Reaction, Movement & Reaction

Reaction time measures a performers ability to sense and interpret information before making a movement in sport, based on perceptual ability. The following shows the relationship between reaction time, movement time and response time for an athletics race.
Figure 1

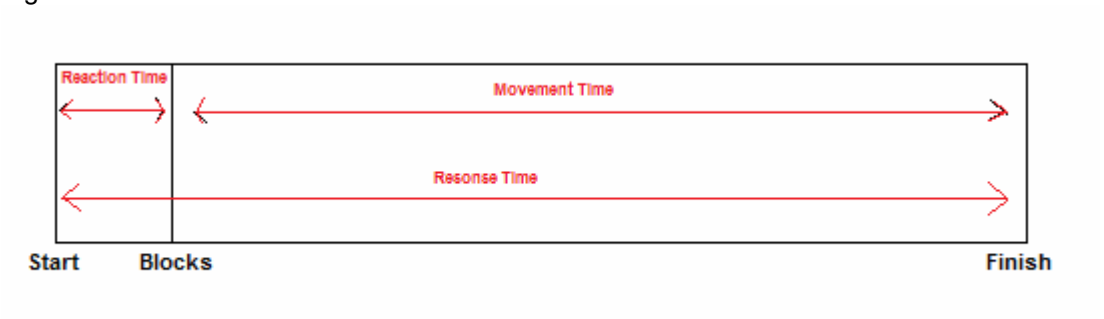


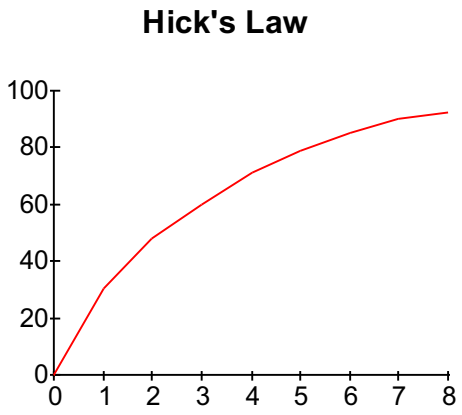
Figure 1 shows us that reaction time is the time between the onset of the stimulus and the onset of the response. There is no movement in reaction time; it is the processing of the stimulus before movement takes place. For example, at the start of the race, the reaction time is the period from hearing the gun until just prior to leaving the blocks.
Movement time is the time from the beginning to the completion of the task, so that in my example would be from the first movement until the race is finished.
Response time is from the onset of the stimulus to the completion of the task, which in my example is the time from the athlete hearing the gun to finishing the race. Therefore **Response time is the sum of Reaction time and Movement Time.**

In sport, the more choices the performer has to make, the slower the response time will be. A **simple reaction time** is when a performer needs to react to just one stimulus, which means they know what stimulus is coming and they must react to it, therefore a faster reaction time can be achieved. An example of this is going back to my first example of an athletics race, where the performers listen for the sound of the gun to signify the start of the race. With a focused approach, the reaction time should be quick.

A **choice reaction time** is when a performer has to choose from a number of options, such as a basketball player in possession on the oppositions 3-point line has 4 options: they can wait for a break; have a shot at the basket; attempt a lay-up; or a bullet pass to any one of the players inside the key. The player can use this to their advantage by using many or all of these options throughout the game meaning that it is more difficult for the opposition to anticipate or second guess what the player will do. Because there are many options to choose from, the reaction time is slower than that of a simple reaction time.

The relationship between reaction and the number of choices is explained by Hick's Law, which states that an increase from a simple reaction time of one choice to a choice reaction time of three or four choices would cause a relatively large increase in reaction time. However, an increase in the number of choices from four to five, six or seven would only increase reaction time by a relatively small amount. Hick's law is illustrated in Figure 2.

Figure 2



Reaction time is influenced by the following factors (which in turn affects response time, since it includes both reaction time and movement time):

- **Age** affects response time, as older performers tend to react more slowly. Generally a veteran in a sprint race would not be as quick out of the blocks as a young athlete.
- **Experienced** players tend to react more quickly because they can anticipate more readily. In a squash game, the experienced player dominates the centre of the court, knowing where the ball will land, while the less experienced player is forced to run around the court.
- Some studies have shown that men react faster than women, so **gender** appears to affect reaction time.
- The effect of performance-enhancing **drugs** will affect reaction time, so if an athlete was taking steroids, they may be able to start a swimming race a lot faster than others.
- The level of **fitness** affects reaction time, so that an athlete who has undergone strength and power training may produce a faster more explosive start.
- We tend to react more quickly to an **intense stimulus** (very well demonstrated by myself), such as a loud shout from a team-mate in football.

Coaches use their knowledge of response time to develop fast reactions in their players. The strategies used to improve reaction time include:

- Mental rehearsing (running through a performance in the mind, without requiring physical movement)
- Getting the performer to focus (e.g. an athlete concentrating on a point down the track before the start of a race or increasing selective attention)
- Enhancing the fitness levels of the performer

Fast reactions are also promoted by the ability to anticipate. There are three types of anticipation:

- Effector anticipation- getting a feel for the skill, rather like a cricketer would get a feel for the wicket before anticipating the pitch of the ball.
- Receptor anticipation- experienced players are good at anticipation because the can read a game by looking at the stance and body language of their opponent, I.e. using the cues, or stimuli, from the environment (using receptor mechanisms).
- Perceptual anticipation- developed from external sources, such as by studying an opponent on video or receiving extrinsic feedback from a coach on an opponents style of play.

Anticipation in sport is seen as a gamble: if you anticipate correctly, your reaction times will be quick; however, incorrect anticipation can cause reaction time to slow.