



**Al-Mustaqbal University**  
**College of Engineering & Technology**  
**Biomedical Engineering Department**



**Subject Name: Biomechanics Design Lab**

**5<sup>th</sup> Class, Second Semester**

**Subject Code: [MU0115206]**

**Academic Year: 2024-2025**

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**Lecture No.: - 3**

**Lecture Title: [Biomechanical Analysis Using Kinovea]**





### **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**

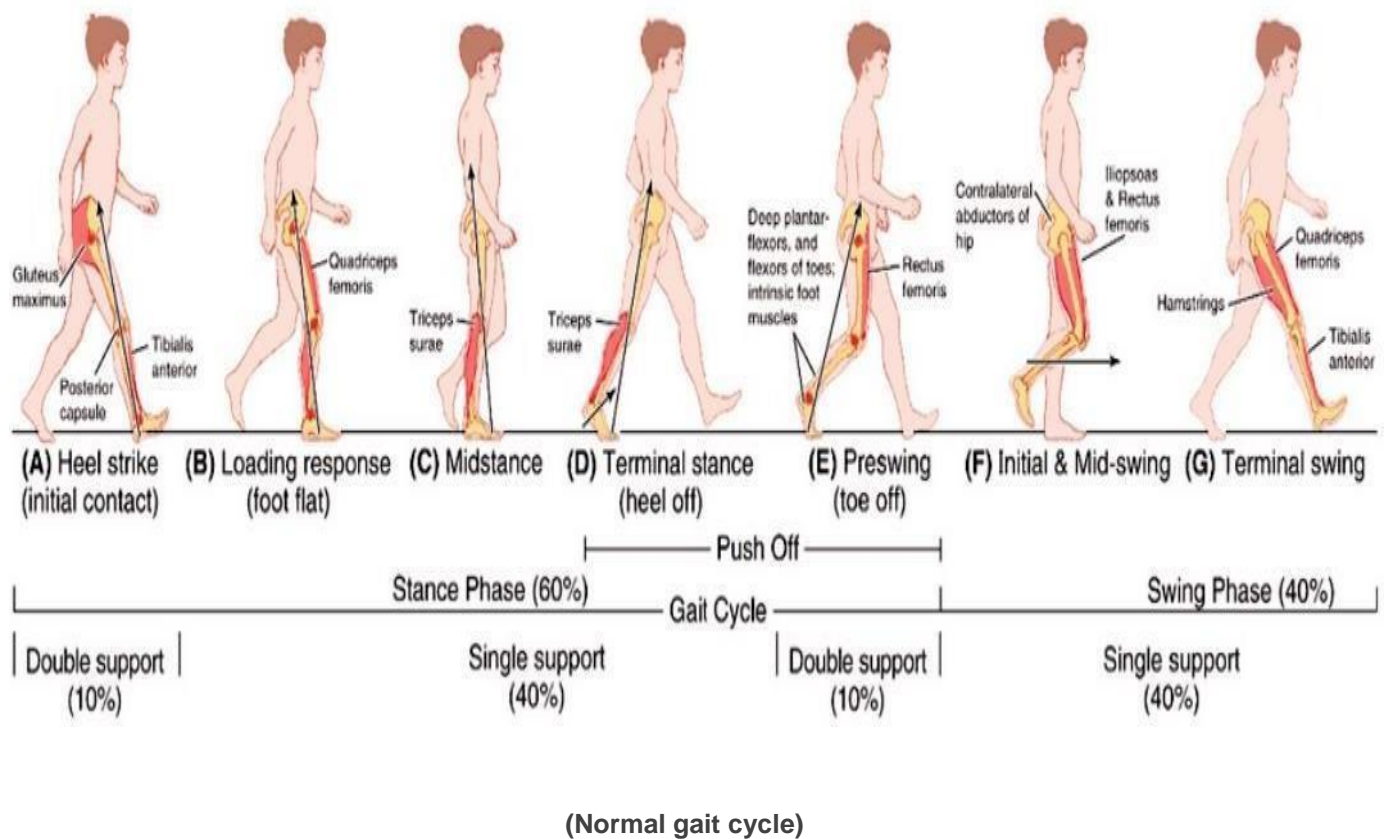
A **gait cycle** is a period beginning with the initial contact between the heel and the ground of one leg up to the subsequent contact between the heel and the ground of the same leg .

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



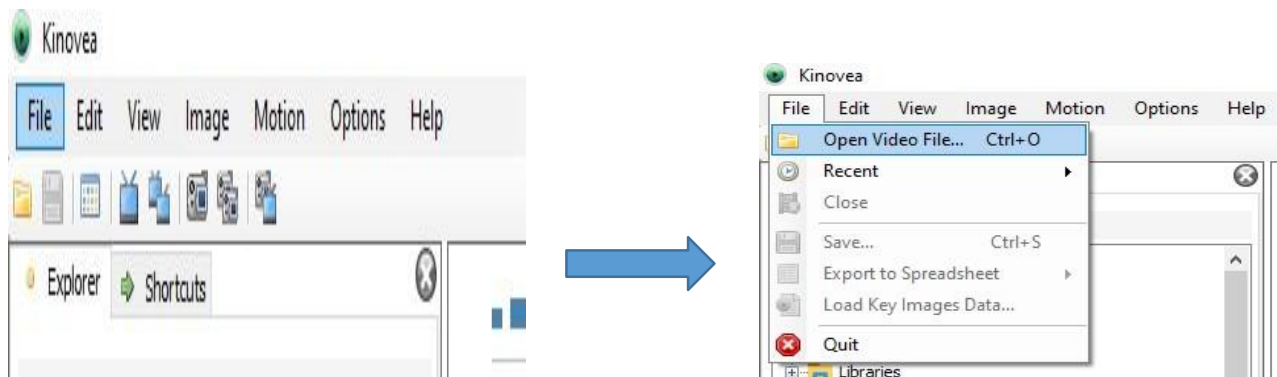
## Measure

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

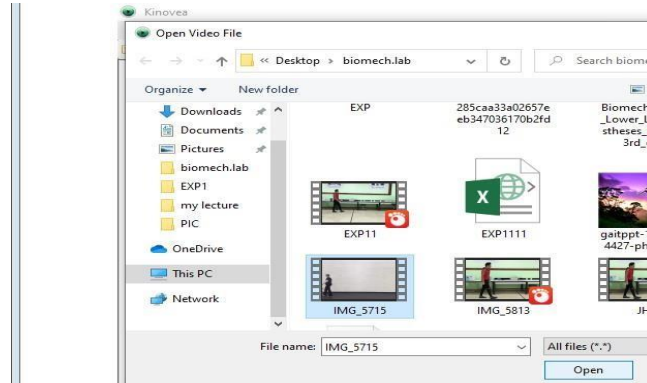
## HOW to used Kinovea

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

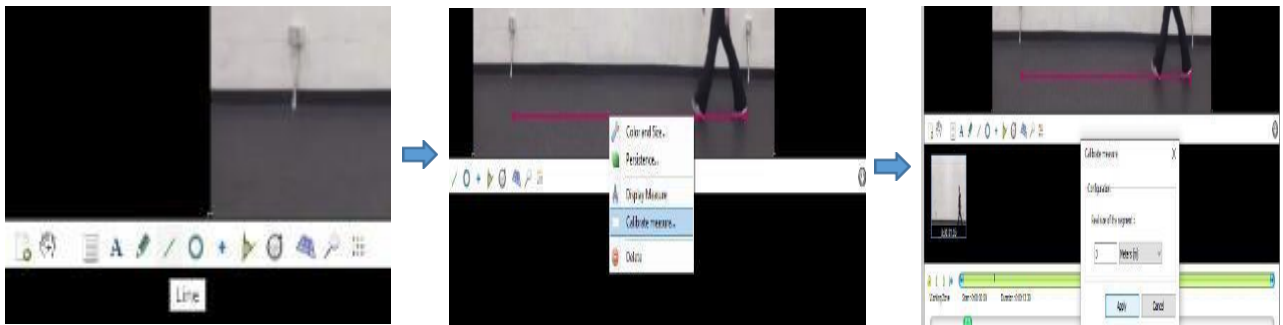
- Open Kinovea.
- Click on **File** then select **Open Video File**.



- 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**.



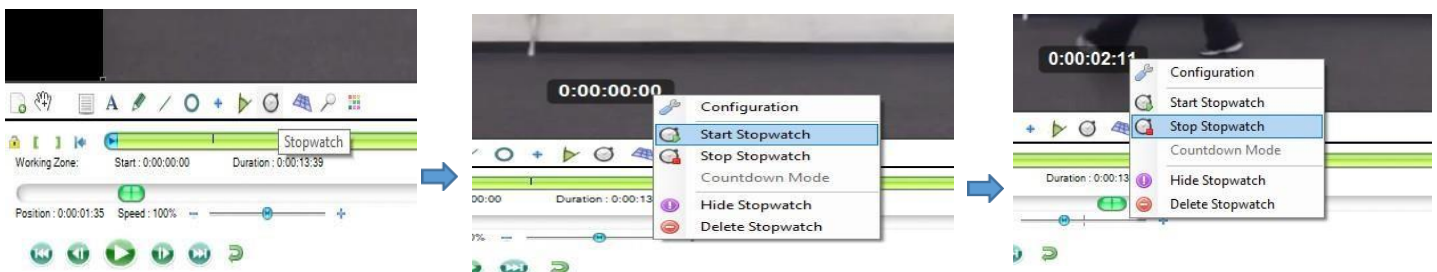
- From **IMAGE** select **Coordinates system origin** ,Next set origin then click **APPLY**.



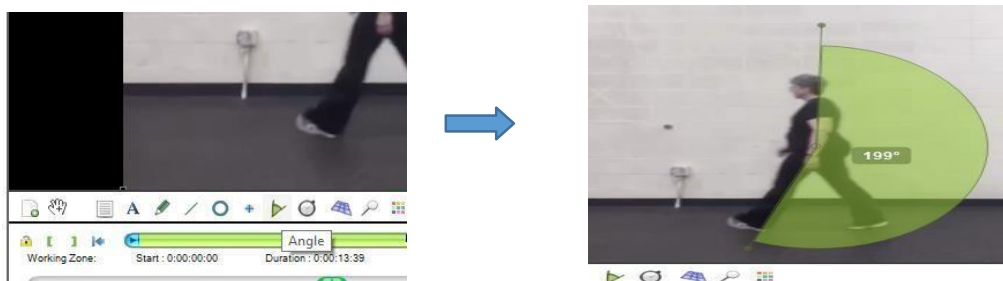
- Make **cross point** on object want to track, NEXT **Right click** the object to track and use the menu **display coordinations**.



- **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.