Plates

Between pages 38 and 39

Preface

Ball games are big business! They occupy the playing time of millions of people throughout the world and the watching time of countless more. Top professional players earn large sums of money, spectators contribute massive financial support to their teams and international tournaments are arranged in which monetary expenditure is often of little object. Even international prestige centres around the results of European, Asian, American and World competition! In spite of the continued outflow of time, money and energy, the coaching of ball games remains an art. A sophisticated art it is true, but an art nevertheless. The amount of time and money spent on research investigations into ball skill acquisition or the psychological, sociological and physiological effects of games playing is trivial.

This book sets out to review the experimental literature which does exist with a view to its application in the acquisition of ball skill. In the main, such literature is not from the field of sport since what is written in such books is generally subjective or related to the attainment of success by particular players or teams. This is not to deny that sports writers have not been aware of many of the issues raised but, so far, there does not seem to have been a book published which is devoted to an objective view of the important factors in the acquisition of ball skill in general.

Perhaps the most numerous body of people concerned with the teaching of ball games are those in the physical education profession (although it is worth noting, and may be of significance, that those concerned with introducing children to the initial stages of ball game skill will not be specialist trained teachers of games). Although such people are concerned with the *training* of players for ball games, they are also educationalists. This necessarily means, that they have wider considerations

than the development of ball-game playing ability in their children to the exclusion of all else. Such teachers will be concerned with and may put primary emphasis on the social, emotional and recreative aspects of games participation in addition to any skill development which may take place. They may be using games as a means of education in which the attainment of a high level of proficiency is incidental. In spite of such considerations, the cult of the school team and the prestige that success carries, will often mean that with some children at least, training in top level ball skill is a fundamental consideration.

It is this two-fold approach—*training* in ball games and *education* through the medium of ball games—that bedevils the methodology of instruction. In saying this, it is not intended to put a value judgement on either of these procedures but it does mean that considerations for one of these approaches may not be suitable for the other. Without therefore being in any way critical about the process of education through games (an approach to which I would subscribe), such considerations will be of secondary importance throughout this book. The primary consideration will be with some of the principles involved in the *training* of ball-game players. Nevertheless, the principles involved are considered to be basic to physical educationalists, coaches, teachers, players and to the more sophisticated spectator.

If there is one principle which has become reasonably well established in the experimental analysis of human performance, it is the *specificity* of skilled behaviour. By this statement is meant that if success is to be attained in a particular skill area, extended practice in *that* area is a prerequisite. If this principle is accepted, then the training of ball players outside the game situation must be viewed with caution and all concerned with such procedures must be clear on what they are trying to achieve by such methods. An appreciation of this problem is perhaps illustrated by current training procedures which attempt to make ball skill practices taken out of the context of the game as near as possible to the game situation. In so doing, the coach is making the assumption that transfer of training from the 'mini' situation to the full game will be brought about by such a procedure. He may well be right. Although the literature on transfer of training is considerable,

the exact nature of transfer in any situation is far from well defined. This has led Meredith (1966) to comment that:

> . . . the statistical facts of transfer are so dependent on the educational context that they are too diffuse to be capable of precise investigation except in carefully specified circumstances.

If, however, the evidence amassed by experimental psychologists such as Osgood (1953) is considered, it will be found that while maximum facilitation as would be expected, occurs when both stimulus and response situations are functionally identical, transfer effects fall off as the degree of similarity between stimuli and responses in the two tasks differ. In this context, the relationship between practice and game conditions must be very carefully considered. A similar principle is involved in Holding's (1962) concept of 'inclusion' in relation to transfer effects from difficult-easy and easy-difficult situations. This suggests, that where a subskill has been practised out of the context of a skill complex, positive transfer from the easy to the difficult task might be expected. It must, however, again be asked how close in terms of both perceptual and motor characteristics is the subskill when practised outside the game situation to what is supposed to be the subskill within the game itself?

If such considerations raise difficult problems for skill sequences supposedly extracted from the game and practised in near game situations, how much more difficult it is to justify the practice of isolated skills if eventually it is the game itself in which primary interest lies. What purpose is served for example by chest-passing in pairs across the gymnasium for potential basketball players or stationary passes in hockey for budding hockey players? What is happening when children are allowed to deliberately go for rallies when learning racquet games? True, it maintains their interest (which may be of fundamental importance), but in as far as in games competition the purpose is not to have rallies, it is necessary to justify the former procedure for achieving the latter. Perhaps education and training are again being confused in this context?

Unfortunately, evidence is sparse for any of the procedures suggested and as in education in general, method follows current fashion and myths can easily be perpetuated. Circular reasoning does not help in this situation. Because a certain amount

of success is achieved by a given method, it does not mean that it is the best or only method although it may be sufficient justification for the teacher or coach in control. So many things lead to success. The really enthusiastic teacher with little technical knowledge can achieve quite outstanding team results *just* by the interest he takes in the team he is with.

What all this amounts to, is that little is really known about 'how' to teach ball games in the most successful and efficient way, or whether methods should differ at different ages and with differing abilities. Teachers and coaches learn from their teachers and coaches—methods of approach are perpetuated. Results of some kind or other are achieved and accepted. There is a need to question fundamental approaches, to initiate investigations to clarify some of the issues and above all for teachers and coaches to be aware of possibilities. As stated at the beginning of this preface, many of the problems are imposed by philosophical considerations which need to be resolved before methods of teaching/coaching can be justified. It is not intended to develop this theme any further, suffice it for the reader to understand that it is the *training* of ball skills that is being considered here.

The book is designed to establish a basic model for skill in the first chapter. Subsequent chapters develop particular systems of the model in relation to the acquisition of ball-game skill. Throughout the book, references are given which enable the interested reader to follow up particular topics which have received only a limited treatment. In this way, the book will be of particular interest to students in training and should serve as a source of reference from College of Education level to higher degree work.

Leeds 1968 H. T. A. WHITING

CHAPTER 1

Introduction

The decision to restrict the scope of this book to ball* skills can be misleading since the reader may form an impression that such skills are entirely in a class of their own. While the presence of a ball—particularly of a ball in flight—adds important considerations to the acquisition of such skills, it is worth stressing that similar models have been suggested for skills in many different categories. Welford (1958) for example talks about the acquisition of *motor* skills and Argyle & Kendon (1967) about the acquisition of *social* skills from similar viewpoints. Thus, two seemingly diverse categories of skills have been analysed in similar ways. But even here, a decision to classify skills as *motor* or *social*, while being useful from the point of view of emphasising the observed behaviour with which different workers are primarily concerned, can be misleading in as far as it focusses attention on a limited area of the whole skill sequence. The current trend is rather to consider all skills as perceptual-motor thereby stressing the important relationship which exists between input and output data in their performance. To Welford and Argyle & Kendon, such a proposition is axiomatic. Throughout this book, the prefix 'perceptual-motor' will likewise be assumed to apply to the skills discussed even when not specifically stated. In this respect, a *skill* has been defined by Argyle & Kendon (1967) as:

> . . . an organised, coordinated activity in relation to an object or a situation which involves a whole chain of sensory, central and motor mechanisms.

Knapp (1964) has also drawn the distinction between 'skill' and 'a skill'. The former she defines as:

> . . . the learned ability to bring about predetermined results with maximum certainty often with the minimum outlay of time or energy or both.

* Hereafter, the word 'ball' will be taken to stand for ball, shuttlecock, puck, etc.

It might therefore be useful to think in terms of more or less skilful players in one or more ball skills. Since any of the major games (football, hockey, golf, lacrosse, etc.) involve a variety of ball *skills*, it is to be expected that individual players may be *skilful* in some or all of these skills and since more than one player is usually involved, social skills may also be important.

Systems-Analysis of Perceptual-Motor Skill Performance

The use of models of human performance serves as an aid to the understanding of the function of such a complex system as the human body. The 'systems approach' to model building abstracts the common procedures from amongst the multitudinous acts of behaviour and categorises them as components in which their function may be more easily understood. By such techniques, an attempt is made to determine the relative functioning of subsystems of such components with respect to the entire system. An approach of this nature will be used in relation to perceptual-motor skill and built up in four stages. While not being the only model put forward as an aid to the study of skill acquisition, it has the merit of simplicity, particularly in elaborating important concepts. In a later chapter it will be necessary to introduce an 'information theory' model. Other useful models have been reviewed by Fitts (1964).

In terms of the *physical* components of human perceptual-motor performance, it is useful to consider first of all a simple model—Figure 1—representing the link between sense organs,

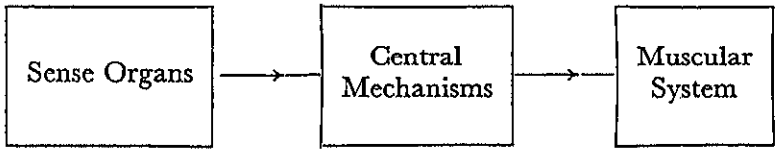

FIGURE 1
Physical components

central mechanisms of the brain and the muscular system (Singleton, 1967). At a functional level such physical components give rise to the reception of *input* data via the sense organs, *decision making* in the central mechanisms and *output* data via the muscular system—Figure 2. The central mechanisms may be further elaborated in terms of the functions they are known to perform (Welford, 1960)—Figure 3. Three primary systems are recognised—*perceptual*, *translatory* and *effector*.

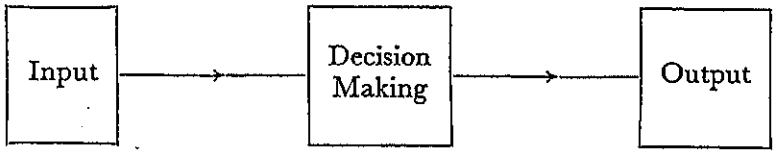

FIGURE 2
Functional components

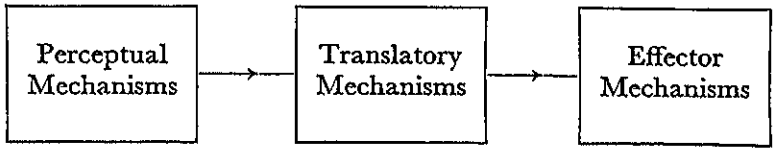

FIGURE 3
Central mechanisms

Finally, these three simple models can be incorporated to give a more complicated but at the same time more informative systems-analysis of perceptual-motor performance—Figure 4.

One of the difficulties in presenting two-dimensional models of this kind on paper is that they give the reader the idea of a static system. The nervous system of the human body is constantly active (in terms of the firing of nerve cells), the environment (both internal and external) is continually changing, attention fluctuates and man is never still. The components of the model while maintaining their overall basic structure and function are in a continuous state of change, of elaboration and sophistication. The model must be conceived as a dynamic model.

Basically, the systems' components in this composite model together with their interactions can be elaborated as follows:

Information about the *display* (immediate external environment in which the skill is to be carried out—Plates 1 and 2) or about the internal environment (proprioceptive* information)

* The kinaesthetic (receptors in the muscles, tendons and joints) and vestibular senses are sometimes collectively referred to as the proprioceptive senses (Morgan & King, 1966).

is relayed to the central mechanisms of the brain via the sense organs. Since the performer of a skill cannot utilise *all* the information available in the display at any one instant, *selective attention* determines both the area of the display which is scanned and the particular information which is abstracted. Sensory data from the external and internal environment is interpreted (the process of *perception*) in the central perceptual mechanisms. On the basis of such perceptions, decisions are made with regard to new responses or adjustments to ongoing responses. If a response is to be made, the translatory mechanism selects the appropriate response pattern and the effector system gives the executive command to appropriate muscular response systems. The carrying out of an effector response brings about a change in the display giving rise to 'feedback' information about the effectiveness of the response. Such information together with other information from the display and the internal environment can then be monitored by the sensory systems and used in the control of ongoing responses or utilised in initiating future responses.

This brief outline has introduced a number of concepts which may be new to the reader. Those which are considered to be of particular importance are elaborated briefly below. Additional information and background reading can be obtained by following up the references quoted.

Display (Plates 1 and 2)

The display is that part of the external environment which contains information which is likely to be of use—or in some cases necessary—in performance of the skill. It will be that part of the external environment towards which attention needs to be directed for the purpose of taking in information the processing of which gives rise to decision making which will affect the performance of the skill (Shackel & Whitfield, 1963).

Perception

In attempting to understand perception in relation to ball skills, it is necessary to realise that the distance receptors (eyes and ears) which play such an important part in monitoring information from the display are sensitive to incoming light or sound energy. At the receptors, such energy is converted into

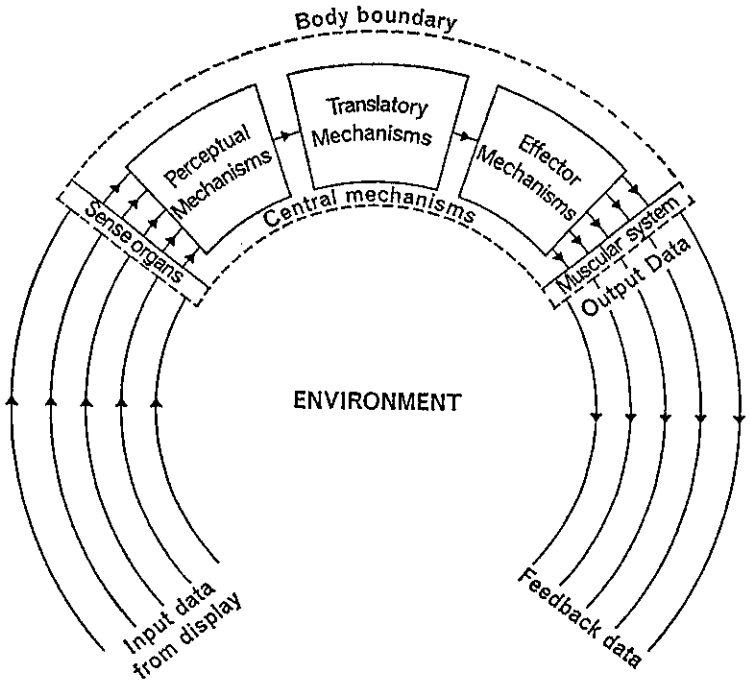

FIGURE 4

Systems analysis of perceptual-motor performance

chains of electrical impulses (neural coding) and relayed to the central mechanisms via the appropriate nerves (Gregory, 1966). It is these impulses which give rise to the patterns of brain activity the processing and interpretation of which constitute the act of perception. It is the brain which is responsible for perceiving and not the sense organs!

Selective Attention

Because of the limitations of the sense organs, the amount of information present in any display and the necessity for information to be obtained with an optimum level of speed and accuracy, it is necessary for attention to be selective. By this is meant that consciously or unconsciously, attention is focussed on particular areas of a display. Such focussing may be a random process but is more likely to be determined by the past experience of the person and the current skill being performed. It will be appreciated that one of the requirements of a good ball-skill coach is that he should know what information within a display is worth attending to, i.e. those particular stimulus situations which give rise to information the monitoring of which is essential for the performance of the skill at a particular level. For example, the coach may instruct a player to 'keep his eye on the ball' because he thinks that this is the most important source of information in the control of the skill. In such cases, the coach will be attempting to make the players' attention selective. It appears that stimuli which are not attended to are excluded from perception (Horn, 1966) so that a person may also be considered to demonstrate selective *perception.* It is also worth noting that in concentrating attention on relevant stimuli, it is necessary to ignore stimuli which are irrelevant. As Rabbitt (1967) has recently pointed out, this may equally well be a learned ability.

Feedback

Although 'feedback' is a common enough term in relation to the control of machine systems, its adoption in the description of human control systems is comparatively recent and would appear to have developed from Wiener's (1948) elaboration of Cybernetics (the science of control and communication). Although the analogy between the control of machine systems and the control of the human system is a useful one, there are

important differences in the characteristics of the two systems (Milhorn, 1966). In terms of the human control system, feedback is often designated 'knowledge of results'. Holding (1966) with others distinguishes between internal and external feedback. Internal feedback—in terms of proprioceptive information—is intrinsic to all human performance. External feedback—represented by changes in the display—may be intrinsic to a particular performance in as far as it is the direct result of the action. However, it may also be provided by an external agency (such as a coach) giving rise to what has been termed *augmented knowledge of results.*

Feedback may be utilised in the control of ongoing responses (action feedback) or it may be retained in memory store and used in the control of subsequent responses (learning feedback). Thus, information about the result of hitting a ball will be monitored by a player and such information used to help in the control of either ongoing movements—as in dribbling a hockey ball—or future movements of a similar kind.

If the 'black-box'* model given in Figure 4 is considered useful in analysing the components of a skilled action, it may also be found useful to look for breakdown in skilled performance in one or more of these mechanisms and their related feedback. While a breakdown in skilled performance will always manifest itself in inadequate or inappropriate motor behaviour, it does not follow that there is necessarily any deficiency in the *effector* system. A number of subsystems contribute to total effective performance. For example, in performing a ball skill, a player may fail to select the important information from the display. On the other hand, he may focus his attention on the right area of the display but put a wrong interpretation on the data conveyed via the sense organs to the central perceptual mechanisms. Correspondingly, the right perceptual interpretation might be put on appropriate sensory input but an inappropriate response might be selected. Finally, there may be a failure on the effector side in terms of such variables as timing, effort, or feedback control of ongoing movements.

An analysis of a situation in these terms may lead a player or

* The 'black-box' approach to modelling is in terms of a system which will account for all the known responses. It is used because in general, interactions of variables inside the black box are not known (Milhorn, 1966).

a coach to ask further questions in an attempt to arrive at a reason for a breakdown or lack of development in a particular ball skill. The failure of a player to select the right information from the display might be because he does not know what to look for, either because he has not had enough experience in the situation or because his attention has not been directed towards appropriate information in the display or *has* been directed towards inappropriate information. This stresses the importance once again of the coach being aware of information in the display which is worth having in relation to the performance of particular ball skills and at particular levels of skill development. Very often the coach restricts his comments to 'watch the ball'! Limitations in this respect are reviewed in the next chapter.

Putting the wrong interpretation on information which has been received may again reflect inexperience in a particular situation or a lack of awareness of possibilities. In as far as the art of misleading the opposition in a ball-game is considered to be an essential part of competitive play, players are in fact concerned with confusing the display (by for example dummying, feinting, changes in tactics, etc.) in such a way that opposition players either put a wrong interpretation on selected information or selectively attend to less important cues. This procedure might be considered in some instances as an additional social skill to be acquired, since control of the ball itself in such situations may be incidental. Other possibilities of this nature can be exploited by the interested reader.

At an everyday level, considerations such as those outlined above may lead to an adjustment in training techniques based on the appropriate monitoring of skill deficiencies rather than on vague ideas of where such difficulties might have arisen.

Categories of Ball Skills

Three general categories of task in the performance of ball skills can be outlined:

1. The acquisition* of a ball in flight via the visual pathway followed by capturing it in the hand(s) or into an instrumental extension of the hand(s) such as a lacrosse stick.

* In this context refers to focussing the eye(s) on the ball in flight and tracking it through all or part of its trajectory.

2. The acquisition of a ball as in category 1 followed immediately or after a minimal period of time by its direction towards a target which might be stationary or moving (as in batting skills or throwing in from the field at rounders).

3. Propelling an already acquired ball towards a target (as in golf, or a stationary corner kick in football).

A descriptive model for skills in categories 1 and 2 is given in Figure 5.

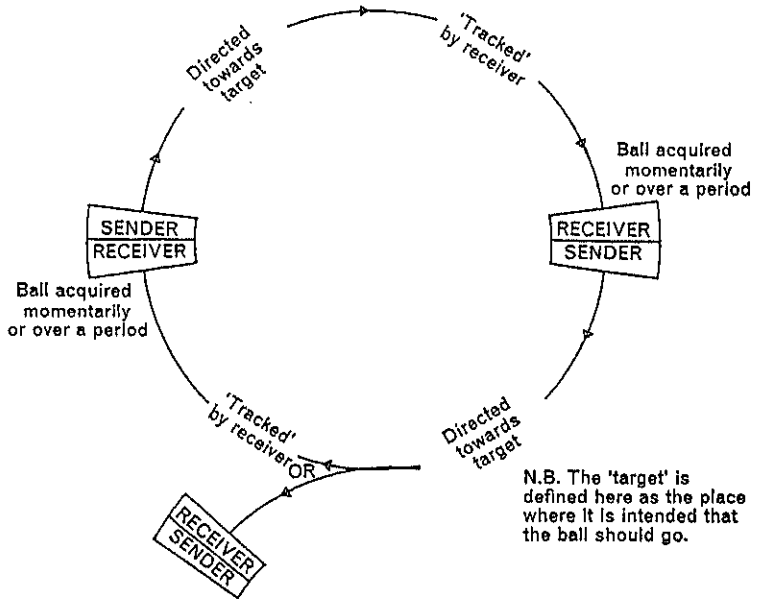

FIGURE 5

A simple model for ball skills in categories 1 and 2

*'Open' and 'Closed' Skills**

Knapp (1964) extrapolating from the work of Poulton (1957) has classified skills in categories 1 and 2 as being towards the 'open' end of an open-closed skill continuum while skills coming under category 3 would be towards the 'closed' end. Basically, the continuum (Figure 6) ranges from skills which are pre-

* By 'closed' is implied that sensory feedback which guides the skill is in terms of proprioception while in 'open' skills, information for guiding the skill comes primarily from the display.