Victor in mente, victor in corpore

Part 3

Mission control

It has been suggested that coaching is 'more of an art than a science'. Perhaps this idea evolved to explain the existence of several outstanding coaches who have had little or no formal scientific education. They may not have studied biomechanics, physiology, anatomy, and so on, but they will almost certainly claim to be students of human behaviour. Students, moreover, who derive their knowledge from practical experience of working with athletes, rather than from textbooks. This knowledge might include an understanding of teaching methods, individual motivation and the relationships between athletes in a team or squad. In his own way, such a coach is using a scientific approach, for the study of behaviour is the science of psychology. The 'art' of coaching is the ability to relate several sciences to assist an athlete in his pursuit of excellence. Not only is psychology one of these sciences, it is central to equipping the coach to relating them to athlete and sport. This is the framework within which the 'people business' of coaching operates effectively. The most relevant aspects of psychology for coach and athlete are discussed in this section. Chapter 10 has been prepared by Miroslav Vanek and Pamela F. Murray. Chapter 11 is revised (1996) in consultation with Miroslav Vanek and Pamela F. Murray.

10

Victor in mente, victor in corpore

(A mind to conquer, a body to conquer)

Responsibility for the preparation of the athlete has traditionally rested with the coach. The coach-athlete partnership is the long-term aim of any coach wishing to develop his athlete and guide him through the sport. However, the education of the athlete by the coach and supporting team of specialists, and the self-education thereafter, is an underoptimised if not underestimated aspect of training.

Intellectual preparation of the athlete

To maximise performance achievement, the athlete needs to develop his intellectual capacity. Access to knowledge relevant to performance success is a fundamental part of the preparation of the athlete. Each sporting event and discipline requires technical understanding and the beginner generally embarks on a process of gradual accumulation of information pertinent to his activity. The coaching continuum (Dick, 1992) consists of four coaching styles which follow the developmental needs of the athlete: directing, coaching, supporting and counselling.

The directing style of coaching provides the necessary input which the learner accepts and takes on-board. There is little negotiation given the lack of experience and knowledge on the part of the athlete. With more time and experience the coaching style is employed; the athlete may now participate in decision-making during this more interactive style. Psychological preparation can shadow this process and the athlete is encouraged to make independent assessments and begin to reflect on the results of given actions. Outsiders to the coach-athlete relationship, such as specialists dealing with aspects of sport science support, may offer input. This is taken one stage further when the development of the athlete is planned by role exchange and the coaching role assumes functional interchangeability. The athlete may, for example, report on given nutritional advice to other athletes and so maintain athlete motivation for learning while other suitable coaching responsibilities may be passed over to the athlete. The following style along the continuum is that of supporting, where the athlete is more independent in sharing plans and ideas with the coach. The athlete contributes to training programme design and the planning of competitive activity. Continued role interchange encourages the development of the athlete through the style spectrum. The counselling style is used with an accomplished athlete able to manage a lifestyle compatible with training and performance demands. Sufficient input from outside specialists has enabled the athlete to combine personal experience with systematic support. Whilst described as a progression, an athlete may well respond best to one coaching style when concentrating on technical form, but prefer another when handling another aspect of training.

The intellectual preparation of the athlete is designed to develop the ability to accumulate a relevant reservoir of knowledge necessary for successful participation in sport. Decision-making ability and cognitive creativity in part determine how efficiently the athlete will compete. The athlete must be independent, not vulnerable to manipulation by the coach or any other administrator within the sport, and be able to control himself in the chosen competitive arena. Such development of thought capacity requires years, and a patient coach who strategically plans the individual's preparation through integrated inputs. Sport science support is necessary to give an objective foundation to the development of athlete cognition. Such universal preparation is now a basic requirement for the athlete competing against organised coaching systems operating in other countries, which emphasise overall development. The terminology should not put coaches off making use of specialist input; a cognitive strategy is simply needed for a thinking competitor. Given that competition implies adaptation to changing variables, the athlete should not be limited through lack of intellectual preparation.

Sensory motor training (SMT), and modelling

The most highly developed form of training for stressful experiences, such as experienced by the athlete under competitive conditions, is that of the senses. SMT, if adequately handled, will give the athlete the opportunity to develop event-specific sensory perception. As a leading sense from the sensory complex will inform the athlete of actual happenings during performance, the coach can rehearse competitive conditions with the aim of developing sensory reception and the ability to read and respond. Modelling is a form of SMT that seeks to reproduce aspects of competitive performance, giving competition specific sensory motor training. It must be said that some competitive characteristics cannot be reproduced, such as the atmosphere. The use of noise or music will not elicit the same response in the athlete as on the day of the event, as was previously thought possible, and the coach is better advised to replicate environmental conditions such as altitude, humidity, time and temperature. Other techniques such as giving a leading or trailing handicap of 10 metres will let the athlete practise the feeling of running from in front or behind and reproduce psychological situations. Team sports, similarly, can make use of tactical advantages and disadvantages during rehearsal activity, such as playing with the restricted use of a particular shot or space.

Role playing has proven to be a most effective technique within modelling, where the role of the opposition can be taken on by some of the

potential competitors. Prior to a major championship, the Czechoslovakian artistic gymnastic team were divided into two groups; one group played the role of the then Soviet team, and the other group retained home-nation identity. So realistic were the accompanying conditions, with the roles of dressed officials also being played, that a strong emotional element was created within the model competition. Coaches and gymnasts were thus effectively guided in the refinement of individual preparation strategies. Therefore it is more important for the coach to consider factors which directly affect the performer within competitively induced situations when creating a situational model, than to pay attention to indirect conditions.

Successful models have been created in soccer for goal practice for striker and keeper using an overcrowded goal area, reducing decision-making time and thereby imitating real-game characteristics. Decisions to be taken by striker and keeper are left open to continually rehearse spontaneous situational coping. Such practices without the inclusion of real-game conditions are underoptimised in terms of SMT. The coach can produce innovative practices, taxing the player through the combination of technical and tactical demands. Overloading can also be used to enhance resistance. Very occasionally, the coach may suddenly change a previously agreed session thereby surprising the athlete. For example, if a track athlete is coming to the end of a 300m run and the coach shouts instructions to carry on for a further 150m, the athlete will be forced to mobilise his reserves. Whilst immediately unpopular, the coach has in fact used a technique which will help the athlete when moving into stressful conditions!

Modelling takes many forms. The sensory motor training involved will teach the athlete how to make appropriate adjustments conducive to success-related activity under varying conditions. However, successful training models used by one athlete or team, may not be suitable for use by others. Models are a result of coaching experience, careful observation (perhaps using technological means), and subjective measurement using esteem and self-esteem scales.

■ Esteem scales and self-esteem scales

Esteem scales, used by the coach to evaluate the athlete, and self-esteem scales, used by the athlete to rate himself, are examples of psycho-diagnostic tools at the disposal of the coach. The coach can compare the information revealed through other observational techniques such as video performance and training observations, to either reinforce facilitating aspects or identify existing discrepancies. The construction of esteem and self-esteem scales depends on the coaching style used by the coach, the event, and the personality-determined needs of the athlete. Each coach can design his own scales to provide relevant training design and preparation planning guidance. Flexible designs which alter according to the information required will give both coach and athlete the opportunity to reflect on aspects related to training and competing, which either assist the athlete or detract from optimum conditions. Figures 53 & 54 show flexible designs which are changed in accordance with the information required.

Overuse is not encouraged but certainly use pre-, mid- and post-season is beneficial, with occasional use when the coach wishes to identify specific pre-determined characteristics, whether positive for reinforcement, or negative for eradication.

This type of design is part of a scale appropriate for a coach wishing the athlete to evaluate his training management. For example, if the athlete is seen to be constantly distracted, the design will allow for the consideration of lifestyle management giving an insight into the broader aspects of the athlete's activities:

training	*rating*	*perception*
Training organisation		
Session organisation	1 2 3 4 5	–3 –2 –1 0 1 2 3
Enthusiasm whilst training	1 2 3 4 5	–3 –2 –1 0 1 2 3
Ability to give maximum effort	1 2 3 4 5	–3 –2 –1 0 1 2 3
Communication with coach	1 2 3 4 5	–3 –2 –1 0 1 2 3
Commitment to programme	1 2 3 4 5	–3 –2 –1 0 1 2 3
Interaction with other athletes	1 2 3 4 5	–3 –2 –1 0 1 2 3
Technical support		
Technical expertise of coach	1 2 3 4 5	–3 –2 –1 0 1 2 3
Technical understanding of own event	1 2 3 4 5	–3 –2 –1 0 1 2 3
Sport science support	1 2 3 4 5	–3 –2 –1 0 1 2 3
Personal input to technical programme	1 2 3 4 5	–3 –2 –1 0 1 2 3
Support of other coaches	1 2 3 4 5	–3 –2 –1 0 1 2 3
Recovery		
Recovery within session	1 2 3 4 5	–3 –2 –1 0 1 2 3
Recovery between sessions	1 2 3 4 5	–3 –2 –1 0 1 2 3
Effectiveness of active regeneration	1 2 3 4 5	–3 –2 –1 0 1 2 3
Nutritional care	1 2 3 4 5	–3 –2 –1 0 1 2 3
Sleep pattern	1 2 3 4 5	–3 –2 –1 0 1 2 3
Out of training worries	1 2 3 4 5	–3 –2 –1 0 1 2 3

Please comment on the following aspects of your training management on a scale of 1–5 where 1 = not good and 5 = excellent. The second scale from –3 to 3 is a perception scale by which you can indicate to what extent you feel that this is facilitative or detrimental. –3 represents a very negative response whilst +3 represents an item which you find very positive.

Fig. 53 *Self-esteem scale – to be used by the athlete in a self-rating style*

Competition specific scales may be constructed to include aspects which are thought to influence the athlete at this time. Areas to be covered may well include emotions such as excitement, fear, anxiety, enjoyment; feelings prior to the start of the event; control over self at this time; interference of concentration by others; reaction to opposition; delivery of coach instructions whether unclear or clearly understood; ability to regain focus if interrupted; goal focus; or use of competition plans. The items included are then indirectly athlete initiated.

The scale construction of figure 54 allows the coach an insight into how the athlete approaches training and competition using his personal judgement to assess the athlete:

training and competition behaviour	*perception*
Training	
Athlete gives maximum effort	–3 –2 –1 0 1 2 3
Responds well to informative feedback	–3 –2 –1 0 1 2 3
Communicates feelings	–3 –2 –1 0 1 2 3
Follows the agreed programme	–3 –2 –1 0 1 2 3
Fatigue	
Loses motivation when tired	–3 –2 –1 0 1 2 3
Gives greater effort when fatigued	–3 –2 –1 0 1 2 3
Loses concentration easily	–3 –2 –1 0 1 2 3
Can mobilise reserves	–3 –2 –1 0 1 2 3
Is prone to negative feelings	–3 –2 –1 0 1 2 3
Competition	
Pre-game/event plan organisation	–3 –2 –1 0 1 2 3
Confidence approaching event	–3 –2 –1 0 1 2 3
Reliance on coach/other	–3 –2 –1 0 1 2 3
Use of performance plan	–3 –2 –1 0 1 2 3
Distraction	
Ability to focus	–3 –2 –1 0 1 2 3
Ability to recover from loss of focus	–3 –2 –1 0 1 2 3
Tendency to relax following score	–3 –2 –1 0 1 2 3
Easily distracted when under pressure	–3 –2 –1 0 1 2 3
Post competition	
Accepts +ve or –ve result	–3 –2 –1 0 1 2 3
Accepts himself as worthy individual	–3 –2 –1 0 1 2 3
Ability to analyse objectively	–3 –2 –1 0 1 2 3
Overly self-critical	–3 –2 –1 0 1 2 3
Return to training following competition	–3 –2 –1 0 1 2 3

Fig. 54 *Esteem scale – for use by the coach evaluating the athlete*

Motivation

A highly researched area with many schools of thought, motivation continues to elude coaches and researchers alike, given that there is no finite nor precise list of motives, and also due to the fact that motives cannot be identified through experiment. The development of theories remains an important task. Many current theories are based on the concept of perceived competence such as attributions, goal orientations and intrinsic motivation (Biddle, 1995). Achievement motivation and motivation in the form of competitive stress are also considered by sport psychologists (Weinberg & Gould, 1995). Thus we have to accept some operational theories which fit the competitive basis of sport. In this case we refer to motivation as considered by the McClelland-Atkinson model (McClelland, Atkinson, Clark & Lowell, 1953; Arkes and Garske, 1982) where two factors determine whether an athlete will engage in competition: the motive to achieve success and the motive to avoid failure. Often referred to as competitiveness, achievement motivation has been considered by sport psychologists as a personality factor, where personality traits influence the athlete's need for achievement. An interactional view accounts for more changeable goals, identifying how these affect the situation and the influence the goals themselves exert over the situation.

The motive to achieve success, regarded as the athletes' self-confidence or efficacy, is believed to represent an athlete's intrinsic motivation when approaching a competitive situation. The motive to avoid failure is represented by the individual's personality disposition for anxiety. Motivation consists of a cluster of motives which are inner needs (urges or tendencies), plus external stimulus; *motivation = motive + external stimulus (actual or signal)*. Inner and external stimuli create the motive, however the final behaviour will depend on the mental capacity of the athlete. A motive is the basis for energy and direction of behaviour where the athlete requires both movement and mental skill to reach a goal. Singer (1968) proposed that performance is a function of motivation and skill, $p = f(m+s)$. The specific cluster of motives is important given that some combinations may be incompatible: *do not like training* (negative), with *have to compete* (negative); *want to go out with friends* (negative), with *look forward to training* (positive); *want to win* (positive), with *want to train* (positive). Achievement motivation can be described as the predisposition of the athlete to win. Athletes motives are not static. Emotions such as fear, joy or anger are also regarded as motives. The athlete will respond at every moment to the dominant motive according to his intellectual capacity.

Intrinsic and extrinsic motivation should be combined to establish an optimum motivatory effect. Whilst a balance exists, intrinsic motivation should prevail as the goal-centred athlete has greater motivation. If we take the example of the professional footballer anticipating payment, he must first win, and so attend to the actual performance goal before considering the financial bonus following success. Risk-taking behaviour describes a situation where the athlete seeks challenging achievement situations where there is a fifty percent probability of failure. A situation with a low or very high chance of failure would depict an athlete low in the motive to achieve success, as the athlete will either win easily, or be excused for losing against such tough opposition. In this way his self-esteem is not threatened.

Motivation does not operate in isolation. Coupling with cognition, it is thought to form the motivation for the next goal. In terms of goal setting, dealing with success and coping with failure should be approached from mid-term and long-term perspectives; the athlete who performs poorly at a home international or commonwealth games should review the performance in terms of Olympic preparation. Fuoss and Troppmann (1981) used the acronym SCRAM to describe the properties of effective goals: specific, challenging, realistic, and measurable. The

coach and athlete should be able to establish appropriate values for these in the knowledge that the stress of competition infers change to such parameters (Beggs, 1993).

All performances are interpreted according to the mid- or long-term goal. This would be impossible to do without first, the motivation, and secondly, the cognition. There is then a relationship between the actual state and expected state (Vanek, Hosek & Man, 1982).

The effect of goal setting is not in itself unlike competition, as challenging goals can be perceived as stressors (Huber, 1985). Proximity, difficulty and specificity have been shown crucial goal-setting characteristics. Proximal goals in training, those which are closer to the athlete rather than distant future goals, are reported to increase the athlete's confidence, strength, stamina and skill, reducing the likelihood of being adversely affected by competitive stress (Beggs, 1993). In conjunction with this input, the operational coaching style will influence the commitment from the athlete, in that a supportive style will allow the athlete to play an active part in goal setting. It is more than likely that assigning goals for the performer using a directive style will not result in optimum conditions for goal achievement. Acceptance of the goal, commitment to the goal, and the responsibility for the goal are encouraged by athlete participation. The coach can provide the athlete with many opportunities to rehearse anxiety-management skills during such times. A goal-setting programme utilising appropriate sub-goals to manipulate the goal type will expose the athlete to various strategies.

Emotions and arousal effect

There exists a biology to basic emotions in which certain points in the brain house emotions such as fear, aggression and pleasure. One point of stimulation can be continually aroused, as with the drug abuser becoming addicted, and the individual will behave in a certain way to bring about that specific emotion. Sport is one such stimulus, a need to be fulfilled by the athlete. Participation in competitive sport is related to pleasure whether through the movement itself, or through the accompanying money, glory, or effort and pain accompanying training. Educating the athlete to behave according to an appropriate value system can change such behaviour. New emotions and needs come from the external environment, and so the athlete will internalise emotions related to the fulfilment of these needs. The level of the athlete's needs is then raised. With further internalisation the athlete will have greater influence over the external environment, and be in a position to give others new values, skills and approaches to society. This process is called externalisation. The coaching continuum provides a useful analogy, and indeed mirrors, the process. Directing activity sees the athlete receiving information and knowledge which is internalised allowing the athlete to develop a little and move on to the next style, coaching, where the athlete now becomes more involved with training decisions. Again the role interchangeability raises the needs of the athlete who progresses to supporting style. The coach adjusts the style according to the developing needs of the athlete. The athlete externalises information setting an example for other athletes. With more experience and competence the athletes evolving needs require a different style of coaching; from a counselling style the athlete independently manages training and competition activity although the coach can assist with the overall planning.

The autonomous athlete, having reached an élite level, should not divorce himself from those values which underpinned his early career, nor the emotions and behaviours of that period. A higher complex of values now influence the athlete, and this in turn provides others with 'messages' due to the process of externalisation. It is vital that replacement emotions are guided by ethical values. Ethical behaviour does not simply arrive with the rise to élite performance level, and yet performers at this level carry a great responsibility to ensure that behaviour is commendable. Behaviours can be changed through education, a responsibility of both coach and athlete. Coaching systems should be based on the process of athlete internalisation-externalisation, ensuring the necessary progressive development.

Extreme positive or negative emotion can detract from an appropriate mental state for performance, as arousal may increase quite dramatically blocking movement co-ordination and mental processes such as cognition. Under such conditions, the athlete is unable to produce a normal performance. The personality of the athlete will determine how the stresses are coped with. For those individuals who perform better when external pressures cause inner tension, performance in competition exceeds that of training. Such athletes have frustration tolerance, a higher level of resistance, whereas those who perform better in training than in competition have a very low frustration tolerance. From the coaching point of view it is important to realise that mental resistance, sometimes referred to as mental toughness, is either inborn, influenced by the type of education received by the athlete, or influenced by experiences under stressful conditions. It is advisable to create a system of athlete education leading to the independence of the athlete, involving complete knowledge of the self, and optimal risk-taking. The resistance level and frustration tolerance of the athlete can be established through athlete observation whilst training and competing, self-esteem scales carried out by the athlete, and esteem scales used by the coach. Competitive stress has been approached by both emotion-focused and task-centred methods: emotion-focused coping methods, such as relaxation techniques and self-talk, attempt to address anxiety and other non-facilitative emotions. Task-centred coping methods, such as goal setting, aim to remove the cause of unwanted emotions (Cohen and Lazarus, 1979).

■ Psychological management of the opposition, and self-management

It is important to teach the athlete how to handle the opponent psychologically, as he will not be looking out for the best interests of fellow competitors. There are many behaviour patterns which will assist the athlete prior to the event, at the competition site and in other areas such as the athlete village.

As with event favourites, Danek, a Czech discus thrower and world record holder of the time, received much media attention and support prior to the Tokyo Games. His main opposition came from the American, Oerter, who also proceeded to confirm Danek as firm favourite, sure to win the competition in his absence as he was too injured to throw. On the day of the competition, Oerter turned up with a bandaged shoulder, visibly distracting Danek. Danek started with a throw of 59m, short of normal performances. Oerter's first throw was 62m. At this moment Danek was crushed, his arousal was so high that further attempts were not completely co-ordinated.

Pre-performance and performance routines should cover a range of potential incidents as risk-management for the athlete. Every athlete must learn how to handle the opposition psychologically. This is not unethical but more along the lines of self-preservation and quite pragmatic. Every activity must feed the athlete's performance, and not detract from it in any way. To reduce pressure as event favourite, he must think of challenging for the medal rather than defending himself against challenges. If he has a high performance expectation, it is easier to achieve this goal from the position of the outsider than from the lime-light. Competition strategy involves learning about self-portrayal; focus on goal fulfilment should be cleared of distractions. Each athlete will create his own recipe establishing flexible successful ingredients. The athlete must also exert complete self-control learning to adapt to a range of situations. A British international high jumper reported that he liked to feel 'bouncy' before competing. When asked how this was achieved, the athlete stated that running round a 400m track and jumping the occasional hurdle was necessary. This same athlete was about to compete in an indoor arena with a 200m track. Suffice to say that the performance was certainly not supported by this rigid performance plan. Competitive experience will assist in the design of such plans, and various should be devised and rehearsed in light of changing conditions. The mental plan will direct energy and effort carefully in light of familiar experience. Contingency for the unknown is not as difficult as it may sound – the athlete will have a range of mental skills at his disposal which provide tools with which to approach adversity. Confidence is instilled by the very fact that the performer can call upon internal resources to help deal with the unexpected. Central to the success of a plan is athlete control. No athlete can afford to wait for the opposition to impose competitive conditions. If the athlete allows this to happen, he is abdicating the responsibility for the performance.

Table 20 *Race focus plan for international 800m runner*

600–800m	trigger 'squeeze'; kick hard
600m	get ready to kick
500m	trigger 'stay up'; work onto the back straight
200m	in position, stay relaxed
Start	trigger 'get out fast'
Pre-start	alone, ignore people around me, avoid eye contact. Attention on breath control, relaxation routine

Plan development I

The plan is followed from the lower sections upwards, as the athlete visualises the ascent to victory within the structure of the plan. The performer was shadowed in training and competition to establish relevant plan ingredients. A loose structure was implemented to guide the acquisition of relevant mental training skills. Warm-up races, such as club commitments and national championships, were used to refine the flexible framework.

Table 21 *Refocusing plan for rugby international*

KEY: when you pass the ball, you don't give away responsibility.

1. *Loss of concentration through mistakes*	
Attention lost on missed kick	park it
Use gear box	select a gear, 1st to recover, 2nd gear up to playing speed
Concentration 1	use movement pattern – still loss of focus
5-point kick plan	visualise, successful imagery
Concentration 2	use trigger word 'precise'
Return to game pace	change gear, 3rd for aggressive acceleration. 4th gear – in control, smooth play
2. *Loss of concentration through fatigue*	
Reinforce gearbox	keep changing gear
Positive self-talk	use triggers 'big hit'; 'safe hands'
Team energy	talk to team-mates, remember 'the hill'
Energise	energy-ball imagery
Be aware of roles: attack, support.	
3. *Heads are down*	
4 points down	we need 5 to win
Team energy	keep recycling
Basics	simple moves
Time	use every second

Plan development II

This player established a range of plans reflecting his individual needs throughout the game. Training camp venues were used to introduce and practice mental training techniques in controlled and modified

conditions. Personal reserves such as emotional and physical commitment were necessary throughout the intense training activities. Individual and collective strategies were implemented, where the player could call upon internal reserves and the accumulated willpower of the group. During match play, associated emotions are recalled by the player which help elicit a similar response. Complete control is assumed.The player, with a specific route in mind, thus remains the driver and does not become a passenger throughout the game. Cues relevant to the immediate game can be attended to in the secure knowledge that the problem will be effectively handled. Technical training sessions were used to rehearse the different techniques, where conditions reflected the real game demands more closely. Non-league games theoretically provided the next step in plan refinement, however due to the vast difference in the approach of the player to this type of game as opposed to a league game, and the difference in the level of performance arousal, it rarely provided a sequential progression.

The player must realise that such plans do not fall into place on their own. He is actively involved in making them happen. The mental plan can be reviewed through post-game analysis one or two days following the event, in addition to a short self-esteem scale designed for this purpose. Practice is essential. Confidence in mental plans is fundamental and therefore supporting staff should be careful to refer to aspects of the player's plan so as to publicly reinforce its practical value. The integration of mental training with the physical preparation of the player is vital.

There are also potential problems away from the competition site which the athlete can address. The athlete village at any major championships plays host to many potential stressors which may affect the athlete: distractions from social activity, continued presence of the opposition, and the constant intensity which distinguishes the site from the home environment. Experience reveals that it can be a testing ground for athletes wishing to psyche-out opposition. The athlete must live amongst failures, those with great aspirations, and those with unethical values. To be polite, calm and live in comfortable isolation may then suit those wishing to conserve performance energy. Carl Lewis did not stay at any Olympic village, preferring to stay away from that type of environment and successfully minimising his exposure to other variables, which he perceived as potentially distracting. Refraining from other athletes' psychological handles can be difficult, and so the athlete can be comfortable in the knowledge that predetermined routines will look after his respective interests.

Performance support should also be aware of the potential downfalls associated with athlete deprivation at competition sites. For instance, athletes competing abroad may experience taste deprivation, a desire for food that satisfies their specific requirement. Whilst competition hosts may offer excellent facilities, it is important for the athlete to operate within a comfortable zone, in touch with aspects typical of the home environment. It is worth sending a cook from home with any travelling team, as did Nestlé sponsoring the Swiss team during the 1980 Moscow Olympics. The athlete should not spend too much energy adapting to constant change.

Pre-performance routines within the long pre-start conditions (fig. 56) provide familiar structures and flexible, but controlled, patterns. The performance routine, within the competition itself, will facilitate consistency. Boutcher (1993) reports further advantages: attention control is increased, helping the athlete to concentrate more efficiently; the warm-up decrement is addressed, concerned with a loss in motor performance following a short break by giving psychological and physiological warm-ups in stop-start activities; and automatic skill execution is encouraged.

Despite the use of naive, so-called non-scientific, techniques designed to harmonise bodily and mental states, there are occasions when the desired result is not achieved. Therefore the athlete should have an operational understanding of mental training techniques with a scientific basis such as Jacobson's progressive relaxation (1929), which involves a systematically ordered tensing and relaxing of muscle groups; or autogenic training, similar to progressive relaxation with an emphasis on how the body parts feel (Schultz and Luthe, 1959; Harris and Harris, 1984; Nideffer, 1985; Orlick, 1986).

It is possible to identify which mental training techniques and cognitive strategies successful performers use. Weinberg and Gould (1995) report a qualitative approach to the investigation of differences between successful and less successful athletes, using in-depth interviews with the 1988 U.S. Olympic wrestling teams. Medal winners used more positive self-talk, had a narrower and more immediate focus of attention, had better mental preparation for unforeseen negative circumstances, and had more extensive mental practice.

Many procedures have been developed, but not all are as effective as they are claimed to be. Whilst the athlete should learn to relax the body as a basis for intervention strategies, he must also learn reactivation, depending on the athlete and sport. Players in English first division rugby are currently making effective use of a combination of pre-game relaxation followed by individually designed reactivation strategies. Individual programming is crucial for both team and individual sports where blanket strategies may even serve to distract some players, and certainly not produce a viable ideal performance state for all within the

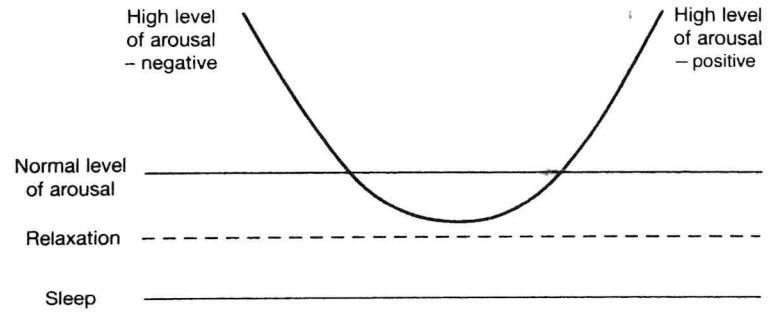


Fig. 55 *Competition-induced arousal* (Vanek, 1967)

team. The relaxation-reactivation is rehearsed for competition-type whether for home and away games, or national and international events. Competition-induced arousal is given a new direction.

Theoretically, arousal can be very low such as sleep, or higher for normal daily activities. It is described as physiological and psychological activation (Gould & Krane, 1992). A high level of arousal results in mental activation which can manifest itself in sweating, increased heart rate, and respiration. Some individuals may experience overarousal to the extent that they lose control over their actions. Arousal does not infer either negative or positive reactions. However, anxiety is a negative emotional state characterised by feelings of apprehension associated with the activation or the arousal of the body (Weinberg & Gould, 1995).

Figure 55 shows the arousal level prior to competition (on the left), which is negatively affecting the individual. Using a mental training technique, this is reduced to a relaxed level, but not sleep. From there, reactivation occurs with the use of an appropriate follow-on technique. The arousal again increases but this time with a new direction, positively affecting the athlete (to the right of the figure). The performer has controlled pre-competition anxiety avoiding, for example, loss of energy leading to a feeling of flatness. In addition, an indirect consequence is that of increasing self-confidence. The athlete, in the knowledge that self-management techniques have been learned and rehearsed, will approach competition with self-assurance. Risk management activity is a fundamental part of performance preparation.

Many arousal models exist, describing the anxiety of the athlete and subsequent behaviour; Hardy and Fazey's (1987) catastrophe model assumes that anxiety is made up of cognitive anxiety and a physiological response. When physiological arousal is high, such as on competition day, this model predicts that a negative correlation between cognitive anxiety and performance exists, although moderately high levels of physiological arousal are necessary for peak performance. Reversal theory (Apter, 1982) asserts that a high arousal level occurring within an evaluative state will be negatively interpreted as anxiety, whereas the same level of arousal occurring when the athlete is within a non-evaluative state will be interpreted positively.

The category and perception of anxiety determines the athlete's responses and coping strategies; identified differences between cognitive and somatic anxiety influence stress management models (Davidson and Schwartz, 1976). The mental component of anxiety, referred to as cognitive anxiety, is caused by either negative expectations of success, negative self-evaluation, or diversion of attentional focus (Burton, 1990). It is characterised by worry, negative self-talk and imagery, and loss of attention. Somatic anxiety is the physiological or affective component related directly to autonomic arousal which may be manifested in a range of physiological responses including clammy hands, muscular tension and rapid heart rate. Important for both coach and athlete when managing the arousal-performance relationship is a multidimensional perspective (Martens et al, 1990). The athlete, regarded as a processor of information within a cognitive approach to sport psychology (Straub & Williams, 1984) is potentially vulnerable to differential effects on aspects of the information-processing system when under the stress of competition (Jones, 1990). The aim of good mental training is to harmonise the mental and training/competing states. It may take several months to half a year to master control over arousal. Coping skills must be rehearsed and practised under simulated conditions to maximise their efficiency. These techniques should not be carried out without specialist training and objective measurement. Imagery, audio and video tapes are only part of any procedure. This said, mental training is not to be overestimated as it is only part of the overall psychological preparation.

■ Performance management

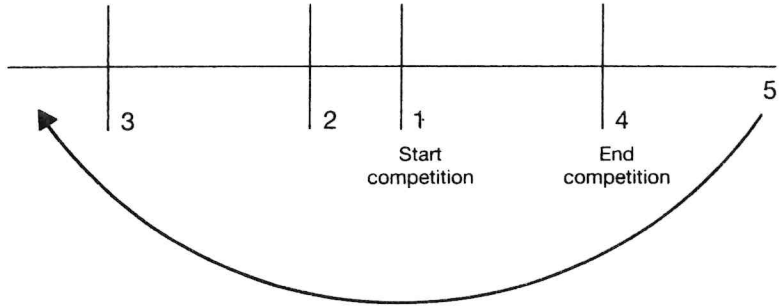


Fig. 56 *The stages of time of competition*
(1) start conditions – the starting mental state of the athlete (minutes and seconds prior to the start)
(2) short pre-start conditions – short-term pre-start mental state (minutes, hours)
(3) long pre-start conditions – long-term pre-start mental state (weeks, days, hours)
(1–4) competitive conditions – competitive mental state
(4–5) post-competitive conditions – post-competitive mental state

The ability to understand and manage the stages of time of competition optimises the conditions which are under the control of the athlete. Each stage should be carefully analysed so that coach and athlete can manipulate existing variables. In no single stage should the athlete feel loss of control or uneasy with how things are going. Of particular importance is the handling of the post-competitive mental state (5) as this stage influences long pre-start conditions (3). This determines the actions of the coach following defeat and success to ensure that the athlete is able to re-enter at the pre-competition stage in a comfortable mental state. Care of the athlete is personality related, however sensitivity on the part of the coach following competition is more likely to contribute to the athlete's recovery from one competition and thereby assist his

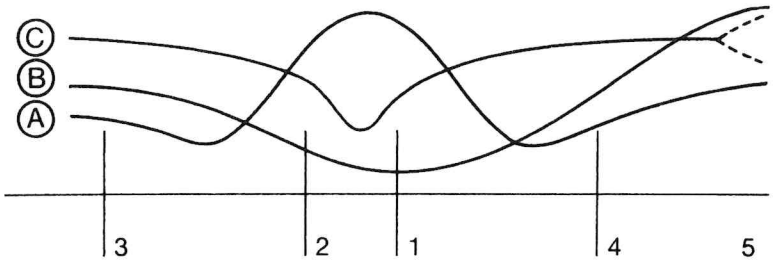


Fig. 57 *Arousal A: the arousal is too high in the short pre-start conditions. Thereafter, during the competition, the arousal falls due to its premature intensity prior to competition, leaving Athlete A feeling flat and drained; Arousal B: this profile represents low arousal in training, such as when there is little effort on the part of the athlete (long pre-start conditions). It slowly rises but optimal arousal is only reached following the competition. A poor performance for Athlete B; Arousal C: falls in the short pre-start conditions, rising in competition to a facilitating level. This demonstrates the correct timing and level according to the arousal level of the finished effort for Athlete C*

preparation for the next. Arousal can be depicted along the stages of time of competition. A simplified approach highlights the profiles of three athletes, A, B and C, in fig. 57.

Each athlete is, of course, different and will display a unique arousal pattern. However, it is a basic responsibility to explore the varied conditions under which the athlete will perform well or badly so that the accompanying skills and coping strategies can be learned. The day of the competition should not bring unexpected conditions, only a mixture of familiar experiences, or at least ones which the athlete can relate to. Post-competitive conditions are closely associated with the finishing arousal and effort of the athlete. Reactions may include euphoria or depression as these are part of the motivational cluster associated with the new training phase. Immediate post-game input should be neutral, free of value-judgements. Performance management is an integral part of coaching methodology.

Personality of the athlete

Given that personality is determined by an individual's characteristics, each person is unique. Hollander's (1971) notion of personality divides it into three separate but related levels: the psychological core, typical responses, and role-related behaviours. The psychological core, internal and most consistent in nature, includes the individual's self-concept, central attitudes, values and motives. As the deepest component of the personality, it represents the 'real you' (Weinberg & Gould, 1995). Typical responses, represented by the way in which an individual responds to an environmental situation, will give an indication of the individual's psychological core. If an athlete consistently avoids social situations, it is likely that he is introverted. Role-related behaviour is engaged in to fit the individual's perception of the environment. As the environment or perception changes, so too does the behaviour. This aspect of the personality structure is most superficial and changeable. The parent-coach can often have difficulty with the coexistence of both roles. Despite the fact that various methods have been designed to measure personality, such as rating scales, questionnaires and unstructured projective tests, including the Athletic Motivation Inventory (AMI), (Tutko & Richards, 1971, 1972); Cattell (16PF) Personality Factor Questionnaire, (1965); the Eysenck Personality Inventory (EPI), (1968); and the Minnesota Multiphasic Personality Inventory (MMPI), (in Cox, 1990), it is highly unlikely that a cause-and-effect relationship exists between a personality trait and athletic performance. This is also partly attributable to methodological concerns.

Personality differences between athletic females and non-athletic females exist. The female athlete has been shown to differ from the normative (non-athlete) female but to share personality traits with her counterpart, the male athlete and the normative male, such as assertiveness, achievement orientation, dominance, self-sufficiency, intelligence and reservation. Fencing, ice hockey, track and lacrosse demonstrated low personality variation, suggesting the viability of specific personality profiles in different sports (Williams, 1980). Elite sport lends itself to personality profiling. The coach must treat all athlete's as individuals, recognising that an exceptional talent may differ from the norm. However, knowledge of an individual's personality traits is not a predictor device.

Some researchers have turned their attention to how the situation and the environment affect the individual's behaviour (Bandura, 1977). According to the situational approach, environmental influences determine the way an individual behaves. A timid individual may play an extremely assertive game of soccer, the game situation necessitating the behavioral change. Despite the fact that the situation can certainly influence behaviour, it cannot accurately predict behaviour (Weinberg & Gould, 1995).

Superficial inventories cannot penetrate the personality. North American and British approaches have made extensive use of such inventories, whereas Soviet approaches have been inclined to use experimental methods, trying to establish and record objective data associated with the nervous activity of the subjects under observation (Vanek & Hosek, 1974). The coach, using personal experience, time spent with the athlete, and combining such factors with esteem and self-esteem scales, can make a fairly accurate assessment. It is better to construct an athlete profile over a period of time using simple observation techniques to get to know the athlete in different situations.

Relationship between athlete and coach

Initially, the athlete must adjust to the disposition of the coach given that the coach is stable and the athlete transitory. The coach has an approach consisting of systems and styles with which to influence the athlete directly and indirectly. Therefore the athlete should maintain self-direction, where the coach will identify with the athlete's personality and establish areas for reinforcement. A flexible structure is used by the coach throughout his operations – adapting to changing development needs of the athlete.

The science of coaching as a body of knowledge must be constantly innovative. The coach has a responsibility to continue his own learning by reading, listening, and attending workshops, clinics and courses. Only by thinking and reflecting on his work, and by integrating the supporting disciplines such as sport psychology, nutrition, physiology and bio-mechanics, can the coach continue to develop the discipline and his position within it. Murray (1995) notes that it is the synthesis of sport science information which produces the shift from multidisciplinary to interdisciplinary activity. Specialists can then provide a supporting network which informs, reinforces and enhances the operations of the coach-athlete partnership, reducing the possibilities of contradictory conclusions. Coaching methodology is, as a consequence, extended, broadening the scope for decision-making. The coach should learn to lead and co-ordinate the work of the support team, optimising individual input within a context specific to the athlete's needs. Within professional sport, such support should not be financed in accordance with session input, but should reinforce the partnership with specialist and coach by linking payment with performance outcome. Martina Navratilova maintained such a support team of 8 or 9 specialists including two sport psychologists, one handling training motivation, and the other tournament motivation, given that she felt it difficult to be constantly motivated. Communication occurring in two dimensions is therefore fundamental to performance support, coach and specialist, and specialist and athlete. The coach should be informed of discussions, for example, between psychologist and athlete, where the psychologist is respectful of confidential information. Unethical activities on the part of the sport psychologist include betrayal of trust and overestimation of abilities as a psychologist. The sport psychologist will work in different ways, observing, assessing, and testing players where results inform coaching activity and performance preparation, or again, as a consultant with both coach and athlete, giving psychological guidance. The number of people operating around the coach can either contribute to coaching aims or conflict with them. Overinvolvement should be avoided by strategically planning support with clearly identified roles.

The art of coaching is the experimental learning from value-judgements made on a trial and error basis. The coach records daily input so that decisions can be reflected upon in terms of the related outcomes. Socially sensitive individuals are more able to progressively accumulate and develop the art of coaching. The centrality of the people business cannot be substituted by any other factor such as supporting technology. Technology should not detract from the creativity of the coach but only play a facilitative role rather than replace value-judgements. At the disposal of the coach is a complex system of metacommunication, where the tone of the voice, a certain look, or small signal can provide the athlete with very clear information. The coach does not need to use too many words but should also find a variety of metacommunicative methods. Short instructions are best suited prior to and during events. Following defeat there should only be instruction on immediate activities such as showering or refreshments. The coach will also be in an emotional state and should not risk anything said which may be difficult to recover from. Post-match/event analysis is more objective after a good nights sleep! In addition, a good performer never needs to be told when he has performed badly. The coach should not be interested in scoring points at this time.

Full team/squad meetings should be democratically executed, a formal and open route which the athlete can use without fear of recriminations. The athlete should be an active participant in the planning of his own destiny and be able to accept responsibility for under achievement or other problems because he has continuing personal involvement. The range of coaching styles can be used to reinforce different messages; a decision taken at such a meeting must be adhered to, thereby introducing a directive coaching style which the team associate with necessary discipline within a just environment. Coaching and supporting styles encourage the player to contribute to his own development, inviting constructive athlete input. End of season team meetings provide the opportunity to fully evaluate results with the benefit of hindsight, where responsibility for errors can be attributed providing useful information for the planning of post-season screening and guiding the pre-season training structure. In-between meetings occur in light of flexible adjustments to the coaching or performance programme and should follow a similar pattern. Consistency on the part of the coach creates a force on which the athletes can rely. Meeting procedures will allow the attending parties to focus on the relevant issues rather than be distracted by the order of the day. Language should also be grammatically uniform: it is not acceptable to say 'we won' and 'you lost'. If periods of success have the coach referring to 'we' and 'our', periods of adversity should also adopt the plural. Players subjected to coach inconsistency will begin to doubt the sincerity of the coach before losing trust completely.

Image and self-image of the athlete

Self-image is the result of self-reflection. The starting point comes with dealing with failure – 'why did I fail?' The point of failure is analysed giving the athlete the opportunity to compensate for practical aspects revealed in the analysis. If the self-image of the athlete is a positive one,

where the athlete feels good about himself, he will comfortably identify with the goal and related activities in a confident manner. The athlete must accept himself regardless of any result at a competition. A non-achieved goal is not apparently as devastating as a failure. The coach observing the attributions selected by the athlete can evaluate the perceptions of cause and effect displayed. It makes sense for the athlete to attribute failure to an unstable cause, such as luck or lane draw, as this implies that the result may not be repeated. If, on the other hand, the athlete attributes the failure to a stable cause, such as lack of necessary skill, then this is in part predicting future failure (Weiner, 1985). The coach can encourage the athlete to attribute failure to causes such as lack of commitment, using unstable causes which the athlete can change next time. The converse relationship thus advises the athlete to attribute success to an internal, stable cause, such as ability, resulting in increased confidence.

Image is the product of the commercial sphere. The media creates and develops an image compatible with product advertising. A positive image is not the same as a positive self-image; self-image is more important for dealing with success and coping with failure. A winner must know himself and be comfortable pursuing his aims.

Cohesion

A most important task of the coach is to create a certain cohesive element allowing sufficient integration to polarise group members. Considerable research within the 1970s and 1980s reveals equivocal results as to the effects of cohesion; some studies of teams clearly demonstrate that greater levels of cohesion lead to success (Carron, 1982; Carron & Ball, 1977), whilst others report performance success with lesser levels of cohesion (Landers & Leuschen, 1974; Lenk, 1969). In the 1990s we are still investigating the determinants of cohesion in sport groups and teams, with the aim of identifying aspects within the control of the coach to enhance training and competition conditions (Murray, unpublished thesis). A sociological perspective identifies a group as more than a collection of individuals, in that individuals working together towards a common goal are much more effective than if they were to work independently of one another. Cohesion has been linked with certain factors fundamental to group development, such as increased communication, productivity, satisfaction, behavioural change, persistence, conformity and attendance (Carron, Widmeyer & Brawley, 1985). Within this context cohesion is seen to contribute to the development of the team, its maintenance and to the accomplishment of group goals. Certainly there exists a potential team-synergy which raises performance.

Cohesion acts as a uniting force influenced by both external and internal factors. Where pressure exists from other teams, the group will be more resistant, although excessive pressure can break the spirit of the group; for example, in times of intense emotion associated with failure, individuals may seek to look after themselves. Low external pressure will not serve to increase team cohesion. Conditions should be anticipated, allowing appropriate preparation. Inter-team conflict need not relate to a negative scenario. As the sport environment evolves so too does the range of potential differences, such as between team member and opponent, player and manager or athlete and coach. Inter-group differences can be used to resolve conflict if the method used to resolve the differences follows a pattern of integration; to bring together the various points of view without diluting respective principles nor merely achieving a short-term compromise. A satisfactory conclusion for those involved is more demanding intellectually than simply adhering to a decision made unilaterally. This type of approach will maintain consistent variables crucial to a team's operating efficiency. Constructive cohesion is a state in which team polarisation may or may not take place but which facilitates performance (Murray, 1996). Synergistic properties are associated with cohesive teams.

The application of cohesion within the sport environment has met with many problems due to the predominance of a unidimensional approach. However Carron et al (1985) produced the Group Environment Questionnaire (GEQ), presenting cohesion as a multidimensional construct comprising of individual and group aspects, each of which has task and social orientation. Some members of the team may be more interested in the task at hand and therefore integrate well together during a set practice or a game, whereas others may be attracted to the group for social reasons and find that they integrate better if allowed social opportunities with other team members. Each cohesiveness construct is assumed to be related through the interaction of task and social orientations as perceived by the group. The coach can obtain a measure of the cohesion level within a team or squad setting, indicating the orientation of the team players.

There are other team-cohesion questionnaires such as the Sports Cohesiveness Questionnaire (SCQ) as developed by Martens and Peterson (1971), Gruber and Gray's (1981, 1982) Team Cohesiveness Questionnaire (TCQ), and the Sport Cohesion Instrument (SCI) developed by Yukelson, Weinberg and Jackson (1983, 1984). This information will help the coach rate the importance of social events in terms of the well-being of the group, and design the training structure and environment in light of player requirements. The team-cohesion instrument should reflect the interests of both the coach and the athlete, and therefore the selection should be made carefully and in consultation with a sport psychologist. Coaches of individual sports can also benefit from an understanding of the cohesion profile of individual athletes given that there are many aspects to training. A training component, for example a speed or plyometric session, may be optimised in terms of training with a partner, within a squad or in the presence of the coach. Each athlete will train best in relation to a facilitating cohesive element which supports the athlete's personal motivations. For the coach to be comfortable in the knowledge that a custom-designed programme is fully serving the needs of the athlete, he should appreciate the conditions under which the athlete operates best.

Age and gender

Coaching behaviour also takes into account the specific age range of athletes. Prior to puberty, girls and boys need little differentiation in activities designed to give children confidence. A mother-figure among pre-school age children provides an input compatible with the child's level of development. Thereafter with the school age group the coach can be more demanding, not only supporting and encouraging but also introducing a father-figure into the family. Following puberty, girls are more sensitive and should be coached in a warmer, more friendly manner giving confidence. The coach can develop their competitiveness according to individual personality. With junior boys, a stronger handling is advisable. No matter what role the coach is fulfilling, mother role, father role, or full coaching role, he can introduce and implement basic psychological preparation. Performance enhancement through this channel will then be a natural progression within the athletic lifecycle.

Whilst there is empirical evidence to suggest that males do not attribute a win or a loss to a specific cause any more than females do, (Cox, 1990), coaches have almost certainly experienced other scenarios. Despite the fact that sport psychology literature does not reveal a consistent difference between the causal attributions of men and women, there is evidence to show that males are more likely to attribute their successes internally than females (Ickes and Layden, 1978). The coach to the female athlete should encourage the athlete to consider poor performance in terms of unstable characteristics such as effort and luck. Olympic volleyball player Peppler (1977) commented on the fact that male players participating in her volleyball clinics could be repeatedly beaten but were ready to try again showing complete confidence. External attribution should be practised so that failure is viewed as a passing result not adversely affecting self-confidence or self-esteem. The athlete does not always attribute performance outcome in a logical manner, such as when using an ego-enhancing strategy, attributing all successes to internal causes, or when using an ego-protecting strategy attributing all failures to external causes. There is obviously a danger if another party is constantly blamed for failure. Therefore the coach has to maintain a balance between enhancing the athlete's self-esteem, ensuring protection at vulnerable times such as following a defeat, and also maintaining a realistic perspective of actual performance.

At the beginning of the athlete's career, the aim of the coach should be to prepare a fully independent individual. Professional athleticism demands appropriately directed education from which the athlete can grow and develop. This leads to a self-educated athlete with knowledge of appropriate support sport sciences, and lifestyle, performance and medical management. Each coaching style: directing, coaching, supporting and counselling, enhances athletic, intellectual and motor abilities as the athlete has the opportunity to learn, reinforce, practice and implement skills within modified and, later, realistic situations.

Selection

Talent scouts can ensure that no child misses the chance to develop a natural talent or attribute. Children can be gradually introduced to competition through simple competition structures such as class v class and school v school, then moving on to national and international competition. Consequently, young gifted talent may be identified. Where the child can enter a sport (depending on the accepted system operating in the country), his subsequent participation remains his decision and that of his parents. The UK tolerates a club-driven system and tends to regard specialist training schools as rather extreme. However, it makes a lot of sense to observe young athletes and thereafter select them for a sport depending on their specific somatotype and displayed tendencies, effectively reducing the occurrences of disappointments at a later stage and giving the child the chance to move on to another sport which shares a similar core training preparation. The incidents of lost or mishandled talent are frequent and not something of the past. The youngster finishing with artistic gymnastics can make a very useful transition to athletics, particularly with the addition of more jumping events for women. Team sports such as volleyball also require gymnastic attributes. It is up to the coach to use his vision to provide the orientation for the young athlete. An integrated coaching network where core skills are imparted would ensure that every child has a basic preparation appropriate for a variety of sports increasing the young athlete's choice and access to sport in general. Non-residential academies of sport can provide an ideal base for a balanced approach to the preparation and care of the young athlete – the opportunity to enjoy specialist coaching and the normality of the home environment. One sport's loss should simply be another sport's gain. This situation is greatly preferable to losing the child to sport altogether.

Summary

There are no fixed ingredients to success, but the coach can teach the athlete to be aware of every possible ethical performance indicator and facilitator. Good organisation of each psychological preparatory step, from the management of coaching staff and integration with the sport science support team, to the actual movement of the athlete on the day of the competition, is vital. Accompanying administrators should also be carefully selected, goal-orientated and trained for the event conditions. Constant communication providing the extended support team with necessary information will create a positively controlled environment. The coach and team are there to help the athlete. Every step towards competition preparation is a step towards victory.

11 Technical training

Motor learning

Every individual has a need of movement, whether this is the fundamental requirement of the movement of inner organs or the movement of the muscles. Body movement may be either inborn, or acquired, although the exact determination cannot be identified. Accepted movements are certainly attributable to society, and are cultivated to form developed patterns of behaviour according to social politeness. General aims of education through physical activities are to let the participant understand that regular systematic movement is both a part and philosophy of life, and that sport is a school for life.

A range of conditions contribute to individual orientation. Differences between people are determined by factors such as cultural, political, and socio-economic backgrounds. National characteristics will also play a determining role in differentiating individuals. Conditions therefore contribute to differences between people; inter-individual differences distinguish one individual from another, whereas intra-individual differences occur within a person according to the situation, for example the athlete under stressful conditions. The athlete must be viewed as a unique entity, where individual personality is accounted for. Those involved in sport are advised to implant and nurture the need of motion throughout the entire lifecycle whilst acknowledging individual difference.

Motion, aptitudes and ability

An ability is a stable characteristic or trait, inborn and unaffected by practice and rehearsal. An aptitude on the other hand, can be developed or lost. Given this, the coach can assist the athlete through the development of aptitudes central to movement technique, and ultimately performance. To do so using motor learning theory in practical technique training, the coach emphasises first the sensory part of reactions or responses and, second, complete awareness and control over what is going on. Every sport has sensory aspects such as concentration on listening for the gun prior to a sprint start. The coach can take time to reinforce the sensory aspect of a particular technique or part of a technique, and environmental conditions. The tennis coach can emphasise the different sounds from the racquet where the player must identify the type of shot played; the blindfolded ice hockey player should be able to comment on the speed of the puck; the rugby player may rehearse the feeling of a specific movement to optimise use of information. Different sensory information is therefore available to facilitate 'reading' performance.

Development of sensory perception is accompanied by knowledge of what is going on in the body. As a result a total awareness and control of co-ordination and balance will become automated. The circus juggler must carry out different hand activities and simultaneously co-ordinate each independently whilst maintaining balance. The athlete must therefore learn to anticipate requirements. Feedforward, information sent ahead in time to prepare for following sensory feedback, has been shown through research on visual perception to advantage the performer (Gallistel, 1980). A copy of the motor (efferent) command sent to the eye muscles is, in addition, sent to a location in the brain; the visual perception system is in this way informed about the imminent movement of the eye. Schmidt (1988) notes that this 'efference copy' mechanism may indeed exert similar parallel control over the movement of the limbs as well. Evarts (1973) reported neurological evidence indicating that sensory information which is to be received by the muscles, is also sent to locations in the brain. Thus the aim of such activities may be to inform the sensory system and to prepare it for reception of feedback.

To develop sensory perception and necessary awareness, modified activities and games can be used to create a rich reservoir for understanding and perfecting techniques. The ballet dancer rehearsing movements before a mirror is educating the body in an entire movement range, teaching it through pre-determined sequences and acquiring more knowledge of what is involved. The athlete must consciously make himself aware of responses and reaction thereby accumulating movement information.

It is evident then that this movement must be harmoniously controlled, a function carried out by the pyramid and extra-pyramid cells coming from the sub-cortex and connecting every part of the brain responsible for movement. Co-operation between pyramid and extra-pyramid nerves is very subjective where potential influences include feelings and emotions. A lack of co-ordination results in a certain mental state, expressed by a movement error during performance. Each small discoordinated activity contributes to failure. Thus the aspect of self-control under a range of conditions faced by the athlete should be rehearsed where the athlete is to maintain a performance-facilitating equilibrium.

Feedback and knowledge of results

The coach regularly provides the performer with feedback regarding athletic movement. Feedback is information from the environment which informs the athlete about performance efficiency during and/or following the movement. Feedback can be further classified into intrinsic feedback, which provides a basis for movement evaluation, and extrinsic feedback, information produced to augment intrinsic feedback. Both are of great

importance to the athlete wishing to develop his performance. However, the value of feedback would be severely limited without a dimension of external feedback known as knowledge of results (KR). KR, a verbal form of feedback, provides the performer with information which compares the actual performance with the intended goal. The athlete can use this information to improve performance. Another function of KR is that of motivation. The athlete's knowledge of results can motivate further performance improvement. Goals must be established for KR to be effective and meaningful to the athlete. A result without a pre-determined goal offers little value. Clearly videos and videographics are valuable tools in providing KR.

The learning concept

The concept of learning as a process of conditioned responses has now been superseded by a more complex model of events. This model might be represented as illustrated in figure 58a which is based on Bernstein's depiction of learning as a type of self-regulating system. Although the terminology differs from that used in Bernstein's (1957) picture of things, Anochin (1967) and associates explained the underlying theory of learning a technique along similar lines (fig. 58b). This theory is so frequently referred to in literature on technique training, that Anochin's explanation is briefly outlined thus: incoming information is supplied by two types of afferent.

(1) The situation afferent embraces all environmental stimuli and consequently includes stimuli both relevant and irrelevant via the sensory organs (proprioceptors). Recollected stimuli may also be included. This area of afference causes an integration of the nervous processes which precede the causal afferent.
(2) The causal afferent is the 'reading' of the situation afferent and selection of the relevant from the irrelevant.

This collective afference is referred to as the *afferent synthesis* and it concludes with the intention to act. Such intention is given expression by the *effector* apparatus. When afferent synthesis ends and action is effected, a specific afferent apparatus is formed which is called the *action acceptor*. This compares the afferent synthesis (the plan of action) with the completed action on which information is brought back via situation and causal afferents. If there is agreement, the cycle is complete. If not, new reactions are formed as the difference between planned and achieved action is assessed, and corrections made as the effector apparatus modifies the original action until agreement is reached.

In cybernetics, this concept of reafference is referred to as back-coupling or feedback. Principal types of reafferent may be classified as follows.

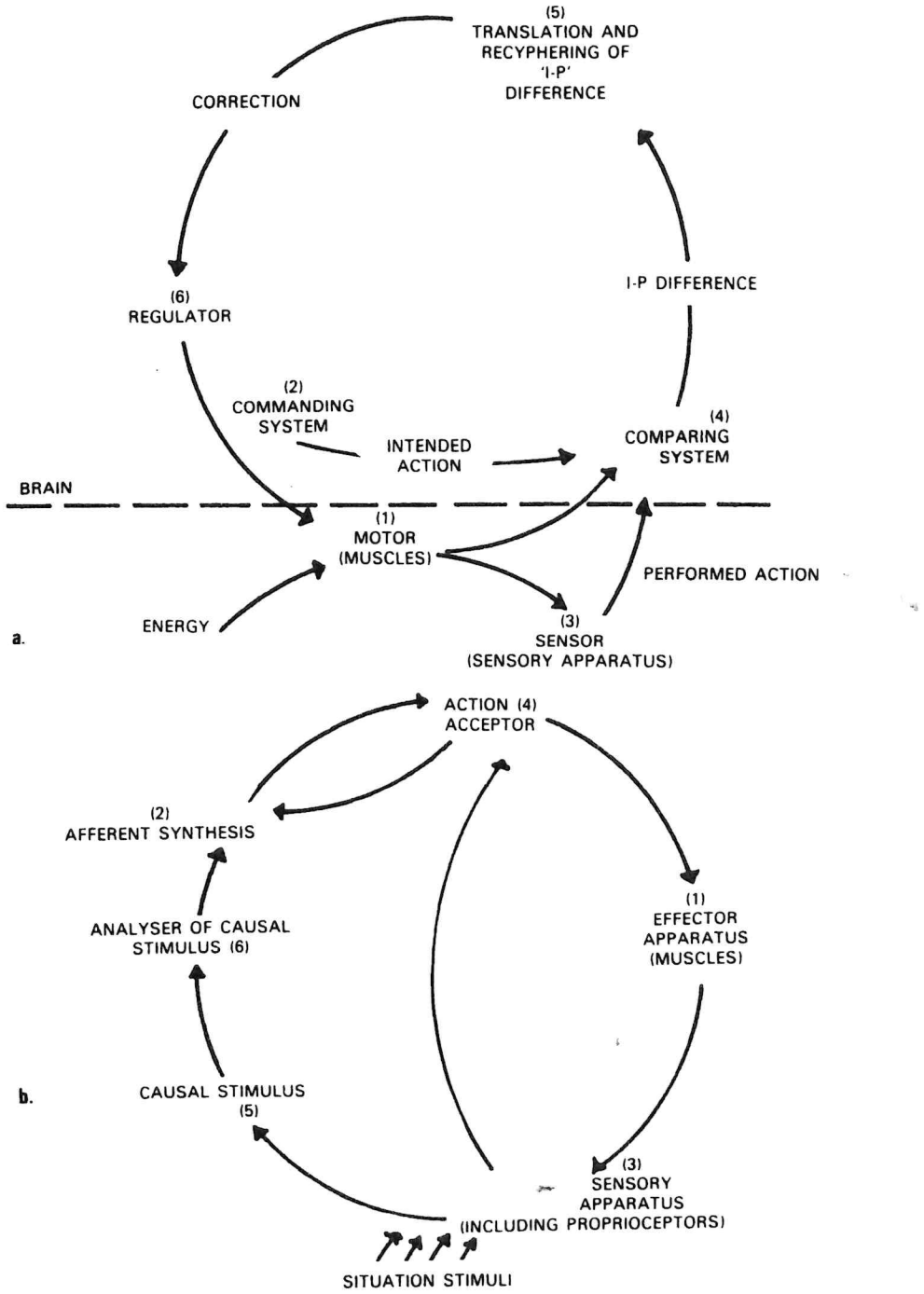


Fig. 58 *Events in the learning process (a) based on Bernstein's model; (b) based on Anochin's model (Numbered to help comparison)*

(1) Kinaesthetic afferents, which are represented by proprioception.
(2) Resultant afferents, which comprise all afferent characteristics which relate to the result of the completed action. However, all new actions arise from previous actions and those new actions will in turn form the basis for future actions. Hence Anochin's (1967) subdivision of resultant afferents:

- **episodic** reafferent, which provides information on intermediate actions
- **final** reafferent, which provides information on the final execution of the original plan of action.

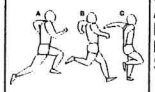
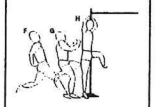
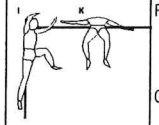
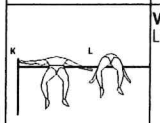
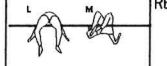
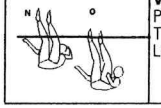
The suggested existence of an afferent synthesis confirms the importance of factors such as training environment, motivation and a complete understanding of a given technique by the coach, while the action acceptor emphasises the importance of previous experience and a complete understanding of a given technique by the athlete. It rests with the coach to ensure that such factors are carefully assessed if technical training is to be efficient.

■ Senses and the afferent syntheses

Although we traditionally recognise five senses: visual, auditory, taste, smell, and touch, thirty such sensor receptions exist. Internal and external proprioreceptors register signals which form a complex support system often underutilised by the performer in sport. Visual stimuli often lead the sensory complex, however, other sensations affect the performer such as the feel of the weight and size of the ball used by the footballer or basketball player, or the smell of the chalk on asymmetric bars. Established Soviet and Czech coaching methodologies have long made successful use of sport-specific leading senses within the sensory complex. This is known as the afferent synthesis (see p. 156) providing the performer with permanent information prior to, during and following performance. The motor learning of an activity includes an appropriate breakdown of the skill, identifying and reinforcing the afferent synthesis. For example, a breakdown of high jump technique (Dick, 1993) can easily include the appropriate development of the leading analyser which will of course be athlete-determined (table 22).

During the movement series the leading senses are dynamically changed according to the demands of the movements of the body. If for instance the high jumper fails to clear the bar, knocking it off with the left lower leg, then the afferent synthesis will automatically facilitate greater attention to the awareness of the activity of the left lower leg in the next attempt. The performer is informed through this mechanism at every moment.

Table 22 *Model technique analysis sheet for the Fosbury Flop* (adapted from work by G. Tidow)

FOSBURY FLOP	PHASE	REFERENCE	CRITERION	LEADING ANALYSER SENSORY REINFORCEMENT	ASSESSMENT
	**I** Approach PENULTI- MATE STRIDE	A 1 foot plant 2 body/trunk 3 arms B 4 front supp. BC 5 supp. knee B 6 rear arm C 7 arms	ball contact/curved path inclination/slight forward lean counter arm swing heel lead yielding held back parallel/behind trunk	*Visual* as look for spot above the bar; *Kinaesthetic* as feel high knees to penultimate stride.	
	**II** Approach LAST STRIDE	D 8 trunk 9 supp. leg DF 10 take-off leg E 11 arms F 12 body/trunk F 13 foot plant EF 14 free leg	upright horizontal pushing action fast & active plant/pre-tension/'long' starting double swing inclination/backward lean 'through' the bar/optimal take-off pos bending/forward-upward movement	*Kinaesthetic* as feel tall; *Auditory* as hear foot plant; signal then to initiate upward push; *Kinaesthetic* as feel arms then lean.	
	**III** TAKE-OFF	FG 15 take-off leg FH 16 arms FH 17 free leg GH 18 free knee H 19 arms H 20 shoulders H 21 body	minimal & passive yielding active double arm swing active knee drive 'opening'/block in horizontal pos. blocked/bent lifted/horizontal vertical/parallel to upright	*Kinaesthetic* as feel arm swing & knee drive.	
	**IV** RISING OPENING	I 22 head I 23 outside arm IK 24 body IK 25 arms IK 26 free leg K 27 back K 28 head	view; along the bar 'leading' longitudinal axis rotation 'opening' lowering parallel to bar backward movement	*Visual* as spot over the bar; *Kinaesthetic* as feel body opening; feel rising.	
	**V** LAYOUT	KL 29 arms L 30 hips L 31 legs L 32 back L 33 head L 34 longit. axis	extended/'diving action' hyperextended/elevated bent/directed downwards 'arched' thrown back rectangular to bar	*Kinaesthetic* awareness of back & hips; exaggerate arched feeling.	
	**VI** RECOVERY	LM 35 pelvis M 36 head/trunk M 37 hips M 38 legs M 39 arms	active lowering 're-active' countermovement active bending synchronous active knee extension bending	*Kinaesthetic* acknowledgement of lowering of pelvis; *Visual* as see clearance of legs.	
	**VII** PREPARA- TION FOR LANDING	NO 40 head NO 41 hips NO 42 arms NO 43 body NO 44 legs	raised bent/blocked spreading in 'L-position' extended/directed upwards	*Kinaesthetic* with raised head; maintain 'L' shape feeling.	

In a competitive situation emotions can block the awareness of the afferent synthesis. Given this likelihood, the athlete should take the opportunity to engage an appropriate mental training technique. Similarly, following error, the athlete can make use of a compatible technique such as successful imagery or relaxation. Team and individual sports competitors use a range of mental training techniques reasonably successfully. The coach can ensure that the athlete/player has the opportunity to undertake such training with a specialist input. Useful mental training methods are integrated with technical training, optimising training conditions for the athlete. The athlete must be able to analyse the afferent synthesis so that he can read the appropriate sense and use it for anticipatory purposes. Beginners do not have this sense and

so may find themselves stretched. For example, the young soccer player may pass the ball behind an oncoming team-mate. Anticipation together with the process of cognition gives the prediction and prognosis of events. It is sensible for the coach to include this type of training within the planning of competitive conditions.

The creativity of the coach will determine the effectiveness of such specialised input. Selected attention to specific performance components requires a thorough analysis of the movement by the coach, aided by video analysis, videographics or photo sequences, etc. demonstrating the movement of the limbs and/or entire body. Joint angles and the synchronisation of joint movements using the recorded locations of the limbs provides objective movement measurement. Electromyographic (EMG) recordings also record the movement in a muscle by establishing the electrical activity associated with the contraction of muscles specific to a response. The weak signal within the targeted muscle is amplified and then stored on a polygraph recorder for later analysis. Such a procedure can also be used to identify any associated signals when using imagery.

Internal imagery is primarily kinaesthetic in nature as the athlete feels himself performing whilst 'seeing out' from within his own body. External imagery is considered to be visual as the athlete pretends to watch himself perform from the outside. Internal (kinaesthetic) imagery has been proven a superior method given that it results in actual subliminal muscle activity in the muscles associated with the imagined actions (Mahoney & Avener, 1977). Both internal and external imagery skills should be developed.

Without doubt, one of the most powerful and effective technological aids in development of technique and technical application through imagery will come through the interactive potential of virtual reality.

With the need to develop the leading sensory channel, and the dynamic change of leading channels, a variety of practices should be designed. Approaching the hanging ball from different directions will assist the footballer with the skill of heading; the rugby team warming up for the game can increase the kinaesthetic feeling for the ball by passing the ball around the body and on to the next person in a circular formation, altering the activity whilst standing on one foot; the tennis player maintaining a bouncing tennis ball on the racquet whilst keeping a balloon off the ground with his foot couples sensory awareness with the attention required for a specific activity.

The kinaesthetic sense is often regarded as the dark sense as it is difficult to know what is sensed by the muscular apparatus. However, appropriate skill breakdown where the sensory complex is managed and reinforced will enable the performer to exert control over this automatic process. The actual breakdown and integrated series of practices, as with the high jumper, will help the athlete learn control at a conscious level. This type of sensory training shadows the athlete through his skill development. At the initial stages of games learning, activities for children involving throwing a variety of suitable objects such as soft miniature items and balls will introduce sensory awareness. Likewise an élite javelin thrower can benefit from increased kinaesthetic awareness of the hand by changing the throwing implement with emphasis on good technical form. Where every activity has a specific complexity of afferent synthesis, both coach and athlete can explore training opportunities to reinforce appropriate sensory perception. Patience is required as motor learning is not directly observable. However, practice and subsequent learning is relatively permanent; the athlete following such input will change in some way whether it be in how an activity is viewed or approached.

Learning

Learning is a process involving the acquiring of increased skill capability. A series of internal processes associated with practice or experience will influence this capability for skilled behaviour, resulting in relatively permanent change. An individual will learn from the participation itself within an appropriate situation, and from the breakdown of skill. Whole and part approaches should be combined. To optimise later skill automaticity, part-skill practices should shape the first learning conditions. A learning ceiling is presumed when some success is experienced by a performer, however there is evidence to suggest that further practice brings about continued skill enhancement due to 'overlearning' (Schmidt, 1988), as opposed to learning beyond the original learning goal. Given the possibility of further improvements in performance, the learning design should facilitate adequate opportunity:

part skill – whole/modified
part skill – whole/less modified
part skill – whole/realistic situation
part skill – whole/game situation

Basic skills should be mastered sequentially to arrive at precise task performance. Whether premier division football, first division rugby or NBA basketball, fundamental errors are apparent particularly during emotive periods of the game; related consequences including breakdown in discipline, increased likelihood of distraction, and inability to attend to situationally-appropriate information can be reduced given thorough learning.

Associated with this notion is that of effort. As an athlete learns a motor skill, the subsequent execution of that skill requires less effort (Kahneman, 1973) leaving the athlete freer to attend to game/event specific information. Learning should allow the athlete processing and movement efficiency. Every life activity is directed by a high level of automisation of the basic elements of sensory and motor control. Given that the athlete must be able to concentrate on a range of game/event induced aspects if performance is to be successful, information processing should not be overloaded. Automaticity infers that skills do indeed become more automatic thus interfering less with other tasks. Learning occurring in the overlearning phase reduces attentional load and,

according to Schneider and Fisk (1983), allows more accurate secondary task performance. Such improvement can perhaps be attributed to less interference from the main task.

Standard situation learning

The part-whole system must respect the most frequently occurring situations in the game/event and, taking advantage of existing technology, analyse each situation. Statistical analysis reveals such standard situations, which will then direct the central content of the whole learning to be automated by the athlete. It is the same for the co-acting athlete from an individual sport as it is for the interacting athlete within a team sport. Practice variation is vital. The athlete must become a sports-literate individual, able to read internal and external cues which enhance the execution of performance activities.

Aims of technical training

The general aims of technical training are as follows.

(1) To direct the athlete's learning and perfect the most efficient technique(s) relative to a given sport. This demands that the coach has a complete understanding of the sport and its particular technical demands, of the athlete's present capabilities and his potential development, of techniques used by other athletes who are enjoying success, of teaching and developmental methods, and so on. In short, the coach must establish a sound technical or biomechanical model, based on athlete and sport, towards which the coach must direct the athlete.
(2) To direct the athlete towards a stable performance of the learned technique. This implies a progressive 'opening' of the situation in which the athlete must perform the given technique. One might visualise an initial stage in the process where all conditions for learning are perfect and totally without distraction. A final stage might also be visualised where, irrespective of the bombardment of distracting factors and within biological limits, the performance of a given technique is as perfectly reproduced as if the situation was without interference. Environmental interference may come from wind and weather, apparatus, altitude, spectators or other athletes.
(3) A further aim might be considered for sports where the athlete is forced to make a rapid selection of correct technique from a reservoir of many. The coach must direct learning of this capacity. Thus, it is not only the techniques themselves that separate the weight lifter from the football player, but also the total nature of the competitions in which their techniques must be perfectly executed.

Classification of technique

Attempts have been made to classify technique. The three classifications are determined by the nature of technique: single or multiple; and the performance/competition situation: constant or variable. These classifications are listed opposite.

(1) Sports where a single technique determines the performance, and which are based on a constant technical model, where the structure of competition is relatively constant. This includes most track and field events, swimming, bowling, shooting, archery, etc. Any variation within the structure of competition is restricted to factors such as weather, competition surfaces, facilities and equipment, etc.
(2) Sports where a multiplicity of techniques determine the total performance, and where the structure of competition is relatively constant. Within each sport there exists a similarity of technical model between certain techniques, but each technique is identifiably quite separate. Constancy of technical performance is made possible by the structure of competition and the conscious differentiation of techniques. Into this category will come artistic gymnastics, dance, figure skating, diving, etc.
(3) Sports where a multiplicity of techniques may be demanded of a rapidly changing competition structure. Athletes here must select appropriate techniques to meet the changing demands of competition but must also master each technique in the 'reservoir' at the athlete's disposal. Into this category come all team sports, combat sports, sports where there are exchanges with an opponent (such as racquet games) and sports where environmental demands other than the opponent, (e.g. weather, terrain), necessitate rapid and/or accurate selection of the most expedient technique (sailing, climbing, golf, canoeing, etc.).

The development of technical training must follow a different course for each classification.

Class 1

- Develop the technique in a closed situation (e.g. without environmental or competitive interference) as a 'performance'.
- Introduce a progressively open situation (e.g. more variables) while maintaining the 'performance' approach.
- Introduce a progressive intensity of competition.
- The general progression is from performing a technique to applying the technique in competition. In some cases the latter demands greater application of strength, speed, etc., (e.g. long jumps) while in others, accuracy of performance is essential (e.g. shooting).

Class 2

- Develop each technique separately and in an order which permits the learning of each to proceed without the interference of the other.
- Again, the situation for learning each technique must be closed.
- The situation is now opened through the use of other equipment, different facilities, etc. It may also be opened through a combination of techniques in movement sequences, etc.
- This progression may be pursued throughout the athlete's future development as new techniques are introduced and new permutations and combinations of these techniques are advanced.

- Introduce a progressive intensity of competition.
- Here the progression develops accuracy of reproduction in performance of techniques.

Class 3

- Develop each technique separately in a closed situation and in an order which permits no mutual interference.
- The situation is opened primarily by applying the technique in a changing situation (e.g. active opposition, varying climbs, sets, etc.).
- The athlete must also be exposed to technical adjustments necessitated by varying playing conditions, weather, etc. A more complex opening is where one of several techniques may be chosen by the athlete in the face of active opposition or varying terrain.
- Introduce a progressive intensity of competition or climb, etc.
- Here the progression is from learning and developing each technique to learning to select the correct technique for given competition demands.

Technique may also be classified by considering the aim of each technique. On this basis, Dyatchkov (1967) offered the following classifications.

(1) Sports where the aim of technique is to express intensive strength of brief duration within the ideal technical model, such as sprints, jumps, throws, weight lifting.
(2) Sports where the aim is endurance development with an optimal expression of strength. This embraces middle and long distance running, skiing, rowing, swimming, cycling.
(3) Sports where the aim of technique is development of those physical abilities which permit accuracy of performance of movements within a prescribed programme. This includes gymnastics, trampolining, figure skating, diving.
(4) Sports where the aim is the solution of those complex problems associated with interplay of athletes and/or environment, i.e. team games, combat sports, racquet games.

Despite these attempts to classify technique, certain activities may fall within several categories. However, the aim of classification is primarily to establish the planned technical development of an athlete. Consequently it is sufficient that the coach identifies the specific aim of technique for an athlete in a given sport. Having done so, it then rests with the coach's knowledge of anatomy, biomechanics, physiology, rules of the given sport, experience within that sport, the status of the athlete, and so on, to formulate a plan of technical development.

■ Learning technique

In general terms, it would appear that the learning process follows the pattern indicated in table 23. However, it will be recognised that the athlete arriving at stage 1, equipped with many (if not all) of the basic components of the total technique to be learned and with a sound background of general conditioning, is better prepared to advance through the stages than the athlete with little experience or conditioning to call upon. Returning to the concept of the learning process, one might suggest that it is in the interest of the athlete to be exposed to an education of basic movement components in pursuit of providing a more sophisticated action acceptor. Physical education appears to have focused emphasis on increasing the scope of a child's 'movement experience'. If such experience moves from the general and extends along a specific avenue of activity, it seems logical to anticipate the natural evolution of 'fundamental components'. From these fundamental components, highly specialised techniques may develop (fig. 59). The concept of fundamental components, and the development of exercises based on them, has been used in gymnastics in the German Democratic Republic (GDR) and it would appear that the concept could be applied to other sports.

Table 23 *Outline of learning stages in the acquisition of techniques*

stage or phase	morphological/ functional	regulative/ neural	teaching/coaching methods and conditions
1. Irradiation of stimulation processes	First concept of movement is learned, followed by an attitude to its learning.		Previously acquired related knowledge plus general total concept of action influence this stage.
2. Irradiation of stimulation processes	First ability to perform action and first acquisition of the action i.e. the basic form of the action is performed.	There is a generalisation of motor reactions together with muscle tensions and unnecessary movement, brought about by irradiation of stimuli to neighbouring areas of the cerebral cortex.	Teaching objective is to produce an accurate basic action and eliminate unnecessary movements, etc. Demonstration and film accompanied by verbal instruction (simple) is indicated. Training must be concentrated but too frequent repetition within a training unit will fatigue the beginner and impede learning.
3. Concentration through development of inhibitory processes.	Correction, refinement and differentiation. Finer co-ordination of movement.	Concentration of focus of cerebral cortex processes. Movement is accepted more fully into the consciousness and in greater detail. Individual phases of movement become stabilised. Proprioceptors begin to take a leading role.	Detailed learning of the movement is now worked on. Methods based on kinaesthesis (the feel of the movement) are used. Intervals between training units can now be increased, as can the number of repetitions within each unit.

Table 23 *(continued)*

stage or phase	morphological/ functional	regulative/ neural	teaching/coaching methods and conditions
4. Stabilisation and Automisation	High degree of precision in performing the action in a closed situation.	Complete harmony of neural processes where proprioceptors and cerebral cortex eliminate interference due to unnecessary movement; and rapid adjustment to changing conditions allows performance of a perfect action.	Stabilise action and perfect technical detail. Training is designed to eliminate variables and give opportunity for 'perfect' execution of the action.
5. Stabilisation and Automisation	Precision in performing the action in an open (more variable) situation.		Progressive development of physical capacities (e.g. strength, elastic strength, speed, etc.) necessary for long-term development in performance.

Establishing exercises based on components demands a detailed knowledge of the original technique used. Each of these exercises must have the greatest possible range of application in techniques within its sphere, yet the essence of the component must not be destroyed by further breakdown or modification of parts. This suggests the possibility of derivatives. Derivatives of the first degree coincide with the essential parts of the component, whilst derivatives of the second degree are characterised by comprising only some of the essential parts of the component. It will be appreciated, then, that the role of these components in the GDR research was in two parts.

(1) *The integrating role* (establishing the complete technical model from the components),
(2) *The differentiating role* (establishing stability of the technical model by ensuring an ability to clearly separate one technique from another, correct movement from wrong movement, and so on). From this, and similar work, some important points emerge:

- when the first component learned is one that unites as many parts as possible of the final technique, learning time is reduced
- learning time for differentiation is also reduced by this approach
- the use of first degree derivatives does not demand stability of the component, but second degree derivatives must not be introduced until the component is stable, otherwise there will be negative interference.

Each component must be constantly related to the whole technique. This is most important where the derivative is of the second degree, or where the derivative of the first degree contains a limited range of essential

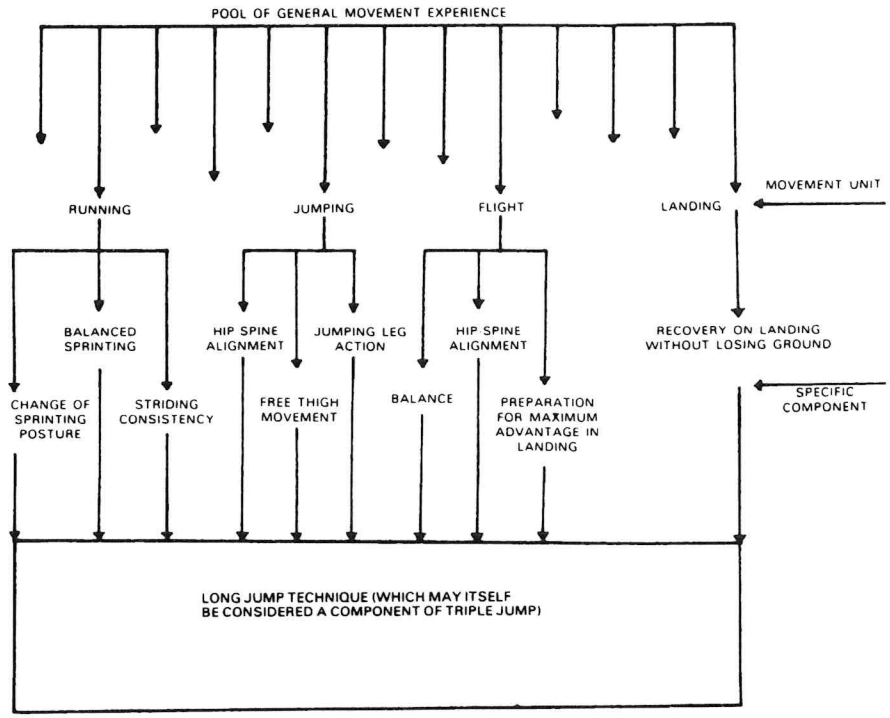


Fig. 59 *The development of specific technique via fundamental components*

parts. Harre has noted (1973) that athletes who learned derivatives of the first and second degree, by conscious acquisition of fundamental exercise, and who were made to differentiate consciously, proved, when learning new movements, to be more capable of distinguishing the details of the movement and performing them with accuracy. A progressive development in ability was noted with the increasing mastery of varying exercises.

The athlete must be offered the benefit of expert guidance during the learning of technique. Consequently the practice of providing instruction for beginner-athletes via novice coaches might be the basis of a poor technical education which will make itself evident at a later date in faulty technique.

■ Faults and corrections

Without the assistance of sophisticated equipment, the coach offers instruction based upon the comparison of a 'mental' technical model and what may be readily perceived. There are very obvious limitations to what *can* be perceived at any one time, so the coach relies mainly on experience of cause and effect. The immediately apparent problems are that coaches have varying amounts of experience and even with experience, cause and effect are not always easily identifiable. It is

nevertheless essential to the athlete's development that accurate information is readily available when kinaesthetic impression and concept of movement are fresh in the athlete's mind. If there is no immediate feedback for the athlete, there is considerable risk of stabilisation of faults.

In order to provide immediate feedback to the athlete, the coach must consider use of polaroid photo-sequence cameras, video tape, film, kinographs, print-outs on force components, velocities, etc., photo-electric apparatus, computerised segmental analysis, and so on. Even if some of this equipment is not readily available for showing the athlete's own performance (e.g. video tape), it should still be possible to show the *correct* technique where the athlete is not matching the technical model (e.g. film, photo-sequences, demonstration, etc.). The efficiency of technique might be evaluated in one or several of the following broad categories of method.

(1) As implied above, evaluating the athlete's technique against the technical model. This approach is used in many so-called 'skill tests', with the athlete 'scored' against norms. It is also used in comparative analysis of the athlete with another athlete known to be technically proficient, or of the athlete with a film of himself performing a technically proficient jump at some previous date and so on. Filming techniques, photo-sequence techniques, light-track photography techniques, or standard testing techniques may be applied to this type of evaluation.

(2) Another type of method is the comparison of actual performance with theoretical performance. For example, a comparison of the height through which the athlete raises his centre of gravity with the height actually jumped in a high jump competition. This method may be extended to include comparison of performance with related criteria in standard tests.

Thus, the long jump athlete may compare competition long jump performance with, on the one hand, standing long jump, sargent jump, 30m sprinting speed, and so on, or, on the other hand, the horizontal velocity and parabola of flight of the athlete's centre of gravity. Again, filming techniques and a knowledge of related standard tests may be applied.

(3) A third class of method evaluates a particular technique relative to its success or failure against opposition. Thus, technique is evaluated on the basis of training advantage in attack over defence or, conversely, in gaining advantage from defence over attack. It could be argued of course that, in this instance, tactics rather than technique are being evaluated in, for example, team games. Filming techniques are essential to this class of evaluation.

Despite detailed and expert planning, it is nevertheless possible for faults to arise. Before any attempt is made to correct such faults, the exact cause or causes must be determined. This is emphasised because, due to the fact that 'effect' is more readily recognised, the coach may occasionally reduce the effect of a fault, rather than eliminate the cause. It is also important to assess how well established the fault has become. Faults that come to light during the early stages of learning are less difficult to correct than those which have become stabilised to such an extent that they are almost a part of the athlete's technique. Possible causes of faults are listed below.

During learning	*Well established*
misinterpretation of kinaesthesis and/or poor motor ability	rational technique has not been learned
misunderstanding of concept of movement	technique was not established before competitions were introduced
negative interference from another technique	athlete has known the fault but has lacked either guidance for correction or knowledge of the correct movement
insufficient previous experience of components	due to poor status of physical abilities in learning, compensating movements have been introduced
interference of a poor learning environment (e.g. cold, poor equipment)	the technique is incompatible with the athlete's physical structure of levers
premature introduction of strength and/or speed in technique	coach has been lacking in knowledge as the athlete has progressed. (A technique which has brought success at a lower level, may be inappropriate at a higher level)
lack of physical abilities required of technique (e.g. strength, mobility)	poor training conditions
fear of injury	injury has caused compensatory movements
poor demonstration and/or explanation of technique	poorly organised training programme
impropitious timing of technique training relative to athlete's growth and maturation	

Correction should always ensure the athlete's understanding of the technical model, the fault and the correction. This is vital because frequently athletes who are technically lacking in proficiency may produce superior performances and the novice may seek to follow *that* technique because it produces favourable results. Faults must be discovered and corrected early. To delay will stabilise the fault and possibly cause a stagnation in performance. Moreover, should the athlete 'grow with the fault' then any attempt at correction becomes more difficult. This is due to the basic inertia of an entrenched pattern and also because performance in general will fall below that recorded when the 'wrong' technique is used, thereby causing a loss of confidence in the process of developing a correct technique. Finally, the additional time required to correct a well established fault is hard to justify when the time should be directed towards improving an athlete's performance.

Correction may be pursued by contrasting faulty and correct technique via film or demonstration, guiding the correct action, encouraging the athlete to exaggerate the action, working on an individual faulty component, arranging that faulty performance is impossible, and practising the movement with, for example, the *other* leg or arm. The progressive replacement of a faulty technique with a correct technique appears to advance in four stages. The time span involved varies with the stability and nature of the fault.

Stage 1: the faulty technique asserts itself whenever concentration is lost. The correct technique is occasionally reproduced.

Stage 2: neither the faulty nor the correct techniques are strong enough to dominate, so there is frequently a confusing or mixing of techniques. The correct technique is reproduced more frequently.

Stage 3: there is a conscious differentiation, with the correct technique only occasionally lost, in fatigue, stress, etc.

Stage 4: complete stability of correct technique.

Opinions differ on the relative merits of massed and distributed practice as the athlete learns technique. Personal experience, in the absence of conclusive evidence, suggests an initial massing of practice until the whole activity can be put together, then a gradual separation of practice units.

■ General points on technical training units

It is impossible to be dogmatic in determining exact durations for technique training units because individual athletes vary not only in their capacity for concentration but also in their status of physical abilities. Several points might be made, however, as a basis for establishing suitable unit construction in technique training.

(1) Concentrated technique work should not go beyond 20 minutes without a break.

(2) The prospect of a long unit of technique work prepares the athlete for an extended distribution of effort. Consequently a prolonged unit must be divided into sub-sections, possibly with each section having a separate emphasis.

(3) Reduction of fatigue improves motivation, not only within the session but from day to day. Thus, within a training workout a technique training unit must come before a conditioning unit and a 'technical day' should not be preceded by a heavy 'conditioning day'.

(4) A compromise must be effected between maintaining the excited state of the neuromuscular system and allowing recovery from a previous effort. This will be individually arrived at. It would appear that during recovery from technical training there is a perseveration of neural processes. This may be because when intense external stimulation ceases, internal consolidation occurs. It has also been suggested that organisms are refractory to (resist) early repetition of an act.

(5) During recovery there may be a tendency for incorrect associations to be 'forgotten' faster than correct ones. This could be due to the non-existence of positive reinforcements.

(6) In technical development, unit construction should be so arranged that all practices are related to the given technique, unless the objective of the unit is to develop the ability to differentiate techniques, select appropriate techniques, put together a sequence of techniques, etc. Practices may be related by similarity of content, technique, principles, etc. It should be appreciated that these practices are techniques or sports in themselves and are not to be confused with components.

(7) Only one technical point should be considered at any one time.

(8) Adapt sport to athlete before adapting athlete to sport. This principle should be followed unless adapting the sport creates a wrong basis for development. Thus, hurdles are reduced in height and spacing, and 'mini' ball games are developed.

(9) Approximately 80% of what is learned is from visual stimuli, so correct demonstration or a well explained film is more appropriate than words alone.

(10) It is important to note that the novice athlete must be given expert technical instruction when being introduced to sport. Conversely, the novice coach must not be used as teacher of the novice athlete.

(11) 'Repetition is the mother of learning.' The athlete must know the correct technique(s) to repeat and be fit enough to perform sufficient repetitions without fatigue-induced compensations creeping in.

(12) The progressions of adding endurance, resistance or speed to development of technique can only be introduced within the limits of keeping the technical model intact. To continue technique work without an intact technical model, can lead to 'chronic' rather than 'acute' technical errors.

(13) When technique breaks down, it is essential that 'rebuilding' is done at a slower overall speed. The speed should be such that the athlete can feel the correct sequence of individual body segment contribution to the technique.

(14) Because concentration and freedom of movement are fundamental to learning technique, conditions must be favourable. A warm, windless environment without interfering variables such as noise or distracting movements must be available. However, once the technical model is well established, the athlete must learn to keep technique intact in a climate where hostile variables increase in number and degree.

(15) There appears to be little difference in the methods used in teaching techniques to both women and men. However, there can be variance in the techniques of men and women – even in the same discipline.

(16) Children may not be equipped to learn techniques used by mature élite performers. It is the basic technical model which the young athlete learns, and not some sophisticated elaboration of that model.

Summary

Fundamental to the athlete's long-term development is the learning of sound technique. The coach directs such learning and works towards stability of technique through technical training. The classification of technique determines its course of development but, broadly speaking, coaching method is geared to various learning stages. An interpretation of cybernetic theory affords an explanation of the concept of learning. Within the framework of this concept the coach will identify the role of fundamental components, the need for accurate identification and speedy correction of faults, and the importance of providing the beginner athlete with the best available technical expertise.