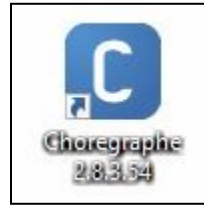


Robot Arms



Goals for this session:

- Understand the purpose of Timeline in Choregraphe
- Create and save a basic Timeline of arm movements

This lesson assumes you know the basics of Choregraphe (box libraries, root directory, etc.)

Why use Timeline?

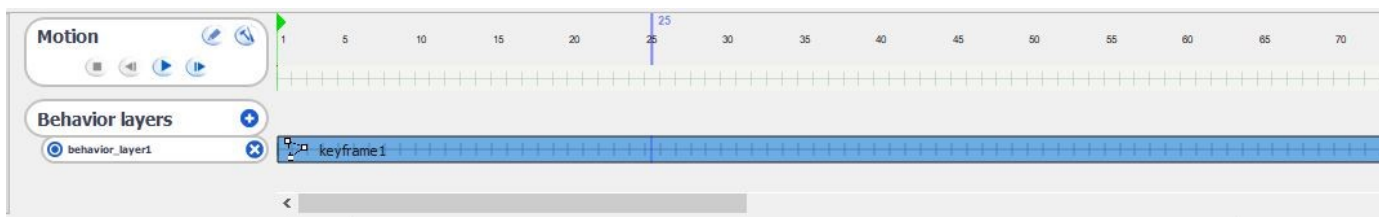
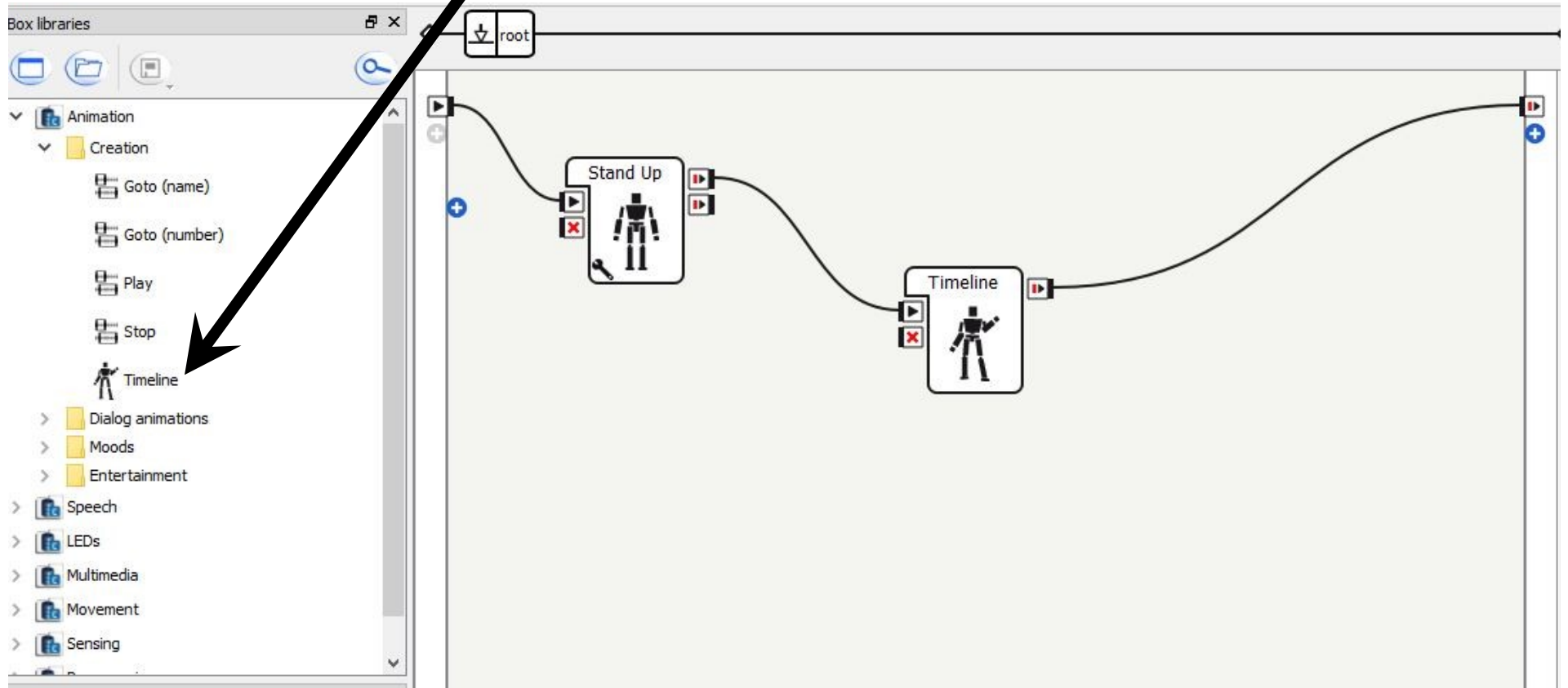
- Timeline is the main way to program movements on the NAO robot. Timeline can be considered a sub-program within a larger program. It can also be used as a pre-programmed box that can be added to the box library and then used again and again. Today we are only talking about arm movements—moving the legs and integrating sounds are other lessons.
- The easiest way to use Timeline is when you are directly connected to the robot and can physically move the robot. In this class, you will be moving the virtual robot instead.
- Note that while programming leg movements it is challenging for the robot to maintain its center of gravity and has a high likelihood of falling over. Programming leg movements will be covered in a separate class.

Create a Timeline:

Remember: It's always good practice to start and end your program with a "Stand Up" box.

Navigate to "Animation" > "Creation" and drag the "Timeline" box onto your workspace.

Double click the "Timeline" box to open it.



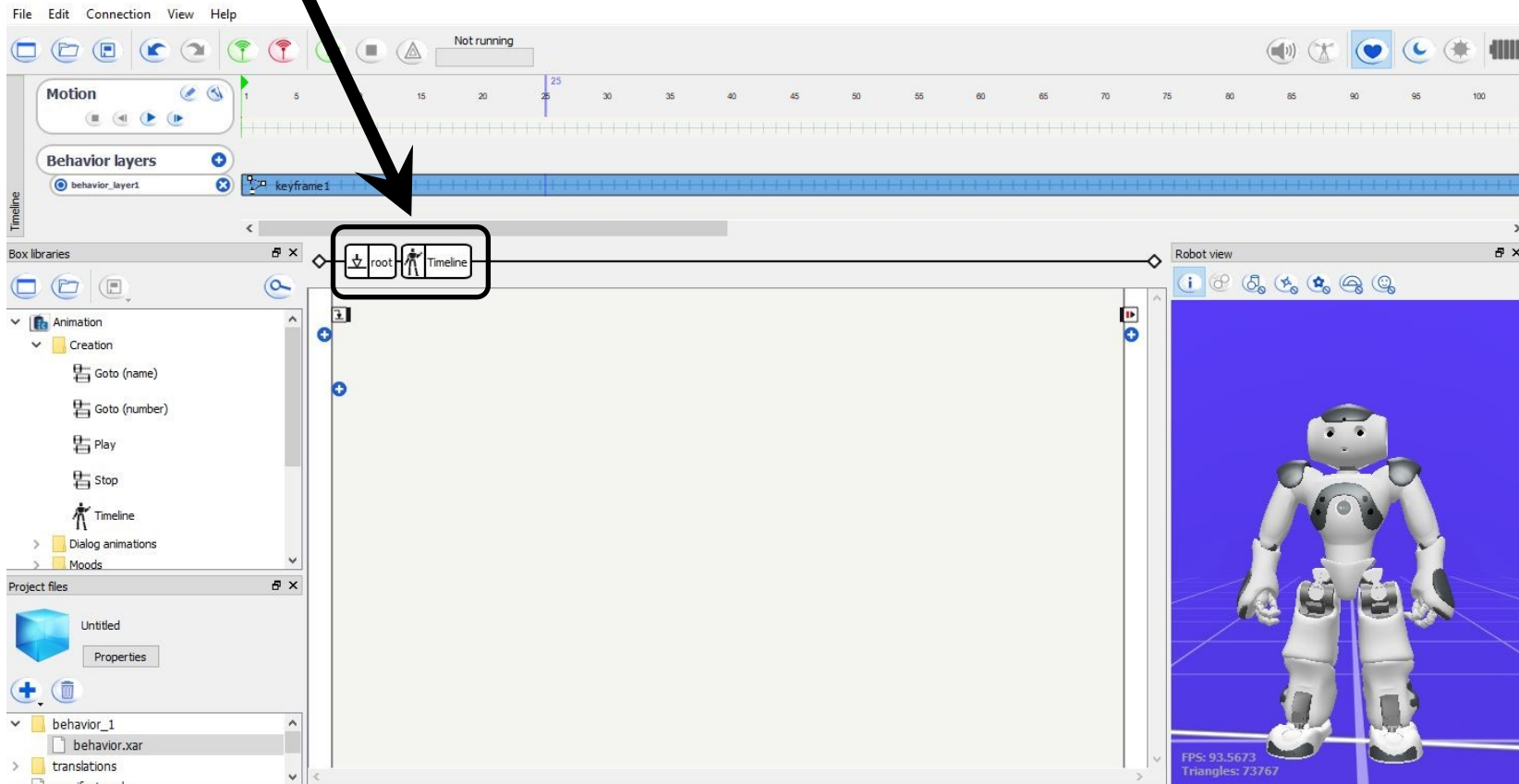
Inside the
Timeline box.

Within the "Timeline" box there are numbers running along the top and a layer labeled "Behavior Layers" below.

Let's start by making the robot wave.

Always start with your robot in a balanced and neutral position.

This line indicates where you are in a program

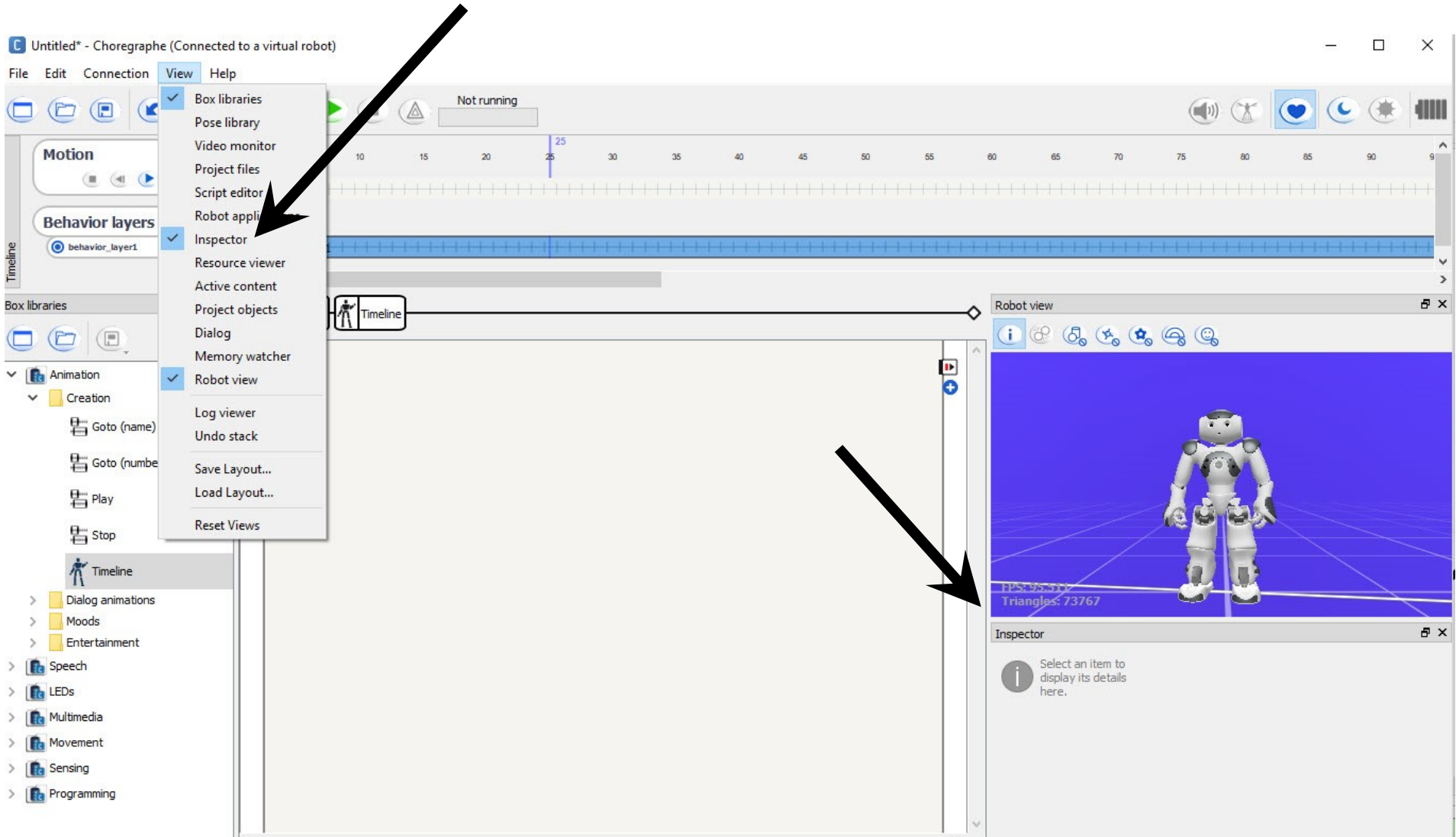


First, we need to open another View on our workspace.

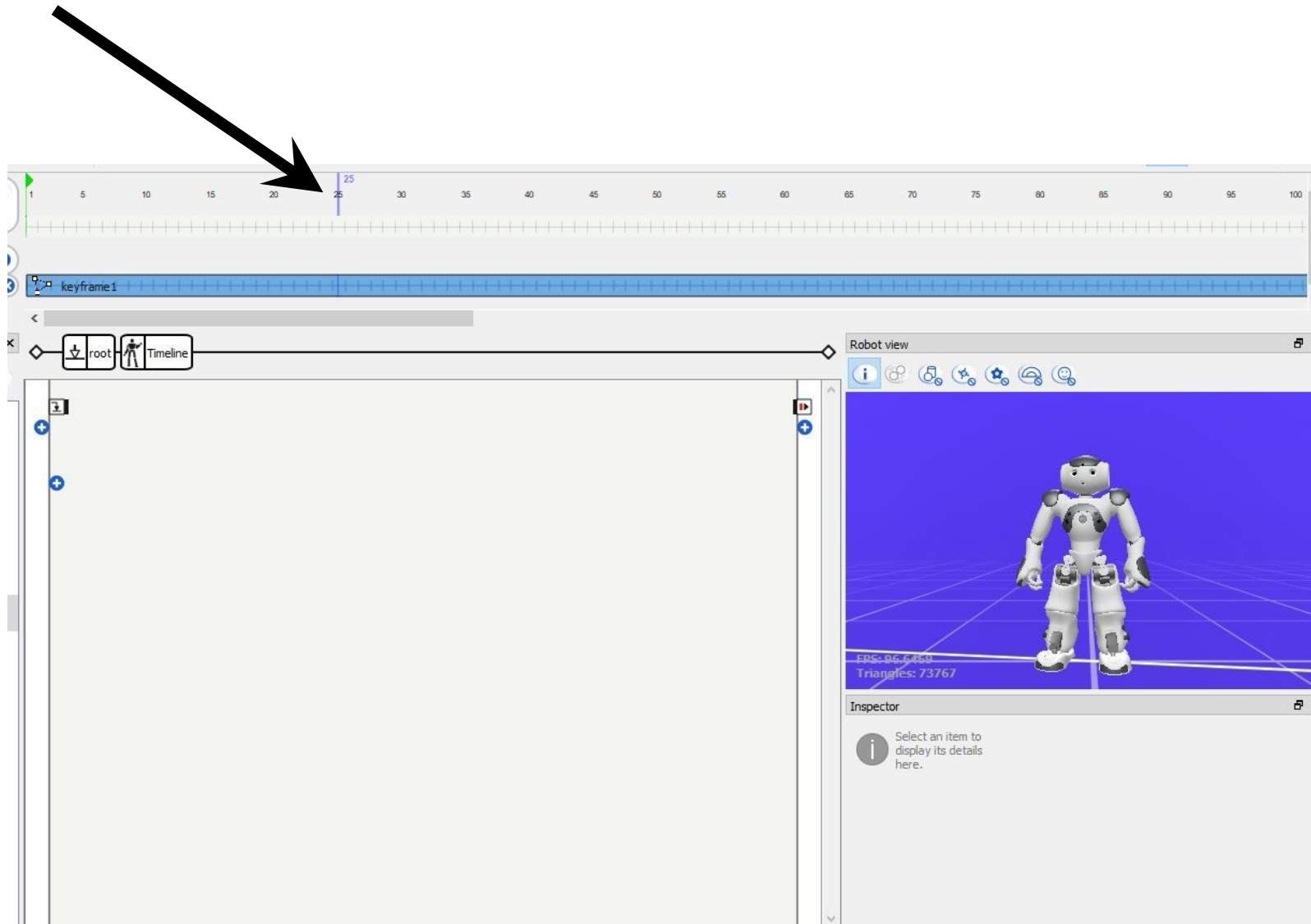
Click on "View" at the top of your screen to get a dropdown menu.

Pick "Inspector".

A new part of the screen will appear to one side of the workspace.

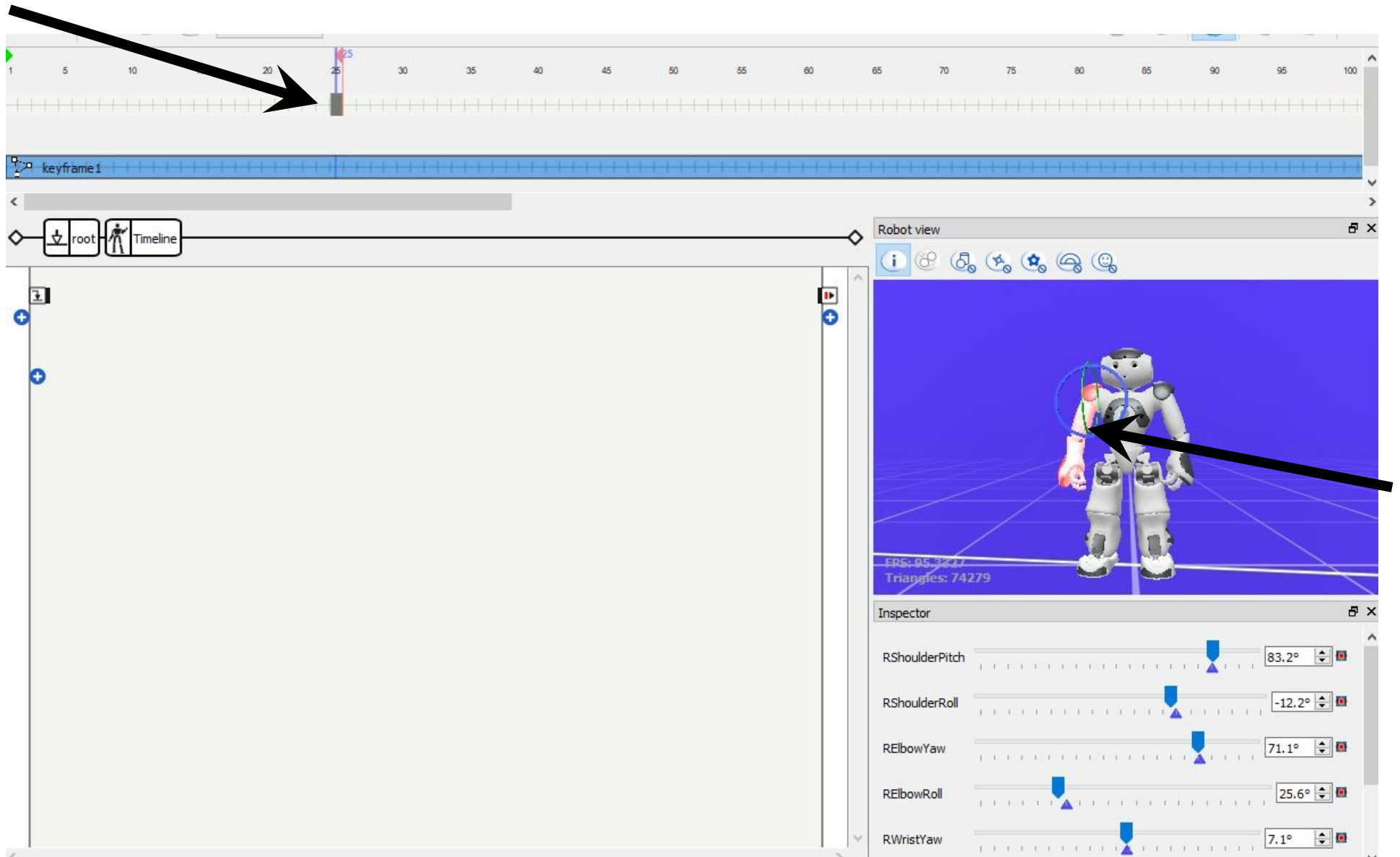


Move the cursor to a point on the timeline. A purple line will appear, indicating where the first posemark will go.



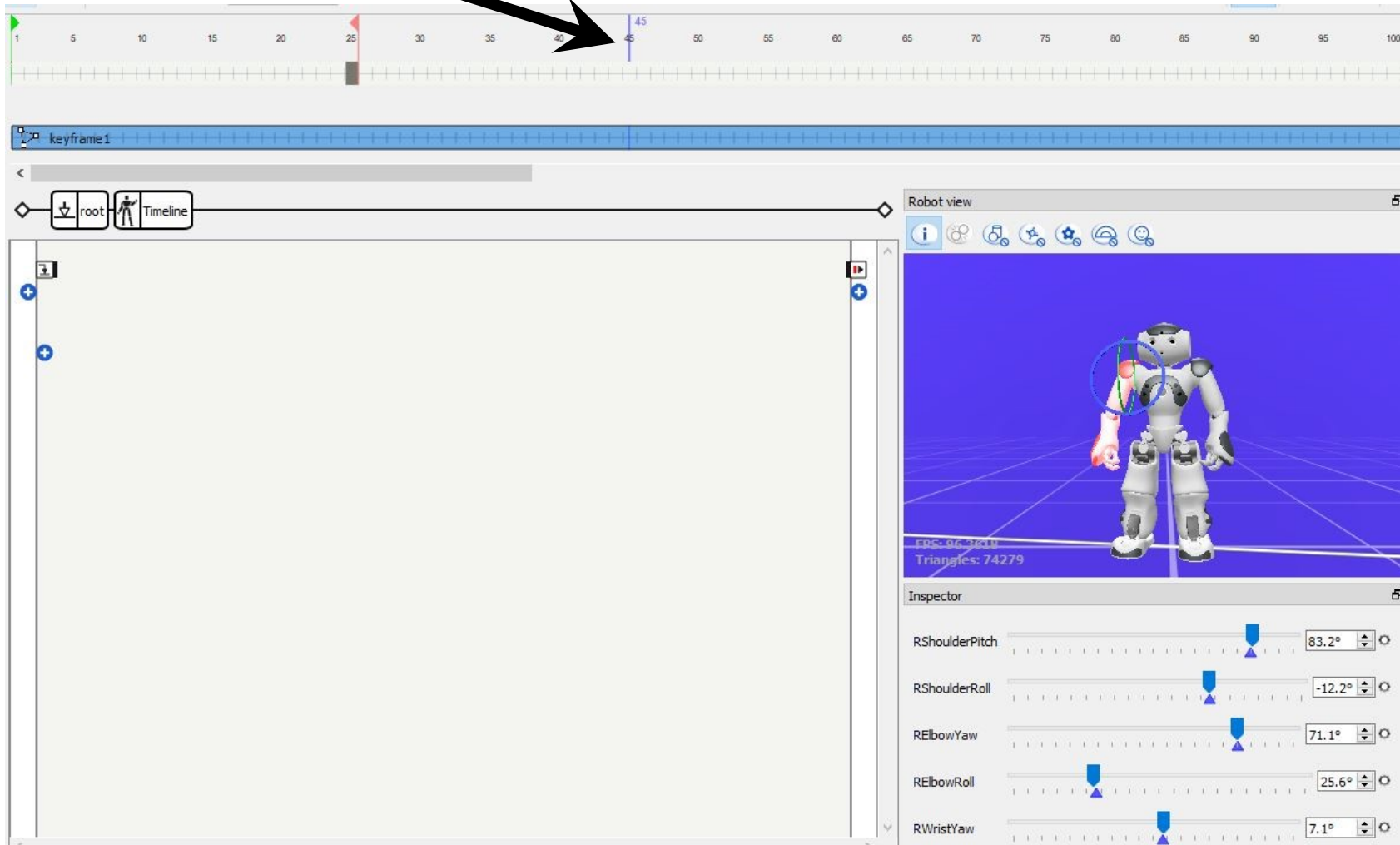
Now click on a limb on your virtual robot.

A number of things will happen simultaneously. The limb you are working on will highlight red; the Inspector View will now show all six degrees of rotation that the arm can perform, and a posemark will appear by the purple line on your Timeline.



To store the next part of your movement, FIRST move the cursor to the point on your timeline where you want the next posemark to be, otherwise the new movement will replace the previous posemark. Always move the cursor first, and pick your next pose second.

Another purple line will appear

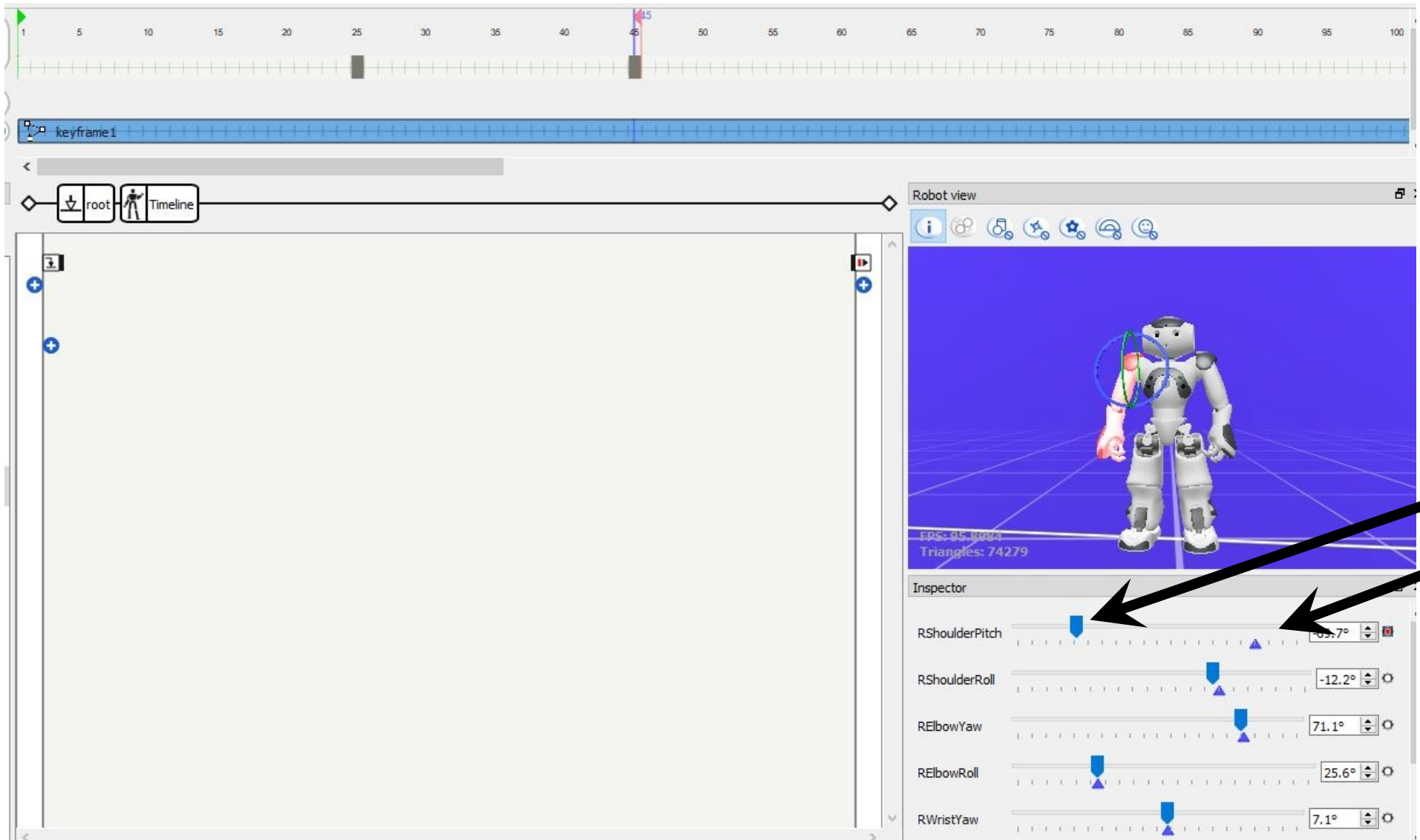


Now drag one of the arm controls until the arm is where you want it.

Another posemark will appear but the arm on the virtual robot will go back to neutral. You can tell you made a change by comparing where the blue flag on the arm control is compared to the purple triangle which always shows what position the robot is in stasis.

To bring the arm back, again move the cursor on the timeline first to make a purple line appear, then move the arm control in the Inspector view.

If the posemark is not where you want it, you can drag it up and down the Motion line to adjust it.



Let's look more closely at the "Inspector" view and see what the different controls do.

In this example, we have clicked on the right arm.

The image shows a software interface for a robot simulator, divided into two main sections: the "Inspector" panel on the left and the "Robot view" on the right.

Inspector Panel: This panel displays a list of joints and their current values. The joints listed are:

- RShoulderPitch: 83.0°
- RShoulderRoll: -12.3°
- RElbowYaw: 69.0°
- RElbowRoll: 24.1°
- RWristYaw: 6.1°
- RHand: 0.30

Below the list, there are controls for "Stiffen chain on/off" and "Mirroring".

Robot View: This panel shows a 3D rendering of a robot in a blue environment. The robot's right arm is highlighted in red, and a red crosshair is visible on the elbow joint.

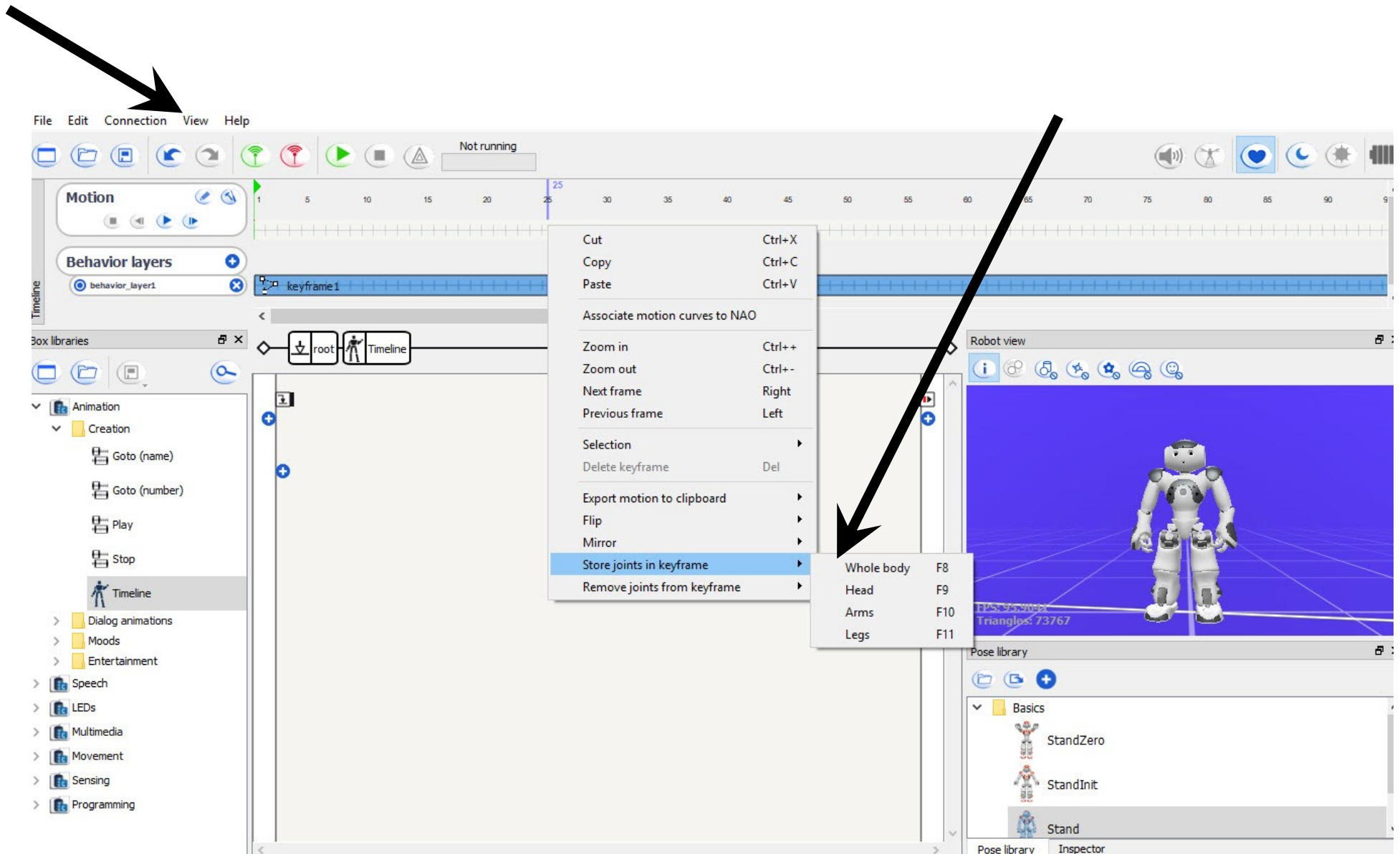
Callout Boxes: Several callout boxes with arrows point to specific joints in the Inspector panel, explaining their functions:

- Right Shoulder Pitch—Forward Up and down:** Points to RShoulderPitch.
- Right Shoulder Roll—Up and Down to the Side:** Points to RShoulderRoll.
- Right Elbow Yaw—twists the elbow:** Points to RElbowYaw.
- Right Elbow Roll—Bends the elbow:** Points to RElbowRoll.
- Right Wrist Yaw—Wrist rotates:** Points to RWristYaw.
- Right Hand—Fingers open and close:** Points to RHand.

To easily bring the robot back to a neutral position, Click on "View" and choose "Pose Library" from the drop down menu.

Click on "Stand" to make the robot stand in a neutral position and save this as your last posemark on your timeline by right clicking on the Timeline to bring up the dropdown menu. Pick "Store joints in keyframe" and "whole body" to save the position.

Click on robot view and then click play to see your virtual robot perform the movement.



Moving the limbs while connected to a live robot:

Programming movements while connected to a live robot uses a different and much easier technique.

Open "Timeline". Turn off Autonomous Life.

Click the "Vitruvian Man" button at the top of the Choregraphe screen.

Now if you tap a limb bumper (back of hand; top of head; front of feet), you get control and if you tap the bumper again it freezes the limb again in the pose you moved it to.

Then you can tap the head to save the pose or save the pose as usual.

