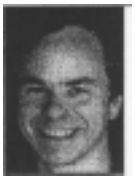
Bob Jewett



Thin Hits

Learn this to psyche out your opponents.

Do you feel good about your thin hits? Would you like to play them better and smarter? If so, read on.

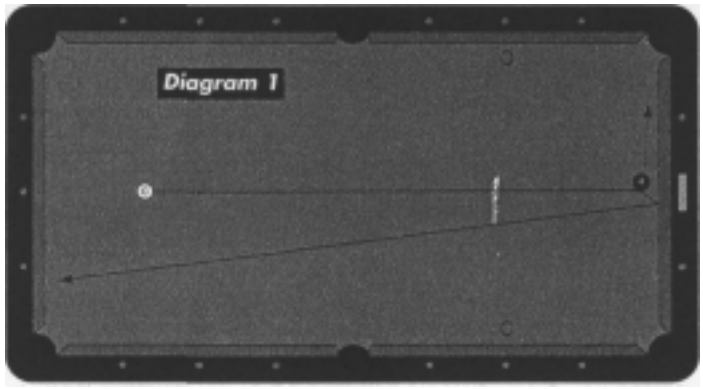
If you play any pool game, you will often find yourself in a situation like **Diagram 1.** The cue ball is a mile from the object ball, and you need to both make a good hit on the object ball and leave no shot. Is a thin hit — just nudging the ball so it moves as little as possible — the right shot for you?

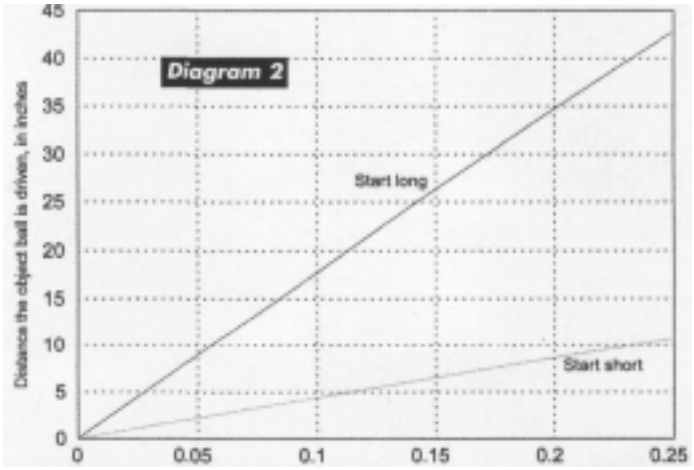
In the extreme position shown, you should probably shoot something else if it's available, but let's look at the thin hit a little closer. The goal is to get a hit, come off the far end rail, and bring the cue ball back to its starting point, more or less. There is a problem on each side: If you miss the ball entirely, you foul and give up ball in hand or a point or worse; if you hit too much of the ball, you give up an easy shot to your opponent.

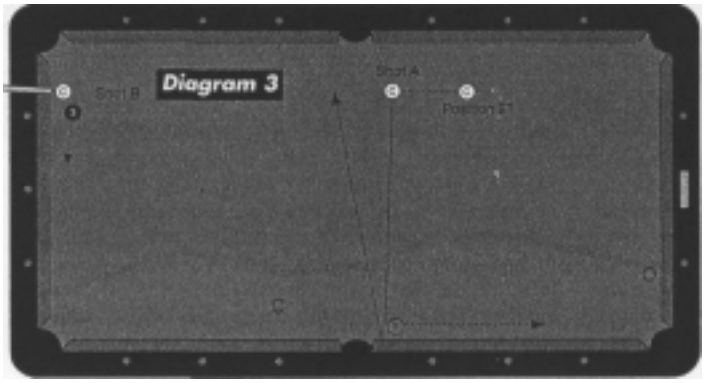
The first considerations are the table and the cue ball. If you are familiar with both of them, you know whether to expect roll-off. Some players are able to allow for the "windage" due to table slope, but you might also run into a cue ball that's slightly lopsided, and might roll left or right unpredictably. I've seen balls that might be off by as much as a tenth of an inch by the time they reached the object ball for the shot in Diagram 1.

Diagram 2 shows how accurate the hit has to be to control the distance the object ball is driven. The fuller you hit the object ball, the farther it will travel. Along the bottom is how full the ball is struck in inches of overlap. (Think of how much the edge of the cue ball overlaps the edge of the object ball from the tip's-eye view. Overlap of 1.125 inches would be a half-ball hit.)

The vertical axis is how far the object ball will roll for a shot that just brings the cue ball 8 diamonds back to the end cushion you start from — use the "Start long" curve for this. For example, if you hit a tenth of an inch of the object ball, it will be driven about 18 inches along the end rail. If the cue ball or table is not quite right, and you get a tenth of an inch of roll-off, you could get no hit at all or the object ball would be driven 35 inches or about 3 diamonds. That would be very bad for your safety, as it would leave the ball in front of the corner pocket.





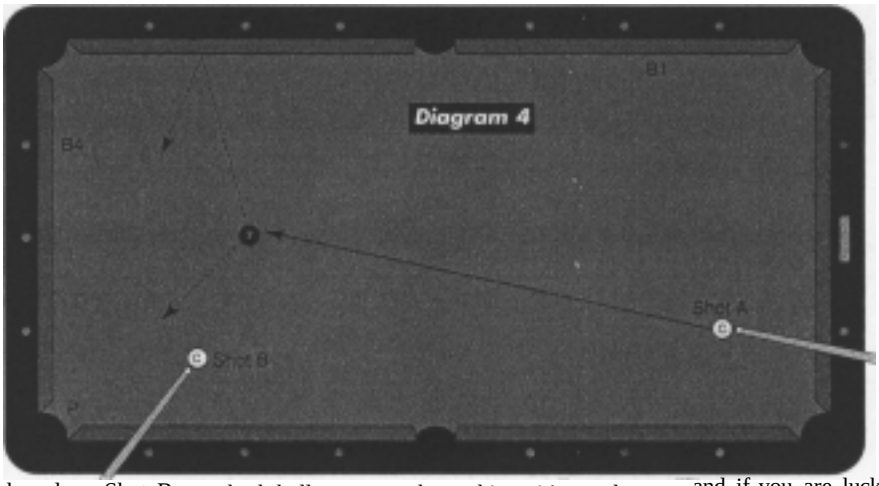


So, how good are your thin hits? In **Diagram 3** are a couple drills to test and improve them. Shot A is the same sort of safety as in Diagram 1, but arranged the short way on the table. Play the thin hit to see how little you can move the object ball. Start with the object ball near the side pocket, and leave it in position for each following shot, but move the cue ball so you will be shooting directly across the table each time. How many times does it take you to get the object ball to the end cushion? On each shot, you have to bring the cue ball back at least close to the side rail you are starting from.

When you have mastered the short way for this drill — or at least improved — put the cue ball at C and the object ball at O and try it again, with the requirement that you have to return the cue ball to near the head rail. As you progress, move the cue ball's starting point farther back. To avoid problems from table roll on these drills, be sure to play the shots to both sides. For example, after you have worked the object ball to the left with the drill shown until it is almost to the rail, work it back the other way. Is your table flat? Is your cue ball round?

In Shot B of Diagram 3 is a different thin-hit situation. This time you are close to the object ball, so the hit is much

easier, but you still want to drive the cue ball eight diamonds for the safety. It turns out that the object ball is also not driven nearly as far for a given thickness of hit as for the long safety in Diagram 1. This is because it doesn't lose a lot of energy in the cushion right after the ball contact. The thickness/drive curve for this case is shown in the lower plot in Diagram 2. Hitting a tenth of an inch of the object ball should be duck soup from this distance, so the object ball should only move 5 inches if you just barely get to the end cushion.



You can set up a drill based on Shot B; keeping in mind that you should be able to nudge the ball at least six times before it reaches the end rail.

If your thin hits aren't working, or you don't know how the table is rolling, you need to have alternatives. In Diagram 1, a standard fuller-hit safety is to hit about half of the object ball on the right side and use a speed — this comes through practice — to leave the object ball near O and the cue ball near C. This may leave a bank for your opponent, but it's not a nice angle, and if both balls are near the cushions it's tougher still. A subtle point is that a half-ball hit causes the cue ball and object ball to move almost the same distance off the end cushion. Fuller, and the object ball moves more than the cue ball; thinner, and the cue ball moves more. If they move the same amount, the balls will be left straight across from each other, which is a nasty situation for banking.

Thin hits are not just for defense. **In Diagram 4** are two shots useful in one-pocket that require very thin hits. In Shot A is a common leave with the object ball on the spot and the cue ball on the bad side of the table — your pocket is P. A thin hit can make the ball. Do you understand why it is almost impossible to scratch if you make the object ball from the spot? In Shot B, you are banking the spotted ball to pocket P. The cue ball will hit at Bl for its first cushion, and B4 for its fourth cushion, and if you are lucky, end up down by the Shot A cue ball for the safety. While there are less aggressive alternatives for both of these shots, if you have your thin hits perfected, these shots can be psychologically devastating to your opponent. You'll know you've won the mind game when you hear him muttering, "How can he make *that* shot?"

Bob Jewett

Where's Your Elbow?

Do you want to be a piston or a pendulum?

In sports such as golf, swimming, and track and field, there is a lot of recent activity applying new technology to understanding how the body can achieve maximum performance. When sports science appears on TV, you might see a wired-up swimmer in an aquatic treadmill or a golfer with glowing spots taped on each of his joints and in front of a computerized camera that catches each arc and acceleration and hitch.

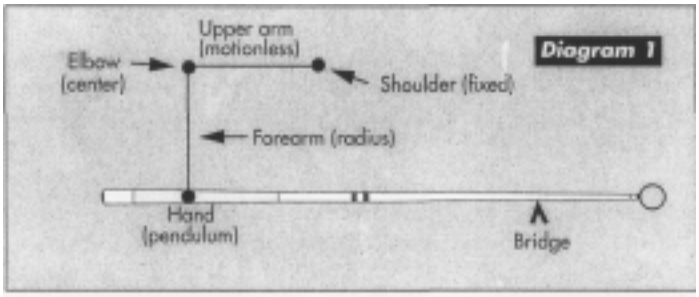
I'm sure the funding will soon start rolling in for such projects with billiard players, but in the meantime we have to study billiard biomechanics and carom kinesiology with simpler and cheaper methods.

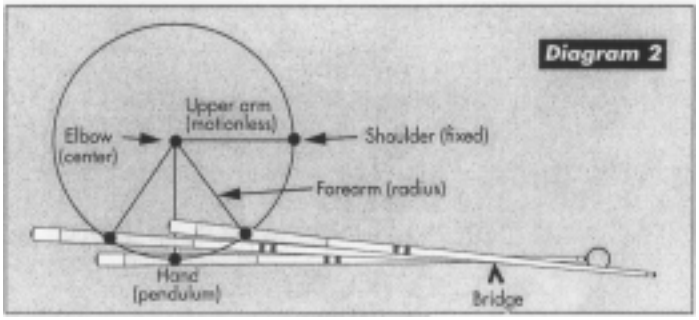
What is a good stroke? What do you want in a "correct" stance? How does the body actually move the stick, and how can the typical player improve the motion? What should you spend your time working on, stroke- and stance-wise?

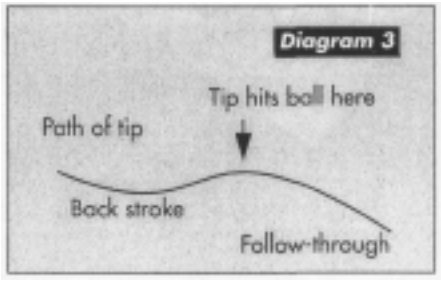
Let's begin by looking at a very simple model of the player. We're going to ignore muscles and tendons and even the third dimension for the time being. In **Diagram** 1 is a side view of our model player. He's simply three dots and two straight lines connecting the dots, plus a pivot point representing his bridge hand. Call him Ed. Later we'll try to give him more personality-

If Ed has the unfortunate habit of jumping up and raising his whole body during the shot, just run a long pole through his shoulder to both walls, so his shoulder does not move during the shot. By not moving the shoulder, I mean the dot which represents the shoulder stays in one place. Maybe the upper arm moves, and this requires a rotation at the shoulder joint, but the shoulder can rotate to move the upper arm without moving itself.

As the next simplification, let's assume that the upper arm doesn't move. We'll relax this requirement soon, but for now, just the threat of another pole will get Ed to keep his elbow in one place.







Ed's last joint is his wrist/hand at the grip on the cue. Again, we simplify the situation by assuming that Ed is not into wrist-flipping to get that special action on the cue ball, and that the wrist acts as a simple pivot point.

We're also going to take the rails off the table so that Ed's stick can be horizontal at the instant it hits the cue ball. In reality, nearly every shot must be played with significant elevation because of the presence of the rails.

The resulting motion is the classic "pendulum" stroke. Ed addresses the ball in the position shown with the tip close to the ball, then swings his hand and the stick back moving just the lower arm and pivoting at the elbow. The hand swings forward, following a perfect circular arc, with the elbow as its center and Ed's forearm as its radius. The tip contacts the cue ball when the stick gets back to its starting point, at which time the forearm is straight up and down and perpendicular to the cue stick. The stick follows through the ball with the hand continuing its circular arc. The elbow has not moved an iota.

Successive positions of this action are shown in **Diagram 2.** The main thing to note here is that the stick does not move in a straight line either before or after it hits the ball. At the end of the backswing, the butt of the stick has risen considerably, and at the end of the follow-through, the butt has risen again. This is a simple consequence of the pendulum motion — a pendulum is obviously lowest at the bottom of its swing.

While the stick is wobbling up and down during nearly all of the stroke, it is going straight forward at the instant it hits the cue ball. This is illustrated in **Diagram 3,** which shows the path of just the tip during the stroke. As it's drawn back to the bridge hand, it first drops a little as the back hand rises, then it comes back to the addressing/contact point, then as Ed follows through, the tip drops again with the rising of the grip hand.

At the instant of contact, the path of the tip has no up or down component; it is traveling straight forward toward the ball.

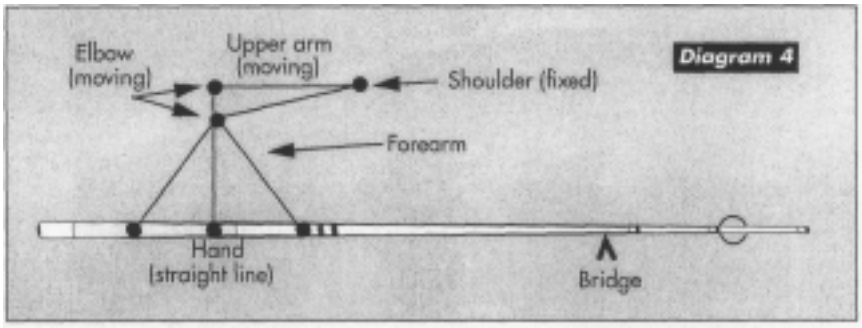
What are the advantages of this simple form of stroke? Just the simplicity is important; remember the KISS principle (Keep It Simple, Stupid). The less there is, the less there is to go wrong.

A second advantage is that you will hit the cue ball exactly where you address it. Is it useful to know where you hit the ball? Many think so.

A minor advantage is that it takes the least amount of effort to hit the ball this way — just pull the pendulum back and gravity does the work until the bottom of the arc, and then gravity starts slowing the stick. A fairly common principle in

mechanics is that the easiest way to do something is often the most accurate.

Now you may jump up and say — remember what we do to people who jump up — "Wouldn't it be better to have a stroke that didn't get the wiggly tip path in Diagram 3, but instead brought the stick straight back and straight through?" Diagram 4 shows the successive positions of Ed's elbow needed to achieve this motion. Note that as the stick comes back, the upper arm must rotate down, letting the elbow drop so that the stick is not raised at the end of the back stroke. As the stick comes forward, the elbow rises to its peak position at the instant of contact, and then must drop again to maintain a straight path on the follow-through. Of course, you could also get some of the up-and-down motion by moving your whole body, but Ed can't because of the pole.



This is clearly a more complicated motion for the body, but it can be learned. In fact, there are stroke-training devices on the market that will teach you what might be called the "perfect piston" motion, with the stick moving just along its axis without any teeter-totter from the pendulum.

My main objection to this motion is that it requires correct timing of two motions. The elbow's drop-then-rise must be synchronized with the forearm's back-and-forward movement. For example, if Ed's elbow has gone up too much at the instant of tip-ball contact, Ed will hit too low on the cue ball. As drawn in the diagram, which is nearly to scale for a normal player, if the elbow is raised by 3 mm, Ed will hit 1 mm lower than intended on the cue ball. Is 1 mm important? For most draw shots, it will mean you are about 10 percent off on the spin. Is 3 mm a lot of accuracy to expect in dynamic elbow position? It's the thickness of two pennies stacked up.

But enough of this arm-chair hypothesizing; let's do a little lab work. The first part of your homework is to watch players' elbows — be discreet, as elbow oogling is still illegal in some jurisdictions. First note if their shoulders are moving during the shot. If so, watch someone else who seems to have better basic form. Note how and when the elbow moves. Does it move both before and after the shot? For each player that you watch, be sure that you catch both fast and slow shots, as some players seem to have more than one style of stroke. If you have tapes of professional matches, the pause button will help, but the camera angles are not always ideal.

The second part of your homework is to try to figure out what your own stroke is doing. If you don't have a video camera, enlist a friend. You might also need a long pole.

Next time I'll go over my own observations, some of which I'll be making at the 2003 Mosconi Cup in Las Vegas.

Bob Jewett

Where's Your Elbow Now?

It takes all kinds (of strokes) to make a Mosconi Cup.

Last month, I started a discussion of billiard stroke mechanics. My hope is that eventually some serious scientific research will be done in the area, but for now we have to settle for armchair (bar stool?) analysis and table-side observations.

It is interesting to note how instruction has changed over the years. **In Figure 1** is a drawing from Kentfield's 1839 book, "The Game of Billiards," which was printed until the 1880s. If anyone wants to try me some 9-ball with that stance and wearing a long coat and tie, they've got the wild 8. At least the player is shown holding the correct end of the cue, which was a fairly recent innovation in those days — 50 years before, most players shot with the blunt end of the stick, which was called a mace.

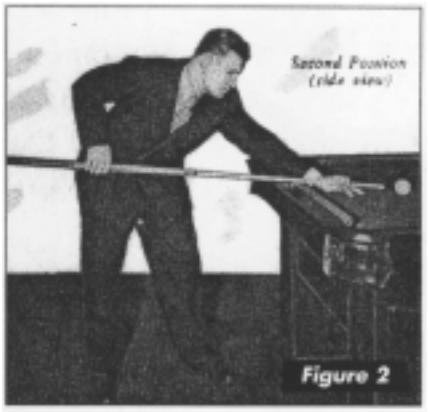
Note that the forearm of the player's back arm is vertical at the moment of contact with the ball, but Kentfield doesn't explicitly mention this. He does say that the body should not move until the shot is over, so that only the arm moves, but he doesn't specify which part or parts of the arm.

Figure 2 is from a 1948 booklet by the Billiard and Bowling Institute of America, and shows the progress in stance over the intervening century. At least we got rid of the long coat. The text recommends that the forearm should "hang almost perpendicularly" without really explaining what that means. The player's hand as shown in the picture will actually be a hand's-width or two forward of perpendicular at the instant of impact, which I'd call considerably off perpendicular.

Figure 3 shows a modern stance with the chin nearly on the stick. Almost all top players use this stance or one very near it on long shots that require accurate aiming. It is interesting to read even some recent instructional books that say such a stance cramps the stroke, and then to watch a player draw the cue ball a table length and a half with chin-to-cue. You can't believe everything you read.

But you can believe much of what you see. Your homework assignment was to observe what players' arms, including your own, actually do during the stroke. While this is not guaranteed to tell you the single best way to play, if you observe good players and bad, you can probably start to figure out what seems to work well.

I conducted my field work in December at the Mosconi Cup in Las Vegas. This was the first time in its 10-year history that it was held in the U.S., and I'm sorry for those who weren't there. The format consists of six-man teams, the U.S. vs. Europe, with the first to win 11 short matches the victor. Europe led going into the fourth and final day, but Team USA pulled out the victory. (For more info, see the cover story in last month's issue or visit the Mosconi Cup's Web site: www.mosconicup.com.)



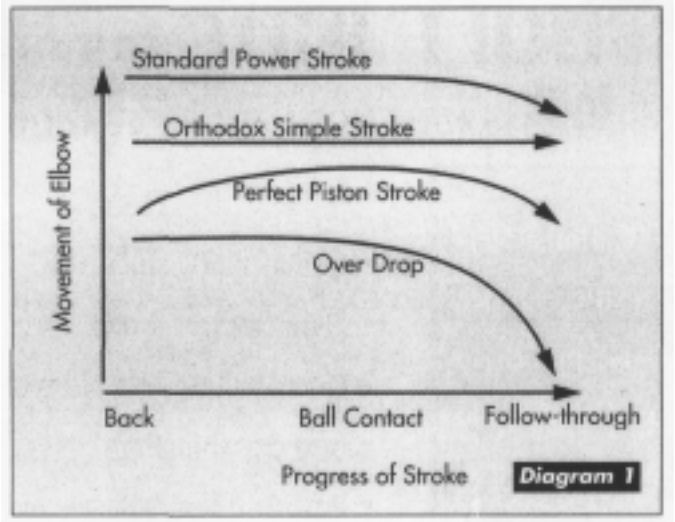
It was not so easy for me to watch elbows during the matches; I'm programmed to pay more attention to the balls and situation on the table than the players' mechanics. I hope you had an easier time with your homework. I did manage to make some useful observations of four different types of arm motion.

The first stroke is what I will call the "standard power stroke." The elbow is essentially motionless until the end of the forward stroke when the forearm starts to close against the biceps, and the upper arm drops about its own width, or roughly four inches. This is the arm motion you will probably see in the above-mentioned draw shot. I need to study some slow-motion video to be sure, but my suspicion is that the drop is a simple mechanical result of the forearm closing on the biceps. It seemed to me that most of the strokes in the 9-ball competition were in this category.

The second stroke **I'll** call the "orthodox simple stroke." Here, the upper arm moves almost not at all, so the motion is confined to just the forearm. Even for some players who often use the first motion, this simpler stroke is used for soft shots. **I'll** have to do some more field work at straight pool and one-pocket events, where a larger fraction of the shots are delicate ones. One player who used the orthodox simple stroke even

on the faster shots was Tony Robles, who is known for his straight-pool prowess.

A third type of stroke is the "perfect piston stroke," which I described last time. The elbow goes up and down in such a way that the stick moves in a perfectly straight line. While this sounds simple, it requires a fairly complicated motion from the arm. The elbow must drop as the stick is drawn back, rise as the stick comes forward to contact, and then drop again during the follow through. The only player of the twelve at the Mosconi Cup that I saw with this action was Jeremy Jones. The only other player I've seen use this stroke is Hall-of-Fame member Loree Jon Jones. If you notice any other adherents to this method — especially one not named Jones — please let me know.



The fourth and final type of stroke is the "over drop." In this stroke, the elbow comes down much more than with the first type, so that the tip of the stick ends well above the level of the ball. In the extreme form of this, the stick will actually hit the rail, making a clacking sound. The only player in Las Vegas that seemed to have this technique was Nick Van den Berg from Holland. I have not yet figured out any possible advantage for this stroke. It seems to me that it doesn't get any more power into the ball, since the motion of the upper arm drives the butt down rather than forward toward the ball, and it would seem to be a disaster for consistency due to the timing required to get an accurate hit on the cue ball.

Having noticed this anomaly in Nick's technique, I was fascinated by an on-air interview with Earl Strickland after his fourth-day defeat of the Dutch player. Earl certainly raised some hackles when he said that his apparent easy win was not surprising against someone who did not know how to play, that he would be surprised if Nick's game held up until he was as old as Earl is now, and that if Nick were required to "break from the box" (with the cue ball in the middle of the table rather than against a side rail) he would probably break his hand. I wonder how many in the audience understood that Earl was referring to Nick's elbow. I think young Van den Berg would do well to try to get past the put-down and understand Earl's point.

Finally, in Diagram 1 is an illustration of what the elbow is doing on each of the four kinds of strokes described above during the final forward stroke. Along the horizontal axis is the position of the cue tip; back at the bridge hand, at the cue ball, at the end of the follow-through. Along the vertical axis is the up-down motion of the elbow. Which do you like? Which is like you?

Bob Jewett

Not So Simple

Look, Ma! No rails! Jewett plays a little "Run This Rack" of his own.

Everything should be made as simple as possible, but not simpler.

— Albert Einstein

In last month's column, I urged you to keep the mechanical part of your game as simple as possible, applying the KISS principle — Keep It Simple, Stupid. Many endeavors are ruined by complication.

I had the pleasure of taking a few lessons from the great player Jimmy Caras. He recounted the times when he and Babe Cranfield — another Hall-of-Famer-to-be — would watch Ralph Greenleaf play 14.1. Cranfield had an uncanny knack for predicting the order that Greenleaf would shoot the balls, rack after rack.

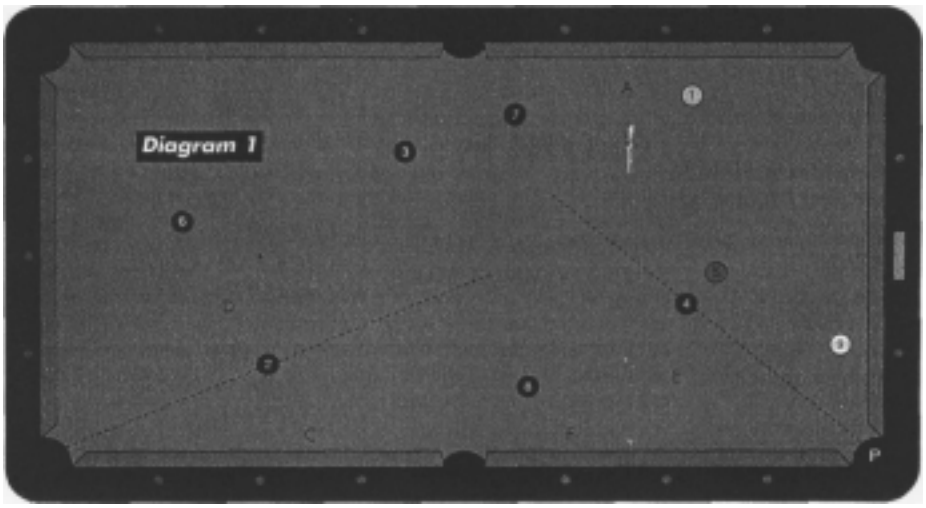
In his book "The Straight Pool Bible," Cranfield reveals the secret to his clairvoyance: Greenleaf played every rack as simply as possible. In the book, Cranfield gives examples of how to simplify your runs, but he also shows when you might want to add some flourishes for straight-pool strategy.

Another author who promotes simplicity is George Fels, in his "Advanced Pool." Early in the book, he introduces nine "whenever possible" principles, such as not using English, not hitting rails, not bumping balls, all whenever possible, or "WP."

In Diagram 1 we have nearly a best-case situation at the start of a 9-ball game. Your opponent has scratched, there is no bothersome cluster, and it looks like you can get through the rack without touching a cushion. Do you see how?

There are several advantages of not using the cushions during your run. The main is that the cushions can be surprising: surprisingly dead, strangely fast, remarkably crooked, or sticky beyond belief. If you never visit them, they can't hurt you. A hidden reason is that if you don't go to a rail, there is almost never any reason to use sidespin. (If you're not already convinced that sidespin has many traps to avoid, there's little I can do to help you.)

Cranfield revealed **the** secret to his **clairvoyance: Greenleaf played** every rack as simply as possible.



When I'm playing in tournaments, if I encounter a table as friendly as the one in Diagram 1, I'll go for the no-bumper solution. Here's how I would approach this particular layout, along with alternative shots.

With ball in hand, you have the luxury of placing the cue ball at A, with a slight cut to the left on the 1 ball. For position on the 2 ball, you want to get close to straight — in along the dashed line through the 2. Many players overlook the no-rail way, and place the cue ball at B for the first shot, figuring to spin back from the cushion.

It's best to run slightly past straight — in on the 2, so that you can stun over to D. Using rails, you should leave yourself more angle on the 2, so you can go to the rail near C and bounce over toward the 3. From D, the main objective is to get to the straight — in line on the 4. Note that D gives you a slight angle to get over to that line. If you don't quite reach the 4-line, it's okay, since you can draw over for a shot to pocket P with the 5. If you do get a little past the line, which is best, you can stun the cue ball over to E, leaving a slight cut to the right on the 5. Now for the hardest shot of the series. You have to play the right amount of speed and draw for the angle you've left to bring the cue ball to the line between C and D for the 6. Then, stun over for the 7.

If you get straight — in on the 7, just follow forward past B for a draw shot on the 8. Note that a far more common play for the 7-8-9 sequence, and one that requires less precision with speed control, is to go about halfway from the 7 to B, for about a half-ball cut on the 8 ball, with the cue ball coming off F with a little left English to help it down to the 9.

Similarly, if you end up with a shot from C for the 3 ball, you can spin off the cushion above the side with right English to run toward the 4.

Here is a drill you can try, which is a modification of Ron Shepard's "progressive 9-ball" drill. Put two balls on the table randomly, and see if you can run them in order without touching a rail. (The harder

form permits no cushion even after the final ball.) If you do two, try for three, then four, and so on. If you fail to run the table with the "use no rail" requirement, decrease the number of balls you're trying for. A good way to make sure you get a random set of ball placements is to break the full rack and then remove the lowest balls to leave your current number.

In Diagram 2 is a typical shot for position to get from the 1 to the 2. For the various cue ball positions shown (A through D), which path would you use? (If you had ball in hand, I hope you would be anxious to try the no-cushion option by putting the cue ball down by the short rail.) For the positions shown, I think A is the simplest shot. If you just let the cue ball roll after it strikes the 1, it will bend forward a little after the cushion from the natural follow, and take the path along A1. If you use a little outside English, the ball will come over to A2. As the cue ball gets closer to the cushion at B, C and D, the one-cushion option becomes much harder, even though it remains the simplest way to do the shot. From C, or even B, many players prefer to use either the follow path with right English, or the draw path with left English.

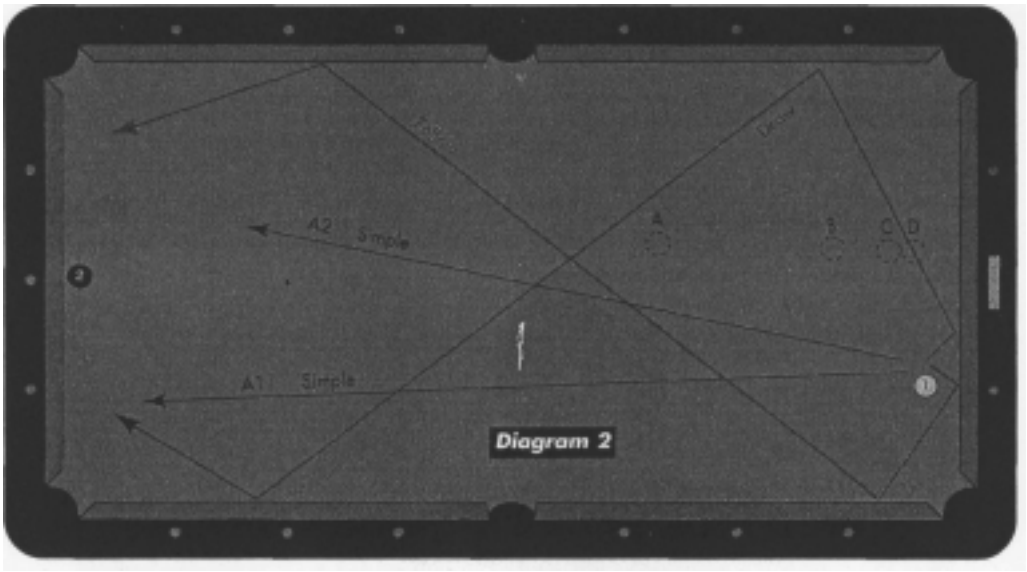


Diagram 2

If you ever have shot D, you shouldn't be mad for not having perfected your draw-with-English stroke; you should be disappointed that you didn't put the cue ball at A so the shot would be a simple roller. However, if you want your game to be complete, you need to have all of these shots in your repertoire.

Do you work to simplify your game? If you need examples, I'll recommend you not study Efren Reyes, but instead check out Buddy Hall's minimalist techniques.

Bob Jewett

Short Kicks

Learn to use the mirror system to makes these shots less tricky.

When you have to play the cue ball to bank off one cushion to hit an object ball several feet from the rail, the most you can count on is to hit the ball, or, with a little luck, to hit the ball on the correct side. With tremendous luck, you might actually pocket the ball.

When the object ball is close to the cushion, your odds improve tremendously, to the point where even beginners can count on making some short shots. With a little more experience, you can count on controlling the cue ball after contact. Let's go over some systems and practice techniques that will help you perfect this part of your game.

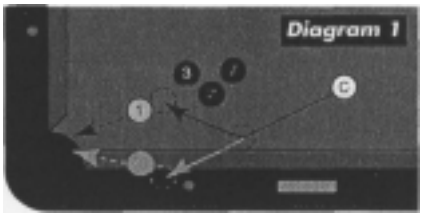
In Diagram 1 you'll find a typical situation where the object ball is blocked from a direct shot, but is still eminently makeable. Shown is the path of the cue ball to the object ball, along with several other clues for aiming the shot, including the locations of the cue ball at the moment it contacts the cushion and when it hits the object ball. The cue ball at the instant it hits the object ball is referred to as the "ghost" or "phantom" ball.

In addition, the "mirrored" object ball and ghost ball are shown. These are the positions of the two balls as they would appear in a mirror that was held up near the cushion. Why is this mirror idea important? Ideally, the cue ball will "reflect" from the cushion making the same outbound angle as the inbound angle. This is the same way that light behaves when reflecting off a mirror — the angle of incidence is equal to the angle of reflection. Let's not worry for now about the fact that cushions are not perfect reflectors; let's just see where this idea takes us.

Also shown is the mirrored path of the cue ball, which is a straight-line extension of its path into the cushion, and the mirrored path of the object ball. It turns out that the center of the mirrored pocket is, amazingly, in the same place as the center of the real pocket: the center of a ball on the brink of the pocket.

A major point to note is that the cue ball is not reflected from the nose of the cushion, as some authors imply. The ball is really reflected at what I call the "rail groove," which is the line half a ball from the nose of the cushion that often shows wear on old cloth. It is where the center of the ball is when it hits the cushion. Mike Hilden, a math professor at the University of Hawaii, recently pointed out to me that the only geometrically consistent way to diagram a ball's path for cushion contacts and ball-ball contacts is to draw the path for the center of the ball. Think on this a while, if you're not convinced. If you remain unconvinced, you should look up Mike Shamos' *BD* article on accuracy in billiard diagrams. If you see a diagram with ball paths actually touching the noses of the cushions, please realize that the diagram is inaccurate and misleading.

OK, philosophy mode off and practical mode on. This means that you need to get to a table to study the shot carefully. But first, you need to do a little preparation. Make a round target out of paper 2.25 inches in diameter. A small jar lid may be a suitable template, or go to the the San Francisco Billiard Academy Web site



(www.sfbilliards.com), and in the "miscellaneous files" section, you'll find a file of ball outlines that you can print out and make targets from. The other item you'll need is something to precisely position and re-position the object ball. I recommend donut-shaped self-stick paper hole reinforcements for binder paper, which you can get at any office supply store.

Place the 1 ball exactly a ball off the cushion, on its reinforcement. Place a target on the cushion even with the 1 ball and also even with the nose of the cushion, as in the diagram. Do you see why the target is the reflected object ball? If you want, also place a second target, at the reflected ghost-ball position, so that you will have a direct sight line for the cue ball. There is no reason yet to place the 2, 3 and 7 on the table; they just complicate things at the start.

Try the shot with just enough speed to get the 1 ball to the pocket. If your setup is correct, and your stroke true, you are almost certain to hit the 1 ball too full, and it will hit the long rail. The reason for this is that when the cue ball is played softly along the cushion, the angle of reflection is closer to the rail than expected, due to the follow on the cue ball. Bud Harris, a former U.S. three-cushion champion, showed this to me a long time ago. Bud pointed out that the angle off the cushion is only about 70 percent of the angle expected, and this holds fairly well for all kinds of side spin. That is, even with reverse side spin on the rolling cue ball, for a very shallow contact with the cushion, you still get about a 30 percent reduction in the outbound angle.

Well, how can we compensate for this fact? The first is to play with a combination of speed and spin that doesn't require any compensation for the perfect mirror system. Ron Shepard has pointed out that if the cue ball has no draw or follow when it hits the rail, and just enough side spin to roll rather than rub one way or the other on the nose of the cushion, then the minor idea has the best chance to work for a large range of shots. Try this sort of stroke, especially with no follow or draw. (By this point in your career, I hope you know that to get the cue ball to arrive "dead ball" at any distance, you need to start it with at least some draw.)

Can you get the shot to work with Shepard's "dead ball on the cushion" technique? While it can be made to work, it's not always the best way to play the shot for position, and you are not always close enough to the cushion to get stop action just as you hit the rail. Let's try to use Bud's idea to modify the mirror system for soft, rolling hits. Clearly the target has to be farther from the nose of the cushion to land farther out on the 1 ball. How much? Experiment. Since the target as shown is about a ball and a half from the mirror (center of target cut-out to the rail groove distance), try increasing that distance by about a third, which when decreased by Bud's 70 percent factor should be back to the right point on the real object ball.

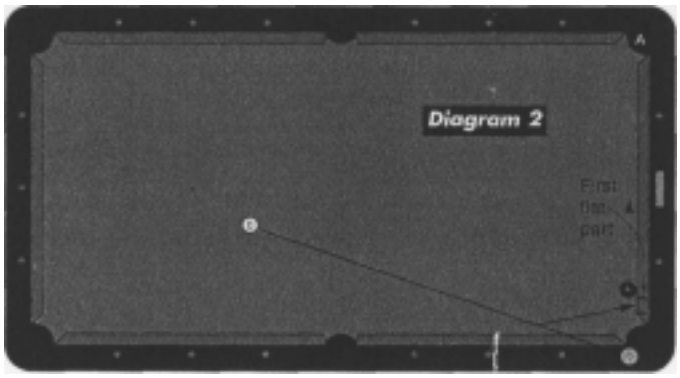
When you have the target in the right position for the shot shown and for a softly rolling cue ball, try placing the cue ball in different locations to see if the same target — which we can call the "reflected ghost ball with Harris' compensation" — is still valid. I think you will find that for nearly

any rolling cue ball that comes in more or less along the cushion, your target will still be valid.

Now, let's try a different goal. Often you have to hit a ball as in Diagram 1 without any intention of pocketing it, but rather with safety in mind. In the position shown from a game of 9-ball, it would be a bad idea to pocket the 1 ball with the 2 ball so infelicitously disposed. A very effective solution is to hit the 1 ball nearly full with nice soft draw — but not too hard — and try to draw back onto the cluster. The 1 ball, if it has a lick of sense, will scoot up the table to an inaccessible position.

Set up the target again, but this time you need only the reflected 1 ball and not the reflected ghost ball. Try to aim full at the target, and move the target closer to and farther from the cushion nose until you get a full hit on the 1 when aiming at the reflected target. Is the target at the ideal mirror position? Does it work for different approach angles for the cue ball? I'm not going to answer these questions for you; you have to see how the system works on your table and for your stroke. Maybe you will need to figure out a "fiddle factor" like the one-third adjustment mentioned above for Bud's observation.

In Diagram 2 is a common situation from a game of one-pocket in which you can use this "reflected target" idea with great effectiveness. Your pocket is A, and your opponent has a ball close to his pocket on the short cushion. The idea is to play the cue ball off the side cushion and knock the ball toward your pocket. The delicious secret to playing this shot is that on many tables, the pocket iron provides a reflected target that will land the cue ball on the first ball-width of the flat part of the end cushion. By this, I mean that the cue ball, when it hits the end cushion, will have its edge near the pocket just even with the nose of the pocket. Table designs differ, so you will have to experiment with exactly where the target is on your table.



At straight pool, there is a two-cushion-first safety to brush the side of a full rack that uses the same aiming idea. It was used by Willie Mosconi, Irving Crane and Eddie Kelly, but even you can do the shot if you have this aiming trick and a little control of spin and speed.

At one-pocket, the shot should usually be played at a speed that returns the cue ball to the head cushion for the safety. More running English or more angle into the first cushion will generally give the object ball more speed. As with any shot, you need to practice it before you need it. When you have it down, it is easy to make small changes, for example to hit an object ball that is farther from the pocket.

In a future column, I'll cover more shots based on the mirror idea and the required corrections. If you have a favorite shot or system that is similarly based, please send it in. My e-mail address is on the SFBA Web site, or you can send it addressed to me in care of this magazine.

Bob Jewett

More Aiming Systems

Here's how to separate the bogus from the brilliant.

In this column in June of 2000, I looked at the defects of some common aiming systems, Since then, quite a lot of new material has come into circulation, so it's time to revisit the topic. It's one of the most common items discussed in the various Internet forums, since every beginner wants a way to know where to point the cue stick.

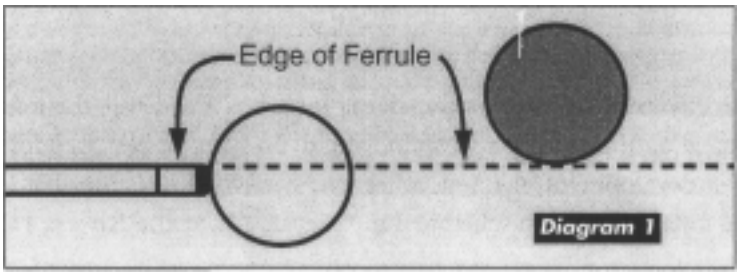
There are a lot of bogus ideas being passed off as aiming systems. It's clear that the proponents of such methods and the students who seem to find them useful are not capable of the basic geometry that reveals the flaws. You might say, "If it helps them, why point out that their beliefs are blasphemy, geometrically speaking?" There is the additional danger that, as with many beliefs, if the believer thinks you're a non-believer, you may get a violent reaction for your meddling.

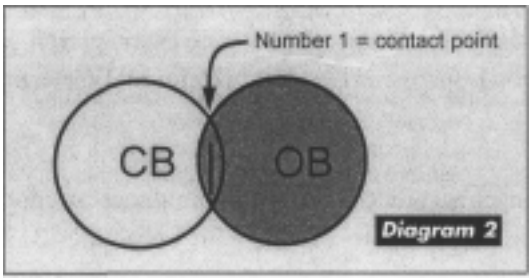
While some system-promoters tout falsehoods, others have the irritating habit of ignoring systems that are already in circulation. In the new literature I surveyed, two different authors described as "new" a system that was published more than 25 years ago and may well be much older than that. It's hard to believe an author who can't do basic homework.

On the other hand, I think any system, method or technique that puts aiming into some kind of framework and provides a way to categorize shots is useful, because it allows you to more easily relate the current shot to shots you've taken before. Most beginners just bang balls around without the benefit of a method that would allow such connections to be built up.

So, if you are going to try to adopt a suggestion for improving your aim, first measure its bogosity by looking at the geometry involved. If it passes, remember that you have to practice with it for a long time and under many conditions before you can really rely on it. Further, you have to be prepared to be flexible; if, on a particular day or table, the system has you driving balls into rails rather than pockets, you will have to modify the system or abandon it.

One of the most interesting new publications I've seen on aiming is a book called "The Secret of Aiming," self-published by Randy Lee Kukla (P.O. Box 108, Essexville, MI 48732). The main point is to give the shooter specific targets to aim at. Half-ball is an obvious one. A little more nebulous is the point where the base of the ball joins its shadow. I suppose: you need to practice this with a certain intensity of light on the table.





(I hope you are already thoroughly familiar with the fractional ball description of the fullness of hits/cuts, such as "half-ball." If not, see any of many pool and billiard books that cover it, or see page 20 of the Basic Clinics Handout on the Web site www.sfbilliards.com.)

With the full, half-full and three-quarters-full aiming points established, four more are set by spots halfway between those. So far, all of the aiming points are within the span of the cue ball. Two more are added by imagining where the side of the ferrule is pointed and making the projected ferrule just touch the outside of the object ball. That is, if the cue ball vanished as you stroked straight forward, the ferrule would just graze the edge of the object ball, as shown in **Diagram 1.** A last target is added by having the ferrule miss the cue ball by "a little bit." The angles not yet covered on the face of the cue ball are filled in by adding other "little bits" to the previous aiming targets.

As a practicing geometer, I'm not entirely comfortable with these constructions, but I can see how the non-geometers among us might take to them. Personally, I'd like to see a table of targets and angles. Kukla does provide a table of ball positions and the appropriate target to use.

Kukla mostly leaves uncovered cut angles that require the stick to be pointed outside the object ball. He does offer the thin-cut system shown in **Diagram 2.** His description may be the first appearance in print of this system, although it was independently discovered and discussed on the Internet discussion forum news:rec.sport.billiard, and I discussed it here briefly in November 1999.

In the diagram, you have a thin cut shot on the ball, and the shot is shown from the tip's-eye view. Note the contact point. If you are trying the shot, use the 1 ball, and turn the numeral so it is vertical and at the contact point. If you imagine the cue ball and the object ball as two equal circles or discs, and the act of shooting as projecting the cue ball's circle onto that of the object ball, there will be a lens-shaped overlap that is thinner according to the thinness of the cut.

The amazing result is that the contact point is at the center of this lens-shaped area. Another way to say the same thing is that if from your aiming position, you see the edge of the object ball sticking out to the side of the contact point by a little bit, you have to aim so the edge of the cue ball is going that same little bit to the

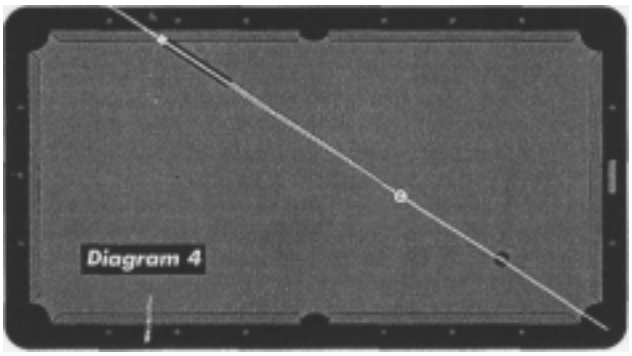
other side of the contact point.

This thin overlap aiming system is geometrically equivalent to the ghost ball system, which is the golden standard for systems, if you include the effects of throw. In theory, it works even for full hits, but usually it's harder to aim with the edge of the cue ball when it is lined up so far from the contact point.

Another new vision of how to aim has been developed by Ron Vitello of New York. I had the pleasure of discussing his methods with him for most of a day when I visited Santa Barbara, Calif., where he was giving a clinic. He has developed a workbook profusely illustrated with pictures of shot alignments. **Diagram 3** is an example. This shows another way to use the ferrule to aim. In this case, the projection of the stick forward, which is what the picture shows, has the side of the ferrule again touching the edge of the object ball, but now the ferrule is inside the object ball.

Note also that the picture shows reflections of lights visible on the object ball. Vitello goes over situations in which those reflections — whether on the cue ball or object ball — can be used for alignment. Frankly, I thought such "lights on the balls" systems were totally useless until Ron forced me to really think about the geometry. A warning: The reflections are not useful on all shots.

Here is a simple example of how to use the reflections of a light to help you find the centers of the object and cue balls.



This is especially useful for players with vision problems who cannot accurately see where the center of the cue ball is. Yes, there are a lot of such players, and a symptom of their malady is frequent unintended sidespin.

Find an elevated light easily visible from the table. Where I play, there are some tall windows that are bright during the day. You may have a beer sign or some such available — the light over an adjoining table may be too low. Standing by a pocket, line up the object ball and the cue ball so they are straight towards the light, as shown in **Diagram** 4.

Now, when you are down on the shot, the pocket, the object ball, the cue ball, your stick, and the light should all be in a straight line. You should be able to see the reflection of the light on both the cue ball and object ball. Because of the symmetry of the situation, the spots will be very accurately in the centers of the balls, and any misalignment, especially of the stick on the cue ball, will be immediately apparent.

Vitello hasn't published his workbook, since it is intended only to be used in a hands-on clinic, but you can contact him at vitelloaim@aol.com. Finally, a new book by Gerry Kanov and Shari Stauch, "Pool Player's Edge," has a fairly detailed section on various things you can fiddle with to improve your aiming. I especially like their final item for players with a lot of experience, which is to give up systems and rely on your feel for angles.

Bob Jewett

Long Kicks

All you'll need for this handy system is a bar stool.

In my May column, I covered some techniques for aiming short kick shots, where the object ball must be struck after the cue ball goes to a cushion, but the distance is short and the shot is fairly easy. The two main points to recall are that the mirror-system target is reflected at the rail groove and that for shallow shots with follow, the ball lengthens by about 30 percent regardless of any running or reverse side spin.

This time the shots are tougher — or at least longer.

Shown in the right half of **Diagram 1** is an ideal case where the object ball is hanging in the jaws of a pocket. All you have to do is find where on the cushion to hit, and the shot is easy. If the cushion works like a mirror — the angle of incidence is equal to the angle of reflection — the following system gives the perfect answer.

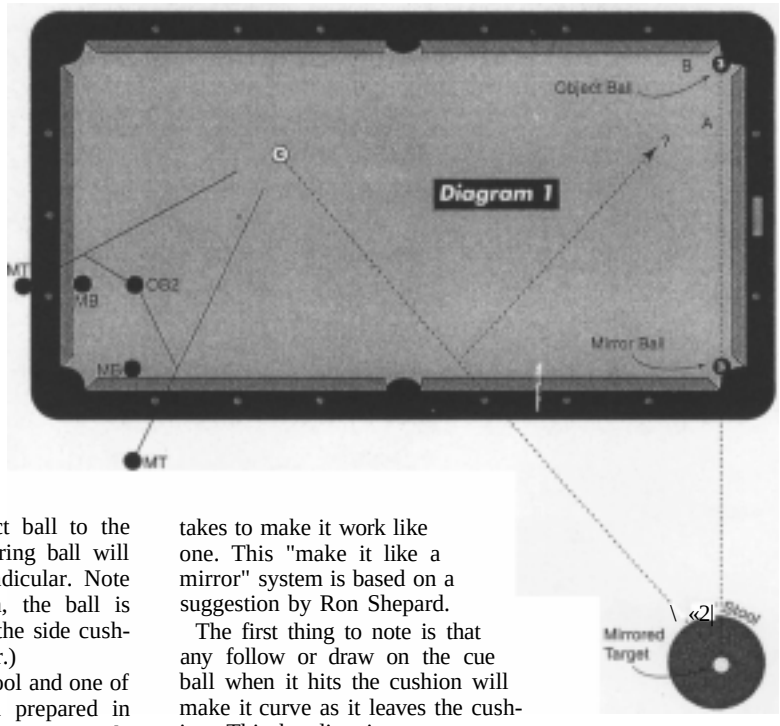
Also shown are two props to help you calculate the angle. Place a "mirroring ball" in the jaws of the opposite corner pocket. In general, it needs to be touching the cushion the cue ball will bank from, and as close to the target ball as possible. (Technically, if you drop a perpendicular from the object ball to the mirroring cushion, the mirroring ball will be at the base of that perpendicular. Note that for the example shown, the ball is placed where it would touch the side cushion if the cushion were longer.)

Now, you will need a bar stool and one of the round paper targets you prepared in May. If you've lost the targets, use a soda pop can or an object ball, but those are less likely to stay on the bar stool. Place the mirrored target so it is exactly in line with the other two balls and so the two distances are equal, ball-to-ball-to-ball.

Now, no matter where the cue ball is, if you are going to bank off the side cushion to sink the object ball, the mirrored target ball gives you the exact target — if the mirror system works for kicks. Try it from various angles and at various speeds before you continue with the rest of this column.

Unless you have an amazing stroke and a strange table, the system did not work for most of your shots. For the angle shown, at slow speed, follow will bend the cue ball after it leaves the cushion and it will hit at A. Shoot harder or with draw, and the cue ball ends at B. You probably found that when the cue ball was near the head cushion, the system worked tolerably well, but up there it is easy enough to just guesstimate the angle.

The problem is that the rail is not a mirror. To solve the problem, let's see what it takes to make it work like one. This "make it like a mirror" system is based on a suggestion by Ron Shepard.



The first thing to note is that any follow or draw on the cue ball when it hits the cushion will make it curve as it leaves the cushion. This bending is easy to see on new cloth (or with a waxed cue ball), because the slippery cloth lets the action take longer in time and over a longer distance. So, shoot the equivalent of a stop shot at the cushion. To see what angle this gets us to, move the cue ball close to the rail and hit the ball right in the center. You could shoot from farther back, but then you would have to judge how much draw to use to have no spin at the rail.

Does angle in now equal angle out? Probably not, because there is one other factor, and that's the cushion rubbing side spin onto the ball. This will tend to make the cue ball "go short" and hit at point B. So, we need to apply a final correction, and that's to put just enough running English on the ball so that it rolls on the cushion rather than rub in either direction. How much side spin? That's for you to determine with practice, although Shepard has worked out a formula for it. Fortunately, if you have the bar stool set up with your target, you don't have to count diamonds with each cue ball position. Just pick a spot for the cue ball, and aim at the mirrored target. In theory, you should be able to play the shot at any speed and get a perfect reflection with this method, once you get the spin perfected.

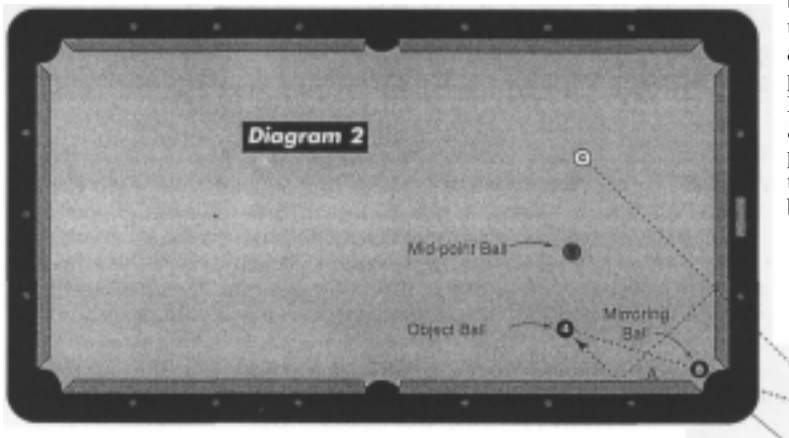
In the left half of Diagram 1 are two shorter kicks using the same cue ball but a different object ball (OB2). For each of the two cushions that might be used, the mirroring ball and the mirrored target are shown. See if you can get a full hit from each rail.

In **Diagram 2** is an extension to a two-cushion kick. Again, we're going to assume that the rails are perfect and see where it leads us. The problem is to play the cue ball off the end and side rails to get to the object ball. To construct the mirrored target, place the mirroring ball in the corner where the two banking cushions meet, and then place the target on the straight line that goes out from the object ball through the mirroring ball. Make sure that the two distances are again equal.

This time, you should use a paper reinforcement to mark the position of the object ball, so you don't have to remeasure for the mirrored target each time.

Can you find a stroke that's most consistent over a wide range of angles? Trying to

apply the idea of "stun shot, roll on the nose" from above is not practical, since we are unlikely to get the perfect spin on both cushions. I think you'll find that for many cue ball positions, follow and running side give fairly consistent results. The spin will tend to make the cue ball hit near A on the second cushion, but the same spin will bring the cue ball out to the object ball. Perhaps better is to have the cue ball arrive at the cushion with no follow or draw, but plenty of side. See what works best for you on your table.



Also illustrated is a system that gives the same aiming line but doesn't require a bar stool next to the table. To go two cushions out of the corner to the object ball, first find a point that is half-way between the balls. I've marked that with the "mid-point" ball. Now sight from that point through the middle of the pocket in that corner to a distant target. Ideally, the target should be infinitely far away, but 20 feet beyond the table should do. Just shoot to the target with the spin you have found that works. Do you see from the diagram why that target will give you close to the same aiming line? Do you see why a target too near will give the wrong line?

There are two ways to compensate for not playing in a large enough room to make the angle right. First, you can find the line from the mid-point ball to the corner and then just shoot parallel to that line. I have a lot of trouble with this method because my stick seems never to come over parallel to the original line. I guess it's an optical illusion for me, but I tend to turn the stick toward the corner. A second way is to find a relatively near target along the "far target" line, and then take a new target the same distance to the side as the cue ball is from the mid-point ball. For example, in Diagram 2, the cue ball line is about a foot to the left of the mid-point ball. Find your "not so far" target, say the left side of A nearby table. Now take a point, perhaps in the air, a foot to the left of that target. A line from the cue ball to that new "offset" target will be in the correct direction.

If you're having trouble kicking out of safeties, try these systems. Of course there are lots of others, and there are many ways to calculate the ideal reflecting line, but these are easy to use and experiment with and perfect once you have your mirrored target set up.

Bob Jewett

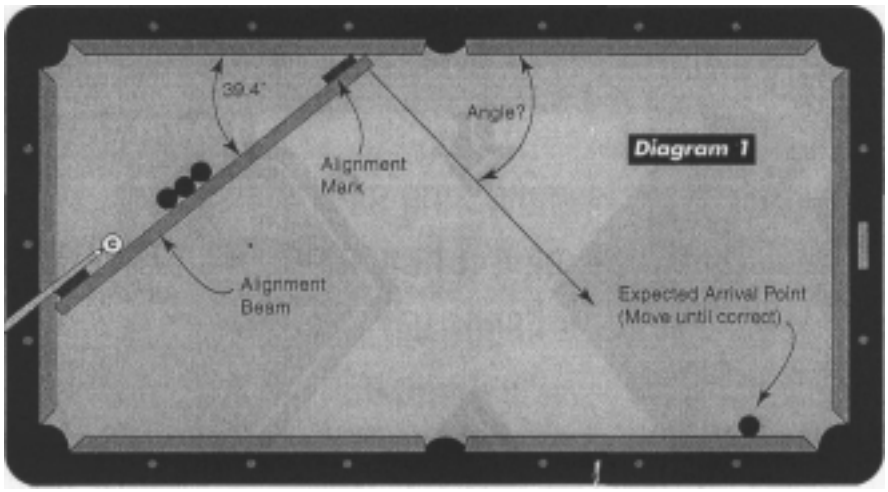
Shortening Banks

Bob Jewett wipes the egg off his face.

In my July 2003 column, I covered several loose ends and indicted some common myths. I proposed some experiments for you to try if you happened to still believe in any of the myths. This month **I'll** report on my own results from one of those experiments — results that were surprising.

The trek from my comfortable armchair to a table was precipitated by the rather prominent repetition of the myth in question right here in these pages. As Click and Clack, the Tappet brothers would say, I hope to distance myself from that article.

So, the question to be answered is: Does more speed on a bank shot shorten it, and if so, under what conditions? (Remember that a ball is said to bounce "shorter" off a cushion if it comes straighter off the cushion and "longer" if it goes more parallel to the cushion.)



The previous experiments that I had done were fairly rudimentary, and since there seemed to be knowledgeable players weighing in on the side of the myth, I felt that more care and completeness was called for. Many casual experimenters — sometimes including me —• will take a couple of quick shots and be satisfied with the hypothesis. Not this time.

The main problem with testing bank shots is the difficulty of repeating the shot with sufficient accuracy so that you vary only the parts of the shot you want to vary. If you just shoot a bank shot in a couple of different ways, it is too easy to subconsciously add a little English or take off a little speed or change the cut a little to get the result you expect.

The typical setup is shown in **Diagram 1.** A line of three object balls is set up along the bank angle to be tested. For this experiment, that angle was about 40 degrees from the cushion. To make sure that the balls were aligned the same way each time, an aluminum L-beam was placed on the table, and the location of its ends were marked on the cloth. Then the three balls were placed against the beam and moved up to another mark on the cloth which set the amount of travel of the banking ball to the cushion. The balls were separated from each other by a small amount to prevent the possibility of any funny interaction as you sometimes see among clusters of frozen balls. The beam was removed, and a cue ball was shot directly into the combo with no spin.

For the position shown, I measured the landing spot on the second cushion of the banked ball for two speeds: soft, which is just hard enough to bank off the second rail; and hard, with speed at the high end of normal bank shots — maybe 12 MPH. To measure the landing spot, I placed another object ball at the expected arrival point, and repeated the shot until the banked ball consistently arrived for a full hit on the extra ball. From the distances on the table, it's a simple matter of trigonometry to figure out the angles into and out of the first rail.

Once I had measured the angles with the balls starting back some distance from the cushion, I moved them up near the cushion but not quite touching it, and measured the angles again for hard- and soft-speed shots. Balls for this part of the experiment need to be fairly close to the cushion, because any follow the ball picks up on its travel to the rail may have some influence on the angle off the cushion. The reason to leave a small gap between the banking ball and the cushion is so the banking ball will be free from the ball that hits it in the combination, and there can be no "funny business" while the ball is actually on the cushion.

Similarly, the bank angle is less than 45 degrees because that's the angle at which you start to risk a double kiss for a combination frozen on the rail. (In a recent column, Willie Jopling showed how not to kiss for **a** 60-degree angle in a proposition frozen combo bank shot, but the cue ball is not shot along the line of the combo.) The object ball will sink into the cushion for fast shots and tend to avoid the kiss, but for softer shots, you don't have as much margin on the kiss, so keep the angle under 45 degrees.

Once I had measured for fast and slow shots with long and short distances to the rail, I waxed the banking ball and remeasured the angles. This is like playing on new cloth without the cost of actually changing the cloth. The wax makes the ball-cloth friction lower.

Once I had measured all eight cases on the pool table, I tried the same experiment on a five-by-10-foot carom table and then on a six-by-12-foot snooker table, giving 24 cases in all.

The pool table was a Gold Crown III with moderately worn Simonis 860 cloth on cushions that had been recently replaced. I think it's fair to say this is representative of the better tables most players will encounter. Shown in **Diagram 2A** are the results for a normal ball compared with the ideal perfect reflection angle of 39.4 degrees. The five arrows coming out from the cushion are the ideal angle and the four cases of near/far fast/slow. **Diagram 2B** shows waxed-ball results.

For each of the two kinds of balls (waxed and unwaxed) only one of the angles really stands out. That is the soft shot from a distance. It is about 14 degrees "longer" (more

along the rail) than the other bank angles for the normal ball and about 15 degrees longer for the waxed ball.

There is only a small separation between the three other bank angles (slow and near, fast and near, fast and far) for both the waxed and normal balls. In fact, in **Diagram 2,** it's hard to tell them apart. The conclusion is that the bank angle is nearly constant except if the ball is allowed to acquire roll before it gets to the cushion. Looking more closely at the results, it turns out that for the unwaxed ball starting close to the cushion, the hard shot banks 0.9 degrees shorter than the soft shot. That's about an inch difference in the distance across the table. However, for the waxed balls, the harder shot actually banked longer by 0.3 degrees, exactly contrary to the myth. In **Diagram** 3, I've put together a table showing the numerical results. The shots that are represented by larger angles are "shorter," smaller number mean "longer" rebound angles.

On the carom table, the results were similar with the three angles clustered close together, but for both the normal and waxed balls near the cushion, the hard shot banked about 2 degrees shorter than the soft shot. While this is in the direction of the myth, it is a very small effect compared to the 15 degrees you pick up from letting the ball roll with follow into the cushion.

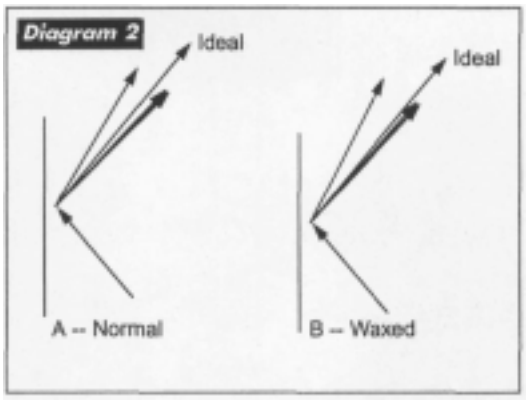


Diagram 3	Hard	Soft
Far (normal)	43.2°	30.8°
Close (normal)	44.9°	44.0°
Far (waxed)	41.4°	26.9°
Close (waxed)	42.6°	42.9°

The largest surprise for me was what happened on the snooker table. This was a British-style six-by-12-foot table by BCE, with napped cloth and L-profile cushions. Follow on the banking ball caused about as much lengthening as on the other tables, but for the close ball, shooting softly shortened the shot by 3 to 4 degrees. This is directly contrary to the myth, and is a very significant change in angle, amounting to nearly three ball diameters in where the ball lands on the second cushion for this angle and table.

One explanation for this large change with speed on the snooker table is that the L-profile cushion is thinner than the K66 profile on the pool table. If the rubber is compressed so far on a hard shot that it loses its rebound, the speed coming off the cushion will be reduced, while the speed along the cushion will not change as much. This will lead to a longer angle off the rail. Of course, until more exact measurements are made, perhaps with high-speed cameras and accelerometers, this explanation is just speculation.

My conclusion from this experiment is that on bank shots, speed changes the angle mostly by changing how much follow is put on the banking ball — if the ball is sliding into the cushion, speed changes the angle only slightly. Furthermore, with new (or maybe slippery) cloth, you might see the opposite effect, in which a harder bank shot actually goes longer than a soft shot. With L-profile rubber, the lengthening of hard shots is very significant.

Bob Jewett

Short Banks

Sink 'em with this target-point system.

In my last article, I showed some results from an experiment that studied how speed causes banked balls to go "shorter," or more perpendicular to the cushion they strike. A major point to note from the measurements is that the banking angle for a ball without spin was nearly independent of speed. This suggests the following system.

In the ideal mirror banking system, one of the very useful and amazing features is that the reflected pocket is always in the same place. If you have set up a marker at that place — which is out in space — you are not required to count diamonds or construct crossing isosceles parallelograms or drop mutually orthogonal perpendiculars. You just shoot toward the target.

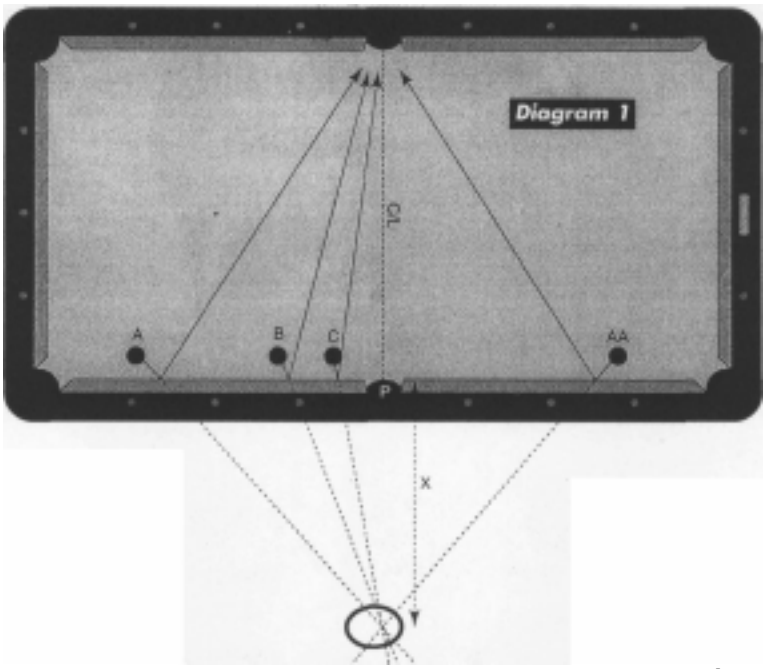
The problem with the ideal mirror system is that it usually doesn't work. As shown by the measurements last month, the actual angle is usually either more or less than the ideal reflection angle, depending on the shot's roll and distance from the cushion.

Now suppose that there is a similar target for banks for sliding balls. If such a target existed, it would have all the benefits of the mirror target with the added big advantage of working for a large class of shots. Where might such a target be? How could we find it?

In **Diagram 1** is an outline of how to find the target, if it exists. Shown are three shots — A, B and C — all to the side pocket. The aiming lines are extended off the table, and they are shown all meeting in a point, more or less. This suggests a way of finding that point: just shoot bank shots from these locations until you find the correct aiming line for each starting position. Then draw the lines, maybe by placing cue sticks on bar stools, and see where they intersect.

There is a faster way if you use a trick. Imagine that the side pocket P is not there on the first rail, so that if the object ball were on the centerline C/L, you would bank it straight back along the centerline. This means that if the magic point exists, it is on the centerline. Now you only have to find the aiming line for one shot, for example A, to find the target point for all the cross-side banks.

When shooting the shots, it's important to remember that the object ball must be sliding when it hits the cushion. If the ball starts very close to the cushion, the speed is not important, but if the ball starts farther away from the cushion, say two diamonds, you have to use enough speed to make sure that the ball doesn't pick up much follow before it hits the rail.



If you do use the fast one-shot method of finding the target point, it's important to test the point with the other shots. Note that the bank shots from the other half of the table, such as AA, have the same target point. Everything is nicely symmetrical.

The target point can be given by a single distance: how far the target is from the nose of the banking cushion, shown as X in Diagram 1. On the two 4.5- by 9-foot tables I tested, that distance is close to 35.5 inches. This is just a little less than three diamonds and close to 70 percent of the width of the table. And on the tested tables, there is a single target point for all cross-side banks.

If you are familiar with "spot on the wall" systems, this is similar. The big difference is that the spot for this system is at a precise, fixed location close to the table. I've seen an instructor try to use a spot on the wall for this kind of bank that was 10 feet back from the table. While that might work for a couple of shots that are close to the correct line to that far point, it is guaranteed to fail for most cross-side banks. The main point to learn here is that not all system concepts apply to all situations, and a deeper understanding is often needed to see the limitations and extensions of a system or concept.

Because any system requires practice before it can be added to your arsenal, here are some drills. At first, shoot the shots with the target on a bar stool at the correct distance for your table that you found earlier. For a variety of shots close to the cushion, like the ones shown, see how many you can make in a row, starting close to the side pocket. As we will see below, you need to be very careful about keeping sidespin off the cue ball, hitting straight along the aiming line, and making sure that the object ball is sliding when it hits the cushion.

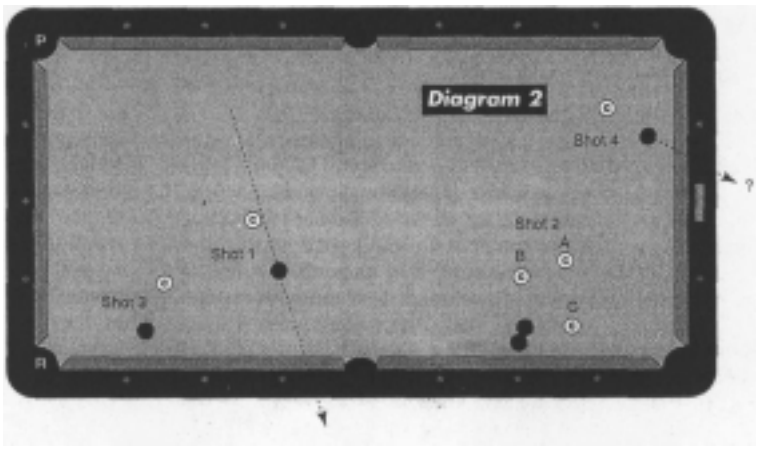
Next, try banking without the target present. You can find the line by using your cue stick. For my stick, if I place the tip against the side-pocket iron pointed straight at the side pocket I'm banking to, the butt-side of the joint is exactly the right distance out in space. Looking back at the cue and object ball, I can get a feeling for the line of the bank.

In **Diagram 2** are some extensions of the system. You will still need the target on the bar stool for the setups. In Shot 1, the idea is that the angle is off for the simple bank, and you need to do something special to

move the angle back to the side pocket. As shown, the normal angle would go wide of the side pocket, and just cutting the ball to the right is dangerous because of the kiss. A little "hold up" English, in this case left, will change the angle back in two ways. First, throw will move the object ball to the right, but more significantly, the spin transferred to the object ball will take on the cushion and bring the ball off straighter.

Try Shot 1 with the angle set up wrong in both directions, and see how much you can correct the angle with sidespin. Alternatively, place the two balls lined up straight toward the target, and see how far to either side of the pocket you can take the object ball but still have a full hit on it.

Another kind of throw on bank shots is shown in Shot 2. First, set up the two object balls straight toward the target, and place the cue ball at A, also on that line. Hit the shot straight-on and firmly to make sure the bank goes into the side. Now set the balls up again in precisely the same spots. If you used donut-shaped reinforcements before, this will be easy. Shoot from B directly at the **front** object ball. Where does the second ball bank to? Try the same shot from C. What I think you will observe is that a shot from B will bank short (landing on your side of the side pocket), while a shot from C will bank long. I think you'll be surprised by the size of the effect.



In Shot 3 is an extension of the system for cross-corner shots. Do you see immediately where the target should be to get to pocket P?

A final extension is Shot 4 to pocket R. I didn't have particularly good luck with this one, probably because the shot is much harder, but a first guess for the location of the target is 70 percent of the length of the table away and along the line of the side cushion.

This system is so simple and so much more accurate than the standard mirror system that I would be surprised if it hadn't been discovered before, so I will hold off on claiming its invention.

On another note of discovery, it turns out that the "lens-shaped overlap" aiming system that I credited to Randy Kukla in my June column had been previously described in these very pages by Robert Byrne in December 1989, at which time he gave credit to Paul Hahn, who had sent it to him. That column is available in Byrne's "Wonderful World of Pool and Billiards." My oversight would have been less embarrassing if I hadn't chided aiming-system authors for not doing their homework.

Bob Jewett

Useful Strokes

Add these to your arsenal.

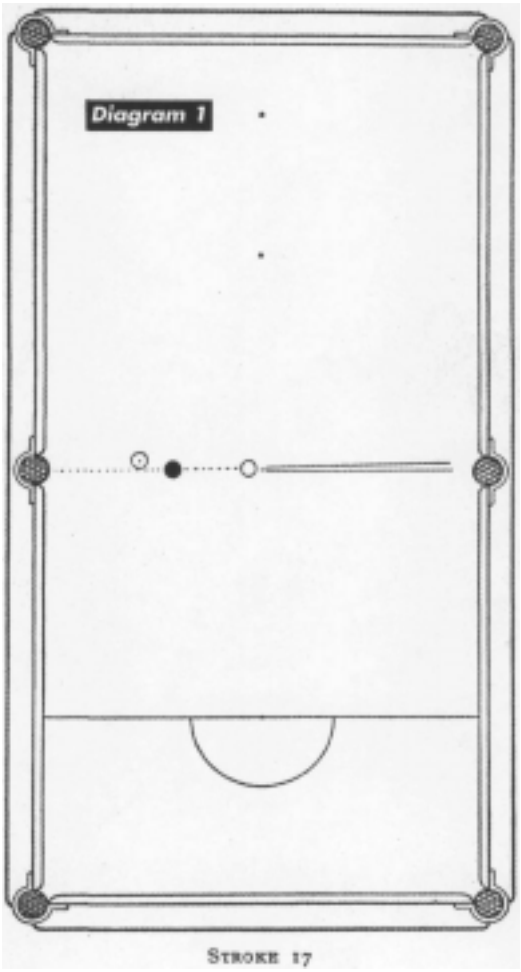
How many different shots do you know? Technically, even a simple straight-in shot has an infinite number of variations if you include speed and spin, but psychologically I think the number is much smaller. It seems to be a natural human tendency to categorize similar things and put them into pigeonholes. When I was starting to learn to play, I had names for shots like "a little off straight in" and "a little backwards cut" and "real thin near the pocket" and "pretty close to a spot shot."

Putting shots into named groups helps the player to recognize the shots when they come up and to remember how to play them. At first, you may have only a few "plays," but with more experience you might add such techniques as "thud the cue ball sideways," "run around the corner with spin and follow," "slow kill on the rail," "soft draw for no scratch," and "impossible cut."

Authors often mirror this natural learning method by giving us lists of shots we should know. The most recent is Robert Byrne's "Complete Book of Pool Shots," with 350 items. Twenty-seven years ago, Ray Martin wrote "The 99 Critical Shots in Pool," and 63 years ago Willie Hoppe gave us "Billiards As It Should Be Played," which included several dozen "key shots," as Hoppe called them, as easy examples of classes of shots to try. Some authors go on to link multiple "plays" together to solve whole-table problems (like the new "Run This Rack" feature on page 22), but for now let's just consider individual shots.

A century ago, prolific British billiard author Wallace Ritchie wrote a book called "Useful Strokes for Billiard Players." He thought that 50 shots would be sufficient for the purpose of instructing most players. In his introduction, after lamenting that only 1 percent of the players of his time had ever read a book on billiards, he stated his hope for his list of shots:

"For the remaining 99 per cent, theoretical dissertations on their favourite pastime have no attraction whatever; but while this is perfectly true I can say unhesitatingly that in all my long experience I have never met a solitary player who was not always deeply enough interested in having any specially useful stroke explained to him. It has occurred to me, therefore, that a collection of such useful strokes, with a clear though by no means deeply theoretical description of how they are to be made, will be welcomed by a very large proportion of those hundreds of thousands of players who do not appreciate the study of the more intricate treatises on the game."



STROKE 17

Keep it short, keep it simple, keep their attention and get their money. A good idea still.

Diagram 1 is from his book, and shows one of his shots that you may have seen before. In the game Ritchie is describing, it's good to scratch, so the not-so-obvious play is to hit the black ball full, which clears out the other ball, and allows the cue ball to follow forward into the pocket. Such clearance shots are standard these days for trick-shot shooters, and can be useful at 9-ball — imagine the 9 is by the side pocket — or for safety play — imagine that the cue ball will follow through to a spot where your opponent will be very uncomfortable.

(A brief aside: You may have noticed that Ritchie's balls are too big to fit into the corner pockets. The pockets are drawn the correct size for a 6-by-12 table, but the balls have been magnified to allow the reader to better see how full the shot is and what side spin is used. A much better way to do this is seen in Eddie Robin's books, where a magnified inset shows tip placement, elevation and fullness of hit.)

In the case of this clearance shot, the problem during play is often just to recognize the possibility to play it. If you have "two ball clearance with a full hit and follow" in your repertoire, maybe you'll remember it the next time it comes up before you settle for something worse. Or, that notion might even trigger an extension with the cue ball following at a slight angle and with spin to come off the cushion to a really nasty safety position.

Not all of Ritchie's shots are so useful. In his day, it was OK to jump over a ball by scooping under the cue ball. He recommends against the standard suggestion of that time to elevate the butt and "aim at the cloth an inch in front of the ball," and instead proposes to lay the stick flat on the table and just slide it along under the cue ball. Well, maybe the shot is useful. Suppose you need to play safe at one-pocket and the only shot available is to jump softly to pocket a hanger in your opponent's pocket.

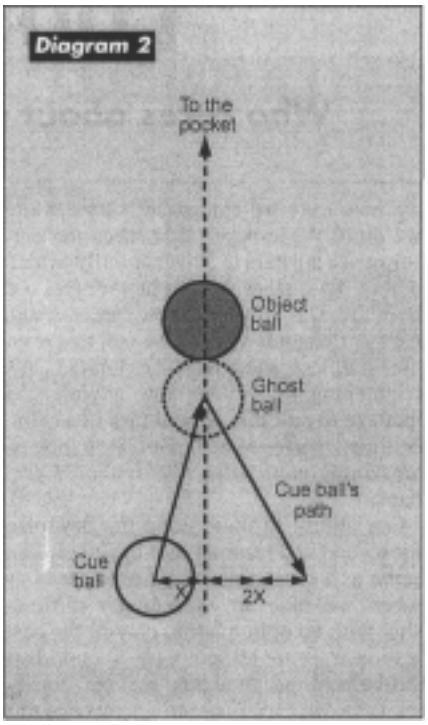
Is there any rule to keep you from using Ritchie's method, given that you are ready to take a foul for strategic purposes? Should there be such a rule?

One piece of his advice I do object to is his bogus recommendation, still parroted by modern authors who should know better, to pocket an object ball frozen on the cushion by hitting the ball and cushion simultaneously. If that idea is in your own personal list of shots, erase it immediately!

A very useful shot — sometimes I overlook it myself — is the kiss-back. When the object ball is on the cushion, can you control where the cue ball will kiss to if you hit it full enough for a double kiss? Ritchie shows several variations, including straight back, nearly straight back, and 45-degree angles. I think this shot is worth ten minutes of your next practice session. See if side spin changes the result.

For draw shots, he shows about three kinds: right-angle draw for a half-ball hit, straight back draw for a completely full hit, and something in between. I suppose you don't want to clutter up a beginner's brain with complications, or as Ritchie might put it "theoretical dissertations," but there is a general system to find the cue ball angle for draw shots, and once the system is understood, all draw shots fit into a single category. That system is shown in **Diagram 2.**

Look at the shot along the path of the object ball, for example to the pocket, directly in the line of the object ball and the ghost ball (cue ball at instant of contact). The cue ball starts out from some distance "X" to one side of that line. It will draw back somewhere to the other side of that line. The splendidly simple system is that it will come back twice as far to the other side of that line, shown as "2X" in the diagram. For nearly full shots, this means that the angle the cue ball is deflected to the side from its original path is three times the cut angle of the object ball, and sometimes angles are easier to think about than distances. But this "X/2X" system works for all fullnesses of hit, provided that you have lively draw on the cue ball. If you only have middling draw for the speed of the shot, the number 2 is bigger. How much bigger is up to your stroke.



Is this universal system better than knowing three — or four or six — different draw shots? Being a geometrical sort of person, I think it is. For Richie's hypothetical antitheoretical player, who may be repulsed by even the simplest analysis, maybe it isn't. Which way of organizing your shot concepts do you prefer?

If you like to think in systems rather than unique shots, go back to your double-kiss-back practice and see if you can come up with some sort of rule that governs a wide range of angles. If you do, let me know and I'll present it in a future column.

Bob Jewett

Stroke Straightening

Would it do you good to iron out your swing?

Is it good to have a straight stroke? By "straight," I mean that the back of the stick may go up and down some, but there is no movement side-to-side.

There are lots of great players to point out as contrary examples. Old-time carom players were particularly flamboyant. Willie Hoppe had a side-arm stroke from learning to play when small, and Bill Hawkins, who held the U.S. high-run record for years, swerved to the outside on every side-spin shot.

But if you look at most of today's top players at carom, pool, and especially snooker, you will see sticks confined to a very narrow, vertical plane during the final forward stroke.

How is your stroke? It is not so easy for a player to tell on his own. For many years, I had a very pronounced and unintended left-to-right swerve in my stroke. I suspect it developed because I had my dominant eye in the wrong place, so I simply did not see the center of the ball correctly — by up to a whole tip. Through long hours of practice, my arm learned to get the tip to the center of the ball when needed, even though I had no awareness that my arm had taken over control of the stroke.

The most standard practice to test your stroke is the "over the spots" drill. Place the cue ball on the head spot, and shoot over the foot spot, hoping to return the cue ball to your tip. Here are some variations on this old standby to make it more effective.

Use a striped ball as the cue ball. Place it so that the stripe will roll like a tire with colored tread and a white hub. If you put any sidespin on the shot, it will be immediately obvious as a wobble in the stripe. Use a dark color, so that you can see where the tip hit the ball — there will be a small chalk spot on the ball. The special cue ball that comes with the Elephant Practice Balls set holds this mark better because it is made from a more porous material than high-quality object balls. (It also has a bull's-eye for centering.)

The stripe also allows you to see whether your tip is centered on the "cue" ball. If your set is the kind that has the "eye" for the number in the stripe, turn that toward you so that your tip is centered on the eye.

Instead of watching the ball or *the* far cushion when you shoot, try watching your ferrule. Does it come straight back and follow straight through? To help with this, you can use self-stick paper hole reinforcements. Place one for the ball to start in, and place a second straight up the table at the length of your normal follow-through. If your stroke is straight, the tip should end centered on the farther white donut.

If you can make the ball return to your tip for a shot just hard enough to get back (six diamonds up and six diamonds back), crank up the speed. Can you make the cue ball hit the center of the far cushion twice? Can you make it hit the center of the cushion you are standing by twice? Even as you increase the speed, monitor the stripe wobble and/or the finish by the donuts.

The StrokeTrainer's aim is a perfect pendulum swing.

Once you are satisfied that you are hitting the cue ball in the center even at pretty high speeds, here is a final test that's deceptively difficult: Play the shot just hard enough to get back to your tip, but play it with your best (lowest) draw. Do you know why it is so much harder to get the cue ball to come straight back with this shot? Think on it for a while.

There are some other easy drills for stroke measuring and straightening. Just practice stroking with the stick up on the rail, aligning the cue with the line between the rail cloth and the rail cap. (Or, you could draw a line on the table or use tape, as Bob Byrne suggests in his "Power Pool Workout" video.) The eye picks up small side-to-side movements fairly easily in this setup. Or you could use lined note paper — lots of lines parallel to the direction you want the stick to move.

If you set up a shot so that the stick passes over the rail and your hand almost reaches the rail at the end of the follow-through, you can put a piece of chalk on the cushion on each side of the stick with just a little clearance at the end of the stroke. If the chalk moves, your stroke is crooked. Out in the open table, tubes on end — empty toilet paper rolls? — could define limits for your stroke.

I think the stroke drills that allow you to actually shoot a shot and make a ball are the most useful. Being able to stroke the stick in a perfectly straight line on your dining room table does you little good if your arm (like mine) takes over control when it's time to put a real ball in a real pocket for glory and honor and maybe a little real cash. I think your practice has to be as close as possible to the final competitive situation for that practice to hold up under pressure. Which of the above suggestions can be cast into a game-like setting?

One of the problems with all of the drills above is that they don't provide much feedback during the stroke itself. There is a new product on the market called the StrokeTrainer, shown in the photo here, that tries to fix this. It has two major parts. A vertical board is positioned where your grip hand swings. This gives you immediate feedback: Your hand moves away from or runs into the board if your hand wobbles or swerves side-to-side. The second part consists of two vertical rods which form a narrow goal for your shaft to pass through. This gives you mostly visual feedback on the front end. The construction is quite solid, which means that it will stay in position well in spite of your hand bumping into it, but repositioning is more effort.

Note that since the front-end alignment is set by vertical rods, your stroke is allowed to be like a pendulum rather than like a piston. (See my March 2004 column for why

you might refer to the latter as a "Jones stroke.") If you really wanted to do the piston thing, the rods should be replaced by a ring.

Is it worth the cost? There have been unsolicited testimonials by long-time crooked-stroke sufferers who swear by its healing powers. It's clear to me that for some players it's a major help. While it's simple enough that you could build one yourself, some of us tend to produce no more than sawdust when we get near power tools. I think the best customers for the StrokeTrainer are instructors and pool halls, where many end-users can effectively share the cost.

As an engineer, it's hard for me not to make suggestions when I see a new techno-toy. While the hand is prevented from moving to one side or the other by the single vertical board, why not have boards on each side? Maybe bumping knuckles or friction would be a problem, but a light glove or padded sides might fix that. I think the additional restriction might also reduce any tendency toward rotating the stick during the shot.

I saw a higher-tech version of the StrokeTrainer about 10 years ago when I visited Terry Baker, who did some of the technical drawings for Eddie Robin's instructional books. He had built a "cue on tracks" which allowed the stick to move only in a straight line. The construction prevented it from being placed on the table. The idea is interesting, though: Force the arm to move with a particular motion, and then when the restriction is removed, the improved motion will be retained. My question about this — Where is a sports psychologist when you need one? — is whether forcing perfect motion is a more effective training method than providing mistake feedback, as with the StrokeTrainer.

Do you have a good way to develop true cueing? Let me know about it so I can blab it to the world in a future column.

If any disciples of the New Yankee Workshop are out there, here is my suggestion for the "stroke forcer" device that I've envisioned. Make a cue stick with a narrow slot cut through its center over a large part of the middle of the length. This will be easier with a one-piece, but I suppose it could work with just a butt on a jointed stick. Make a thin plate several inches long that will just fit through the slot and attach it to a base so it will stand vertically on the table. Slide the slot in the stick down on the vertical plate. If you now try stroking, the plate will restrict your motion in two ways. First, only straight forward and back will be allowed, as long as the base doesn't move. Second, you cannot twist the stick while you stroke, or the slot will jam against the plate. If anyone does make such a device, please let know how it comes out.

I hear from a correspondent that an even higher-tech tool is in the works. It will keep track of your alignment electronically, and give audible feedback if you go off-line. Providing that the inventor figures out how to make this work for the majority of shot situations, while pocketing real balls, I think this might be much better than the current tools for stroke straightening.

Do you have a good way to develop true cueing? Let me know about it so I can blab it to the world in a future column.

Bob Jewett

Help With Aiming

Some devices of the past still prove useful.

Did you do your homework from last month? If so, your stroke is perfectly straight now. With that foundation, let's move on to a few devices that will help you perfect your aiming.

Perhaps the most remarkable device ever made to assist in lining up shots is shown in **Diagram 1.** It is the "Pointer" developed by Colonel C. M. Western, and is described in a 154-page book published in 1911. The list price for this Wonder of Victorian Science was under two dollars. For any cut shot on the table, you set up the "No. 1" arm (marked O-R) along the line of the path of the object ball and the No. 2. arm (S-A) along the line of the cue ball. This will make the slider E move along O-R and indicate how full you need to hit the object ball. Note the marks along the O-R arm which are labelled in eighths of fullness of hit, although there are sub-marks down to 32nds of fullness. Point O is at the center of the object ball and P is the center of the cue ball at impact. In a separate table, Col. Western shows all the cut angles so the student will be aware that a 17/32 hit will give an object ball cut angle of 32 and 1/12 degrees. (Western lists thinness rather than fullness of hit, which is more natural geometrically, but the rest of the world does it the other way.)

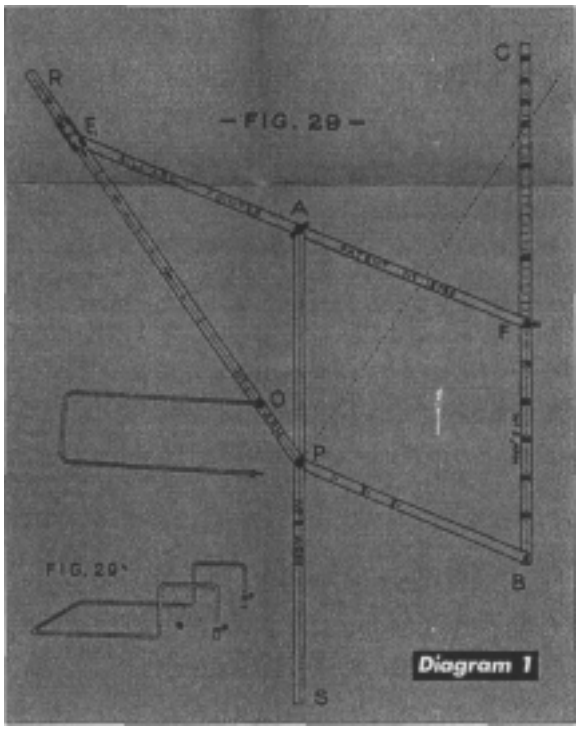


Diagram 1

But even more useful is the other arm of the Pointer. If you know what sort of draw or follow you are going to have on the cue ball when it gets to the object ball, the numbers along the right arm give **the** direction of the cue ball as it comes off the object ball after its curve finishes. For example, if you have #36 follow on the cue ball, which happens to be normal rolling, the cue ball will follow a string stretched from point P past the number 36 on the right vertical arm. Western provided two 8-foot silk cords for this purpose which were colored alternately red and white in each foot. The Colonel was very thorough.

For draw shots, there is a simple calibration for you to do with a half-ball shot that might produce a number like 85. With this single number, you can find the draw angle for any fullness you set up simply by running the cord from P to 85, assuming a similar quality of draw.

You may note that the device is patented, but if you're handy with sheet metal you have my permission to make a Pointer, provided that you send me a copy. Remember to number both sides so that it will work for both left and right cut shots.

Shown in Diagram 2 is a somewhat simpler device called "The Arrow" from "The Straight Pool Bible" by Hall-of-Famer Babe Cranfield with co-author Larry Moy. It looks pretty simple, especially compared to Western's opus, but Cranfield says, "I seriously considered focusing this entire book on aiming with the Arrow. It can teach new players, and remind experienced ones, how to aim the cue ball. I have never found a device or system that works better for me or my students."

I can safely say that Cranfield ran over 200 balls more times than you and I together will ever run 100, so you might want to consider his advice.

To use the Arrow, place the forked part under the object ball so that the Arrow points away from the pocket (or other target) and the "interior point" is right under the edge of the object ball. The tip of the Arrow will then be where the base of the cue ball must be when it contacts the object ball, and you simply aim at the tip of the Arrow. Cranfield also shows how to use the Arrow to aim dead-ball caroms in the book.

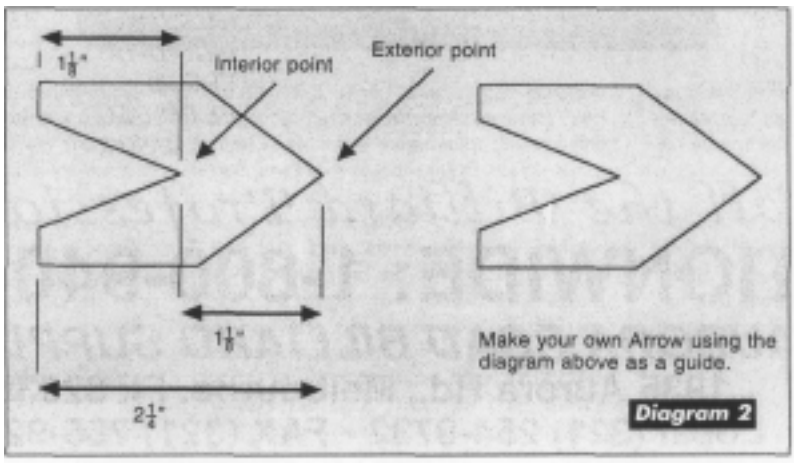


Diagram 2

The device is remarkably simple, but it gets the job done. I hope you're not put off by the lack of levers, pivots, pulleys and silk cords. If you make your own, don't bother to send me a copy, as I already have one.

The final device for this month is shown in **Diagram 3. It** shows the cut angle for **a** half-ball hit, which is when the cue stick is directed through the center of the cue ball at the edge of the

object ball. It is made from paper or posterboard in two parts: the circle and the triangle. For the 2.25-inch circle, any drawing program should let you print one the right size, or you can print out the example from the www.sfbilliards.com "miscellaneous files" page. The triangle is tougher, as you need a little trigonometry. I have it dimensioned for cutting out of 8.5-by-ll-inch paper. If you use 11 inches as one side of the triangle, and the other side is 6.3508 inches, then the angle will be 30 degrees.

I find that this is a little small for accurate sighting, so you might want to make your angle indicator out of a larger piece of paper, say with the longer side 24 inches long.

You could use the same proportions given above or a table of tangents, but there is an easier way. Go to the www.google.com search engine on the Internet and type in "tan(30 degrees) * 24" as the thing to search for, and Google will figure out that you are trying to do trigonometry and will tell you thai the other side of the triangle needs to be 13.86 inches long.

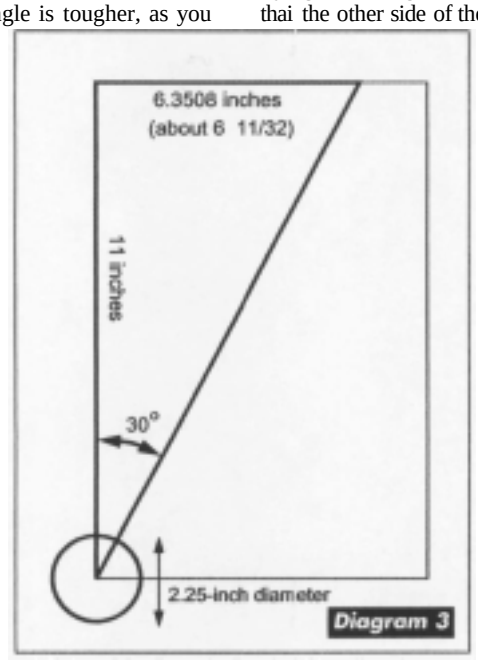


Diagram 3

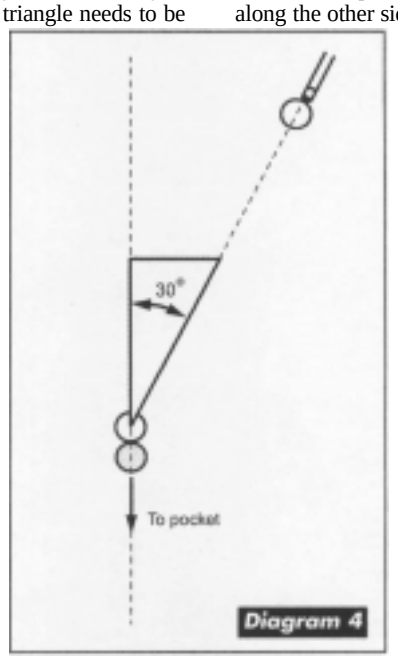


Diagram 4

Using this aid is as simple as it is single-minded. Place the circle where the ghost ball will be to pocket the object ball, and make one side of the triangle point straight towards the pocket. The cue ball must be along the other side of the triangle, as shown in **Diagram 4.** Unlike the first two devices, this works only for one angle, but I think that angle is important enough to have its own special tool.

Here are two more exercises. Using the half-ball tool, find out where on your table you should place the cue ball to have a half-ball spot shot. A half-ball hit will have about two degrees of "collision-induced" throw.

On a spot shot, the object ball travels 35 inches to the pocket. How much error at the pocket will that result in? Hint: ask google about tan(2 degrees)*35.

Is that much throw significant?