

Movement Analysis

Detailed analysis of movement is a complex activity requiring sophisticated equipment. However, the fundamental analysis of motion can be done visually and should involve the following:

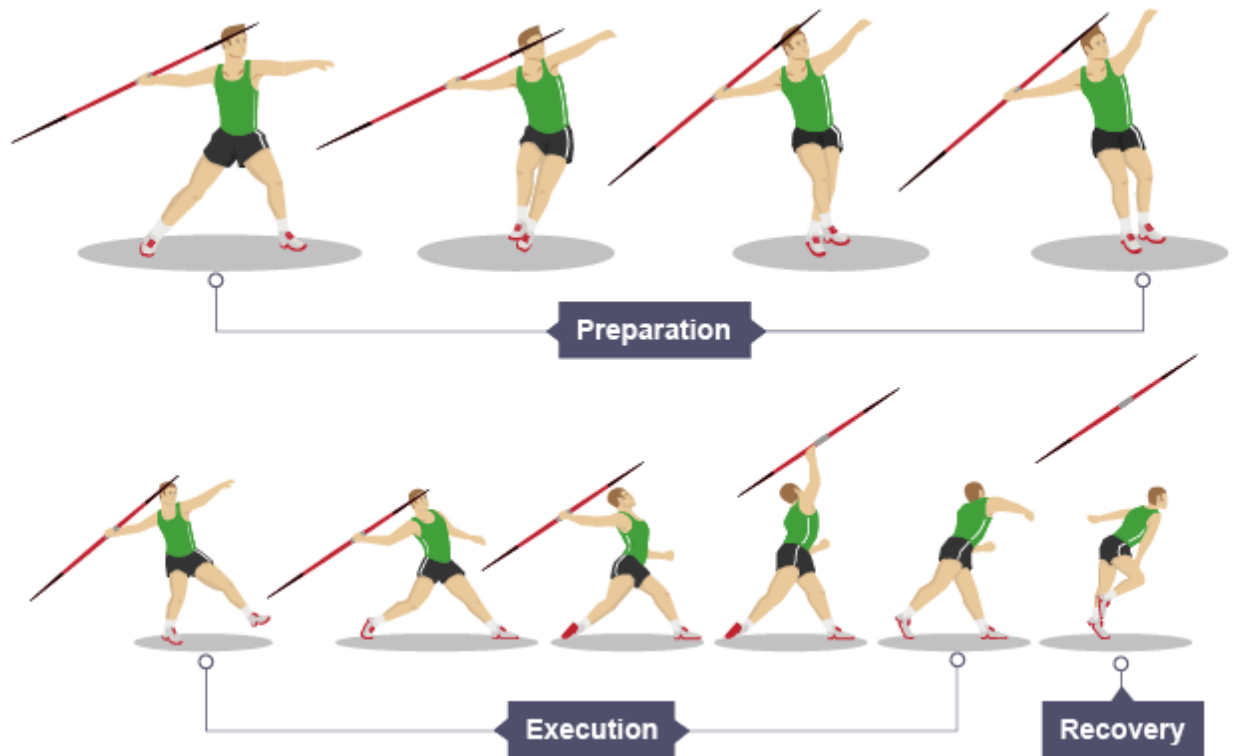
- A description of the actual actions which occur at the joints involved
- The plane(s) in which the movement occurs
- The muscles producing the movement
- The function of the muscles involved (agonists, antagonists, synergists & fixators)
- The type of contraction (isotonic - concentric or eccentric, isometric) The range of the muscle action (inner, middle, outer)

Analysis of movement

Biomechanics is the analysis of human movements in sport. It explains how and why the body moves. There are a number of methods used to analyse movement. One used often by coaches and sports scientists is the analysis of **movement** phases. There are three movement phases:

- **preparation** – the movements an athlete makes while preparing to perform the skill
- **execution** – the movements made while performing the main part of the skill
- **recovery** – the movements that allow an athlete to regain balance and/or position after performing the skill (sometimes in order to go into action with another performance)

As sports movements are complex, each phase is often divided into sub-phases. For example:



It is helpful to consider the musculo-skeletal system when carrying out movement analysis. The following aspects should be included:

- joint (including type and bones)
- type of movement
- muscles involved
- muscle function

Types of Movement analysis

There are **Three** types of Movement analysis those are as follows

- ❖ Kinesiological Analysis
- ❖ Biomechanical Analysis
- ❖ Cinematographic Analysis

Kinesiological Analysis:

It is the one type of movement analysis in this type of movement analysis during the analyzing the movement take considerations of kinesiological factors involving the particular movement or motion. For Example analysis like what are the fundamental movement take place in a particular movement and what are the muscles and joints are involving in that movement.

Biomechanical Analysis

In this type of movement analysis analyzer has taking the considerations of biomechanical principles involving that particular movement. For example, if a movement takes place that time we have to analyze like in which plane that movement occurring, around the which axis that movement takes place, which lever principle is adapted like that.

Cinematographic Analysis

It is also one of the modern movement analysis types in this type of analysis movement analyzer going to analyze the movement pattern with the help if video. Like if one executes the movement that time recording his/her video and analyzing his/her movement pattern with the help of computer device or some sophisticated equipment.

Methods of Movement Analysis

Analyses of Movement may be classified under three general areas: subjective, objective and predictive techniques. Most coaches and paramedics use varieties of subjective evaluation techniques during their normal interaction with athletes or patients. They watch a subject, for example, to determine whether there are any gross abnormalities in the range of movements at the joint during walking, lifting, takeoff or release of an implement, such as in a javelin throw or the ball in jump shot. Sometimes, a coach may measure the forces a high jumper exert on the ground during a takeoff, by using a force platform to determine a change in the approach velocity. Predictive

techniques attempt to answer the ‘what if...’ questions. For example, what effect would reducing the angle of ball release of a basketball player who consistently misses free throws have?

There are three Movement Analysis Methods, those are as follows

- Qualitative Method of Analysis
- Quantitative Method of Analysis
- Predictive Method of Analysis

Qualitative Method of Analysis:

Qualitative analysis methods are also referred to as subjective methods, involving a non-numerical evaluation of a skill and are most frequently performed during direct observation of movement. It is a seemingly natural characteristic of good coaches and clinicians. This is the description of quality without the use of number. This skill can be learned and improved through practice. However, Adrian and Cooper (2005) explained that, for one to be consistent and reliable both in observing a performer’s learning motor skills and in evaluating movement for practical, diagnostic, clinical or research purposes (viewed either in life or film), a researcher must adopt a definite observational plan. The plan might include the following steps:

- a. view multiple times
- b. view from multiple perspectives (planes)
- c. focus on parts, then whole, then parts
- d. form a visual mental image of the performance
- e. use a checklist: either construct your own or use available ones.

Therefore, qualitatively describing the kinematics of a movement will entail identifying the joint actions, including flexion, extension, adduction/abduction, rotation and so forth. A detailed qualitative analysis might describe the precise

sequencing and timing of body segment movement. This translates to the degree of skill evident on the part of the performer.

Most qualitative analyses are carried out through visual observation, performance deficiencies may result from errors in technique, perception, or decision-making. Therefore, added that it will require more than visual observation to solve the performer's problem, making a combination of both qualitative and quantitative analyses imperative.

Quantitative Method of Analysis:

This method is otherwise known as objective technique in biomechanical analysis. This is the collection, measurement, and evaluation of data from the activity of interest. Quantitative analysis implies that numbers are involved. According to Hall (2009), sports biomechanists often quantitatively study kinematics features that characterize elite performance of a particular athlete. Sometimes, this type of analysis results in constructing a model that details the kinematic characteristics of sound performance for practical use by coaches and athletes

Steps in quantitative analysis include the following:

1. Pre-observation stage; and this should include:

- a. Determination of performance goal and mechanical variables
- b. Identification and selection of critical variables
- c. Determination of acceptable range for these variables

2. Development of an observation plan; to include:

- a. Observation desired
- b. Response observed
- c. Response diagnosis
- d. Discrepancy (allow for individual variation)
- e. Identify errors

- f. Rank errors
- g. Remediation
- h. Communicate error correction strategies.

Predictive Method of Analysis:

Computer simulation and optimization techniques have been applied widely in studies of sports and human movement to predict sports movement. Adrian and Cooper (2005) explained that researchers have combined the mathematical modeling of the anatomical characteristics of a living body with simulation techniques for the purpose of predicting performance achievements and developing new performance techniques. The general aim of work in this area is that, by using a computer model of a person or piece of equipment (the 'system') to predict changes which would occur in a movement as a consequence of alterations to the input parameters.

Computer simulation is the use of a validated computer model (a set of mathematical equations describing the system of interest) to evaluate the response of the model to changes in the system parameters. Computer simulation has been used to evaluate the biomechanics of a wide variety of equipment and body movements, from an equally wide variety of approaches. It is beyond the scope of this write up to list and comment on the approaches used and the systems modelled, but they vary from the consideration of the human body as a point mass representing the centre of gravity, to a simulation of 3D muscle mechanics and skeletal dynamics of the lower limb during walking and other movements. Most of the programmes are written specially for the system under consideration, although the use of generalized simulation packages, such as symbolic manipulation programs, is increasing.