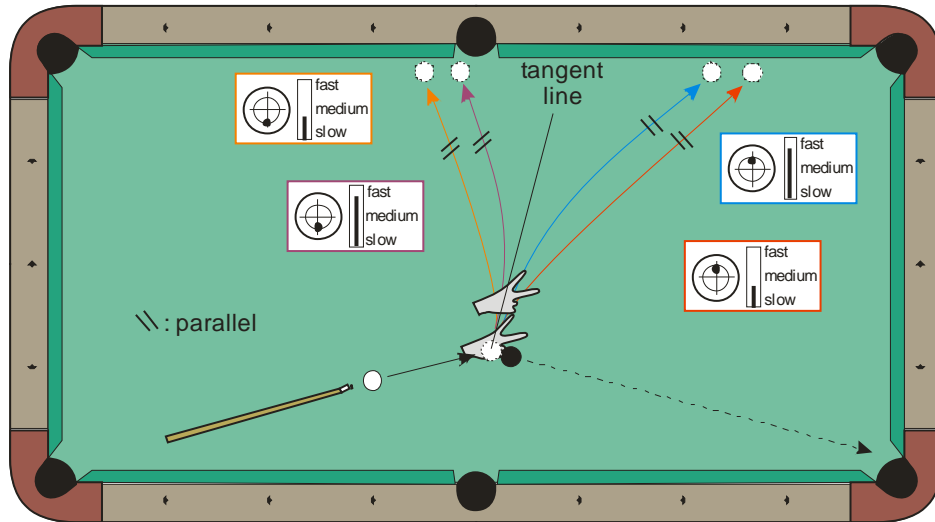


Diagram 4 Speed effects



NV B.45 – Cue ball path speed effects

Well, I hope you are enjoying and benefiting from my series of articles on fundamentals. Over the next three months, we will continue looking at important issues related to CB control. Specifically, we will look at some examples, thin and full hits, and speed control.

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 billiards.colostate.edu.
- I know other authors and I tend to use lots of terminology (e.g., squirt, throw, stun, impact line, etc.), 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 "Jal" on the BD CCB online forum. 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 a mechanical engineering professor at Colorado State University in Fort Collins, CO. He is also author of the book, DVD, and CD-ROM: "[The Illustrated Principles of Pool and Billiards](#)," and the DVD: "[High-speed Video Magic](#)."