



Wrong Size, Wrong Shape

You should probably have that looked at.

Recently on the Internet discussion group rec.sport.billiard, Pat Johnson of Chicago mentioned a problem he had with his new cue ball. When he put the cue ball on the table and surrounded it with six used object balls from the poolhall, he couldn't get all the balls to freeze. There would be gaps between the object balls, and if he moved the balls around so there was only one gap, it was 3/32nd of an inch, as shown in **Diagram 1**. This seemed to show that the pool balls were smaller than the cue ball. Pat's question was: How much smaller are the object balls?

I made a quick guess that if you divided the gap by 6, the diameters of the object balls would be smaller than the cue ball by that amount, or 1/64th of an inch. It turns out that I was off by a factor of two. Two other participants in the newsgroup, Jim (who goes by the user name "JAL") from Indiana and David Hood from Colorado correctly pointed out that the ratio is about 3, so Pat's cue ball was a whole 1/32nd of an inch larger than the object balls he was trying to play with.

By a coincidence, just after this online discussion, one of the players in the 14.1 league I play in brought his new cue ball to use in his match. I showed the two players how much of a gap the cue ball caused between the surrounding balls, and it looked to be 1/8 of an inch. We then tried putting the house cue ball in the middle of the cluster, and we got a different type of gap. It was between the frozen object balls and the cue ball, and it was nearly as large as the gap illustrated in **Diagram 2**.

Amazingly enough, according to Jim's and David's analyses, you can find the difference between the cue ball's and object balls' diameters again by dividing the gap by 3, even though the gap is made in a very different way. For this example, the house cue ball was smaller by 1/24 of an inch.

Is 1/24 of an inch enough to worry about?

It depends. The difference in size has a corresponding difference in weight, and that will make the cue ball rebound off the object ball differently. If you have only a vague idea of where the cue ball is supposed to go on any particular shot, the difference will not be noticed, but the better your position play becomes, the more such discrepancies will bother you.

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Let's take an example of a draw shot with the small cue ball. If a normal ball is 6 ounces, the small cue ball is only 5.67 ounces. (This is calculated from the cube of the ratio of the two diameters, if you want to try a different case yourself.) Suppose you

feet, just from being that small amount lighter.

Now suppose the poolhall buys new object balls, but keeps the old cue ball. That would roughly double the relative differences in diameters and weights, and for the example draw shot I just described, the cue ball would come back twice as far (four feet) as a standard cue ball against a standard object ball. If you instead try to follow with the light cue ball, you will be similarly surprised when the ball goes forward only 64 percent as far as you were expecting. So three diamonds-length of attempted follow ends up a whole diamond short.

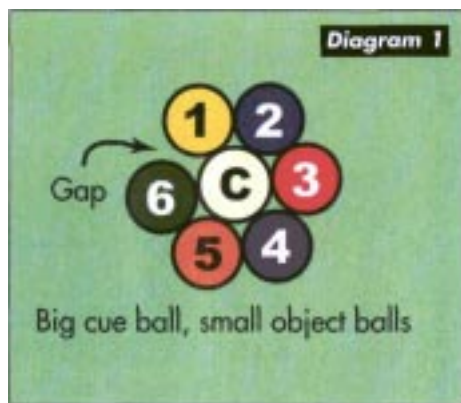
How do these measurements compare to the equipment specifications in the Billiard Congress of America rule book? Balls are supposed to be 2.25 inches in diameter within a tolerance of +/-0.005 inches. (Typical high-quality new balls are much more exact than that.) Assuming that the middle ball in the cluster is the correct size, this means that the gap when you attempt to freeze six balls around it can be no more than 0.015 inches, which is about 1/64 of an inch, or the thickness of a business card.

So far, we've been assuming that the object balls are all the same size. If a ball has to be replaced, this will not be true. The object balls we measured above were about 1/24 inch smaller than a new ball. Suppose the 9 ball has to be replaced in that set. There's no way that you will ever get a tight rack with the new 9 ball in the center because the old, small object balls just can't stretch around it.

Unfortunately, even a 1/64th-inch gap—which you might see with new, in-spec

balls—is large enough to make a difference in how a rack breaks.

Many years ago, before I had my first run of 50 at straight pool, I played day and night in a rec room with old, worn balls. I thought I was pretty good because I could draw the cue ball all over the table. What I didn't real-



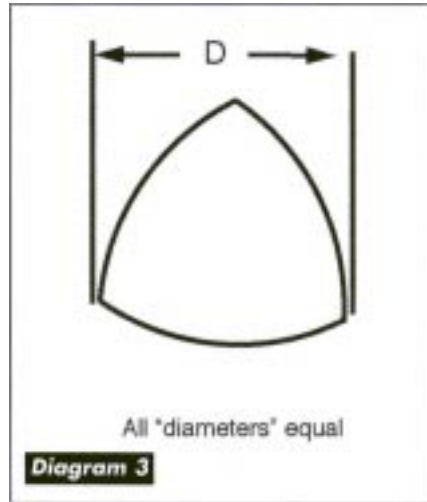
are making a shot where, if you start the cue ball with near-maximum draw, it might arrive with about half of that after rubbing on the cloth on the way to the object ball, and you would get two feet of draw. On the same shot, the smaller cue ball will get about 43 percent more draw and come back three

ize, even though it was in front of me on every shot, was that the cue ball was tiny compared to the object balls, relatively speaking. With draw coming so easily and naturally, my position play and patterns evolved to where I was using draw on most shots.

Eventually, I got up enough courage and funds to make a trip to the local poolhall to try my luck in a competitive match. The cue ball there looked a little funny. It seemed big. It seemed rough, as if someone had taken sandpaper to the surface. Maybe it was a big barbox cue ball that had migrated to a regular table, or perhaps it was an old, mud break ball. In any case, it didn't draw. I was helpless. The local hotshot would miss until the last three balls, because he quickly figured out there was no way I could get position two shots in a row. I didn't have my rent money with me, so the lesson that day was worth more than the price, although it took me a while to figure out what the lesson was.

I've mentioned here before that cue balls can also be off-center or out of round. You may notice this when the ball is rolling a long way to a stop. One time it might roll a little to the left. The next, along the same path, it might roll to the right. Back when ivory was the preferred material for carom balls, this sort of behavior was fairly com-

mon, and shots were often made or missed by the little hook the ball took at the end of a low-speed shot. When a billiard ball got too oval, it had to be turned down with a spe-



cial lathe to make it "true" again, and the balls became smaller and smaller.

Trying to test the roundness of a pool ball is far harder than testing the size. You might measure a bunch of diameters of the ball, but even if they are all the same, you can't be sure that the ball is really round. Look at the two-dimensional shape in **Diagram 3**. Measure its "diameters" or the distances

across in all directions — they are all the same, but the shape is clearly not a circle. Similar weirdnesses can happen in three dimensions. One simple test is to use a perfectly circular hole just a little larger than the ball and make sure there is a constant clearance all around the ball no matter which way it's turned in the hole.

One tool I've seen in a billiard-supply store is a stand where the ball sits on three ball bearings while a feeler gauge touches the top of the ball. As you rotate the ball on the bearings, the feeler gauge indicates how many thousandths of an inch the top of the ball moves up and down. One precise technique scientists use is to measure the deviation from roundness of a bunch of "great circles" around the alleged sphere. A great circle is a circle on the surface of a sphere that has the same diameter as the sphere, dividing it into two equal hemispheres, like the equator on the Earth. Mathematical techniques allow scientists to connect the circles together to find the topography of the sphere, accurate to about 1 part in 10 million. I think for the purposes of pool, just watching for inconsistent roll-off as the ball comes to a stop is good enough.

Should you worry about all of the above? Only when your game is ready for these details, such as when you can control the roll of the cue ball to better than one diamond.

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