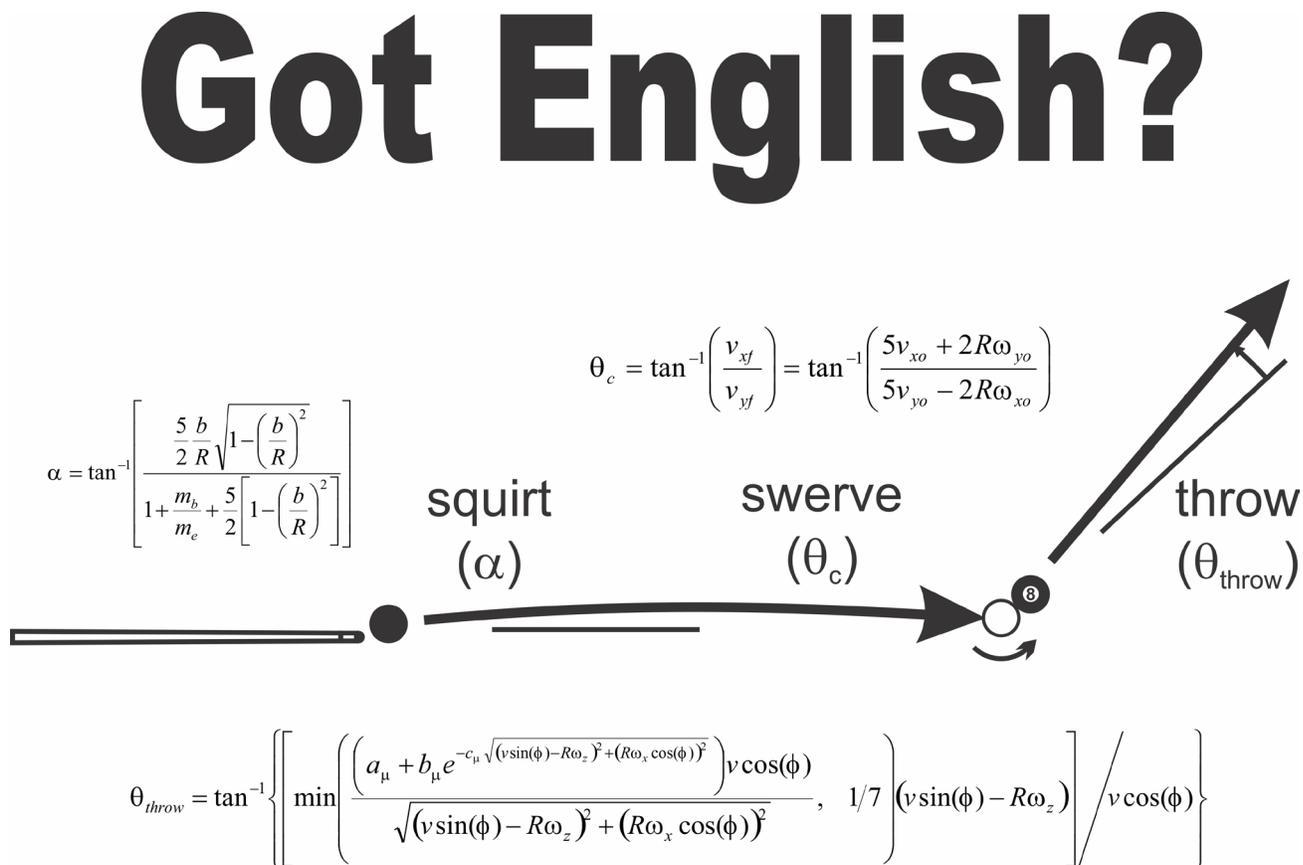


Supporting narrated video (NV) demonstrations, high-speed video (HSV) clips, technical proofs (TP), and all of my past articles are available online at [billiards.colostate.edu](http://billiards.colostate.edu). Reference numbers used in the articles help you locate the resources on the website.

Recently, I came out with a T-shirt containing the image in **Diagram 1**. Some people have suggested that the “Got English?” title might offend foreign nationals (or others) who don’t speak English very well; but obviously, with the pool shot diagram and physics equations on the shirt, this should not be the case. Here, “English” refers to sidespin, and the shirt illustrates the important effects of squirt, swerve, and throw that occur when hitting the cue ball (CB) off center.

**Squirt**, also called CB deflection, refers to the sideways motion of the CB caused by an off-center hit. Instead of the CB going straight in the direction of the cue, it goes off at an initial squirt angle. The amount of squirt depends on the properties of the shaft and the amount of sidespin. **Swerve** is the curving of the CB’s path in the opposite direction from squirt. Swerve depends on shot speed and distance, cue elevation, and cloth conditions. The combined effect of squirt and swerve is sometimes called **squerve** or “net CB deflection.” **Throw** refers to the sideways push of the object ball (OB) off the expected “line of centers” direction due to friction between the CB and OB. Throw is caused by relative sliding motion between the balls during contact due to cut angle (called “cut-induced throw” or CIT) or sidespin (called “spin-induced throw” or SIT).



**Diagram 1** “Got English?” T-Shirt design

The T-shirt includes accurate physics-based math equations that predict all squirt, swerve, and throw effects in complete detail. For the physics nerds out there, complete derivations of the equations can be found in online Technical Proofs [TP A.4](#), [TP A.14](#), and [TP A.31](#). I put the equations on the shirt mostly to be silly, but some people might actually appreciate them. They are also good conversation starters.

New online video [NV J.9](#) demonstrates the T-shirt effects and shows the basics of how to adjust your aim for squirt, swerve, and throw when using sidespin. The video also contains demonstrations of numerous interesting game-situation english examples where the aiming techniques are applied. Back-hand english (BHE) and front-hand english (FHE) techniques are featured in the video. More information related to the BHE/FHE techniques can be found in the "[english](#)" section of the FAQ page at [billiards.colostate.edu](http://billiards.colostate.edu).

This article provides a concise summary of all important squirt, swerve, and throw effects that must be taken into consideration (consciously, or intuitively based on extensive experience) when aiming shots with sidespin. Supporting video demonstrations, articles and other info for each item in the list below can be found under "squirt, swerve, and throw effects" in the "[english](#)" section of the FAQ page at [billiards.colostate.edu](http://billiards.colostate.edu).

## Squirt, Swerve, and Throw Effects

### Squirt:

1. Squirt increases with the amount of sidespin.
2. Squirt does not depend on shot speed; although, squerve (see below) does.
3. Squirt increases with the amount of shaft "endmass" (e.g., a low-squirt cue has less endmass and results in less squirt).
4. Squirt is slightly less with a heavier CB and slightly more with a lighter CB.

### Swerve:

5. Swerve increases with cue elevation and the amount of sidespin.
6. Swerve occurs with practically all sidespin shots because the cue must be elevated to clear the rails.
7. Swerve is delayed with faster shot speed.
8. Swerve occurs only while the CB is sliding; once rolling begins, the CB heads in a straight line.
9. Swerve occurs earlier with sticky cloth and later on slick cloth.
10. Swerve occurs earlier with a follow shot than with a draw shot.
11. Swerve angle is larger with a draw shot than with a follow shot.
12. Swerve angle can be predicted and visualized using the Coriolis massé-shot aiming system.

### Squerve:

13. Squerve (net effect of squirt and swerve = net CB deflection) can be zero with certain speeds and cue elevations for a given shot distance, amount of sidespin, and cue.
14. Squerve is less for follow vs. draw shots.
15. Squirt or squerve can be canceled using a combination of BHE and FHE.

## Throw:

16. For small cut angle shots (i.e., fuller hits), the amount of CIT does not vary with shot speed, but increases with cut angle.
17. For larger cut angle shots (i.e., thinner hits), the amount of CIT is significantly larger for slower speed shots as compared to faster speed shots.
18. The amount of CIT decreases some with larger cut angles, but not by much (especially for slower speed shots).
19. Maximum CIT occurs at close to a half-ball hit (30-degree cut angle).
20. In general, throw is larger at slower speeds, and for stun shots.
21. Maximum throw, under typical conditions, is about 1 inch per foot of OB travel, or 1/2 a ball per diamond on a 9' table, which is about 5 degrees.
22. Excessive throw (more than the amount expected) can occur if there is cling/skid/kick.
23. Both follow and draw reduce throw, and they do so by the same amount.
24. Effective throw (combined effect of throw and OB swerve) can be slightly larger with follow vs. draw shots, especially at slower speeds (and with cling/skid/kick).
25. The largest discrepancy between throw values for stun and follow/draw shots occurs close to a half-ball hit (30-degree cut angle).
26. The difference between the throw of stun and follow/draw shots is not as great at larger cut angles.
27. More sidespin gives you more SIT only up to a point. Additional sidespin beyond that point actually reduces the amount of SIT (i.e., more sidespin doesn't always give you more throw).
28. SIT is largest for a slow stun shot with about 50% of maximum sidespin.
29. The amount of throw can increase significantly as a small amount of sidespin is added, especially for a stun shot.
30. SIT is independent of speed (i.e., the throw is the same at all speeds) for small amounts of sidespin.
31. "Gearing" outside english (OE) results in absolutely no throw. The amount of sidespin required for "gearing" increases with cut angle. At a half-ball hit, the amount of sidespin required is about 50%.
32. At very small cut angles, inside english (IE) and OE create similar amounts of throw (although, in opposite directions).
33. For large cut angles, a small amount of OE can result in more throw than shots with no sidespin.
34. For large cut angles, IE results in less throw than shots with no sidespin.
35. IE increases throw at small cut angles, but actually reduces the amount of throw at larger cut angles.
36. OE can cause throw in either direction depending on the amount of sidespin and the cut angle.
37. Even for large cut angle shots (thin hits), excess OE (more than the "gearing" amount) can be applied to throw the OB in the SIT direction.

38. The amount of throw with IE can be much more consistent than with OE if the amount of sidespin varies a little. In other words, the amount of throw varies more with tip placement for OE vs. IE. This might explain why some people prefer using IE on cut shots ... because they can better anticipate and adjust for the amount of throw.
39. The least amount of throw, and the most throw consistency, occurs with fast IE shots.
40. With a small-gap combo with a gap size close to 3/8" (9.5mm), the 2nd ball heads very straight (i.e., the throw effect cancels the cut effect) over a fairly wide range of 1st-ball angles, regardless of ball conditions.

That's 40 different effects that come into play when aiming pool shots! This is one of the things that makes pool so interesting and challenging (... and frustrating at times). Obviously, to develop and master intuition for all of these effects can take a lifetime, and only if you learn from all of your mistakes. Based on countless years of successful experience, top players instinctively know how to compensate for squirt, swerve, and throw, and they aim and align their cue in the required direction based on shot speed, distance, amount and type of spin, and conditions. Hopefully, some of the simple techniques presented in online video [NV J.9](#) might help you become more effective immediately and help speed up your learning journey, without needing to know and understand the entire list of effects.

If you want a "Got English?" T-shirt, it is available for sale at [DrDaveBilliards.com](http://DrDaveBilliards.com). The shirt is fun for the pool nerds out there like me. When an opponent misses a shot due to lack of understanding of important sidespin effects, you can just point at one of the equations on the shirt. They'll love it. Just don't get "beat up after class."

Good luck with your game,  
Dr. Dave



normal video

[NV J.9](#) – "Got English?" – How to Aim Using Sidespin, With Game-Situation Examples



technical proof

[TP A.4](#) – Post-impact CB trajectory for any cut angle, speed, and spin

[TP A.14](#) – The effects of cut angle, speed, and spin on OB throw

[TP A.31](#) – The physics of squirt

PS:

- I know other authors and I tend to use lots of terminology, and I know not all readers are totally familiar with these terms. If you ever come across a word or phrase you do not fully understand, please refer to the [online glossary](#) at [billiards.colostate.edu](http://billiards.colostate.edu).

*Dr. Dave is a PBIA Advanced Instructor, Dean of the Billiard University, and author of the book: [The Illustrated Principles of Pool and Billiards](#) and numerous instructional DVD series, all available at: [DrDaveBilliards.com](http://DrDaveBilliards.com).*