

Unlike some animals who are born instinctively knowing how to swim, humans are not. Most people have learned how to swim at some point in their lives purely as an essential life saving skill, and most people can make it from one end of the pool to the other (if they had to). In competitive swimming, there is a lot more science that goes into a swimmers ability to make it to the end of a race where fractions of a second count. Knowing this science and how to use it to your advantage will give a swimmer the competitive edge over those unknowing or unwilling to use the science. As I am always looking for that edge, during this time I will continue putting out more swimming science weekly to you all!

I tried to not go too far into the weeds, but I am known to get carried away. If you would like articles to support these please email me and ask and I would be happy to send them!

I hope you all enjoy

Drew

**Streamlining:** The fastest and most important position in swimming. Its basic and it can be boring but if your streamline is better than your competition, you have the advantage from the start (literally). In a 2009 study conducted by the Journal of Applied Biomechanics, the same person pushing off the wall in streamline versus pushing off the wall with their hands at their sides will find a reduction in drag by over 30%. 82.4% drag for hands at sides, 48% drag for streamline. Not to mention the amount of drag and time to get your arms back over your head to start swimming at some point. This means you could potentially be 34.4% faster than someone the same size as you who is using a poor streamline. Someone who is larger than you having to move more mass through the water will experience more drag, someone smaller than you moving less mass will experience less drag. Either way, have the better streamline ALWAYS.

**Inertia:** Newtons first law of motion. Everyone repeat after me and be loud in the back. "An object at rest wants to stay at rest. An object in motion wants to stay in motion at the same speed and in the same direction until acted upon by a force." -Sir Isaac Newton, 1666. As we just discussed in **Streamline**, when in the water you are being acted upon by forces. The first force when you push off the wall is thrust force propelling you forward through the water. This force is acted upon by drag force, the density of water limiting your forward progress. Drag force is a constant force as opposed to thrust force which will vary depending on how hard and effectively each swimmer pushes off the wall, streamlines or pulls (this is what racing is, the person who is the best at overcoming drag force). Next is the force of Bouyancy, a persons natural ability to stay afloat in water. Your body and the water does not want you to go deeper, thats why when you push off the wall you dont immediately sink and are brought up to the surface. You can use this force in events like butterfly and breaststroke to your advantage if you understand that your body and the water are going to help you in upward travel, so propel yourself forward and let the water do the upward work for you. Last force you are experiencing in the water is your own body weight. Again refer to Newton's law: a body at rest wants to stay at rest and a body in motion wants to stay in motion. If you are sitting at the wall before

you push off, you are at rest and your body wants to stay that way. You have to create thrust force in order to move. A heavier and bigger person will have to push off much harder in order to go the same distance a smaller and lighter person would. Now the lighter person will slow down faster because the thrust force and mass behind it is less for the drag force to overcome, but the drag force is stronger on the larger person because they have more surface area for it to act upon. Its all about finding the balance and which force you can overcome and use.

Think of it this way (Silver 2's I talk to you about this all the time) when you are coming into a wall to do a turn, are you stopping forward progress and turning around? Or are you using the momentum of your body and redirecting that force? Object in motion wants to stay in motion. Do not stop your momentum at the wall, simply redirect your force and add to it!

**Surface Tension:** Taking it back to 7th grade science class at Toano Middle taught by Mr. Ellis (see water strider). Surface tension for a swimmer is important to understand as water molecules at the surface have a natural tendency to bond more strongly than those under the surface. Meaning, there is less drag when you push off (in good streamline) and kick underwater than when you are swimming at the surface. This is why the 15m underwater rules exists or else swimming would be nothing more than underwater kicking competitions. The 15m rules was introduced to different strokes at different times, first in 1956 for Breaststroke but was later removed. Use surface tension to your advantage, push off atleast 6 Inches under the surface as opposed to on the surface and kick out to a strong break out!

<https://www.youtube.com/watch?v=Vox9KOxC1ZA>

## HISTORY

**Lane Lines and Gutter Systems:** These both serve a purpose beyond that of determining who swims where and keeping the water in the pool. In 1924 at the Paris Olympics, the first ever lane lines were put into use. These were made out of cork solely to identify who swam where. Since then, modern lane lines have evolved with a more scientific purpose, reduce in water turbulence. As your swimmers know, when swimming in a lane with others (especially physically larger swimmers) they create wave forces that act upon your body in the water slowing you down and disrupting your strokes. Lane lines make a huge difference in limiting this force, the difference between a 4 inch line disc and a 6 inch line disc is a 70% decrease in turbulence and drag. Gutter systems act the same way. In 1976, gutter systems were first introduced to competitive swimming pools which allows turbulent forces to exit the pool and be recycled as opposed to bouncing off the walls back at the swimmer.