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USRPT DEFINED: AFTER TWO YEARS USRPT COMES OF AGE**Version 1.2****Brent S. Rushall, PhD**March 14, 2016

Abstract

Ultra-short race-pace training (USRPT) has developed over 50+ years. Originally, the physiological advantages of short-work short-rest repetitions were touted but did not capture the attention of swimming coaches. The importance of technique being the most influential variable for differentiating successful from less successful swimmers has come to the fore. Also, the relatively large impact of race-specific thought content has been shown experimentally but it too has not received much attention. Although commonly overemphasized in traditional training, physiological factors and training have the least impact on swimming performances at the highest levels. The emergence of the specificity of technique and energy utilization with velocity has brought to light the relevance of race-pace training and irrelevance of non-race-pace work for competitive preparation. When the hierarchy of scientific domains that affect swimming performances is combined with the principle of specificity of swimming training, the unique holistic USRPT model emerges. That model is mostly opposed to traditional swimming training. Whilst USRPT is completely steeped in scientific research, when evidence is asked to substantiate traditional training it is seriously lacking. If the implications of science are deemed to be essential when adopting a basis for swimming coaching, USRPT stipulates that the techniques of surface swimming and racing skills be emphasized over other domains. To coach techniques, coaches need to be competent motor-behavior instructors who understand the principles of sport pedagogy. Knowing about technique but not having the expertise to instruct properly, largely negates efforts to change technique behaviors. The influence of racing strategies that govern the execution of every stroke and skill execution in swimming events also has been shown to elevate accomplishments in high-level competitions. The least effective influence on swimming performance is conditioning because the demands for energy in a race or race-simulation come from the technique swum and the intensity of the exercise. To produce the greatest carryover of training effects to competitions the intensity of swimming training would need to be at the race-paces of the particular events. To gain the greatest impact from USRPT a program needs to a) primarily stress technique acquisition and excellence; b) have the coach design and execute principles of pedagogy that make technique instruction the most effective possible; c) develop mental content that directs a swimmer to sustain technique features, to pace race efforts optimally, and maximize the use of effort-features that produce the highest level and tolerance of fatigue; and d) practice the above in the short-work short-rest race-pace interval format that is the conduct hallmark of this swimming development model. Coaches likely will

have to train or retrain in the knowledge areas of USRPT to govern its correct implementation. Since four scientifically-based areas of coaching will need to be understood and designed for swimming programs, it should take considerable time before a full USRPT model of swimming training is implemented. To judge if a program does or does not faithfully offer USRPT, at this time in swimming history it should be each prospective swimmer and/or family/representative that makes that judgment. In the future, certification of the four scientific aspects of USRPT should become available.

Introduction

Ultra-short race-pace training (USRPT) has developed since the very early 1960s. Dr. Daniel Thompson (2014) briefly recounted the development of the terminology, particularly that of *ultra-short training*, and its applied format. The conditioning aspect of USRPT, the most recent and final aspect (Rushall, January 2014) of the holistic model of USRPT, has attracted much attention. A slightly modified version of Thompson's work follows.

In the early 1960s, Swedish scientists published research on the benefit of short-work, short-rest repetitions (e.g., <http://coachsci.sdsu.edu/csa/vol71/astrand.htm>). The pace was full-bore, without the specificity of USRPT. Rushall used this form of interval training with great success in high-school rowing, and Forbes and Ursula Carlile used it effectively in swimming at that time. To label it, Rushall coined the term "*ultra-short*" in his 1967 Honors MSc thesis at Indiana University. He first published the term in an article in 1970 (Rushall, 1970). The article was reprinted in *Amateur Athlete* (May, 1970); *Swimming World* (May, 1970); and *International Swimmer* (June, 1970).]

In the ensuing 45 years however, swimming came to be dominated by aerobic and lactate tolerance training, and the only mention of ultra-short was by Rushall, in publications such as Rushall and Pyke (1991). Nonetheless, rowers, kayakers, and track athletes used ultra-short training to great advantage, as did some teams in various codes of football (Australian Rules, Rugby Union, Rugby League). In 1996, Rushall used it to train two girls in Kayak who dominated the 1996 US Olympic Trials. That followed similar work with Cathy Marino who under difficult circumstances qualified several times to represent the USA at World Championships and Olympic Games.

Some coaches were experimenting with short-work, short-rest training sets with considerable repetitions during that time (e.g., Beckett, 1986; Mujika *et al.*, 1996; Termin & Pendergast, 2000). However, the dogmatically couched and fantastically developed traditional training model, the focus of many swimming coach education schemes, was gaining much following.

In 1990, a significant study by Toussaint *et al.* (1990) on velocity-specific techniques attracted Rushall's interest [despite the same implication being published by Craig and Pendergast in 1979]. At the time, however, Rushall was preoccupied. He coached rowing, commuted to Australia as Director of Coaching for NSW Swimming, and busied himself with dispelling the myths of lift theory and Bernoulli's Principle as being key mechanisms of propulsion in swimming (Rushall *et al.*, 1994).

But then, in the 1990s and early 2000s Belgian, Dutch, and Portuguese scientists produced further exciting research on the interdependence of technique, velocity, and energy supply. This grabbed Rushall's full attention, and he embarked on a deeper exploration of its implications for swimming, as related to the *Principle of Specificity*. He found no research to support the belief that traditional training (and its adjuncts, such as land-training) consistently benefited performance. Ultimately, in 2011, USRPT conditioning came together as a mature concept, formally presented as the first edition of *Swimming energy training in the 21st century: The justification for radical changes* (see second edition - Rushall, January 2014).

At that time a groundswell of broad-minded coaches and swimmers took notice and brazenly put USRPT to the test. Early implementers included one of the leading age-group clubs in Australia,

Cherrybrook Carlile. Cherrybrook's Head Coach, Greg McWhirter, compared ultra-short race-pace training to traditional "slow" training, as advocated in swimming LTADs (Rushall, 2010). His investigation was for partial fulfillment of the requirements for Gold Certification in the Australian Coaching Education Scheme. Age-group swimmers overwhelmingly opted for ultra-short race-pace work for training and technique work. The findings of McWhirter's study pushed Brent Rushall to introduce USRPT. At almost the same time Coach Brendon Bray, then with San Diego State University Women's Swimming program¹, studied and implemented the ultra-short race-pace training format from early 2009. A grass-roots phenomenon was born with the publication of the "*Energy training*" paper in 2011. Rushall responded by adopting his current role as mentor to the movement -- with occasional seminars, consultations, and, as feedback streamed in, explanatory articles in the *Swimming Science Bulletin*. He says, "To this date, I have not had one suggestion where I might be wrong in the interpretation of the research involving humans and sporting endeavors" [with regard to USRPT].

The above recounts the timeline for the conditioning aspect of swimming using USRPT. In its early stages, it was promoted as a method for developing sprinters, which it does very well. However, it is just as effective for distance swimmers and perhaps is even more effective than for sprinting. USRPT is not only conditioning. It involves a variety of coaching emphases so that the development of swimmers is embraced by the areas of sports science that govern competitive performances.

USRPT is now defined by a formula with each element in the order of importance in the complete USRPT model:

**USRPT = Race-specific technique instruction
(modified by coaching pedagogy)
+ race-specific psychology
+ race-specific conditioning.**

Technique

Race-pace stroke technique (biomechanics) is the most significant feature that differentiates Gold medalists/better swimmers from non-medalists/lesser swimmers in the highest levels of competitions (Cappaert *et al.*, 1996; Cappaert, Pease, & Troup, 1996; Chatard *et al.*, 1990; D'Acquisto *et al.*, 2004; Dutto & Cappaert, 1994; Havriluk, 2010; Kame, Pendergast, & Termin, 1990; Stewart & Kagaki, 1998). Since technique is the principal factor that governs elite swimming success, it is an aspect of swimming that should be stressed more than conditioning. The scope of technique instruction in USRPT is wider than normally attributed to stroke technique. Racing-skills (e.g., turns, dives, underwater kicking) warrant as much emphasis in instruction and practice-time allocation as is afforded surface swimming. While coaches have recognized the importance of racing-skills, seldom are sufficient practice times and/or correct motor-learning instructional strategies programmed. Rushall frequently states that USRPT is a technique-oriented model. It is the main responsibility and should be the principal focus of swimming coaching. Since stroke technique is specific to the velocity of swimming (Chatard *et al.*, 1990; Craig & Pendergast, 1979), if preparation for competitions is important then as much swimming practice as possible should be performed at competition paces (i.e., race-paces). Ignoring that fact and its implications is to remove swimmers' training experiences from having value for improving competitive performances.

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Race performances require specific techniques (skills and stroking), mental content, and energy provision. The measure of stroke-technique effectiveness is termed "*propelling efficiency*", which is the most important objective measure of how well an individual swims (D'Acquisto & Berry, 2003; D'Acquisto *et al.*, 2004; Huang *et al.*, 2010). An important aspect of biomechanics is the effectiveness with which propulsive forces are developed in swimming strokes. For that to occur, the velocity of swimming, the mental control of the energy resources provided for that velocity, and the instructional technique content for that velocity have to be specific. Nowhere in sport science do unrelated training activities unequivocally transfer to improve performances in high-caliber athletes.²

For swimming techniques to be scientific their features have to 1) conform to known laws and principles of physics and mechanics (Rushall, 2013a), 2) be demonstrated at least in part by elite champion swimmers (see *How Champions Do It*), and/or 3) be the product of acceptable scientific research (see *Abstracts in the Biomechanics of Swimming*). In the context of USRPT, Rushall (2013b) produced a coaches' manual that documented stroke-technique features of the four competitive strokes that conform to the above criteria. In that manual, the elements are presented in a pedagogically correct sequence that coincides with the conditioning aspect of USRPT. The manual structure is designed to guide a coach in how to integrate technique work with USRPT physical conditioning. What to include in the instruction of the technique elements and visuals to aid instruction were also appended to the manual. The intention of this publication was to produce a scientifically valid resource that featured only stroke-technique elements that work to improve or maximize swimming performances.

In the USRPT world, the role of the coach is seen primarily as a teacher of technique. A secondary role is that of program designer and manager. Activities such as timing swimmers, calling when to start repetitions within a set, etc. are seen as inefficient use of potentially valuable coaching time.

Since technique is the cornerstone of USRPT³, it is important for swimming coaches to be excellent teachers. Unfortunately, not many swimming coaches are effective teachers of the motor skills involved with competitive swimming strokes and skills. Consequently, to elevate the standard of technique instruction the second important feature of the USRPT formula should exist, that is, a demonstrated capacity of a coach to adhere to the principles of pedagogy (the science of instruction). Good motor-skill instructors will be better coaches than those lacking instructional skills. Knowing what to teach and being an effective teacher are two different capacities and should not be confused.

Pedagogy

To a large degree, the effectiveness of swimming skills and stroke instruction will govern the performance progress of competitive swimmers. There is more to swimming instruction than a well-intentioned coach turning up on a pool deck.

² In sport, there are a variety of paradoxes that indicate practice activities are beneficial for one performance level of athlete but might even be harmful for another level. In swimming, drills, equipment, and slow-swimming might benefit beginner swimmers but at the other end of the performance spectrum, such activities are either irrelevant or detrimental.

³ To hear most coaches talk one would think that conditioning is not only the major contribution of USRPT but the only important feature. In this paper, one of the main aims is to relegate physical conditioning to its rightful place in the hierarchy of importance in coaching and swimming program activities.

Since most competitive swimming clubs are divided into performance classifications, a coherent progression of skills and knowledges is required from low/young to high/older performance groups. In any admirable educational venture, the progression of learnings and experiences in maturing participants is defined by a curriculum. In the swimming arena, instructional curricula have been used for learn-to-swim programs. None appear to have been used in competitive swimming organizations (Arellano, 2010).

In 2006, after one-month of participation in the Forbes and Ursula Carlile Swimming Clubs at Cherrybrook and Ryde (New South Wales, Australia), Rushall (2011) produced a coaching manual focused on swimming pedagogy and curricular organization. While the three-level curriculum was tailored to the Carlile situations, its universality was recognized by Professor Arellano (2010) in his recommendations that the program be adopted by national organizations. A major point behind a curriculum in competitive swimming organizations is that swimmers' experiences in years of participation will be coordinated, progressively developed, and oriented toward an excellent standard of performance at the highest level. A curriculum brings programmatic direction to a multi-layered swimming organization. That is an important feature of swimming pedagogy.

The observation that swimming teachers/coaches usually adopt an inefficient/incompetent teaching style/strategy/method that is inertial, is a feature that has been known for 40+ years (e.g., Rushall & Smith, 1979). Improved coaching effects throughout a coach's tenure are rarely demonstrated. The need to understand even the basics of motor-learning instruction in group settings in aquatic environments was recognized. Rushall (2011) also described the instructional sequencing of stroke and skill elements that will lead to effective behavior changes. As well, the central element of effective instruction, the provision of task-reinforcement, was described and included more powerful environment-specific influences than the coach. The cornerstone features of effective behavior modification in swimming environments are known, have been described, and endorsed (Arellano, 2010).

For effective instruction of stroke and skill techniques, the instruction itself needs to be efficient. If instructional effectiveness is low to non-existent,⁴ then the stroke and skill techniques of swimmers will be plagued with errors, better swimmers surviving despite the coaching to which they are exposed. If a coach is not a good teacher of movement skills and characteristics, then swimmers' techniques will be poor resulting in less than optimal performances during their residence in the environment controlled by the coach. Consequently, for the most important aspect of USRPT to be accommodated, the skill of the coach in fostering appropriate behavior changes is the governing factor. That is why in the formula for USRPT offered at the start of this paper the technique factor is moderated by the pedagogical skills and elements of the coach(es).

Racing Psychology

Rushall (1995) produced a detailed swimmers' manual covering why and how to develop racing strategies for individual events. A coach's resource is included in *Mental Skills Training for Sports* (Fourth Edition) (Rushall, 2003a). Concerted research showed that specific types of thinking elevated swimming performances without any increase in volitional effort (Chorkawy, 1982; Crossman, 1977; Ford, 1982; Johnson, 1991; Rushall, 1982a, 1982b, 1984; Shewchuk,

⁴ Instructional ineffectiveness of swimming skills in an environment is demonstrated in swimmers who persist with movement elements that are inefficient/harmful and in group situations where individuals do not conform to the same basic mechanical principle(s).

1985). The various aspects of thinking that do enhance performance were included in Rushall's manual.

Since particular types of thinking and how they are integrated into the structure of race-strategies do enhance competitive swimming performances (Rushall, 1979), when practicing for racing it is valuable to practice the thought content to be used in a race. Rehearsal of that kind is tantamount to swimmers developing scripts for their events, a dialogue that is the major activity for developing what is commonly known as "*focus*". With the combination of focused and intensified thinking (Johnson, 1991; Martin, 1989), a swimmer's race-application will be overwhelmingly determined by intrinsic factors and capacities, resulting in the greatest application of a swimmer's resources to a competitive effort. Enacting race-strategies in events leads to greater performance reliability as well as enhancing post-race de-briefing, the content of which should be used to modify training that follows a performance. Race de-briefing enhances the value and individuality of training prescriptions (Rushall, 2003a).

If swimmers do not have a detailed race-strategy that governs the thought content associated with every stroke in a race, then a maximum performance cannot ensue. One might contend that such a statement is overly arrogant. However, in many of the researches referenced in this section, developed thinking produced performances elevated above the traditional thought-content associated with "normal" racing. In many cases, performances were enhanced immediately by more than 2%. While few coaches use or even know about performance enhancement through thought content, that does not mean such activities are not useful – it merely shows the low level of knowledge that is endemic in the coaching of swimming (and many sports for that matter).

The role of cognitive activity in sports is not limited to race strategies. Within exercise physiology, a new realization about the role of the brain is emerging (Noakes, 2012). Early in the history of the physiology of human activity, the interaction of the brain with physiological functioning in exercise was recognized. To the way of this writer's thinking, the role of cognitive activity in physiological responses was downplayed to eventually be ignored as the field changed from "*work physiology*" to "*exercise physiology*". Noakes reinvigorated the role of the central nervous system in physiology through an analysis of the phenomenon of fatigue. In its role, the brain acts as the governor of exercise response intensities, adequacies, and limits. Seemingly, and understandably, pre-task cognitive activity determines the level of fatigue that an individual is willing to reach in an ensuing "fatiguing" task (such as a swimming race). Such a role contrasts with the common limited exercise physiology explanation of the terminal fatigue mechanisms residing in the physical periphery. Noakes listed many factors that govern the adequacy of physical responses to demanding tasks. Although not included in his compendium, the race-strategy factors described by Rushall (1979, 2003) are further central nervous system functions that moderate the adequacy of important "maximal" swimming/athletic performances.⁵ It is likely that the next breakthrough in human work capacities will be the manipulation of the thought structures and content which precede exceptionally demanding tasks. As athletes become willing to increasingly extend the threat that exercise efforts bring to their bodies' homeostasis, so will fatigue-dominated performances be improved. The determination of how to extend

⁵ It is interesting to note that Noakes' well documented paper makes the case for "maximum" efforts not being maximum at all. While the common man attributes wonderful attributes that produce hard work and outstanding performances, the efforts of the human body do not approach the limits of actual physical capacities. For example, ". . . skeletal muscle is never fully recruited during any form of exercise . . . it is now established that fatigue in all forms of exercise develops before there is complete skeletal muscle recruitment. Indeed only between 35 and 50% of the active muscle mass is recruited during prolonged exercise . . . during maximal exercise this increases to only about 60% (Noakes, p. 4).

swimmers' tolerance of fatigue in training and races will lead to an obvious "breakthrough" in swimming standards. It should be noted that in the USRPT model, the fatigue endured at practice imitates that which occurs in races. In the traditional model of swimming training, the fatigue incurred at practice is foreign to that which happens in relatively brief competitive races (Rushall, 2013c, 2013d).

The roles of the elements in cognitive activity that can be used to improve swimming performance levels need to be embraced by exponents of USRPT. If they are ignored, then performances will not reach their potential maximums. Improving the quality of performance of all strokes in races and extending the extents that fatigue will be tolerated in competitive circumstances will produce relatively large performance improvements in potentially all swimmers. Cognitive activities of those natures need to be incorporated into USRPT. They are an essential element and are very likely to yield much greater performance gains than training which is preoccupied with physical conditioning.

Physical Conditioning

Physical conditioning is the least important feature of the cornerstones of USRPT. Unlike traditional training where swimmers practice to supposedly alter physiological factors, USRPT only trains the energy demands associated with the technique used in intended race-pace repetitions. With every change in technique (i.e., alterations in muscle functions), energy needs are adjusted accordingly. The energy demands of a task are specific to the intensity and form of the performance. The assumptions underlying traditional conditioning are absolutely wrong. Only when the brain repeatedly experiences the energy proportions and anatomical locations of a particular exercise form and intensity will the ability to energize movements be extended. This is particularly appropriate for advanced or serious performers. This strict interpretation is modified slightly with mainly untrained learning swimmers. In the context of coaching serious swimmers, general mainly irrelevant physical conditioning is largely a waste of time. It is also dangerous because it excessively fatigues swimmers and elevates the potential for injury ("*Swimmer's Shoulder first emerges in excessive fatigue*"; Stocker, Pink, & Jobe, 1996).

The purpose underlying the design of USRPT repetition sets is to create a platform where the greatest number of race-specific technique features can be performed. It is the format for teaching and practicing technique, skills, and the mental skills associated with racing. If significant volumes of race-pace specific techniques are performed, appropriate conditioning of the underlying muscular actions will take care of itself. The body automatically energizes movements. It is a matter of whether or not the movements at training replicate the tasks of competitions and sufficient repetitions of simulated strokes are provided. There is no other true/valid interpretation of the energy requirements for relevant/effective physical conditioning for any sporting movements.

The velocities at which swimming races are performed and the entry and exits of the associated skills in those races are identifiable and specific. The aim of conditioning should be to replicate as many race-pace stroke cycles and skill executions as possible. That will enhance the precision of stroke and skill techniques as well as develop the capacities needed to energize those activities for as long as possible. That is a purpose of the USRPT format. Very short-work short-rest repetitions facilitate the greatest volume of high-intensity (i.e., race-pace) work. In the context of

USRPT practice priorities, the greatest number of race-relevant cyclic movements that can be experienced⁶ is one index of the value of a training program.

It is hard for many to accept the scientific finding that short-work short-rest physical training facilitates the greatest volume of high-intensity work cycles. The case for short-work short-rest repetitions (now termed "ultra-short" training) was re-made by Rushall (January, 2014) citing the original works of Swedish researchers (e.g., Christensen, Hedman, & Saltin, 1960). Few realize that in the context of work and rest cycles in physical training, it is the rest period where the brain/body makes adjustments to the training stimulus in the work (Rushall & Pyke, 1991). Traditionally coaches have programmed varying work and rest periods as "training sets". In contrast, USRPT stipulates that rest periods not be varied from ~20 seconds except for repetitions of 25 y/m, which should be reduced to ~15 seconds. Rest periods in the ultra-short format serve a simple function: they maintain exceptional aerobic function during the work and rests in the set, and they support the recovery of immediately available oxygen resources and phosphate compounds. The ultra-short format facilitates continual maximal or supra-maximal oxidative (aerobic) functioning for the task and is the best way to stimulate Type IIB fibers to become oxidative Type IIA fibers. One might ask: "Why is that important?" It means that muscle fibers that are anaerobic under traditional training formats become oxidative in the USRPT format. Rests longer than 20 seconds after short work periods allow too much recovery to occur. All successive repetitions start from a less than desirable level of oxidative function resulting in less aerobic/oxidative adaptation. Differing longer rests alter the nature of the energy provision in repetitions. Fixed short rests are the basis of the effectiveness of USRPT which results in greater aerobic adaptation than is possible in altered longer-rests training (Christensen, Hedman, & Saltin, 1960; Olson *et al.*, 2012; Trapp, Boutcher, & Boutcher, 2004; Zafeiridis *et al.*, 2009). Someone who alters the rest periods in training sets and claims to be conducting USRPT is not providing USRPT. They violate the most basic premise of USRPT. Without knowing the actual alterations/extensions, it is difficult to hypothesize what adaptations would occur. It is reasonable to assert that the relevance of such training would stray from that which is desirable. The alteration of the fixed rest periods negates any claim of USRPT.

It is important to realize that USRPT must be executed exactly. Changes in either or both work and rest durations will introduce greater variations in the responses to what is intended. The greater the alteration, the less will be the relevance for particular swimming events in any individual. As the conditioning aspect of USRPT stands, it serves as the training format that adjusts every training task to the needs of every swimmer. In traditional training, swimmers are asked to perform complete sets of repetitions. The variations in performance across those sets or the degree of departure of training velocities from intended race-velocities renders their effects as largely general and non-specific.

Established traditional coaches have paid lip service to USRPT often with the false statement that it has been around for a "long time". Typically, what is alluded to is the distance of the repetitions. For example, "*Coach X was doing repeated 25s in 1976*". Such statements are glib and show a lack of understanding of USRPT and the vagueness of the reference serves no value. Performing a few broken-swims or a low number of race-pace efforts is not a way of gaining any substantive training value. There is more to programming technique-oriented training sessions that replicate what is to be performed in races. For an activity to have productive value, a

⁶ An upper-age-group masters swimmer who recently established a new middle-distance world record estimated that he had completed ~68K race-pace stroke cycles using USRPT prior to his outstanding performance. That interpretation of the training experiences is better than total yards, sessions trained in a week, etc.

training effect has to be produced. If the effect is not related to racing velocities, then it is irrelevant for developing competitive improvements. The fatigue level promoted by USRPT mainly involves the neural system. Typically, when a standard of performance no longer can be maintained in the USRPT format, a fatigue condition akin to what is developed in well-paced races is established. One would hope that swimmers would not tire so much in a race that their performance standards would diminish drastically in the latter stages of an event. Even pacing is desirable for producing the best competitive swimming performances. USRPT requires even-pacing (and is a good method for developing race-appropriate pacing) with performance deterioration finally occurring despite brief opportunities for extra recovery and greater mental application. That degradation usually is beyond the fatigue level incurred in races. Swimmers do not prepare to enter a race to slow markedly in the last portion. Unadvisedly, many swimmers "hold-back" so that a good finishing effort can be performed which means a race was completed without incurring a level near maximum fatigue. Thus, the demands of USRPT sets are such that swimmers are exposed to fatigue expectations that are approached in races. The recovery time from such fatigue is quite fast and at most, several hours.

When individuals claim to be doing USRPT or know of individuals who did do it in the past, the following criteria need to be fulfilled to satisfy similarity.

1. The standard of performance of each repetition should be the same or slightly better velocity than the average for a race and should not fall below that absolute value for as many repetitions as possible.
2. The rest periods are fixed at ~15 seconds for repetition distances of 25 y/m or ~20 seconds for repetition distances of 50 y/m or longer.
3. The total number of strokes or distance covered in an individual's set should be between 5-6 times⁷ that performed in a race. Anything greater than six times the targeted race distance starts to become boring and yields little added value.
4. Performances in repetition sets should be monitored. The main task of a USRPT set is to complete as many race-pace repetitions as possible before the first failure to hold the target pace. With successive attempts at the same set, swimmers should aim to complete more repetitions before failure than in the previous execution of the set. As the number of successful completions increases, it is valid to assert that the swimmer has improved his/her capacity to swim at the target velocity before a loss in swimming speed. That clearly indicates to swimmers they have improved in the event for which they are training and consequently, they should expect their performance in the next race to also improve. The continual drive to improve and the objective measure that improvements have occurred at training have wonderful effects on swimmers' motivations for the sport and its competitions.
5. Once technique instruction is initiated and the appropriate psychological preparation for races completed, each repetition in a USRPT set should involve a focus on one or more improved technique elements and the thought structures that focus on those elements that will be used in the next race. Racing while undergoing USRPT, should introduce and continue a swimmer's improvements in techniques and focused-thinking that have been practiced. Races are purely a manifestation of the degree of benefits derived from practicing. Swimmers who do not improve in races have displayed no transfer of training

⁷ This value is reduced to 2-3 times for 800 and 1500 m races, and 3-5 times for 400s.

effects or possibly accumulated excessive fatigue, which logically implies that training has developed nothing that is relevant to racing.

6. The conduct of USRPT sets should be controlled by the swimmers. After sufficient instruction, each swimmer should take responsibility for determining the race-pace time for each repetition, calculate the rest interval to determine the repetition interval, and time each swim and start each repetition on the determined interval within the lane group. At the completion of every set, swimmers should record in log books or journals the nature of the repetition set, the number of successful repetitions before the first failure, and the total of successful repetitions before two successive or three failures. At any time, swimmers should know their numbers and be able to recite them to the coach or use them to determine if a completed set is an improvement over the most recent set. With swimmers responsible for conducting the conditioning activities coaches are freed to focus on technique instructions and feedback. Allowing swimmers to take ownership of an important part of their training is a substantial motivation boost for individuals.

The absence of any of the above six criteria means USRPT has not been provided. For coaches who claim to have been programming USRPT in the past, there has to be a degree of delusion or ignorance of what constitutes USRPT.

Physical conditioning in the USRPT format is solely a means of providing an appropriate platform for velocity-specific techniques and velocity-relevant thought processes to be developed. If swimmers perform a simplified USRPT set, that is those two foci are not entertained, then the training effect will be less than optimal. Unfortunately, the quickly emerged concept for USRPT has been that it is a conditioning model. That is a pity because the technique and psychology emphases are likely to produce greater performance gains than a simple limited conditioning emphasis. To ignore them is to do swimmers a disservice. This paper is intended to clarify what constitutes USRPT and to correct the more common perception of a process-only scope.

Developing and teaching technique and psychological control behaviors place much greater demands on the efforts of coaches. Coaches will have to work harder when correctly implementing USRPT than is required for dubious traditional training. Because there is an increase in coaching-task difficulty and scope, does not mean that it should not be done. It takes time to establish the procedures whereby technique elements are shaped into swimmers' styles and the appropriateness of their thinking enhances performance standards considerably. A concerted introduction of those two emphases in the USRPT format will result in motivated swimmers who improve continually throughout any swimming season, not "hopefully" after a mystical guess-work formed taper of short duration (Rushall, March 2014).

After a little more than two years since the introduction of the *USRPT 21st Century Energy* paper, coaches are reporting delightful gains in swimmer experiences and performances. One can estimate that the adoption of USRPT programming (at least conditioning), is developing exponentially⁸.

⁸ That rate is justified when the continually increasing number of email inquiries about USRPT that cross this writer's desk is considered. Being overwhelmed by requests is unsatisfactory but the logistics required to fulfill correspondents' expectations are impossible. Hopefully, the continual production of specific-topic USRPT related papers will answer more questions removing the need to seek specific answers to questions and concerns from this writer.

The following was an unsolicited testimony from a parent-coach who, with other parents, withdrew their children from an unsatisfactory traditional program and started a now successful USRPT swimming club.

Our club has had extremely great success with USRPT over the past short-course season. We launched our club last May 1 with only six swimmers. We now have 69 athletes. The kids absolutely love the training. It's refreshing too for them to actually get to race every day and gauge where they are and the progress they're making, rather than slow, drudging workouts with the hope it will help them once per month at a meet.

For this past short-course season, among all age-groups, we saw nearly all of our 50-yard and 100-yard races result in new PRs being set while 76% of 200-yard races and 82% of races 500-yards or longer resulted in new PRs.

The full USRPT model is scientifically based. The substantive researches that underlie the developed principles for competitive-swimming related biomechanics, pedagogy, psychology, and conditioning have been documented in the books and web sites of this author. Self-education and where feasible, educational gatherings, are in order to accommodate the different learning styles of the legion of swimming coaches seeking to implement USRPT.

One way of determining if USRPT is being followed in a swimming program is to evaluate the swimming tasks of training. For technique, psychology, and energy provision a training item should describe the following features:

Repetition distance, stroke, race-pace, and rest interval]
 + *Optional [Personal maximum repetition volume],*
 + [technique feature to be changed, technique feature(s) to be retained]
 + [race strategy content to accompany each repetition]
 + [race situation to be imagined].⁹

The development of USRPT resources has been in stages with the last component being conditioning. First, the psychological aspect was developed (Rushall, 1995, 2003a). Technique was also developed in stages as part of university instruction in biomechanics (Rushall, 2003b). Pedagogy was addressed as the precursor to technique instruction (Rushall, 2011). Once the final conditioning/practice platform of ultra-short race-pace repetitions was introduced (Rushall, January 2014), a technique manual that integrates technique content with the conditioning format was published (Rushall, 2013b). These developmental stages were directed more by this writer's interests and circumstances than by any intended sequence.

The single sign that indicates a program is not USRPT is a training prescription of the form of:

number of repetitions + repetition distance + event race-pace + (work + rest interval)

An example would *20 x 50 @ 200 BKR on 1:30*. Translated it means all swimmers are to complete 20 repetitions of 50 m swum at 200 backstroke race-pace on a total interval of one minute 30 seconds. The set is not individualized. Rather than all swimmers completing the same number of repetitions, a USRPT format would require a swimmer to complete as many repetitions as possible with 20 seconds of rest with a maximum of three failures, each failure

⁹ When evaluating claims of established traditional coaches that they offer USRPT or that it exists elsewhere, a discerning person should compare programming elements against the criteria in this paper. A failure to satisfy these characteristics removes a stipulated program from the USRPT genre. However, if a coach modifies claims by indicating that a team/club's development is scheduled to include currently non-offered features then it is worthwhile to give the coach/program the benefit of any doubt about USRPT intentions.

being followed by missing the next repetition to allow for more recovery and reflection on how to swim the next 50 m. As well, the rest interval is too long and does not simulate the incremental fatigue signs that occur in a race and provokes too much of the set as physiological adjustment rather than consistent physiological demand.

To conform to complete USRPT programming, most coaches will have to retrain or become educated in performance variables other than conditioning. That will take time. If coaches aim to be USRPT compliant, they will have to embark on a concerted personal-development program. The various facets of USRPT need to be ordered to develop adequate understanding and coaching content and the way they are introduced to the swimmers. Because ultra-short race-pace training is the format in which the other factors are practiced, the introduction of compliant USRPT sets (conditioning) is the first priority. That should not be construed as suggesting conditioning is the most important feature of USRPT. It has to present the ideal movement base for refinement of techniques and race-strategies. The next order of coaching development should be pedagogy. Establishing curricula and performing effective behavior modification are activities that guide the total experience of swimmers in a program. The next feature to be introduced should be technique, delivered on cyclic repetitions of a structured macrocycle. The final feature should be race psychology and integrating it into sets of repetitions so that individual swimmers can determine what is the best thought content for themselves.

USRPT Existence and Certification

The growth of USRPT programs is such that persons increasingly inquire as to where a USRPT program exists in a new location. Recommending locations is difficult because of imposters, erroneous program structures, and the lack of knowing where real programs are being offered. In time, those problems will be eradicated.

Locating existing individuals (e.g., masters swimmers training on their own or in small groups, assistant coaches in larger teams/clubs, dedicated USRPT teams/clubs) would seem to be the most immediate action. Denaj Seymour (<http://usrpt.com/>) has established a web site that demonstrates and lists USRPT individuals and groups world-wide. This writer urges all persons with an interest in implementing USRPT to make their intentions known to Mr. Seymour. If that is followed, then networking will be facilitated and the quality of USRPT offerings should be improved.

The task of verifying true USRPT programs is difficult, primarily because the "movement" is still in its early developing years. In time it will be possible to "certify" coaches/programs. However, at this stage it is best if prospective clients evaluate what is offered by coaches/programs. It is unlikely that a full USRPT enterprise as described here is available in many places. At this stage, one can guess that the majority of programs are "partial", in that they only offer the physical conditioning feature. There are a substantial number of persons across the world who have invested in the three USRPT-related books and downloaded the web-site articles¹⁰. They could serve as resources for completing the implementation of a full USRPT program. It is reasonable to assume that extended time will be needed by most individuals/clubs to provide all facets of USRPT at an acceptable standard. Tolerance of the need for self-education and planning time is recommended.

At this time it is suggested that coaches/programs advertise themselves as USRPT focused, but to indicate that a full implementation is a "work in progress". In interactions between interested

¹⁰ See the *Swimming Science Bulletins* after #38 for USRPT-relevant articles (<http://coachsci.sdsu.edu/swim/bullets/table.htm>). Also, go directly to USRPT articles at <http://coachsci.sdsu.edu/swim/usrpt/table.htm>.

parties and coaching personnel, the features indicated in this paper can be discussed with the prospective clients determining the degree to which acceptable compliance exists in the coach's descriptions or actual programs.

Conclusions

USRPT is a science-based model of competitive swimmer development that embraces four domains of coaching expertise. It requires the following:

1. The greatest coaching attention should be given to the instruction of surface-swimming and race-skill techniques;
2. The personal development of coaches should be such that their instructional competencies reflect the principles of pedagogy and the program structure establishes an environment that facilitates the best forms of learning;
3. Attention should be given to the development and learning of detailed race-strategies that facilitate swimmers to perform with total attention on their performance elements and effort distribution; and
4. The format of training follows as much ultra-short race-pace repetition work as possible because it is the most relevant platform for swimmers to perform and to integrate the physical and skill elements developed through technique and mental skills instruction.

The difference between USRPT and traditional swimming coaching is extreme. Traditional training could be said to have evolved through the belief-based propositions that lead to myths and dogma resulting in practice activities that are very largely irrelevant for affecting competitive performances. On the other hand, USRPT is based on scientifically verified behavior principles that are often diametrically opposed to traditional practices. In one sense, USRPT has emerged as an extensive set of behavior principles that will correct the false and very often dangerous practices of traditional swimming coaching.

The entrenched traditional swimming coaching field has reacted negatively to USRPT probably because of the exposure of its deficiencies. When the "promises" of USRPT effects are realized, swimmers and their supporters (mostly parents) are very suitably impressed. What will happen in the future now that USRPT has gained a foothold in the international swimming scene is perhaps best summed up in the following two quotes:

"A new scientific truth does not triumph by convincing its opponents and making them see the light but rather its opponents eventually die and a new generation grows up that is familiar with the truth" (Max Planck); and

"There is nothing more difficult to take in hand, more perilous to conduct, or more uncertain its success, than to take the lead in the introduction of a new order of things, because the innovator has for enemies all those who have done well under the old conditions, and lukewarm defenders in those who may do well under the new" (Nicolo Machiavelli, 1446-1507).

USRPT will continue to undergo development as new research findings are published and research directly involving aspects of USRPT is completed. For example, without any hard data and only reports of satisfaction, several coaches are experimenting with minimizing or even eliminating the amount of slow-swimming that is performed at practices. No swim downs or warm-ups will be performed because of their dubious value. No cruising 25 and then sprinting 25, etc. (except in long-course pools). The question being asked is what happens if a swimmer only

experiences swimming fast? If the brain only associates swimming with very fast movements, is there any benefit over mixed experiences? The hypothesis is: *There is no value derived from swimming slow. Warm-downs and recovery can be any physical activity and are not enhanced by slow-swimming.* It is helpful if coaches and swimmers investigate what happens when this alteration of training experiences is implemented. Often early implementation of an hypothesis yields factors that have to be considered in experimental designs to improve the standard of research that is finally conducted. It has already been reported that it is best to try only-fast-swimming for at least a week rather than just a day or two¹¹. Apparently, some time is needed for differences to occur to the level where they are sensed by participating swimmers. USRPT is likely to continue to evolve by adding features as well as removing initial features that prove to be ineffective when new elements are incorporated.

Epilogue

Ultra-short race-pace training (USRPT) is a description of swimming training based only on scientific evidence. An attempt has been made to exclude belief-based components. Some might consider that extreme, but it is very much better than the belief-based convolutions that now pervade competitive swimming. The difference between evidence-based and belief-based (traditional) coaching/programs is that evidence-based offerings are based on showing effects that if described correctly, indicate how to improve swimming performances. The intermediary step that manifests belief-based coaching is simple guesswork that something might happen to swimmers exposed to an assumed/invented variable/procedure. There are few attempts to justify the belief-based activities that are now entrenched in traditional swimming coaching.

If a science-based structure of swimming coaching is implemented, it needs to be done exclusively of belief-based activities. If all the premises of USRPT are true and many of the traditional belief-based training are false, it takes only one false premise (belief-based activity) to be mixed with USRPT to pollute/dilute the effectiveness of USRPT.

In true USRPT programs, the activities to which competitive swimmers are exposed should have direct effects on their competitive performances. An aim is to have practice sessions include only activities that are relevant to racing. An ideal would be to have the total swimming experience involved solely with relevant activities. That contrasts to traditional training when the bases for many forms of training (e.g., aerobic training, various training classifications, lactate-tolerance training, drills, board kicking, etc.) have no support in data-based studies of the scientific world. USRPT versus traditional training is a contrast between effective optimal relevant training and largely ineffective irrelevant training which leads to the assertion that USRPT swimmers should improve at a greater rate and more often than traditionally-trained swimmers. In one year, USRPT swimmers might experience four – six – eight or higher times more effective training than traditional swimmers. That could be interpreted as meaning that USRPT swimmers will have markedly noticeable improvement rates in their competitive performances when compared to traditional trainers. The performance gap between long-term USRPT swimmers and traditionally-trained swimmers should increasingly widen with each successive year.

The biggest threat to USRPT swimming is coaches who claim to use the coaching model but fail to include all its integral parts and/or hybridize swimmers' experiences by retaining some/many

¹¹ In the USRPT model, minimizing or eliminating slow-swimming is part of the peaking process. The question addressed is what if slow-swimming was reduced to an inconsequential amount or removed completely for all training?

irrelevant traditional practice activities. The determination of what is a good USRPT program and what is not is a challenge that is being considered at this time.

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