

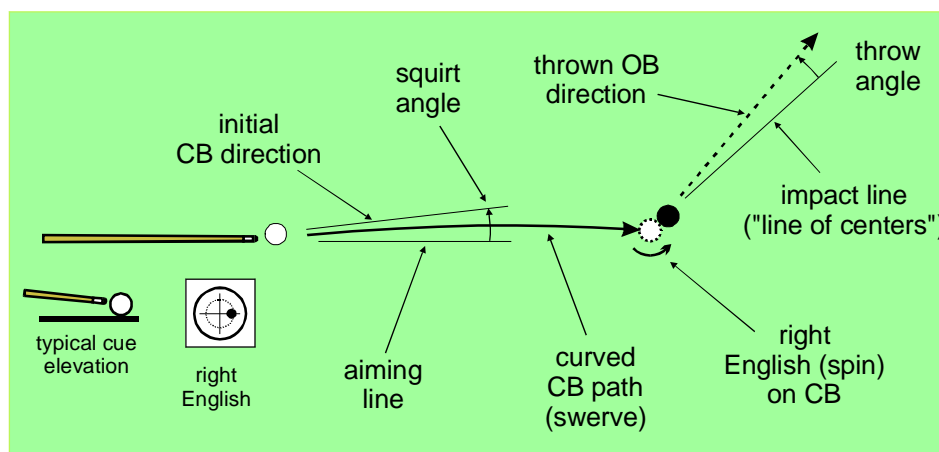
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*Note: Supporting narrated video (NV) demonstrations, high-speed video (HSV) clips, and technical proofs (TP), and all of my past articles, can be accessed and viewed online at [billiards.colostate.edu](http://billiards.colostate.edu). The reference 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.*

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In case you haven't noticed, I just dedicated the last 20 articles (almost two years worth) to squirt, swerve, and throw. I'm sure many of you are thinking: "enough, already!" Well, before moving on to other topics, I wanted to give some examples that bring together some of the information in a "big picture" sort of way.

**Diagram 1** illustrates all of the effects that come into play when using English. 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. The amount of squirt increases with the amount of English. For more information, see my August '07 through March '08 articles and **NV 4.13**, **NV A.17**, and **NV B.1**. The CB also **swerves** (curves) on its way to the object ball (OB). The amount of swerve depends on cue elevation, shot speed, and distance between the CB and OB. For more information, see last month's article and **NV 4.14**, **NV 7.12**, and **NV B.1**. 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 OB impact (see my August '07 and March '08 articles for more information). Finally, the OB gets **thrown** off the impact line (AKA "line of centers") on its way to the target. The amount of throw varies with cut angle, speed, top/bottom spin, and the amount and type of English. When throw is due to cut angle only, it is called **cut-induced throw (CIT)** and when it is due to English only it is called **spin-induced throw (SIT)**. For more information, see my August '06 through July '07 articles and **NV 4.15**, **NV 4.16**, **NV A.21**. If you want to refer back to any of my past articles, they are all available on my website ([billiards.colostate.edu](http://billiards.colostate.edu)).



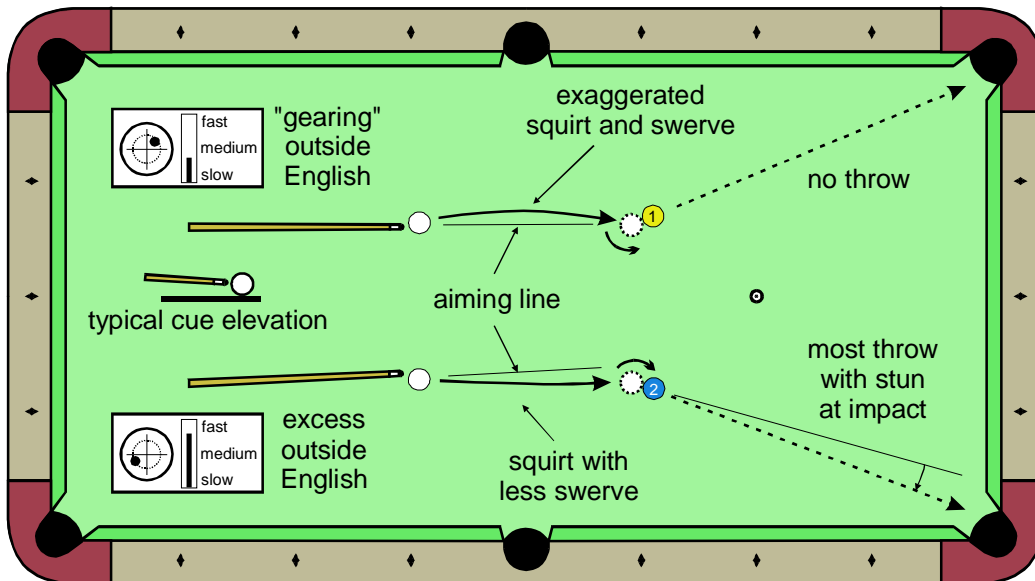
**Diagram 1** All English effects: squirt, swerve, and throw

Diagram 1 actually appeared in my May '07 article dealing with throw. I mention this because I received several messages from people wondering if there was an error with the throw direction in the diagram. Apparently, some people think throw is always in the CIT direction (which would be to the right of the impact line in Diagram 1) when there is a cut angle. Throw can be to the right or left of the "line of centers" for any cut angle, depending on the amount of English. As shown in my January '07 article, if there is more outside English than "gearing outside English," the OB will be thrown toward the "inside" of the cut (to the left of the impact line, as shown in Diagram 1). If there is inside English, or outside English less than the "gearing" amount, the OB will be thrown toward the "outside" of the cut (to the right of the impact line in Diagram 1). I just wanted to clear that up because several readers asked about it.



- [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 7.5](#) – Frozen ball throw
- [NV 7.6](#) – Frozen cue-ball throw
- [NV 7.12](#) – Small-curve massé shot
- [NV A.17](#) – English deflection (squirt) vs. speed
- [NV A.21](#) – Bank shot using throw and spin transfer
- [NV B.1](#) – Mike Page's squirt and swerve video

**Diagram 2** shows two examples illustrating the effects of speed and amount of English on aim and throw. Both shots are using "outside English" (right English for a cut to the left, and left English for a cut to the right). With the 1-ball shot, just the right speed is being used so swerve exactly cancels squirt. As a result, the CB hits the OB exactly on the aiming line at the desired "ghost-ball" target. The speed necessary for this depends on cue elevation, distance between the CB and the OB, and table and ball conditions. Also, "gearing outside English" is being used, so there is absolutely no throw (see my January '07 article). The 1-ball heads exactly along the "line of centers" impact line.

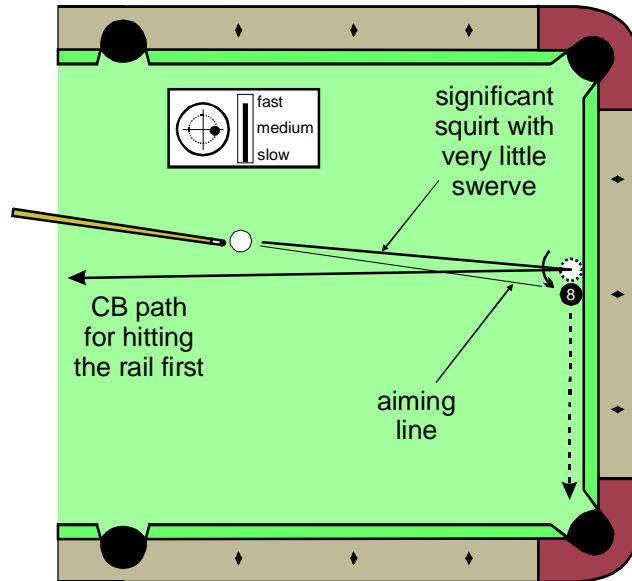


**Diagram 2** The effects of speed and amount of English and aim and throw

With the 2-ball shot, more speed and English are being used. Also, the CB is struck slightly below center, creating stun at impact with the 2-ball (after the slight bottom spin wears off). With this shot, the swerve hasn't taken completely yet due to the higher speed. Therefore, the CB will end up right of the aiming line due to squirt, and the shot would definitely miss to the left if there were no throw. However, because the English is more than "gearing," the 2-ball throws to the right toward the pocket. Because the CB has stun at impact, the amount of throw will be much larger than if the CB were rolling (see my October '06 article). The end result of all of this is: the 2-ball goes in the pocket. However, if the speed, the amount of English and bottom spin, the aiming line, or the cue elevation were changed, it is easy to miss the shot, especially if the pockets are "tight." For example, with less English, the 2-ball would actually throw the other way (to the left); and depending on how you adjust your aim for squirt, you might miss the shot by a large margin.

Concerning the 1-ball shot in Diagram 2, you might be thinking: "Why shouldn't I always use gearing outside English with just the right speed (for the given shot distance) so swerve would cancel squirt, and so there would be no throw, and both the CB and OB would always go exactly where I'm aiming?" Unfortunately, this approach is not very practical, because position play and bridging constraints often require us to vary cue elevation, speed, and English. Also, it is difficult to have perfect intuition for exactly how much speed and English to use to have everything cancel anyway. Squirt is fairly easy to predict for various shots (see my November '07 article), but swerve varies a lot with shot speed and distance, cue elevation, and table conditions. The best we can do is to learn all of the effects (see my June '07 and March '08 articles for complete summaries of all English effects) and practice a lot to develop solid intuition on how much to adjust in different situations, based on the effects.

**Diagram 3** shows a rail cut shot that might look extremely difficult to some people but can be relatively easy with the help of running ("natural") English. The trick is to compensate for squirt and be sure to hit the rail first. When the CB hits the rail with the running English, the CB heads toward the 8-ball, helping to send it along the rail. There is a larger margin for error than you might expect because the CB can hit the 8-ball during or after rail contact and still send the 8-ball down the rail (more on this in a future article). If you have a cue with a natural pivot length well matched to your bridge length, this is an example shot where back-hand-English (BHE) aim compensation (for squirt) can be very effective (see my November '07 article). With fast and/or short shots like this, swerve is not as much a factor, so the CB heads relatively straight in the squirt direction. Notice the aiming line in the diagram. Depending upon how much squirt your cue has, your aim point can be well into the 8-ball. Again, the key to this shot is to have the CB hit the rail with lots of running English to the left of the 8-ball (e.g., see **HSV A.132**).



**Diagram 3 Firm rail cut shot with running English**



**HSV A.132** – rail cut-shot hitting the rail first, with natural (running) English

One important issue when using English concerns whether or not you have a low-squirt cue. In my December '07 article, I made a case for some of the possible benefits of a low-squirt shaft (e.g., Predator, OB-1, Universal SmartShaft, etc.). One thing I didn't mention is if you are used to adjusting your aim for squirt with a higher-squirt cue, it might be difficult to adjust to a low-squirt cue (i.e., you will need to aim differently to compensate for the less squirt). I want to thank "Cornerman" on the BD CCB online forum for encouraging me to not just focus on the advantages of low-squirt cues. Other disadvantages include: a low-squirt shaft can be expensive, usually has a small diameter taper and tip, and might change the balance and "feel" of your cue.

I hope you have enjoyed and benefited from my many articles dealing with squirt, swerve, and throw. Even if the information in the articles hasn't helped you improve your game, you should at least have a bunch of new excuses now when you miss shots. :) Seriously though, I do hope you now have a better appreciation for all of the factors one must consider when using English. If you're tired of squirt/swerve/throw stuff, don't despair ... I plan to cover a totally new topic next month. Can you believe it?

Good luck with your game,  
Dr. Dave

*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."*