Explaining the Metrics

TRITONWEAR
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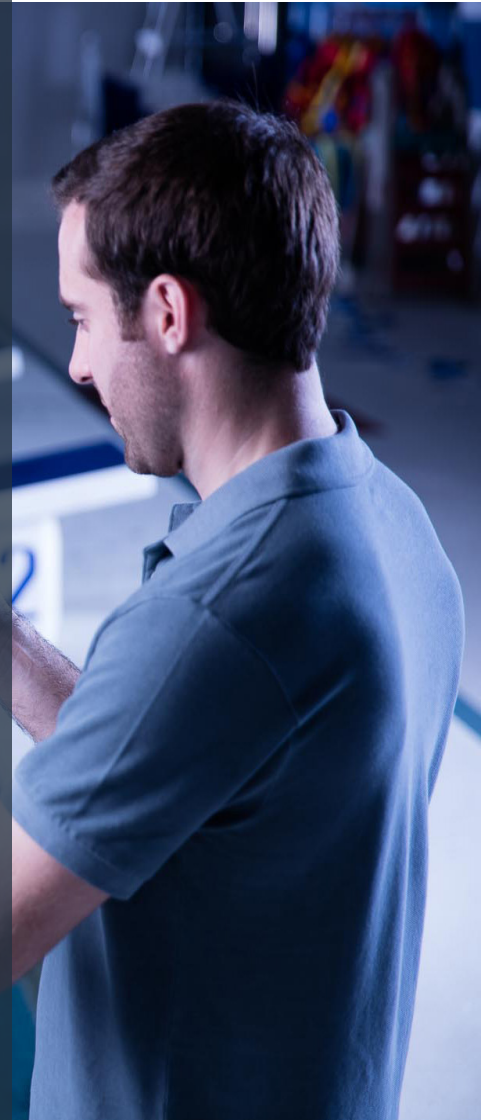
TritonWear's metrics analyze a swimmer's behaviour in the water. This data can be used to locate specific strengths to be built on and used to each athlete's advantage. More importantly, these metrics can be used to target specific weaknesses that can be improved upon.

With TritonWear's metrics, it is easy to determine specific areas of struggle for any given stroke or distance. Looking at the metrics individually offers plenty of information. If you want to take it a step further, combining data from different metrics can provide even more insight on ways to improve overall performance. This enables fine-tuning of workouts for more targeted training.

All this information is great for analysis, but can be a little overwhelming to make sense of all the different metrics when you first get started. So, let's break it down to get a deeper understanding of how each TritonWear metric can help you train smarter.



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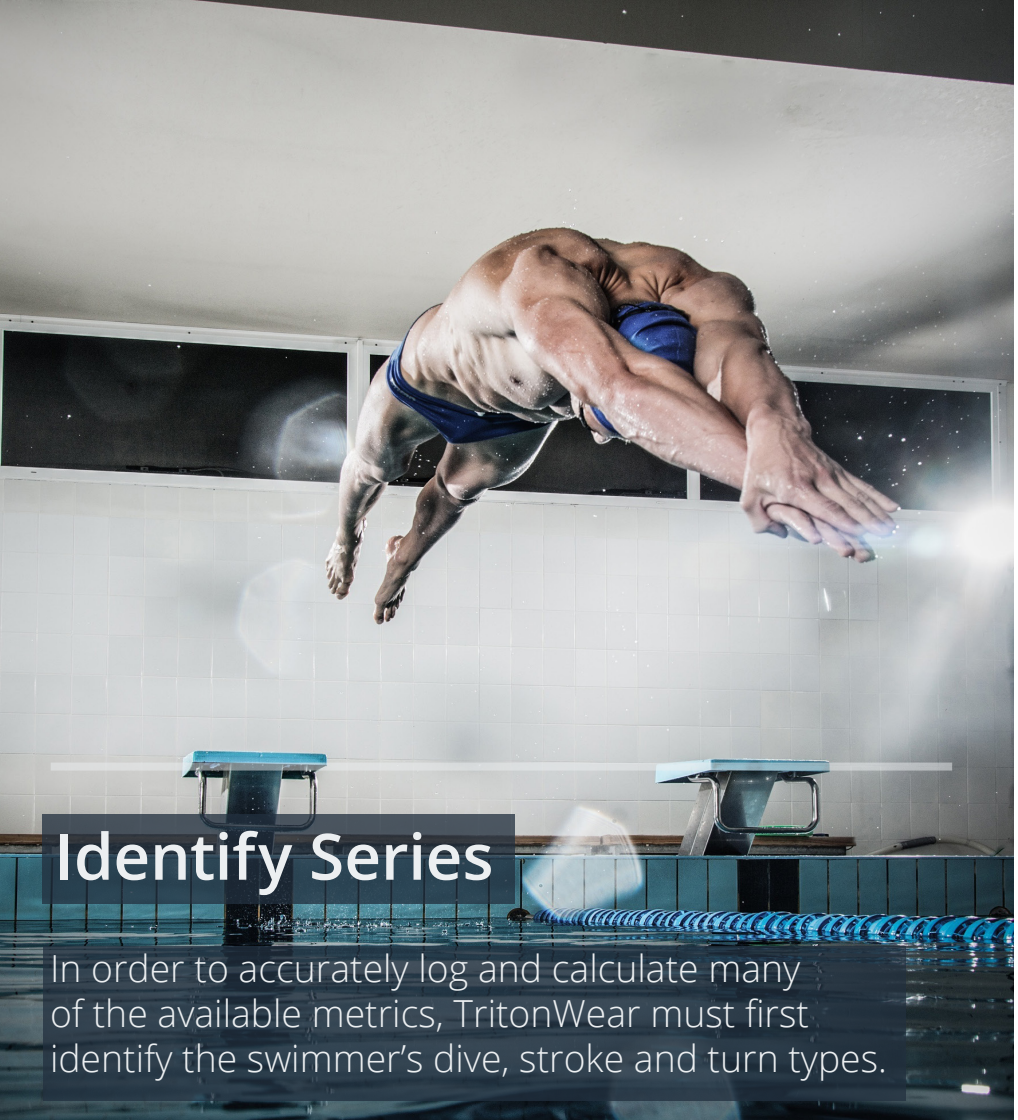


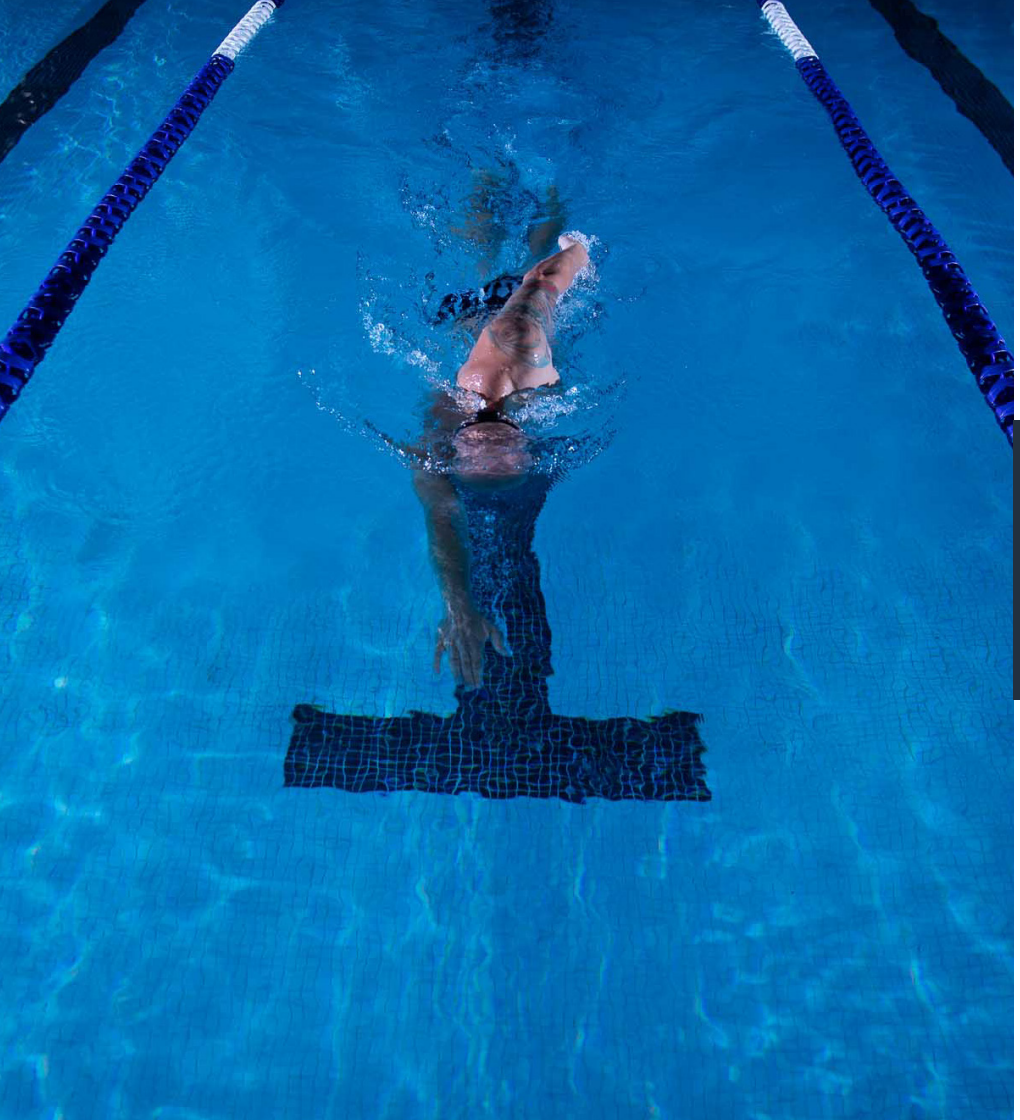
Identify Series

In order to accurately log and calculate many of the available metrics, TritonWear must first identify the swimmer's dive, stroke and turn types.

Start Type

TritonWear detects the first forward/upward motion the swimmer makes to begin analyzing. It interprets the start type based on the swimmer's range of motion. Detecting start based on front or back swimming, and distinguising between push (training) and dive (racing) starts.

Starts are the main point where we see differences between stopwatches and recorded lap/rep times. This is becuase the unit starts counting based on the instant movement begins, whereas stopwatches include a human reaction time. There is a reaction time between hearing go and moving, and a reaction between seeing movement and starting a stopwatch.



Stroke Type

Once in moving through water, TritonWear analyzes both the acceleration and rotation of the swimmer's head to detect the stroke type for a given lap.

Strokes detected:

- Butterfly
- Backstroke
- Breaststroke
- Freestyle
- IM*
- Mixed*

The stroke type influences how TritonWear detects other metrics such as stroke count, stroke rate, and breath count.

The metrics for different stroke types will have different implications. So, when adjusting workouts based on the other metrics, take the stroke type into account.

* Stroke types are only recognized on a rep level - mid-length transitions to a different stroke type are not supported.

Turn Type

Now that you've perfected your start, and swam your chosen stroke, let's look at what happens as you reach the wall at the other end.

There are 3 main types of turns which can be detected:

Flip / Tumble Turn	Typically used in freestyle and backstroke, where the swimmer does a forward flip towards the wall before pushing off.
Open turn	Typically used in breaststroke and butterfly, where the swimmer touches the wall with both hands (one hand if used in freestyle or backstroke) before tucking their legs in, rotating and pushing off
Crossover / Bucket turn	Sometimes used in the back - breast transition in an IM, where the swimmer comes in on their back, touches the wall with their hand, then flips over to push off for their breaststroke pullout

TritonWear again uses movement to determine which type of turn is being executed, then computes the time it takes for the swimmer to complete the turn.

The default turn type is an open turn, when the unit detects a change in direction. It is only when the unit recognizes the downward movement of a flip or crossover turn that is identifies these turn types.

Improving transitions can be the split second factor determining the success of a swim, especially in short course distance events.

Performance Series

Performance metrics look at the big picture, and are the most commonly measured.

However these metrics simply reflect the results of training, rather than providing insight on areas to address for improvements.

In this series we look at split time, speed and pace time, to understand how each is impacted by different actions, and what can be done to stabalize or reduce the overall results.

Split Time

Split time is simply the time it takes to complete one length of the pool, regardless of the distance.

TritonWear captures split time based on start, turn and end swim characteristics. The start of a swim is when the swimmer's feet leaves the wall (for a push start) or when they start movement up and forward (for a dive start).

During a turn, the end of a split is captured when the swimmer hits the wall (when their hands hit in open or crossover/bucket turns, and when their feet hit on flip turns).

The end of a swim is captured when a swimmer hits the wall with their hand and stops swimming. For greatest accuracy, the swimmer needs to end hard (head down, touch, stop) and return to vertical head position right away. So even if behind pace, the swimmer should stop and stand vertically for a few seconds to ensure the unit recognizes the end and beginning of each rep.

If drills are being performed, which require mid pool starts and stops, or multiple strokes to be performed in a single length, the unit may still recognize swimming, but will not be able to accurately calcuate most metrics.

Pace Time

Pace time is the time from the start of the previous rep to the start of the current rep, rounded to nearest 5 seconds.

This is used by the system to recognize lengths, reps and sets, to accurately build out the workout without any input required.

Speed

Speed is measured as the average speed over the course of a length.

Calculation: Distance of lap/Split time

Breaking down the speed per length is helpful in determining which lengths a swimmer might need to make changes on, in terms of pacing for specific distances.

Speed looks at the overall picture of how fast a swimmer is going. If there is a change in speed in a given length, but DPS and stroke rate remain consistent throughout the rep, check the transitions.

DPS and Stroke Rate are them main contributing factors to Speed, we will learn about them in the stroking series, coming up next.

Stroking Series

The stroking series highlights the metrics that focus on stroke technique and efficiency, which make up the majority of a swimmer's performance each split.

With these metrics, you can isolate specific areas to work on for any given stroke. Once it's been located, you can figure out which drills or dry land exercises to perform for more targeted training sessions.

Small improvements in each area of struggle lead to improvements in overall form and efficiency.

Distance Per Stroke (DPS)

Distance per stroke (DPS) is also called Stroke Length, and measures how far a swimmer travels with every stroke. TritonWear provides a precise measure of DPS, by taking into account the underwater portion of the length. Calculating DPS according to the distance spent stroking, and the number of strokes over that distance, in the users desired display settings.

Calculation: Stroking Distance / Stroke count

DPS is the metric that comes closest to measuring stroking "technique". Although arm length is a factor in DPS, increasing it generally means improving swim technique. To generate a high DPS swimmers need to have a consistent pull on the water, right from the catch at the front to the exit at the back. They also need to keep a good streamline throughout to reduce drag both during the pull and during the glide between strokes.

For sprinters, studies have shown that the swimmer who can attain the highest DPS at slower speeds are the same swimmers who go the fastest. For distance swimmers, a higher DPS usually translates to higher swimming efficiency and energy in the tank for later splits as fewer strokes need to be taken and drag is reduced.

That being said, a high DPS does not translate directly to higher speed. Too much glide between strokes can cause the swimmer to slow down on every stroke, requiring extra effort to speed up again during the pull to maintain speed. By powering through the water at a faster stroke rate, a swimmer might be able to get faster even while sacrificing DPS.

Stroke Rate

While DPS looks at how far each stroke takes the swimmer, Stroke Rate looks at how fast the swimmer takes each stroke. Stroke Rate is measured as the duration of a single stroke cycle (i.e. completing a pull on both arms).

TritonWear measures Stroke Rate as the average duration of all the stroke cycles in a single lap. A higher stroke rate means that the swimmer is pulling at a slower speed.

Measuring Stroke Rate allows you to pinpoint specific laps where there are increases or decreases in stroke rate, and make necessary adjustments to maximize stroke efficiency.

Different distances will require different stroke rates for proper pacing and maximum efficiency. For instance, sprints would most likely require a faster stroke rate than long distance swims. In either case, faster stroke rates should not come at the cost of compromising form or DPS.

With TritonWear, you can find the optimal stroke rate for a swimmer for any given stroke and distance, and see which laps might need improvement. Having a target stroke rate per lap helps in maintaining a consistent pace.

Stroke Index

The Stroke Index is a measure of a swimmer's overall stroke efficiency.

Calculation: Speed x DPS x Cycle Multiplier

The Cycle Multiplier is used to convert distance per stroke into distance per cycle.

The Cycle Multiplier for freestyle and backstroke is 2 (2 strokes = 1 cycle), and the Cycle Multiplier for breaststroke and butterfly is 1 (1 stroke = 1 cycle).

The goal is to get a higher Stroke Index, because a higher Stroke Index means the strokes are more efficient: the swimmer is going faster (Speed) and farther per stroke (DPS).

Since Stroke Index is a culmination of the other performance metrics, it can be used to determine how changes in certain areas (based on other performance metrics) affect a swimmer's overall efficiency.

Find the optimal balance between speed and DPS to achieve the highest stroke index. This can give the swimmer a target speed and DPS per lap in any given stroke or distance.

SWOLF (Swim Golf)

SWOLF is the easiest way to measure a swimmer's overall efficiency.

Calculation: Split Time (in seconds) + Strokes

The goal is to get a lower SWOLF score because a lower SWOLF score means the strokes are more efficient: the swimmer is going faster while taking fewer strokes.

SWOLF can also be a measure of consistency. For instance, a swimmer can have the same stroke count per lap but clock in slower splits, resulting in a higher SWOLF score. This might indicate that while the swimmer may be maintaining their DPS, they are still swimming at an inconsistent pace - gliding too much and not moving through the water fast enough.

SWOLF is a simple, yet effective, benchmark for swimmers to measure their stroke efficiency and consistency.

Count Series

The Count Series highlights the metrics that look at rhythmic movements in the water: strokes and breaths.

These metrics play a big role in dictating a swimmer's rhythm and timing in the water, which can make or break their swim, for any given stroke.

Stroke Count

Counting the number of strokes per lap is a good measure of stroke consistency. It is also a contributing factor to DPS: higher stroke count = lower DPS.

For freestyle and backstroke, strokes are counted every time either hand enters the water.

For breaststroke and butterfly, strokes are counted every time the arms recover.

Shorter strokes lead to higher stroke counts, and this means that each stroke is not being maximized. So, the goal is to have low, consistent stroke counts.

Inconsistent Stroke Counts might indicate an inconsistent pace, especially in long distance events. For instance, increased stroke count in a lap could suggest that the swimmer is no longer pulling with sufficient force, kicking enough, or did not maximize their push-off and time underwater.

Inconsistent stroke counts might suggest improvements on:

- The catch
- Pull strength
- Kicks
- Timing of pull/breaths
- Breath counts
- Overall form
- Or a combination of these factors.

Look at how different stroke counts affect a swimmer's speed and overall time to determine the number of strokes they should be targeting per lap for any given stroke or distance.

Properly timing breaths is critical because it factors into form, rhythm, and overall pace in any distance for any given stroke.

Breath Count

Breath Count is gauged by a swimmer's head movement and maximum head tilt. When the swimmer's head is tilted on an axis, TritonWear will pick this up and classify this as one breath.

TritonWear makes a judgement call for breath and non-breath movements in each stroke. This judgement call is based on previously recorded data from the same swimmer. This distinction is made because different swimmers have varying degrees of movement when taking their breaths.

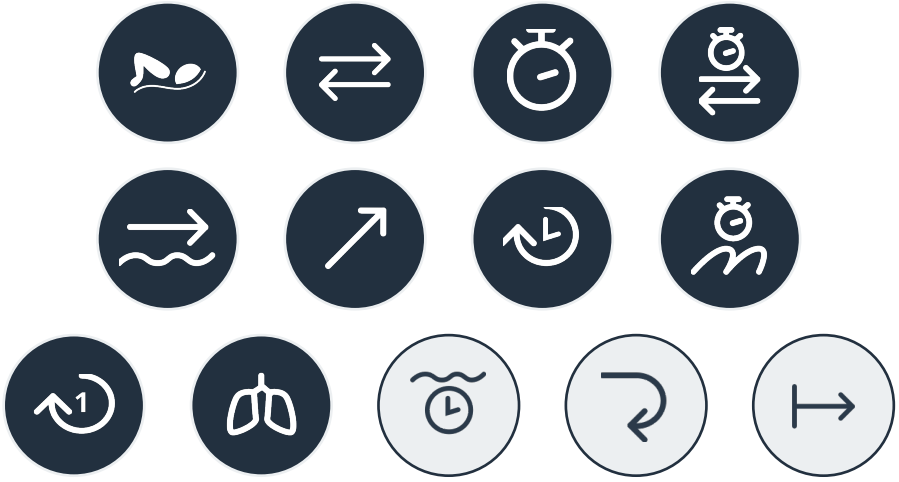
For freestyle: head tilting to the side = 1 breath

For breaststroke and butterfly: head coming up and back = 1 breath

Breath Count requirements typically vary depending on stroke and distance. For instance, a lower breath count would be a better option for a swimmer doing 50m freestyle than a swimmer who needs to keep pace doing 1500m freestyle.

A consistent breathing pattern helps in maintaining steady rhythm and pace. This is especially important in longer distances. So, knowing the breath count can be beneficial in determining proper pacing and maintaining good rhythm for longer distances, or giving that extra advantage in sprint events.

Transitions Series



The metrics under the Performance and Count Series make up the majority of a swim, but split second victories are often won in the transitions.

Efforts on and off the wall can make all the difference in beating a personal best or out-touching an opponent to the wall. Even minor improvements in these metrics can give that extra edge the swimmer wouldn't otherwise get on the rest of their swim

Time Underwater

Time Underwater is the time between the push-off (or dive) and the breakout.

The amount of time a swimmer should spend underwater varies depending on stroke, distance, and underwater technique.

Comparing different times underwater to overall time is a good way to determine a swimmer's optimal time underwater for a given stroke or distance.

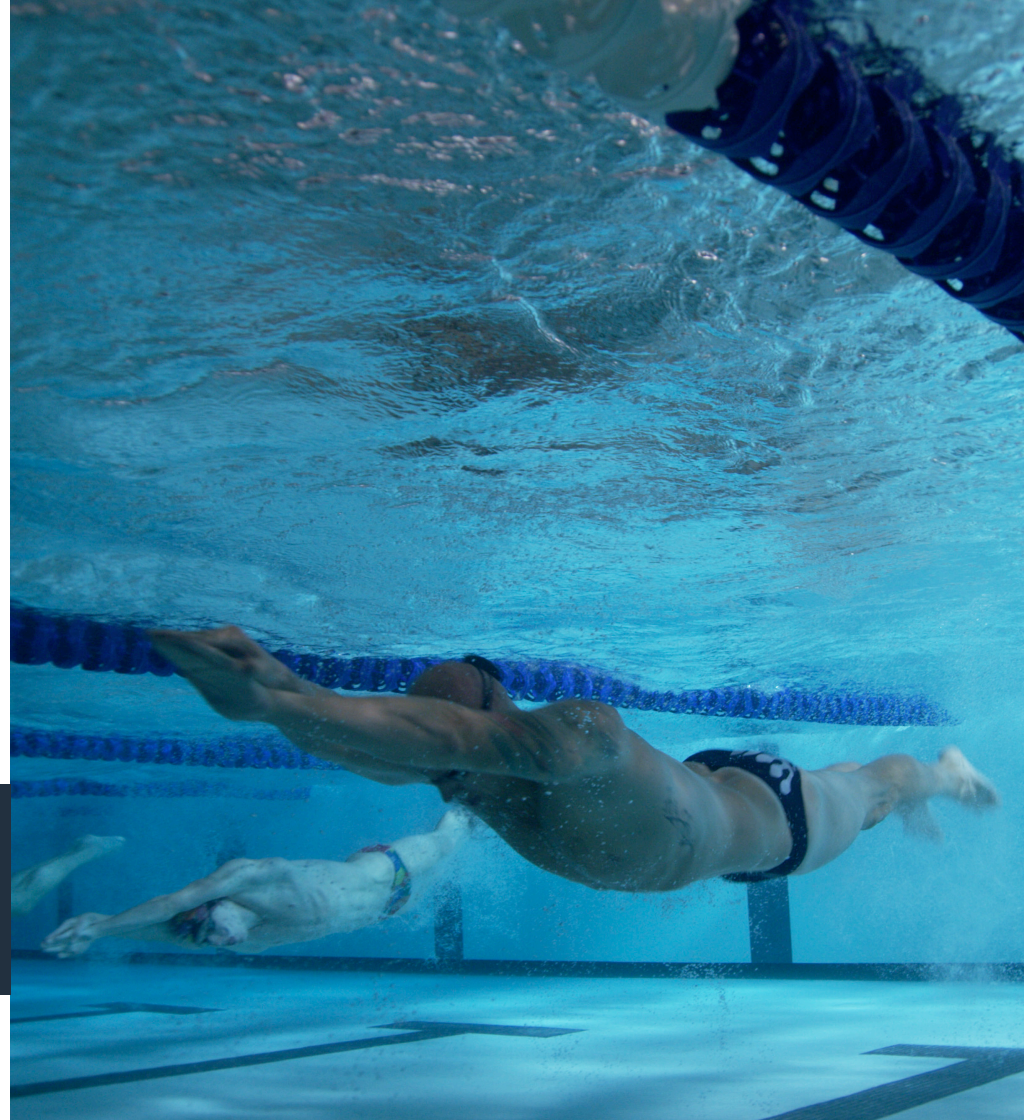
Another comparison that could be made is between time underwater and the distance of the breakout from the wall. In this case, the goal is to spend the least time underwater for the farthest distance.

For freestyle, backstroke, and butterfly, consider counting dolphin kicks. Compare this to time underwater, distance of the breakout, or overall time, to find the optimal number of dolphin kicks. With enough practice, performing this number of dolphin kicks will maximize time underwater. This would also help time the perfect breakout.

To maximize time underwater, focus on:

- Push-off
- Streamline – better body position, less drag
- Form and power of dolphin kicks or breaststroke pullout
- Timing – from the glide off the wall to the 1st kick or the pullout
- Timing of breakout

Another critical factor in maximizing time underwater, either during dolphin kicks or breaststroke pullout, is the push-off.



Turn Time

Good transitions begin at the turn, with the proper combination of speed and technique. Turn time is simply the time it takes a swimmer to complete a turn.

Flip turns: turn time is measured from the initiation of the turn (head begins to slow down), to the moment the feet touch the wall.

Crossover/Bucket turns & Open turns: turn time is measured from the initiating hand touching the wall, to the moment the feet touch the wall.

The goal is to turn as fast as possible without compromising form. The 1st step to performing a great turn is a strong approach to the wall – head down, legs up, and a perfectly timed last pull before (or at the start of) the turn. A strong approach, combined with proper technique and speed,

Improvements in turn time lead to improvements in overall swim time. Also, a good transition off the wall sets the swimmer up for a powerful push-off and efficient time underwater.

Making small but specific adjustments to a given turn type can lead to smoother and faster transitions off the wall.

Push Off Strength

Push-off Strength is measured by the speed of the swimmer upon leaving the wall. This value has no upper bound, but most swimmers won't see values higher than 40. A high push-off strength means that the swimmer is going faster and farther off the wall.

A strong, sustained push, with good streamlined form off the wall is key to a powerful push-off. While the turn is not accounted for in the calculation of this metric, a properly executed turn is the perfect set-up for a strong push-off.

To increase push-off strength, consider focusing on:

- Improving the turn (technique and time)
- Increasing leg strength
- Tighter streamline and better body position (for less drag)

The momentum built from the push-off helps maximize time underwater and lead to a powerful breakout, which can ultimately shave off crucial seconds in overall time.

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