



A Modest Proposal

Thoughts on the double-hit rule

The rule that causes the most problems in pool is the one about hitting the cue ball twice. Here is the wording in a proposed revision of the World Standardized Rules: "If the cue stick contacts the cue ball more than once on a shot, the shot is a foul. If the cue ball is close to but not touching an object ball, and the cue tip is still on the cue ball when the cue ball contacts that object ball, the shot is a foul."

The problem is that most players and many referees cannot figure out when the rule has been violated. There is a guideline in the current rules that talks about the situation when the cue ball is within a chalk's width of the object ball. It suggests that if the cue ball penetrates the space occupied by the object ball to more than a half-ball distance, the shot is probably a foul. Unfortunately, that is only a guideline, and not a rule, although many have assumed it is a rule. Further, illegal shots might be judged as legal if people only pay attention to the guideline, while some legal shots might be judged as illegal.

By legal, I mean according to the rule quoted above. Here are two examples: Suppose the cue ball is half an inch from the object ball and you shoot straight toward it with elevated draw. The cue ball penetrates the space of the object ball by an inch and then draws back. This is almost certainly a foul, but by the guideline it is OK. On such shots the cue ball usually stops dead as soon as it hits the object ball, and the only way to get even

an inch of movement forward is for the cue stick to hit the cue ball again. Or, suppose you play the same shot with a level stick and aim high on the cue ball and use one of the techniques I described in August to avoid the double hit. The cue ball will pause after hitting the object ball and then follow forward. The guideline would rule such a shot a foul if the cue ball follows for-

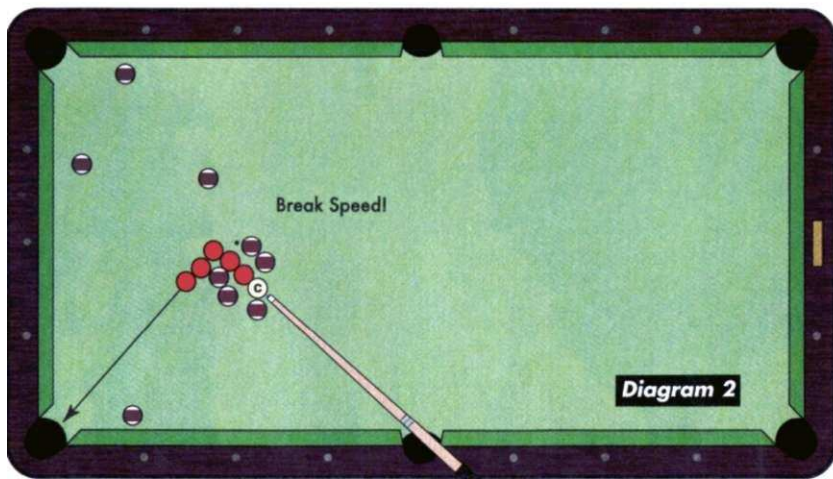
ward more than a half-ball distance. Some leagues have developed their own rules to cover this shot. One invokes the 45-degree rule: When the cue ball is close, the cue stick must be angled to at least 45 degrees, either vertically or as cut angle. I think there are a couple of problems with this

rule. The shot may still be a foul according to the rule above, depending on exactly how the player shoots. That is, you can foul on close shots even with a nearly vertical cue stick, and you can also foul when cutting a close ball 45 degrees, especially if you use outside English. The other problem is that few players understand how high a 45-degree elevation is, and I suspect that

most of the league players who "avoid" the foul by jacking up are not in compliance with the special league rule. It's not just leagues that make up their own rules for double hits. In the 1980 World 14.1 Championship, the rule was that if the referee couldn't actually see the cue tip hit the cue ball a second time, the shot was fair regardless of the action of the cue ball. In the PBTA rule book — the PBTA was the former men's pro association, now defunct — the rule was that it was OK to shoot directly at a close ball as long as you elevated some and used draw. Also, in at least one official set of rules for English 8-ball (which is very different from American 8-ball), it is permitted to play a double hit provided that the referee cannot see the double hit with the naked eye. I

suppose it is permitted to line up for the shot and then wait for the referee to blink and shoot during the blink. It helps to shoot with a lot of speed for such shots.

By contrast, at carom billiards and snooker, the rule is that you can only hit the cue ball one time. Judging double hits usually



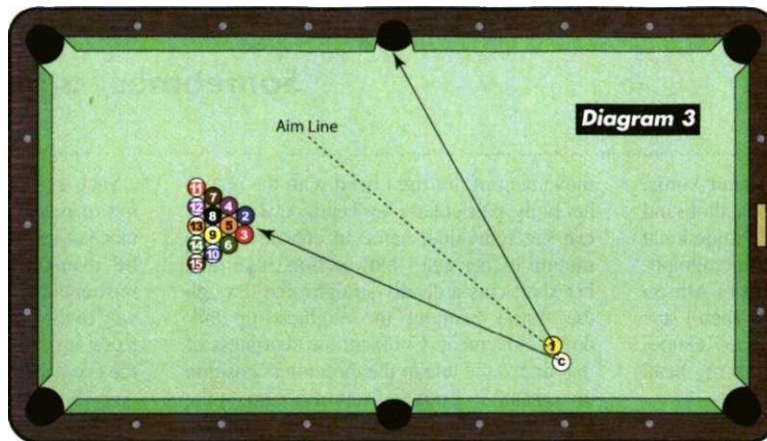
seems not to be a problem. In any case, there seems to be quite a lot of sentiment in favor of a rule change at pool with the goal of removing the problem of judging double hits. My proposal for such a rule is: "It is permitted for the tip to strike the cue ball more than one time, provided that it is done with a single forward stroke of the cue stick."

This doesn't require the referee to have fast or slow eyes. This would certainly eliminate some of the arguments that happen currently. Assuming that such a rule is adopted, what new shots become available that are not played normally today?

In **Diagram 1** I've shown a situation from 9-ball. Your opponent has scratched, and you would like to play the 1-5-9 combo, but the 3-4 cluster is in the way. Just put the cue ball down an inch from the 1 ball and shoot straight toward the 3-4. Use just a little draw on the cue ball. The 1 ball takes out the 3-4, and the cue ball, which arrives after the blockers have vamoosed due to the slowing

action of the draw, passes through to the tasty combo.

Shown in **Diagram 2** is a situation that could be from 14.1 or one-pocket. Your opponent has left you nearly frozen on the



side of the rack, perhaps two millimeters from the first shaded ball. You notice that the line of shaded balls points straight to the corner pocket. Under the current rule, there is no way you could get enough power into the first ball to activate the chain reaction without a double hit, but with double hits allowed you could just lay into the shot with break-shot speed. At

one-pocket, you would have the additional advantage of having so many balls in motion that two or three of them would also go into your pocket.

Finally, **Diagram 3** shows a shot from straight pool. The 15th object ball (the break ball) is just over the line. You have left the cue ball in the rack, so you can place it anywhere behind the line. Put it 1 millimeter from the object ball so the line is straight to the side pocket. Aim your stick roughly along the line shown and shoot hard. The cue ball will smash straight into the front two balls on the rack.

Should these three shots be allowed? If you have a better solution for a modified rule to cover double hits, please send me an e-mail (jewett@sfbilliards.com). If you missed the August article, it is now available online along with all my previous *Billiards Digest* articles at www.sfbilliards.com/articles/BD_articles.html. Some other articles in 1993 also discussed close ball situations.

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Better Safe Than Sorry

Poor shot selection left a foul taste in Marlon Manalo's mouth

The International Pool Tour's "King of the Hill" tournament, which took place in Orlando, Fla., in early December, was an event you should not have missed. What amazed me was that I actually enjoyed watching 8-ball, although it was not the kind of 8-ball you see at "The Rack and Roll" on Friday night.

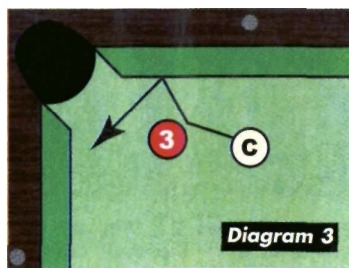
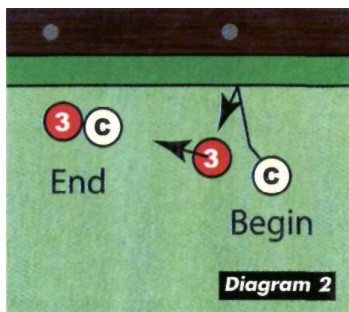
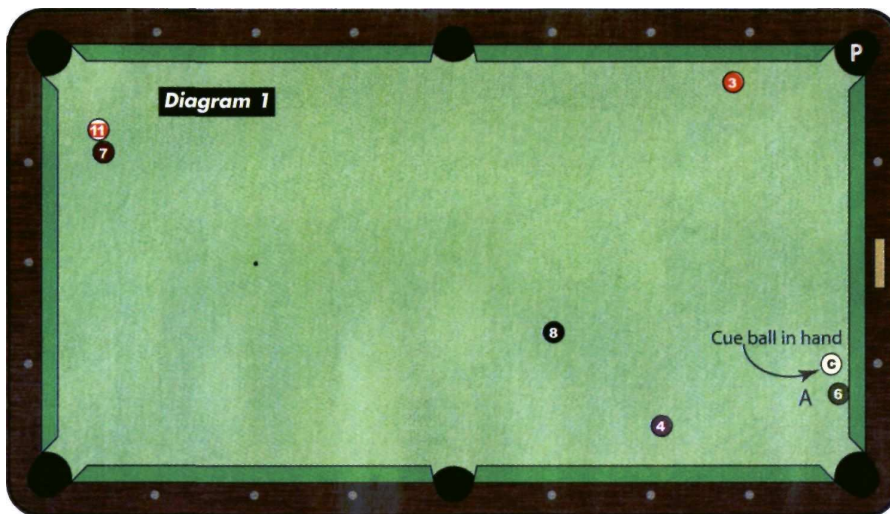
Diagram 1 shows a situation that came up in the match between Francisco Bustamante and Marlon Manalo late in the final round-robin stage. The shot was pivotal in deciding the winner of the tournament, in that the winner of the stage would go on to face Mike Sigel for the crown. Bustamante had just fouled, and Manalo had to decide what to play. There was no particularly good way to break out Manalo's 7 ball, which was stuck against Bustamante's 11 ball.

A major factor in the choice was that the tournament was using the three-foul rule: If you fouled three times in a row, you lost the game. This rule had been in the Billiard Congress of America rules for 8-ball from 1980 to 1985, but was dropped presumably because the clumped and cluttered layouts common with bad bar-table breaks often led to "cheap" wins. (See my February 2002 column for a brief history of 8-ball rules.) Three fouls came up maybe only 1 percent of the time in the "King of the Hill" tournament, perhaps because the very tight racks left few clumps.

The shot that Manalo chose was to softly nudge the 6 ball toward the pocket and leave the cue ball near that same rail. I

was puzzled when I saw he was about to play this, since it was sure to leave a direct path to the 11. Of course, Bustamante had little chance to make the 11 on the shot,

using the 3 ball. It was close enough to the cushion to make the shot in Diagram 2 relatively easy. Hit the 3 ball thinly and just hard enough to come off the cushion



and was likely to break out the tied-up solid. Disaster struck when Manalo hit the cushion rather than the 6 ball first and got no cushion after contact, committing a foul of his own. At the time there was some confusion about the referee's foul call, but a later video replay showed that the referee had made the right decision. Bustamante banked the 11 to pocket P and ran out the match.

What would you have played from the comfort of your armchair? A better choice than nudging the 6 toward the pocket would be to play a soft shot, placing the cue ball at A and against the 6, leaving Bustamante jacked up for any shot toward the 11 and likely to accrue another foul.

My choice is a safety

to rest against the 3, which is a little farther up the rail. (The before and after positions have been moved apart for clarity; the balls don't actually move that far up the cushion on the shot.) You have to practice this shot, or else it won't work when you need it. Try the 3 ball at various distances from the cushion and see where to place the cue ball and how full to hit it to end up with the cue ball frozen against the 3, so that there is no direct path up the table. If the 3 is very close to the cushion, the shot is dead-simple unless you hit the ball like King Kong.

See how far you can move the ball out before you can't get the hook. For practice, see how many times you can play the shot, while each time leaving the 3 ball where you've moved it from the previous shot, but with cue ball in hand. Let's say that the direct path up table must be blocked and the cue ball must end within a ball of the 3 to avoid any hope of a jump shot. Notice that this is a one-ball safety. Usually in 9-ball this doesn't work, because you can't hide behind the ball you just hit. In 8-ball, and sometimes in straight pool and one-pocket, it's often exactly what's needed.

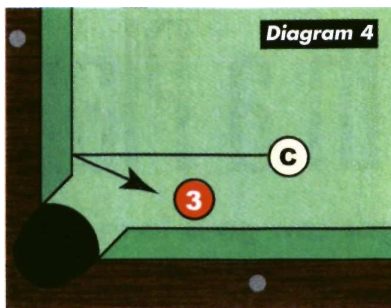
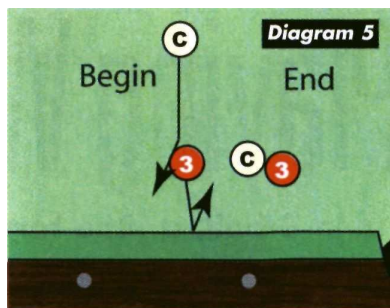


Diagram 3 shows another one-ball safety. Imagine that you have another ball that's locked up by your opponent's ball, and there is no good way to break from the position shown, even though you have a very easy shot. To play the safe, barely skim your ball and duck behind — the 3 ball should barely move. Depending on the starting position of the cue ball, you may want to hit the 3 fuller and drive it to the rail and back out a little while the cue ball comes off the cushion with a little right spin. At one-pocket, this shot can leave your opponent very cramped. Again, you need to spend a few minutes of practice before you try the shot in a game.

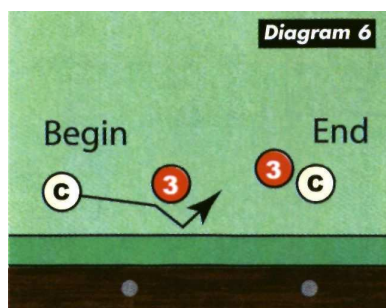
Diagram 4 requires you to go to a cushion



ion first to get to the back of the 3 ball. If the cue ball starts close to the cushion, you will need considerable left spin to get the angle off the cushion. With this shot, it's important to hit the 3 ball before the second cushion or you might give up ball in hand.

Diagram 5 is not with ball in hand. The cue ball is roughly straight out from the 3 and you have to drive the 3 to the cushion and hide on one side or the other. If the 3 ball is close to the cushion, the shot's easy, so move it out and find your limit.

Finally, **Diagram 6** shows a safe like Diagram 3, but you have no second cushion to help out. Can you freeze or nearly freeze the cue ball to the back of the 3? Experiment.



These one-ball safeties can come in very handy, but most players never shoot shots at the very soft speed needed to make them work well. That's why you have to practice them. Practice them now, and you'll have shots in your arsenal that some champions apparently don't have. After Manalo's loss to Bustamante, his first loss of the tournament, he had to play Efen Reyes, and although he led 4-0, he ended up losing 4-8 as Efen advanced to the final match and a \$200,000 prize. Manalo ended up with just \$60,000 for want of a single safety.

Bob's past columns from Billiards Digest are available online as the first item in <http://www.sfbilliards.com/misc.html>.

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A Carom Puzzle

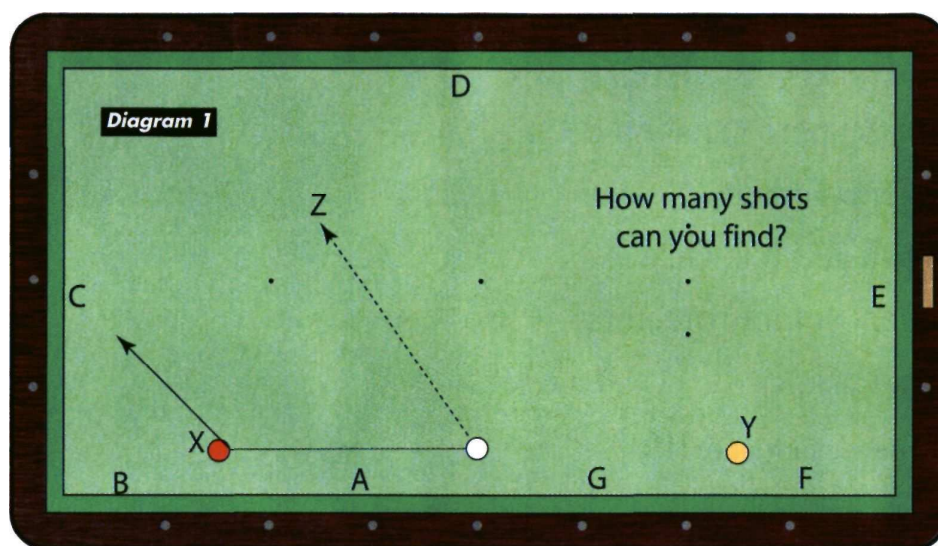
This puzzle will turn your grey matter red, white and yellow.

Here's a chance to win a free one-year subscription to *Billiards Digest*! Solve this carom puzzle with the highest score, and the prize will be yours. Ties will be broken by random draw — only one prize will be awarded.

But first, a little background: Carom billiards is played on a pocketless, 5-by-10-foot table and uses three balls that are slightly bigger and heavier than pool balls. The yellow and white are the cue balls, one for each player, and the red is always an object ball. The goal is to make your cue ball hit both the other balls. If you succeed, you get a point and the chance to shoot again. A century ago, players mastered the easy form of the game, which requires only that you strike both balls, and they made runs into the tens and even hundreds of thousands — literally. Restrictions were added to make the game more challenging, and the championship game now requires that you contact at least three cushions before hitting the second ball, hence the name three-cushion billiards.

A typical situation in a carom game is shown in Diagram 1. The challenge is not to find a shot, but rather to decide which one is the most advantageous among the many shots available. One way would be to play off the right side of ball X, as shown, and then hit cushions C, D, and E before hitting ball Y. For the purposes of this puzzle, that shot would be called XCDEY. That pattern is a freebie. Your job is to find the rest and send me a list of them.

For measurement's sake, all three balls are located the distance of one and a half balls away from the bottom cushion, so a ball could pass through the gap, if needed. Balls X and Y are located one and a half



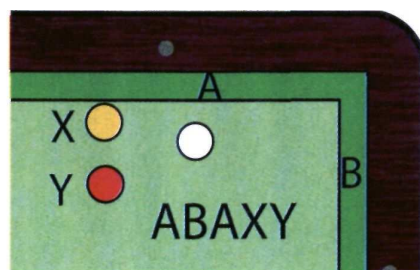
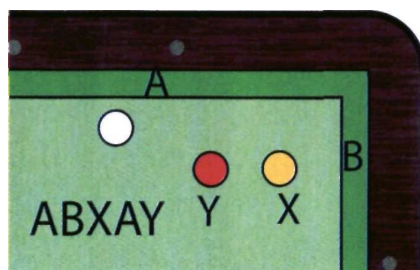
diamond lengths away from the side rails.

In his 1942 essay, "Mechanics of Billiards, and Analysis of Willie Hoppe's Stroke," Professor A.D. Moore claimed that he knew a position of the balls that yields 14 different solutions. We can do better than that. Of course, special positions, like the one shown, have many solutions, but it's always good to find several shots that will lead to success when playing a game. At the Pendennis Club in Louisville, Ky., which is a hotbed of carom

within five tries. The table I will be using for all tests is a century-old Brunswick with cloth and rails fast enough to make a nine-cushion shot, but not 11. (There are tables lively enough to get 11 cushions, but they are newer and heated.) If the shot is too outlandish, I'm not even going to try it. As an example, I'd be willing to try XAEFY, although I don't know yet if I can come close in five tries. It's hard to draw between Y and the cushion. If you list a shot that turns out to be unreasonable in the opinion of the judge, you lose one point.

Also, for every shot that hits ball X before Y, there is a mirror-image shot that hits ball Y before X because the lay-

out is symmetrical. In your list of shots, only show the "X first" shots, and I'll give you credit for the mirrored "Y first" shot. XCDEY gets you YEDCX for free. You should not mention F or G just before Y unless those contacts are required for three cushions. For example, XCDEFY is the same as XCDEY. Getting that last little kiss of a cushion doesn't change the shot



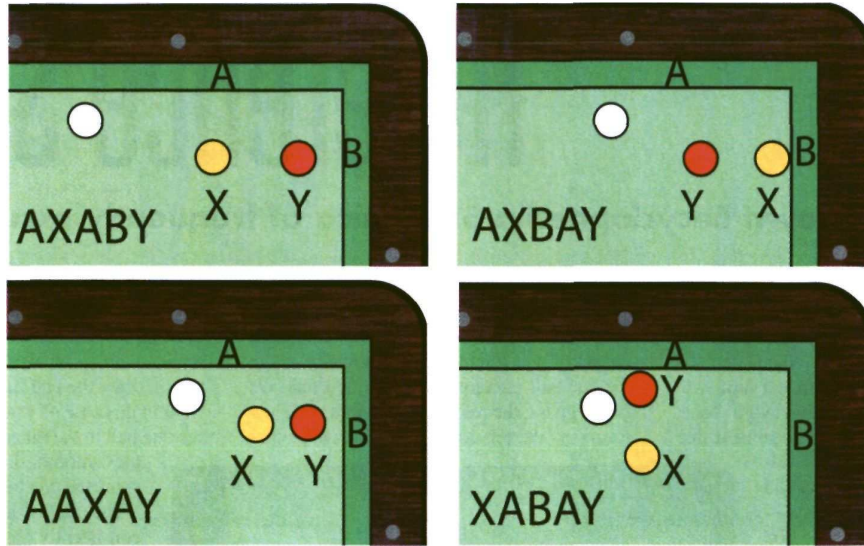
activity, the general rule of thumb among the players is to find four shots. The goal is to not overlook the best shot.

Note that the rules do not require that you hit an object ball first. If you shoot along path Z, there is at least one reasonable shot. As for what I consider reasonable, for the purposes of this puzzle, let's say that I have to come pretty close to making it

enough to get credit, just as hitting the rail by the pocket just before the ball goes in at bank pool doesn't count as a bank. XCDEY can be played with left, right or no spin, but only the letter order is important.

About masse shots: There are several possible shots involving only X, A, G and Y in some order. I'm not averse to trying these shots since I have a masse cue and I'm ready to use it, but the table is not mine, and I predict a rather loud veto coming from the desk on about the third vertical miscue. Vetoed shots don't count one way or the other.

So, here is a rule summary: Write down a list of shots for the above position as strings of letters from the list ACBDEFGXY with



Y always last. You get two points for each reasonable shot due to the mirror-image shot. You lose one point for each unreasonable shot. If I don't get to test a particular shot, it's null and void. If there is a tie, I'll draw from among the highest scores, but there is also a tie-breaker below.

Just to get your imagination working a

Y are exactly one ball apart.

Send entries by e-mail to jewett@sfbilliards.com, or by land mail to this magazine [122 S. Michigan Ave. Suite 1506, Chicago, IL, 60603]. I'll cut off entries one month after I get the first one, and announce the winner in my first column after that. Good luck.

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Straight-Pool Wrinkles

Smooth out your straight-pool game with this overview on offense.

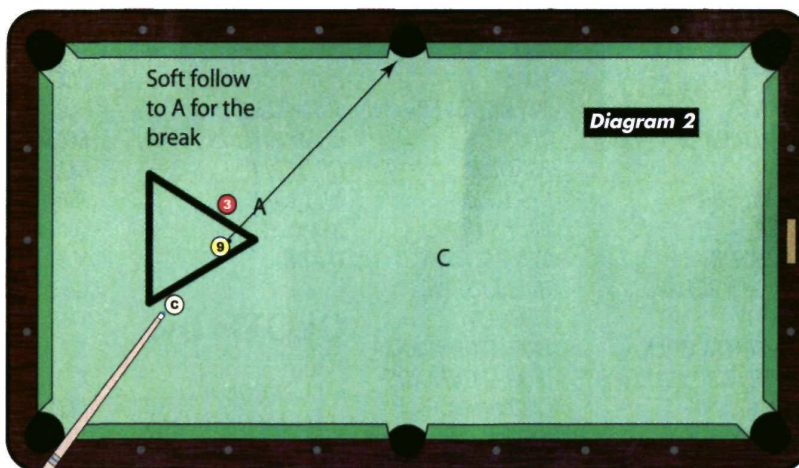
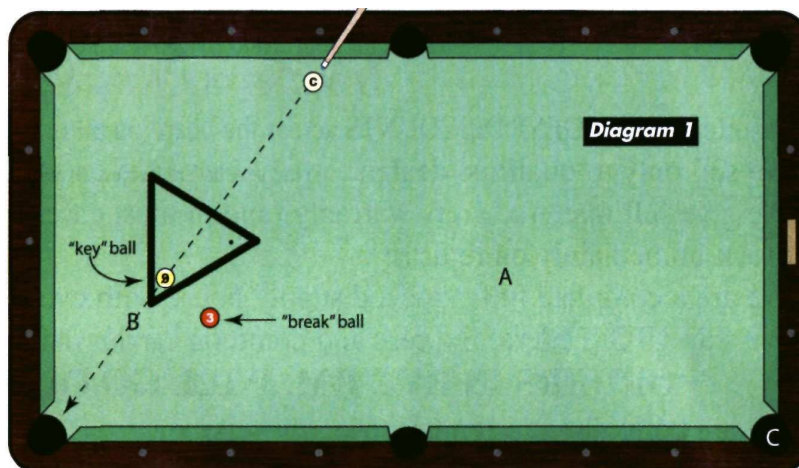
This January, I had the pleasure of watching all of the straight-pool competition at the Derby City Classic in Louisville, Ky. I also had the duty, since I was the main scorekeeper and helped run the event. The competition was not head-to-head play, but rather each player against himself, starting from a good break shot to see how many balls he could run. This is pure offense.

After the last major U.S. 14.1 competition, which was the 2000 U.S. Open at the Roseland Ballroom in New York City, my column covered safety plays. Now we get to look at the other side of the game. There were eight runs of 100 or more during the whole competition in Louisville, and I got to see them all from the scorer's seat next to the table. Danny Harriman had the high run in the prelims with a 139. In the finals, where the number of tries was determined by the player's best run in the prelims, Thomas Engert from Germany was the winner with a 128.

I was hoping to see a player set a new competition record. The old record was 182, set in 1951 by Joe Procita against Willie Mosconi, who holds the record for the highest exhibition run of 526. The equipment that was used during the straight-pool tournament at Derby City, 9-foot Diamond tables, dictated that any high run would be hard-earned. These tables feature pro-cut pockets, and two balls would fit only part way into the jaws of the corners. Diamond Billiard Products was offering a bonus prize for any run of 200, but it turned out to be a safe bet.

One thing I would change about the tables is the sticker on the foot spot. While such a cloth or paper patch is useful protection in games like 9-ball or 8-ball, where the smash breaks tend to drive the apex ball into the cloth and can create a crater, there is no such problem at 14.1. Several times when the player was maneuvering in the rack area, the cue ball caught the edge of the spot sticker and rolled a little off-line. In 9-ball, such minor adjustments of the cue ball's position are less important, because the player usually stays back farther from the object ball, and such a small change in location makes little difference to the cut angle. The solution is to mark the foot spot with a small X made in pencil instead.

One major marking that was missing from



the table was the triangle outline, where the balls are generally racked. This marking allows the player to judge more easily whether the 15th ball will be in the rack or not. Many poolrooms are reluctant to add this marking to the tables, leaving 14.1 players with the difficult determination of whether a ball will make a good break ball or not. While the rules don't permit touching the triangle to test for in/out, the rules also require the outline of the triangle to be marked. I feel that if the latter rule is broken, the player should be able to ignore the former. In addition, the long string (the line down the middle of the table) should be marked to allow accurate spotting of the balls, although for the DCC format, no ball

was ever spotted.

There was one rule that players overlooked that ended two long runs. One player was faced with the situation in **Diagram 1**. He had the perfect break ball in position and a reasonable, if not perfect, key ball left as the final ball of the sixth rack in his run. The problem was that he left himself straight in on the key ball. Drawing back to the side cushion and out to A would have been heroic. He went for the more prudent shot of rolling the cue ball to B and playing the break ball into pocket C. He made the shot, but the resulting weak break soon ended the run.

A second run-ender occurred with the shot shown in **Diagram 2**. Again, a minor error in positioning caused the problem — the

shot into the side pocket is too straight. If the cue ball were slightly lower, a simple follow shot would take the cue ball to perfect break position, but a very soft follow is required in the position shown. The raised spot sticker may have also contributed to the run-ending miss.

In both cases, the shooter overlooked a very important end-of-rack rule in 14.1: If the cue ball is left in the rack area (as defined by the triangle outline), the cue ball is taken in-hand anywhere behind the head string. In both of the diagrams, ball-in-hand behind the head string for the break shot might be frightening to you or me, but it shouldn't phase a player who is likely to run 100 at any time. In both diagrams, a simple stop shot would easily have left the cue ball in the rack. Sometimes it's a good idea to play to leave the cue ball in the rack even when you're not forced to. Suppose you have an object ball at C in

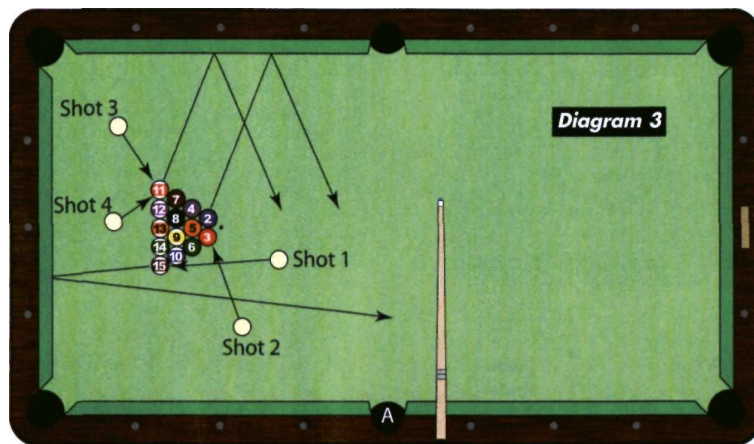


Diagram 2, and it's the only reasonable break shot left on the table. The angle needed is the problem, because it needs to be within a narrow range to break the rack well. This is especially a problem if the cue ball has a long run from the 14th ball to the break-shot position. If you leave the cue ball in the rack, your problem is solved. With the freedom to place the cue ball anywhere behind the line, you can select the best angle for the break.

Finally, since this format is solely offense, it's important to know some non-standard

break shots. **Diagram 3** displays four that were tried at the Classic. Shot 1 is to bank the corner ball back to the head pocket. Use inside English on the cue ball to help the angle and hit as much of the ball as you can.

Shot 2 requires that you play one of the two head balls of the 14-ball rack cross-side. You need a tight rack for this one. Experiment with the cue ball approach angle that works best on your table.

This was made and missed once in the competition. You'll probably find that the ball banks wide most often, and that more speed will help shorten the bank.

Shot 3 was tried in desperation. The head ball didn't go in the side pocket A, but two other balls from the rack did. Worth further study?

Finally, Shot 4 was tried once, but missed. This is my favorite of the bunch, as I feel you can adjust the angle more than with the other choices.

See you at Derby City in 2007. Have your offense ready.

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Where's The Rub?

More aspects of throw and spin transfer.

About 15 years ago, I had a conversation with Don "The Preacher" Feeney. Don is a student and teacher of the game and plays all three disciplines — pool, snooker and billiards. Don mentioned that he felt that draw and follow changed the cut angle on shots. I remember that he felt that one would increase the angle and the other would decrease it. Since I saw no easy way to test the hypothesis, I put the idea aside for a while.

Since that time, pool researchers have been looking at the problem, and there have been considerable advances in the theory. The important factor is the force that the cue ball generates on the object ball, not by pushing on it (that is what drives the object ball towards the target and away from the contact point), but rather by rubbing on the object ball. Ideally, the object ball leaves the collision with the cue ball along the line joining their centers at the instant of contact. The term "throw" refers to the departure from that line due to friction between the balls.

The pushing force is called a "normal force" by physicists because it is perpendicular to the surface of the ball, and "normal" is another word for perpendicular. The force pushes the two balls apart, and in an ideal world, would be the only force players would have to worry about.

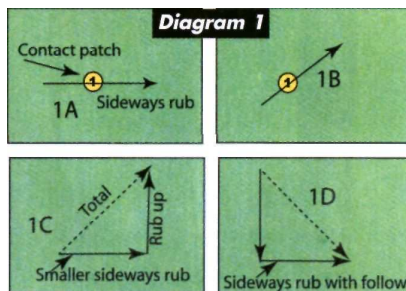
The rubbing force is called "tangential," because it acts along the tangent, or kiss line of the two balls. This is caused by the motion of the surface of the cue ball across the surface of the object ball and due to the fact that the balls are not perfectly smooth. To a physicist, this is "sliding friction."

Let's look at a few basic ideas of sliding friction. Imagine you have a cardboard box of stuff on a linoleum floor. You want to slide it across the floor, but it will take a little extra effort to start it sliding because "static friction" is usually stronger than sliding friction. Once moving, the box will require a constant sideways force to keep it moving.

The force required is usually a constant fraction of the weight of stuff in the box. For example, if the contents weighed 100 pounds, it might take 10 pounds of sideways force to keep the box moving. If we doubled the weight to 200 pounds, we would need 20 pounds of pressure to keep the box moving. In this case, we would say that the "coefficient of friction" was 0.1 or 10 percent. So,

the harder the two surfaces are pressed together, the more difficult it is to slide them against each other.

There are a couple of wrinkles I've observed in this nice simple theory. If the speed of sliding increases, the friction actually decreases some. The exact result depends on the hidden details of the surfaces. Fortunately, Wayland Marlow in his 1996 book, "The Physics of Pocket Billiards," has already done the measurement for us. He says that friction does decrease significantly



between pool balls as the speed of sliding increases. This is why less throw is observed for faster shots.

A second observation is that the friction seems to decrease with more pressure. Pressure is just force per area, so you would get more pressure if you shot harder. However, we can change the speeds of the surfaces without the cue ball moving any faster. This is done by applying sidespin. The predicted result is that, by using lots of inside English (left English on a cut to the left), there will be less throw than if you play the shot with no English. Looking into the details further, this doesn't apply to nearly full shots, where you have little sideways motion from the cut angle.

During the collision, the balls compress at the contact point. You can observe this by covering the surface of one ball with a thin film of something (such as wax) and then hitting it with another ball. The coating will reveal a round spot. Theory predicts such a spot, and says it depends on the hardness of the balls and the speed of the shot. If you know the time of the contact, you can figure out the size of the contact spot.

Again, Marlow made the necessary measurement, and got a time of about 200-millionths of a second. In a future column we will see why the contact patch is important.

How does this theory apply to the problem at hand of draw and follow increasing or decreasing the cut angle? **Diagram 1A** shows the contact patch on the object ball for a cue ball cutting it without draw or follow. The motion of the cue ball's surface is straight, sideways across the object ball, and the force of friction is also across the ball as shown. The length of the arrow represents the size of the force, and the direction of the force. This force will do two things: First, it will throw the object ball off-line from the ideal cut — it will not go straight away from the contact point, but will be pulled to the side that the rub is acting toward. Secondly, some spin will be transferred to the object ball by this tangential force.

What happens if we add follow or draw to this situation? **Diagram 1B** displays a situation that requires draw on the cue ball. Because of the back spin on the cue ball, the front part of the cue ball, which contacts the object ball, will be moving up. It will also be moving sideways, just from the cut angle. The combination of up and sideways is at an intermediate angle on the surface.

Now, let's go back to our basic theory. The amount of sideways rub is the same, and we have added the upwards rub. This means that the speed of rubbing will be increased over the case where there is no draw. The faster speed of the surface of the cue ball can be expected to reduce the net force (according to Marlow's measurement). This means that the angled arrow will be smaller than the sideways arrow in 1A.

In addition, the angled force needs to be further divided into two parts: One that rubs up only and one that rubs sideways only. From physics, we know that the three corresponding arrows form a right triangle, as shown in **Diagram 1C**. We can see that the sideways force must be less than the angled force, which is the hypotenuse of the right triangle. This is a further reduction of the size of the sideways force, which gives us throw.

Similarly, if we play with follow instead of draw, the cue ball's surface will be moving down as well as across on the surface of the object ball. Again the starting frictional force will be reduced due to the increase in surface speed and further reduced by the hypotenuse to side ratio of the right triangle of component forces, as shown in **Diagram 1D**.

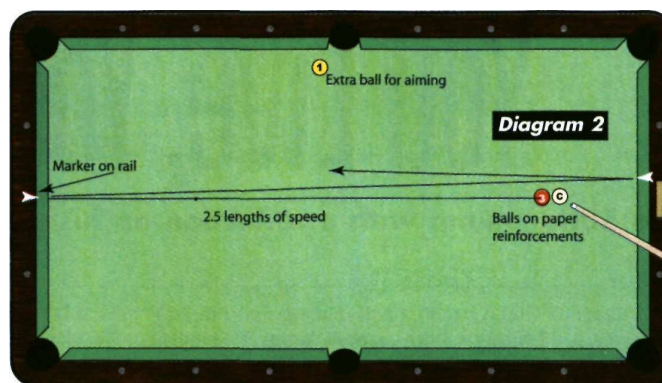
This theory predicts that both draw and fol-

low will have an identical effect, and both will reduce throw during the collision. The theory is nice, but how can we test it?

Diagram 2 is a test setup I tried, and I urge you to try it also. The object ball and cue ball are both placed on donut-shaped paper reinforcements to make sure they go back to the same spot each time. They are about 1/4-inch apart. The idea is to play a cut shot with draw, follow and no spin (a stun shot), and see where the object ball goes.

Because the balls are so close to each other, a small change in your cue stick angle will make very little difference in where the object ball goes, but it's still important to repeat the cut angle as precisely as possible. For this purpose, I put an extra ball on the table, and I always shot the cue ball toward it. I chose a speed that would send the object ball up and down and halfway back up the table. I threw out shots that were the wrong speed by more than a diamond or so. I only tried a half-ball cut, which is a 30-degree cut angle, neglecting throw.

I began with the stun shot and placed a coin



on the far cushion about where the object ball would land. I repeated the shot a dozen times until I felt that the chosen spot was repeatable for that (lack of) spin on the cue ball. I also noted the landing spot on the cushion I was shooting from, and of course the distance the ball traveled.

Next, I tried draw. The ball — same speed and cut — landed on the far rail, four inches from the spot for the stun shot. I was stunned. While I did expect some reduction in throw from the extra spin on the cue ball, I didn't expect it to be that large. The landing spot on the second cushion was a full 10 inches from the original spot for the stun shot.

Here's a question for you: Is a change in cut of 4 inches in 80 (the length of about six and a half diamonds) big enough to worry about? Remember that a corner pocket, after subtracting the width of the ball, is less than three inches wide, and if you shoot for the center of the pocket, you have to be within an inch and a half of that to pocket the ball.

Question 2: Have you ever consciously corrected the cut angle when using draw on a shot? It was with some trepidation that I approached the obvious next step, shoot the shot with follow. Theory predicted that the ball would follow the same path as with draw, but it just didn't feel right. I should have trusted the theory. The follow shot landed in exactly the same places on the cushions as the draw shot. The theory is correct.

What does this mean for your play? Maybe nothing if you already play stun, stop and follow shots accurately. If you have trouble with cut shots, especially when they are stun shots (without draw or follow, but rather just sliding into the cue ball), then maybe you need some practice with the above ideas in mind.

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Straight Statistics

Knowing the odds can help you improve on your high-run record.

Watching a lot of pretty good straight pool at the Derby City Classic 14.1 Challenge event this past January got me to thinking about the chances that a high-run record might be set in the competition. The format had just one player on the table. He began with a typical 14.1 break shot of his choice, and continued until he missed or scratched.

It turns out that a run of 183, which would have been a new record for competition, had about a 25 percent chance of happening given the players and conditions. Some of the following may help you increase your personal record.

First, let's start with some data. There were about 175 score cards with a total of 301 attempts in the preliminary phase of competition and 55 attempts in the finals, which were limited to the top shooters in the preliminaries. A good statistic to look at is the percentage of "table clearances." When starting with 15 balls on the table, getting to the next break shot counts as a clearance.

In the prelims, the average clearance rate was 55 percent, which meant that for the average player, getting through a rack was slightly better than a 50-50 proposition. Of course, the first break shot, which was set up just the way the player wanted, should give a higher percentage of clearances, compared to the subsequent break shots in a run, which had to be played from wherever the player left the 15th object ball and the cue ball. The clearance rate from first break shots was 58 percent, which was a smaller advantage than I had predicted.

In the finals, which had stronger players, the likelihood of table clearance was slightly higher. The overall clearance percentage rose to 60 percent, and the first-rack percentage went up to 64 percent.

Since a rack clearance is composed of 14 consecutive shots (usually), we can calculate the average chance for each individual shot. If we take 60 percent as a reasonable rack value, the single-shot percentage, or chance of making the next ball, is just the 14th root of 0.6, or 96.4 percent. In terms of misses, this is one miss out of 28 shots, on average.

Of course, not all shots in a run are equally difficult. Often runs end on very hard shots. By hard I mean shots the shooter will make only 80 percent to 90 percent of the time. In terms of statistics, if a player has one 80 per-

cent shot per rack, then the average percentage on the rest of the shots has to move up to about 98 percent to maintain 60 percent for getting through the whole rack, and if he has two 80 percent shots per rack, he can afford to miss only one shot in 200 of the easy shots.

Table 1 breaks down the single-shot percentages (labeled "Shot") and likelihood of a miss ("Misses") that will occur based on various rack-clearing percentages ("Rack"). For example, a player who has a 30 percent chance of clearing the table will miss once out of every 12 shots, which is the same as a 92 percent chance of making each individual shot. To figure out your average rack clearance percentage, try 100 innings of the competition format. From there you can figure out about how often you'll miss.

Can anyone get to be 90 percent likely to clear a rack? Maybe. That means that, on average, the player misses one shot in 133. Besides being much more accurate than you or I, such a player must have very few run-ending events, such as scratches, miscues, and skids. For an average player, I suspect that such things happen at least once in 100 shots. For our hypothetical super-champion, they need to be once-a-week or once-a-month occurrences.

What can we say about the high-run records of past champions? Many people who saw several of Willie Mosconi's exhibitions report that he ran 100 or more balls in each one. In a match, he might get several chances to start a run, so let's suppose that he had a 25 percent chance to run 100 from any particular open shot. Taking the 100th root of 0.25, we can conclude that his average pocketing percentage was 98.6 percent, which would make him better than 80 percent likely to get through any particular rack.

Mosconi also holds the exhibition high-run record of 526. Was that a total fluke, or is it reasonable to expect such a long run given his assumed 98.6 percent pocketing accuracy? This is a hard question to answer. In most exhibitions, Willie stopped when the score got to 150, but on March 19, 1954, he agreed to continue until he missed, which happened

on the 527th ball of the run. This turns out to be a 1/1468 chance given that 100 balls was a 1/4 shot for him. In 40 years of exhibitions and perhaps 200 exhibitions per year, we could actually expect several runs over 500, if only he had continued in all of them.

Arthur "Babe" Cranfield was another high-run champion. It is said that, on five consecutive nights, Babe ran 200 or more balls. While we don't know how many innings he had on average before the long runs or whether this was an exceptional week for him, this puts him at a single-shot percentage of about 99 percent, which gets us very close to a 90 percent rack-clearance rate.

Cranfield's lifetime longest run in practice was 768, which is nearly 55 consecutive racks. This turns out to be a 1/2250 chance if you accept the assumptions of his percentages. Given that Cranfield practiced often and didn't stop at 150, a run of this length was quite likely to happen.

Getting back to modern reality, why weren't the percentages at Derby City higher? I think one major factor is that 14.1 is no longer the main tournament game. It is still played in the European Championships, and there are high-run contests there, which helps explain why German Thomas Engert got the high run in the finals at Derby City with a 128. In the finals, he had only two innings, with a total of 185 balls pocketed, one scratch and one miss for a single-shot percentage of close to 99 percent. His lifetime high run is 491, but I think we can expect better.

Many of the players at DCC seemed to struggle with patterns, and the runs were not of the Mosconi, Crane or Cranfield-caliber elegance. Another factor was the stingy pockets. Two balls would fit between the start of the jaws, but they would not get back to the quite deep drop. With tight pockets, every high run was earned, but for setting records, buckets would have been better.

How much better? To examine this, let's consider where the ball arrives at the pocket as a plot of distribution, as in **Diagram 1**, which is for a hypothetical player. I don't think the exact shape of the curve has ever been measured for a real player, but we can

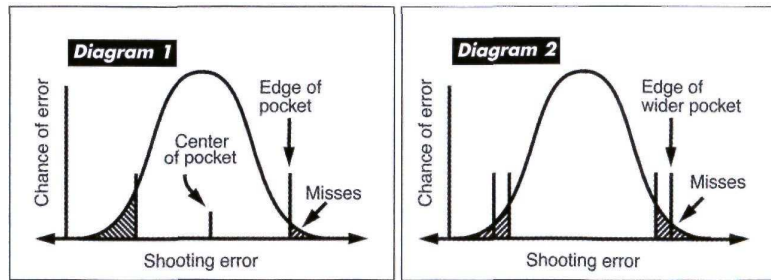
| Rack | Shot | Misses |
|------|-------|--------|
| 10% | 84% | 1/6 |
| 20% | 89% | 1/9 |
| 30% | 92% | 1/12 |
| 40% | 93.7% | 1/16 |
| 50% | 95.2% | 1/21 |
| 60% | 96.4% | 1/28 |
| 70% | 97.5% | 1/40 |
| 80% | 98.4% | 1/63 |

expect it to be some kind of bell curve, with most of the shots near the center of the pocket, and shots with a larger margin of error becoming much less frequent. The height of the curve in the diagrams shows the relative likelihood of any particular amount of error.

When the shooting error puts the ball beyond the edge of the pocket, the shot misses, which is represented by the two shaded regions outside the pocket edges. As drawn, the player will miss about 5 percent of his shots.

For this player, you can see that his shots are falling a bit off-center. If he did center his shots better, and maintain the same accuracy, his percentage might go up by 1 percent.

In **Diagram 2**, the pocket width is increased by just 20 percent. While this makes what seems like a negligible difference in the percentage of balls pocketed, it will make a huge change in the percentage of balls missed. If you assume a "normal" distribution, which is the common bell curve, the pocketing percentage goes to 98.4 percent. Looking at the table, you can see that



this change will boost the rack-clearance rate from about 50 percent to 80 percent — a huge difference.

How can you increase the size of the pocket without actually making it bigger? I already mentioned one way — center your shots. Of course, improving your pocketing accuracy in general will also help. Imagine if you cut your typical error by a factor of 2 — that would effectively make the pocket twice as large, and if you missed 5 percent of your shots before the improvement, you would be down in the one-miss-per-year range.

Another way is to play on new cloth. Pockets tend to play much tighter when the cloth loses its new-cloth slide. Mosconi used a related technique in his exhibitions. He always brought a set of polished balls to use. My suspicion is that they were waxed, and

even if the cloth wasn't quite new, the slippery balls would tend to slide in rather than hang up. Skids should also be less frequent with clean, polished balls.

Another advantage of slippery object balls is that there is less throw both on combinations and on regular shots

where you have collision-induced throw from the cue ball. With less throw, there is less aiming compensation and less error if the compensation is not quite right. I once played with a set of balls that had been in a fire. I'm not sure what that did to the surfaces of the balls, but they had about twice as much throw as normal balls, and every shot was an adventure in guesswork. You don't want to be guessing all the time if your goal is to run 100 balls.

A final way to improve your pocketing percentages is to play shorter position — leave the cue ball closer to the object ball. A longer shot will have more room for error at the pocket than a shorter shot. Similarly, taking smaller cut angles and choosing patterns that utilize the closest pocket will also increase the effective pocket width.

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Carom Conundrum

Creative readers had Jewett working on the rails, all the livelong day.

In the March issue, I proposed a carom puzzle. The problem was to find as many three-cushion shots as possible from the position shown in **Diagram 1**, in which the cue ball must hit both object balls and must make at least three cushion contacts before striking the second object ball.

Here's a rundown of the rules: Because the shot is symmetrical, for every shot that hits ball X first, there is a mirror image shot that hits Y first. Therefore, only shots that hit X first had to be mentioned, and the mirror image shot was also counted for a total score of two points. All three object balls are one and a half ball widths off the long cushion, so the cue ball can fit between the ball and rail, if necessary. The shots had to be "reasonable," or I had to be able to come close to the shot in five tries. I ended up taking more than five tries on some shots because I first had to figure out the best way to hit them. Also, if I lucked into one shot while trying another, I counted it as being made. If it was deemed unreasonable, the entrant lost a point. The shots were submitted as strings of letters, such as XCDEY for the shot shown in **Diagram 1**. I did not count XCDEFY as a separate shot, since the fourth cushion at the end of the shot doesn't change the shot much. My notation for the shot would be XCDEY+ meaning that there might be a little something extra at the end. The mirror image shot would be YEDCX+.

When I first thought about the proposition, it looked like there might be 15 to 20 different shots to try, or 30 to 40 if you count the mirror image shots as well. I underestimated the creativity of the readers. I ended up with 82 different shots to try, which took about six hours of testing. This is the hardest I've ever worked on a

column, but I'm not complaining, because I learned a lot along the way.

Of the 82 shots, I managed to make 30 of them and came close on another 14, for a total of 44 reasonable shots, or 88 once doubled by mirroring.

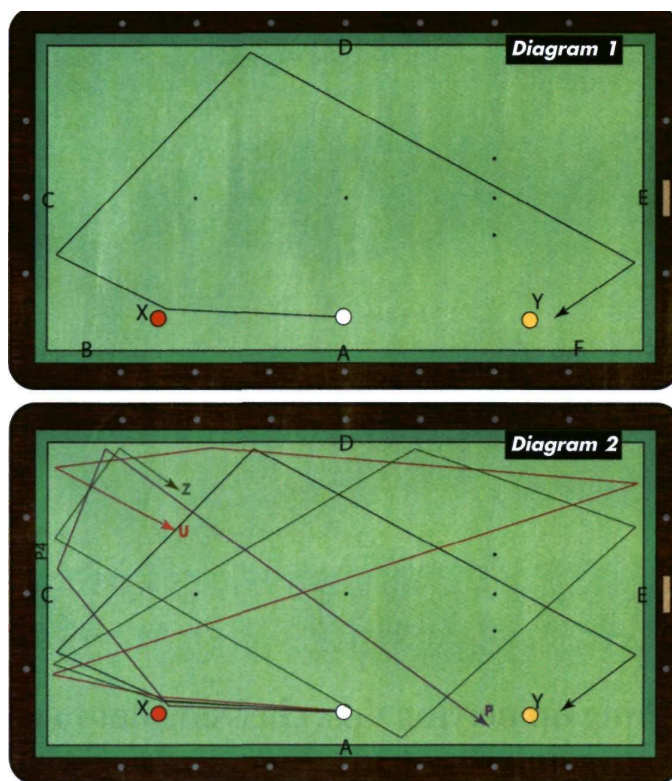
green path marked Z) fits into the general framework of the "corner-five" system, which will tell you pretty closely where to hit on the second (D) cushion when using running (right) English.

Another shot that has a system for planning it is XCDAY, which is the purple path marked P in the diagram. Note that you have to get cushion A just before the Y ball for three cushions. The system to use here is the "plus" system. For this shot, the system says that, if the cue ball is coming from the X ball and you want to go to a point four diamonds farther down the table, you need to send the cue ball toward P4 on the rail. The system is somewhat sensitive to how much running English you use, and will vary from table to table. Place the cue ball at X and shoot directly towards spots around P4 to get a feel for it. This is a good system for kicking out of safeties in pool.

A shot that doesn't follow a system that I know of is XCEDCY+, the red path marked U. I had success with almost no English and a thin hit. This is certainly not the shot you would choose willingly in this position, as it is very sensi-

tive to the hit and the spin.

In **Diagram 3** are three of the 22 good shots that start by hitting a cushion first. The easiest is DCAXY+ (labeled 1). I call this a lag ticky. A ticky is a shot in which you hit the cushion just before the object ball and then go back to that same cushion, getting an easy second-rail contact. For DCAXY, the cue ball will naturally stay close to the cushion after hitting X, and you might score with or without going back to A after X. The similar shot that lands on the "outside" of the X ball (labeled 2) is harder because, if you hit X a little full, the ball will come off the cushion and double-kiss the cue ball. Shot EDCAXY (labeled 3) is easier than it



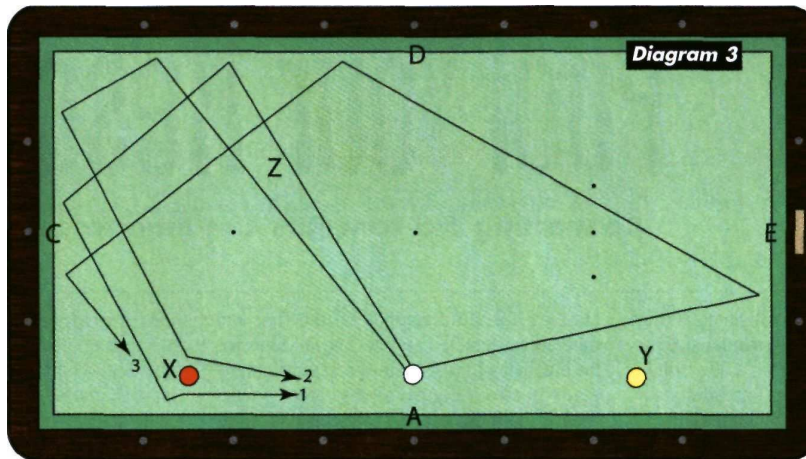
On a side note, when faced with a symmetrical position in actual play, you would usually chose which ball to play first based on the safeness of the leave. For example, in **Diagram 1**, if I play as shown, I can leave my opponent's cue ball (X), in the CD corner and with the right speed, he will be far from the other two balls if I miss. Playing off the red first has less chance of coming out safe.

In **Diagram 2** are several of the good shots that start with XC. There are systems for some of these. (I am going to call the rail that the cue ball starts next to "A" from now on to simplify the diagram and to make the listing of shots unambiguous.) For example, the shot XCDEACDY+ (the

looks once you get the hang of where to hit the first cushion, and the amount of running English to use. This shot ends like the lag ticky.

If you want a cushion-first challenge, try ADCXY+, which is shot into cushion A with reverse (left) English, and then follows the path of shot 2 in Diagram 3. This shot does not work well if the cushions are sticky, as that destroys all the left English on the first contact.

The contest yielded six entrants, one of whom wants to remain anonymous, so he's not in the running. They were from Finland, France, New Mexico, North Carolina and California. Second place went to Lloyd Welcome of Greensboro, N.C. He came up with 36 shots for me to try, but I only made 19 of them for a score of 21 (19x2-17). Ray Piworunas also proposed 19 good shots, but only had four



unreasonable ones, making him the winner. Ray used a 9-foot Olhausen table with carom rails and fast cloth, which probably accounts for his large percentage of reasonable shots. He plays other forms of carom billiards as well, having won the 2005 Balkline Championship at New Mexico Tech in Socorro, N.M. And I bet you thought there were no balkline competitions in the U.S. any more.

If you would like to try all 44 "good" shots, here is a listing of them. Note that

XX means that there is a double kiss. The cue ball hits the X ball full; the X comes back off the short rail and hits the cue ball, sending it to three or more cushions and then the Y ball. Those should keep you busy:

A C A X Y + ,
ACXAY, ACXDEY,
ADCXY+, AED-
CAXY+, AE
C X Y + ,
AXACDEADY+,
A X A C D E Y + ,

AXACDY, AXACY+, AXCDY+,
AXDAY, AXDEY+, CAXAY, CDEAX-
CDEY, CXDEY, DCAXY+, DCXAY,
DXADEY, DXADY, EDCAXY+
EDCXY+, XACA EY, XACAY,
XACDEADY+, XACDEY+, XACDY+,
XACEDCEY, XACEDCY, XADAY,
XADEY, XCDAEY, XCDAY, XCDEAC-
DAEY, XCDEACDEY, XCDEACDY,
XCDEY+, XCECEY, XCECY+, XCED-
CEY+, XCEDCY+, XDEAY, XXADEAY,
XXDEAY.

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I **get** to watch at least part of a bunch of major tournaments each year. The last seven months have been particularly busy with trips to the International Pool Tour's King of the Hill event in Orlando, the Mosconi Cup in Las Vegas, the Derby City Classic in Louisville, the U.S. National 3-Cushion Championships in Miami, a World Cup 3-Cushion tournament in Porto, Portugal, the BCAPL Nationals and the Enjoypool.com 9-Ball Championship in Las Vegas and the World 14.1 Straight Pool Championship in New Jersey. I'm glad I sleep well on airplanes.

Here are some miscellaneous ramblings on running and watching billiard events. I think prospective tournament organizers especially will find something useful below. Lord knows that some of them need all the help they can get.

FINDING THE MONEY

It's much easier to run a tournament with money rather than without it. Most open tournaments at the city and state level in the U.S. are funded from entry fees, with the host poolroom sometimes adding a few hundred to a few thousand dollars. It is rare to have any commercial sponsors for such events. While the poolroom might have higher food sales to make up the gap, this kind of event is usually for promotion rather than profit. The better players like to hang out at poolrooms that have tournaments. At the national level, it is possible to find sponsors and have tens of thousands of dollars of added money. Admission fees are important, possibly covering all of the added money, but incur expenses noted below. It is also possible to find "angels" — people who are willing to donate funds just so the event will happen. At the international level, TV-related sponsorship starts to become important, as we see with the Mosconi Cup, the World 9-Ball Championships and the IPT events, none of which would happen without a TV connection. For most events below that level, TV is a possible revenue source, but you won't find ESPN and Fox Sports begging to let their camera crews in. If you have hired a production company and have tape in the can, they may talk to you.

LOCATION

My favorite tournament site is in the city of

Monte Carlo, Monaco, where a billiard tournament is in progress as I write this. Admission is free, and the best three-cushion players in the world are there. It's amazing what can happen when the money part is taken care of by a billionaire. Most of the time, organizers have to settle for less posh surroundings. Cheapest is in a poolroom. Cheap isn't necessarily bad, as it means less money down the drain that can go back to the players. The next level up is in a hotel, which is a much nicer venue, but adds cost, which is usually borne by the people who rent rooms at the hotel, whether they be players or fans. In return, the hotel provides the ballroom and possibly support services. The hotel will be looking to fill its rooms during a slow season, and while the room rates will not be rock-bottom, they may be very attractive. The tournament I went to in Portugal was held at the nicest hotel I've ever stayed at, with champagne and caviar at the breakfast buffet and complimentary wine at check-in, all for \$130 a night. The rooms were amazing.

If you are a promoter, you will need to sign a contract with the hotel, and this may have to be a year before the event. Typically, you will guarantee a certain number of room nights during the event, and the hotel will reserve those and a few more for players and fans. A hefty deposit may also be required. If you are a fan, you should help support the event by staying at the host hotel, even if it is a little more expensive than the motel across the street. It will be the most convenient place to stay, and if the organizer loses money, the event is unlikely to be repeated.

SAFETY

You might not consider physical security when running a pool tournament. Think hurricanes. The 1976 World 14.1 Championship was held by the beach in Asbury Park, N.J. A major player that year was Hurricane Belle. My flight into Newark was among the last to land that Friday night, as the wind and rain increased beyond safe levels. As I was driving down the coast to the arena, I thought, "Earthquake," but it was just the rising wind that was rocking the car. Once safe and drying off in the bleachers next to familiar faces, I settled down to watch an early-round match. We could hear the storm beating on the roof. There were four tables, one in each

corner of the hockey rink-sized floor, and Herb Lehman, an accomplished 14.1 player from Connecticut, was studying the layout on the near table looking for a safety. With a rumble, the doors at that corner of the arena blew open, the projector screen fell onto the scorers' table, and all the balls on Herb's table blew to one end. This was the second time I had seen rain blowing horizontally across a pool table, the first having been in Saigon. The staff secured the arena, and Herb was able to restore the position and play a good safety. I was reminded of Belle by the recent "indoor rain experience" at the 2006 World 14.1 Straight Pool Championship, which was also in New Jersey. Before I arrived, a leak in the newly-renovated roof of the hotel ballroom had required one table to be moved out of the drip line and designated a practice table. While I was watching matches, a growing line of trash cans and waste-paper baskets started to appear on the tournament floor, to catch what the roof could not. Eventually the ceiling tiles got waterlogged and let loose to plop onto the practice table.

And speaking of earthquakes, back in the 1970s a 6-or-so quake interrupted one of Fred Whalen's 14.1 tournaments in southern California. Dallas West, who was in the lead at the time, packed up and left. The rule in these matters is "no blood, no foul," and fortunately none of these acts of God caused any injury. They did make each event more memorable. To be safest, stay away from New Orleans and New Jersey in hurricane season and California in earthquake season.

OFFICIALS AND OFFICIATING

For the top-level tournaments, it is nice to have referees and score keepers. This takes planning and organization. While you may be able to find volunteers for these positions, it is not fair to offer no compensation at all. Free admission or a small amount per match served is better than just a hearty handshake. A pet peeve: The tournament director should not play in his own tournament. The conflict of interest is obvious. Beyond that, there is usually more than enough for the TD to take care of, and time spent playing matches is time he can't use to do his TD duties. It's not so easy to find good referees. Most people with enough knowledge to ref correctly would rather play. The BCA has a referee

training program, if you are interested in helping at future events — sometimes you might even be paid for your work. If a referee is not trained to a certain level, he may be worse than no referee at all. This is particularly the case for calls on close hits. It takes considerable experience to tell a good hit from bad, and both players usually know immediately which it was. When the referee says something else, there is a big problem.

Score-keeping doesn't require much training, but it does require attention. I have to admit to the occasional brief nap with a pencil in my hand. I was particularly disappointed to see that the recent 14.1 Championship didn't have usable score sheets. Ball-per-inning statistics are important results for straight pool, and the number of innings in each match was not recorded. Due to the very large number of matches, the players sometimes had to keep their own scores, and there seemed to be no uniform way of marking the sheets. Maybe next year.

Let's use the recent 14.1 Championship as an example of the effort needed to "fully officiate" an event. This year, there were 224 matches in the preliminary (round-robin) phase of the tournament on 10 tables. Those matches took about 90 minutes on average, so there were potentially 670 hours of officiating with referees and score keepers. You

need at least two people trained for each position, since they need breaks. That requires 40 people putting in 17 hours each over about three days. That's just the preliminaries. Is that level of cost and effort worth it? I've been to events that did have a full complement of officials, and it can add a lot to the experience.

SEATING

The seating at most major cue sport events is lousy. If most spectators can't see the layout on at least half the tables, the event planner did a bad job. The usual problem is that the seats are too low. Often the VIP seating is on the same floor as the tables. Pssst! Put them up at least 18 inches. This means that the bleachers will have to come up even more. This costs money. So will padded seats for the bleachers. The best viewing I've encountered was at the Roosevelt Hotel in New York City, which had a balcony in the hotel ballroom with perfect sight-lines to all tables.

LEGALITIES

If your tournament is above a certain level, you will have to deal with the government. Some jurisdictions, such as Las Vegas, require you to have multiple business licenses to run a tournament. I heard one event was in danger of being shut down because the

promoter hadn't done the proper paperwork or paid fees to the county. Suppose you pay cash prizes. Do you withhold taxes? Do you file IRS form 1099? Forms 1042-S and 1042-T? The law may require you to do all of these, and as we all know, ignorance of the law is no excuse. Gambling is another issue. Some towns consider any cash prizes in tournaments to be illegal gambling. More problematic is having a Calcutta. This is a separate prize fund formed by spectators bidding on players according to who has the best chance to win the tournament. Bidders "buy" players and then collect from the Calcutta pool according to what place the players finish in. When third parties get involved in the transfer of money, the constabulary takes interest.

POLITICS

Finally, there is the matter of whose feathers you do or do not want to ruffle. There are various organizations trying to assert their control over various aspects of cue sports, and there are good reasons to try to avoid irritating them. There are so few people active in promoting cue sports that battles among our small number makes no sense to me.

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I'll tell you where you can put that cue ball.

Here is an intensive workout to improve your control of the cue ball when you run an object ball along the rail and come off one cushion to position. I'll start with a drill and then explain a game that can be a fun way to refine your skills.

The ball positioning for the drill is shown in **Diagram 1**. The object ball is on the long cushion, one diamond away from the corner pocket. The cue ball is on the long string, which is the line that runs between the centers of the end cushions, and through the head spot and foot spot. Sometimes this line is marked for games where you would spot up object balls. The cue ball is about half a diamond toward the center of the table from the spot. Also, the object ball should not be frozen to the cushion. While that's also an interesting situation, it makes position play quite a bit harder. Once you master the non-frozen case, try the exercise with the ball frozen and see if you need to make changes to your technique.

The goal of this drill is to hit each pair of object balls on the diamonds around the table. Here are three ways to work the exercise:

- **Easy level:** Try to hit the pairs in order. Pocket the object ball and use the spin needed to get the cue ball to contact at least one ball in the first pair (labeled 1). Once you hit it, you can move on to the second, and so on. Once you have gotten to all the pairs, start over and see if you can do it with fewer misses. If you can't get to groups 1 or 2 because you haven't mastered the spin needed, skip them.
- **Intermediate level:** This is the same as the easy level, but you have to hit each pair twice in a row.
- **Advanced level:** You only have to hit each pair of target balls once, but you have to start over on any miss. This is harder, because each shot is different from the one before. Can you get to an additional pair on the other side of the side pocket?

To add even more difficulty, move the cue ball back away from the object ball. To keep the same angle, your cue stick should pass over the same spot on the rail, which is the side pocket. If you were using draw to help

come back to the later groups, you will probably find that you have to use sidespin instead.

This drill so far has been with a single cut angle for the object ball. You can try additional cue ball starting locations at A and B. Is it easier or harder to hit pair 1 from A or B? Is it easier or harder to get the

cue ball out past the side pocket from A or B? A very important thing to note during your practice is the range of resulting angles possible from a starting cut angle. During practice, you need to discover how to increase your "range of motion" as well as what range is comfortable for you.

A final wrinkle is to vary the speed of contact. Can you just barely get to the target balls? Can you contact them fast enough to break them apart?

If drills don't captivate you, here is a challenge shot that gives you a constantly changing target. Try it with a friend to see who can finish it in fewer strokes. The beginning setup is shown in **Diagram 2**, with the 9 ball on the end cushion, a diamond away from the pocket. The goal is to pocket the 9 ball in pocket A, as if you were "riding the money" in a game of 9-ball. The object ball goes near the side cushion, as for the drill above. The 9 stays wherever you drive it until you pocket it. You must pocket the object ball on each shot or you automatically lose the game and have to start over.

For this drill, you have control over the position of the object ball and the angle of the cut. For the first shot, I use a 30-degree cut on the object ball with inside follow.

You will probably discover what not to do on your own, but here are some suggestions:

Although it's nice to pocket the 9 on the first shot, using that much speed is dangerous. If you have the angle slightly wrong, you might well drive the 9 to point B. This is not insurmountable, since you can place the object ball at C for your next shot and have a good chance with inside English and/or follow to herd the 9 back towards the pocket.

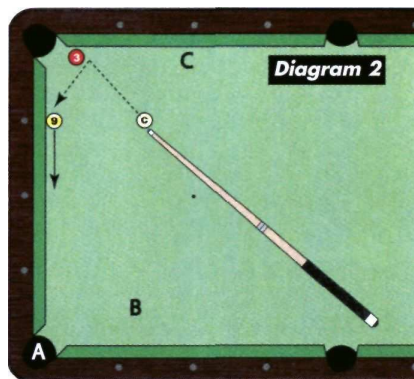
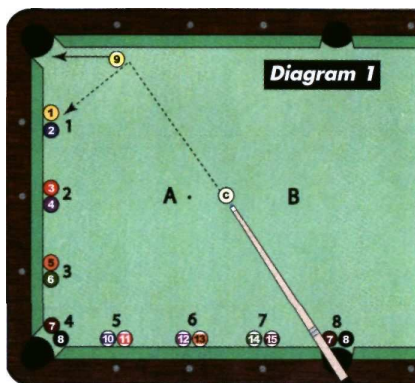
You can be careless when pocketing the first ball when it is close to the pocket, but the resulting cue-ball angles off the cushion will be haphazard. Imagine another five feet of rail stretching out past the pocket and drive the object ball along that extended rail. Pocket the ball with precision. Each degree you are off on the cut angle will cause a similar error in the billiard angle.

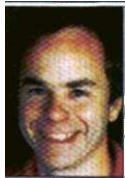
There are two ways to control the angle off the cushion for these shots: You can vary the

sidespin or you can vary the angle of the cut. For the first shot of the exercise, I think using sidespin is easier, but see if you can get to the 9 ball with just follow. On the other hand, I think getting from an object ball at C to a 9 ball at B is most predictable with just follow on the cue ball. How much the

cue ball comes down the table from C depends on how far up the table the cue ball starts. I described a simple system to do the calculation in my March 2005 column, which is available at http://www.sfbilliards.com/articles/BD_articles.html.

The one-cushion challenge shot is similar to the third drill discussed in my April 2001 column. For that, the object ball goes on the end rail by the pocket rather than the side rail, and each shot uses draw to move the 9 ball. I find the draw form quite a bit easier. How about you?





The Cutting Edge

You may need to order more chalk after this experiment.

Recently on an Internet discussion forum, a player by the handle of "Tennessee Joe" asked, "Do you think a ball can be cut more by using inside or outside English?" Inside, outside, center-ball, high and low were given as options.

Think about this for a while before reading on. Which shot is more comfortable for you? Which shot is easier to line up? Which shot gets you into less trouble? Can you cut the ball more than 90 degrees?

If there is no other qualification on the question, the answer is inside English with a lot of elevation. That is the same as a masse shot, and with the right stroke and alignment of the stars, you can cut a ball 180 degrees — that is, you can make the cue ball go out and come nearly straight back and drive the object ball straight toward you. If you have ever watched a good exhibition player, you have already seen something like this shot.

Another way to cut the object ball 180 degrees is to play a jump shot and land the cue ball on the far edge of the object ball. I've done this by accident, but wouldn't take 1-to-100 odds to do it on purpose.

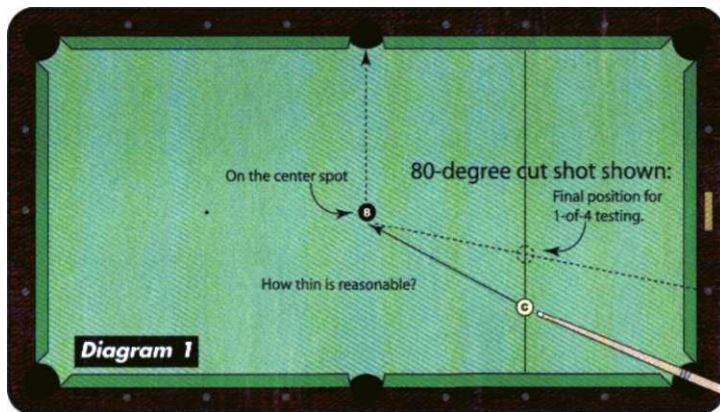
OK, let's put circus shots out of the question. To do that, I propose limiting the shot to a reasonable, if not great, percentage. The resulting "reasonable" shots will vary from person to person. I figure that if I can make a shot in four tries at least half the time, the shot is one I can play under very trying circumstances when nothing else is available. That is, four tries for a dollar should be an even-money proposition on the tough cut shot.

A mathematical side note: You might conclude that a one-in-four proposition is 25 percent on each shot. This turns out not to be true if you look into the probabilities involved. If you have a chance of making a single shot of P and a chance of missing a single shot of Q (where $Q = 1 - P$), the one-in-four proposition is an even-money bet if you are 50 percent likely to miss four in a row. The chance of four events happening in a row is just the product (multiplied together) of each individual probability. So, we know

that Q to the fourth power is equal to 50 percent, and after a couple of square roots and a subtraction, which I won't bore you with, says that P is 16 percent.

So, for this test, a reasonable shot is one that has roughly a one in six chance of working. Why the groups of four? I want to shoot the shots in groups so that I have several chances at a particular angle before changing the shot. You will see below why I want to change the shot after each group.

We need a specific test shot. See **Diagram 1** for the one I chose. The object ball is on the center spot, which is sometimes used in straight pool and is in the exact center of the table. The cue ball is on the head string. The problem is to find how far over I can move the cue ball and still have a reasonable chance at making the ball.



I put the cue ball as shown, with my stick over the corner pocket, and started my first set of four shots from that location. For the first test, I played without any side-spin. I marked the position with a coin. I made the second shot, so I moved the coin half an inch toward the head spot. I made another shot in the second group of four from the slightly harder position, so I moved the coin another half inch. Eventually I missed all four in the set, and I moved the coin a half inch away from the spot. I continued this until the coin seemed to have found its natural resting spot. This turned out to be a 79-degree cut, with the edge of the cue ball about six inches from the head spot.

For that much cut, I found I had to hit the cue ball hard enough to go four lengths of the table. Clearly, you have to maintain good mechanics at speed for this test.

I next tried outside English. There are two competing things that happen on this shot with outside English, which is left for this diagram. First, the cue ball will curve away from the object ball some. That increases the cut angle, and makes the shot harder. In compensation, the outside English tends to throw the object ball backwards if there is enough English. How much is enough? You want the surface of the cue ball at the contact point on the object ball to be moving backwards. I call this "retrograde" spin, and you really have to hit the cue ball well off-center to achieve it. Chalk. I find it's also helpful to have a low-squirt stick for this. (For a definition and explanation of squirt, or "deflection" as it's sometimes incorrectly called, see several previous articles which are online at the www.sfbilliards.com Web site.)

After shooting sets of shots for about 15 minutes, the position ended up at 81 degrees. This is slightly thinner than the first case with no side-spin, but since I was adjusting the angle one degree at a time, the difference is negligible. I noticed that even though I was not hitting the cue ball as hard as with the no-spin shot, the object ball was still making it to the pocket with plenty of speed. My conclusion is that the throw must have allowed me to hit fuller for more speed

but still get the same cut angle.

Next I tried inside English. In theory, this should have prevented any swerve, which, with inside English, would be toward the object ball, reducing the cut angle. This was really uncomfortable for me, as I don't like to use inside English, but the final angle turned out to be 80 degrees. One thing to note is that the object ball didn't have nearly as much speed as with outside English at about the same cut angle. My conclusion from this is that the throw is more important than the swerve.

I also tried a few shots jumping the cue ball onto the object ball, but quickly came to the conclusion that I would need a lot more practice or a much easier cut angle.

If you try this experiment yourself, I think you'll discover a lot about your own play and what's possible on the table.



Round-Robin Revisited

All's fair in love, war and my favorite tournament format.

Those of you who read my series of articles about tournament formats at the end of 2001 know how much I hate double elimination. It was with delight that I heard that the International Pool Tour would be using round-robin for all stages of its events, except for the final match, which is a dramatic head-to-head confrontation. Someone is finally doing things right.

Well, maybe I shouldn't say "finally," since the round-robin format, in which each player in a group gets to play every other player, used to be very common when championships were held with relatively few players in the field. Some events were "double round-robins," which meant that each player got to play each of the other players twice, leaving no excuse for either a bad draw or an off day.

The amazing thing about the IPT format is that it is being done with as many as 200 players in the field. That takes a lot of tables — perhaps over 60 — to get the tournament done in a week.

As an example, the tournament at the end of July at The Venetian Resort Hotel & Casino in Las Vegas had 200 players. A hundred of them played in 20 groups of five on the first day, with three advancing from each group. Each player got to play four matches. The second day saw the other 100 playing. Since in a group of five only four can be playing on two tables each round, "only" 40 tables were required. The matches were races-to-8 and the five rounds of play started every two and a half hours, running from 10 a.m. to 10 p.m.

The third day was the most hectic. All 120 players remaining from the first two days played in 20 groups of six, and 60 tables were in continuous use.

Half the players advanced to form 12 groups of five for the third round, and 36 of those 60 advanced to the fourth round. There they formed six groups of six, with 18 advancing to make three groups of six, and only six advancing to the "semifinal" round-robin round. The two leaders in that round met for Sunday's single, head-to-head

| Group 35 | | | | | | | | | |
|-------------------|----------|----------|--------|------|---------|--------|--------|------|-----|
| Player | Beaufils | Garrahan | Fisher | Hsia | Di Toro | Wins | Losses | Ties | GW% |
| Yannick BEAUFILS | 8 | 8 | 8 | 8 | 4 | 65.31% | | | |
| Theodore GARRAHAN | 6 | 1 | 8 | 8 | 2 | 46% | | | |
| Allison FISHER | 2 | 8 | 2 | 8 | 2 | 62.53% | | | |
| Hui-Kai HSIA | 4 | 4 | 8 | 8 | 2 | 61.06% | | | |
| John DI TORO | 5 | 7 | 1 | 5 | 0 | 36% | | | |

| Group 72 | | | | | | | | | |
|-----------------|-------|--------|-------|--------|---------|--------|--------|------|-----|
| Player | Deuel | Engert | Drago | Montal | Daulton | Wins | Losses | Ties | GW% |
| Conry DEUEL | 7 | 8 | 2 | 1 | 64.83% | | | | |
| Thomas ENGERT | 8 | 8 | 8 | 3 | 64.16% | | | | |
| Tony DRAGO | 8 | 4 | 8 | 8 | 3 | 66.38% | | | |
| Edwin MONTAL | 1 | 3 | 7 | 0 | 62.45% | | | | |
| Shannon DAULTON | 8 | 4 | 6 | 1 | 64% | | | | |

| Group 70 | | | | | | | | | |
|------------------|-------|-------|----------|-------|--------|--------|--------|------|-----|
| Player | Bshaw | Reyes | Beaufils | Peach | Archer | Wins | Losses | Ties | GW% |
| Jayson BSHAW | 7 | 3 | 8 | 1 | 63.89% | | | | |
| Ethan REYES | 8 | 5 | 8 | 2 | 63.04% | | | | |
| Yannick BEAUFILS | 8 | 5 | 6 | 8 | 2 | 64.89% | | | |
| Daryl PEACH | 8 | 8 | 8 | 3 | 66.18% | | | | |
| Johnny ARCHER | 5 | 5 | 3 | 0 | 48.02% | | | | |

match. Both of those players had played 12 hours per day for six days, with time off only in the case of short matches.

Let's take a look at a typical first-round chart of **Group 35**. This is the chart after the completion of the round. The scores for each player are listed on the line for their name, so you can see that Frenchman Yannick Beaufils ("Bo-fee") led the group with four wins. (Maybe you didn't know that there are some pretty good 8-ball players in France.) To see what his opponents scored, find his name in the top row and look down. For example, Theodore Garrahan scored six games against him. Also included in each score square are two other small numbers. The one on the left is "break and runs," in which the player allowed his opponent no trip to the table. You can see that Beaufils broke and ran five racks against Hui-Kai

Hsia from Taipei, and four against Allison Fisher. The small number on the right is the number of 8 balls sunk on the break, which is a game win under IPT rules. There were no such wins in the 117 games shown on this chart.

An important thing to note is that three players were tied at 2-2 for their placement in the group. Ties are possible in all round-robin groups, so a tie-breaker is needed. The IPT uses game-winning percentage, or the number of games a player won divided by the total number of games played. The statistic is listed in the final column of the group summary as "GW%." Not surprisingly, Beaufils led convincingly.

Among the three tied players, only two of whom would advance, Garrahan was eliminated with a games-won percentage of 46. If you look at just the won games you might put him ahead of Fisher, since he had seven "extra" wins in his two losses compared to her four, but if you look at the games against Fisher takes the lead because she whopped both Garrahan and John Di Toro with 8-1 scores, while Garrahan allowed 11 games in his two losses.

The bracket shown can be thought of as a 4-2-2-2-0 result if you list the wins in descending order. While this is a pretty bad case for ties, the worst case is 2-2-2-2-2, which I don't think has occurred yet in the IPT. Any result must have a total of 10 wins, but not all such combinations are possible. For example, you can't have two winless players, since when they play each other someone has to win. It turns out that there are only nine possible results in a five-player group, and five out of those have a tie for third-fourth. This means that a player's game-winning percentage is extremely important most of the time.

If you have some spare time, List the nine possible results for a group of five and the 22 possible results for a group of six. It turns out that a six-way tie is not possible in a group of 6, because you can't divide the 15 wins evenly among six players, but you can have a five-way tie for first or last.

The partially completed chart for **Group**

shows how the chart can become so interesting in the final matches. At this point in the round, two matches are left, denoted by the boxes without scores. Thomas Engert is to play Cory Deuel and Edwin Montal is to play Shannon Daulton. Will Deuel be one of the three to get through to the next round? First, there is no way he can catch the two leaders, so he needs to concentrate on whether he can get ahead of both of the other players. If he wins, he will be 2-2 and Daulton has a chance to tie on match wins. Could Daulton possibly improve his GW% enough to take the lead?

No. To be sure, you would have to look at the total games each had played and figure Deuel's win as 8-7 (the weakest possible win), and Daulton's win as 8-0 (the strongest possible win). To be pretty sure, you can figure the GW% like this: At this stage of the tournament, each player had about 150 games played. One win more or less makes a percentage change of about 50/150 or 1/3 percent. A seven-game swing for Daulton boosts his average against Deuel by about 2.3 percent, but he needs an 11 percent boost.

What if Deuel loses and drops to 1-3? If Daulton wins his match to go 2-2, Deuel exits. If Daulton loses, there is a three-way tie for last at 1-3, and Montal has no more

chance to pass Deuel on average than Daulton. Since the results mean tens of thousands of dollars difference in prize money, you will see a lot of calculators and scratch paper near the tournament scoreboards. As it turned out, both Deuel and Dalton lost, and Cory advanced from round 3 with a 1-3 record.

Finally, look at the nearly completed chart for Group 70. At this point of the round, Beaufils is finished and praying for the right outcomes in the remaining matches. Efren Reyes and Jason Shaw are to play, as are Daryl Peach and Johnny Archer. Archer is 0-3 and has no chance to advance. The story is told by the break and runs of his opponents — 11 in three matches. His opponent, Peach, also had little interest in the match, since only Reyes could catch him for the lead of the group, and three players would advance.

A problem with the round-robin format is that there are often matches in which neither player cares about the outcome. The IPT adds interest by scaling the payouts by GW% for the dropouts of each round. If Archer can improve his GW%, he has a chance to move up in the payouts. In fact, he won his match 8-5 and his GW% moved up by the estimated 1 percent (for three net wins) to 50 percent. A loss would have cost him about \$3,000.

The other match — Reyes vs. Shaw — was quite a bit more interesting. If Efren were to win, he would have a lock on second. If he lost, he was still guaranteed to advance because he was well ahead of Beaufils and Shaw on percentage. Beaufils hoped that Efren would win to keep Shaw down. If Shaw were to win, he'd pick up 1 percent on GW, and edge out Beaufils for third. If Efren were to lose, Beaufils needed him to win at least six games against Shaw.

This illustrates another problem of the round-robin format: Sometimes a player will have the fate of another in his hands at no risk to himself. I'm not suggesting that Efren would ever let someone slip by, and in fact, he beat Shaw, 8-2, making Beaufils very happy. Also, losing any game in any match will bring your GW% down, and even 1 percent can mean an awful lot of money in a tie-breaker. Another thing that can be done to prevent any problem with this kind of situation is for the tournament director to schedule matches so that any pairs of friends in a group play in the first one or two sets of matches. That keeps the "right" person from "surprisingly" winning at the end.

Oh, and as I'm sure you've heard by now, Efren went on to win the tournament and \$500,000. Are round-robin charts more interesting to you now?

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Don't Blow It

You'll bank and kick better if you can contact the rail right on the nose.

Do you know where the nose of the cushion is? Of course it's as plain as the nose on your face, but the details might surprise you. The nose of the cushion is the tip of the rubber that the ball can touch normally. When a fist hits a face, the first thing it encounters is the nose. When a ball hits a cushion, the first thing it encounters is the nose. The exact location of where you need to contact the nose is important for bank shots, kick shots and some tricky situations.

In **Diagram 1A** there is a typical illustration of a bank shot, calculated by the "double-the-diamonds" method. The object ball is on a line between the side pocket and the second diamond from the opposite corner pocket. The usual theory is that if the object ball is shot directly toward the diamond, it will go to the corner pocket, since the outbound angle is equal to the inbound angle, if you don't shoot too hard.

My first comment is that the diagram shown is very inaccurate. The drawn path should show the path of the center of the ball. Here the center of the ball is shown touching the nose of the cushion. That's not possible, so something in the diagram is broken. The path needs to be drawn so that it only reaches the "rail gutter," which is about half a ball from the nose of the cushion, and is under the center of the ball that is frozen to the cushion. This is how **Diagram 1B** is drawn.

So, the first answer to the opening question is that the nose of the cushion is half a ball from the center of a ball that is touching it.

Note that many pool and billiard diagrams are drawn with the path of the ball touching the nose of the cushion. All of those diagrams are wrong. Billiard illustrators, please stop doing that!

Now we can see another problem. The ball clearly makes its turn well before it is even with the diamond, so that if it really does indeed go to the corner pocket, the angle out must be different from the angle in. For the angles to be equal, the ball would

have to contact the cushion at a location even with the second diamond, which is roughly a whole ball farther down the table.

The reason the "double-the-diamonds" system works, when it does work, is that the rail is not a perfect mirror, and the error introduced by taking the simple (but wrong) target of the diamond compensates for inaccuracies in the rebound.

We could as well calculate our spot on the banking cushion by finding the ideal spot at the rail gutter even with the diamond and sending the ball there. That might actually work better on some tables.

The two main styles of aiming with the diamonds are called "through" and "opposite." You aim "through" the diamond when the ball's path goes directly towards the spot on the top of the rail. You aim "opposite" the diamond when you send the ball to a point on the rail gutter that is even with the diamond. In addition, some carom players aim the left or right edge of the ball to either the diamond or the spot on the nose of the cushion that is even with the diamond, but let's not add those complications. I suspect they have been developed to eliminate various poorly understood errors.

Which way of lining up a bank is more accurate? As far as determining where the ball will be when it leaves the cushion. I

think the "opposite" method is better. If you shoot through the second diamond, the ball is clearly not coming "from" that diamond as it comes back across the table; it is coming from a spot about two balls farther up the table. If you want a second opinion on the opposite method, I might mention that Raymond Ceulemans also recommends it in his book on diamond systems, "Mr. 100."

If you do decide to use "through" as your standard diamond method, you can still find the spot on the rail where the ball will hit by placing your stick along the inbound path of the ball and noting where it crosses the rail gutter.

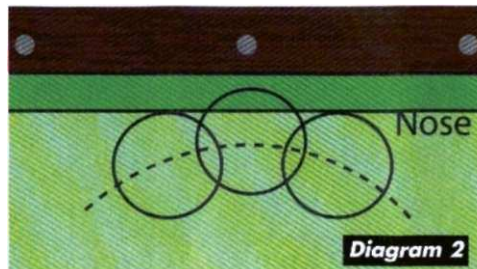
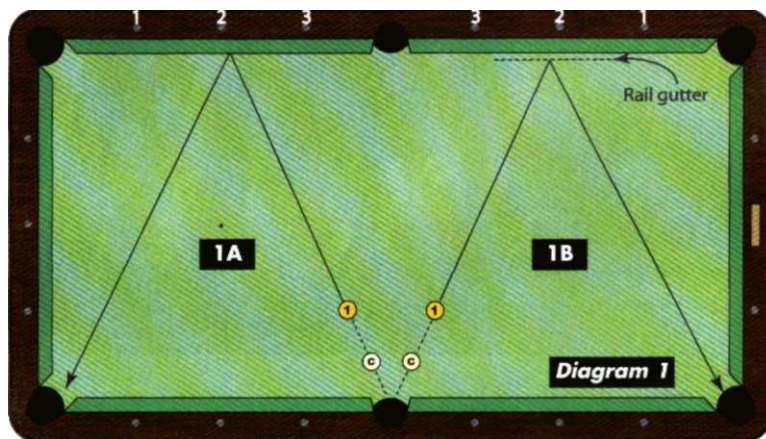
Short kick shots (when you have to play the cue ball rail-first to hit an object ball which is close to that rail) are sensitive to the difference between through and opposite aiming. For more details, see my May 2004 article, which is available at www.sfbilliards.com/articles/BD_articles.html.

Another characteristic of the nose of the cushion is important on some shots: It's soft. When a ball strikes the cushion it is not reflected instantaneously. Instead, it sinks into the cushion, encounters greater and

greater push-back and eventually reverses its path and is ejected. How far does it penetrate? That depends on the speed. On the Jacksonville Project video (see *BD*, April

1999), a ball driven straight into the cushion was recorded at 2,000 frames per second. It was traveling at about 16MPH and went forward into the cushion about 17 millimeters, which is two-thirds of an inch. It spent 6.5 thousandths of a second in the cushion.

If we assume that the cushion push-back goes up directly as the ball goes deeper into it, there are some interesting conclusions we can draw. First, the peak force, which



occurs when the ball is at maximum penetration, is about 135 pounds. Also, if we shoot softer shots, the time spent in the cushion is not expected to change much. Finally, the amount of penetration should go directly with the speed of the ball into the rail, so a ball going into the cushion at only 1.6 MPH will go in less than 2 millimeters before rebounding, and reach a peak force of 13.5 pounds.

For reference, 16 MPH is approaching break-shot speed, and 1.6 MPH is down around lag-shot speed.

What does this mean on kick shots?

The real nose of the cushion is not where we thought it was. If the ball sinks in some, it is effectively being reflected at a point some distance from the rail gutter. For the slow shot above, 2 millimeters seems like not much correction to worry about, but 17 millimeters is almost a third of a ball diameter. In addition, because the push-back builds up gradually, the effective reflection point is about 50

percent farther back into the rail, giving 26 millimeters in from the gutter for the faster shot. That's a full inch. However, if you are not shooting straight into the rail, there won't be as much penetration — 70 percent for a 45-degree angle.

The path of the ball while it is in the cush-

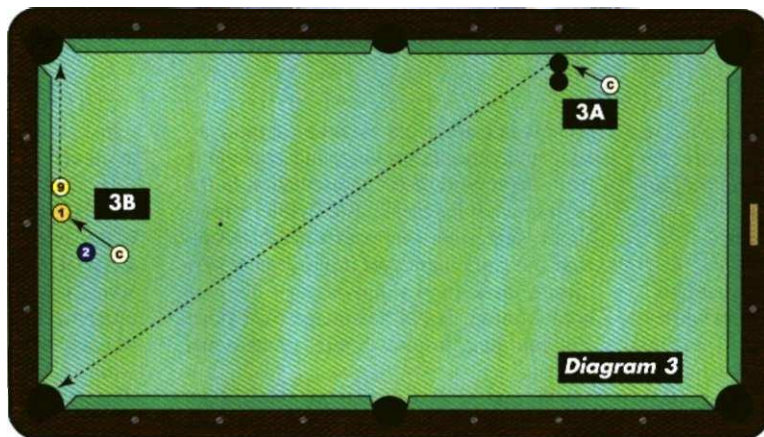
ion is not a straight line as is usually drawn. It is expected to be a curve like a sine wave as shown in **Diagram 2**. This idea was explained briefly in my February 2005 column about getting out of kisses on bank shots. The ball is shown in three positions:

when it first contacts the cushion, when it is at maximum penetration, and when it leaves the cushion. The drawing is roughly to scale for a 16-mph shot.

The moral of this story: Aim a little farther up the rail for faster kick shots, all else being equal. You will need to practice with this in mind.

There are two neat shots that illustrate sinking into the nose. **Diagram 3A** shows the standard "impossible bank" in which a ball frozen to the cushion is banked to the far corner pocket in spite of a blocker being frozen straight out from it. The second is an impossible combination. You would like to play the 1-9 combo, but the 2 ball keeps you from cutting the 1 toward the 9 — you can at best hit it full. The 1 and 9 are

about an inch apart. Shoot straight at the 1 with good speed, and the 1 will follow a path like **Diagram 2** and emerge from the cushion just as it meets the 9. How far up the cushion can you move the 1 ball and still make the shot?



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