

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 my first article in a series dealing with the important topics of aiming, alignment, and sighting. Let's start with some definitions:

aiming: determining the line of the cue necessary to send the cue ball (CB) to the desired ghost-ball (GB) position to cut the object ball (OB) the required amount for the shot.

alignment: how you position your body and head to best enable you to place and stroke the cue along the desired line.

sighting: eye alignment and line of focus used to best visualize and achieve the desired aiming line.

Over the next few months, we will look at each of these topics in detail. This month, we will focus on the basics of aiming.

Diagram 1 illustrates some important terminology. The ghost ball (GB) is the imaginary CB position at OB impact that sends the OB in the desired “target direction.” The “line of centers” through the GB and OB define the necessary contact point (CP) for the shot. The required “aiming line” of the shot defines the alignment for the cue, assuming a center-ball hit (i.e., no English). Shown in the bottom-left of the diagram is the ball-overlap as seen from the shooter's point of view. This illustrates an important fact concerning aiming: From the shooter's perspective, the CP is always in the center of the lens-shaped area defined by the projection of the CB onto the OB.

Before continuing, I should mention that the target direction shown in Diagram 1 is the “ideal” path of the OB, in a frictionless world. In reality, the OB will be thrown off this path slightly by an effect called cut-induced throw (CIT). For more information on this topic, see [NV B.86](#) and the [“throw” FAQ page](#) on my website. Regardless of how you aim cut shots, you need to compensate for CIT (especially with slow stun shots at cut angles close to 30°, where throw is maximum). Also, when using English, your aim must be adjusted for squirt, swerve, and spin-induced throw (SIT). For more info on these topics, see [NV B.70](#) and the [“aim compensation” FAQ page](#) on my website.

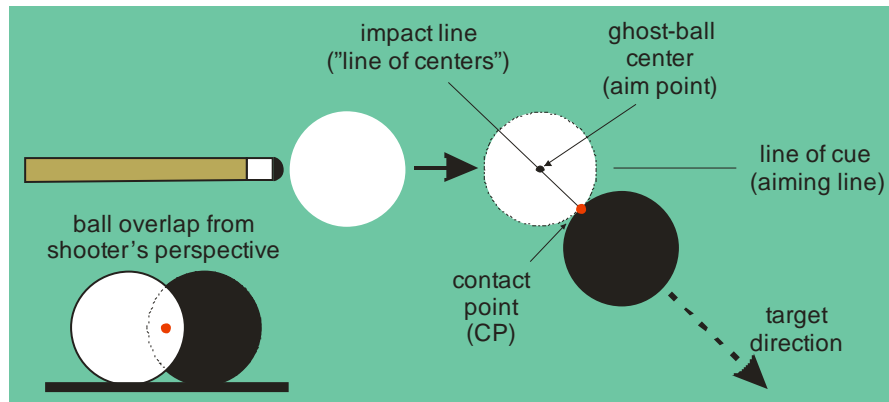


Diagram 1 Basic aiming terminology

Diagram 2 illustrates three common reference shots often cited in discussions about aiming. The dotted lines on the CB and OB represent quarter divisions of the balls. Ball-hit fraction is one approach used to describe the amount of cut needed on a particular shot. This number represents the percentage of ball-overlap. With a $\frac{1}{4}$ -ball hit, the CB overlaps $\frac{1}{4}$ (25%) of the OB, creating a 48.6° cut angle. A $\frac{1}{2}$ -ball hit overlaps $\frac{1}{2}$ (50%), resulting in 30° . And a $\frac{3}{4}$ -ball hit overlaps $\frac{3}{4}$ (75%), resulting in a 14.5° cut. FYI, cut angles for all ball-hit fractions can be found in [TP A.23](#). Again, with center ball hits, the actual angles created at the table will be a little less than reported due to CIT.

The red lines in Diagram 2 represent alternative $\frac{1}{4}$ -point sighting lines. For example, to create a $\frac{1}{2}$ -ball hit, you can aim the inside edge of the CB at the center of the OB, or you can aim the center of the CB at the outside edge of the OB. You can also aim CP to CP, aligning the inside $\frac{1}{4}$ of the CB with the outside $\frac{1}{4}$ of the OB. The $\frac{1}{2}$ -ball hit is a good reference shot because it is very easy to visualize a line through the CB's center and the OB's edge, especially when sighting directly over the cue. This useful alignment is often referred to as the CTE (Center To Edge) line. Notice that with $\frac{1}{2}$ - and $\frac{3}{4}$ -ball hits, there is a clear aiming line through the center of the CB and one of the quarter reference points on the OB. However, with a $\frac{1}{4}$ -ball hit, the line through the center of the CB is outside of the OB, which can be difficult to visualize. This can make the other reference lines (red lines) attractive alternatives for some people. However, as we will see next month, if you sight along an off-center line, your perception of the cue's direction might be misleading. An alternative is to sight through the center of the CB while attempting to visualize and target the entire GB. Another is to imagine and target the resting point of the GB on the cloth. When using this approach, it can help to try to find a visual marker on the cloth at or near the GB resting point (e.g., a chalk mark, discoloration, piece of dirt, or any other visual marker). Alternatively, you can target a point in line with the GB center on a distant rail, or perhaps even another ball.

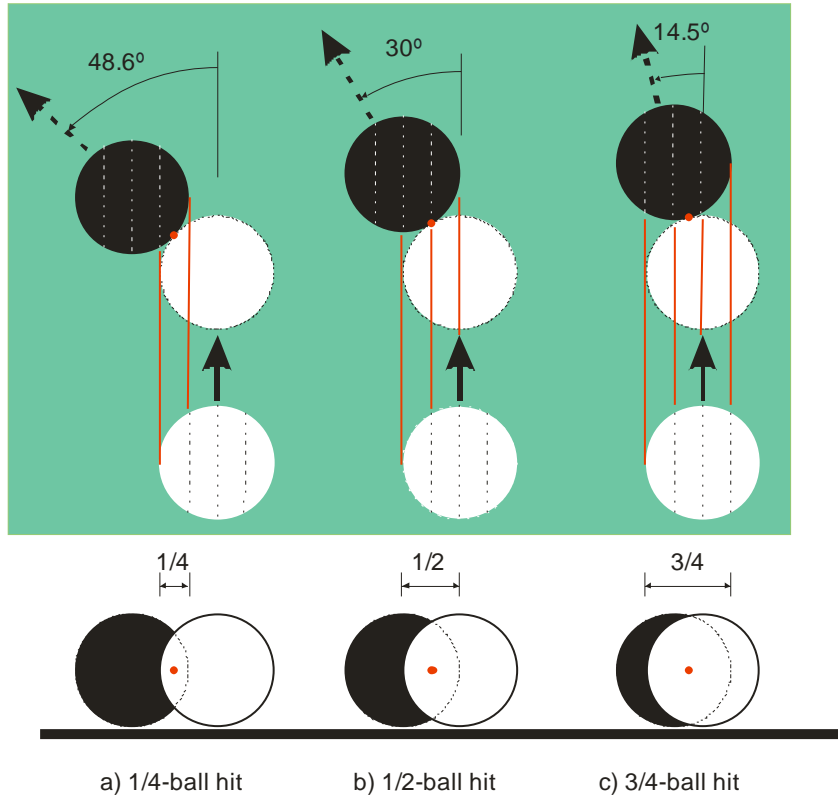


Diagram 2 Ball-hit fractions

If you would like to practice visualizing and executing fractional-ball hits, **Diagram 3** illustrates ball layouts creating each of the three cuts in Diagram 2. The 1-ball is centered on the bottom diamond line, the bottom edge of the 2-ball is about half a ball above the middle diamond line (the long string), and the bottom edge of the 3-ball is right on the top diamond line. As indicated, with the CB positioned as shown, the three balls can be pocketed with $\frac{1}{4}$ -, $\frac{1}{2}$ -, and $\frac{3}{4}$ -ball hits. But remember, the actual OB direction will vary slightly with speed, spin, and conditions because of throw effects.

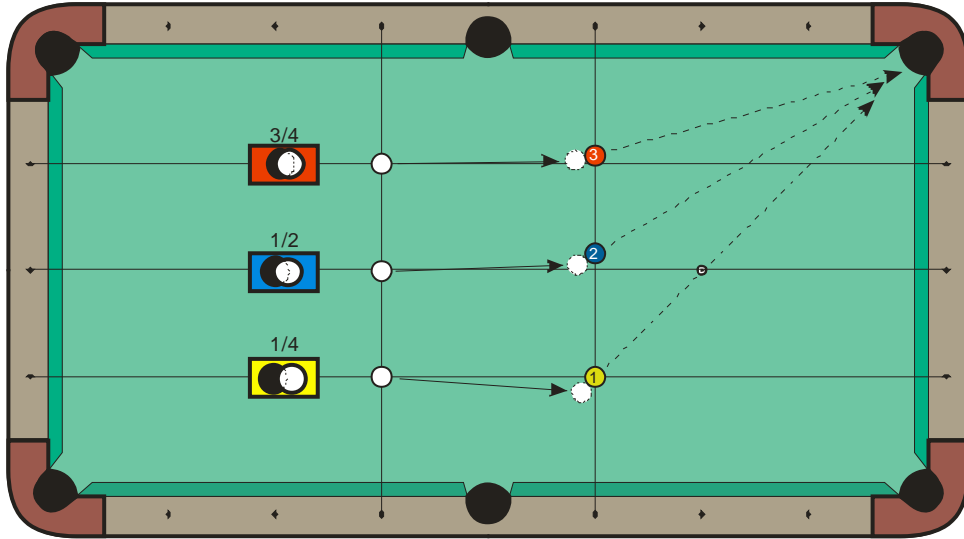


Diagram 3 Standard ball-hit fraction shots

Approaches to aiming vary from person to person. Commonly cited examples include:

- Visualize the GB and align to send the CB to that position.
- Visualize the angle of the shot and the aim line necessary to create that angle.
- Visualize the amount of ball overlap necessary for the amount of cut you need.
- Visualize the required contact point on the OB and aim the CB to create contact at this point.

Some people might also use a combination of these approaches, maybe even choosing different visualizations for different types of shots. Obviously, whatever approach you choose, the key to success is practice. In the [“aiming systems” FAQ page](#) on my website, there is a link to an interesting article: [“How do the Pros Aim?”](#) Most of the pros quoted in the article gave answers similar to those listed above.

A more formal approach to aiming is to use an “aiming system” that prescribes a clear and unambiguous set of steps to help you arrive at the necessary line of aim. One example is the ghost-ball-based cue-pivot method, where you place the tip at the center of the GB position with the cue aligned in the OB target direction, and then pivot the butt of the cue about the tip until the cue is aligned with the center of the CB (see [NV 3.2](#) and my [October '08 article](#)). **Diagram 4** illustrates two other well known systems. The first (Diagram 4a) is the parallel-lines CP-to-CP system, which works as follows:

1. Visualize a line through the center of the OB in the target direction. This locates the CP on the OB.
2. Shift this line to the CB, keeping it parallel to the line in step one (see the blue lines). This defines the CP on the CB.
3. Visualize a line through the CB CP and the OB CP (see the red line).
4. Parallel shift this line to the center of the CB. The result is the required aiming direction (neglecting CIT, of course).

The second system (Diagram 4b) is called “double the distance,” and it works as follows:

1. Visualize the distance “d” from the center of the OB to the desired CP on the OB.
2. Double this distance by adding it to the other side of the CP. This locates the required line of aim through the center of the GB.

Also shown in Diagram 4b, for thinner cuts, it can be easier to visualize the smaller distance “x” from the CP to the outside edge of the OB, which is doubled to locate the inner edge of the GB relative to the CP. More info and illustrations can be found under [“double-the-distance” in the “aiming” FAQ page](#) on my website. Included is a [document from Don Smith](#) that gives more detail on how to use the system. It also shows how the system can result in errors when sighting from a point too close to the OB.

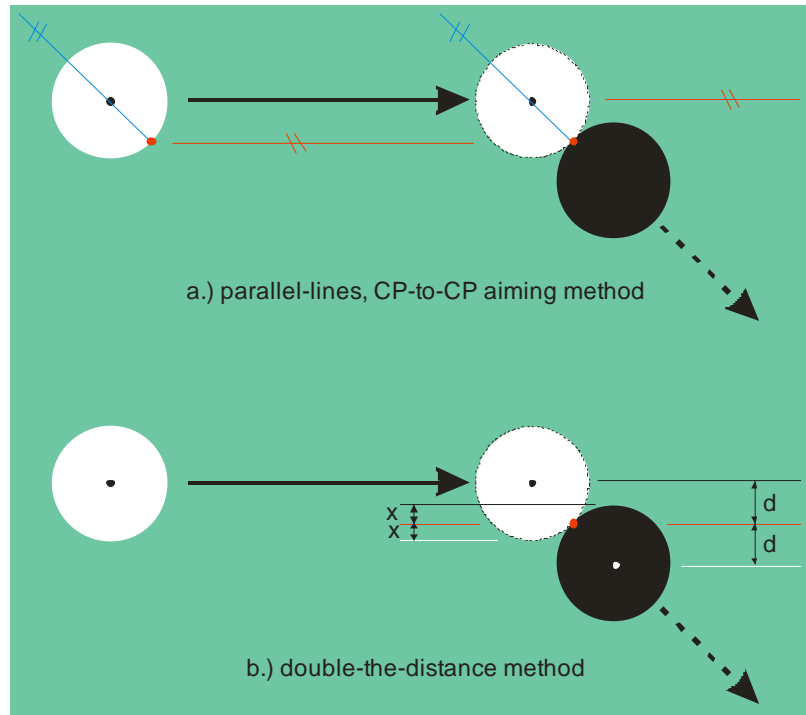


Diagram 4 Basic aiming systems

Some aiming systems are based on aligning and sighting to/from the different CB and/or OB ¼-ball reference points illustrated in Diagram 2. Examples include Hal Houle’s 3-angle system, CTE, and SAM. If you want to learn more about these and other cut-shot aiming systems, see the [“aiming” FAQ page](#) on my website. Any system based on a limited number of lines of aim will obviously not cover a wide range of shots without adjustment (for more info and illustrations, see [“limited lines of aim”](#) on my website’s [“aiming” FAQ page](#)). However, these systems are still of value to some people. If nothing else, these systems can foster a consistent pre-shot routine, focus attention on body and visual alignment, and promote concentration (for more info, see [“benefits of aiming systems”](#) on the [“aiming” FAQ page](#)).

For more information and illustrations related to aiming, see my [October '08](#) and [November '08](#) articles and the [“aiming systems” FAQ page](#) on my website, where links can be found to a collection of relevant articles by fellow BD columnist Bob Jewett. Also, Mike Page has an excellent two-part online video dealing with aiming (see [NV B.3](#)).

Here’s the bottom line: Aiming ain’t easy! If it were, pool would not be as challenging and fun as it is. Please resist the temptation to buy into the “snake-oil” sales pitches common with aiming system “marketing.”

There ain't no "silver bullet!" All we can really do is practice, practice, practice, and then practice some more. We can probably all agree that the best "aiming system" of them all is HAMB ("Hit A Million Balls"). It is certainly the most promising to produce good and consistent results.

I hope you enjoy and benefit from my series of articles dealing with aiming, alignment, and sighting. Next month, we'll look at aiming issues related to visual alignment.



[NV 3.2](#) – Using the cue to help visualize the impact and aiming lines

[NV B.3](#) – Mike Page's aiming video (part 1, part 2)

[NV B.86](#) – Cut-induced throw (CIT) and spin-induced throw (SIT), from VEPS IV

[NV B.70](#) – Squirt, swerve, and throw, from VEPS II



[TP A.23](#) – Ball-hit fraction vs. cut angle

Good luck with your game,
Dr. Dave

PS:

- I know other authors and I tend to use lots of terminology (e.g., squirt, throw, stun, ball-hit fraction, 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 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](#)."