



EXP.NO.3

Biomechanical Analysis Using Kinovea

Aim of EXP.

- To analysis the motion and display the biomechanical output for gait cycle.
- Measure biomechanical parameters during walking .

Introduction

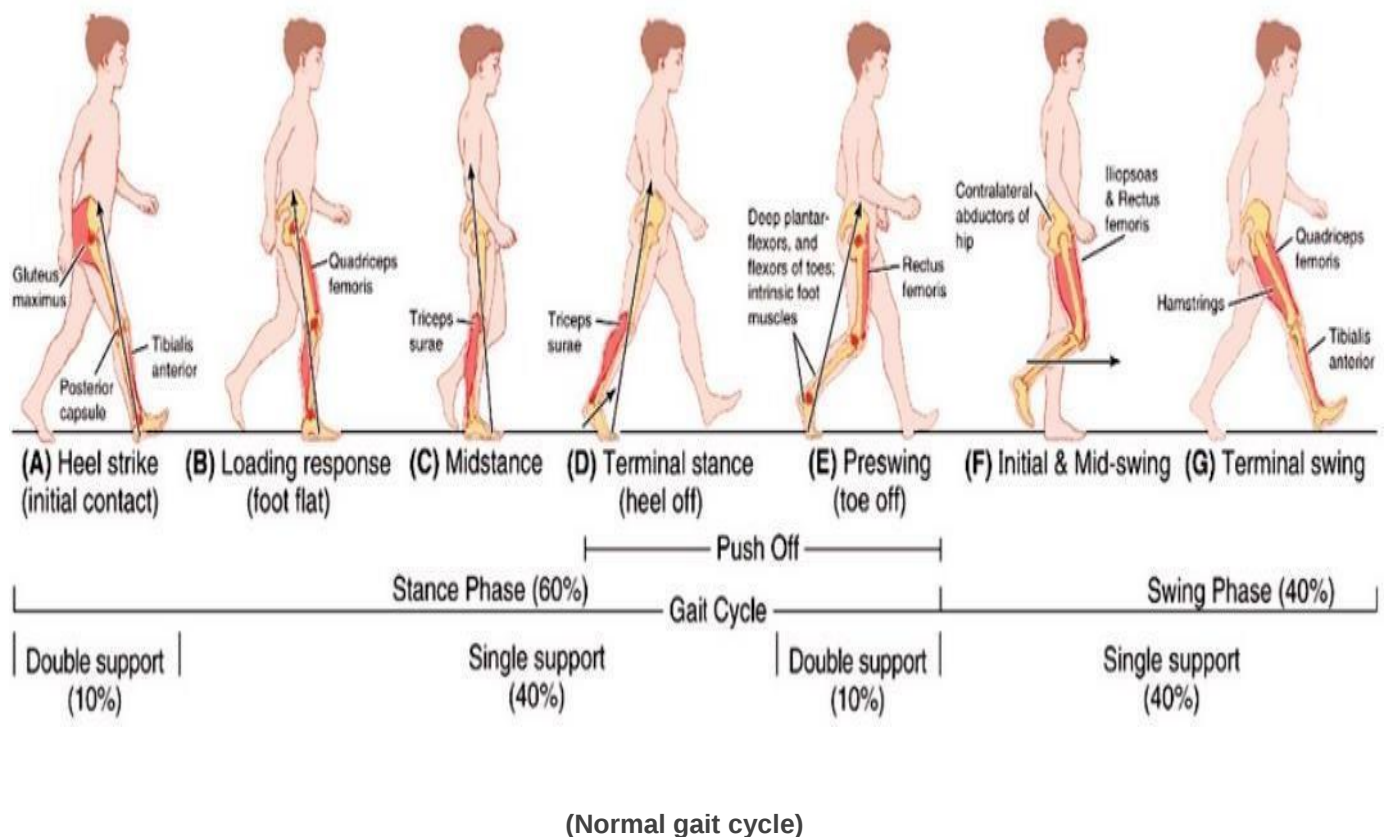
A gait cycle is a period beginning with the initial contact between the heel and the ground of one leg up to the subsequent contact between the heel and the ground of the same leg .

A basic unit of the human gait is a step which is divided into 2 basic phases:

- The support phases (stance phases).
- The swing phase.

The support phase, a foot touches the ground and it takes approximately 60% of the overall cycle duration. The support phase can be double (in the beginning and in the end of the cycle), when the support is provided by both limbs, and a single, when only one limb touches the ground. In the double support, both limbs touch the ground.

The swing phase begins in the end of the support phase, immediately after the push-off, and takes 40% of the gait cycle. In the swing, knee flexors are initially activated, they adduct the lower leg onto the ground.



The stance phase may be subdivided into three separate phases:

- **First double support**, when both feet are in contact with the ground.
- **Single limb stance**, when the left foot is swinging through and only the right foot is in ground contact.
- **Second double support**, when both feet are again in ground contact.

The stance phase events are as follows:

- **Heel strike (Initial contact) (0%)** initiates the gait cycle and represents the point at which the body's center of gravity is at its lowest position.
- **Foot-flat (Loading response) (0-10%)** is the time when the plantar surface of the foot touches the ground.
- **Midstance (10-30%)** occurs when the swinging (contralateral) foot passes the stance foot and the body's center of gravity is at its highest position.
- **Heel-off (Terminal stance) (30-50%)** occurs as the heel loses contact with the ground and push off is initiated via the triceps surae muscles, which plantar flex the ankle.
- **Toe-off (Preswing) (50-60%)** terminates the stance phase as the foot leaves the ground.

The swing phase events are as follows:

- **Initial Swing (60-70%)** begins as soon as the foot leaves the ground and the subject activates the hip flexor muscles to accelerate the leg forward.
- **Midswing (70-85%)** occurs when the foot passes directly beneath the body, coincidental with midstance for the other foot.
- **Terminal swing (85-100%)** describes the action of the muscles as they slow the leg and stabilize the foot in preparation for the next heel strike.

Kinovea is a video player for motion analysis. It provides a set of tools to capture, slow down, study, compare, annotate and measure technical performances



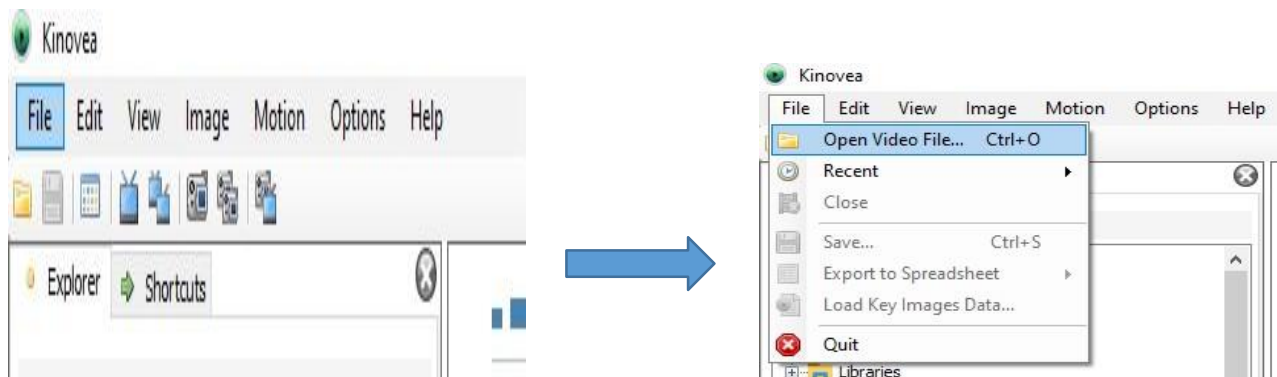
Measure

Measure angles of leg during knee full extention, distances and times manually or use semi-automated tracking to follow the trajectories of points on the video

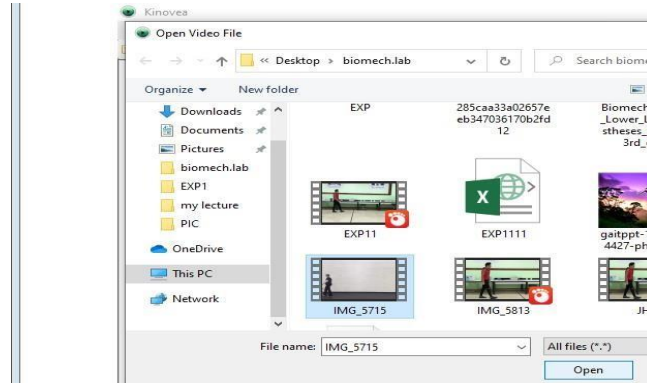
HOW to used Kinovea

The steps involved in tracking an object (or a body joint) in Kinovea are the following:

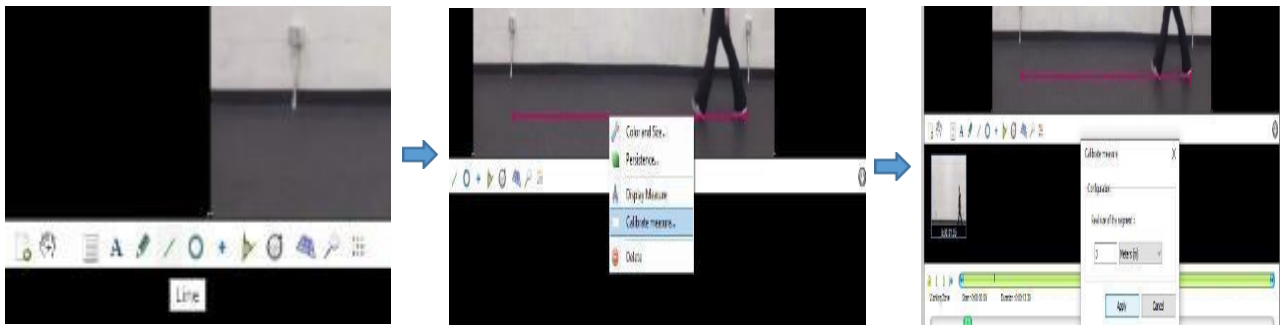
- Open Kinovea.
- Click on **File** then select **Open Video File**.



- Select Video from your PC then click **Open**.



- Select **LINE**, then draw the line that represents the total distance that the person is walked ,Next click on **CALIBRAT MEASURE** to adjust the distance and it's unite Then click **APPLY**.



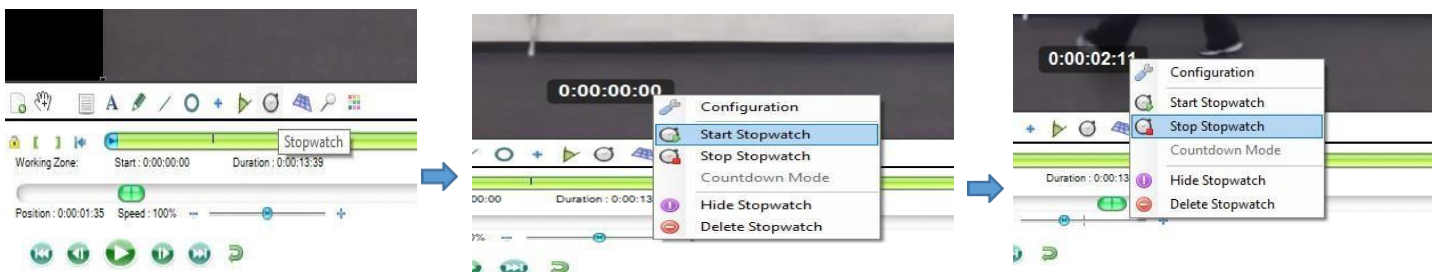
- From **IMAGE** select **Coordinates system origin** ,Next set origin then click **APPLY**.



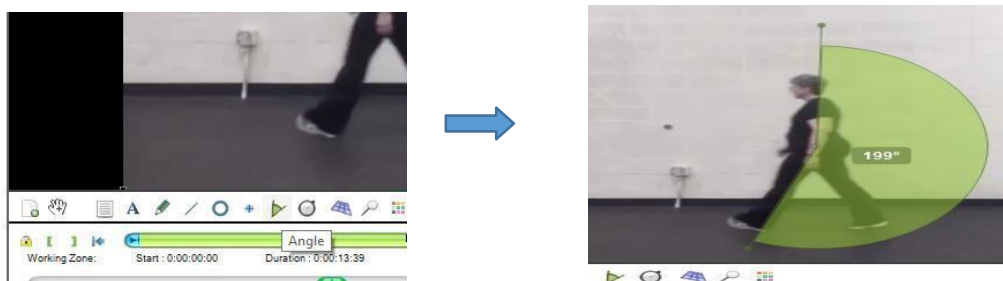
- Make **cross point** on object want to track, NEXT **Right click** the object to track and use the menu **display coordinations**.



- **Right click** the object to track and use the menu **Track Path**.
- Move the video forward using the Play button, the Next Frame button or the Mouse Wheel.
- Adjust point location when necessary during the Path creation.
- To finish tracking, **right-click** and use the menu **End Path Edition**
- To measure time, Select **Stopwatch** and **click** in any space ,then **Right click** and use the menu **Start Stopwatch** ,then Move the video forward using the Play button. When the path ended **Right click** and use menu **Stop Stopwatch**.



- To measure Angle , Select **Angle** and **click** in center of joint that want to measured (we measure the angle of leg when knee at full extension) ,Then adjust the location of angle coords .



DISCUSSION

- Why the stance phase is longer than swing phase?
- Discuss the chart that show in EXP.
- What's the Aim of Kinovea?
- Using Kinovea to Measure Angle of ankle during initial contact.