

## “Just How Big are the Pockets, Anyway? – Part II”

**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](http://billiards.colostate.edu). The reference numbers used in the article (e.g., **NV 3.15**) help you locate the resources on the website. You might also want to view the resources from a CD-ROM. See the website for more details.

In last month’s article, I presented several principles concerning factors that contribute to making some shots more difficult than others based on speed, angle to the pocket, and pocket contact point. All of the principles and effects I presented can be summarized with a collection of graphs I will show in this and next month’s articles. All of these graphs were generated from detailed, physics-based, technical analyses (see **TP 3.5** and **TP 3.6**). Being the compulsive analytical person that I am, it wasn’t good enough to just have an intuitive feel for some of the principles I described and demonstrated in last month’s article. I wanted to know exactly how much a shot’s margin for error changes with angle and distance from the pocket and with speed. The diagrams in this article show some of the results of this detailed analysis. The technical analyses won’t be of interest to most readers (unless you are a geeky engineer or physicist), but the results should be very interesting to most readers.



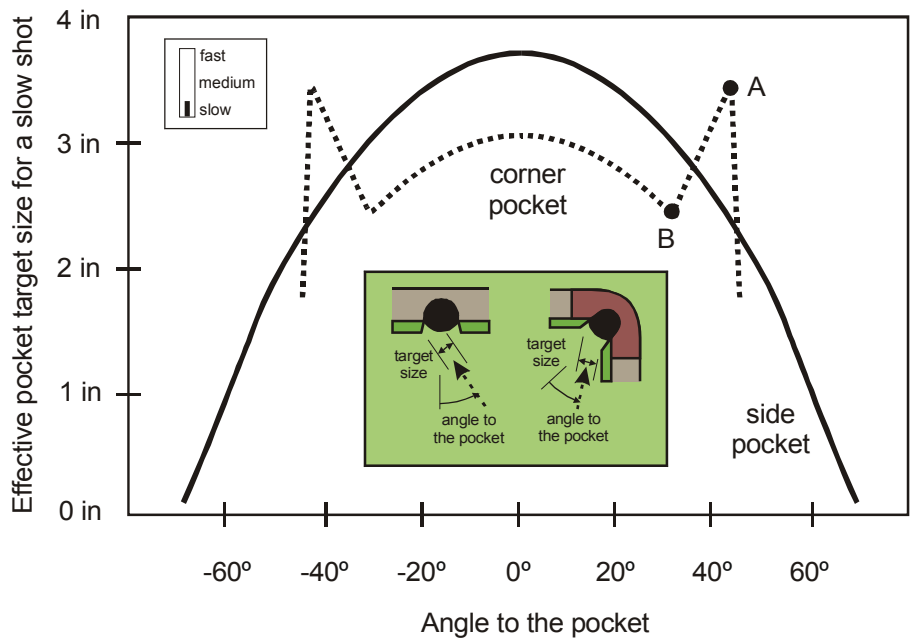
TP 3.5 – Effective target sizes for slow shots into a side pocket at different angles

TP 3.6 – Effective target sizes for slow shots into a corner pocket at different angles

**Diagram 1** shows how the effective target size for slow shots into both side and corner pockets varies as a function of the angle to the pocket. I know this graph might be intimidating to you if you are not used to looking at stuff like this, so I will do my best to make it understandable. The inset drawings illustrate what the terms mean. The **angle to the pocket** is measured from the straight-in direction; so for a corner pocket, the largest possible angle is  $45^\circ$ , where the object ball is rolling along the rail into the pocket. For a side pocket, the angle to the pocket can be much larger. The **effective target size** is a measure of how “big” the pocket is for a given angle to the pocket. As you know from experience, a pocket is a lot “smaller” when the angle to the pocket is large, especially for a side pocket.

Now back to how to read the graph. The vertical scale labels a pocket’s effective target size, in inches. The horizontal scale labels the angle to the pocket, in degrees. The solid curve shows the analysis results for a side pocket and the dashed curve shows the results for a corner pocket. For each angle to the pocket, the height of the curve tells you the effective target size for that angle. For example, for point “A” on the corner pocket curve, the angle to the pocket (reading down) is about  $40^\circ$  and the effective target size (reading left) is about 3.5 inches.

Notice that a side pocket has the largest effective target size at small angles to the pocket, but the size falls off dramatically as the angle from the center increases (see **Principle 12**). Notice that the corner pocket effective target size is smaller than the side pocket for most pocket angles, but the corner pockets are more favorable at shallow angles to the rails (close to  $40^\circ$  from the pocket center). This effect is due to the ability of the ball to go in after hitting the rail (see last month’s article and **NV 3.15**), increasing the effective size of the pocket.



**Diagram 1** Effective pocket target sizes for a slow shot based on the angle to the pocket

**Principle 12** Beware of large side pocket angles

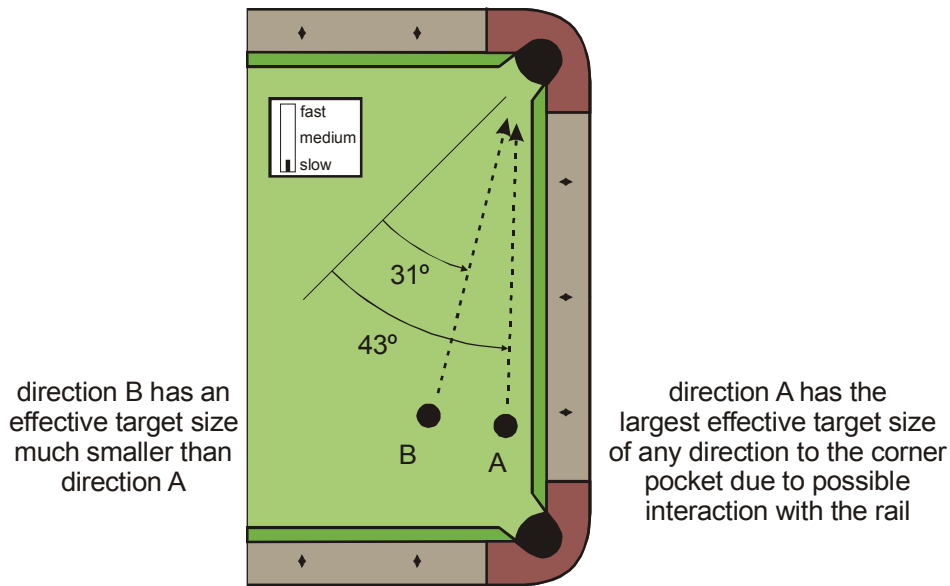
*The side pocket effective target size (and margin for error) decreases dramatically as the angle to the pocket increases (see Diagram 1).*

- When the ball is hit harder, the effective size is even smaller (see Diagram 3).



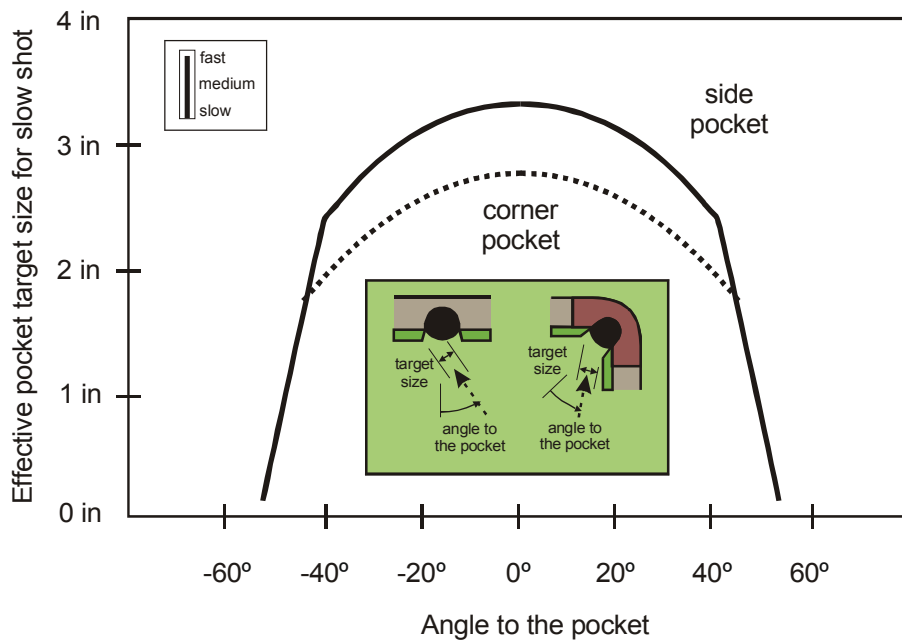
NV 3.15 – Large target size for shallow angle rail shots

To help visualize some of the conclusions you can draw from **Diagram 1**, **Diagram 2** illustrates the shot directions for the two points labeled “A” and “B” on the corner pocket curve. Point “A” corresponds to an angle to the pocket of 43° and the effective pocket target size for that angle is 3.4 inches. This is the largest effective pocket size compared to all other angles to the pocket; therefore, shots from that direction are the easiest to make in the corner pocket at slow speeds. Point “B” corresponds to an angle to the pocket of 31° and the effective pocket target size for that angle is 2.4 inches. This is much smaller (30% less) than the size for point “A,” so shots along the point “B” direction are much more (30% more!) difficult to convert than shots along the “A” direction at slow speeds.



**Diagram 2** Example points from the graph in Diagram 1

**Diagram 3** shows the results for the effective target size for fast shots into both side and corner pockets, as a function of the angle to the pocket. Notice that both pockets have the largest effective target size at small angles to the pocket. The size still falls off dramatically for the side pocket as the angle is increased. But the corner pocket effective size is still smaller for all angles to the pocket. This is because near rail deflections result in missed shots at high speeds (see last month's article and **NV 3.12** through **NV 3.14**). Also, by comparing **Diagram 3** to **Diagram 1**, you can see that the effective target size of a pocket is smaller at higher speeds (see **Principle 13**).



**Diagram 3** Effective pocket target sizes for a fast shot based on the angle to the pocket



TP 3.7 – Effective target sizes for fast shots into a side pocket at different angles  
TP 3.8 – Effective target sizes for fast shots into a corner pocket at different angles

### **Principle 13** Slower speed, bigger pockets

***The effective target size of a pocket decreases at higher speeds (see Diagram 1 and Diagram 3).***

- You must be more accurate for faster shots.
- When the ball is hit harder, the ball is more prone to rattle out, especially if the near rail is glanced first (see **NV 3.12** through **NV 3.14**).



NV 3.12 – Side-pocket near-point effects  
NV 3.13 – Corner-pocket near-rail effects  
NV 3.14 – Near rail rattle

The analyses used to create the plots in Diagrams 1 and 3 above also quantify how far away from the pocket center you should aim. The detailed analysis and results can be found in **TP 3.9**. The most important conclusions are summarized in **Principle 14**.

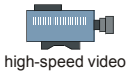


TP 3.9 – Pocket target center offsets based on angle to the pocket

### **Principle 14** Pocket center

***The center of the pocket is not always the best place to aim.***

- You should aim at the geometric center of the pocket opening only for straight-in shots. For shots approaching the pocket at an angle, adjust your aim from the center towards the far inside wall of the pocket (see **Diagram 3**).
- Hitting the near rail or near point creates rail-induced English that can cause the ball to rattle out of the pocket, especially at high speed (see **HSV 3.3** through **HSV 3.8**).
- Sometimes it is desirable to cheat the pocket when you have a straight-in shot but need deflection of the cue ball away from the impact line. English-induced throw can also be used to help cheat the aiming direction. These topics will be covered in a future article.



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

I hope you are enjoying my series of articles on “Just How Big are the Pockets, Anyway?”. In next month’s article, I will show how distance to the pocket, distance between the cue ball and object ball, and cut angle can be factored into the analysis. I will show some cool plots that summarize most of the margin-for-error factors in one place.

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](http://billiards.colostate.edu).
- I recently released an interactive instructional video DVD. If you are interested, you can view excerpts online at [billiards.colostate.edu](http://billiards.colostate.edu).

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