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

"Just How Big are the Pockets, Anyway? – *Part I*"

***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 3.12**) help you locate the resources on the website.*

Did you know that

- the side pocket is typically larger than the corner pocket?
- at slow speeds and certain angles, the corner pocket effective target size is larger than that for a side pocket?
- the part of the pocket you aim at can greatly improve your likelihood of pocketing a shot, especially at high speed?

Also, did you ever wonder

- why the ball sometimes rattles out of the corner pocket when you think you hit the shot well?
- which pocket is better to target (side vs. corner pocket) when you have a option?

Like many good players, maybe you know about all of these issues already because you have built solid intuition from many years of practice and experience (i.e., lots of mistakes). Well, for a geeky engineer like myself, it wasn't good enough to just have an intuitive feel (which I never totally trust). I wanted to know exactly how important these effects are. I also wanted to understand their root causes. In this and my next two articles, I will share the results of some analyses I have done and discuss important principles that might help give you clearer insight into some of these effects.

Before I begin, I want to make it clear that *all pool tables are not created equal*. Pocket size and shape can vary significantly with table size and manufacturer. Also, pockets can be shimmed (decreasing their size) to create more challenging conditions. Coin-operated tables can often be the most out of specification. Often the pocket sizes and shape (e.g., the angle of the pocket walls and how far the pocket opening protrudes onto the playing surface) make it easier to pocket balls. I like to refer to pockets like these as "huge gaping holes." If you think about it, it behooves bar owners to have "generous" pockets on their coin-operated tables. If patrons make shots more easily, they will deposit quarters more frequently, be happier (and drink more "shots"), and want to come back for more. Anyway, for all of my analyses and observations, I assumed the standard and average geometry specifications prescribed by the Billiard Congress of America (BCA) in their Billiards: The Official Rules and Records Book (see the TPs referenced below for specific values).

I will start this series of articles off with some important background information. **Diagrams 1** through **4** illustrate the basic terminology important for understanding shot difficulty. Important factors are the distance between the object ball and the pocket (see **Principle 7**) and the angle of the object ball path from the pocket centerline. As illustrated in **Diagram 1**, when the distance to the pocket is smaller there is a much larger **margin of error**, which is a measure of how much the object ball angle can vary from the target center and still enter the pocket. The **angle to the pocket**, as shown in **Diagram 2**, is measured from the pocket centerline (straight-in) direction. Generally, as this angle gets larger, a shot becomes more difficult because the effective size of the pocket gets smaller at larger angles. **Diagram 2** also shows how the angle-to-pocket error is measured to define the margin of error.

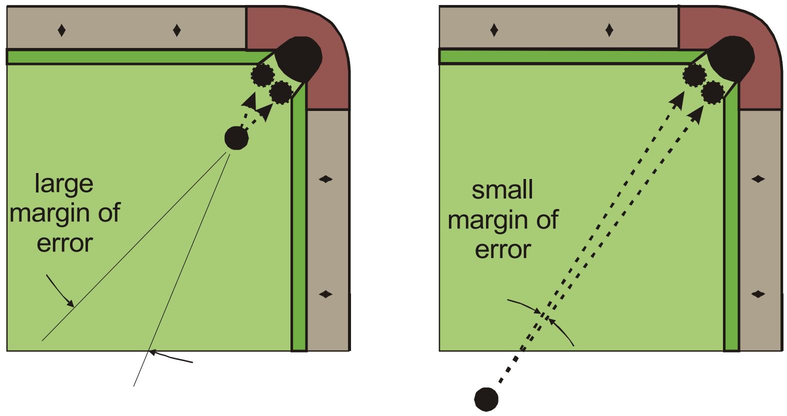


Diagram 1 Margin of error of object ball angle based on distance to the pocket

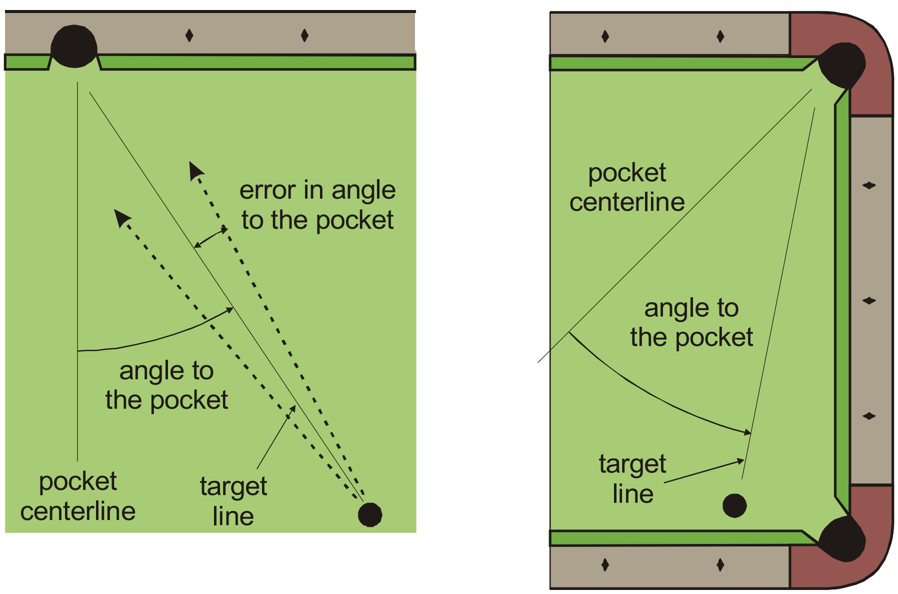


Diagram 2 Angle to the pocket and error in angle to the pocket

Principle 7 Closer to the pocket is better

The margin of error decreases dramatically as the distance to the pocket increases (see Diagram 1).

- See TP 3.4 for the detailed analysis.

technical proof

TP 3.4 – Margin of error based on distance

Diagram 3 illustrates two extreme object ball target positions that result in pocketing the ball in a side pocket for a given angle to the pocket. These positions define the effective **target size** and **target center** of the pocket. The target size is the distance between the two extreme target position object ball paths. The target center is the imaginary line between the two extreme position target lines. The **offset** is the distance between the target center and the imaginary line through the pocket center. For a straight-in shot, where the angle to the pocket is 0º, the offset would be zero and the effective target center is the same as the pocket center.

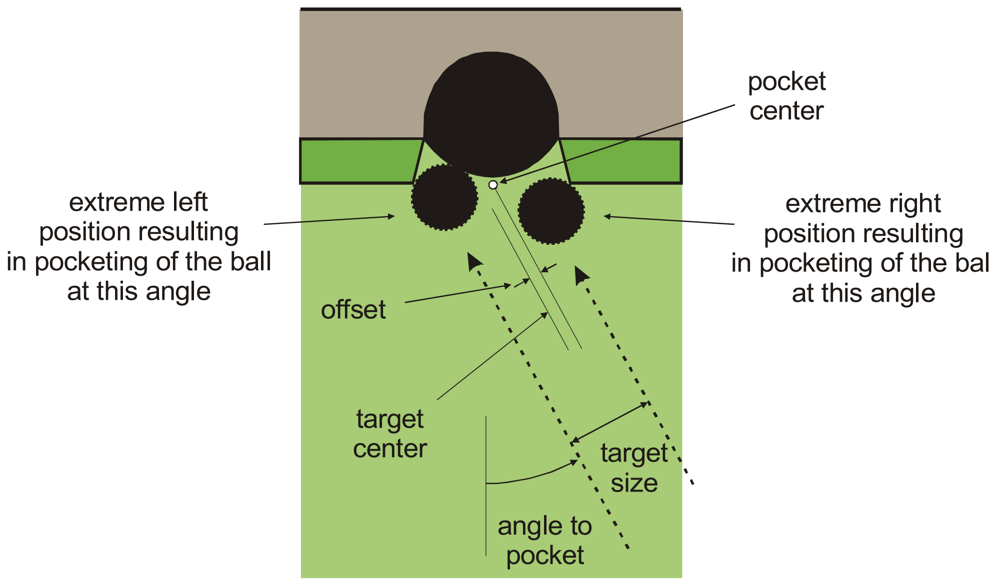
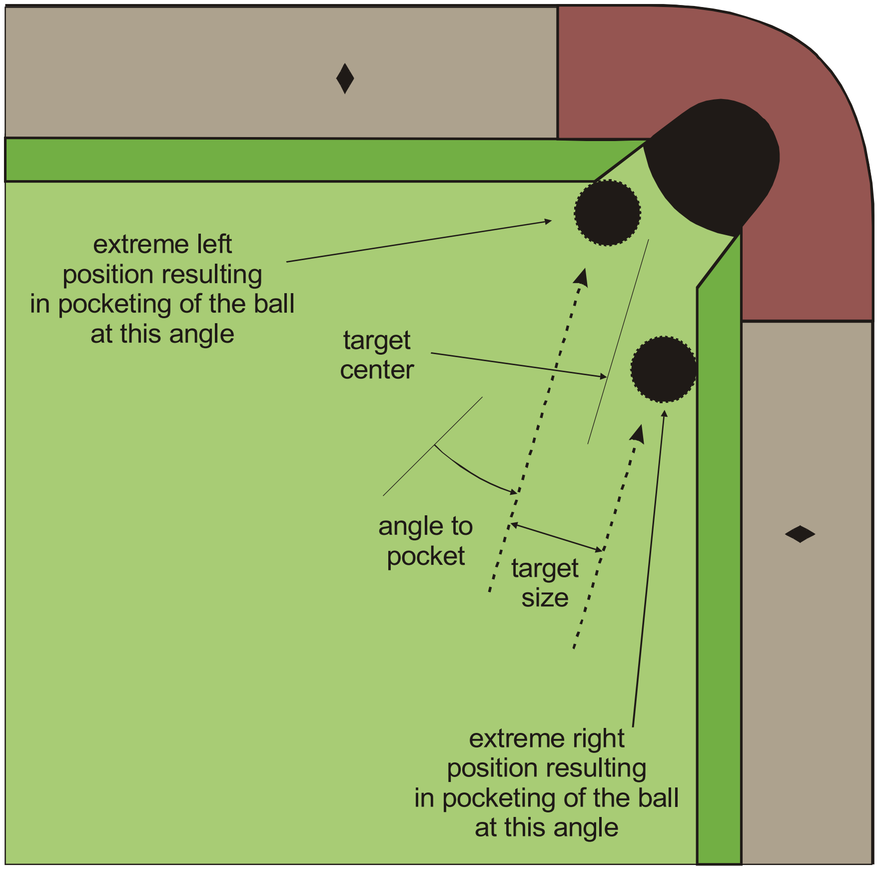


Diagram 3 Effective target size and center for a side pocket

There are several differences between the side and corner pockets. As described in **Principle 8**, the most important difference is that the side pockets are bigger! However, with the corner pockets the object ball can deflect off the near rail and still enter the pocket. This increases the effective target size for the corner pocket at some angles, especially at slower speeds (see **Diagram 4** and **Principle 9**).



<u>Diagram 4</u> Effective target size and center for a corner pocket

<u>Principle 8</u> The side pockets are bigger

The side pockets are bigger than the corner pockets.

- The size of a side pocket opening (approximately 5 1/2 inches), from point to point across the mouth of the pocket, is larger than that for a corner pocket (approximately 5 inches).
- The effective target size can be bigger for corner pockets for balls hit softly at shallow angles to the rail (see **Principle 9**).
- For straight-in shots that must be hit hard, the side pockets are "bigger."

<u>Principle 9</u> The corner pocket is sometimes "bigger" than the side pocket

The effective target size of the corner pocket for a slow hit is larger for shots adjacent to the rail than for straight-in shots.

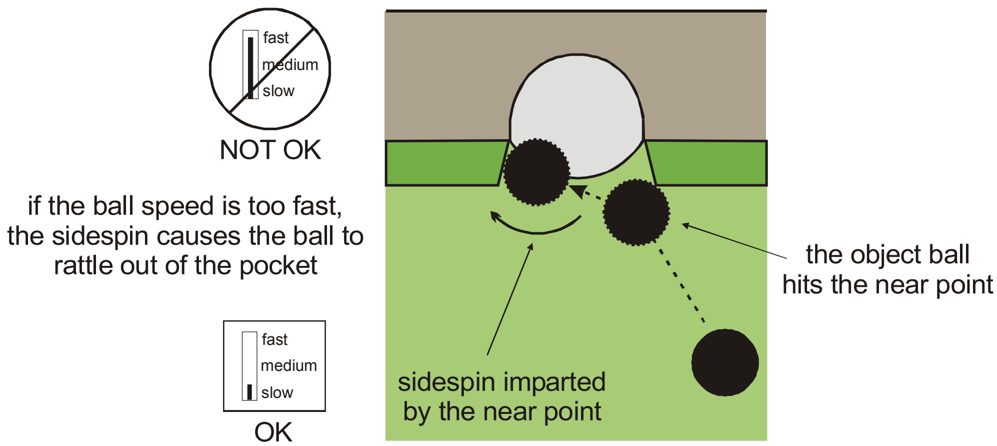
- When the ball is hit harder, the ball is more prone to rattle out, especially if the near rail is glanced first (see **Principle 11**).

When shooting at a side pocket, care must be taken to avoid hitting the near point (see **Principle 10** and **NV 3.12**). As illustrated in **Diagrams 5 and 6**, this is particularly important for a higher speed shot. The reason why the near point must be avoided at high speed is because contact with the point imparts significant sidespin to the ball, which causes the ball to deflect out of the pocket (see **HSV 3.3**). The sidespin is illustrated by the curved arrow in **Diagrams 5 and 6a**. In this case, the point imparts left (clockwise) spin on the ball.

<u>Principle 10</u> With a side pocket, avoid hitting the near point

When aiming at a side pocket from an angle, adjust your aim away from the near point (see Diagram 5 and Diagram 6).

- The reason for this principle is that the point contact causes rail-induced spin that causes the ball to rattle out of the pocket (see **HSV 3.3**).
- As illustrated in **Diagram 3**, the target center is to the left of the pocket center, away from the near point.
- This advice is most important at higher speeds, but it should also be heeded at lower speeds.



<u>Diagram 5</u> Side-pocket near-point speed effect

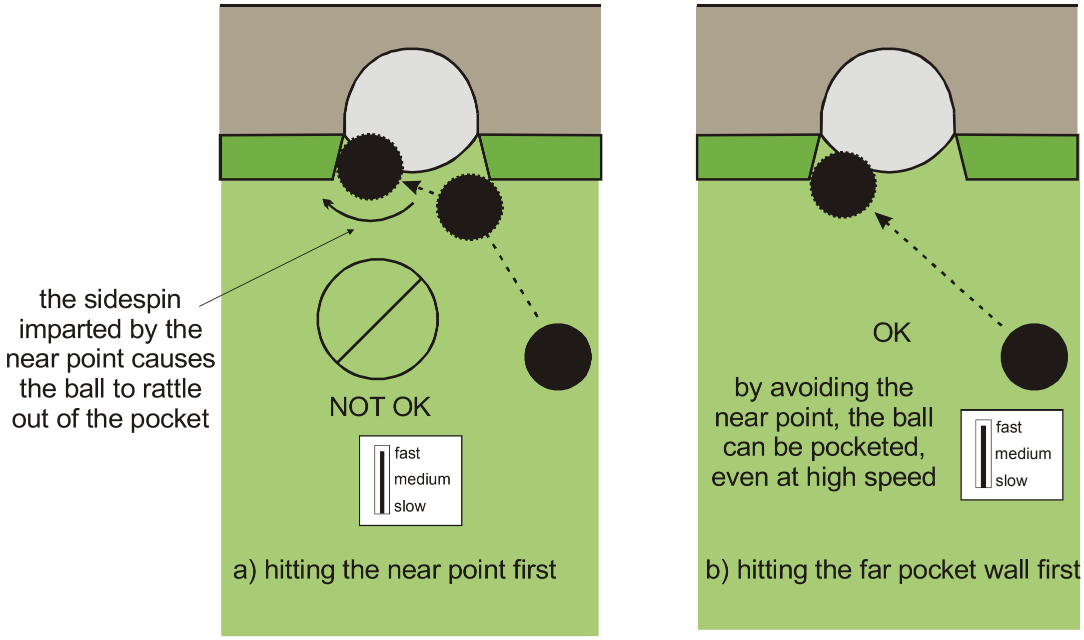
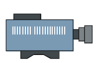


Diagram 6 Avoiding side pocket near point for fast shots


normal video

NV 3.12 – Side-pocket near-point effects


high-speed video

HSV 3.3 – Side pocket miss due to near point deflection
HSV 3.4 – Side pocket miss off far pocket wall
HSV 3.5 – Side pocket near miss due to wall rattle
HSV 3.6 – Side pocket rattle out

When shooting at a corner pocket, care must be taken to avoid hitting the near rail or point (see **Principle 11**). As illustrated in **Diagrams 7 and 8**, this is particularly important for a higher speed shot. As with the side-pocket near-point effect described above, the rail imparts significant sidespin to the ball at higher speeds, which causes the ball to rattle out of the pocket (see **HSV 3.8**).

Principle 11 **Corner pocket rattle**

When shooting fast at a corner pocket at shallow angles to the rail, avoid hitting the near rail or point of the pocket (see Diagram 8); otherwise, the ball will rattle out (see NV 3.13, NV 3.14, and HSV 3.8).

- The rattle-out is due to rail-induced spin.
- Rattle is of little or no concern when the ball is hit softly (see **Diagram 7**). For soft shots, the effective pocket size is large because you can contact the rail far in front of the pocket (see **NV 3.15**).

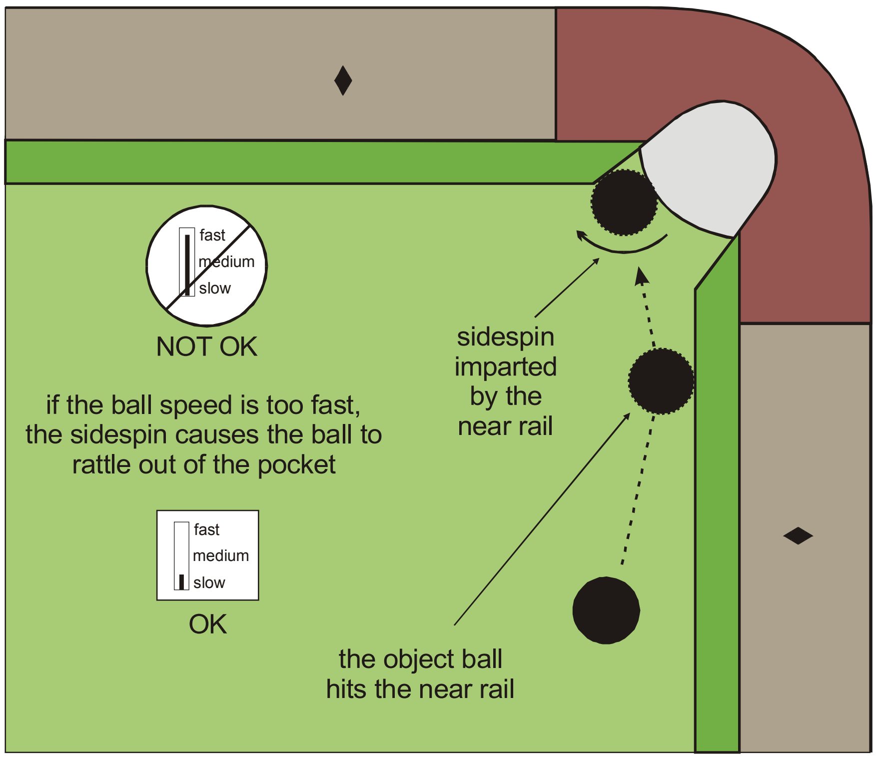


Diagram 7 **Corner-pocket near-rail speed effect**

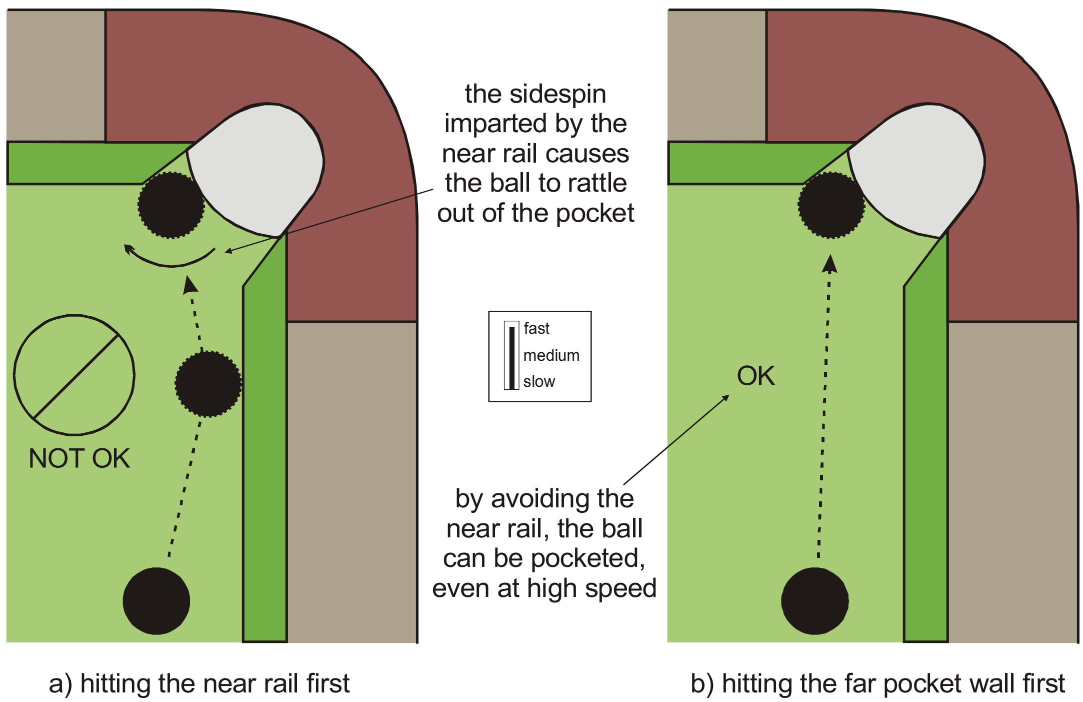


Diagram 8 Avoiding the corner-pocket near rail for fast shots

Diagram 9 illustrates a shot where knowledge of the corner-pocket near-rail speed effect (**Diagram 7**) can be used to your advantage. To an inexperienced player, it might appear hopeless to pocket the 1-ball in the corner pocket because the obstacle 11-ball blocks the direct path to the pocket. However, by deflecting off the near rail with slow enough speed, the ball can be pocketed (see **NV 3.15**). If the speed were too high, the rail would impart significant sidespin to the ball, causing it to rattle out of the pocket (see **Principle 11**).

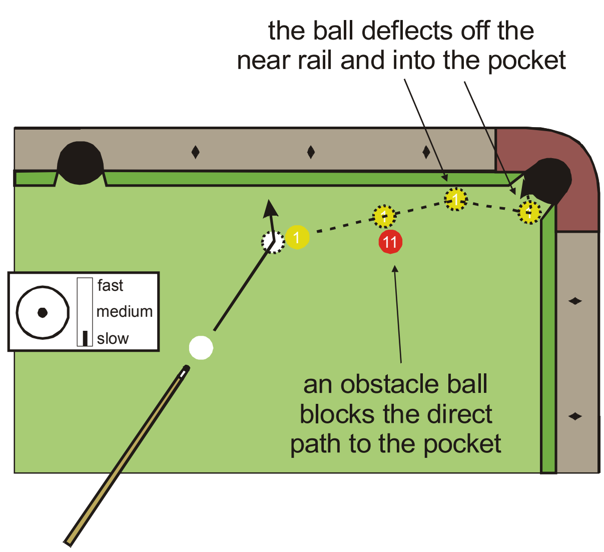
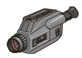
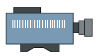


Diagram 9 Example corner pocket shot using slow speed off the near rail


normal video

NV 3.13 – Corner-pocket near-rail effects
NV 3.14 – Near rail rattle
NV 3.15 – Large target size for shallow angle rail shots


high-speed video

HSV 3.7 – Corner pocket, in off near point
HSV 3.8 – Corner pocket miss due to near rail deflection

In next month's article, I will show a collection of plots (generated from technical analyses) that will summarize all of the principles and effects concerning pocket target information. The graphs will help us derive even more insight. I will also show how you can use some of this information in your game.

Good luck with your game, and practice hard,
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 recently released an instructional video DVD. If you are interested, you can view excerpts online at ***billiards.colostate.edu***.
- 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 **NV**, **HSV**, and **TP** resources from a CD-ROM instead. To order one, send a check or money order (payable to David Alciatore) for \$21.45 (includes S&H) to: Pool Book CD; 626 S. Meldrum St.; Fort Collins, CO 80521. The CD-ROM is compatible with both PCs and MACs.

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" (2004, Sterling Publishing).