SPECIFICITY OF TRAINING
A Fresh Look at an Old Principle
Using Aerobic Training to Improve both Aerobic & Anaerobic Fitness
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Most coaches are aware of the basic principles of training such as overload, progression, specificity, reversibility and individuality. These principles form the basis of training plans for swimmers at all levels. Specificity is one of the most important in terms of designing effective training programs. The basic theme of this article is that some coaches may be misinterpreting the principle of specificity and consequently, are implementing training programs that may not be as effective or productive as possible. The effect of this misinterpretation is that training is focussed incorrectly on high intensity anaerobic work at the expense of aerobic work.

The specificity principle is known, at least in intuitive terms, to every coach. All textbooks on coaching and training methodology will espouse the importance of specificity. The highly regarded and successful coaching accreditation courses run in Australia also give prominence to this principle. These courses discuss the categorisation of different sports and events into the various energy systems – the aerobic system, the anaerobic glycolysis (lactic acid) system and the muscle phosphagen system (ATP-CP) system. The specificity principle, taken at face value, suggests that training programs should be designed to equate the volume and intensity of training with the energy demands of the sport or event ... e.g. for a 100m swimming race that is approximately 50% anaerobic and 50% aerobic ... there should be a similar proportion of training time devoted to each energy system. However, experience has shown repeatedly that this is generally not the most effective approach.

Analysis of training programs at the Australian Institute of Sport shows that about 80% of training is aerobic and only 20% is anaerobic, even for sprint swimmers.

In one sense most athletes possess sufficient natural speed for all but the most explosive events. For example, most swimmers can perform several fast sprints (i.e. at competitive race pace or faster) over a short distance (25m) ... e.g. senior male Freestyle swimmers can hold around 11.0 seconds for 25m (approximately equivalent to 44.0 seconds for 100m). However the ability to repeat these sprints many times during a training session or to hold this speed over a longer distance (e.g. 50m, 100m or 200m) is determined by a combination of anaerobic and aerobic capabilities, and neuromuscular limitations. The doyen of Australian Breaststroke coaches, Terry Gathercole, says that every swimmer has the natural speed to break the world record (over a short distance), but only the champions have sufficient endurance to sustain it over the full race distance. On this basis, both the endurance and speed capabilities of sprint swimmers need to be developed.

It is apparent that it is possible for transference of adaptations (improvement) from one energy system to another. We have demonstrated previously that it is possible to develop aerobic and anaerobic capacities using this concept in a three-week aerobic macrocycle (Pyne and Touretski, 1993). We consider this to be one of the most important aspects of preparing high-level swimmers. Our experience, developed with elite sprint and distance swimmers over many years, is that carefully planned and well-monitored aerobic training will lead to the development of aerobic (Al, A2), anaerobic threshold (AT) and maximal oxygen uptake (max VO2) components of fitness. Gennadi Touretski uses this concept at the Australian Institute of Sport, and he expects to see an improvement in all areas of fitness from moderate intensity aerobic work. Lactate and heart rate testing is used to monitor this process.

Aerobic training is used to support anaerobic training both between and within different training sessions. Most coaches would be familiar with the concept of alternating hard and easy sessions in a given micro-cycle (i.e. a week’s training). Moderate intensity aerobic sessions are used to facilitate adaptation, recovery and regeneration from high intensity or quality training sets. This situation represents the utilisation of aerobic training between anaerobic sets to support the development of aerobic and anaerobic capabilities, and ultimately speed. Whilst this basic task of planning is well understood, the concept of designing interval sets that incorporate aerobic work within an anaerobic session is vitally important but sometimes overlooked or misunderstood.

The concept of specificity applied to sprint training has traditionally meant high quality training sets. These sets generally prove to be very demanding for the swimmer and often result in high levels of fatigue. A reduction in skill and technical precision as fatigue sets in is commonly observed. The basic prescription of interval training involves constructing sets using various combinations of distance or duration of work, the distance or duration of rest or recovery activities, the number of repetitions, and the work to rest ratio (Pyne, 1994). Some coaches have used sets such as 20x50m holding 30 seconds on a 60 seconds cycle. This set would represent good quality aerobic work for a female 200m Freestyle swimmer, but the speed is too slow for a 100m swimmer trying to achieve a competition time of 58.0
Rather than concentrating on sprints in just three or four sessions a week, many of the successful
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seconds or a 50m swimmer aiming for a time of 27.5 seconds. Application of the specificity principle is
important in these shorter and faster interval sets. In this case, it may be more appropriate to
undertake some work over 25m and having the swimmer hold 13.0 seconds or faster in order to meet
the specificity and overload principles ... e.g. 4x25m holding 13.0-13.5 seconds on a 2 minute cycle.
For true sprint work, many coaches will plan a number of sprint sets through the training week.
Rather than concentrating on sprints in just three or four sessions a week, many of the successful
Australian sprint coaches incorporate some sprint work into every session. Coaches like Ken Wood and
Bernie Wakefield have built solid reputations on this type of work – the so-called high velocity overloads
(HVOs) where a number of short sprints (commonly over 25m) are undertaken. For the preparation of
1992 Olympic Champion and Men’s 100m Freestyle World Record Holder (48.21) Aleksandre Popov, his
coach Gennadi Touretski also uses small but liberal doses of sprint work. Touretski will often finish a
session with some sprint work such as 4x25m dive or 6x15m sprint (see article by Pyne and Touretski,
1993). The integration of this work with aerobic work appears to be a successful way of simultaneously
developing both endurance and speed.
Where the specificity principle breaks down is in the implementation of longer intervals in a simple
interval format, which if undertaken with sufficient intensity, can be very fatiguing. The demands of a
very stressful set of 100’s and 200’s would be etched permanently in the minds of most current and
former Australian swimmers. These sets will be characterised by high heart rates and blood lactates (i.e.
high energy cost) but often at slower than competitive speeds. Whilst sets of this nature are important,
they need to be well planned and closely monitored. The current thinking is that two to three of these
sets in a single week is the upper limit. In terms of testing, the 6x100m maximal effort test was deleted
from the National Tests after criticism that it was too demanding and provided limited information to
the coach.
Another approach to this type of work is the use of combination intervals. An example of this work
might be a set such as 4x (3x100m Freestyle holding 1:06 on 1:40; 2x50m Freestyle holding 32.0 +
100m Freestyle recovery on 2:00) for a female 400m Freestyle swimmer with a PB of 4:16. In this
example, the swimmer undertakes the 3x100m at VO2 max speed, the 2x50m at race pace, and then an
easy 100m for recovery. By breaking the set into a number of parts, the swimmer has a better chance of
maintaining the required speed throughout the set. Control of the set can be achieved with the timing of
repeats, the use of heart rate monitors, and if available, the measurement of blood lactate.
The specificity of training is also important in both long-term (months to years) and short-term (days
to weeks) planning. Most coaches follow a program where training volume and intensity is periodised
through a season or competitive preparation. Again the traditional interpretation of the specificity
principle, has involved the season being divided into meso- or macro-cycles which consist of early-
season endurance work, followed by mid-season work characterised by a combination of endurance,
speed and technical development. This is followed by the pre-competitive phase or taper that is
characterised by a systematic reduction in the volume of aerobic work and the development of muscular
power and swimming speed.
Integrating endurance and speed throughout the yearly plan is a key element of planning. Rather
than rigidly adhering to the notion that only endurance work is undertaken in the endurance phase,
and only speed work in the speed phase, many coaches integrate different types of work throughout the
training year ... i.e. the early season endurance phase contains some sprint work and the mid-season
phase contains some endurance work. This approach appears to be quite successful when the training
programs of the best Australian and international coaches are examined. A feature of elite swimmers is
their ability to swim fast (i.e. close to competitive speed) throughout the training cycle. This is possible
only when endurance and speed work have been correctly integrated. The failure of some Australian
sprint swimmers to consistently reproduce their best or near-best form may be indirect evidence that
their long-term training programs need a thorough evaluation.
Individual endurance sports that are repetitive and cyclical in nature ... e.g. running, swimming,
rowing and cycling, require a high volume of training. This is particularly evident for the weight-
supported sports such as swimming, rowing and cycling. I contrast the musculoskeletal stress of
running limits the volume of work that can be undertaken before fatigue and/or injury occurs. Sports
such as swimming (e.g. up to 90km/week) and cycling (up to 120km/week) are characterised by very
large, and some times prodigious, training volumes. However these large volumes are necessary to
support the development of the fitness levels required to be successful national and international levels.
Aerobic training also required to support the development of technical abilities and speed (anaerobic
power and capacity) Although many events within these sports are considered to being largely anaerobic,
it is clear the training of many successful athletes features a large volume of aerobic work.
The classic sporting example quoted by many to justify the concept of specificity is swimming. Many onlookers question the need for sprint swimmers (i.e. those swimmers competing in the 50 and 100m events) to undertake large volumes of aerobic training. In the 1980’s there was a trend towards low volume – high intensity training which was popularised, initially in the United States and later adopted by some Australian coaches. This form of training appealed to both coaches and athletes who looked forward to fast swimming, whilst enjoying a substantial reduction in the time devoted to training. In a popular book on swimming written in 1983 by high profile US coach and a leading sports scientist, it was stated that sprinters should devote 60% of the total workout to the ATP-PC system, 25% to the lactic acid system and only 15% to the aerobic system (Troup and Reese, 1983). This breakdown of training is considerably different from the traditions Australian approach, and that of the successful European swimming nations, who favour a more aerobically-based program.

Despite a great deal of initial interest, it became apparent that the low volume-high velocity approach has several shortcomings. Firstly, it is only applicable to the sprint events over 50m, and possibly, the 100m. Secondly, it appeared to be successful only in the older, more mature, swimmer who already possessed a substantial training background developed over a number of years. Thirdly, it became apparent that while the low volume-high intensity training was sufficient to maintain current, or return to previous, performance levels, it proved difficult to develop or improve competitive performance to a higher level. Many national level swimmers who adopted this form of training remained just that, national level, and could not advance to international levels or, ultimately, to international success.

It appears that the nature of the misinterpretation of the specificity principle is that it is applied too generally. The principle of specificity needs to be applied rigorously in some parts of the training program. Obviously speed and sprint work must be undertaken at a sufficient intensity to provide an overload to stimulate the physiological and neuro-muscular adaptations required for improved performance. A number of coaches and scientists have questioned the need for apparently excessive amounts of high quality aerobic work that many leading Australian coaches have built their reputations on. Of course, there is a fine balance, as many of the “work ethic” coaches would question whether some other coaches are too soft and their swimmers under-prepared.

The importance of using aerobic work to support anaerobic or speed training is highlighted by the challenge of the taper or pre-competition planning. All coaches would acknowledge that this is a vital stage of the preparation for major competition, and often can be the “make or break” time. The traditional approach has been for a systematic reduction in the volume of work, with the maintenance, or sometimes an increase, in the amount and intensity of speed or quality work. Some swimmers are renowned for wanting a “longish taper” where they largely rest up and sharpen their fitness with some sprint work. If this work is not supported by some aerobic training, and/or the reduction in aerobic work is too severe, the process of adaptation and super-compensation may become unbalanced, and ultimately fail. This may be one explanation for some tapers that simply have not worked and the swimmer performs poorly at competition despite a lengthy preparation.

In summary, there are several reasons for a balanced and integrated training program should include a sufficient volume of aerobic work.
1. Aerobic work is necessary for the development of the various components of aerobic fitness … e.g. maximal oxygen uptake, anaerobic threshold and efficiency or economy.
2. Aerobic work is necessary to support the development and maintenance of anaerobic components.
3. Aerobic work is necessary to facilitate the recovery from high intensity competition or training.
4. Aerobic work assists in the maintenance of an ideal body composition by manipulating the energy expenditure: dietary intake ratio.
5. Aerobic work is essential for the development of technical skills at lower training speeds, before they are transferred to faster competitive speeds.
6. Aerobic work is an essential element in the taper process that coaches use prior to major national and/or international competition.

Summary
1. The specificity of training is one of the basic principles used in the design of programs.
2. It is suggested that the specificity principle has been misinterpreted by some coaches and applied too generally in the programming of training.
3. Whilst most competitive swimming events have a substantial anaerobic (speed) component, it does not follow necessarily, that a similar proportion of training should also be anaerobic in nature.
4. Highly specialised programs may be appropriate in some circumstances where older athletes in some sprint events can sustain elite levels of performance. However for the large majority of developing and competitive swimmers it is suggested that a balanced program of aerobic and anaerobic fitness work is more appropriate.
5. The process of tapering training prior to competition may also benefit by the inclusion of an appropriate amount of aerobic work to support the processes of super-compensation.

References: