



Experimental Results

Readers reveal their findings on the question of throw.

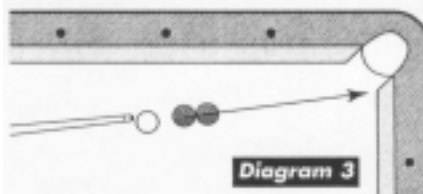
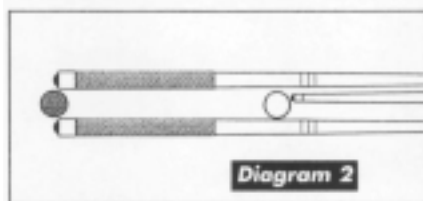
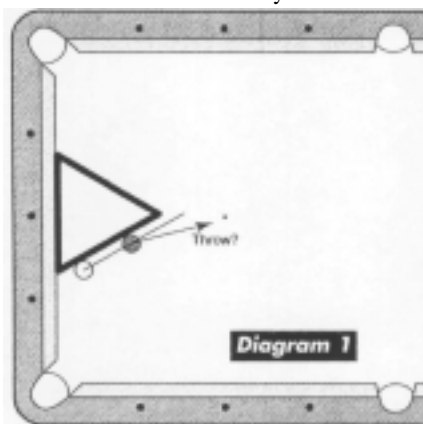
In Mike Sigel's columns last August and October, he presented a remarkable hypothesis: There is no throw between the cue ball and the object ball on normal shots. Since this conflicts with what has been said before by the likes of Willie Mosconi, Robert Byrne and Joe Davis, there was understandably quite a bit of controversy, expressed both in letters to the editor and in lively exchanges on Internet discussion groups.

In my December column, I proposed an experiment (actually, three) for readers to try and to report back on. The response was the largest I've had to such a proposal, with 13 sets of results turned in, including two from group efforts. Several of the amateur scientists had started work before my call for testing went out, and a couple had even finished their studies. One of the responses came from a player who is in prison — did you know that the leather tip was invented by Francois Mingaud while a prisoner in France? — but the analysis had to be done without the aid of a table.

The award for creativity goes to 15-year-old Dave DeSimone, who came up with three different tests. In the early stages of his experiments, to demonstrate the idea to his dad, he used what happened to be available at the time: a cue ball and a baseball. The result was that the baseball was thrown by an easily visible angle, larger than seen with pool balls. He concluded, I think correctly, that there is large friction between the cue ball and the baseball, which makes the angle large. While this doesn't directly address collisions between pool balls, it does establish the occurrence of throw between balls at least under some conditions. This kind of test is often useful in science — do an experiment that is not quite what you want but is easier to do or observe, and try to work the results into a theory that could apply to the test you would really like to do.

Dave realized that the main problem with testing for cue-ball-to-object-ball throw is that you need to know the location of the cue ball when it hits the object ball. He points out that because there is an unconscious tendency to correct for squirt, it's really hard for a shooter to know exactly — within a millimeter or less — where the cue ball is at the instant of contact. His next test

was to set up the cue ball and object ball frozen to the side of the triangle as shown in **Diagram 1**. "Rack side" English and a full hit are used, and the object ball is deemed to have been thrown if it moves away from the straight-ahead line of the shot. This is an effective way to control the



position of the cue ball because, as Dave says, "Even if the object ball is contacted to the right instead of dead on, the rack will absorb the energy and send the object ball at the angle the rack is pointing." In effect, the rack is a very dead rail that makes the ball go nearly parallel to its side.

In Dave's final test, he forced the cue ball to be in a known position by setting up two cue sticks as in **Diagram 2**, with just enough space between them for the cue ball. He reports that the object ball was thrown and that at least on some shots, there was side spin visible on the ball which made it take a noticeably wider angle when

contacting a cushion. He makes the interesting extension that this transfer of side spin is the same thing as the cue ball's transferring follow to an object ball when you play the cue with draw, the usefulness of which any decent player can attest to.

Another reader who started experimenting without being prompted was Ronn Nadeau, who wrote a brief article on the no-throw idea complete with three color pictures. While doing his research, Ronn discovered (or rediscovered) the possibility of "two-ball English-induced throw." His setup is in **Diagram 3**. It is a simple two-ball combination. When testing this shot, make sure you tap the balls into place or use paper reinforcement donuts for repeatability. Normally, you would throw the combination by hitting one side or the other of the first object ball. Suppose that you have to hit that ball full for position or other reasons. Will side spin on the cue ball change the path of the second ball? Ronn thinks so. Check it out.

One semi-anonymous reader named "Pete" from cyberspace tried only the last test I proposed, which was to place several balls as if spotted on the foot spot and see if the back one could be made into a corner pocket. He found that with four balls spotted, and the cue ball starting even with the head spot, about half way to the side cushion, without side spin on the cue ball, it was just barely impossible to cut the fourth ball into the corner pocket as the third was in the way. With side spin (on the side of the third ball) he made the ball ten times in a row. Since the third ball prevents the cue ball from swerving in for a fuller hit, Pete concluded that the only explanation was throw on the object ball: "Although I have not clouded the issue with a lot of spreadsheets, theories of plane geometry or physics, or gobbledygook, I feel that [...] this cuts to the core of the issue and proves that English applied to the cue ball does affect the path taken by the object ball when the two collide."

Of the eight experimenters who tried this last setup, six found that spin helped make a ball that was just barely impossible without it, but two found that side spin didn't seem to help. This is an easy one for you to set up on your own, although it's hard to put an actual number on how spin changes

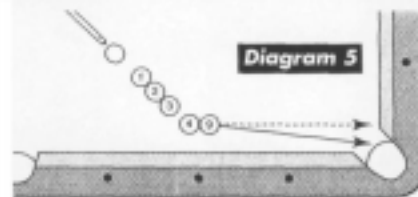
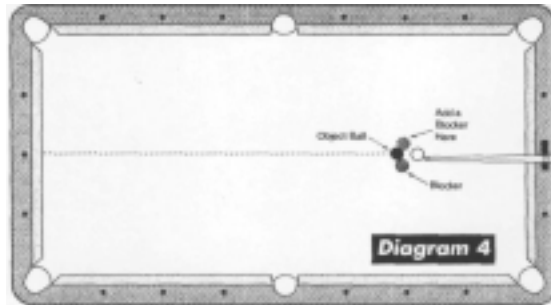
Bob Jewett

the shot.

Nearly all of the experimenters had trouble with my second proposed test, which is shown in **Diagram 4**. The set up is like the "back spotted ball cut" mentioned above, but with more precision in the positioning. The idea was to see if the object ball could be brought across the centerline of the table with spin. The blocker is placed so that the cue ball, when frozen to both balls, is lined up with the object ball straight up the centerline. I have a proposed modification now for this shot, and that's to place a second blocker on the other side so that the cue ball can only be struck at one spot. This is similar to Dave DeSimone's use of two sticks to restrict the position of the cue ball.

Ken Shafer came up with his own test as well, shown in **Diagram 5**. First, set up a frozen ball combination on the 9 — use the 4 ball — that needs to be thrown by hitting the 4 from an angle. Tap the balls or use donuts for repeatability. With the combo set up on the table, line up the 1-2-3 balls in a perfectly straight line pointed to hit the 4 ball absolutely full and at the needed angle for the throw. These balls also need to be repeatably placed. Now remove the 4 ball and shoot the 1-2-3 combo at the 9. The 3

will arrive exactly where the 4 was if you are careful. Ken's result was that the 9 was thrown just as much by the loose 3 ball as by the frozen 4 ball.



How does this show cue ball/object ball throw? Imagine that the 3 ball is the cue ball. In fact, you could use the cue ball in its place, as the last ball in the three-ball line-up. This shot can test whether the cue ball throws the object ball even without side

spin on the cue ball, just as a frozen ball will throw its neighbor. Many authors think this happens, and this kind of throw is called "collision-induced throw." Believers claim that it occurs on all cut shots without side spin. Try the test for yourself.

The best results in terms of quantifying throw were from tests of the first position I proposed, which is like Diagram 4 but without the blockers. You have to be careful with the setup to make sure that squirt and swerve do not pollute the measurements, but the test is quite easy to do.

Next month, I'll go over the numerical results from the 12 shooters who reported on my first position, and we'll have a for-the-time-being final word on whether throw exists, and how big an effect it has if it does exist.

Deciding on the two sets of results to win the prizes was hard, given the innovative approaches. In the end, I chose the results that were most complete in careful setup, number of measurements, and analysis. The winners are Dan White (who did use a spreadsheet) and the team from the rec center at New Mexico Tech, including Ray Piworunas and his coworkers, August, Lloyd and A.J.