Bob Jewett

Making Contact

How to effectively play a ball frozen to the rail.

For a beginner, one of the hardest rules to understand is the requirement to contact a rail. Stated briefly:

No-Rail Foul: On a shot that does not pocket a ball, some ball must be driven to a rail after the cue ball contacts an object ball, or the shot is foul.

The main reason to have this rule is to avoid repetitive simple safeties. At 14.1 or one-pocket, you can imagine the players repeatedly rolling the cue ball up to the nearly solid rack.

At 8-ball and 9-ball, the chance for a full-rack stalemate is less likely, but consider the positions in Diagram 1, which could be from either game. In situation A, if no rail were required, the players could shoot softly to just touch the object ball. With a rail required, a more difficult shot would be needed — perhaps skimming the object ball and spinning the cue ball to the far end rail — and it is likely to leave something for the opponent.

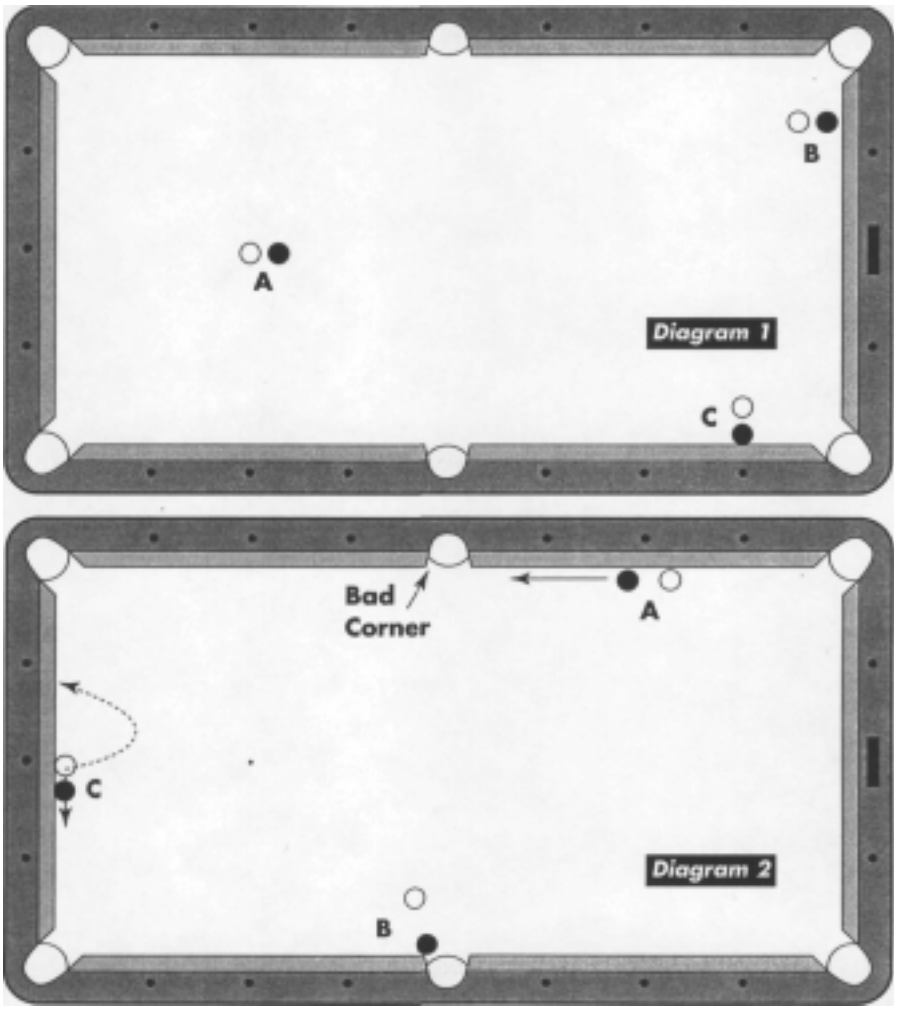
In situation B, which was covered here in October 1997, it is easy to get a rail contact. In 14.1 (and apparently no other game), another rule comes into play: when the object ball is within a ball of the cushion, each player is allowed two simple safes on it, after which the object ball is considered frozen to the rail.

This brings us to another wrinkle, shot C. When the object ball is frozen to the rail, driving it deeper into the rail doesn't count as a cushion contact. Otherwise, the position might well result in a stalemate. One simple way to state this requirement is: A ball is driven to a rail if it is not touching a rail and then touches a rail.

This definition, along with the rule above and the "two shots and it's frozen" rule, covers the problem fairly well. There are a few situations that would not be fouls according to the above, yet are still fouls by the present wording of the rules.

In Diagram 2, suppose the object ball is frozen and you try to shoot it straight into the corner. Unfortunately, the far corner of the side pocket is sticking out, and the object ball hits it and rolls out to the center of the table. Foul. Under the current rules, you do not get credit for the object ball contacting the rail it starts frozen to unless it leaves the rail, hits a ball, and then returns to that rail, which includes both side cushion selections.

In shot B, the object ball is frozen to the corner of the side pocket. You hit it too full, and it rattles between the side pocket jaws and doesn't drop. Foul. Since the object ball started frozen to the rail, you again get no credit for contact on that rail even though the ball clearly leaves the rail between contacts. It's not clear what the call should be if you try to force the object ball through the corner of the pocket and it hits the bottom of the pocket and then rebounds onto the table. Probably a foul.



A little more unusual is shot C, where both balls are frozen to the rail and to each other. Suppose you shoot a thin shot with masse to bring the cue out and back to the same cushion. As long as the cue ball gets back to the cushion, the shot is OK, even if the object ball doesn't reach the pocket.

Should A and B be fouls? Clearly the object ball is driven to a cushion on each. Is there any danger of a repetitive safety? Very unlikely. The rule would certainly be simplified by the wording above.

Those who play snooker know that no rail contact is required at that game. How are stalemates avoided? Part of it is that most no-rail safeties are rolled softly up to balls that the opponent is not allowed to hit on his next shot (the colors while reds are left). When it's down to just the colors, the larger table makes playing a shot that separates the cue and object balls the winning strategy.

Knowing what the rules are can often get you ball-in-hand. Remember, though: a frozen ball must be so declared before the shot, or it is not considered frozen.

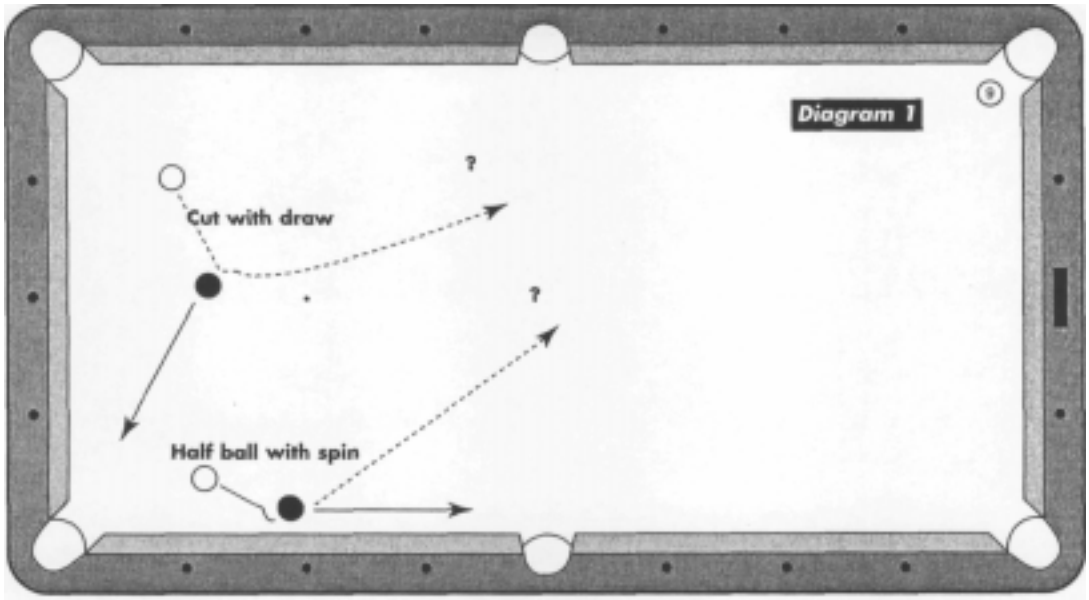
Bob Jewett

More Spin, Less Speed

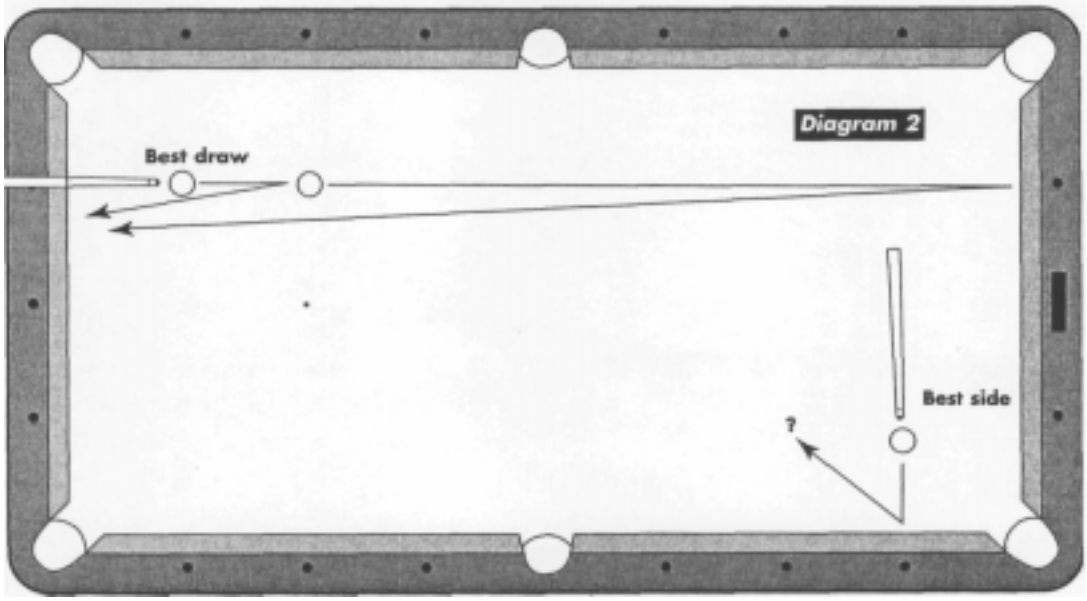
Know the ratio to get the cue ball to behave.

Do you ever find yourself wondering whether you can get the cue ball to take a certain path? Usually the question is whether you can get enough spin on the cue ball, or, more precisely, whether you can get a lot of spin for a given speed — ie., can you achieve a high spin/speed ratio?

Two example shots are shown in Diagram 1. To provide motivation, the goal in each is to pocket an object ball and also pocket the 9 with the cue ball. The side-spin shot is about a half ball cut. Follow will help a little, but the angle off the rail is mostly determined by how much side spin you can get.



Just side-spin is not enough, though. Suppose you shot very hard and just a little off center. There will be a lot of RPMs on the cue ball, but the high speed into the rail will make the cue ball rebound relatively straight across the table. Instead, you need to move the tip as far to the side as possible without entering miscue territory. This increases the amount of side-spin relative to the forward speed, and when the ball strikes the rail, the spin has a chance to dominate. When you try the shot, use just enough speed to pocket the 9, and gradually make the cut harder until the cue ball will not take the right path even with maximum side.



In the draw shot, the goal is also to make the 9 with a carom. The problem with too much speed on the cue ball is obvious — the cue ball will not have time to draw back. What's needed again is a lot of spin (back-spin in this case) relative to the speed of the cue ball. This shot gets a nice hook on the cue ball that startles novice spectators. When you practice this shot, gradually move the cue ball to a thinner cut while lowering your hit on the cue ball. Remember to shoot just hard enough to get to the 9.

In both these examples, speed hurts rather than helps. What you want is lots of spin but not much speed — a high spin/speed ratio. Hans de Jager, the former European champion of Artistic Billiards, refers to this as the "quality" of the shot. What does it take to have a "quality" stroke? How can you measure this "quality"?

According to a simple physical analysis, "quality" is determined by how far from center you hit the cue ball. The more eccentric the hit, the more "lever arm" you have to turn the ball. This analysis also predicts that if you hit the ball 11.43 millimeters above center, the cue ball will start with

exactly enough follow to roll smoothly on the cloth. Let's call this a spin/speed ratio of 1. Is it possible to get more "quality" than this in a shot?

In *Advanced Technique in Pool and Billiards* (page 42), Robert Byrne describes an experiment to test this for follow. It compares a "best" follow shot with a smoothly rolling cue ball to see whether "overspin" can be put on the cue ball. You should try the experiment for yourself, but the answer seems to be, you can't exceed smooth rolling by much.

In my last column I briefly mentioned a series of pool experiments done with high-speed video. The experimenters included Mike Shamos, Jim Buss, Hans de Jager, Walt Harris and me. We refer to the week of tests as the "Jacksonville Project" since that was where they took place. There were several surprises and some interesting measurements, including some related to the spin/speed ratio.

In a side-spin experiment, 19mm of tip offset was used. (This means that the shaft was 19mm away from where it would be for a center-ball hit.) With left-side spin, the camera was focused on the right side of the cue ball. The surprising result was that the side of the ball actually moved backwards at the start of the shot. This means that the spin/speed ratio was greater than one. But by how much?

It turns out that if you look at the point on the cue ball that starts nearest the camera — the eastern-most point as the shooter would see it — and note how far it moves backwards before the forward motion on the cue ball takes over, you can immediately — after a little geometry — determine the ratio. The backwards movement is about 1.7mm, which gives a spin/speed ratio of about 1.2.

Does this result agree with the simple physical theory that says spin/speed is directly proportional to tip offset? If you multiply the 11.43mm mentioned earlier by 1.2, this gives an estimated contact point of the tip from the center of the ball of 13.7mm. This should be compared with the 19mm shaft offset. The apparent discrepancy is due to the fact that it is not the center of the tip that hits the cue ball on spin shots but rather the shoulder, which is about 5mm closer to the center of the cue ball. Thus the measurement agrees with the theory within the accuracy of the data.

In another scene on the tape of a soft by extreme draw shot, the distance the cue ball moved while it rotated backwards 90 degrees was measured, and the spin/speed ratio was again found to be about 1.2.

You may want to test your own stroke without renting $40,000 worth of video equipment. Two reasonable ways to compare tips, sticks and strokes are shown in **Diagram 2.** In the "Best Side" shot, shoot on the equator and straight into the rail and notice where the cue ball lands on the other side rail. Try different techniques and see what it takes to maximize the angle off the rail. Try to use a consistent speed in any comparison.

In the "Best Draw" shot, the idea is to see how little speed you can get on the object ball and still draw the cue ball back to touch the end rail. On most tables, it's possible to get the cue ball to the rail without the object ball touching that same rail. This is a great shot to know at one-pocket.

Another version of this test is to move the object ball to be even with the side pockets and to see how far it moves when the cue ball draws back four diamonds to just touch the end rail. Try it as a challenge shot. Who has the best draw?

Of course you should try to minimize your use of spin — it can lead to misses and miscues — but when you need a "quality" shot, be ready.

Bob Jewett is an advanced level BCA instructor with the San Francisco Billiard Academy — one of seven BCA master academies.

Bob Jewett

Progressive Progress

In order to improve your game/ you must constantly challenge yourself.

In columns in December 1992 and October 1995,1 discussed a form of drill that I call "Progressive Practice." The basic idea is that you set up a particular kind of shot, and make it harder if you make the shot and easier if you miss it. This practice technique keeps you at the edge of your comfort zone, and hopefully lets you push back its frontiers as your game improves in the area you're working on.

Here is a sort of final test to see if you're ready to challenge Buddy, Efren, Earl and Nick. It is the fifth level of Progressive Practice drills from the BCA's Instructor's Manual. Like the first four levels, it tests you with four basic kinds of shot: stop, follow, draw, and cut.

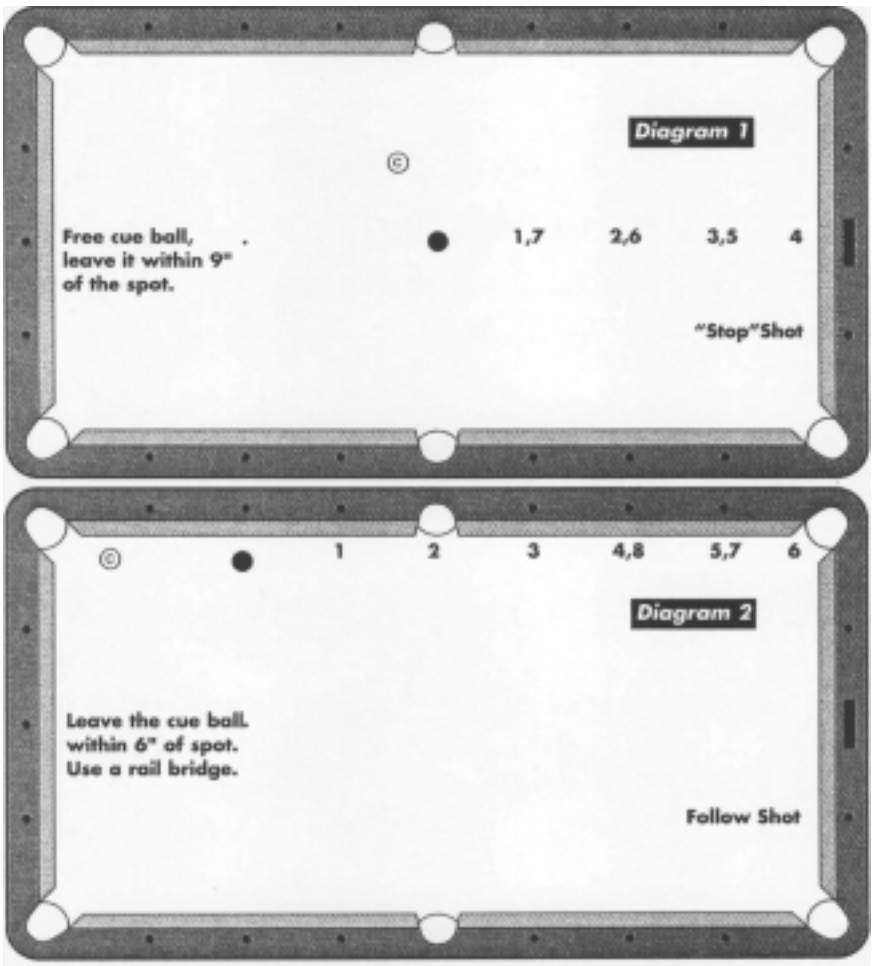
Diagram 1 is a "stop" shot drill. It's really stop at an angle, which is often called stun — the cue ball should travel at right angles to the path of the object ball when struck properly. The object ball is placed in the center of the table on every shot, and the cue ball is placed roughly as shown, but you can take more or less angle as you choose. The goal is to make the object ball in the side and leave the cue ball within nine inches (roughly a hand-span) of the current target.

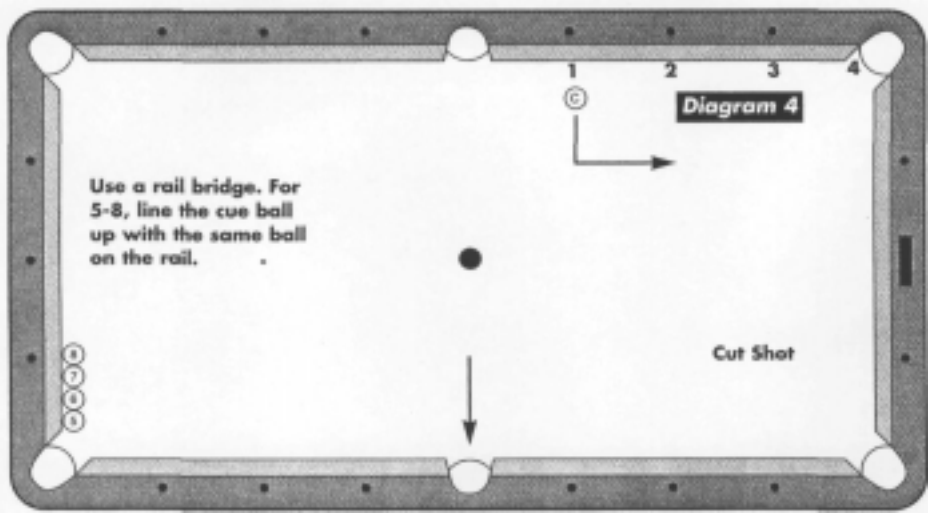
Begin with 1 as your goal, and mark it with a coin. Shoot the shot, and leave the cue ball as close to the coin as possible. If you make the shot, move the coin to 2 and try again. Continue moving the coin a diamond further away until you fail either in the position or in pocketing the ball, and then move the coin to a position half a diamond easier. After your first miss, each movement — easier after a miss or harder after a good shot — is by half a diamond.

Positions 1 through 4 are clear enough, but 5 looks a lot like 3. The trick is that for 5, and also 6 and 7, the cue ball has to return off the end rail.

Remember to move the coin after every shot. If you want to score yourself, shoot the shot ten times, and note the position of the coin after the last shot.

Diagram 2 is a follow shot. The object ball always starts in the position shown, and the cue ball is close enough





to the rail to need a rail bridge. (The exact position is up to you.) The goal is to make the object ball and leave the cue ball by the target. In this case, put the coin up on the rail or out from the rail far enough that it won't interfere with the object ball. Once again, the last positions include bouncing off the far cushion. See where the coin is after ten or 15 tries.

Most players find **Diagram** 3 the most challenging of this set. The goal is to draw the cue ball back to the one-diamond-square box. The object ball moves away from the cue ball to make the shot tougher. If you want to start with a somewhat easier drill, the Level 4 set has a target zone clear across the end rail (one by four diamonds in extent). The exact positions are not critical, but the object ball should be somewhat off the rail, and the cue ball is in-hand behind the line. Don't use the side rail with English; the shot is a straight-back draw with just a little angle.

Diagram 4 is my least favorite in this set: cut the object ball into the side pocket. The object ball goes back to the center of the table, and the cue ball moves up the rail to make the cut harder. At the corner (position 5) there's a problem because if you went a full diamond around the corner, the difficulty would take too big a step up. For positions 5 through 8, note the four balls frozen on the other end rail. The cue ball should be near the opposite end rail, far enough off the rail to form a comfortable rail bridge, and with the corresponding ball making a straight line with the cue ball and object ball. The goal will still be to cut the object ball into the side pocket.

To make these shots a regular part of your practice routine, keep score. All you have to do is note where the coin is after ten or fifteen tries at each shot. As your basics improve, you can watch your score rise. You will probably find that you advance to a certain level (such as 3 for the draw shot) and then oscillate back and forth between two or three neighboring levels. That is your 50 percent point for that shot, which is good to know when facing it in a game situation.

Bob Jewett is a BCA — certified instructor.

Some surprising discoveries about cue/cue hall interaction emerged from the Jacksonville Experiments.

FREEZE FRAME

r^i BOB JEWETT

While the entire series of the experiment with the Kodak Ektapro Hi-Spec Motion Analyzer Model 1012 to witness cue/ball interaction is well-documented in the previous article, we now have some visual evidence of this quasi-historic event. As I have stated before, these results were compiled in the witness by five billiard enthusiasts; you must understand that the conclusions are purely our own, and not necessarily the opinion of *Billiards Digest.* That some of us write for *BD* is purely coincidental.

With that said, let's take a look at what a 12,000-frames-per-second camera could see that the naked eye cannot.

In **Figure 1,** you can see some of the features of the camera and video system that we used to record these findings. They can be found on the black border surrounding the image. (The camera itself was similar to a standard handy-cam, but it had a thick cable going over to a large box of electronics that stored the sequence of images in digital memory, or RAM. The camera was fitted with several different lenses to allow close-ups and normal views.)

The time and date (upper left-hand corner) are obvious. The ID number, 10 (right), shows which scene is being shown. Over the week-long period, we taped more than 250 different scenes.

The REC 3000 (r.) shows that the images were captured at 3,000 frames per second, which is about 100 times faster than standard video. The frame number, which gives the count from the trigger, is -606 (lower left), which means that the trigger will occur in 606 more frames. For all of the inns, the trigger — a button on the remote control —was pressed just after the action, and the camera was set to stop recording on the trigger. This is also reflected in the ET, or, elapsed time indicator (lower r.), which says there are 0.202 seconds until the trigger.

The X and Y numbers on the left show where the cross-hairs are located, and these can be moved around when viewing the video after the recording. This allows exact measurement of distances and provides a good reference.

Now that the numbers don't seem so foreign anymore, let's look at the interesting stuff: the images.

The image in Figure 1 represents one of the first tests we ran. The camera is looking down from above the table. The stick, which is moving towards the cue ball, has been caught at maximum tip compression.

The main test here was to look for bulging of the tip during the shot. In the image shown, the vertical white line or, marker, was positioned so any bulge in the right side of the tip would be highlighted. It isn't possible to see the "before" from this still picture, but the sliver to the right of the marker was only half as wide before impact.

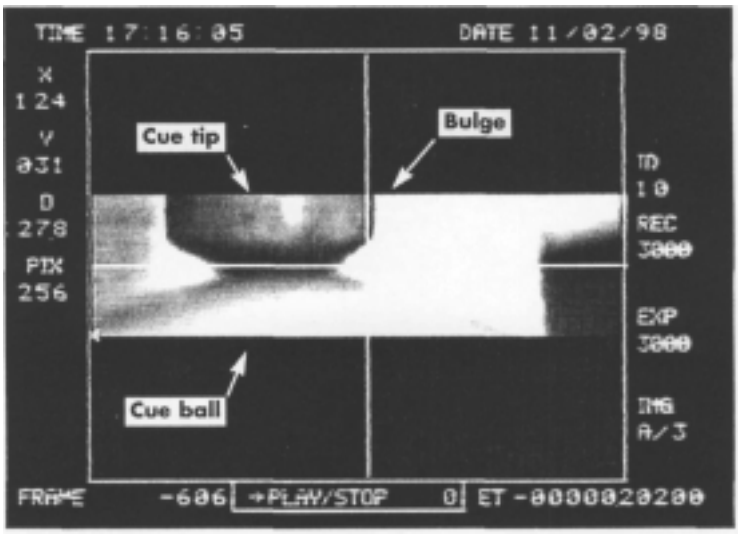


Fig. 1: A captured frame from the Ektapro 1012 at .0003 second. The image to the left of the crosshairs is the cue tip contacting the cue ball at maximum compression. From this shot, we can prove the resilient qualities of a cue tip and the camera's eye for detail.

Figure 2 is a typical view of a side-spin shot, again seen from above. The ball began with the line between the light and dark areas placed perpendicular to the stick, so it has started to rotate a little. The cue stick, which started out several millimeters closer to the center of the ball than in the image, has been moved to the side by the ball's rotation. The dark cloud which is just visible between the tip and the ball is the chalk dust that flies in all directions on spin shots. Below the ball is a grid with minor divisions every 2 millimeters and major divisions each

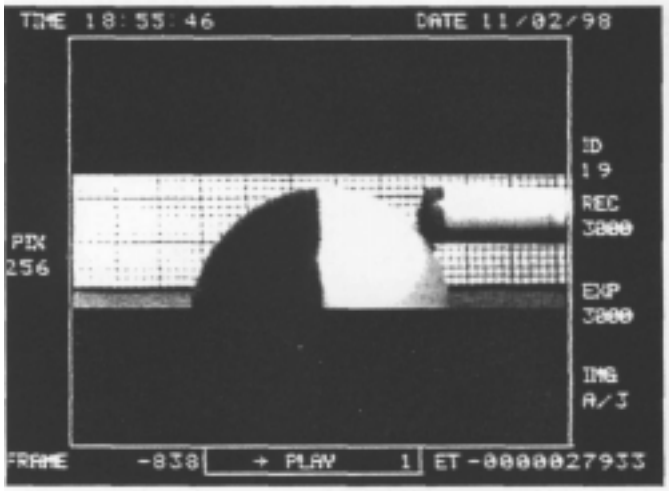


Fig. 2: This model demonstrates how the ball's rotation can throw the cue tip off-center -when English is applied.

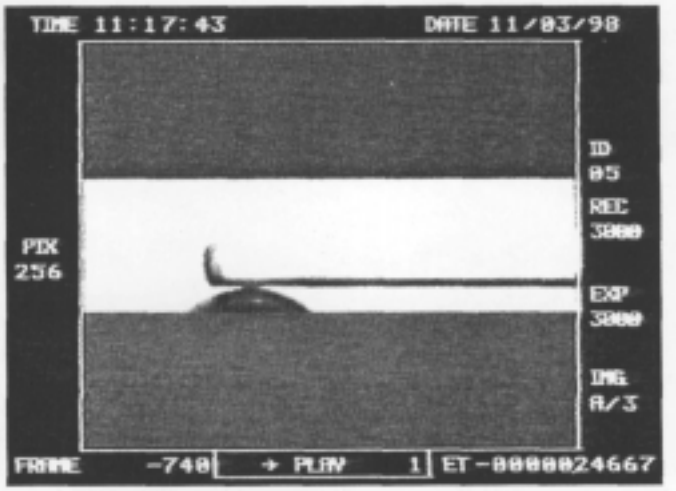


Fig. 3: The most surprising result: On just one miscue, the tip, the ferrule and even the shaft can all contact the cue ball.

centimeter, which allowed accurate measurements of speed and deflection. As we tried more and more English, it wasn't long before we started miscuing.

Figure 3 is the surprising result. In many but not all miscues, the ferrule — or in extreme cases, the shaft — slaps the cue ball several times during the motion.

In **Figure 4,** the speed of the camera has been set to its maximum: 12,000 frames per second. At this rate, each image is a short horizontal slice, and the display stacks twelve of them vertically, reading from top to bottom, giving the history of one-thousandth of a second. This is a close-up of a graphite cue hitting a ball. You can roughly estimate the speed of the stick by noting that in the first 12 frames (.001 second) the stick moves about 3 millimeters, or about 3 meters per second. A grid would have helped, but there was no room in this picture for one. The main point of this test was to see whether the stick hit the ball multiple times. It is pretty clear that the tip makes only one contact. By counting the number of slices in which the tip is touching the ball, you can get the total contact time. It appears that the tip is touching in twelve consecutive frames, which would give a time of .001 seconds. In the last few frames, it's hard to say whether the tip is still touching the ball or not, because the chalk cloud obscures things. Other tests which didn't require side-spin were done without chalk for a clearer view.

Conclusions: How can the above ideas or insights be applied to a game? Here's one example: As predicted by physics, the ball moves off the tip at a speed faster than the incoming stick.

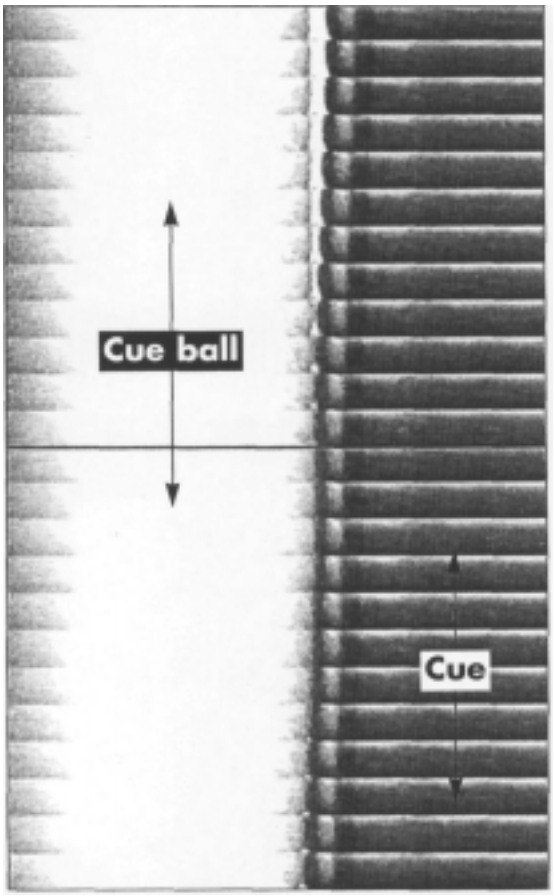


Fig. 4 proves that the cue makes only one contact with the cue ball. Total contact time: .001 seconds.

What is not directly predicted is that this speed-up, which is caused by the springiness of the tip, is not as large as the simple calculation says.

Presumably, significant energy is lost in the tip, perhaps as much as 30 percent. For a break stick, you want to lose as little energy as possible. The suggestion from the video is that work on the tip is more likely to improve a break stick than anything else.

Another major contribution of the tape is an improved understanding of how squirt develops. It is clear now that all sticks must have squirt or deflection on spin shots, because movement of the front part of the stick to the side as the tip rotates sideways with the spinning ball must have an equal and opposite motion to the other side by the cue ball.

However, there is no way to control how much sideways speed the stick gets — that's determined by the amount of spin used — but it is certainly possible to reduce the effect by reducing the weight of the front part of the stick. This result bears out what a lot of people have been saying for some time: balance, length and weight aside, all of the playability of a stick is in the shaft. «d

To obtain your own copy of the Jacksonville Experiment tapes, along with a copy of the notes that were made during the experiments, send $30 ($35 for S-VHS) to Bob Jewett at 962 Stony Hill Road, Redwood City, CA 94061.

Bob Jewett

Judgement Calls

Do you have what **it takes to be a good referee? Give it a shot.**

Are you a good referee? Do you know the rules, and how to apply them? Here is a quiz involving some of the more difficult situations you may face as an official or just an opponent. Take a stab at the following questions and send in your answers to Bob Jewett-Tech Talk, c/o Billiards Digest, 122 S. Michigan Ave., Suite 1506, Chicago, IL 60603. The winner receives a free one-year subscription.

For each of the 10 questions, think how you would handle the situation, first as "Fred's" opponent in an unrefereed match, and then as the referee in a league final:

SCENARIO 1

In a handicapped 8-ball league, you're going to seven games while Fred, a raw beginner and a new player in the league, is going to two. He's ahead 1-0 after you pocketed the 8 on an unintended combo. You play a great safety and leave the cue ball stuck behind three of your balls. Fred plays a three-rail kick to hit his ball. The cue ball comes off the last rail with just enough speed to roll up to his ball and freeze. Fred pumps his fist in the air and says "Yes!" What now?

SCENARIO 2

At 9-ball, Fred plays a smash shot on the 2 ball, and in the chaos, the 9 finds its way to a pocket. The cue ball is rolling up to the end rail as shown in Diagram 1. It looks like it might hit the 8 ball and still have enough speed to reach the pocket afterwards. In his exuberance, Fred sweeps all the object balls down to the front of the table for you to rack. Your call?

SCENARIO 3

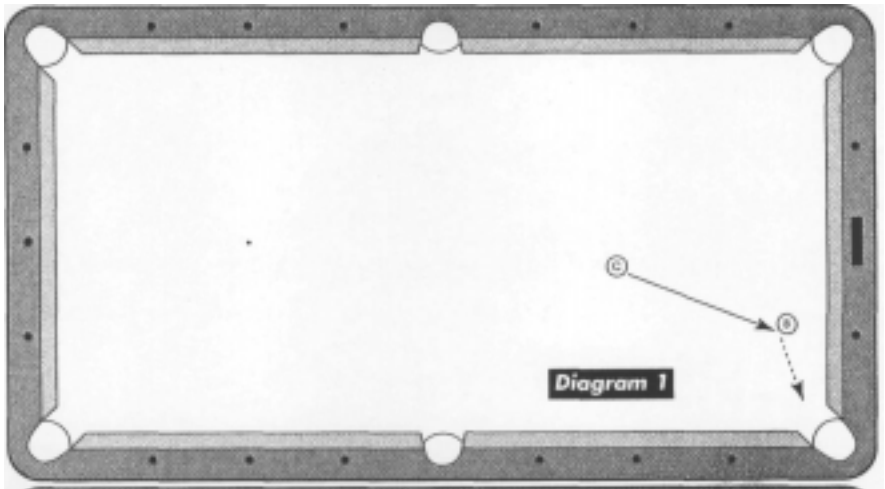
The situation is the same as above, but there is no 8 ball to deflect the cue ball into the pocket, so the scratch appears impossible. Fred grabs the cue ball before it stops rolling. Your call?

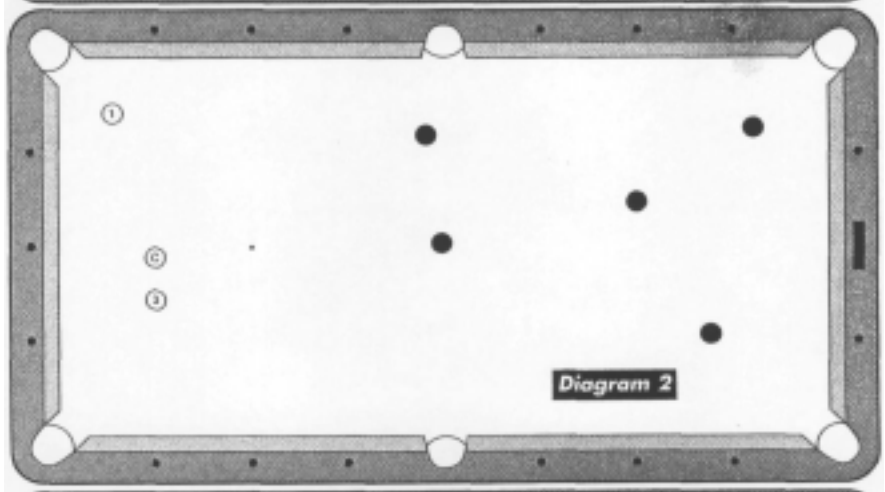
SCENARIO 4

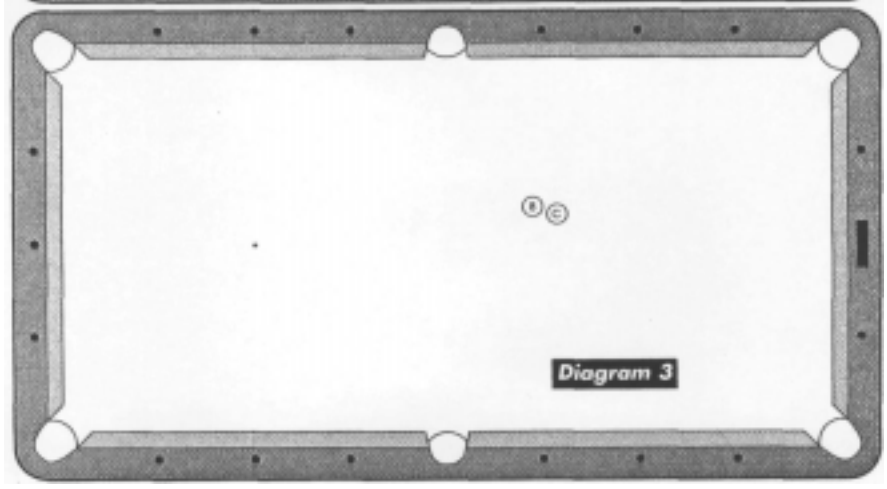
Fred has an easy shot at the 1 ball, except for the 3 ball that is six inches from the cue ball as in Diagram 2. Fred says something about "cue-ball fouls only" and places his bridge hand down on top of the 3 ball. What do you say?

SCENARIO 5

Fred breaks at 9-ball and then announces he's pushing out. He plans to move the cue ball just an inch or two so there will be a tough shot on the 1 ball. He taps the cue ball at just the right speed with the side of







his stick. What now?

SCENARIO 6

Fred is struggling in a 9-ball match. With an easy run in view, he jaws the 6 ball, leaving an even easier run for you. Acting on his frustration, he sweeps up the object balls, saying, "It's yours. I can't do anything right today." Did Fred just do something else wrong?

SCENARIO 7

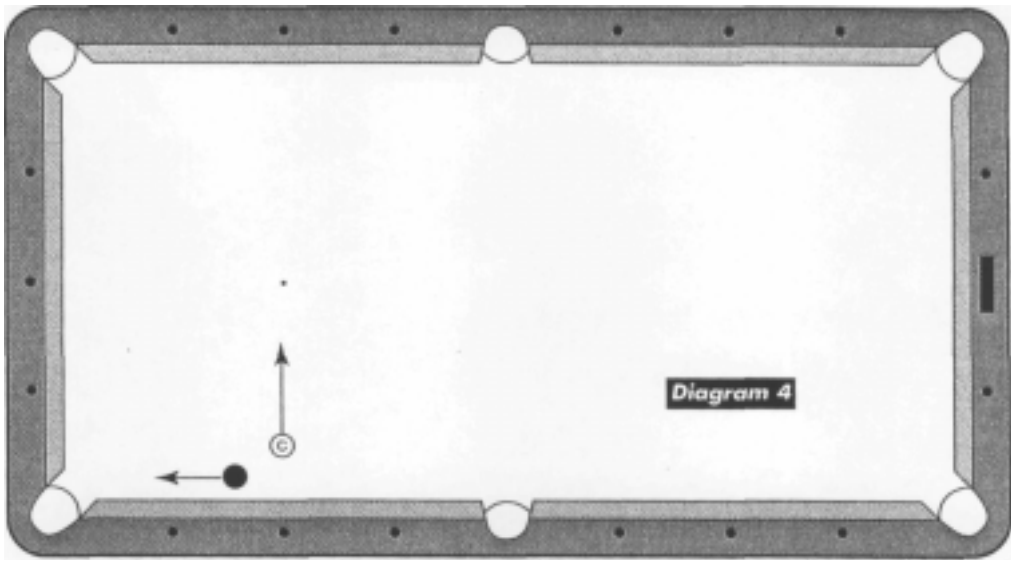
At 8-ball, Fred tries a draw shot on the 3 but miscues, and the cue ball flies over the three and softly bumps up against the five that was frozen on the rail. What's your call?

SCENARIO 8

Fred is trying a new breaking technique that begins with warp-speed warm-up strokes. On one of the warm ups, he barely nudges the cue ball. While he stops to chalk, he says, "I better hit it harder than that." Do you say anything?

SCENARIO 9

Fred has left himself straight in on the 8 ball, but only half an inch away from it as shown in **Diagram 3.** He elevates the stick about 30 degrees and aims for draw. The cue ball follows the 8 to about the middle of the table, but quickly pulls to a stop as the draw takes. What's your call?



SCENARIO 10

Fred is snookered and has to play a two-rail kick to his last ball, which is an inch from the cushion. From your position, you can't see the ball because Fred's in the way. At the end of his shot, you can see the object ball moving parallel to the rail while the cue ball rolls slowly away from the cushion, as in **Diagram 4.** The balls never reach another cushion. What do you say?

If you would like to get training as a referee, contact the Billiard Congress of America about the course they will conduct this month at the National 8-Ball Championships in Las Vegas. For more information, call the BCA at 319/351-2112.

Bob Jewett

Don't Grip It and Rip It

The Jacksonville Experiment also revealed the significance of cue speed.

The video tapes made during the Jacksonville Experiment *(BD,* April) provided the first quantitative information on cue speed throughout a shot. We did this by attaching a graph-paper scale to the cue that would be used for the measurement. The high-speed video camera was focused on the scale, and set to its fastest recording rate. Each of three players took shots at various speeds and with several cue weights.

To convert this raw video data into cue velocity, the sequence was examined frame by frame, and the time for each movement of one centimeter (about four-tenths of an inch) is noted. This gives the time the cue took to move one centimeter. The number could then be turned into speed by simple division. When the resulting speeds were plotted versus cue positions, a graph like Diagram 1 is produced. Along the horizontal axis is how far the tip traveled from the bridge hand. On the vertical axis is the speed of the stick, with negative speed on the backstroke and positive speed on the forward stroke.

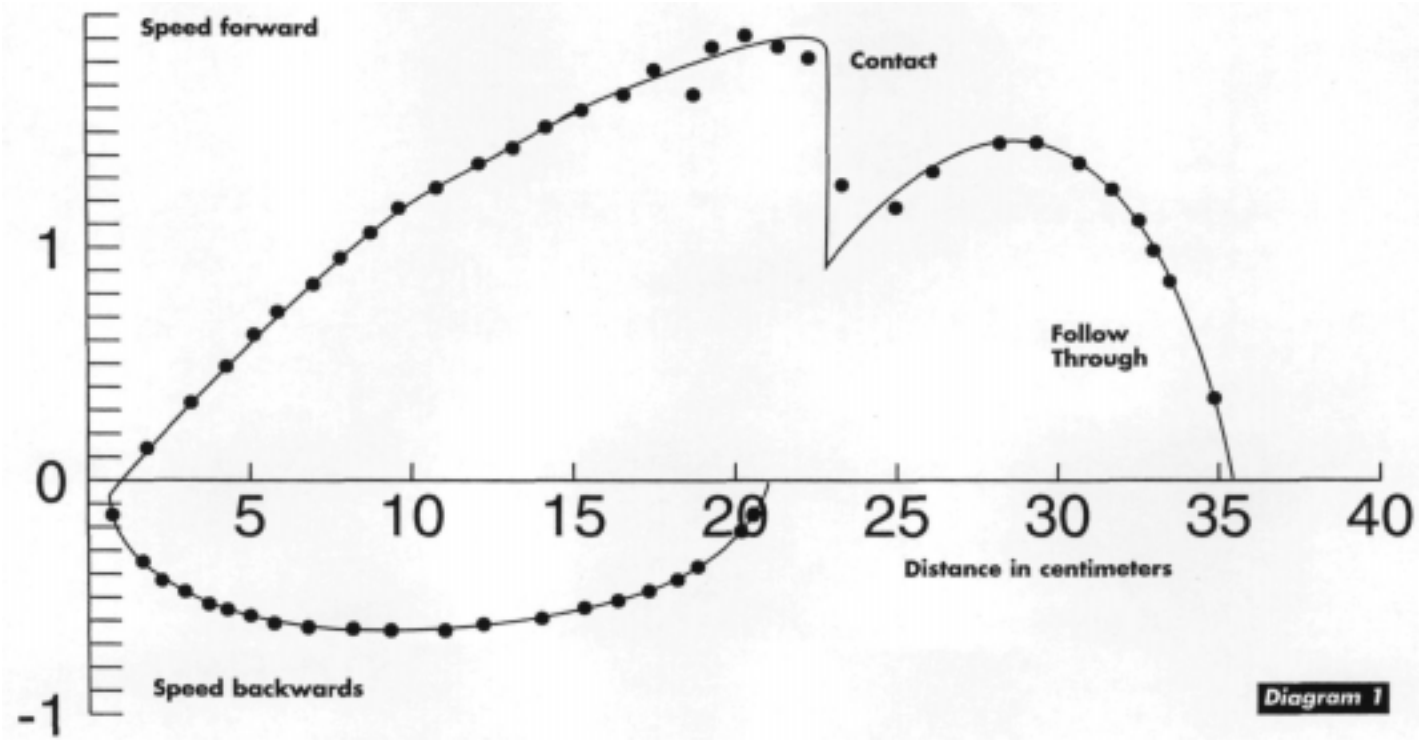
The backstroke begins with the tip almost at the ball — about 22 centimeters, or 8.5 inches from the bridge hand. As the stick is brought back, a peak negative speed of 0.6 meters/second is reached. The stick comes to a stop (speed = 0) with the tip just a centimeter from the bridge. As the forward power takes over, the stick is accelerated to 1.9 meters/second. When the tip contacts the ball, the stick speed suddenly drops to about half its value. This takes only a millisecond (one-thousandth of a second), which is about one-fifth of the time between the measured points, and was determined from separate close-ups of the tip/ball contact. The follow-through takes the stick forward another 12 centimeters as it slows to a stop.

A major point to note on this stroke is, the ball was struck when the stick was at, or very near, the peak of its speed. As mentioned in a previous column, this is theoretically the best time to hit the ball for efficiency and consistency. Just at the peak, the stick is coasting at maximum velocity.

A very interesting and unexpected feature in the plot is that the cue speeds back up after the ball has left. This turns out to be from the hand and arm, which don't slow down much during the very brief tip-ball contact. After the ball has left, the cue, hand and arm gradually go to their average speed, which is about halfway between the peak speed and the reduced cue speed after contact. From the time it takes for equilibrium to be reached, it is possible to estimate how tightly the hand is gripping the stick, compared to how hard the tip is. It turns out that the hand is about 100 times softer than the tip. That is, to push the tip one millimeter into the ball required 100 times the force needed to move the cue one millimeter against the grip.

What does all of this mean for practical purposes? In essence: Let the cue do the work and don't worry about the details. A very major point is that your hand — unless your grip is much, much firmer than mine — cannot have any significant influence on the ball during the brief tip-ball contact. Another point is that a good time to hit the ball is at the peak speed. Notice that if the ball had been an inch (2.5 centimeters) closer, the cue speed at impact would have been nearly the same. This means small errors in stroke timing should have little influence on the outcome.

Bob Jewett is a certified instructor for the Billiard Congress of America.



Bob Jewett

To Kiss Or Not To Kiss

A system to help players avoid the pucker.

Is there a kiss in the cross-corner bank to pocket A in **Diagram 1?**

One of the most difficult skills to learn in pool is to know when a bank shot will kiss out. This knowledge is essential at one-pocket and bank pool, and useful at 8-ball when a crowded table may leave you no other choice. At one-pocket, the possible kiss-out in Diagram 1 can prove costly if the object ball stops right in front of your opponent's pocket. Only by luck could the cue ball end up safe.

There is a rule of thumb for the shot shown, but I've heard two different versions. One says that if the cue ball can be shot past the object ball into the other corner pocket (B), there is no kiss. The other says that if the shot is lined up straight into pocket B, there is no kiss. Major conflict! I have seen both rules demonstrated, but never tried to study this myself. Here are some preliminary test results.

All of the tests were made with no side spin on the cue ball and just enough speed to get the object-ball to pocket A. The object ball and cue ball were positioned exactly by self-adhesive paper reinforcements. For a given object ball starting position — in this case, exactly one diamond from each cushion — the shot was tried for various cue-ball positions up and down the table.

If the cue ball is up the table, say by position C, there is no problem because the cue ball goes to the end rail and back quickly compared to the slower travel of the thinly-hit object ball. As the cue ball gets closer to the shot shown, the speeds of the two balls are better matched, and at some point they will collide around the question mark. I gradually moved the cue ball down the table until it no longer passed out of the way before the object ball crossed its path. The position shown is about the last position where that bank works.

If the cue ball is closer still to the end rail (at D), the bank is hit fuller, and the object ball will travel faster than the cue ball, passing the danger zone before the cue ball returns from the end rail. I tried various banks on this side, and marked the highest position that didn't have a kiss.

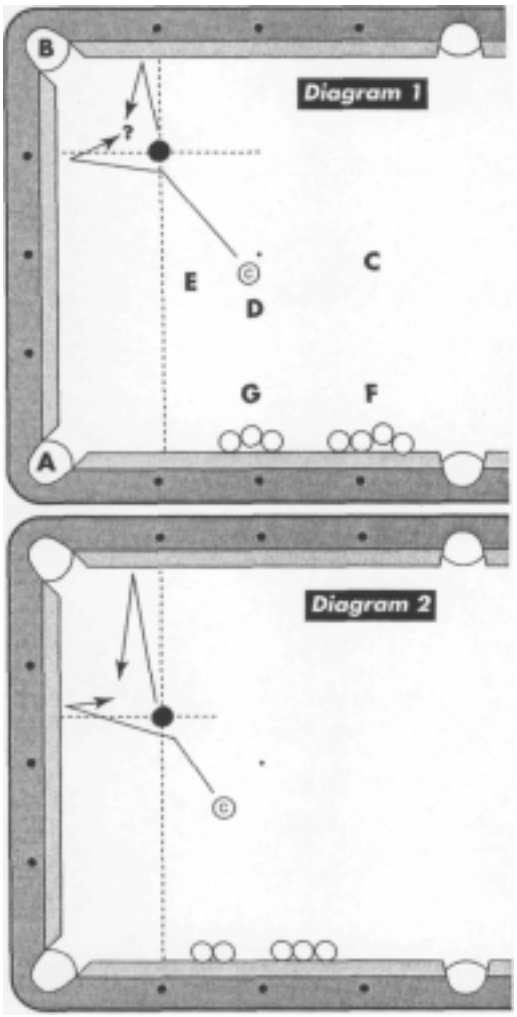
A second kind of kiss happens when the bank is almost a straight shot, say from E. If the cue ball hits the object ball just a little on the left side, it will travel very slowly down the table and meet the object ball at the kiss zone without having hit the cushion. While this kiss is good to know about, it is not covered by either rule of thumb.

Shown on the rail are two clusters of balls at F and G. These show the "origin" of the cue ball for the banks that kiss out. If you are shooting the bank with your cue stick passing over the middle of the F group, you will need to do something special to avoid the kiss. If you are shooting from the ball at either edge of the group, you may miss the kiss by a whisker or maybe not. Since the cue ball is shown with an origin above the cluster, there is no kiss if the shot is hit well.

Similarly, if the origin of the cue ball is from cluster G — such as from E — there will be a kiss unless you do something to change the timing or angle of the shot.

One way to avoid the kiss is with side spin. The usual way to hit a shot from F is to apply right follow so when the cue ball comes off the end cushion, it is bent behind the object ball. I tried left spin, and it also seemed to work. I had to hit the object ball fuller to compensate for the angle change from the transferred spin, and again the object ball passed before the cue ball got back from the rail. For the second kind of kiss, it usually works to shoot straight at the object ball and use a little "hold-up" English, in this case left side. Another possibility is to use draw to slow the cue ball down after the collision. Of course, speed can seriously change the result, but for one-pocket, you want to leave any missed ball close to your hole.

What do these results say about the rules of thumb above? It seems to say that they both are partly true. If the shot is straight — in, the cue ball origin will be about the side pocket, and there will be no kiss. On the other hand, the kisses occur only for shots where the cue ball cannot be shot by the object ball. If the cue ball has a clear path to the pocket, there will be no kiss. Neither rule of thumb really covers all the cases. What the rule does do is let you check fairly quickly for a potential kiss, then it is up to you to decide if there is a real problem that needs evasive action.



In **Diagram 2** is a second shot that's a little different from the first. The object ball is now a diamond and a half from the side rail. The measured "bad" starting points are again shown by balls on the cushion. The shot diagrammed is barely outside of the danger zone. If you want to extend the tests, there are lots of other positions for the object ball.

It's important to note that the exact locations of the "clusters of death" will change depending on the balls, cushions and cloth. I did the experiment with relatively new cushions and clean cloth that is about a year old. Your mileage may vary.

Bob Jewett is a partner in the San Francisco Billiard Academy, one of seven Master Academies certified by the BCA to train new instructors.

Bob Jewett

Judgement Day

Answers give insight into game rulings and reactions.

So you think you're cut out to be a billiards referee? According to the results of my quiz, you'd be a pretty harsh one.

In *BD* May, I offered a series of 10 scenarios that involved shots attempted by my invisible friend Fred — a novice, at best — playing against you in various games, 8-ball, 9-ball, specifically. I then left it to you, the reader, to tell me how you would react or rule in each instance. The best set of answers sent in by readers would receive a free one-year subscription to *Billiards Digest.*

We'll get to the winners in a minute, but I thought I should clarify a few trouble spots that emerged during the judging. One major point that most respondents overlooked was Fred's inexperience in formal play. Does this make a difference in how the rules are applied? In a relatively relaxed situation like an unrefereed match in league play, I think so. If you keep springing rules on Fred that he's never heard of, he's unlikely to return to the game. If you try to make his introduction to the game as gentle as possible while maintaining the spirit of the rules, I think everybody can win.

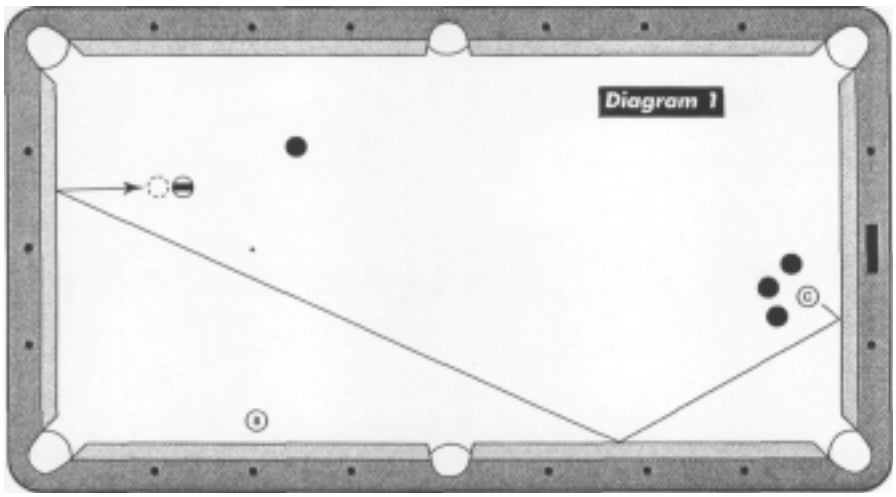
Contestants were also asked to rule as if they were the referee in the league finals. Here, you really can't cut Fred any slack — the ref must enforce all the rules to the best of his ability. A brief explanation may be in order for those cases where Fred clearly has no clue why he fouled.

Having noted these occurrences, here is my view of the calls:

Scenario 1 Fred has just made the beautiful three-rail kick in Diagram 1 to hit his last ball in a game of 8-ball. But he played only hard enough to freeze against the ball. Fred's delight shows he doesn't know about the "No Rail" foul he just committed. As a referee you have to tell him that rails before the hit don't count, and he just gave up ball-in-hand.

As his opponent, you could give Fred the opportunity to try his shot again, unless of course, prior arrangements have turned this game into something more serious.

Of course, this path is entirely outside the scope of the written rules, and another player or the tournament director might object, but I don't think they have much reason to. You might also suggest that Fred ask about any applicable rules before any "strange" shot.



Scenario 2 In a game of 9-ball, old Fred has just made the 9 on a smash shot, and it looked like the cue ball would scratch on a carom off the 8, until he raked the 8 and the other object balls down to the rack area. The rule here is clear: You must never touch any ball until the game is over. This is perhaps the most ignored rule at 9-ball. "Try again" is not an option here for the un-refereed case. Some might argue that under "Cue Ball Fouls Only" there was no foul, but they would be wrong. It is always a foul to intentionally touch any object ball when you are the shooter. As Fred's opponent, I'd be stuck for a middle path — one entry suggested playing the game over. As the referee in this case, the BCA rule you should apply is 2.19, "Illegally Causing Ball To Move." (Rule 3.20 refers to accidental contact.) The possible penalty is loss of game and/or match, as for unsportsmanlike conduct.

Scenario 3 Fred grabs up the cue ball before it stops rolling on a winning shot that has no chance to scratch. I'd warn him of the rule while racking for his next break, but a referee would have to call the foul.

Scenario 4 Fred rests his bridge hand on an obstructing ball for stability. Technically this is a violation of 2.19 again, but I'd try to get him to bridge properly before he shot. As the referee, I'd be reluctant to forfeit the game; ball-in-hand is a more appropriate penalty under the discretionary clause of unsportsmanlike conduct.

Scenario 5 Fred pushes out at 9-ball with the side of his stick. Foul! The only fouls condoned on a push-out shot are No Rail and Bad Hit. You are never, ever allowed to play with the side of your stick.

Informally, try again. Refereed, ball-in-hand, foul, and warn Fred that a second such foul will be loss of match under rule 3.28.

Scenario 6 Fred is so frustrated by this scenario that when he misses an easy 6 ball at 9-ball, he sweeps up the easy run-out and concedes the game. Under Rule 1.14, a concession is permitted, but throwing in four balls borders on unsportsmanlike conduct. I might say nothing to Fred as he racked, or I might point out that I really need the practice. The referee should warn him not to disrupt the game or he may be subject to a forfeit. Warning: In some tournaments, if you forfeit a game, you forfeit the next one as well. It may seem strange, but some players have perfected the concession as a sharking technique. My advice: Never concede the match; the psychological ramifications are enormous.

Scenario 7 While playing 8-ball in Diagram 2, Fred tries a draw shot on the 3, but the cue ball jumps clear over the 3 and softly bumps against the 5 ball which was frozen to the far rail. I didn't say whether anyone had called the 5 frozen before the shot. If not, it counts for the rail contact.

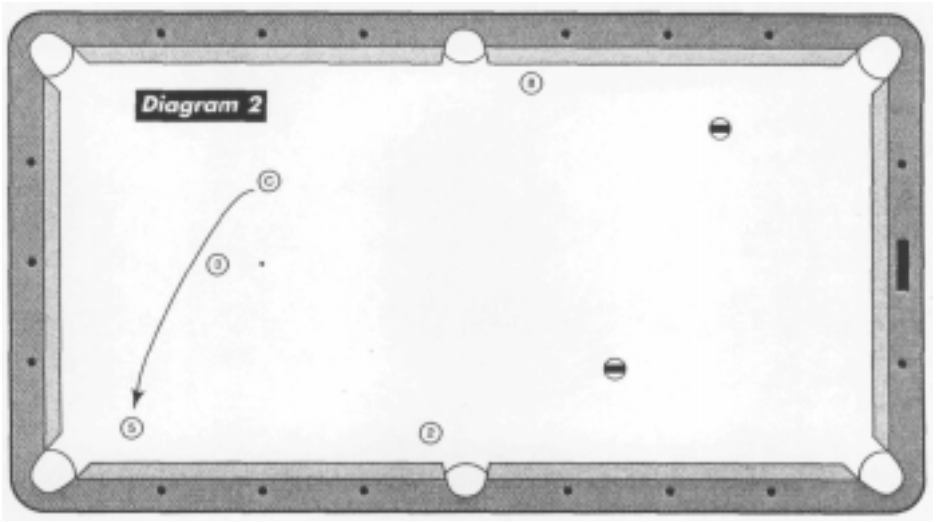
Was the miscue-jump a foul? I don't think so, because Fred wasn't trying a jump shot. It's always risky to include a player's intentions in a ruling, but I would in this case. As

the opponent, I'd explain why my failure to call the 5 frozen cost me ball-in-hand, and that when playing a jump shot, any miscue is a foul (Rule 3.26). Of course the referee would have called the 5 frozen, and it would be a No Rail foul.

Scenario 8 Fred barely nudges the cue ball on the warm-up strokes for his break shot. This is not a foul unless the cue ball is driven over the head string. As an opponent, I might point out the rule, but the referee should not offer this advice.

Scenario 9 Fred played an obvious double-hit shot to pocket the nearly-touching 8 ball. As the opponent, I would have tried to anticipate the shot and have a third party come over to watch the shot after an explanation. After the fact, I suppose "try again" will work, but I'd be tempted to take the win. The referee must, of course, call the foul and loss of game.

Scenario 10 Fred banked the cue ball off a couple cushions to make a good hit on a ball near a cushion, but because he was in the way, you didn't see whether any ball went to the rail after contact. As opponent or referee, the first thing I do is kick myself for being out of position. The next is to ask someone whether the contact was rail-ball or ball-rail. (In the problem statement, I gave the final directions of the two balls,



but depending on the spin on the cue ball, the rail may still have been before or after contact.) As the opponent, I'd ask Fred, and I'd take his word for it. As the referee, I'd ask anyone in position who's opinion I trust. If there is no one to ask — Fred might not have noticed — you cannot call a foul that may or may not have occurred.

And the winner of the 12 great issues of *Billiards Digest* is ... a two-way tie between Erik Franklin of Colorado, and Thomas "Q" Ball of New Jersey. Several others, including Eric Oudsema, Rick Malm, and Tom Tidd, were close behind. Eric gets special mention for the most accurate list of rules references.

The main thing I noticed about all of the submissions is how little slack Fred got on the calls. He's a beginner, for Pete's sake! You sure play hardball out there. I can hardly wait to catch you with Rule 1.22.

Bob Jewett, a member of the BCA Rules Committee, will be happy to discuss Rule 1.22 with anyone who cares to debate it.

Bob Jewett

The New Frontiers

Expanding your shot-making repertoire can improve your win-loss record.

One way to think of your game is as a partially explored country. Some parts are familiar to you, while there are other, wilder, unexplored parts that you would really rather avoid. Although part of your game's development is the cultivation of this easier territory, you should spend some of your practice time extending your frontiers and taking control of new or harder shots as part of your repertoire.

Of course, there are players who will never attempt any shot that has much chance of failure — even during practice sessions — but you're not one of those. Get some extra chalk and warm up your arm, and let's move into uncharted territory and stake some claims.

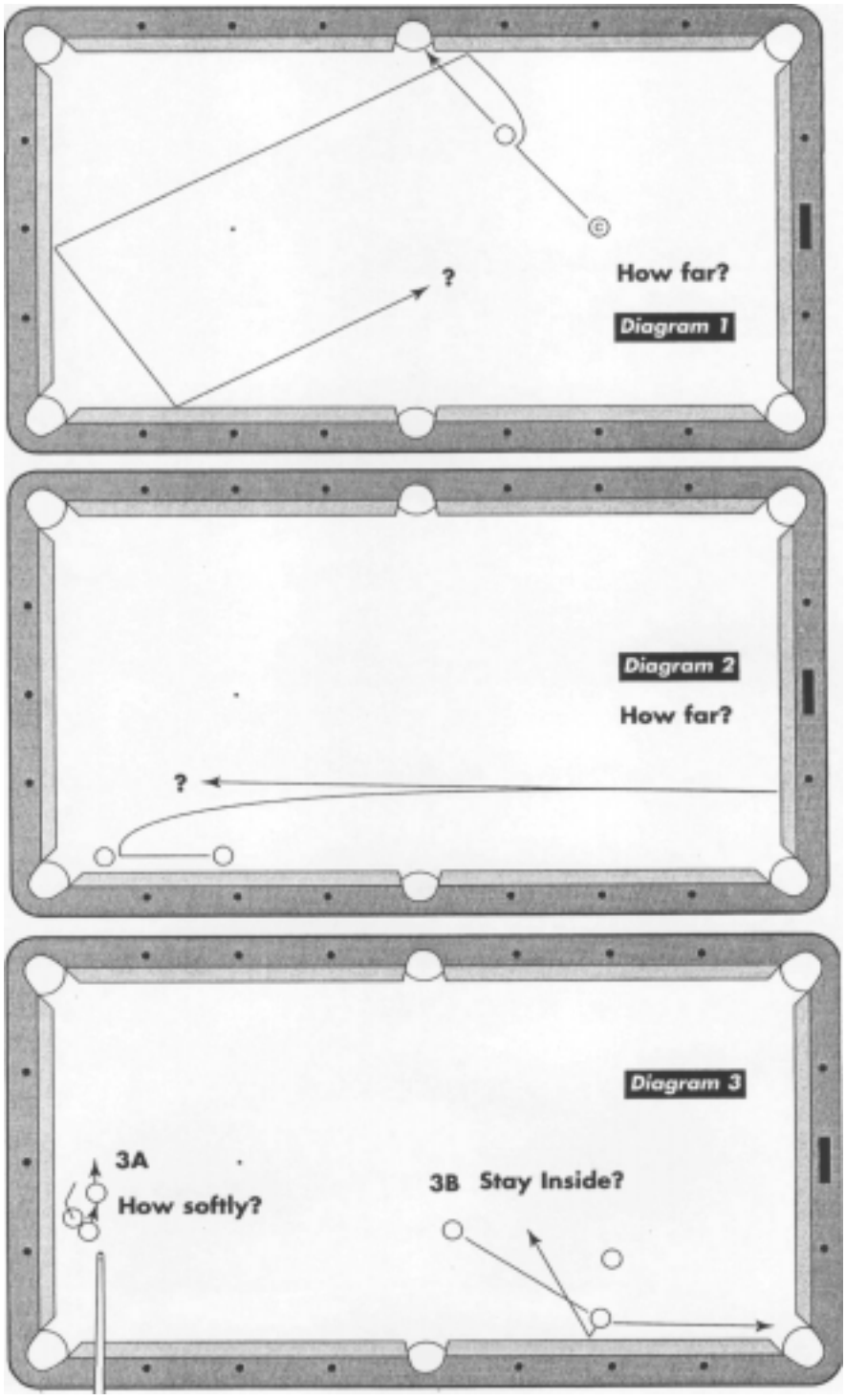
The shot in **Diagram 1** is easy to set up but not so easy to do. The cue ball is on the spot and the object ball is about half way between it and the side pocket. There is just a little cut angle, so the cue ball will follow to the side cushion on the near side of the side pocket. The drill is to shoot with follow and see if you can spin the cue ball around the table. You need plenty of follow, but left english is the key to getting distance on this shot.

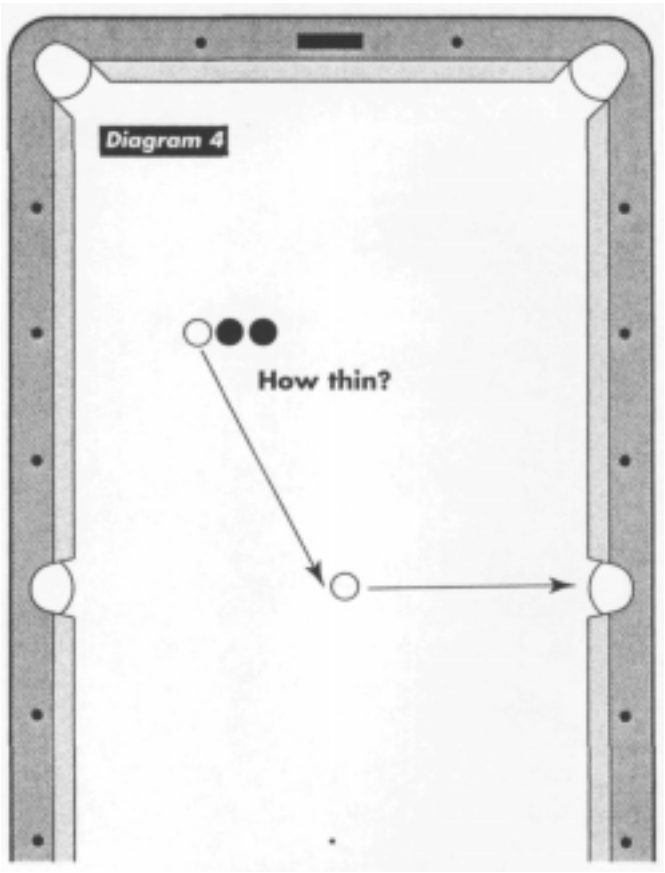
Try progressively longer runs on the cue ball. If you are not yet comfortable with side spin, just try to take the cue ball to the end rail. As you build up strength and confidence, see if you can contact five cushions.

In **Diagram** 2, you are going for maximum distance on the draw shot. Position the balls a little differently if it makes the shot more comfortable for you, but the goal is to draw the cue ball as far as possible. Two full lengths is good. Again, you may want to start with an easier goal, but make sure it stretches your present comfort zone.

To protect the table from miscues and chalk build-up, put a piece of notebook paper or thin plastic under the cue ball.

Diagram 3A is territory most pool players never visit. The shot shown is from carom billiards, or straight-rail. The cue ball must hit both the other balls, but no cushion is required. From the position shown, shoot softly enough that the same position is left after the shot. Some things that will help to master these very soft shots: Get *Daly's Billiard Book*, which describes lots of techniques for these close shots. Try it on a carom table, where the





larger balls will allow easier control. Try a lighter cue until you are used to hitting the cue ball very softly. If you master this speed, a lot of "small" safeties will suddenly be easy.

Diagram 3B shows a shot that is common at straight pool, one-pocket, and 8-ball. You have two object balls near the same cushion, and you need to stay inside the second one while shooting the first one. That is, you want the cue ball to bounce only a little off the cushion so that the second ball will be a cut to the right.

When you first start shooting these shots, you will say to yourself, "No way can I stop the cue ball. I need to use more rails." Often you can't arrange to use more cushions because other balls block the longer path to position.

With practice, you will soon find the right combination of draw and side-spin — in this case-right — to make the cue ball die on the cushion.

Try a little more draw than right for your first tries. Gradually move the cue ball farther off the cushion, so you will learn your limit for various angles.

Diagram 4 will exercise your thin shots. The object ball is on the center spot — in which games is the center spot used? — and the cue ball is on the head string. See how close to the head spot you can bring the cue ball and still make the object ball. This is a good shot to try left and right English to see if either one helps you on such thin cuts.

I'll guess that the problems caused by side-spin — squirt, swerve and throw — make the no-spin shot more effective. That doesn't mean you shouldn't also practice the shot with spin, as you will usually need some spin when the cue ball gets to the far rail in order to get position on the following ball.

Besides the above suggested expeditions into *terra incognito*, you can plan your own. During a match, whenever you come up against a shot you're uncomfortable with, make a note of it, and include it in your next practice session. Soon, it will become a familiar part of your game.

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Bob Jewett

Communication Barriers

Don't let technical terminology tear up your tablemates.

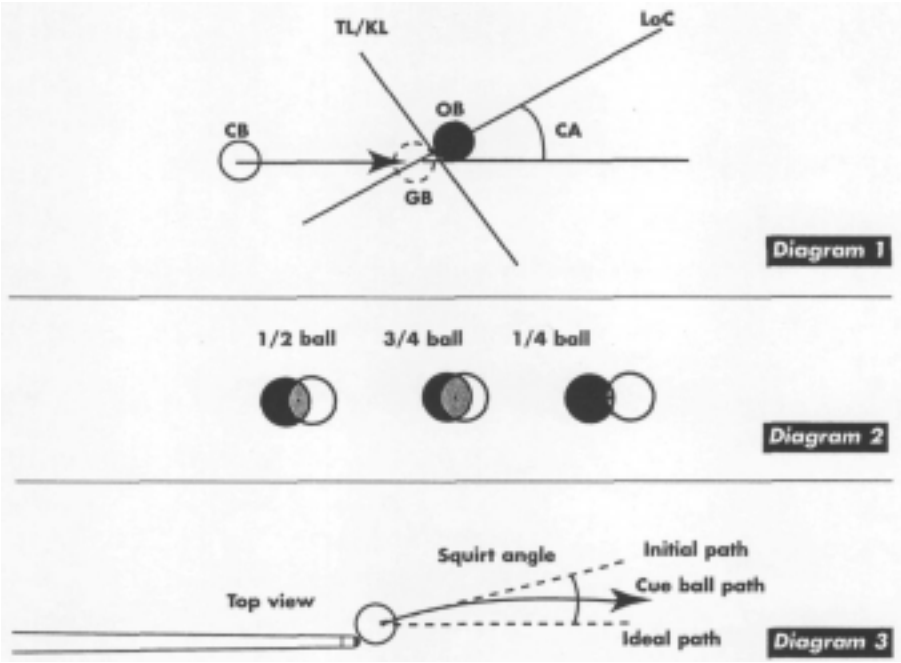
In discussing the technical details of shots, it's essential for the parties to use a single set of terms. For example, I've recently seen two new uses of the term "throw" that aren't even close to the definition below. Sometimes it's possible to see that the word is being used strangely from the context, but usually the mismatched meanings lead to gross misunderstandings. Below is a brief illustrated glossary of some of the more technical terms for the parts of billiard shots which will be used next month in examining various kinds of systems. Even old hands may find something surprising here.

Diagram 1 illustrates the parts of a simple cut shot. Can you fill in what all of the abbreviations stand for? The cue ball (CB) and object ball (OB) are easy. The ghost ball (or phantom ball) is where the cue ball will be at the instant of contact. It's drawn with a dotted line to indicate that it's not a real ball, but rather an imagined location to which the cue ball will hopefully be driven.

The line of centers (LoC) is the line connecting the centers of the ghost ball and the object ball. In an ideal world, the pocket is along that line off to the right, and the object ball will travel along it. On the line of centers is the contact point between the two balls, or CP, which is not marked on the diagram. At a right angle to the LoC is the tangent line or kiss line. The TL/KL touches both the GB and the OB at the CP, right? The tangent line is useful in play because the cue ball, after arriving at the ghost ball position, will travel parallel to the tangent line until draw or follow bends it away.

Also marked in Diagram 1 is the cut angle (CA), which is the angle between the initial path of the cue ball and the path of the object ball. This angle can be given in degrees. The example shown is about 30 degrees, and it is a "cut to the left." If there is no angle — when the object ball is being driven straight ahead — the cut angle would be zero degrees. When the cue ball barely grazes the object ball, the cut angle is 90 degrees (to the left or right).

Another way to describe the degree of a cut is shown in Diagram 2. Imagine you are watching from the point of view of your cue tip as the cue ball contacts the object ball. You will see the cue ball overlapping the object ball by a certain amount. In the first case, when the center of the cue ball is



going towards the edge of the object ball, just as in Diagram 1, the fullness of the hit is called "half ball." Also shown is the contact point, which is exactly in the center of the overlap region. It is useful to know the cut angle for these fullnesses of hit. Half ball ideally produces a 30-degree cut angle, while 3/4-full gives slightly less than 15 degrees, and a 1/4-full hit gives about a 49-degree cut angle.

Several aspects of the use of side-spin are illustrated in Diagram 3. You may have noticed that I tend to use the term "side-spin" rather than "English" when describing such shots. This is to make a clear distinction between side-spin and draw or follow. Some people use the word "English" to refer to any spin on the ball, such as "follow English" or "left English," but that can be confusing.

The ideal path of the cue ball on a side-spin shot is parallel to the line of the cue stick. Unfortunately, the cue ball refuses to behave in such a simple way, and instead starts out at an angle away from this ideal. This angle between the ideal path and the actual initial path is the squirt angle, or just "squirt." The angle varies with the amount of side-spin, the construction of the stick, the preparation of the tip, and possibly the speed of the shot and other factors. Squirt is not fully understood, but it can be large enough to make you miss the object ball entirely if you don't compensate for it.

Swerve, curve or masse is the curving back of the cue ball towards the ideal path. Again, this effect is plenty large enough to cause an "air ball" on thin cuts, or not-such-thin shots if the stick is elevated.

A last aspect of spin shots and cut shots is "throw." When the cue ball arrives exactly at the ghost-ball location, after your careful compensation for squirt and swerve, the object ball does not obligingly go along the line of centers. Instead, friction between the surfaces of the two balls pulls the object ball off-line to the left or right. This effect is easiest to demonstrate by placing an object ball at the ghost-ball location and playing the cue ball to hit that ball full. The resulting throw is fairly predictable.

If it is the cue ball that is making contact, the problem is a lot more complicated. If the cue ball has follow or draw in addition to any side-spin, there will be somewhat less throw. Also, the cue ball may have various amounts and directions of side-spin. Consider the cut shot in Diagram 1. If the cue ball is played with left side-spin, there will be more throw of the object ball to the

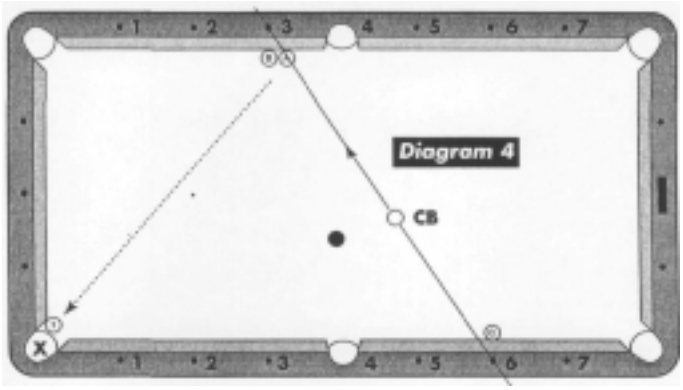
right upon contact. (This is called "inside" English, when the cut is to the left and left side is used, and similarly if both are "right.")

If the cue ball is played with just the right amount of right-side spin, it will roll smoothly across the surface of the object ball and there will be no rubbing or throw at all. (This is called "outside English," when the cut and side-spin are left/right or right/left.) If a lot of outside English is used, it is even possible to throw the object ball to a larger cut angle than the ideal.

It is important to note that "throw" happens on cut shots even when the cue ball has no spin, just due to the motion of the cue ball to one side, and the resulting drag on the object ball due to the friction between them.

Here is some homework to do before next month: freeze two object balls together on the spot pointed up and down the table, and see what combination of cut angle, spin and speed gives you the most throw.

In **Diagram 4,** some points on diamond systems are shown. The goal is to send the cue ball towards pocket X. A simple numbering of the diamonds (spots on the rail) is shown for a one-cushion kick. This simple system says that if the ball's "origin" is twice the number on the target cushion, the ball will go to the pocket. Origin in this case is the diamond number your stick will be over on the cushion when you shoot the shot. The cue ball in the example is placed perfectly on the line between 6 and 3, so the path will be "from" 6. In general, fractions of diamonds will be needed, and the cue ball origin will need to be determined by trial and error.



Some finer details: There are two ways to describe where the diamonds are. In the example, a ball coming from 6 towards 3 contacts the cushion at outline A. If the cue ball has a different origin, but is still sent towards diamond 3, it will contact the cushion elsewhere. Shooting directly towards the diamond marking is called shooting "through" or "at" the diamond. The advantage is easy sighting; the disadvantage is that the cushion is contacted at more than one place. An alternative is to shoot "opposite" the diamond; the cue ball is made to land in position "B" when 3 is the number to contact, regardless of the ball's origin. (You can also think of the numbers as being transferred from the rail to the cloth.) The origin may also change, so the 6 origin is at outline C. Note the considerable difference in the line for the "through" shot and the line from C to B for the "opposite" shot. This second way may seem complicated, but the master billiardist, Raymond Ceulemans himself, recommends it.

Be sure to do your homework and study the above terms before *BD* November (next issue), when we will look at the technical details, strengths and faults of a half-dozen systems.

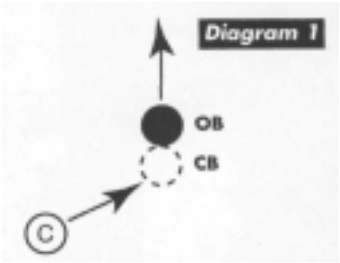
Bob Jewett

Systems of Aiming

Deciding which one best suits your game.

Do you use a system to aim? By system, I mean a mechanical or mathematical method to decide on what cut angle is needed, to visualize the shot, and to line up the cue stick for that cut angle. Don't worry if you don't use a system; you're in good company. However, if you do use an aiming system, and it's not described below, please send in a description so it can be shared in a future column.

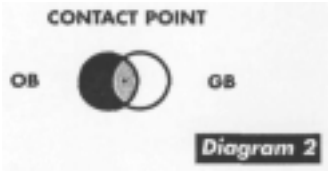
The fundamental system — against which all others can be measured — is the ghost ball system. The simple idea is shown in **Diagram** 1: Imagine the cue ball at the instant it contacts the object ball. Making the shot is as simple as lining up your stick on the straight line joining the centers of cue ball and the ghost ball and bringing your stroke straight through. Simple but difficult, or we would all be champions.



To use any system effectively, you need both belief and understanding. Without belief, you won't trust the system to help you, especially in critical situations. Without understanding, especially of the system's faults — and they all have faults — a system can keep your game from improving.

What are the faults of the ghost-ball system? As mentioned last time, if the cue ball arrives from an angle, the object ball does not take off along the ideal line, but is thrown slightly off-line. Your homework assignment was to measure how much the angle of the cut changes because of the throw. If your equipment is like mine, you discovered that with a soft hit and the cue ball driven about half-full into the object ball, the throw can amount to two or three balls' widths in the distance from the headstring to the foot rail. Clearly this will cause you to miss long shots if you execute the simple system perfectly.

There are two approaches to correct this deficiency of the ghost-ball system. In the ostrich method, you simply ignore the error, and use the system primarily to focus your attention on the angle of the shot. Any correction is done by feel, with subconscious adjustments for the way the throw depends



on the angle, speed and cleanliness of the balls.

The other approach is to include an estimate of the throw in the calculations right from the start. For example, in Diagram 1, you would line up the shot not to the center of the pocket but to the left side of the pockets to match the throw angle you found in your homework. You then visualize the cue ball at the new location. If you execute perfectly — that is, drive the cue ball to take the place of the ghost ball — the object ball goes to the center of the pocket.

Let's look at some tests for the system to see if it's consistently accurate, or if it falls apart for some shots. First, imagine moving the pocket away along the line of the shot. Will the system still give the same aiming point, as it should? If you move the pocket a little to the right or left, does the system tell you to hit a little more or less of the object ball to change the cut angle correspondingly? If you move the cue ball from a full-ball shot to a 90-degree cut, does the system give the correct answer?

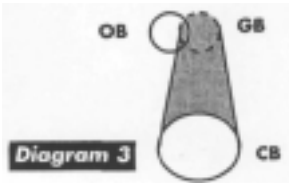
For all of these tests, as long as one of the correction methods is used, the ghost-ball system works. This may seem horribly obvious, and you may wonder why I'm belaboring the point, but we'll soon see systems that don't pass these tests.

For many people, the largest problem with the ghost-ball method is that they cannot easily visualize the phantom ball sitting over next to the object ball. Fortunately, there are lots of alternative visualization methods that give the same target, and one of them may work for you. Some people think of these as separate systems, but they're really all the same, and the tests above don't have to be done again.

The first is the "inch-and-an-eighth" system. For this, you find the spot on the cloth that is 1.125 inches (the radius of the ball) from the edge of the object ball and away from the pocket. This happens to be the resting spot of the phantom ball. If you have this point, just aim your stick at it and shoot straight, hi the diagram, this spot is marked. Some people actually place the tip of their cue on the cloth at this spot with the stick pointed at the pocket, and then pivot around to place the stick over the cue ball, making the shot line clear. Be careful if you use this technique not to leave chalk on the inch-and-an-eighth spot, as that would be a foul.

The second equivalent system is the "parallel lines" system, which is shown in both Mosconi's "Winning Pocket Billiards" and Byrne's "Standard Book of Pool and Billiards." This technique asks you to imagine a stripe on the object ball aligned with the pocket. Next imagine a stripe on the cue ball parallel to that stripe, and then drive the cue ball forward so its stripe lands in line with the object ball's stripe. Another version of this is to imagine just the contact points on both balls and then place your cue stick parallel to the line joining those points.

An equivalent system that I like to use on relatively thin cut shots is shown in **Diagram** 2. This shows the ghost ball overlapping the object ball from the cue ball's point of view. Suppose you have picked out the contact point. Notice how far it is from



the edge of the object ball — say a quarter inch — and then aim the edge of the cue ball so the contact point is in the middle of the overlapping point. In this example, the edge of the ghost ball is a quarter-inch to the left of the contact point. It's not obvious that this is geometrically the same as the ghost-ball system, but it is.

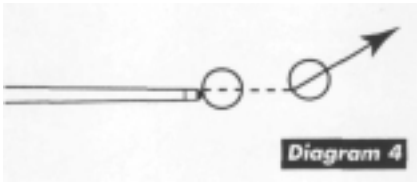
Diagram 3 shows another way to visualize the shot. This helps solve the problem of the cue ball's being bigger than the ghost ball it is being projected to from the player's point of view. Imagine a tunnel from the cue ball to the ghost ball, as shown in the perspective drawing. The tunnel can also be

thought of as all the successive positions of the cue ball on the way to the collision.

Now let's look at some other systems and try to analyze how well they work. One whole family of systems asks you to aim at either the reflections of the lights off the object ball or the edge of a shadow under the ball. This sort of system is quickly discarded as worthless by considering what happens when you have to play on a table with four instead of three bulbs. Or, consider what happens to the reflections or shadows as the cue ball and object ball are moved together around the table, keeping the cut angle constant. The shadows surely will not stay in the same place unless you are playing outdoors on the equator at noon. Conclusion: The spots and shadows systems may be useful to focus your attention, but they have no chance to be accurate. Note that we didn't even have to find out where the spots or shadows were to see that these systems are bogus; we just needed a simple "thought experiment."

Another system that is a little harder to analyze is in Diagram 4. It is very simple to state: Make the extension along the edge of your stick point at the contact point on the object ball, and use the left edge for cuts to the left and right for right. This system is said to work with side spin without any other adjustment, so it potentially has a large advantage over the GB system, which has no provision for using English. Here's some homework: consider cut angles of 0, 30, and near 90 degrees. About how far will this system be off for those shots? Is it as good as the GB system if throw compensation is not included?

One system that has been discussed briefly



in these pages before is to find the point on the object ball that is farthest from the pocket, and the point on the cue ball that is nearest to the pocket, and send the latter towards the former. This will get you to hit the object ball on the correct side, but is not much use beyond that. Here is an analysis trick to see that this system is junk: Consider what happens when the pocket is moved away from the object ball along the line of the shot, as we did for the GB system. The "nearest point" on the cue ball moves which means the system is asking for a different fullness of hit for the same cut angle. People who force this system to work are fooling themselves. Consider this shot if you're not convinced yet: Put an object ball on the rail near a pocket and place the cue ball several diamonds back for a very thin cut. About how much of the object ball is the system asking you to hit?

If you hang around pool players, you're bound to hear more systems. Maybe you will find one that's helpful on certain shots, but with any system you try to work into your game, remember to do two things. First, study the system carefully enough to discover its faults. If you don't understand the faults — and all aiming systems have them — you don't understand the system. Secondly, you need to practice carefully with the system. Pay special attention to difficult shots and shots near the edge of the range where the system is reliable. When you have a shot that's going to win or lose the game for you, and you're going to apply a system, be sure that it can work.

As a final point, remember that all systems need some compensation and that compensation, must be applied by feel. This is true not just for aiming systems, but for banks and kicks. You must trust your own judgement here, even more than you trust the system. Practice will give you that confidence.

Bob Jewett

Hidden Treasures

The diamond system can help you strike it rich on the table.

In last month's column, I went over several aiming systems. This time it's diamond systems — sending the cue ball off one or more cushions to hit a target ball. Again, the emphasis is on looking deeper than the basic description of each system, so that you understand the limitations of each, and how well each can help you in game situations.

In Diagram 1 is the classic "Corner Five" system. This is sometimes attributed to Willie Hoppe, but it was developed by others, and Hoppe never seemed to use it.

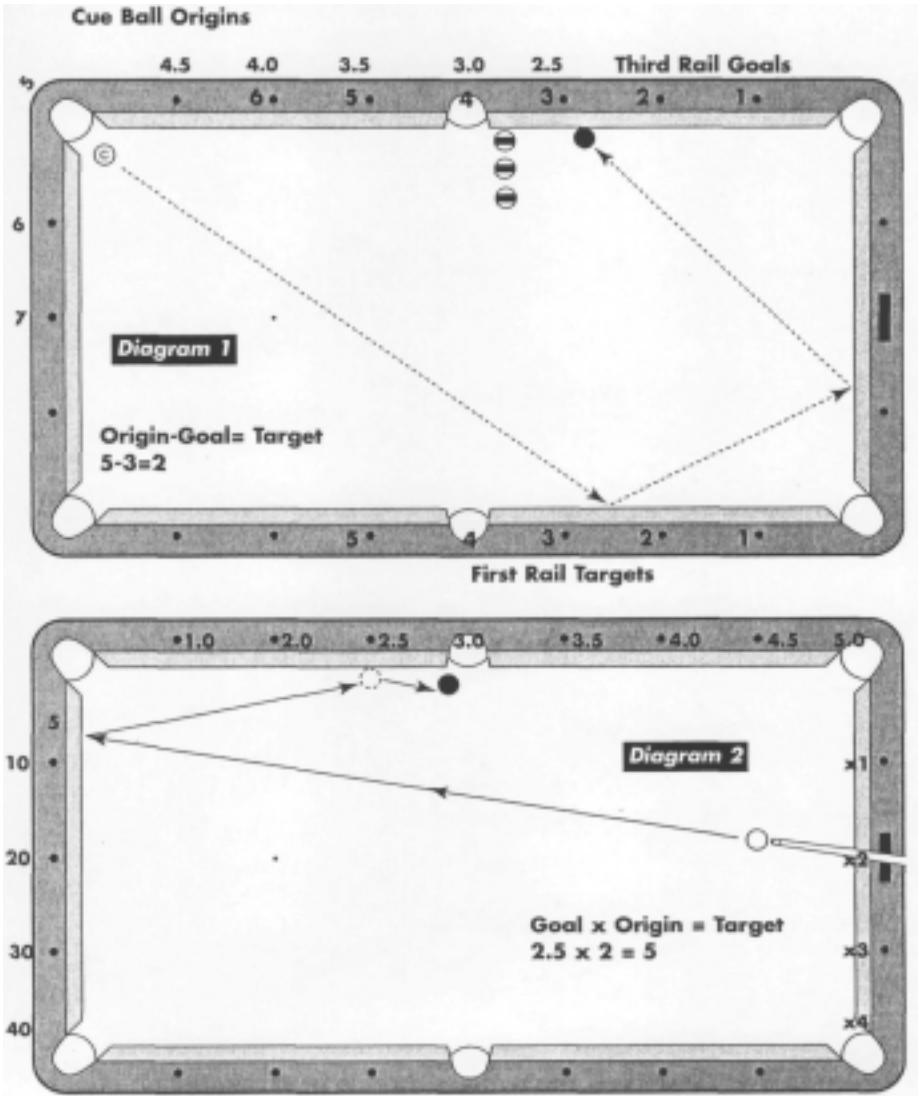
The problem is presented is based from a game of 8-ball. How can you bank the cue ball to hit the 8? The diagrammed path looks likely, but where, exactly, do you need to hit on the first cushion?

The first things to note — and eventually memorize — are the numbers around the cushions. There are three sets, corresponding to the cue ball's "origin," the target on the first rail, and the goal on the third rail. The first set is not obvious, but the other two are simply the number of diamonds from the far end cushion. Note that when the cue ball starts from the corner, it has an origin of five, which gives the system its name. The other cue ball numbers go by halves up the long rail and units along the short rail.

A note on the diamond location: For a start, you will always be going towards a point on the rail that is even with the line of diamonds, and not towards a point on the rail groove. In the diagram, the cue ball is going towards "2" although it will touch the cushion even with diamond 2.5. You may want to try the system using the "opposite" or rail groove points, but first, try the "through" sighting.

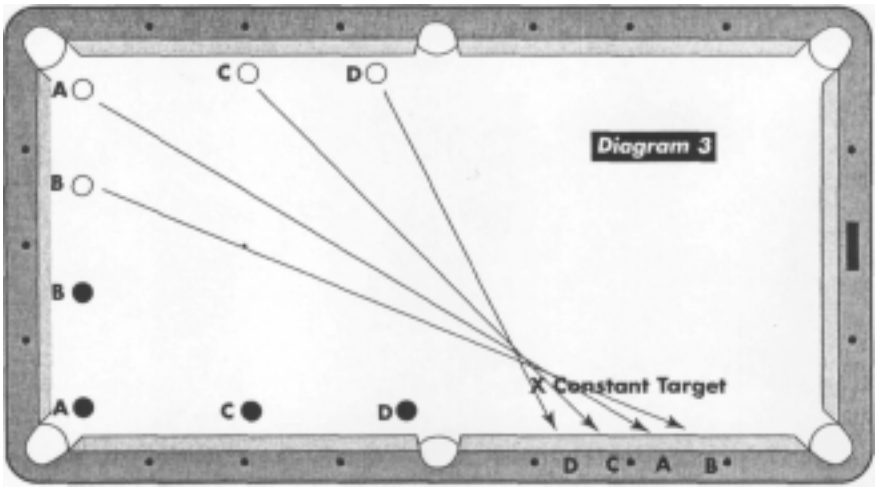
For the shot shown, where is the goal? If you look towards the 8 ball from the approximate place on the second cushion where the ball will land, you will see that you want the cue ball to go towards diamond 3 — the goal. The origin of the cue ball is given by where your stick passes over the rail when you are in shooting position, in this case 5. The arithmetic to find the target on the first cushion is easy: Just subtract the goal from the origin to get 2.

One of the most important parts of this system is to use the correct spin on the cue ball. The idea is to find the spin that makes the shot as consistent as possible. At first glance, it might seem that playing right in the center of the cue ball would be best, but it turns out that far better consistency is achieved by using running English (left in the case shown) on the cue ball. At the same time, you should use follow. This allows the cue ball to have about the same action no matter how far from the first cushion it starts from. If you used center left instead, the angle off the first cushion would change quite a bit depending on how much follow it had picked up from the cloth on the way to the cushion.



Often the target ball will not be on the cushion, and you will have to work a little harder to find the goal on the third cushion. Just sight from the second cushion, and find the goal on the third.

Here's a practice suggestion for this system: First shoot the diagrammed shot until you can hit the target every time. Now vary the speed from just tapping it — perhaps to leave a safety — to warp speed where the cue ball struggles to stay on the table. Once you have this position down, start varying the cue-ball position — you will need to do



some arithmetic — and the object-ball position. Here's one last shot: Move the blockers to below the side pocket and put the 8 in the jaws. From the corner, bank to make the 8. Be careful to chose the third rail goal correctly — it's not 4.

For more details on the corner-five system, and how to select a goal when the target ball is a long way after the third cushion, see Robert Byrne's "New Standard Book of Pool and Billiards." Look in the carom section.

Diagram 2 shows a system from Walt Harris' "Billiard Atlas" he calls "System Sid" after Sid Banner. While the system comes from three-cushion billiards, there's no reason pool players can't use it profitably. Here the goal is to come off one cushion to hit a target. The cue ball's origin numbers are x1, x2, x3... and again you count where your stick passes over the rail when you are in shooting position. The second-rail numbers are as shown — note that there is a change in the spacing of the numbers between 2.0 and 2.5. Also note that this system uses "opposite" or rail groove numbering for the second cushion, so the phantom ball is shown at 2.5. The first-rail numbers are as shown. Again, you just have to memorize these.

The arithmetic is a little harder than before. In the shot shown, you have to land the cue ball at about 2.5 on the second cushion to make the ball in the side. The cue ball is at x2. Multiply the two numbers to get 5, which is the target on the first cushion. Are you good at multiplying two-digit numbers in your head? It's not hard if you practice, but a simpler way is to do the arithmetic for the even diamonds surrounding the cue ball's location, and then splitting the difference according to how far the cue ball is sitting to one side or the other of the space between the diamonds.

This system uses no side-spin, but does use follow. It is critical to the shot to have no side on the cue ball; any little bit will change the path off the end rail. To practice this, use a stripe as the cue ball and see if you can roll the stripe like a tire to the first rail.

The system shown in **Diagram** 3 has been described in these pages before by Robert Byrne, but for a billiard table. Pool table cushions behave differently, often with quite a lot of variation within one brand. You are going to have to figure out how the system works on your table.

Suppose you want to shoot the cue ball three cushions to contact a target ball that is sitting perfectly symmetrically with the cue ball. Shown are four such positions: AA BB CC DD. For example, shoot cue ball A three cushions to hit target ball A. This shot will be close to the path shown in Diagram 1, and the shot requires the same running follow you learned there.

When you are satisfied you have the target on the first cushion for position AA, mark it as shown. Repeat the process for positions BB, CC and DD. Now here is the amazing result: if you join each cue ball location with the corresponding target on the first rail, all of the point will pass through or at least come close to a single point. On my table it is about where X is shown; your table may be different.

Once you know this point, any time a shot like the ones shown comes up, you have a ready target. Even more useful is to note that if a shot is close to the perfectly symmetrical position, you have a starting point for your estimation of the path of the cue ball.

None of these systems will work without practice. During your practice session, pay close attention to the spin you are using on the cue ball and work to find the spin that makes the shot consistently. Try each on other tables — especially comparing results on new cloth to old — to find out how reliable the systems are under changing conditions. Once you have these systems in your repertoire, you'll be surprised how often they come up in games.

Bob Jewett is a BCA certified instructor.