David Alciatore ("Dr. Dave")

ILLUSTRATED PRINCIPLES

The 30° rule: Part III – Carom vs. Cut

__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 (e.g., __NV 3.8__) help you locate the resources on the website. If you don't have access to the Internet, or if you have a slow connection (e.g., a modem), you may want to view the online resources from a CD-ROM. To order one, send a check or money order (payable to David Alciatore) for $21.45 to Pool Book CD; 626 S. Meldrum St.; Fort Collins, CO 80521. The CD-ROM is compatible with both PCs and MACs.

As I pointed out in my last two articles, if you don't know the 30º rule yet, learning it can truly transform your game. Like the 90º rule presented in my previous series of three articles, the 30º rule helps you predict the path of the cue ball after impact with an object ball. You might recall that the 90° rule applies only for stun shots, where the cue ball strikes an object ball with no topspin or bottom spin. However, with many shots the cue ball is rolling (with topspin) by the time it strikes the object ball. This is where the 30° rule comes in handy.

My article two months ago (April, 2004) introduced the 30º rule, when it applies, and how it is used in practice. My previous article (May, 2004) showed some real examples of how you can use the rule in your game to prevent scratches, plan break-up or avoidance shots, and execute carom or billiards shots. In this article, I discuss how the 30º rule can be used to help you choose between a carom shot and a cut shot for a very interesting example.

The key points of the 30º rule are summarized in **Principle 2** and illustrated in **Diagram 1**. The rule states that if the cue ball hits approximately half of the object ball (see **Diagram 2**), the cue ball will deflect off at very close to 30° from its original path. An exact half-ball hit, where the center of cue ball is aimed at the edge of the object ball, is illustrated in **Diagram 2**.

Principle 2 30° rule

When the cue ball hits an object ball with normal roll close to a half-ball hit (see Diagram 2), the cue ball will deflect approximately 30° away from its initial aiming line (see Diagram 1, NV 3.8, and NV 3.9).

- The 30° rule applies only when the cue ball is rolling without skidding at object ball impact.
- There is a fairly large margin of error. In other words, for a fairly large range of ball-hit fractions (i.e., cut angles), the cue ball path will still deflect by approximately 30° (see **TP 3.3**).

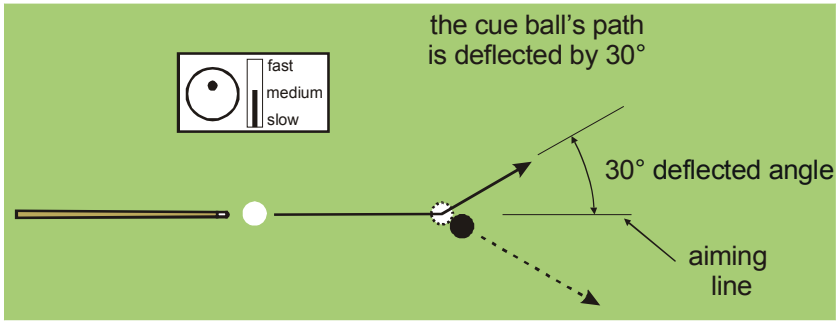

Diagram 1 30° rule

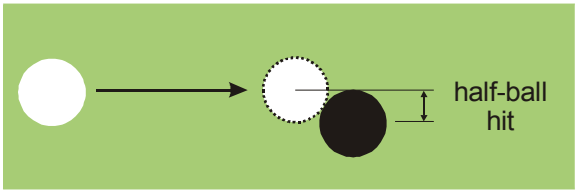

Diagram 2 Half-ball hit

technical proof

TP 3.3 – 30° rule

normal video

NV 3.8 – Using your hand to visualize the 30° rule
NV 3.9 – 30° rule example

Diagram 3 shows the table layout I want to consider in this article. The 1-ball is on the foot spot, the 9-ball is in the jaws of the top-right corner pocket, and the cue ball is on the head string to the right of the head spot. There are many different shot options in this situation, but the two I want to consider are the cut shot illustrated in **Diagram 4** and the carom shot illustrated in **Diagram 5**. Another reasonable shot attempt would be a 1-ball-9-ball combination, but I will not be considering that alternative here. You may be saying to yourself: "The table layout in **Diagram 3** is not going to come up very often." That may be true, but similar situations may present themselves where a carom shot might be an option to consider as an alternative to a cut shot. Also, as you will see by the end of the article, you might want to use this shot as a challenge to friends or naive bystanders that are careless with their money. The challenge would be: "I bet I can make more carom shots in a row than you can make cut shots" (per **Diagrams 4** and **5**). It turns out that the carom shot is much easier to execute than the cut shot ... by far!

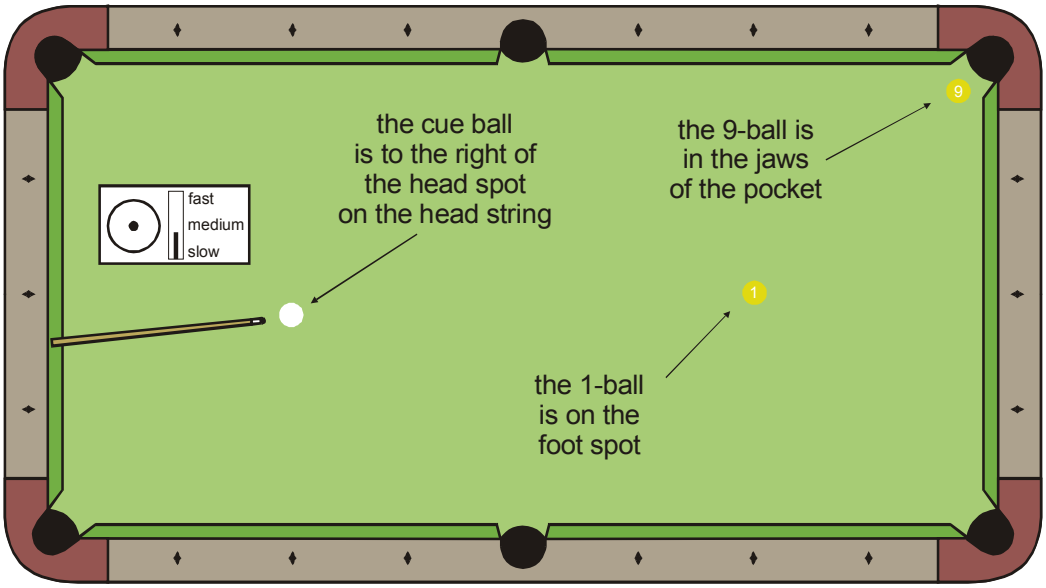

Diagram 3 **Example table layout**

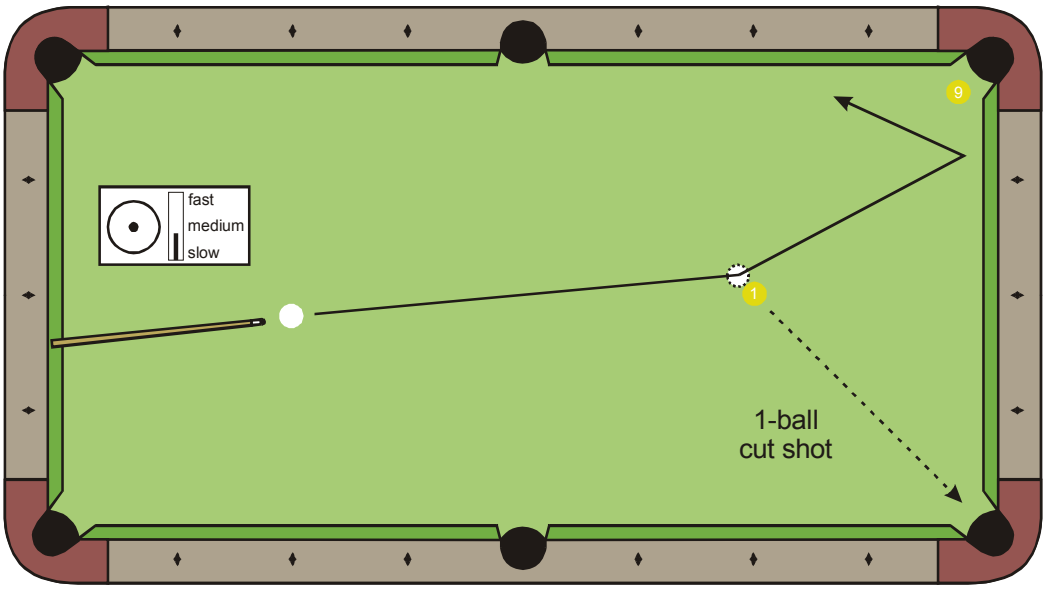

Diagram 4 **Cut shot**

Diagram 5 illustrates the carom shot and why it is so easy to execute. The required angular deflection of the cue ball path happens to be exactly 30º. Because of this, there is an extremely large margin of error for the shot, as illustrated in **Diagram 6** (see **TP 3.3**). You can hit as little as 1/4 of the 1-ball and as much as 3/4 of the 1-ball and still have the deflected cue ball path be very close to 30º, and make the shot.

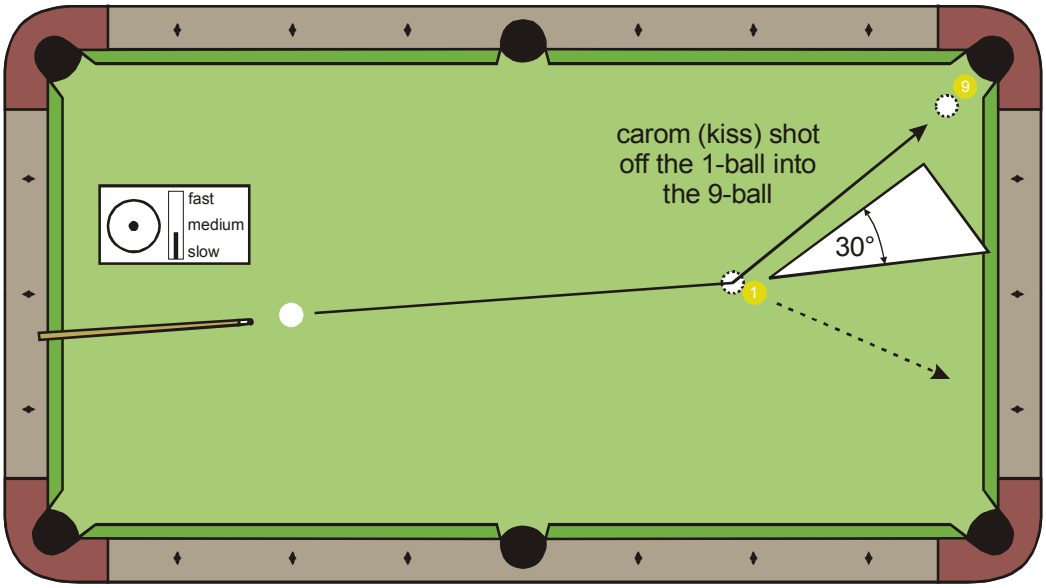

Diagram 5 Carom shot

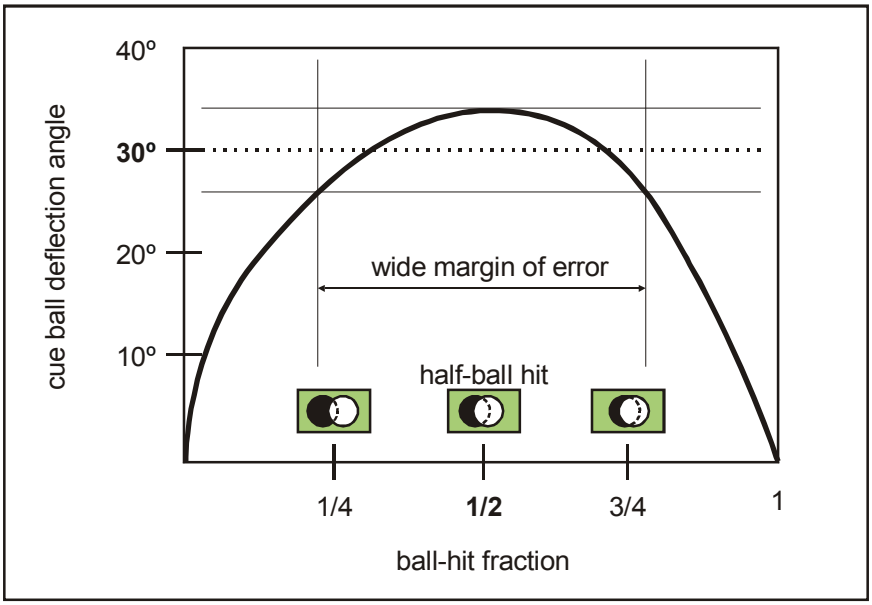

Diagram 6 Carom shot wide margin of error

You may be asking yourself: "How much easier is the carom shot vs. the cut shot?" Well, being the nerdy engineer that I am, I had to answer this question with a detailed and thorough mathematical analysis (see **TP A.2**). It turns out that the carom shot is about 10-times easier to make than the cut shot! It's not just 10% or 20% easier; it is about 900% easier!!! The allowable cue-ball angle error (i.e., the margin of error) for the carom shot is about 1.5º (see **TP A.2**). This is fairly easy to achieve for even amateurs. The margin of error for the cut shot (see **TP 3.4**) is only about 0.15º. Even a pro would not be totally confident in staying within that margin consistently. Actually, the carom shot is even easier than these numbers imply, because my analysis (**TP A.2**) only considers geometry. Another advantage of the carom shot is that it is very easy to visualize the aiming line because you are aiming for a half-ball hit (see **Diagram 2**). With

a half-ball hit, you aim directly at the edge of the 1-ball (which is very easy to see). For the cut shot, you must visualize the ghost ball target necessary to create the required cut angle (see **NV 3.1**). If you watch **NV A.1**, where I attempt the cut shot and carom shot 5 times each, you will see that I am extremely careful with the cut shot attempts, making sure all of my fundamentals are solid and my concentration level is high. I make 4 out of 5, which is fairly good, but I would not have total confidence in making the shot if I had to face it in a critical point of an important game. For the carom shot attempts in the video, I am almost careless, not even really aiming, but I still make 5 out of 5. If I were to give the carom shot the same care as the cut shot, I am confident that I would never miss it. In fact, I would bet anybody in the world any amount of money that I could make more carom shots in a row than they could make cut shots (per **Diagrams 4** and **5**). This is a great example where a little knowledge of the game can give you a huge advantage. In general, carom shots can be much easier to execute than other more obvious options (see **Principle 4**). I encourage you to try the experiment I demonstrate in **NV A.1**. I'm sure you will see similar results with the carom shot.


technical proof

TP 3.4 - Margin of error based on distance

Principle 4 A carom shot is sometimes better than a combo or tough cut

When available, a carom shot with normal roll is usually a better option than a difficult combination shot or an extreme cut shot.

- The margin of error for a rolling carom shot is fairly large (see **Diagram 6**), provided the speed is slow.
- Combination shots can be much more difficult than they seem (as will be presented in a future article).
- The margin of error for a large cut-angle cut-shot can be extremely small (see **TP 3.4**).

Most shots and aiming methods (e.g., for planning bank and kick shots) work on any size table (i.e., you don't need to modify the methods based on the size of the table). The carom shot in **Diagram 5** is an exception. For different size tables, the relative size of the balls compared to the table changes because the balls are the same size on all tables. This relative size difference changes the angles on the carom shot. To adjust for table size, you must shift the initial cue ball placement (see **TP A.1**). For a 6.5' table, you should place the cue ball about one ball to the right of the head spot. For an 8' table, the offset should be about 2-3 balls. And for a 9' table, the offset should be about 3-4 balls. In **NV A.1**, the cue ball offset used on the 8' table was only about 1 ball. An offset of 2-3 balls (on an 8' table) would increase the margin of error even more.


normal video

NV A.1 - Cut shot vs. carom shot example
NV 3.1 - Practicing contact point and ghost ball visualization


technical proof

TP 3.3 – 30° rule
TP A.1 - Half-ball hit, foot-spot carom shot
TP A.2 - Carom shot vs. cut shot example

I hope, by now, you appreciate the potential power of the 30º rule. The example presented in this article is a good illustration of how useful it can be. Also, the 30º rule is an essential tool in position play, where it is important to know where the cue ball will go after impact with an object ball. The 30º rule applies for most pool shots, where the cue ball is rolling at object ball impact and where the cut angle is in a reasonable range (with a ball-hit fraction between 1/4 and 3/4) (see **TP 3.3** and **Diagram 6**). It always surprises me how few people know the 30º rule and how to apply it. Also, it is shocking to me that most pool and billiards books give little (if any) coverage

of this extremely important principle. I hope this series of articles will help you incorporate this useful principle into your game.

Have fun and practice hard,
Dr. Dave

Dr. Dave is a mechanical engineering professor at Colorado State University in Fort Collins, CO. His book, "The Illustrated Principles of Pool and Billiards," is coming out this August.