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Information Processing during the Performance of Skills in Physical Education.

Response Time

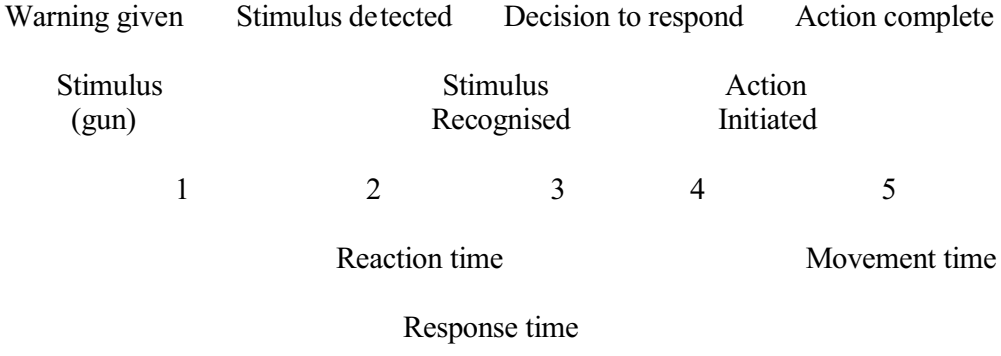
Response time is the total period of time from the presentation of a stimulus to the completion of the response. It consists of two main periods, reaction time and movement time.

The speed at which we make decisions is called our reaction time. In terms of sporting activities, it is important to be able to respond to a stimulus quickly because it allows the performer to be in greater control. Reaction time is also made up of smaller units.

In athletics, during a 100m race, a fast reaction time is imperative for optimum performance. The quicker the athlete is able to respond to the starting gun, the quicker they are able to get out of the blocks allowing them to dominate the race (assuming that they have the strength to sprint at a consistently fast pace).

The time period it takes for an athlete to initiate an action and complete it is called the movement time. Movement time is dependant on the strength and type of the muscle fibre contained within the muscle, and the level of technique that the athlete has acquired.

During a 100m race, the time it takes for the athlete to push out of the blocks until the point at which the athlete crosses the finish line is known as the movement time.



The diagram above shows:

- **Warning given**: these are the words "take your marks…… set" spoken by the official.
- **Stimulus is presented**: this is the sound of the gunfire.
- **1**: this denotes the time it takes from the presentation of **the** stimulus to the point at which the athletes ears detect the sound. This time is known as the stimulus transmission time.
- **Stimulus detected**: the athletes' ears detect the sound.
- **2**: this denotes the time it takes for the athlete to make sense of the stimulus i.e. recognise it.
- **Stimulus recognised**: the point at which the athlete becomes aware that the sound was the cue to begin movement.
- **3**: this denotes the time it takes for the athlete to decide whether to respond to the stimulus (Decision Time).
- **Decision to respond**: occurs when the athlete decides to move away from the blocks.
- **4**: this denotes the nerve transmission time, whereby the decision to respond must be sent to the relevant muscles.
- **Action initiated**: the muscles receive instructions to move, therefore initiating the pushing away from the blocks.
- **5**: denotes the time taken from the point at which the movement action is initiated, to the point at which the action is completed.
- **Action complete**: this is the point at which the decided response to the stimulus is completed.

All of the above create the athletes response time.
Response Time = Reaction Time + Movement time.

Reaction time can be used as an effective tool in athletics. Sprinting recently saw the introduction of a new electronic touch -activated system, designed to detect false starts much more accurately than the eye of the official. It works on the basis that there is a minimum reaction time (100ms for men). The machine detects any athlete who reacts faster than this time, declaring the race a false start, and penalising the offending athlete.

There are many demand characteristics that are likely to affect reaction time:

Stimulus-Response compatibility.

Response capability refers to the degree to which the stimulus and the response are 'naturally' associated. E.g. if the stimulus comes from the right hand side, response is faster with the right hand limbs than the left.

Automaticity.

The more often a stimulus is responded to, the more reaction time is reduced. E.g. the more practise a goalkeeper has in saving shots, the faster their reaction time becomes. Eventually the response becomes automatic and therefore requires little or no attentional effort.

Knowledge.

The more the individual learns about the context in which events occur, the faster the reaction time becomes. They are able to anticipate a stimulus, making them more prepared, and thus, able to react more quickly.

Number of stimuli.

As the number of stimuli increases, the reaction time is increased by a considerable amount. According to Hick's Law, the more choices that the performer has to make, the longer it takes to react. A simple reaction time is where there is one stimulus which the athlete is expecting e.g. starting pistol. A choice reaction time occurs when there are several stimuli from which the athlete has to choose one to respond to e.g. movement of several players on the hockey pitch. The greater the variety of shots you can make from one position on the tennis court, the slower the opponent will be in responding to the shot that is played.

Timing of Stimuli.

If we do not have time to complete an action before the next stimulus occurs, it takes longer to respond to the second stimulus. As we can only process one item of information at a time, our response to later information is likely to be delayed. E.g. a player makes a 'fake' move to the right and the opponent responds to cover the move. If the player then rapidly pushes to the left, the opponent will still be moving in the opposite direction. It takes the opponent longer to follow the move to the left than if the player had only made the move to the left. The additional delay found in this situation is called the psychological refractory period.

Other characteristics that affect reaction time are concerned with individuals' characteristics. These include,

Age and Sex

Research has shown that up until the age of approximately five years of age, both males and females' reaction times are roughly the same. This is because children at this age are still learning basic motor programmes. Beyond this age, males appear to develop a faster reaction time than females, on average. Females are able to rea ct to a stimulus within between 220ms and 200ms between the ages of 10 and 30. Males however, are able to react to a stimulus within between 190ms and 160ms between the ages of 10 and 30.

Health and Body Temperature.

Ill health slows down reactions as the body is already making more decisions than usual i.e. fighting antibodies or healing wounds and broken bones. Bacterium or viruses leave the body feeling drained and weak. Ill health affects body temperature also. The lower the body temperature, the slower the reactions will be. This is because the muscles and the nervous system will not be fully prepared to receive and respond to information.

Personality.

Extroverts tend to have faster reaction times than introverts. This is because extroverts have more confidence, and are usually much more eager. Increased confidence leads to increased motivation and alertness (see below).

State of Alertness/Motivation/Arousal.

The more alert the performer is, the more likely they are to respond quickly. The more alert the performer is, the more prepared and concentrating they are. The more alert a performer is, the higher their arousal levels which leads to an increase in motivation.

Length of Neural Pathways.

The further the information has to travel, the longer it will take. This leads to a slower reaction time, which results in a slower response time.

Feedback

There are many types of feedback, each of which has a different function or purpose. All feedback occurs as a result of an action. It allow s comparisons to be made between the athlete's performance and the 'model' of the correct skill allowing the correction of errors and minor adjustments to take place.

Intrinsic feedback (inherent feedback) is a type of continuous feedback that comes from the proprioceptors. It occurs as a natural consequence of movement.

Extrinsic feedback (augmented feedback) is feedback that is received from external forces. It is a supplementary form of feedback, which can be given by the coach, or by use of a v ideo for example. It can also be used to help the performer develop intrinsic feedback.

There are two types of extrinsic feedback. **Knowledge of results** refers to the outcome of an action. It is easy to measure so is a common form of extrinsic feedback. It enables the performer to understand the end result of the response. The second type of extrinsic feedback is **Knowledge of performance**. This relates to information about the performance of the action. The coach is the key source of this knowledge, althoug h teammates play a part too. Teammates are able to watch each other and analyse the performance, giving them feedback on performance-creating reciprocal teaching. A highly skilled performer can also receive knowledge of performance through kinaesthetic awa reness, as they know how a good performance feels. The use of videos, cameras, digital cameras and video cameras has helped to develop knowledge of performance.

Extrinsic feedback should not be used more often than needed because the performer may become too heavily dependant on it and will not develop intrinsic feedback.

Positive feedback is constructed of three stages and is otherwise known as constructive criticism. The three stages include positive feedback being given by a good coach, followed by error correction and finally a motivational comment.

Negative feedback carries risk and should only be used sparingly as a last resort, perhaps if other types of feedback have not been effective. It must be used fairly and consistently, and only after war ning.

Concurrent feedback is any type of feedback that is given to a performer during their performance.

Terminal feedback is the type of feedback that is given to a performer at the end of the performance.

During a pre-competition warm-up session in long jump, the performer could be rehearsing the take-off phase of the jump. The performer may need to correct the bodyline. Therefore, the coach would watch and then say to the performer "what you are doing is good, but to improve upon it you must try to lean back a little, and if you can do that the jump will improve. I know you can do it so lets see it". This would be an example of **positive feedback** because it follows the three stages from above.

If the same scenario occurred and the coach said to the performer "you are hopeless. If you don't jump over 5m today then I will pick somebody else for the team next week". This would be an example of **negative feedback** because the performer is not being encouraged, but criticised and bullied.

During the competition, when performing the take-off phase, the performer may feel like they are slightly off-balance. This will create an unsuccessful performance. The feeling of being off balance is the **intrinsic** feedback. When the performer lands in the sand pit, they are able to then look at how far they have managed to jump. This measurement (**knowledge of results**) serves as part of the **extrinsic** feedback.

During competition, the competitors are not allowed to talk to their coaches. However, they can look over to receive signals by way of gesture. Therefore, if the performer completes a jump and realises that their approach run did not enable the performer to take-off from the take-off board, they may look to the coach who can signal by hand gesture how to adapt. Not only is this type of feedback **extrinsic** (**knowledge of performance**), but it is also **concurrent** as it is given to the performer during the performance.

At the end of the competition, the coach will have a chance to talk to the athlete. This talk will probably include aspects such as how the performance could have been improved, which sections need working on and possibly video evidence to analyse. This feedback would be **terminal** feedback, as it is given to the athlete at the end of the performance.

There are four functions of feedback

- Information about performance or outcome,
- Reinforcement,
- Punishment
- Motivation.

Feedback as information

The coach gives positive information feedback first, followed by error correction and finally a motivational comment. Before giving feedback, the coach also gives the learner time to evaluate and come to conclusions about the performance. This gives control to the learner, identifies to the coach the ability of the learner to analyse his/her own performance and ensures the coach does not tell the learner what he/she already knows.

Information should always be simple and concise for beginners. It should focus on sequence and timing so that the motor programme can be developed effectively. It should be given as frequently as possible, after each trial is feasible, it should help the learner identify important cues; it should rely on visual and verbal input.

For intermediate learners, feedback can be given less frequently, the learner needs an opportunity to link the feel of the movement with the outcomes, and so information feedback should focus on this. The feedback can be more detailed.

Advanced performers require much less augmented information feedback, and what is given should be detailed and technical.

Feedback for reinforcement

Reinforcement is used a great deal in the early learning stages and through all the phases for the open skills. It can be intrinsic or augmented. Positive reinforcement is given to strengthen the desired technique. It can be used to 'shape' responses. In sports contexts positive reinforcement usually takes the form of praise and encouragement. Augmented negative reinforcement requires the removal of an unpleasant consequence of the error. Practising allows negative reinforcement to eliminate the error and reinforce the correct technique. However, the reinforcement must be given immediately following the response if it is to be effective.

Feedback as punishment

Coaches and teachers should ideally not need to punish, but players are not angels and occasionally misbehave or refuse to accept a coaches or teachers advice. Punishment carries risks and should be used sparingly and only if all other forms of feedback appear to be ineffective. However, punishment should not include physicality's, demean the learner or damage their self-esteem, be given in frustration or anger. Instead, punishment should be perceived as such by the learner. It should be given after warning, be used constantly and fai rly against undesirable behaviour, not the person and be supplemented by positive reinforcement and motivational feedback.

Feedback as motivation

Learners are motivated when they have clear goals and want to achieve them. Goal setting in sport is an important element in learning and the good teacher or coach ensures that learners have clear, achievable goals to which they are committed.

Motivational feedback gives learners information about their progress towards these goals. It helps them to understand the difference between their present performance level and that needed to achieve their goal. It is important that it also gives them self-belief and the confidence to continue to practise through the ups and the downs of learning. Breaking down long-term goals into intermediate goals is a helpful motivational strategy. Progress charts and training/competition diaries are useful in this respect, because they help the learner to see improvement. But often the most satisfying motivational feedback comes as acknowledgment of progress from the coach.