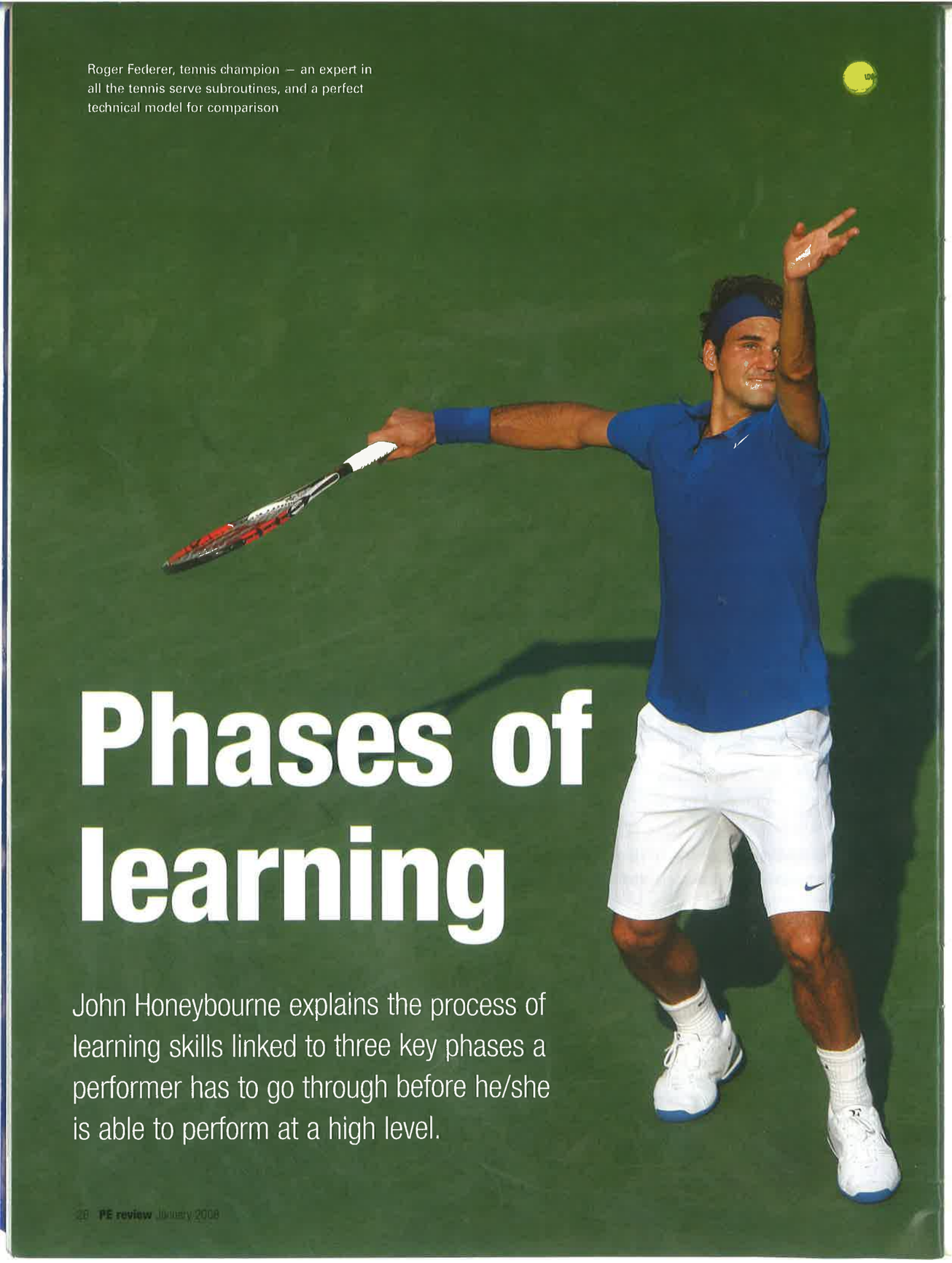


Roger Federer, tennis champion – an expert in all the tennis serve subroutines, and a perfect technical model for comparison

Phases of learning

John Honeybourne explains the process of learning skills linked to three key phases a performer has to go through before he/she is able to perform at a high level.

To enable teachers, coaches and learners to understand the process of learning motor skills, three different stages have been identified. These stages are not the only way of describing the process of learning, but they form a useful starting point in understanding the learning of motor skills in sport.

The cognitive phase

The cognitive phase is also referred to as the plan formation stage. When learning a skill in sport, for example a pass in hockey, a great deal of information must be perceived and understood by the learner. Perception and understanding are **cognitive processes** and therefore the first phase is known as the **cognitive phase**.

Key box 1

Cognitive process A process in which the human brain processes information via perceptual awareness, use of memory and formulating plans of action.

The amount of information available can be too much for some learners of motor skills in sport, especially those who have little experience in related skill activities.

The cognitive phase has also been identified by Martenuik (1976) as the third level of motor control. This third level of control has a **closed loop** element with proprioceptive awareness, but the control of movement is relatively poor for those who are novices. This can be due to a lack of understanding by the learner about the requirements of the movement. For example, in netball a beginner may be confused about the footwork required to receive a pass.

The cognitive phase is the earliest stage of learning, when the performer tries to understand the requirements of skill production. Trial and error is a feature of this stage. The beginner experiments and experiences both success and failure. When successful, the performer's response is reinforced by knowledge of successful results or by feedback and praise given by the teacher or coach.

Key box 2

Closed loop An aspect of information processing when a performer of a motor skill in sport subconsciously takes into account intrinsic feedback (often called kinaesthesis or proprioception). This feedback is used by the performer to detect and correct errors in movement. An example is a cricket fielder who runs to catch a high ball near the boundary and has to adjust his/her position to catch the ball.

If the performer is unsuccessful, he/she needs to understand why failure occurred in order to avoid the same experience in the future. Teachers and coaches may use demonstrations and other relevant strategies to establish understanding. For example, if a novice badminton player is in the cognitive phase of learning and needs to perform a flick serve, the teacher or coach will demonstrate the correct technique and highlight or cue the important movements so that an accurate mental representation can be created in the mind of the learner.

In the cognitive phase a plan of action needs to be formulated and this often involves sequencing each component of the skill, or putting the **subroutines** of the skill in the right order. For example, in tennis, the correct grip, the distribution of weight, the throw up of the ball and the position of the racket are all important in the sequence of events for the serve to be successful.

There is a limit to the capacity of the receptor systems and there are a number of factors that affect their efficiency (Honeybourne 2006):

- The **stimulus intensity**. If the stimulus stands out against its background, it is more likely to be detected. Using brightly coloured balls in tennis may help the novice to hit the ball.

Key box 3

Subroutines The elements that make up a movement. They must be performed in the correct order for a skill to be executed successfully.

- **Sensory acuity**. The sense organs that are used must be effective if stimuli are to be detected correctly.
- **Specificity of detection**. This is related to the idea that detection ability is specific and not general. Stimulus detection may be good in one context but not necessarily effective in other discrimination tasks. For example, a cricket umpire might detect accurately whether there is contact of a bat on the ball, but might not be able to judge the flight of a ball as well as a slip fielder.

Footwork is natural to expert performers at the autonomous phase

■ **Sources of stimuli**. If there are stimuli coming simultaneously from more than one sensory source, then there is a limited capacity for detection. For example, if information is coming from both sight and sound, the brain can only deal with one piece of information at a time. The other piece of information is held in the short-term memory. The ability to be selective about the stimuli that are attended to (**selective attention**) is crucial if learning is to be effective.

■ **Perceptual capacity**. The number of stimuli processed effectively in acquiring motor skills depends on the perceptual mechanism. Perception is the interpretation of the stimuli or sensory information.

Key box 4

Selective attention The process thought to take place in the short-term sensory store of the memory that filters out unwanted information or stimuli so that the learner can concentrate on the important stimuli necessary for the movement to take place.

Perception involves the coding of information so that it makes sense to the performer.

Individuals perceive differently. One basketball player may see the flight of the ball and perceive that it must be caught; another player may move into space away from the ball because she perceives that another player must receive the ball.

Summary of the cognitive phase

■ This phase is when the performer *understands* what needs to be done in order to complete the skill successfully.

■ This understanding is dependent on factors related to perception of incoming stimuli that can be helped or hindered by the demonstrations of the teacher or coach.

The associative phase

In the associative motor phase, the learner practises the motor skill and compares or associates the movements produced with the mental image created in the cognitive phase. Intrinsic feedback is more easily available to the performer and is acted upon more readily in this phase. The learner also becomes aware of more complex cues or sets of stimuli.

There is usually a vast improvement in performance during this stage. **Motor programmes** are beginning to be formed, although skills are yet to be fully learned and autonomous.

Key box 5

Motor programmes Learned, generalised series of movements, thought to be stored in the long-term memory and brought into action by the performer making a single decision.

The associative phase is often referred to as the '**fixation phase**'. The amount of practice needed depends on the complexity of the skill and the motivation and past experience of the performer.

The associative phase can be related to the second level of motor control, which involves feedback with greater control that is less conscious. The process of **temporal patterning** takes place.

Key box 6

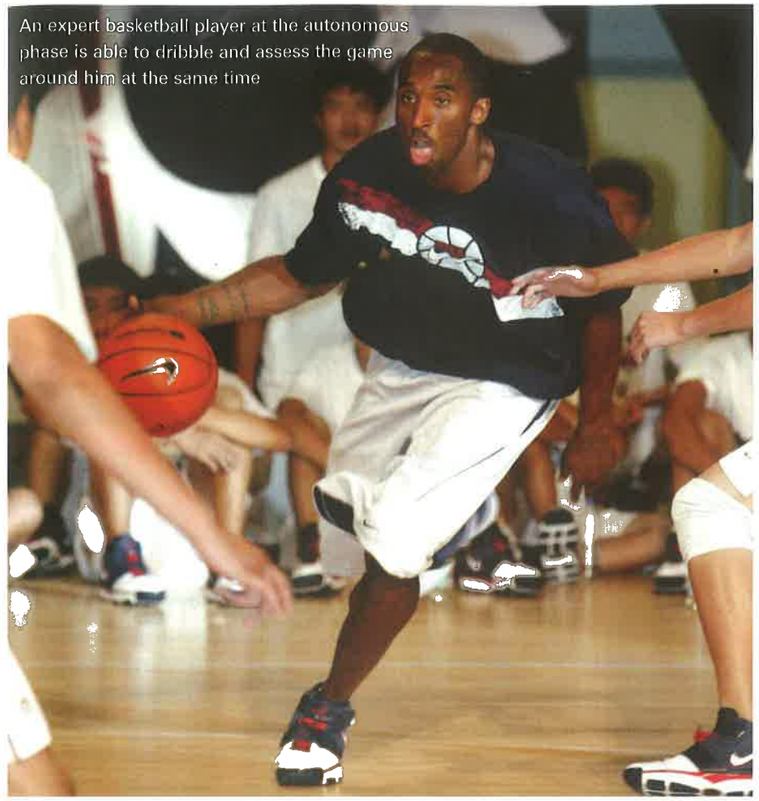
Temporal patterning The links made between subroutines and the control necessary for effective skill production.

Age is a factor in learning in this phase. Children tend to use trial and error, whereas adults strive for the best results possible over as short a time as possible.

Demonstrations by the coach, teacher or another performer take on a different role. Instead of giving information as a starting point, in this phase demonstrations are used to give information that will lead to temporal patterning.

Feedback is an important factor in the correct learning of any motor skill, so the coach or teacher has an important role to play in ensuring that the learner gets appropriate and accurate feedback.

A catch in the slips requires the player to use open loop control



An expert basketball player at the autonomous phase is able to dribble and assess the game around him at the same time

Summary of the associative phase

■ The associative phase is the longest phase.

■ The learner must concentrate on the organisation or temporal patterning of the skill to progress further.

■ Feedback is crucial to give the learner information to improve and to reinforce successful performance.

The autonomous phase

This is the final phase of the skill learning process and is often referred to as the 'autonomic' phase. Movements related to the performance of a motor skill are almost automatic and there is little conscious thought or control.

The first level of motor control can be related to the autonomous phase. This is often referred to as **open loop** control.

Temporal patterning has been almost perfected and results are consistently correct. It is thought that during this phase the movement required for the skill to be performed is relegated down the hierarchical organisation of skill performance, which allows other peripheral stimuli to be attended to (Honeybourne 2006). For example, the basketball player dribbles the ball without much conscious control. This is because the basketball dribble is now in the autonomous phase of learning and the player can look up and recognise possible passes or a drive to the basket.

Key box 7

Open loop When open loop control takes place, there is insufficient time to take feedback into account. Open loop control is applicable to autonomous or well-learned performers who run motor programmes with little conscious control. Open loop often occurs in sudden, ballistic movements — for example, a tennis volley at the net or a slip catcher in cricket.

Summary of the autonomous phase

■ In this phase, any distractions to the performer of a motor skill are largely ignored and the performer is able to concentrate on more complex strategies and tactics.

■ During this stage, motor programmes are completely formed in the long-term memory and therefore it takes only a short time for the performer to react.

■ Many performers may never reach this stage or may reach it with only the basic or fundamental movements.

■ To stay in this phase performers must frequently refer back to the associative phase, where practice helps to reinforce motor programmes.

Questions

Q1 What are the main characteristics of the cognitive phase of learning?

Q2 What is temporal patterning in the associative phase of learning?

Q3 Describe the autonomous phase of learning.

Further reading

Adams, J. A. (1971) 'Closed loop theory of motor learning', *Journal of Motor Behaviour*, Vol. 3, pp. 111–50.

Fitts, P. M. (1967) *Human Performance*, Brooks/Cole, San Francisco.

Honeybourne, J. (2006) *Acquiring Skill in Sport: an Introduction*, Routledge.

Honeybourne, J., Hill, M. and Moors, H. (2000) *Advanced Physical Education and Sport*, Nelson Thornes.

Magill, R. A. (1993) *Motor Learning Concepts and Applications*, Brown and Benchmark, Guilford CT.

Marteniuk, R. G. (1976) *Information Processing in Motor Skills*, Holt, Rinehart and Winston, New York.

Whiting, H. T. A. (1975) *Concepts in Skill Learning*, Lepus Books, London.

John Honeybourne is an A-level Principal Examiner and GCSE Chief Examiner for a major examination board. He is author of numerous A-level, BTEC and GCSE textbooks and an Ofsted inspector for PE and sport.