

How Tough is Tough?

by BOB JEWETT



DOES A LONG, straight shot require more accuracy than a shorter thin cut? Is a bank or a cut easier? The answer is partly individual; you might love thin cut shots but dread long shots. Such preferences aside, simple geometry can be used to assign a difficulty factor to each shot and allow an objective comparison.

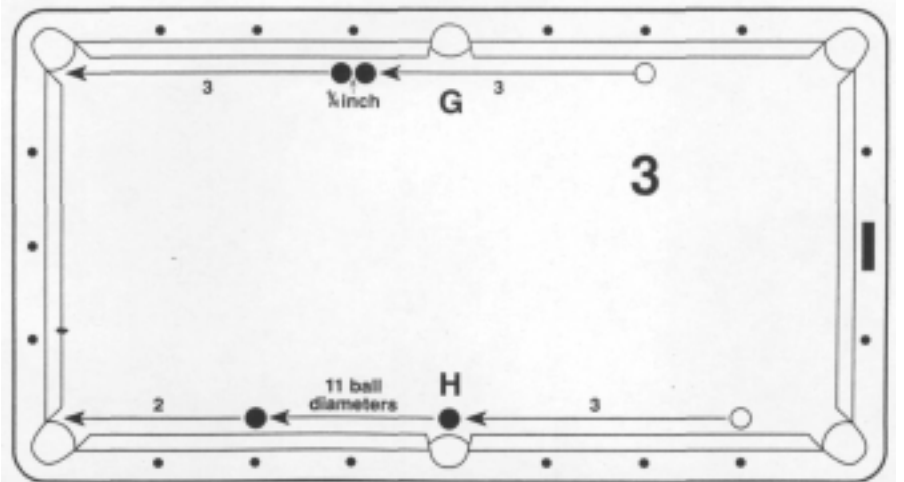
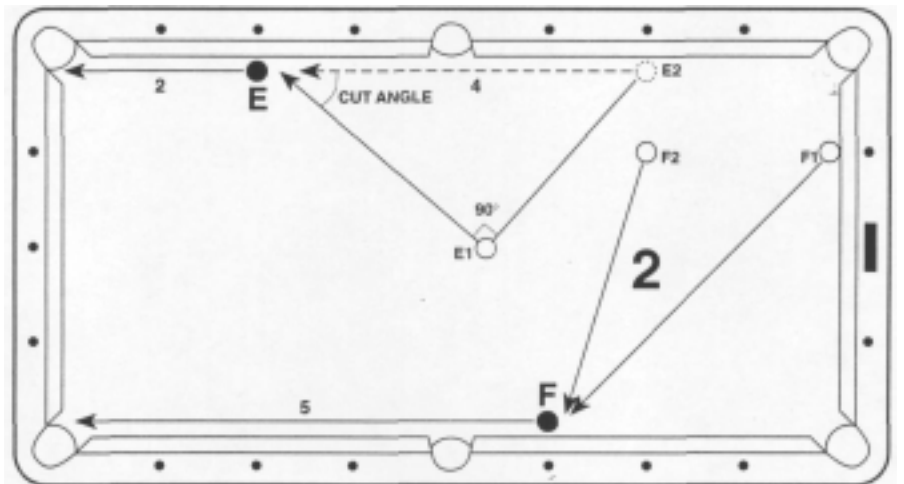
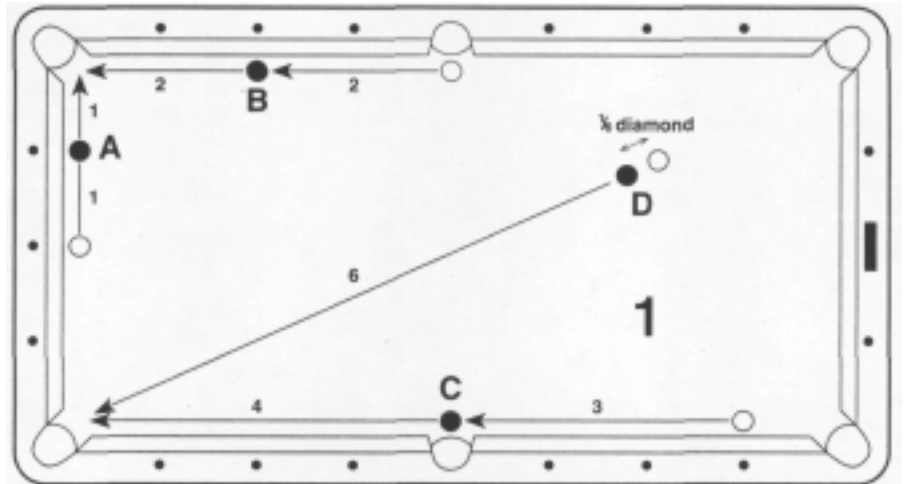
The basic difficulty of a shot is determined by two distances: how far the cue ball travels to the object ball and how far the object ball travels to the pocket. Let's measure these distances in diamonds. The difficulty on a straight shot is found by multiplying these two distances together.

Figure 1 has several examples. Shot A has each distance equal to one, so its difficulty is $1 = 1 \times 1$. Shot B has each distance equal to two for a difficulty of four. C, at 12 (3×4), starts to be tough enough you might look for another shot or safety.

This difficulty number tells you directly how accurate your mechanics have to be on the shot. Let's assume that your bridge hand is placed perfectly, and all the error is in where your grip hand is at the instant of tip-to-ball impact. Using similar triangles, typical pocket size, and average wing span, it turns out that the total "window" for your back hand to come through is just one over the difficulty factor, with the answer in inches. Shot C is a 12, so the window is only a twelfth of an inch wide, or a twenty-fourth of an inch to either side of perfect. The margin on shot A is much more comfortable: one inch total or half an inch to either side.

Shot D, with the cue ball only a ball diameter (about a sixth of a diamond) from the object ball is only a "one" but it looks a lot tougher. It illustrates the point that even though the total shot might be long, if either distance is very short, the shot is easy. The hardest shot for a given total length is when the object ball is about half way between the cue ball and the pocket, as in C.

How does a cut influence the difficulty of the shot? There is a simple way to construct the equivalent straight — in shot. In Shot E, draw the line from the cue ball to the object ball (E1-E). Through the cue



ball, draw a line perpendicular to E1-E, and extend it until it meets the extended path of the object ball at E2. Shooting from E2 requires the same precision as from E1. The difficulty is $8 = 4 \times 2$.

Shots F1 and F2 are more difficult cuts. With graph paper or using the geometry of similar triangles, we can find that F1 has a difficulty of 30 while F2 is a 50.

Combinations are another complication that is easy to include in the calculation. Multiply the three lengths of travel together, but measure one of them in ball diameters. For example, in Shot G, the distance between the two object balls is only a quarter inch or a ninth of a ball diameter. That makes the shot a "one" ($3 \times 3 \times \frac{1}{9} = 1$). Shot H, on the other hand, has the middle distance equal to 11 ball diameters (two diamonds) for a difficulty of 66. Combinations should be avoided unless one of the distances is small.

For bank shots or kick shots, just remember that the distance to use is the total length traveled by the cue or object ball. Not included are the effects of side spin (planned or accidental) and other facets of ball-rail interaction, which are sure to make the shot harder.

For most of the shots shown, the balls have been in positions that are easy to calculate. Real situations will either need a tape measure and a T-square or a little practice at guesstimation. Getting the distances within half a diamond is close enough for most purposes.

Besides allowing you to choose the easiest shot from several options, the difficulty factor is useful to measure position play and shot making ability. During a match, note the difficulty of each of your opponent's shots and note the ones he misses. Does he leave himself a lot of 2s and 3s, or is he stabbing at 15s and 20s? Does he usually miss anything tougher than a 10? Leave him 15s.

I recorded shot difficulties in seven matches at the 1976 World Open 14.1 Championships (the one in Asbury Park with the hurricane). Players like Mizerak, Crane, Rempe, Sigel and Fleming had average shots between 3.5 and 4. The best one-game average I recorded was 3.43 by Larry Liscioti, who went on to win the tournament. If you want to measure yourself against this standard, videotape yourself in a match or train a practice buddy in difficulty estimation.