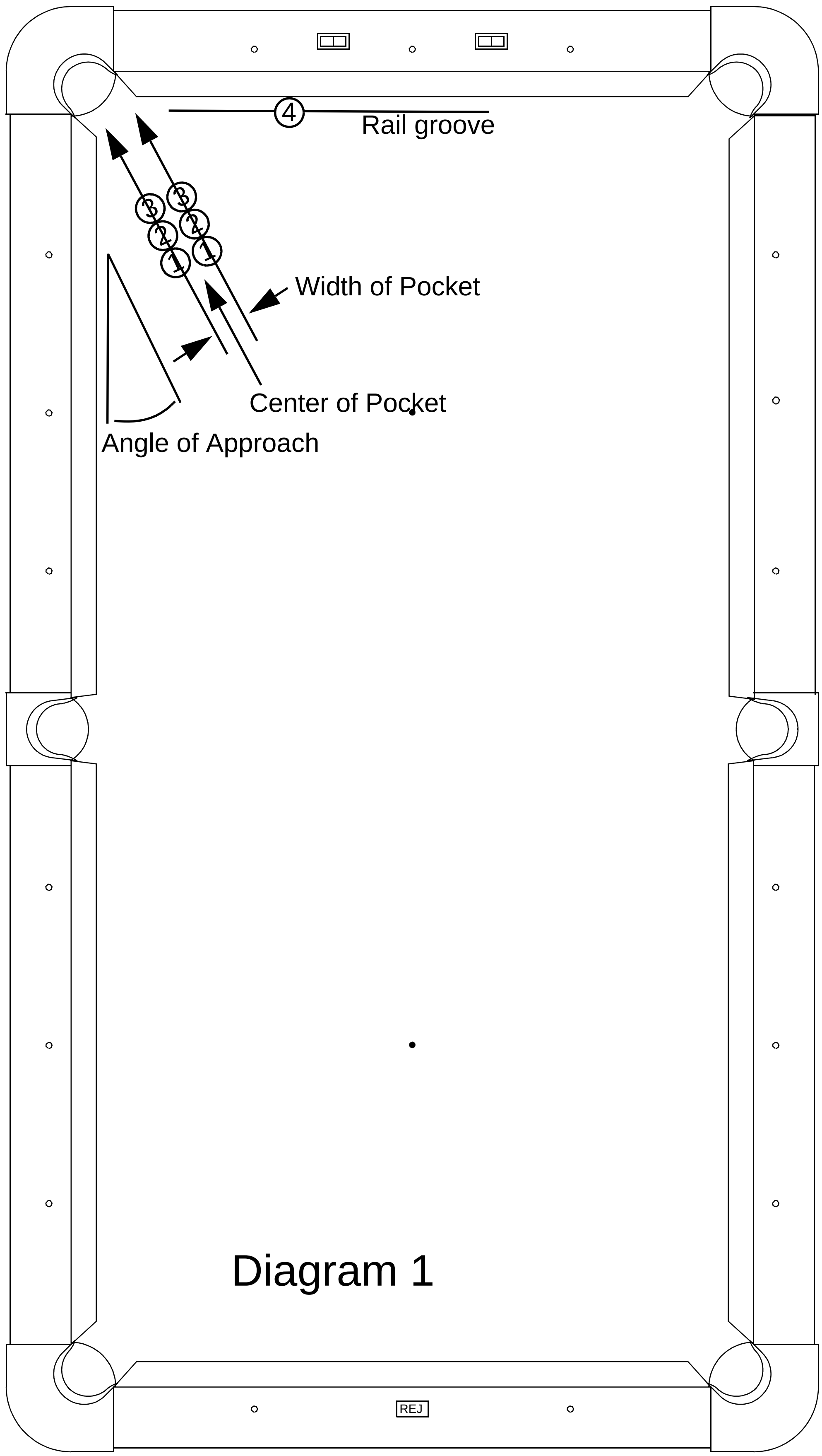
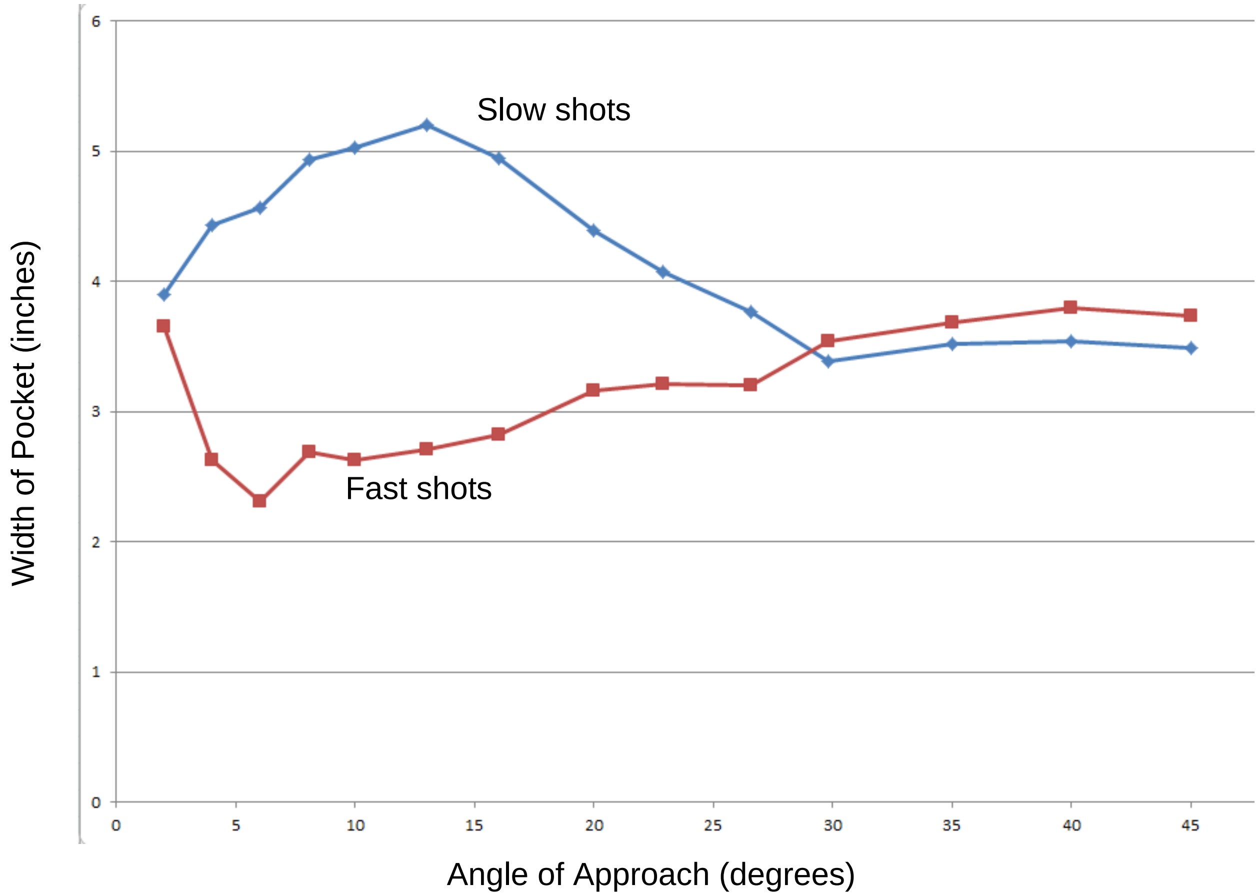

4
Rail groove
3
3
2
2
1
1
Width of Pocket
Center of Pocket
Angle of Approach
REJ

Diagram 1



Width of Pocket (inches)
Slow shots
Fast shots
0
1
2
3
4
5
6
0
5
10
15
20
25
30
35
40
45
Angle of Approach (degrees)

Diagram 3

Where’s the Pocket?
They change size and shape.
by Bob Jewett

You would think that after all the years the game has been played that someone would have figured out where the pockets are and how large they are. Although you look at them every time you play pool, I’ll bet that your current notion of their shape and location is flawed.

I gave a rule of thumb for where they are in an article in April 1997. (This is available on-line at http://www.sfbilliards.com/articles/BD_articles.html) My guess was that if a single point is the best target for a corner pocket regardless of angle of approach, that point must be the intersection in the pocket of the “rail grooves” which are the worn white lines that show up on most tables half a ball from the noses of all the cushions. What I mean by angle of approach is shown in Diagram 1 where two sets of combination balls are aimed along the same approach angle towards the corner.

The size of the pocket is also important as it affects your chances of making shots. My guess early on was that the size of the pocket is roughly constant and you can mostly not worry about it. The size of the pocket is also shown in Diagram 1 where the two sets of balls are set at the extremes of where the last ball will go into the pocket. Any farther apart and the ball will rattle and hang or bounce away.

It turns out that I wasn’t quite right on either location or the size.

About 10 years ago fellow columninst Dr. Dave Alciatore looked more deeply into how large the pockets are from various angles. In his calculations he included multiple bounces between the jaws. The angle of the pocket facings -- they are rarely parallel -- and the depth of the pocket “drop” -- where the slate falls away -- were also taken into account. It turns out that his analysis predicted some interesting features of how the pocket size depends on angle, but again the details turned out to be not quite correct.

How do I know our original theories were partly in error? Dr. Dave and I got together a while back and did some actual measurements. There is nothing like cold, hard data to spoil a nice, simple theory. Or even a complicated theory.

The picture shows one of the intrepid experimenters in action. The combination is set on a piece of ruled paper held in place by donut reinforcements on the paper. Four balls are used in a straight line so that very little spin can be transferred to the last ball. (In addition, the shooter tried to shoot straight in the first ball without side spin but he has a notoriously crooked stroke.) Note that the table has fairly generous pockets and that the cloth still has considerable slide.

The angle was determined by a thread that was stretched out on the table and then the distance of the thread from the cushion was measured at two known distances from the pocket. A little trig gives the angle. The lines on the paper were then aligned exactly to the thread so the combination had the same approach angle to the pocket as the thread.

To determine the width of the pocket, the paper was moved left and right relative to the pocket while keeping the lines parallel with the thread. Multiple shots were taken at any distance setting that was iffy and the placement that gave about a 50% pocketing success ratio was taken as the "edge" of the pocket. To find the width of the pocket for a particular angle, you just take the difference in distances for the two edges of the pocket.

It is common knowledge or at least a belief that the harder you shoot the smaller the pocket gets. We have all seen slow rollers drop into pockets that appear huge while another shot along the same line at high speed will rattle out. How much does the size change with speed? To find that out we measured pocket widths for two shots speeds, "soft" and "firm". It would have been nice if we could have more carefully controlled the speed, but no pool-shooting robot was available. In this case soft meant that the object ball was shot slowly enough that it was rolling smoothly on the cloth, and for the harder shot the ball was not rolling smoothly but at least partly sliding. With a robot we could have added "medium" and "warp" speeds.

In the plot in Diagram 3 are the results of our measurements. There are several interesting features. The plots show the pocket width measured in inches on the vertical axis and angle of approach on the horizontal axis. The plot that is mostly higher is for soft shots.

The first surprising result is that for shots that are nearly along the rail (angle is near 0) the hard and soft shots have close to the same margin of error. We didn't actually get to zero angle as we needed a little space away from the rail for the measurement.

As the angle increases, the hard shots do start to see a smaller opening, and for an incoming angle of around six degrees the pocket is twice as wide for a soft shot as a hard one. (For those who are not well calibrated on what six degrees looks like, it is a slope of the length of a dollar bill in the length of a cue stick.) While the general shape was predicted by Dr. Dave's theory, the extent of angle over which the change takes place is a little surprise. The main reason that the soft shots fall more often is that the follow tends to carry them to a better place on the second jaw and then helps them on over the brink which the fast shots have little follow to help and if they did have follow it would not have time to take.

Another suprise occurs around an angle of 30 degrees. For such shots which are going more or less straight into the pocket a different phenomenon takes over. It is well known to trick shot artists that the ball can be forced through the corner of the pocket. Usually this is demonstrated with a ball on the corner of the side pocket which is made simple by shooting it into the pocket ignore the fact that the corner is sticking out. (Try it if you haven't seen it -- shoot from about 45 degrees.)

In the plot you can see that the pocket gets larger by about quarter inch for fast shots near the 45-degree line. While this seems obvious now (after considering the trick shot) it is against traditional wisdom. In any case, the difference is not nearly as large as the nearly two-to-one "tightening with speed" that we see for shots between about 5 and 20 degrees.

Next time I'll discuss how the center of the pocket moves with speed and show some more results from a table that is closer to tournament conditions.