
Note: Supporting narrated video (NV) demonstrations, high-speed video (HSV) clips, and technical proofs (TP) can be accessed and viewed online at billiards.colostate.edu. The reference numbers used in the article help you locate the resources on the website. If you have a slow or inconvenient Internet connection, you might want to view the resources from a CD-ROM or DVD. See the website for details.

This is the fifth article in my series dealing with “squirt.” So far, we have looked at basic terminology, the physics behind squirt, some experimental results, the effects of follow and draw on squirt and swerve, and techniques for compensating one’s aim for squirt. To refresh your memory, **squirt**, also called **deflection**, refers to the angular change in the initial cue ball (CB) direction due to an off-center hit. In other words, when you use English, the CB doesn’t go where you are aiming because of squirt. For more background information, see my August ’07 article and refer to **NV 4.13** and **NV A.17**. When using English, it is also important to be aware of the effects of **swerve** (see **NV 4.14** and **NV 7.12**) and **throw** (see **NV 4.15**, **NV 4.16**, **NV A.21**, and my August ’06 through July ’07 articles). Sometimes, the phrase “**effective squirt**” or the term “**squerve**” is used to refer to the net effect of both squirt and swerve on the shift in the CB position at object ball (OB) impact (see my August ’07 article for more information). If you want to refer back to any of my past articles, they are all available on my website (billiards.colostate.edu).



normal video

- NV 4.13** – Squirt due to high speed English
- NV 4.14** – English curve due to an elevated cue
- NV 4.15** – Using throw to make a partially blocked shot
- NV 4.16** – Over-cutting a cut shot to compensate for throw
- NV 7.12** – Small-curve massé shot
- NV A.17** – Effective squirt vs. speed
- NV A.21** – Bank shot using throw and spin transfer

This month, we’ll look at low-squirt cues. Several cue manufacturers offer these. Some of the most popular brands and models are the Predator Z and 314 shafts, and the OB-1 shaft. In my August ’07 article, I explained and illustrated the physics behind squirt (see **TP A.31** for the nitty-gritty details). Basically, the less mass the cue has at the end of the shaft (close to the tip), the less squirt it will have. The stiffness of the end of the shaft can also have an effect (see TP A.31). Techniques used by manufacturers to reduce the “endmass” include using a smaller diameter shaft and tip, using a smaller and/or lighter ferrule, and/or drilling out the core of the end of the shaft. All of these measures help create a low-squirt cue.



technical proof

- TP A.31** – The physics of squirt

Users of the BD CCB online discussion forum often discuss and debate whether or not a low-squirt cue is worth the money. To try to focus the debate and find out where various users (pool enthusiasts, instructors, players, etc.) stand, I posted a poll on the forum. Here is how I stated the question:

A low-squirt (AKA "low cue-ball deflection") cue creates less squirt (i.e., the cue ball heads closer to the stick's aiming line direction when struck). Therefore, not as much aim adjustment or compensation is required when using English with a low-squirt cue. However,

the value of this is debatable ... hence this poll. I hope people from both sides of the argument will participate in the poll and add comments for discussion.

Can a low-squirt cue make a player better, and can it help one level of player more than other levels? When answering the question, assume the player has always used the same cue. So you are comparing how good the player would be if they had always used a low-squirt cue vs. how good they would be if they had always used a cue with more squirt (e.g., twice the amount of squirt as the low-squirt cue). Assume all other factors are equal. Also assume that the player uses English (i.e., squirt will be a factor).

I know that there might be more options, and these options might not be perfect; but please try to select what you think is the best of the answers provided, and add comments if necessary to better explain your position.

Diagram 1 shows the seven answer options I provided along with the poll results. Unfortunately, I did not design the question and answers carefully enough to take everything into consideration, and this was not a controlled study, and only 39 posters responded, but I thought the results were interesting and worth presenting anyway. The most popular choice was option A (53%). These people thought a low-squirt cue could help any player. 17% chose option C, indicating that the type of cue makes no difference for players at any level. A significant number (15%) chose option D, indication that only a beginner or intermediate player would benefit from a low-squirt cue. I guess the only result that surprised me was option C, because I think if a beginner or intermediate player uses English and is not very good at compensating for squirt, a cue with less squirt might result in them missing fewer shots; but apparently not everybody agrees with this viewpoint. To read some of the comments and debate that went along with the votes, see “cue” – “low-squirt cues” – “poll concerning usefulness” in the “Online Discussion Threads” section of my website.

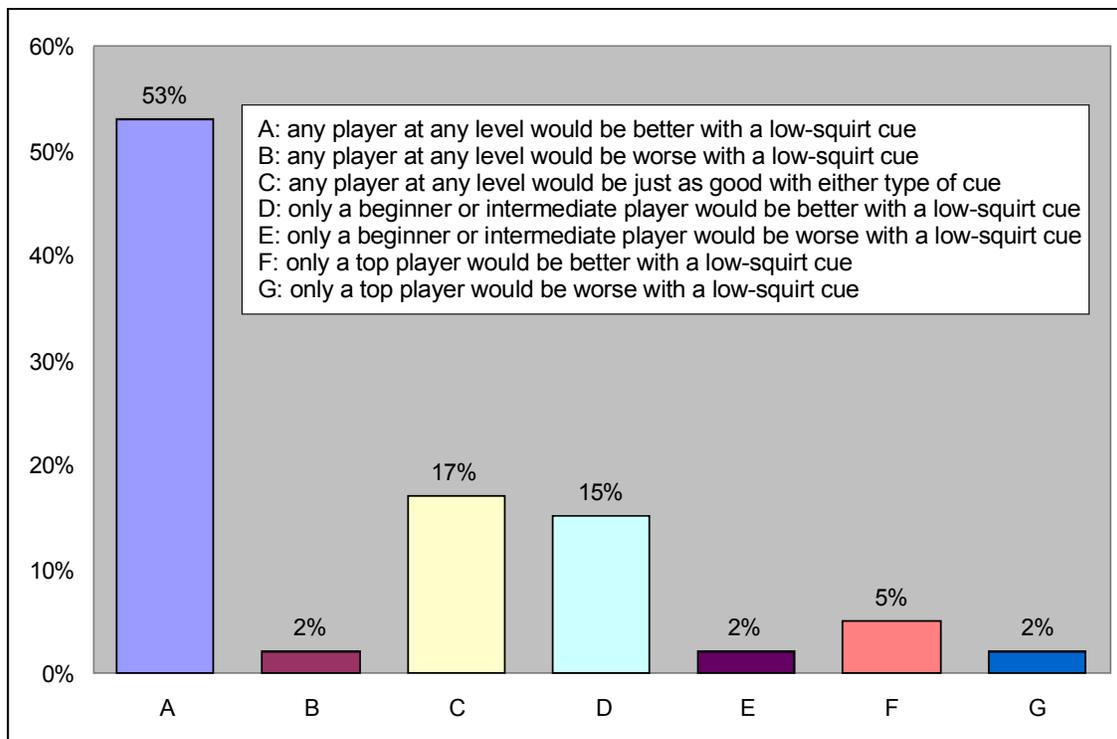


Diagram 1 Low-squirt cue poll results

To try to more scientifically answer the question of whether a low-squirt can help some players, I decided to do a simple analysis. **Diagram 2** shows the results graphically. As reported in my September '07 article, “low-squirt cues” typically have about 30% less squirt than a “regular” cue (i.e., a “regular” cue has about 40% more squirt than a “low-squirt” cue). This difference is illustrated with the green bars in the diagram. One thing I assumed in the analysis is that the typical error in judging the amount of squirt for a given amount of English will be a fixed percentage of the overall squirt range for the cue. So for a cue with a larger squirt range, the typical error in judging the amount of squirt will be proportionally larger (see the red bars). This assumption seems reasonable to me. If the amount of squirt varies over a larger range, you will probably be less accurate with identifying a specific squirt value within the range. Some people think they can be equally accurate regardless of the size of the range, but I don't think that is the case for most people. One exception might be a player who uses back-hand-English (BHE) aim compensation and has a cue with a natural pivot length well-matched to his or her preferred bridge length (see last month's article for more info).

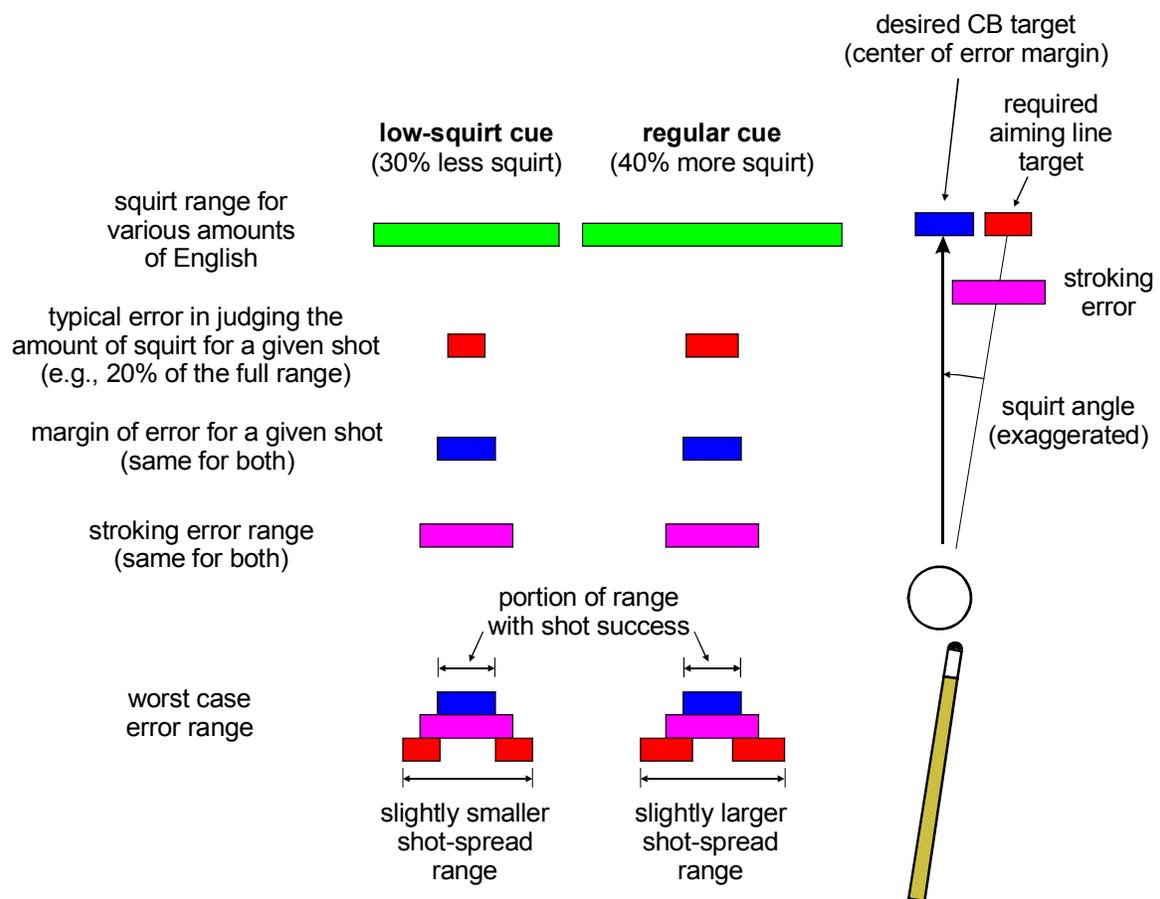


Diagram 2 Error comparison between low-squirt and regular cues

As shown with the figure on the right side of Diagram 2, for a given shot using English, there is a desired target for the CB (in the center of the blue margin-of-error bar). Nobody's stroke is perfect, so you will have some random error in your stroking accuracy (see the magenta [light purple] bar). Finally, you might not judge the amount of the squirt for the shot accurately (see the red bar). Because the stroking error range is shown larger than the acceptable margin of error for the shot, the implication is that you wouldn't make this shot 100% of the time, even if you did compensate for squirt perfectly. At the bottom of the diagram, I show how all of these

considerations affect your likelihood of making the shot. Due to the larger uncertainty in squirt for the regular cue, the shot spread will be slightly larger, and you will miss the shot more frequently. Now, the relative sizes of all of these bars will vary from shot to shot and from person to person, but I think the simple analysis suggests a low-squirt cue might offer a slight improvement in shot success when English is being used.

Another small benefit of using a low-squirt cue is the ability to get slightly more English than with a regular cue. **Diagram 3** illustrates the rationale behind this. The amount of English depends on the effective offset of the line of action, not the actual tip offset (see TP A.31 for more details). The larger the squirt angle, the smaller the effective offset will be. However, this effect is very small since typical squirt angles are so small (1-3 degrees). The increased-English effect certainly isn't strong enough to justify purchasing a low-squirt cue.

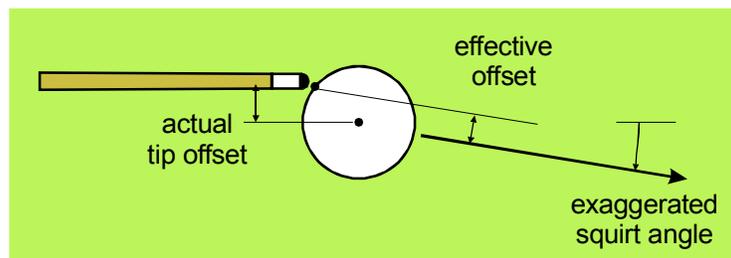


Diagram 3 Actual vs. effective tip offset

I hope you are enjoying and learning from my series on squirt. Next month, we'll look at the effects of tip size and shape on squirt and aim compensation. I hope you look forward to the remainder of the series. By the way, my answer to the question of whether a low-squirt cue can help is: yes, especially if you believe it can help you. The mind is a powerful thing. I use a low-squirt cue and I think I play better with it; therefore, I probably do.

Good luck with your game,
Dr. Dave

PS: I know other authors and I tend to use a lot of terminology (e.g., squirt, throw, cling, stun, tangent line, 30° rule, etc.), and I know not all readers are totally familiar with these terms. If you ever come across a word or phrase you don't fully understand, please refer to the glossary in my book. For convenience, an expanded version is posted online in the "Instructor and Student Resources" section of my website.

PS: I just released a new DVD called "*High-speed Video Magic*." It features billiards, but it also includes stupid human and animal tricks, balloons popping and bouncing, things breaking, engineering stuff, toy physics, and fluids and foods in motion. For more information and video excerpts, see the website (billiards.colostate.edu).

Dr. Dave is a mechanical engineering professor at Colorado State University in Fort Collins, CO. He is also author of the book, DVD, and CD-ROM: "The Illustrated Principles of Pool and Billiards," and the DVD: "High-speed Video Magic."