SWIMMING TECHNIQUE

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FEATURES

In Swimming Technique Magazine, we are dedicated to bringing you the best information in the areas we feel are vital to swimming and coaching better. We've broken down our content in seven categories, and every issue we will do our best to give info in each. The categories are as follows:

- MP — MENTAL PREPAREDNESS
- TC — TECHNICAL
- N/R — NUTRITION/RECOVERY
- TR — TRAINING
- EV — ENVIRONMENT
- S/T — STRATEGY/TACTICS
- SI — SCIENCE & INNOVATION

So dive into our new issue, and we hope you enjoy Swimming Technique!

On the Cover:
Melanie Margalis by Peter H. Bick

PRIVATE LESSONS WITH WAYNE

by Wayne Goldsmith

The development of swimmers from their first learn-to-swim practice to the realization of their peak performance potential as elite athletes is both an art and a science.

The art of coaching—the philosophies, practices, principles and programs of coaches is an art form: an integration of physical preparation activities, mental skills development, technique and skills training and strategic and tactical abilities development. Much of the art of coaching is difficult to quantify, almost impossible to measure and challenging at best to study objectively.

The science of swimming—physiology, biomechanics, psychology, sports nutrition, performance analysis, sports medicine and the other disciplines offer objective measurement and quantification to the sport: to measure what's measurable and count what's countable.

In the most effective and successful swimming programs around the world, the art of coaching and the science of swimming work together in harmony with a common goal: to help each individual swimmer realize the full extent of personal potential.

Swimming Technique is focused on bringing together the art of coaching and the science of swimming.

The information, ideas and innovations presented in this magazine will feature both: a balanced perspective of coaching and science, practice and research, application and analysis.

The magazine is organized into seven distinct sections:

- Technical (e.g., swimming stroke technique, swimming skills)
- Training (e.g., physical training, physiology, strength training, recovery practices)
- Strategy and Tactics (e.g., pacing, prelims to finals, race tactics)
- Mental (e.g., emotion management, confidence, mindfulness, mental toughness)
- Environment (e.g., culture, team dynamics, leadership)
- Nutrition (e.g., hydration, supplements, peak performance diet and nutrition management)
- Science and Innovation (e.g., current scientific research, literature reviews)

The overall philosophy of *Swimming Technique* is to offer coaches, sports scientists, athletes and others involved in the preparation of swimmers for national- and international-level swimming a unique coach-driven, multi-disciplinary approach to athletic performance enhancement.

There's a saying attributed to Albert Einstein (among others):
- Not everything that can be counted counts.
- Not everything that counts can be counted.

Swimming Technique will deliver a magazine devoted to the things that can be counted and the things that can't: for it is in the marriage of the intangible and the tangible, the subjective and the objective, the instinct and the evidence—the art and the science—that the sport of swimming can evolve, flourish and grow. ◄

Wayne Goldsmith
Managing Editor of Swimming Technique Magazine

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[Photo Courtesy: Singapore Swimming Federation]

USRPT FOR THE REST OF US

by Bridger Bell

In 2015, Coach Bill Smyth of Boston University gave his team a season of "textbook" USRPT training, following Dr. Brent Rushall's system. The following year, Coach Smyth drew from that experience to integrate race-pace sets within a more traditional training program. Data suggests the latter program yielded greater rates of success. BU's experience may offer the rest of us valuable lessons for our own teams, and may raise questions about how experimental data should inform swim training.

As Dr. Brent Rushall's training regimen —Ultra-Short Race-Pace Training (USRPT) —has become well known, more and more coaches have considered the extent to which they should apply it. One NCAA Division I program, Boston University, went all-in two years ago (2014-15). That experience informed a different approach last year (2015-16). Performance comparisons between the two seasons may offer insights about how best to implement race-pace training.

HISTORICAL CONTEXT

Much of the value Coach Smyth found in USRPT training can be traced back to earlier training methods. When asked about USRPT's unique contributions to the sport, Coach Smyth points to the system's rigidity and specificity, especially about rest intervals (18-23 seconds). Coach Smyth notes that race-pace training has been around for decades, stressing that the Australian distance swimmers led in modeling its success from at least the 1980s (an observation also noted and argued by Dave Kelsheimer and Rebecca Wilson in *Swimming World Magazine's* June 1995 issue).

A "SAMPLE SIZE OF 1"

Coach Smyth is very cautious about claims that his experience should be considered scientific rather than anecdotal, emphasizing that his team is only a "sample size of 1."

Even the most academic swimming performance research—and much of what's cited in Dr. Rushall's USRPT literature—is often based off sample sizes smaller than one or two dozen swimmers on the same team (even as few as six). One study cited by Dr. Rushall followed seven cyclists (a group of three and a group of four) (Usaj, et al. 2009). The BU data offers 26 groups of two to six swimmers over two school years. Far from being "a sample size of 1," the quasi-experimental data from Coach Smyth's two seasons is comparatively robust.

SCIENCE OR PSEUDO-SCIENCE?

In defense of USRPT, Dr. Brent Rushall writes that many staples of traditional training—isolated kicking, equipment, drills, pulling and dryland—are "irrelevant training," and faults "dogmatic" coaches. Drawing a contrast, Dr. Rushall's purportedly research-based alternative claims to prove such traditional training methods worthless.

Dr. Rushall writes, "Most other sports have different energy demands, forms and patterns of force development, and rest opportunities," and faults coaches for modeling swim training after data from other sports. However, in the same article, Dr. Rushall himself cites studies of cross-country skiers, military units, runners, cyclists, treadmill participants, triathletes and soccer players. [In a footnote, Rushall writes that studies of other exercises were only used when "their findings are not sport-specific," yet no criteria was offered for determining whether the findings are sport-specific.]

According to Dr. Rushall's standards of relevance, BU's results—being swimming-specific and looking at a relatively large numbers of swimmers—should not be lightly dismissed.

"COULDN'T GIVE UP THE WEIGHT ROOM"

Coach Smyth noted that Dr. Rushall's strict USRPT system precludes many aspects of collegiate training programs: isolated kicking, equipment, drills, pulling, dryland, lifting and recovery practices. Weight training and recovery swims were among the few exceptions to BU's 2014-2015 USRPT orthodoxy; they adhered to the USRPT regimen with intentionality and rigidity.

In Coach Smyth's estimation, they followed Dr. Rushall's exact specifications to at least 85 percent faithfulness. Offering some experimental control, those aspects that did deviate from USRPT—three lifts and a recovery practice each week—were held constant through both seasons.

During the USRPT season, according to swimmers and coaching staff, kicking faltered, especially toward the ends of races. In response the following year, BU greatly ramped up both isolated kicking and post-summer aerobic base training. The results follow.

MEASURING EFFECTIVENESS: CONFERENCE RESULTS – 2015 USRPT VS. 2016 TRADITIONAL

Using CollegeSwimming.com's "improvement" statistic, we see the following rates of improvement among Boston University swimmers at their conference meets under the strict 2015 USRPT regimen versus the more traditional 2016 program featuring race-pace training sets. (*Fig. 1*)

According to Coach Smyth's more robust internal statistics and observations, strict USRPT was most effective for the 100 fly for both teams (men and women), 200 breast and 200 IM for men and the 100-200 free for women.

	2015	2016			2015	2016
W 500 Free	0.60	0.83		M 500 Free	1.00	1.00
W 200 IM	0.75	0.80		M 200 IM	0.83	1.00
W 50 Free	0.83	1.00		M 50 Free	0.80	1.00
W 400 IM	0.33	0.67		M 400 IM	1.00	1.00
W 100 Fly	0.50	1.00		M 100 Fly	0.75	1.00
W 200 Free	0.75	1.00		M 200 Free	1.00	1.00
W 100 Breast	0.00	0.00		M 100 Breast	1.00	0.67
W 100 Back	1.00	1.00		M 100 Back	1.00	1.00
W 1650 Free	1.00	0.50		M 1650 Free	0.00	1.00
W 200 Back	1.00	1.00		M 200 Back	1.00	1.00
W 100 Free	0.80	1.00		M 100 Free	0.80	1.00
W 200 Breast	0.67	0.25		M 200 Breast	0.83	1.00
W 200 Fly	0.25	1.00		M 200 Fly	0.67	1.00
OVERALL AVG:	0.65	0.77		OVERALL AVG:	0.82	0.97

(Fig 1)
Number of BU improvements out of number of BU swimmers in each event as a decimal (e.g., 3 improvements out of 4 swimmers = 0.75):

Out of 26 individual events with anywhere from two to six swimmers per event, there were only three events in which BU swimmers showed more improvement under USRPT, according to the CollegeSwimming.com statistic. [This particular statistic does not take into account magnitude of improvement. It best reflects whether an athlete peaked at conference (improvement) or peaked earlier in the season (non-improvement).]

"USRPT AS SEASONING RATHER THAN THE MAIN COURSE"

USRPT is intended to be a comprehensive training program that is followed strictly. Coach Smyth studied every facet of Dr. Rushall's program and implemented almost to the letter. Relative success with USRPT was limited to a few events for each team (men and women). According to one measure, only three out of 26 events benefited more from a USRPT regimen. The data supports arguments for more variegated, traditional methods such as isolated kicking, equipment, drills, pulling, dryland, lifting and recovery practices (in addition to race-pace sets). Thus, Coach Smyth concludes that race-pace sets are best used "as seasoning rather than the main course." ◄

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About the Author:
Bridger Bell has written for Swimming World, Swimming Technique, Swimming Science and SwimSwam, and is head age group coach and an assistant national groups coach at Team Santa Monica in Southern California. Bell was head coach of Donner Swim Club (Columbus, Ind.), an assistant at Johns Hopkins University, a high school coach and has coached University of Virginia Swim Camps. Bridger also served for six years as the national director of Collegiate Club Swimming for the American Swimming Association. Coach Bell has a master's degree (political philosophy concentration) from the University of Virginia, and double-majored in mathematics and political science at The Honors College at the University of Houston.

N/R

WHAT YOU NEED TO KNOW ABOUT ICE BATHS IN SWIMMING

by Jan Homolak

Cryotherapy is a five-dollar word for application of extreme cold in medical therapy. Although its use in sport is escalating, this form of therapy is old news. Even good old Hippocrates of Kos was advocating this form of therapy back there somewhere around 400 BC.

Hippocrates was glorifying cryotherapy (literally meaning cold medicine) for its pain-relieving benefits. Today, nearly 2,500 years later, many athletes use some form of cryotherapy for anything from sport injury rehabilitation to performance enhancement and speeding up recovery between training sessions.

Use of cryotherapy is clearly shown to be beneficial for pain management and rehabilitation, but when it comes to the benefits in recovery, the field of sports science is somewhat divided. Some say the benefits are outstanding and others propose that this form of recovery stands in the way of adaptation and training gains. As it usually is, the truth is in between the two extremes.

THE PHYSIOLOGY BEHIND THE MAGIC

In order for you to understand when and how you could use this technique to recover faster and more importantly, why it works, I will briefly run through the physiology behind the magic. Getting familiar with the physiological response to cold will help you to implement this form of therapy intuitively in your training and competition schedule.

The first step in understanding the physiology of recovery and adaptation is to understand what the training stimulus does to your body.

Training represents a stressful stimulus designed specifically to induce adaptation and improve functionality of an organism. In other words, training simply represents a challenge, and since a basic principle of life is to adapt, whenever you create a challenge for your body, it naturally tries to adapt so it can be more efficient in the future. How the training will affect your body depends on the duration and intensity of the stimulus and the ability of your body to endure the stress.

Another important principle that needs to be mentioned when we are debating about adaptation is the Arndt-Schulz law, which says that for every substance, small doses stimulate, moderate doses inhibit, large doses kill. Change the word "substance" for "training stimulus," and you will still be right.

In order to create good training, you have to find the sweet spot between effortless and demanding. If you succeed and create such a challenge, you will induce anabiosis—i.e., after you recover, you will be better than before. Your body will be more up to the challenge, and you will do the task more efficiently next time.

This may sound too basic and unrelated to the topic, but true understanding of the training principles illuminates the paradox of the use of cryotherapy for recovery. Loss of function and muscle damage with all of its consequences is crucial for adaptation, and any intervention that speeds up the recovery process by alleviating stressful stimuli will move us to the right on the Arndt-Schulz graph and lessen the need for adaptation and improvement.

HOW TO APPLY THIS KNOWLEDGE

Now that the general idea of inevitable connection of stress and adaptation is, in general, somewhat clearer, I will go through the complicated algorithm and show you why we can't dissect adaptation and stress, and how we can apply this knowledge in swimming training plan construction:

1) In swimming—and any other sport—your muscles have to be functional in order to engage in exercise.

2) Exercise means stress that is primarily metabolic and mechanical in nature.

3) Mechanical stress causes:

• Inflammation (DOMS—delayed onset muscles soreness) by several mechanisms;

• Damage to muscle structural proteins.

4) Metabolic stress causes:

• Na/K ATPase (sodium-potassium adenosine triphosphatase) to stop working because this enzyme needs ATP (cellular energy) in order to work properly;

• Reactive oxygen species (ROS) generation;

• Accumulation of metabolites.

5) Na/K ATPase is very important in regulation of fluid and ion trafficking, and malfunctioning of this enzyme causes edema formation.

6) Edema formation...

• makes it harder for oxygen to be delivered to your muscles because it has to travel longer in order to come to the mitochondria;

• causes compression of blood vessels and lowers blood perfusion.

7) ROS damage DNA, RNA, enzymes, structural proteins and lipids.

HOW ARE THE TERMS IN ALGORITHM RELATED TO TRAINING ADAPTATION?

Both mechanical and metabolic stress is important in adaptation to training. Inflammation is an important part of adaptation to training stimulus, and it has been shown that methods that lower inflammation (such as non-steroidal anti-inflammatory drugs and cryotherapy) reduce adaptation to training.

Metabolic stress activates ROS signaling that is also an important factor in exercise adaptation as well as metabolic waste products (metabolites) that engage in their own signalling pathways.

Edema formation lowers muscle functionality, but also acts as a mechanical stimulus for adaptation and prolongs hypoperfusion stress (i.e., causes muscle to be poorly perfused and, hence, to adapt to poor perfusion by creating new blood vessels).

ROS-induced damage to proteins and other cell components induces creation of new ones and activates cell pathways important for synthesis.

HOW DOES CRYOTHERAPY AFFECT THE TERMS IN ALGORITHM?

Cryotherapy reduces metabolic stress better than mechanical because it slows cell metabolism and, hence, metabolite formation and ROS production. Cold also causes bloodvessels to contract and block edema formation. All this results in lower levels of damage to cell components, lower levels of metabolites and lower inflammation.

On the one hand, this effect speeds up the recovery process, but on the other hand, stimulus important for adaptation as well as important signalling pathways are stopped.

CRYOTHERAPY IN SWIMMING

Now that we understand that recovery and adaptation are inseparable, we have the scientific foundation to make the translation of basic principles to swimming.

Cryotherapy is obviously a good enhancer of recovery, but it should not be overprescribed if we want an athlete to continue adapting.

In swimming, one example of smart use of this recovery method is to use it during part of the season when the swimmer is focusing on performance-specific training and technique development. This way, we can allow swimmers to quantitatively spend more time practicing technique because we will eliminate fatigue that emerges as a consequence of prolonged muscle work, edema formation, etc. Since moving pattern execution is in correlation with time spent practicing, we can facilitate specific training results.

In contrast, using cryotherapy during the period when a swimmer is developing basic strength and endurance skills—and when prolonged stressful stimulus is important—would be contraintuitive because cold application will attenuate the training effect. However, during this period, cryotherapy can help reverse early symptoms of overtraining.

Another great way to take advantage of this recovery method is the implementation of cold baths in the competition period when basic adaptation is not the primary goal. This will allow an athlete to recover more rapidly in between two races, resulting in better overall performance. However, if applied incorrectly or for too long, it can lead to poor performance because muscle and nerves have to be at optimal temperature in order to work efficiently. Cryotherapy also seems to be an effective painkiller, which makes it even more attractive as a recovery tool.

In the end, it should be noted that cryotherapy has its risks. Strong activation of both the sympathetic and parasympathetic nervous system—also called autonomic conflict—can cause potentially fatal arrhythmia. Amateur application can also lead to skin damage.

In conclusion, cryotherapy really is a great recovery tool, but its usefulness depends on how we use it. If you use it in the right way, in the right place and at the right time of the season, there is a great chance you can better your performances. However, if you fail to adjust the therapy to your needs, the results can be nonexistent, bad or even fatal. ◄

MP

FIND YOUR MANTRA

by Brad Jones

[Photo Courtesy: Al Bello]

Modern pain science has taught us a lot about the importance of our thoughts and how they influence the feeling of pain or discomfort. The new research can easily be applied to competitive swimming and how swimmers cope with discomfort during practice and meets.

Pain is an output of the brain, not an input from the body: This is the fundamental paradigm shift that has recently occurred in pain science. Pain is created by the brain, not passively perceived by the brain as a preformed sensation that arrives from the body. Many different parts of the brain help process the pain response, including areas that govern emotions, past memories and future intentions.

If you feel pain, it means that your brain thinks the body is under threat, and that something has to be done about it. In this sense, pain is a survival mechanism of fundamental importance in times of true threat or danger. The more that a swimmer can normalize the discomfort they feel during practice or a meet, the more they can reduce the threat that the brain interprets, which often happens unconsciously.

There is a very real physiological effect that happens when the threat of pain or discomfort is increased or heightened. If a swimmer starts to feel that discomfort that we have all felt during a race and lets his/her thoughts go to a "worst-case or catastrophic scenario," thoughts such as, "*I'm dying,*" or "*I'm never going to make the cut,*" or "*My coach is going to be so pissed,*" will start running through his/her head.

When discomfort strikes, the worst thing you can do is embrace the pain. When you start to focus on the discomfort and think—"*This hurts. I feel tight. My legs are tired.*"—negative thoughts begin to pile on. As the swimmer's nervous system ramps up to the fight or flight mode, the brain will release adrenaline and cortisol, and increase muscle tone—all things that increase the discomfort and make the swimmer slow down.

A POWERFUL TOOL

The mantra is a powerful tool to help swimmers manage discomfort and keep the nervous system in that focused calm place, where the best performances happen. **A mantra, simply put, is a repeated word or phrase used to set or fuel an intention or desired outcome.** An effective mantra addresses what you want to feel, not the adversity you are trying to overcome. A good mantra diverts your mind from thoughts that reinforce the pain to thoughts that help you transcend it. For example, as the discomfort comes on, you might repeat, *"All day. I can deal with this ALL DAY!"* Or you might say, *"Pain. I eat that stuff like candy!"* Or maybe the mantra could be focused on technique: *"Stay long. Breathe. Relax."*

Mantras should be:

- ***Short****—just a few words that can be repeated;*
- ***Positive****—full of action words;*
- ***Individualized****—you must find something that works for you...don't use someone else's mantra;*
- ***Used frequently in practice****—like any skill you develop in swimming, you have to practice it a lot for it to work in a meet situation. To do this, you must get comfortable with discomfort.*

We have all heard of the mind-body connection. All swimmers should understand the power of their thoughts and how they influence performance. Something as simple as a mantra can keep your focus in the right place mentally. A mantra can also help control your physiology and nervous system in a way that will have your body ready to perform at the highest levels. ◄

» MICHAEL PHELPS & RYAN LOCHTE

SPECIAL SETS: 2008 U.S. OLYMPIC TRAINING CAMP

by Michael J. Stott | photos by Peter H. Bick

» ALLISON SCHMITT

» CAROLINE BURCKLE

The 2008 United States Olympic Swimming team consisted of 43 athletes and eight coaches under the direction of National Team Director Mark Schubert. Head coach for the men was Eddie Reese, and his assistants were Bob Bowman, Gregg Troy and Frank Busch. The women were led by Jack Bauerle and assistants Paul Yetter, Teri McKeever and Sean Hutchison.

Schubert delivered the keynote address at the ASCA World Clinic that September, opening with the words, "What we learned in Beijing was that it takes six-and-one-half pounds of pressure to activate the touchpad." His comment, of course, was directed at answering the question in everyone's mind: "How did Michael Phelps win the 100 meter butterfly over Michael Cavic?"

The following is the workout from an open practice on July 12—about a month before the Olympic swimming events began on Aug. 9—that Bowman gave the swimmers in his group (among them, Phelps, Ryan Lochte, Allison Schmitt and Caroline Burckle). Phelps went on to win a record eight gold medals in Beijing, while Lochte added two gold and two bronze, and Schmitt and Burckle both swam on Team USA's 800 free relay that earned the bronze medal.

SATURDAY, JULY 12

Morning workout for Michael Phelps, Ryan Lochte, Allison Schmitt and Caroline Burckle (6,000 meters - LC)

- 800 Mixer
- Kick-casual @ 8:00 + 8 x 50 @ :55 @ 1:20, descend (1-4) x 2
- Pull buoy + paddles—400 breathe 3, 5, 7, 9 by 100s + 4 x 100 on 5:40, descend 1-4 @ 1:20
- Drill 200 IM
- 8 x 50 @ :50, 2 each (1-BUILD, 1-25 Fast + 25 EZ) (3000)

	PHELPS/LOCHTE	*SCHMITT/BURCKLE*
• 16 x 50 @ :45, every 4th FAST -	Fly 26s	Free Held 29s
• 12 x 50 @ :50, every 3rd FAST -	Back 28s	Free Held 29s
• 8 x 50 @ :55, every 2nd FAST -	Breast 33s	Free Held 28s
• 4 x 50 @ :60, all FAST -	Free 26s	Free - BEST YOU CAN!

Coach Bowman: *"I seem to remember Ryan being a little faster on back and breast."*

* 3-minute lactate test and clearance protocol (5000)

- 10 x 100 free @ 1:30 (men hold under 1:08; women hold under 1:12) (6000)
- Test + Swim until 2,000 or under
- Dryland and media afterward ◄

DEVELOPING A FOCUS ON MENTAL TOUGHNESS

by Dave Crampton

Mental toughness in swimming is something that coaches welcome, athletes strive for, scouts seek and most swimming parents ignore!

It is also something that coaches rarely do enough of, athletes do it only if self-driven, and it's something that parents don't understand and want to leave to the professionals.

Similarly, there are some coaches who don't speak much about it, let alone define what it is. Yet these coaches will say mental toughness separates the good swimmers from the great swimmers! So, why don't they focus on it more?

In training, the focus is 90 percent physical and 10 percent mental, but in races, it's 90 percent mental—because there's very little that separates swimmers physically at the elite level.

If swimmers train harder, they will demonstrate their talent and their hard work, and they will get better times—and that's the aim of training. Better times, good technique, good stroking, job done—until it falls apart at a competition...and, suddenly, swimming is not so much fun.

You see, talent, harder training and stroke work do not necessarily lead to mental toughness or resilience. Top swimmers can still get nervous in competition, concentrate on the wrong things or lack self-confidence.

Mental toughness is arguably one of the most important psychological attributes in achieving peak performance. How you develop your mind, how you increase self-confidence, how you improve your focus and how you develop resilience will directly impact how you compete and how you train.

So, here are some starter points:

1. FOCUS ON WHAT YOU CAN CONTROL

Your effort and your attitude—including insecurities or lack of focus—are the only two things you can fully control. You cannot control your lane, the water temperature, the outcome, past results or your competitors' performances—so why even consider thinking about them? Instead, use self-talk: the internal monologue we carry on with ourselves, as opposed to talking aloud with others.

Remember this: your words dictate your thoughts; your thoughts control your actions; and your actions determine your success.

2. FOCUS ON INTRINSIC MOTIVATION

Motivation is the prerequisite for all mental toughness, based on learned habits that form the foundation of mental beliefs that have the potential to transform a good swimmer into a great swimmer.

There are two types of motivation: extrinsic and intrinsic. Athletes with extrinsic motivation are moved by external factors, such as beating others, fame or money. Intrinsic motivation comes from within. If you enjoy an activity or see it as an opportunity to explore, learn and actualize your potential, you are more likely to reach it.

Intrinsic motivation should outweigh extrinsic factors. Focusing on intrinsic motivation will keep you motivated throughout your career and help you realize why you love your sport.

If one does not possess the passion and perseverance for never giving up, the other layers become less important, such as confidence.


[Photo Courtesy: Annie Grevers]

3. FOCUS ON SELF-BELIEF AND CONFIDENCE

To attempt anything in swimming, you need a sense of belief and trust in yourself. You also need some level of trust in your coach, who may well be attempting to instill a greater sense of self-belief beyond your comfort zone.

This self-belief leads to enhanced confidence. Confidence and athletic success are closely correlated, and they reinforce each other. When you swim well, your confidence increases, and when you improve your self-confidence, you tend to swim even better.

Confidence is similar to a built-in GPS system. It's the belief that we will succeed. It is the attitude that we will find a way to succeed. Like a car's GPS system, confidence points us in the direction we're supposed to go. Once we know which direction we're supposed to go, we then make a choice whether or not to go there.

So, confidence facilitates greater focus on the task at hand, be it a personal best or a significant qualifying time. When achieved, this leads to increased self-belief.

But what happens if you don't swim to expectations? You lose confidence, and your focus can diminish. That's where resilience comes in.

4. FOCUS ON RESILIENCE

Resilience is the ability to handle stress, adversity and failure. Some days, things just won't go well no matter how talented you are or how hard you have trained—whether you are mentally tough or not.


[Photo Courtesy: Abby Boone]

You may be plateauing, feel low on energy or regularly placing lower in your races. This is where character develops—or where emotions can take over and you swim below your potential. How your character develops depends on whether you view negative or unwanted performances as a threat or a challenge—whether you overcome them or succumb to them.

Great swimmers have both resilience and mental toughness. Rather than seeing less-than-optimal performances as threats to athletic development and career progression, they're seen as challenges to improve next time.

By being mentally tough and resilient, you can bring your talent, skills and hard work to life. When your mind is in the right place, your body can go into "auto-pilot," and you'll be able to swim at your best without being distracted by any mental or physical blocks. You will overcome challenges, exceed your limitations and perform at your best. ◄

THE AGE PROBLEM IN CANADIAN SWIMMING

by Rick Madge

It probably seems ridiculous to talk about a serious problem in Canadian swimming after their fantastic Olympic results in Rio. Canada won six medals—including one gold—and had an incredible number of second swims. It's the best the country has done in a long time.

But those results are just masking a problem that needs to be addressed right away.

The problem is this: Canada's top swimmers are much younger than the rest of the world, and Canada is getting younger each year.

True, it has some great junior swimmers as well as some great university swimmers, but beyond that, Canada has very little. And the problem is that the vast bulk of Olympic medalists and Olympic finalists are, on average, much older than elite Canadian swimmers.

Put another way, Canadian swimmers are exiting the sport before getting to their prime years.

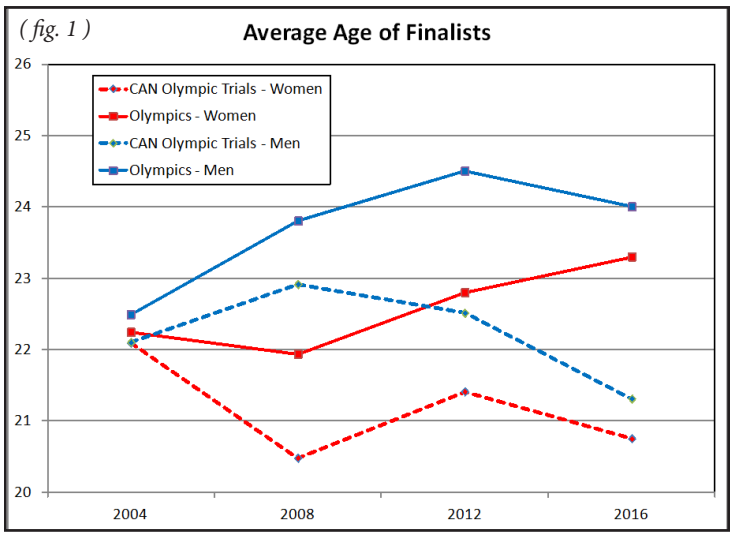
Swimming Canada and its funding partners—including Canadian Sports Institutes, Own The Podium and the Provincial Sporting Organizations—needs to address this now, as well as revisit many of its policies that may have led to this situation. In particular, these organizations need to start programs immediately to assist post-university swimmers in finding employers or sponsors who can allow them to continue in the sport...instead of policies that push them out the door.

For the purpose of this article, these organizations collectively will be referred to as Canadian Swimming Stakeholders.

EXAMINING AGE DATA

Let's take a look at the data. **Fig. 1 ("Average Age of Finalists")** includes Canadian Olympic Trials finalists and Olympic finalists from 2004 to 2016.

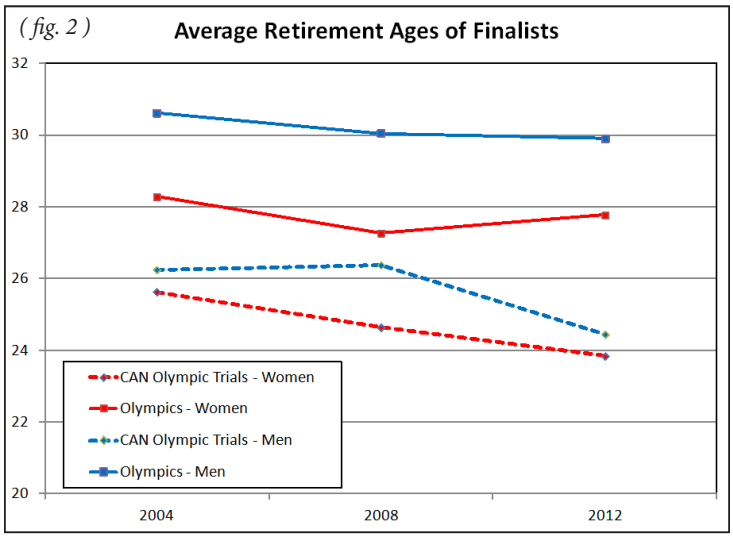
(fig. 1)



What this shows is amazing. In 2004—a truly horrible year for the Canadian Olympic team—the average ages of Canadian Trials finalists and Olympic finalists were very close. Canadian swimmers were statistically the same age as the rest of the world, but clearly something else was getting in the way of elite performances.

Every Olympics since 2004, the age gap has widened to the point that it is now an astonishing 2.5 years! Canada is competing with younger swimmers against a world of older, more mature swimmers.

One interpretation to this data is that young Canadian swimmers are pushing older Canadian swimmers out of the Olympic Trials finals. **Fig. 2 ("Average Retirement Ages of Finalists")** addresses this interpretation by looking at the



average retirement age of finalists from the 2004, 2008 and 2012 Olympics and the Canadian Olympic Trials.

The difference here is even more dramatic. Elite Canadian swimmers are retiring far earlier than elite international swimmers—even in 2004. By 2016, we can see a retirement difference of four years for the women and five-and-a-half years for the men. Clearly, Canada's lack of older swimmers is due to the fact that its swimmers are retiring far earlier than the rest of the world. In fact, they are retiring at about the age that elite international swimmers are just reaching their prime!

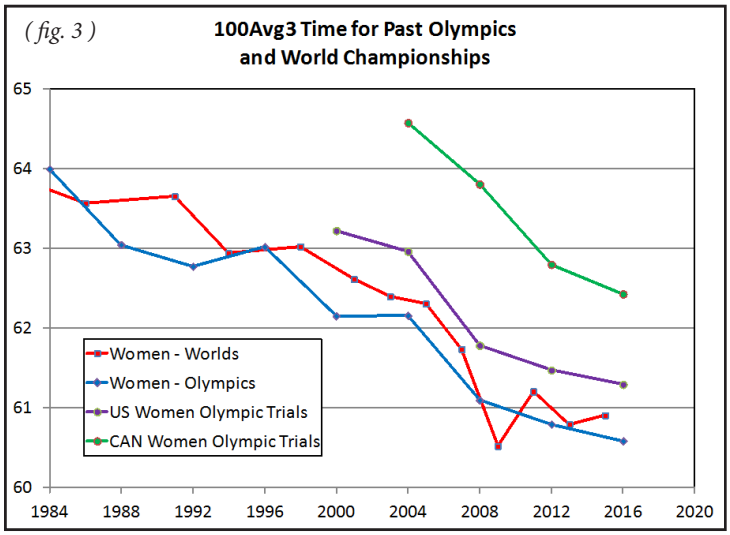
AUTHOR'S NOTE: *It may look like the average retirement age of Olympic finalists is decreasing slightly. However, I couldn't include any swimmers who had not yet retired (and there were a LOT). A quick look at the data while estimating retirement ages for continuing swimmers suggests that the average retirement age is probably increasing slightly.*

EXAMINING PERFORMANCE DATA

The next step was to see if this lack of older swimmers was affecting Canadian performances. After all, Canada did win five medals in Rio and had an enormous number of second swims and finalists.

In my recent blog post, "Are Swimming Performances Starting to Stagnate?" (see https://coachrickswimming.com/2016/09/01/are-swimming-performances-starting-to-stagnate/), I developed a new method to analyze the performances at a swim meet, and then developed a single number for each gender to quantify those performances. This metric, called 100Avg3, takes the average of the top three times for each Olympic event, converts this average to 100 meters, and then averages all of these times to get the 100Avg3 time for the meet.

Fig. 3 ("100Avg3 Time for Past Olympics and World Championships") applies this method to the Canadian and American Olympic Trials and includes my Olympic and World Championship calculations from my blog post.



We can see the world gradually getting faster, with a significant drop during the brief "shiny-suit" era (2008-09). And we can see the U.S. Olympic Trials tracking world times very closely.

In 2004, Canadian women were about 2.4 seconds per 100 meters slower, on average, than the rest of the world. This probably explains the poor performance in Athens. But since 2004, we see a significant improvement in performance times, with the gap to the rest of the world getting smaller. By 2016, Canadian women were only 1.8 seconds per 100 meters slower, and were competing at the level the world was at in the early 2000s. This improvement is quite encouraging for Canadian Swimming.

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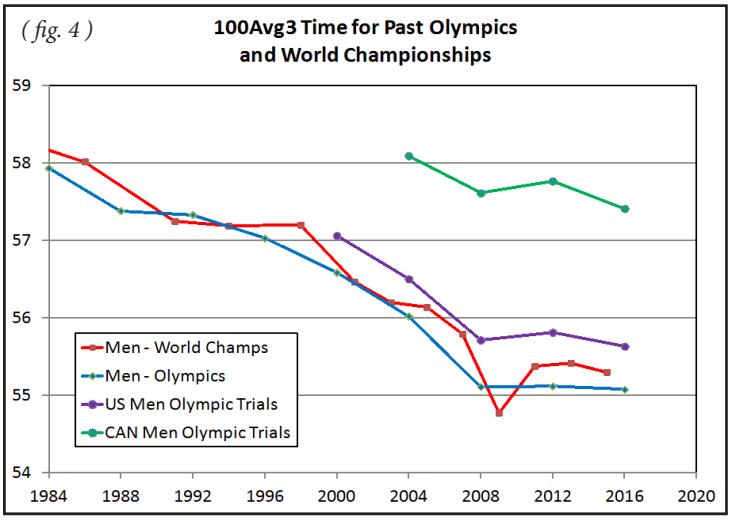

The men's chart (***see Fig. 4, previous page***) shows a drastic difference. In 2004, Canadian men were two seconds higher than the world 100Avg3 time, and that difference has increased since then. The gap is now sitting at 2.4 seconds. Canadian men are now competing at the level the world was at in the late 1980s, and the improvement trend is not encouraging for Canada.

Whatever led to improvements for Canadian women since 2004 has clearly not worked for Canadian men. The big question is why Canada's men are doing so much worse than its women?

MEN AND WOMEN

The answer lies in the difference between how men and women compete. Women generally compete on aerobic fitness and strength/weight ratio. The limited testosterone in their bodies limits their overall strength, so years and years of strength training can only have limited benefits.

Men, however, compete primarily on the basis of strength. Testosterone levels much higher than women allow men to build far more muscle, and that additional muscle must be trained before it's effective. It's the reason why teenage boys can look muscular, but, in general, have significantly less power than equally muscled men.

To illustrate this difference in training time required to reach elite levels, **Fig. 5 ("Medals by Age")** breaks down the Olympic swimming medals from 2004 to 2016 by age.

# of Olympic medals from 2004 to 2016 won by swimmers who were	Women	Men
18 or younger	16	3
19 to 20	28	21
21 to 26	95	100
27 to 28	9	22
29 or older	8	10
NOTE: not including relays; 156 total individual medals available for each gender		

(fig. 5)

Notice the incredible difference between men and women in the 18-and-under age bracket. The difference decreases noticeably for 19- to 20-year-olds. Then the bulk of the medalists are pretty evenly distributed for the ages between 21 and 26. Lastly, there is a slight increase in men's medals over women for the older ages, but clearly women can still win their share of medals when 27 or older.

This table shows that women can compete at an elite level at ages much younger than men, while still competing in the older age ranges as well. From the Canadian point of view, this explains how 16-year-old Penny Oleksiak was able to perform so incredibly well, and why Audrey Lacroix at age 32 was still able to get a second swim in the women's 200 fly. It also explains why Canada's young male teenage stars, such as Javier Acevedo, had trouble breaking through.

CANADA AT RIO

Fig. 6 ("Rio Performances") takes a look at how Canada did in Rio. There are several things that can be concluded from this table.

Rio Olympics Women	Second Swims (Age)	Finals (Age) - Place
50 FR	C. Van Landeghem (22)	
100 FR	P. Oleksiak (16) Van Landeghem (22)	P. Oleksiak (16) – 1st
200 FR	K. Savard (23) B. Maclean (22)	
400 FR		B. Maclean (22) – 5th
100 BK	K. Masse (20) D. Bouchard (25)	K. Masse (20) – 3rd
200 BK	H. Caldwell (25) D. Bouchard (25)	H. Caldwell (25) – 3rd
100 BR	R. Nicol (23)	R. Nicol (23) – 5th
200 BR	K. Smith (22)	K. Smith (22) – 7th
100 FL	P. Oleksiak (16)	P. Oleksiak (16) – 2nd
200 FL	A. Lacroix (32)	
200 IM	S. Pickrem (19) E. Seltenreich-Hodgson (21)	S. Pickrem (19) – 6th
400 IM	E. Overholt (19)	E. Overholt (19) – 5th
Men		
50 FR	S. Condorelli (21)	
100 FR	S. Condorelli (21) Y. Kisil (20)	S. Condorelli (21) – 4th
1500 FR		R. Cochrane (27) – 6th
100 FL	S. Condorelli (21)	

(fig. 6)

First of all, the Canadian women are certainly doing much better than the men. But notice that nearly all of this success is coming from women who are 23 years old or younger.


[Photo Courtesy: Vaughn Ridley/Swimming Canada]

» PENNY OLEKSIAK

Canadian women are clearly benefiting from the fact that younger women can compete at the elite level more easily than men. But it also shows that Canada has a huge hole in the program in terms of older female swimmers.

Secondly, the limited success on the men's side is generally coming from young men, although Ryan Cochrane, 27, finished sixth in the 1500 free. Interestingly, Santo Condorelli had three of the five Canadian men's second swims, but is actually U.S.-trained and can compete for Canada on the basis of his Canadian-born mother. Since he isn't a product of the Swimming Canada system, it's almost unfair to include him in the analysis. Without him, Canadian men only had two second swims.

Given the generally young age of elite Canadian men and the tendency for elite international men to be older, it may not be surprising that Canada had limited success on the men's side in Rio.

POSSIBLE CAUSES OF CANADA'S EARLY RETIREMENT PROBLEM

After reviewing the data in Figs. 1-6, it's only natural to speculate as to why Canada has a problem of keeping its swimmers in the sport as long as other countries around the world.

The problem is seriously hurting all ages on the men's side, and while Canadian women are certainly achieving success, the data suggests that keeping Canada's elite women in the sport longer would certainly bring even more success.

Here are four possible reasons as to why Canadian swimmers are exiting the sport far too early:

1) The sport's infrastructure in Canada doesn't support swimmers past university age. Once a swimmer has finished college, he or she is faced with limited options. Generally, universities will allow post-university swimmers to train with them, but not all of those teams are geared toward international swimming. The competition season is filled with university meets, while elite swimmers need to get to international meets.

Another option is for swimmers to go to one of the few Canadian super clubs, where they will be expected to compete at international meets. However, there aren't many such clubs, and finding one in the same area as a potential job market can be difficult.

The key here is that the swimmer must be either independently wealthy, or he or she has to find a job **(see #2 below about funding problems)**. But the job needs to provide adequate pay plus frequent time off for training and swim meets. And if at all possible, it should provide some experience to assist the swimmer in his/her post-swimming life.

To make things worse, even universities are not fully on board with supporting athletes. Many university athletes in challenging programs (e.g., engineering) report that no special consideration is given to athletes when there's a conflict between a big athletic competition and tests, exams or assignments.

Possible Solution: Canadian Swimming Stakeholders need to do far more to assist swimmers during their post-university life. They need to assist swimmers in the process of finding appropriate jobs that will provide the flexibility required to compete at an elite level, and possibly even provide them with useful experience for their post-swimming life.

They should also be more active in assisting swimmers to find corporate sponsorships so that the swimmer doesn't have to make that "eat-or-swim" decision.

2) The Canadian Swimming Stakeholders made changes in the last

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[Photo Courtesy: Rob Schumacher/USA Today Sports Images]

» SANTO CONDORELLI

quadrennial toward funding and team selection on the basis of a multiple priority system, including an important one that favors younger fast swimmers over post-university faster swimmers. This "trending time" criteria places even more arbitrary obstacles in front of post-university swimmers who are already facing difficult job/training tradeoffs. Ignoring Canadian Trials champions and/or taking away national funding just pushes older swimmers out of the sport.

The worst part is that there is no guarantee that these younger swimmers will ever get faster than the older ones they replaced. It's all a bet on the part of the Canadian Swimming Stakeholders—and one that often has unfortunate consequences for the defunded swimmer.

Here's an example: Zack Chetrat of Toronto won the 200 fly at the 2014 Canadian Swimming Trials. However, Chetrat, who was 24 at the time, wasn't selected for the British Commonwealth Games team. Instead, Canada selected Evan White, 18, and Gamal Assaad, 19, who were each three or more seconds slower than Chetrat. And while both White and Assaad swam well at the British Commonwealth Games, neither made finals. To his credit, Chetrat didn't quit, and in 2015, he was selected to the Pan Am Games team and ended up with a silver medal and a Canadian record at the Games.

But not everybody is so fortunate. Some defunded swimmers in their early 20s responded by quitting. The case of Matthew Swanston, for example, is well known. As a multiple-time Canadian champion in backstroke, Swanston ended up leaving the sport in anger after too many slights on the part of Swimming Canada.

The impact of this funding/team selection policy on older swimmers in Canada has been devastating. Rather than face that type of treatment, they pre-emptively exit the sport and look for a job so they can start their "real life." The result is that Canada's few older elite swimmers are often self-funded or family-funded.

Possible Solution: The Canadian Swimming Stakeholders fully need to embrace the philosophy of adequately supporting the fastest swimmers in Canada—regardless of age. These swimmers need to be celebrated and funded, where possible—not demoralized and set adrift.

At the same time, the Stakeholders should continue to provide a solid development and acknowledgement program for younger swimmers with a promising future, while being aware that fast swimmers in their mid-teens don't always end up being fast swimmers in their mid-20s .

3) Canada is one of those few countries that has established artificially lower qualifying times to swim in the Olympics (or other major championships). As far as I can tell, these times roughly correspond to somewhere around 12th- to 16th-place at the World Championships from the year before. The rationale of not bringing anyone who doesn't have a reasonable chance for a second swim may sound harsh, but it's legitimate.

However, the ripple effect is enormous. Swimmers know that you not only have to place in the top two at the Trials—something every swimmer is fully prepared to address—but you also have to swim a truly world-class time in the finals. Putting such artificial, but significant roadblocks in front of swimmers may tip the risk/reward balance in favor of exiting the sport and starting their non-competitive swimming lives. And this decision to exit the sport will affect everyone around that swimmer as well.

Putting this in perspective, Canada only fielded two male swimmers in two events in Rio—the 50 and 100 free. In six other events, Canada fielded one male swimmer...and in five more events, it didn't field any swimmers.

The bottom line is that the harder it is to make the team, the lower the chance that a swimmer will commit to the years of hard training and put off their life in order to take that risk.

This is the exact opposite of generating excitement and emotional connections in the sport.

Possible Solution: Get as many swimmers into major international competitions as possible. Find the money however possible. When this happens, the excitement of being in a major championship ripples through the whole swimming community.

4) Changes by Swimming Canada in the last quadrennial also involved drastically lowering Age Group Nationals (AGN) qualifying times, requiring swimmers to make three times just to swim in the meet.

In 2012, the AGN meet had roughly 1,800 swimmers in attendance at the four-day meet, and that certainly strained the ability of the meet organizers to make things run smoothly. Swimming Canada responded the next year with the changes previously mentioned.

To many, the changes seemed like a bit of an overreaction, but necessary nonetheless. But the underlying problem was that the changes resulted in a meet in which there weren't even enough qualifiers to fill some finals!

It now appears that this meet may be cancelled permanently, in favor of a junior nationals-type meet.

There are three repercussions from these AGN qualifying changes:

• The big meet format created a "depth machine" for Canadian Swimming. Qualifying for this meet galvanized not just the swimmers in attendance, but the swimmers in their home clubs. This created a huge amount of excitement in age group swimming, and was the focal point of the year for many.

The drastic changes by Swimming Canada created a meet roughly one-third the original size, sending a massive message of failure to age group swimmers as well as the other swimmers in their home club. If you didn't make the new times, you just weren't good enough. Age group swimming survives on excitement and the contemplation of the possible. The changes seriously hurt that.

• The new qualifying requirements benefited early-maturing swimmers and genetically-gifted swimmers, and they penalized late-maturing swimmers. The problem is that Canada's age analysis shows that swimmers don't reach their peak until their early- to mid-20s, and can swim at an elite level into their 30s. Is it reasonable to think that pressured, early-maturing swimmers will stay in the sport that long...or that discouraged, late-maturing swimmers will stick around to see if they can make it big?

• The tougher qualifying times put even more pressure on young swimmers to train even harder in order to make those times. This grinding effect may, indeed, push some swimmers to higher levels, but it can also lead to burnout. And Canada doesn't have a large enough population base to grind swimmers and hope they will remain in the sport a decade later.

Possible Solution: It may be too late now. But if possible, Swimming Canada should reinstate qualifying times for Age Group Nationals that allow as many swimmers as possible into the meet. The ripple effect of that excitement will galvanize the swimming community.

The Canadian Swimming Stakeholders should also develop methods of ensuring that late-maturing swimmers aren't left out of the excitement. Fast age-groupers are great, but Canada needs these potential future stars in the sport for at least another decade or more.

SUMMARY

The data clearly shows that Canadian male and female swimmers are leaving the sport far too early. The lack of older elite male swimmers has been devastating in the country's international performances.

And while the women are doing much better than men in international competitions—mainly because women can compete at an elite level at a much younger age than men—Canada is still losing out on the benefit of having its female swimmers stay in the sport longer. Remember, Canada should want its elite athletes staying in the sport until their late-20s or early-30s. And it is nowhere near that right now.

The Canadian Swimming Stakeholders need to acknowledge and investigate this problem as soon as possible. Policies should be revisited, and an honest evaluation carried out to determine the real effects.

Just as importantly, the Stakeholders also need to start programs to assist post-university swimmers in finding suitable employment that enables them to swim as well as enhances their post-swimming careers. And they actively need to seek out corporate sponsorships for post-university swimmers. ◄

About the author:
Rick Madge is head coach of the Mighty Tritons Aquatic Club in Milton, Ontario, Canada, and is a former Canadian national swim team member (many decades ago). He's also an engineer, and he uses his love of science and his love of swimming when writing his CoachRickSwimming.com blog.

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TRAINING LOAD AND ILLNESS MANAGEMENT IN SWIMMERS

by David Pyne

[Photo Courtesy: Delly Carr / Swimming Australia Ltd.]

The demands of balancing the training load and risk of fatigue, injury and illness have long occupied the minds of swimming coaches and scientists. The training of high-level swimmers—predominantly the pool training, but also the demands of dryland and conditioning work—is one of several factors that influence the risk of illness. Illness is an inconvenience at best, and moderate to severe symptoms at the time of competition might very well put a swimmer out of medal contention. Coaches and swimmers are keen to adopt strategies that minimize the risk of illness and injury.

WHAT DOES RESEARCH TELL US ABOUT HIGH-PERFORMANCE SWIMMING AND THE PATTERN OF ILLNESS?

A large prospective study of national-level French swimmers over a four-year period showed the risk of common illnesses was significantly higher:

- *during periods of intensive training rather than the build-up, taper or competition;*
- *in national rather than international swimmers; and*
- *after a previous occurrence of illness (Hellard, et al. 2015).*

The odds of respiratory illness increased in proportion to increases in resistance and high-load swimming training. Clearly, attention should be paid to the prescription of training particularly during intensive periods (regular weekly training and training camps) and over winter. Given the importance of competition, it is also recommended that team and individual swimmer needs be assessed prior to and during local, national and international swim meets.

Experienced coaches understand it is the cumulative effects of training load that is the issue as the season progresses. Traditionally, the focus of discussion has been to avoid overloading of swimmers. This is a reasonable and common-sense approach, given the accepted paradigm that doing too much too soon can increase the risk of injury and/or illness.

However, in recent years, the approach to minimizing problems has broadened to account for both underloading and overloading. In many cases, problems are caused by overloading, in which the swimmer is unable to cope with increases in training load. However, both the practical experience of coaches and, more recently, some research studies point to the issue of underloading as a primary cause of injury and illness. Underloading occurs when a swimmer takes a break after a major competition or misses training because of an injury, illness or some other personal reason.

A new term has emerged in high-performance sport that provides the coach with a means of objectively determining the degree of underloading and overloading. The likely risk of injury and illness can be identified using the so-called "acute:chronic workload ratio" or its predecessor, the "training stress balance" (Gabbett, et al. 2016). Although most of the research to date has examined relationships between injury and the acute:chronic workload ratio, it is likely this paradigm also fits the risk of illness. A large study in athletics (Raysmith and Drew 2016) points to these relationships, and more research on patterns of illness and training in high-level swimmers would be useful.

Guidelines for minimizing the risk of illness include

establishing a good (moderate) level of training over several weeks and ensuring this is maintained on a consistent basis. Many coaches and scientists advise that consistency in training is a good attribute and give priority to avoiding large week-to-week fluctuations in training loads. Illness doesn't always coincide with the heaviest periods of training, and there is often a lag period where the swimmer shows signs of symptoms in the weeks after a competition or a spike in training loads. It can be useful to think of a range—or the so-called "floor and ceiling"—in training frequency and volume to keep swimmers in good shape.

For example, an age group swimmer is comfortable with four to six sessions per week, totaling 15,000 to 30,000 meters; or a senior swimmer might typically complete nine to 10 sessions in the pool, totaling 40,000 to 50,000 meters. Coaches have learned from experience that if you try and increase too quickly from outside this individualized range, then problems can ensue.

HOW DOES A COACH KEEP TRACK OF TRAINING LOAD?

Load is defined by scientists as the product (combination) of training duration (volume) and training intensity. Training volume is easy to determine in swimming by recording the yardage completed in each session every week.

Training intensity is a bit harder to quantify. A lot of work has gone into using heart rate, or perceived exertion, or combination measures like the session-RPE (rating of perceived exertion). Another method is to quantify the volume of yards/meters of training as a function of race pace—i.e., how many meters above, at or below race pace.

A challenge comes in how you combine the pool and dryland elements of training into a single measure of metric. For example, how does a 6,000-meter session in the pool compare with an intensive 30-to-40-minute session of resistance training in the weight room? Coaches should keep a detailed logbook, using either the traditional hard-copy variety or an online package that are now readily available.

The impact of training load is best measured by a combination of measures, including sleep duration and quality, perceived fatigue, soreness, mood state and recovery (Crowcroft, et al. 2016) in addition to training and competition performances. These measures are usually self-recorded by the swimmer and provide a means of monitoring how a swimmer is feeling—and responding to the training program—from day to day.

Similar to training, large or persisent deviations away from an individual's typical response profile is worth investigating. These measures or groups of measures are useful, but best combined with the coach's observations and a face-to-face conversation with the swimmer.

Swimmers with a prior history of problems—perhaps a pattern of recurrent or persistent illnesses—warrant close attention. Other individual factors to consider include age, training background and recent training history.

It is worth having a conversation with a newly arrived swimmer on what training they have done in the past and in recent weeks. It is often useful to contact the swimmer's previous coach to ascertain more background details on their swimming, training history, issues with illness or injury and, of course, personality, character and temperament. Sometimes, other lifestyle issues are a factor at home or at school/college, given that personal relationships can become stressful enough to impact training.

Other considerations to minimize the risk of illness include management of any underlying health or medical issues, good sleep practices, good personal hygiene as well as nutrition and dietary issues. Given the central role of the swim coach, he or she should maintain close interaction with the swimmers, parents, assistant coaches, support staff and relevant medical practitioners on training and health issues. ◄

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PRESEASON SETS

by Michael J. Stott

This special set piece concentrates on college preseason practices before the start of the official season.

In the afterglow of the Olympics, college swimmers have traipsed back to campus, faced with the prospect of starting over or continuing a summer of successful training. NCAA rules regulate the amount of preseason activity that supervised athletes can perform.

"D-I and D-II are allowed a 144-day season in which they are permitted 20 hours of required countable athletically-related activity (CARA)," says Joel Shinofield, executive director of the College Swim Coaches Association of America. "During the school year, outside of the 144-day declared season, teams are allowed eight hours of CARA per week with slightly different policies on use. Coaches have flexibility on when to start their 144 days and how they plan the periods of 20-hour weeks and eight-hours weeks," he says.

Preseason conditioning is rife with different approaches, and coaches are ingenious in concocting various forms of training to persuade returning natives to get with their programs. Before classes even start, often the weight room becomes a coaches' library of choice. Holding class outside is another. At Georgia, Coach Jack Bauerle entreats athletes to push 45-pound barbell plates across an Astroturf practice field. They push "with their hands, pumping their legs very close to the ground. We usually do relays. If they win, they can sit one out," he says.

Running is done at Sanford Stadium, where "steps are very much a part of our August/September tradition—so much so that some of the second-year kids actually do some before they ever come back," says Bauerle.

When Randy Reese, now at Clearwater Aquatic Team, was at the University of Florida, his team did a lot of river swimming. They also did plenty of "wheels," whereby swimmers rolled themselves up stadium ramps on two-by-fours strapped to a small set of wheels. Swimmers placed the contraption under their knees, laid out in a push-up position, and then used their hands to propel themselves up the inclines in Ben Hill Griffin Stadium.

Not to be outdone, D-III programs are also all-in, albeit on a little different level than D-I and D-II programs. "All divisions are allotted a certain number of weeks that they can have official workouts, which are defined as structured practices under the direction of a coach," says Denison coach Gregg Parini. "Typically, D-I/D-II programs are given more weeks than D-III, which is allotted 19 weeks of official practice.

"Counting back 19 weeks from the last non-championship meet of the year gives us the starting date of our season. Weeks in which the athletes are not involved in official practices (i.e., Thanksgiving week) do not count against the 19 weeks," he says. Parini also notes that some conferences have more restrictive rules than the NCAA—thereby cutting back on training opportunities for their athletes.

D-III school approaches regarding preseason practices vary widely. When she was at Washington & Lee, the team did not normally have preseason practices, says past captain Susan Crook. "When we did, our coach often gave us sets," she says.

At Denison, home of the men's 2016 national champions, the coaching staff posts workouts for the swimmers to use during rec/lap swims that are open to the entire campus. "Our senior leadership focuses its attention on team-building

exercises during the preseason that will ultimately carry over to the regular season. Per NCAA rules, workouts during the preseason are strictly voluntary—a rule we take seriously and abide by consistently," he says.


[Photo Courtesy: Haley Good]

» MARIAH WILLIAMSON (LEFT) & KENYON TEAMMATES

KENYON WORKOUTS

At rival Kenyon, forever a dominant D-III aquatic force and runner-up to Denison last March, preseason training is captain-centric. "I think the biggest idea the seniors at Kenyon try to incorporate in pre-practice is preparation. Very literally, this means bringing everyone to a point where they can handle the workload associated with the season physically and understand the basic terminology/practice structure," says Wes Manz, a former captain and member of the Lords' 2015 winning 200 medley and freestyle relays.

"It also means providing the basics of what is to come once the rigors of the real season hit. We try to construct the captain's practice schedule so athletes can make necessary changes to succeed in their academic endeavors—before they're asked to run full-bore, building into the season.

"Returning to campus, there is a wide-range of physical fitness within the team. This is the result of many factors largely, I believe, because of the inability of our college coaches to run a club team. This puts all D-III teams in a precarious position to start the year. Start too hard, too early, and you risk injuring those who took the summer off. Start too slowly, too late, and you're banking on the conference meet as your only solid option for NCAA cuts (like the NESCAC). This requires the seniors to have an honest idea of where their teammates are and adjust the work accordingly," says Manz.

Kenyon has a tradition of selecting captains at the conclusion of the season. "This gives the entire senior class a unique opportunity to reach the team on a more individual level. While the seniors act as a unit to create and run team-wide swim workouts, seniors associated with different training groups help bring the freshmen along in more specific workouts, such as sprint lifting versus distance dryland," he says.

Wes Manz Sample Workout

WARM-UP
- 300 easy
- 2 x 150 easy - 25 kick/50 swim free
- 6 x 50 moderate - 25 drill/25 swim choice
- 4 x 25 variable sprint - fast/easy, easy/fast, easy, fast

1,000 (1,000)

MAIN 1 - 4 ROUNDS
- 2 x 50 swim moderate - IM order by round
- 4 x 50 kick moderate/fast - choice
- 1 x 50 easy
- 2 x 100 swim moderate/fast - free on short interval

3,200 (2,200)

MAIN 2 - 2 ROUNDS
- 1 x 75 moderate - technique swimming, main stroke
- 4 x 25 easy - skull/drill by 25
- 1 x 75 easy - free

3,700 (500)

WARM-DOWN
- 200 easy - loosen

3,900 (200)

* * *

Another Kenyon captain and distance ace, Mariah Williamson, graduated in 2016 as a 15-time All-American. For her career, she finished top eight in all 12 individual events she swam at NCAAs.

Given the NCAA prohibition against early coach involvement, Kenyon official practices usually began toward the end of September. "For the first couple weeks of school, the senior class writes practices and organizes a lifting schedule," says Williamson. "Given that we vote on captains at season's end, the whole senior class generally works together to lead the rest of the team during these weeks.

"We don't typically write intervals beforehand, although sometimes we make suggestions. There's a wide variation of fitness levels during the first few weeks back, so some people may be able to make an interval that others can't. We generally work through these practices in groups based on preferred intervals, but the whole team is in the pool at once, so it feels like a 'real' practice.

CONTINUED »»

"These sessions aren't mandatory, but most of the team makes an effort to be there, so there's generally a good turnout." says Williamson.

Following is another example of a Kenyon set during the first weeks of the season when the pool is set in long course meters:

- 1 x 300 freestyle, open turns
- 3 x 100 choice, 50 kick/50 swim
- 6 x 50 choice, odds scull/swim evens drill/swim

- 1 x 200 free, NS (negative split) easy/moderate, emphasize turns (fast into/dolphin kicking out of)
- 3 x 100 free SD (step down, descend) 1-3
- 8 x 50 IMO 1 kick/drill 1 drill/swim (moderate)
- 3 x 100 IM SD 1-3

- 1 x 200 kick easy, on your back working on streamline
- 3 x 100 kick choice moderate
- 6 x 50 kick fast, choose a challenging interval

-100 easy cool-down
(3,000 meters total)

* * *

[Photo Courtesy: Haley Good]

» ARTHUR CONOVER OF KENYON

Arthur Conover was Kenyon's 1650 national champion in 2015 and will be counted on as one of the team's leaders for the 2016-17 season. He was all-in when swimmers arrived on campus in September, joining other seniors who split dryland, lifting and in-water responsibilities.

Conover says, "I have three focuses for fall practices:

• Fostering a team dynamic: for the first few practices together as a new team, we want everyone to feel that they are doing things together.

• Introducing the freshmen and reminding the team of practice conventions: we use a color system to dictate intensity, so we want to teach the system to freshmen and refresh it for returning swimmers.

• Giving swimmers the opportunity to swim a practice that challenges them properly: since swimmers will be in different places fitness-wise, and considering that we want to foster a team dynamic, this means having a couple options for finishing points.

Arthur Conover Sample Workout

OPTION #1 (LC)

WARM-UP
- 300 easy freestyle
- 3 x 100, scull/swim by 25
- 6 x 50, 25 choice, 25 freestyle

MAIN SET
3 rounds of the following:
- 3 x 50 kick, 1 easy, 1 moderate, 1 fast
- 100 IM, ascend by round fast to easy
- 100 freestyle, descend by round easy to fast
- 50 easy and regroup for the next round.

(Option #1 to finish: 100 easy, total 2,200)

OPTION #2 (LC)

WARM-UP AND MAIN SET
- Same as Option #1

Add 4 rounds of the following:
- 2 x 50 IMO by round, kick/drill by 25
- 4 x 25 variable sprint (1 fast/easy, 1 easy/fast, 1 easy, 1 fast)

(Option #2 to finish: 100 easy, total 3,000)

OPTION #3 (LC)

Option to do next set once or twice. If twice, pull second round.
- 400 free easy
- 300 free easy/moderate
- 200 free moderate
- 100 free fast
- Finish (100 easy, total 4,000 or 5,000)

"These practices are optional, but highly encouraged," says Conover. "We ask that swimmers attend at least four per week, but we will hold seven or eight weekly. In addition to this, there will be three scheduled times for freshmen to lift with upperclassmen to learn what we do in the weight room." ◄

HOW TO SET SWIMMING GOALS LIKE A B.A.D.A.S.S.

by Dave Crampton

[Photo Courtesy: Christopher Hanewinckel-USA TODAY Sports]

Most people involved in swimming have goals—everyone wants to win with a personal best time, but not all do. The problem is that many don't have a plan to reach their outcome goals.

Goal setting is one tool to help you create a vision of what you want to accomplish...with a plan for how to get there. If you know what outcome you want to accomplish—be it a personal best or a significant qualifying time—you may need to set some specific short-term process goals and longer-term performance goals to motivate yourself to get there.

In fact, of all goal setting, process goals are the most important... but the most neglected by both swimmers and coaches. These are goals set during training sessions and address the question, *"What am I here to achieve in the pool today?"* They motivate you to do better each day. Without them, you won't achieve your true potential, and your outcome goals will be either too easy or irrelevant.

When you set your goals, you should first set your outcome goal, then set your process goals to lead to that outcome. However, when you take steps to achieve your outcome, you must first tackle your process goals. These goals should include your mental approach—such as visualization—your technical proficiency, your race plan and tactics, physical preparation and nutrition.

You should also set performance goals that track your improvement in the pool. These goals are a key indicator to achieving good outcome goals. They address the question, *"How have my training sessions improved my swimming?"* But if you don't meet your process goals, all other goals are vague and irrelevant.

Outcome goals are focused on the end of the process, such as getting that qualifying time, national title or personal best time. They address the question, *"Did I produce my optimal performance?"*

THE B.A.D.A.S.S. APPROACH

American strongman competitor Josh Thigpen has what he calls the B.A.D.A.S.S approach to setting performance goals. It's SMART—**S**pecific, **M**easurable, **A**ttainable, **R**ealistic and **T**ime-bound—and requires commitment and mental toughness. It also requires resilience if things don't immediately go to plan.

First, you have to BELIEVE that you can reach the goal you set. If you don't believe you can achieve your goal, you most probably won't attain it. Once you have that belief, then you can take ACTION to reach that goal. The first action is to write down the goal and act on it at your next training session.

You must then have the DISCIPLINE to continue the actions repeatedly in training—even when you'd rather not, or it gets too hard. After a while, it's good to ASSESS and identify what is working and what is not working. Once you have done that, you then SIMPLIFY your goals and cut out what is not working—you should streamline things to reach your goal.

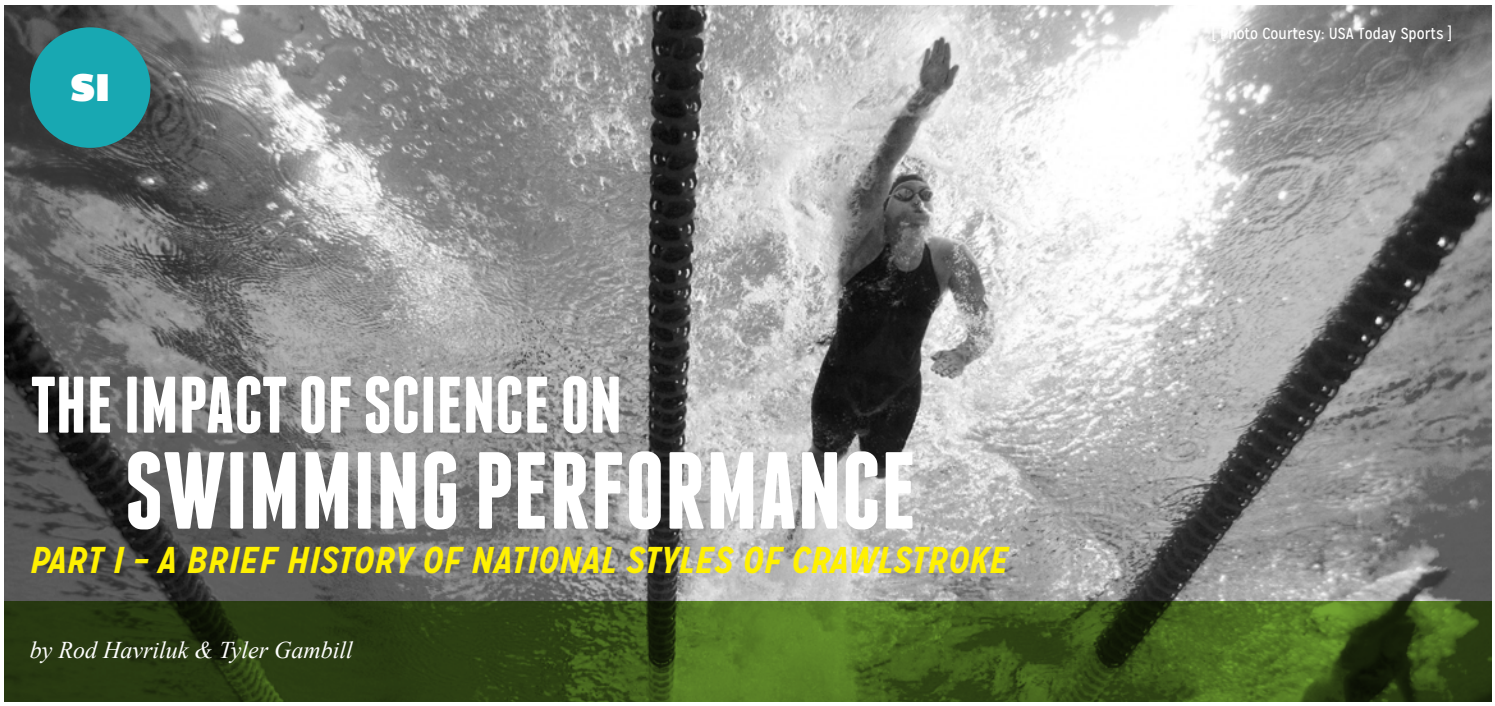
Finally, you must STAY THE COURSE and be resilient when things get tough or if you have some failures despite following the other steps. Resilience means picking yourself up and revisiting the first step: belief. If you believe and follow the steps, you will reach your goal and achieve your optimal performance.

Then you can reward yourself for a job well done. You are a "B.A.D.A.S.S." ◂

BENEFITS OF SETTING GOALS

- *Goals assist in creating accountability and help swimmers maintain a good attitude. This is because goals are challenging, they provide direction (since they give swimmers something to work toward), and goals develop a swimmer's skills.*

- *Goals also provide a means to evaluate progress. They make the job of coaching easier, and they offer further opportunities at a higher level in the sport.*



THE IMPACT OF SCIENCE ON SWIMMING PERFORMANCE

PART I – A BRIEF HISTORY OF NATIONAL STYLES OF CRAWLSTROKE

by Rod Havriluk & Tyler Gambill

The end of an Olympiad is the perfect time to review progress made over the past four years. With swimming world records available for well over a century of performances, it is also a fitting time for an historical review. Specifically, dramatic fluctuations in the rate of improvement are coincidental with major historical events and suggest we can determine the impact of science on performance.

The graph in Figure 1 shows the rate of improvement (ROI) by Olympiad for all Olympic freestyle events. The graph includes data for all the Olympic crawlstroke (freestyle) events: 100, 200, and 400 meters for men and women; 800 meters for women; and 1500 meters for men. The improvement for each event was calculated by Olympiad as the time per 100 meters so that the distance of an event would not skew the data.

(fig.1)

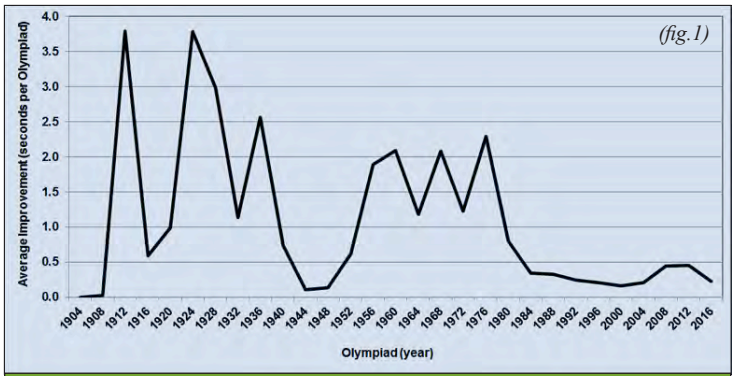


Figure 1. *The average rate of improvement by Olympiad for all freestyle events from 1908 to 2016.*

The most prominent are peaks at 1912 and 1924, with a smaller peak at 1936 and a sustained peak from 1956 to 1980. Noted troughs occurred at 1916 to 1920, 1940 to 1952, and since 1980. Before addressing swim-related events, it is important to recognize that the first two troughs are coincidental with world wars. It is understandable that global conflict could have had an impact on these trends.

As far as swimming history, the variations in the rate of improvement are consistent with events associated with the application of both trial-and-error experience and science. Part one of this three-part article examines the first experience era from 1904 to 1960. Coach Forbes Carlile first identified this trial-and-error process used to improve technique in his 1963 classic book, "Forbes Carlile on Swimming."

CARLILE IDENTIFIES NATIONAL STYLES OF CRAWLSTROKE (FREESTYLE)

The major freestyle technique changes from 1904 to 1960 indicate a relationship with the ROI. Carlile attributed a "national style" to the country with the most prominent (and usually successful) technique elements over a period of years. An examination of the key technique elements of each national style provides a rationale for changes in the ROI.

(fig.2)

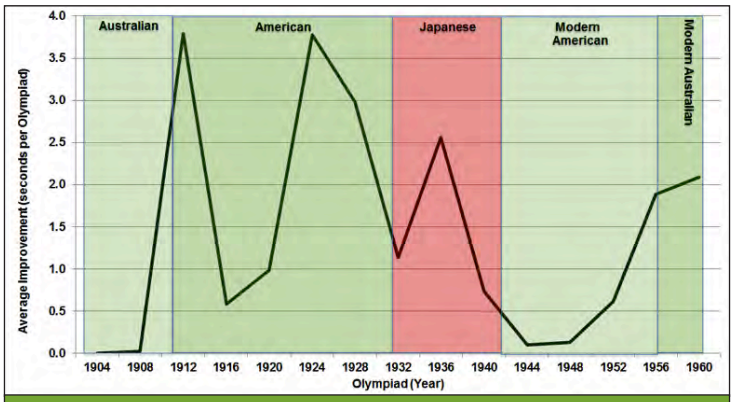


Figure 2. *The average rate of improvement by Olympiad for all freestyle events from 1904 to 1960 with the time periods for each national style.*

AUSTRALIAN CRAWL

There was a rapid improvement in performance during the time period of the Australian Crawl. As shown in Table 1 (next page), the Australian Crawl had a number of effective technique elements including a vertical flutter kick, flexing


[Photo Courtesy: John Valenzuela]

the elbow on the arm recovery, and breathing to the side. It is likely that each technique element was the result of coaching experience, but they are each also scientifically defensible.

The resulting performance improvements are not only supported by science, but also by the success of swimmers from the country of the national style. While swimmers from many countries certainly benefitted from Australian Crawl technique elements, Australians benefitted the most as they set 45% of the freestyle world records during the Australian Crawl years of popularity.

AMERICAN CRAWL

There was also a rapid improvement in performance during the time period of the American Crawl. Substantial improvements over the Australian Crawl included very effective technique elements such as elbow flexion on both the pull and push phases. Another important improvement was an "arms opposite" coordination that provided a more continuous source of propulsion. Once again, while technique improvements were likely based on the insight from coaching experience, they had a sound basis in science.

Once again, swimmers from the country of the national style enjoyed success. During the years of the American Crawl, Americans set 59% of the world records.

JAPANESE CRAWL

There was a more modest improvement in the ROI at the beginning of the Japanese Crawl years of popularity. However, by the end of this time period, the ROI was the slowest in history to that date.

In contrast to the success of the Australian and American Crawls, the Japanese Crawl had major technique limitations. One technique regression was that the backward hand motion ended at the hip. The main drawback, however, was that the glide after the arm entry negatively affected the arm coordination producing gaps in propulsion. In the case of the Japanese Crawl, the trial-and-error process clearly produced a major error that would later be confirmed by science (Counsilman, 1955).

In contrast to the success of the previous national styles, the Japanese did not fare as well with their national style. In fact, during the time of the Japanese Crawl, there were no world records set by Japanese swimmers.

MODERN AMERICAN CRAWL

There was a very slow ROI at the beginning of the Modern American Crawl period, but a much more impressive ROI towards the end. One important technique advancement was keeping the arm near the body midline to increase the mechanical advantage. Once again, the experiential process was consistent with scientific principles.

Americans did not see significant benefit from their new national style, probably because of a confounding factor. Carlile noted that the glide after the arm entry (of the Japanese Crawl) was not eliminated until the Modern Australian Crawl debuted in 1956. Consequently, swimmers probably suffered from this technique element throughout the years of the Modern American Crawl, resulting in only 20% of the world records set by Americans.

MODERN AUSTRALIAN CRAWL

The ROI continued to increase from the end of the Modern American Crawl and through the Modern Australian Crawl time periods. Pushing the hand back beneath the thigh was one main technique

CONTINUED »»

improvement. Improving the arm coordination by eliminating the glide after the arm entry was probably the most important feature as it produced a more continuous source of propulsion. Interestingly, the trial-and-error process favored science and corrected the error of the Japanese Crawl.

The swimmers from the country of the national style again had great success. During the time of the Modern Australian Crawl, 74% of the world records were set by Australians.

SUMMARY

During the first experience era, the adoption of the key technique elements of a national style was usually related to an impressive improvement in the ROI. Swimmers hailing from the country of the national style typically benefitted the most and set a large proportion of the world records. The key technique elements of each national style are not only supported by swimmer success, but also by science – specifically, the application of mechanical principles to produce effective technique elements.

The one exception to the ROI trend is during the time period from 1940 to 1952 that overlaps the end of the Japanese Crawl and the beginning of the Modern American Crawl. The Japanese Crawl evidently had a pervasive and negative effect well into the period of the Modern American Crawl. The Japanese Crawl featured a negative index of arm coordination (i.e. catch-up stroke), which is counterproductive because it produces gaps in propulsion. In 1955, Dr. James Counsilman published a study that showed the advantage of a continuous source of propulsion, as opposed to the gaps in propulsion produced by the Japanese Crawl.

The major historical events, therefore, are coincidental and consistent with the variations in the ROI. Most importantly, technique elements supported by science as effective were consistent with improvements in the ROI. In contrast, a single major technique limitation (as shown by research) is consistent with a considerable time period of almost no improvement. The trial-and-error process of the first experience era shows that most of the trials were successful because they were supported by science. The successful application of scientific principles probably paved the way for the first scientific era to begin in 1960. ◄

Style Name	Years of Popularity	Key Technique Elements	Relative Impact of Technique Elements on Performance	WRs by Swimmers from the "Style Name" Country (%)
Australian Crawl	1902-1912	• vertical flutter kick • flexed elbow recovery • side breathing	Minor Improvement	45
American Crawl	1912-1932	• pull and push arm motion with elbow flexion • arms opposite coordination • s-shaped hand path • kick with pointed toes and feet submerged	Major Improvement	59
Japanese Crawl	1932-1942	• long glide after arm entry producing gaps in propulsion • backward hand motion ended at hip	Major Regression	0
Modern American Crawl	1942-1956	• arm motion near body midline to increase mechanical advantage	Minor Improvement	20
Modern Australian Crawl	1956-1960	• greater rotation including shoulders, hips, and legs • hand pushed back beneath thigh • steep angle of arm entry • elbow maintained above wrist • eliminated over-kicking • eliminated glide after arm entry	Major Improvement	74

Table 1. *The table shows freestyle technique as attributed to the country with the most prominent (and generally successful) technique elements.*

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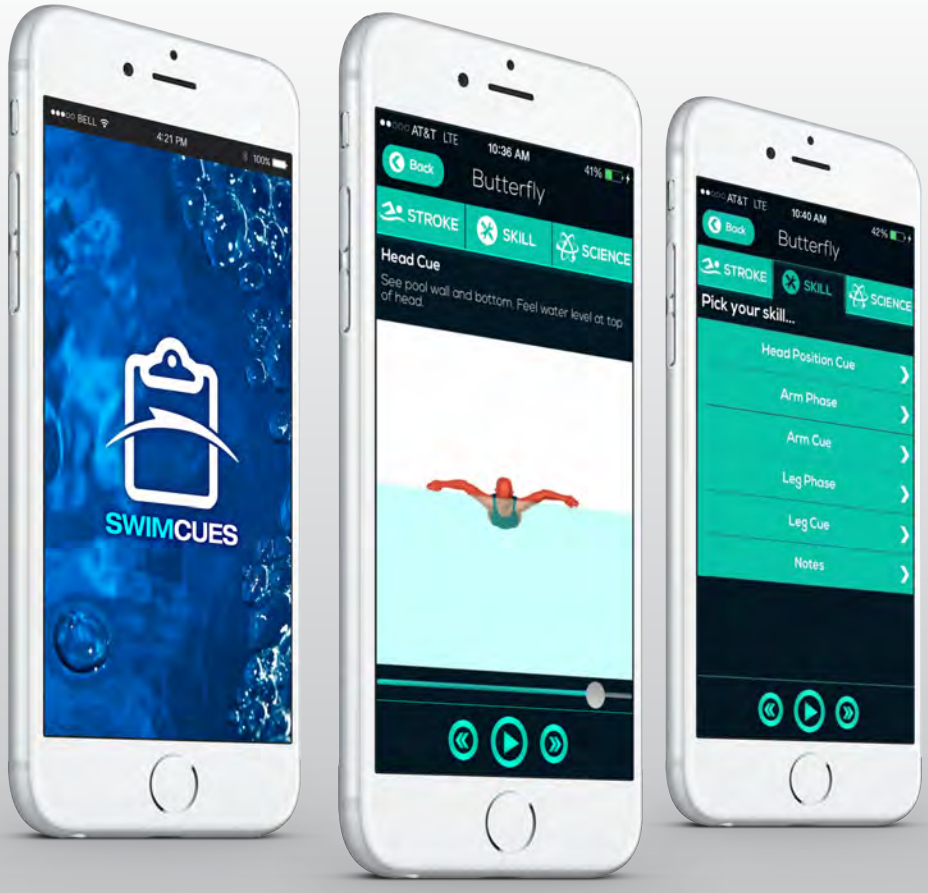

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Pictured: *A young Don Schollander prepares to dive into the pool. Schollander would go on to win five gold medals competing in the 1964 & 1968 Olympic Games.*