

BACKWARD CHAINING: A METHOD OF TEACHING MOTOR SKILLS

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an alternative method

use for problems with basic technique

ABSTRACT

Backward chaining, a teaching method emanating from operant psychology was contrasted to the traditional methods. The learner experiencing terminal reinforcement at every trial was considered an advantage of backward chaining. The matching of this method to the special nature of motor tasks was seen as an additional advantage. That is, backward chaining was seen as facilitating the acquisition of 'temporal patterning' which is often essential to skilled motor performance. The difference between 'temporal patterning' and 'timing' was highlighted.

RÉSUMÉ

L'enchaînement à rebours, méthode d'enseignement issue de la psychologie opérante, a été opposé aux méthodes traditionnelles. L'avantage de la méthode d'enseignement à rebours réside dans le fait que le sujet fait d'abord l'expérience d'un renforcement final à chacun de ses essais. L'appariement de cette méthode à une tâche motrice spéciale présente un avantage supplémentaire. On a perçu que l'enchaînement à rebours facilite l'acquisition d'un "enchaînement temporel" souvent indispensable à la réalisation d'une habile performance motrice. On a fait ressortir la différence entre "l'enchaînement temporel" et le "synchronisme".

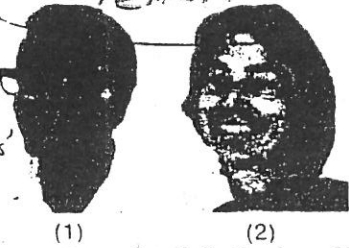
Teaching methodology is the subject of extensive research with much effort devoted to improving various accepted methods and devising new ones. Physical educators and coaches are constantly endeavouring to apply learning theories to the teaching of motor skills. Adams (1971), Cratty (1967), Fitts and Posner (1967), Gentile (1972), and Lawther (1968) among others have advanced theories to explain the processes and dimensions of motor skill acquisition.

More recently, Rushall (1972), and Rushall and Siedentop (1972) have proposed that the principles of operant theory should be used in teaching motor skills. The basic tenet of operant psychology is that behaviour is controlled by its consequences. Management of these consequences is the mainstay of those involved in developing and controlling behaviour. One of the teaching methods emanating from operant psychology is "backward

chaining", which has received very little attention as a possible method of teaching motor skills. This article describes backward chaining and provides a rationale for the use of backward chaining in teaching various motor skills.

Chains

It is common practice to treat a complex motor skill as composed of specific subskills or subroutines. For example, a lay-up shot in basketball is broken down into the approach, the take-off, and the laying up of the ball. In the operant theory of motor learning, a serial task such as the lay-up shot is termed a behavioural chain and is defined as a "... series of responses linked together by stimuli that function as both reinforcers and discriminative stimuli". (Rushall and Siedentop, 1972, p 128). That is, a basketball lay-up is the whole chain and the steps are the series of responses within the chain. The



completion of each unit while reinforcing the preceding response, also acts as a stimulus that triggers the subsequent response. Conceptually, the whole-part, executive program-subroutine (Fitts and Posner, 1967), and the chain-link terminologies are analogous to each other in that each one of them breaks down a complex task into meaningful units which are sequentially arranged.

Methods of Teaching

Forward Chaining

Once a skill has been broken down into its component parts, one traditional approach in teaching the skill has been to teach the parts one by one in their sequential order. For instance, if a skill is comprised of parts A, B, and C (appearing in that order), the customary approach for teaching the skill is to:

- First do part A
- Then do part A with B
- Finally do part A together with B and C.

Related to the "part" and "part-whole" method, Cotton et al. (1977) have provided some evidence that the difficulty of the subroutine dictates the order in which it should be taught as well as the most efficient methodology to be used. In the many variations of the above method (e.g., "part", "part-whole", "repetitive part", "progressive part", etc.) the fundamental sequence of learning is from the first part to the last part of the skill. Operant psychologists would call this method "forward

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chaining". That is, the chain is built forward from the first unit to the last.

Backward chaining

There is, however, the method of "backward chaining" which stresses that the student learn the last element first, and proceed backward to the penultimate part and so on to the first part. The process can be schematically presented as:

- First do part C
- Then do part B and follow with C
- Finally do part A and follow with B and C.

The process is best illustrated by an example from sport. Consider again, the lay-up shot in basketball and its parts: the approach, the take-off, and laying-up of the ball. Using the method of backward chaining, the student would first practice the last unit — the lay-up. That is, the subject would stand close to the basket on his left foot (with the right leg tucked up toward the chest) and flip the ball into the basket. Once he has mastered this last unit, he stands on his right foot one step away from the basket, and steps forward onto his left foot, jumps up and lays the ball up. In this stage he also learns to carry the ball from the waist to his shoulder level and upward, and to kick up with his bent right leg for vertical momentum. In the next stage, the subject stands two steps away from the basket. He bounces the ball on the floor and catches it while both feet are off the floor, lands on the right foot, (the material thus far is new to the learner) and then continues on with those units that he has already mastered — stepping with his left foot, jumping up

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smashes it. Then, the element of jumping is introduced. The next step is to throw the ball a little further and higher and spike the ball after the scoot and jump. Finally, with a partner throwing the ball the learner starts with a step and continues on with the scoot, jump and smash. Subsequently, the learner performs the sequence on the court with the net lowered and progressively raised to the legal height. This procedure enables the student to learn both temporal patterning and timing concurrently.

Timing, then refers to the initiation of the sequence relative to an external stimulus while temporal patterning refers to the blending of the units in the proper sequence. The distinction made here between timing and temporal patterning is consistent with Whiting's (1969) position that the so-called open skills should be viewed as "... closed skills in an open environment" (p. 10). That is, the perceptual component of when to initiate a movement (which involves timing) is differentiated from the motor component (which involves temporal patterning). In sum, timing is relevant to open tasks while temporal patterning is necessary for both open and closed tasks.

While Gilbert's theoretical framework regarding backward chaining appears to be sound, the research findings have not been entirely supportive of his claim that backward chaining is superior to other teaching methods (Balson, 1971). Perhaps the reason for such equivocal findings is that the specific advantages of a method have not been related to the relevant attributes of the task. For instance, the subject matter presented to the learner has been most often cognitive in nature like learning poetry (e.g., Heartly and Woods, 1968), or solving arithmetic problems (e.g., Balson, 1971). These tasks do not require the temporal patterning required in sports tasks. In addition, mastering of the first verse in reciting poetry may in itself be sufficient reward. But mastery

of one unit of a sports task often does not provide the reinforcement except when it is the last unit.

Thus, the special features of backward chaining are seen as matching the requirements of some serial psychomotor tasks. Singer (1977) has emphasized the need for matching the method with the learning material.

... classification of psycho-motor tasks may suggest different learning strategies, a factor usually overlooked by instructional designers (p. 486).

While Gilbert (1962a, 1962b) and his associates hold the extreme view that backward chaining is the best teaching method, the present authors advocate it only as another alternative. It is stressed that backward chaining may be a better method in those sports tasks where the temporal blending of the subroutines is crucial. This view is supported by the fact that many teachers and coaches do adopt this method in teaching various skills. In fact, some textbooks on teaching of skills, do specify this method (e.g., Ebert and Cheatman 1972, p. 83-85; and Hayes, 1977, p. 38-41; specify backward chaining methodology for teaching the lay-up in basketball). Unfortunately, in the above examples the rationale for teaching a skill via backward chaining has not been specifically stated.

Summary

In summary, the paper has described the method of backward chaining in teaching complex sports skills. The advantages of backward chaining lie in: 1) the terminal reinforcement being available to the learner at every attempt; and 2) its value in development of temporal patterning that is the hallmark of efficient skill performance. It is hoped that the present paper has provided a basis for considering backward chaining as an equal viable method of teaching motor skills

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