How to realise movement and dance

Pepper has 20 degrees of freedom throughout its body, an anthropomorphic shape and flexible joints, so Pepper can use these joints to achieve a wealth of dance and movement. So how do you get Pepper to move?

1 Uncover the mystery of Animation

These Animations are actually created by qianim and pmt files.

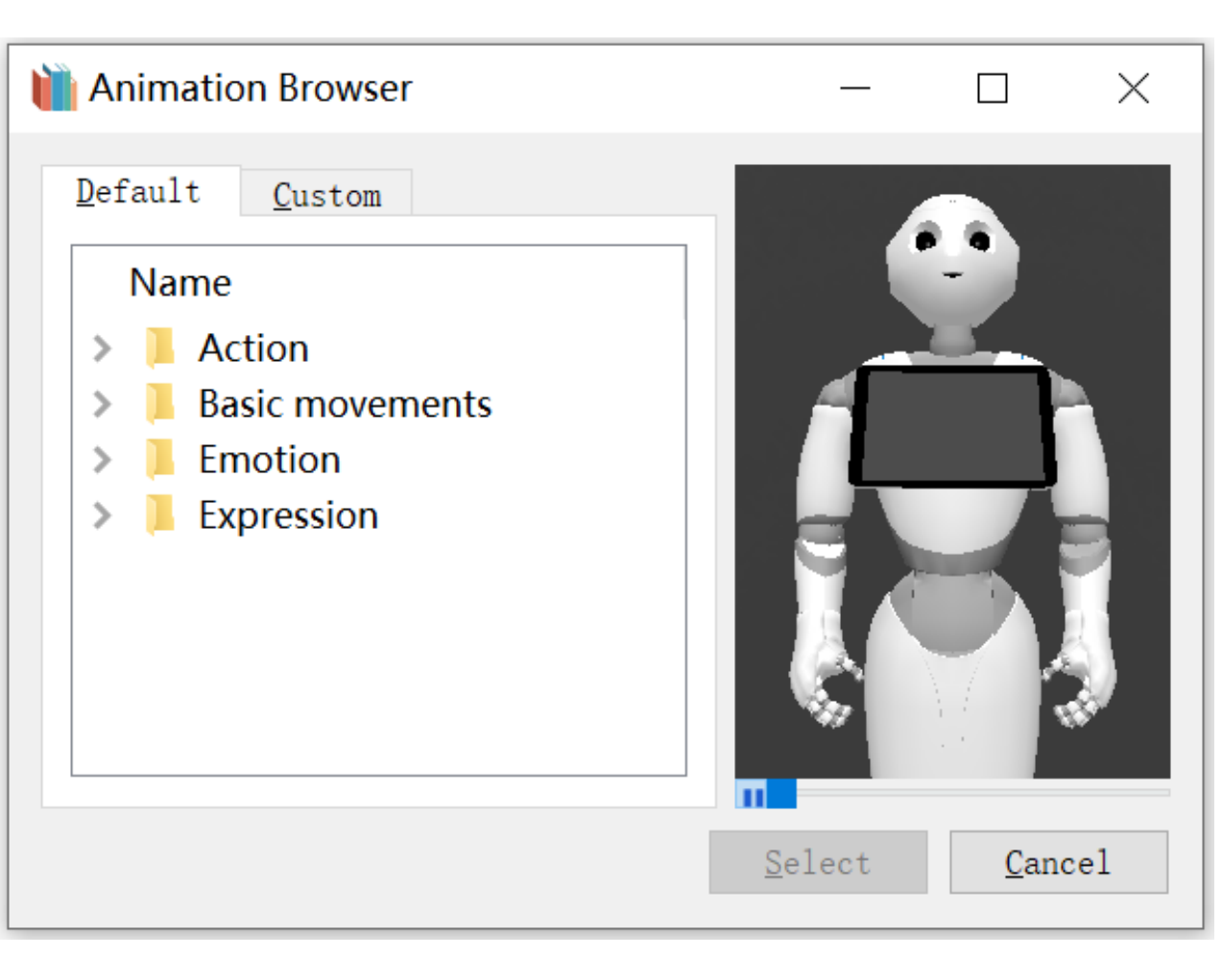
1.1 What is a qianim file?

A qianim file represents Pepper's body movements. With these movements, Pepper's image will be more vivid.

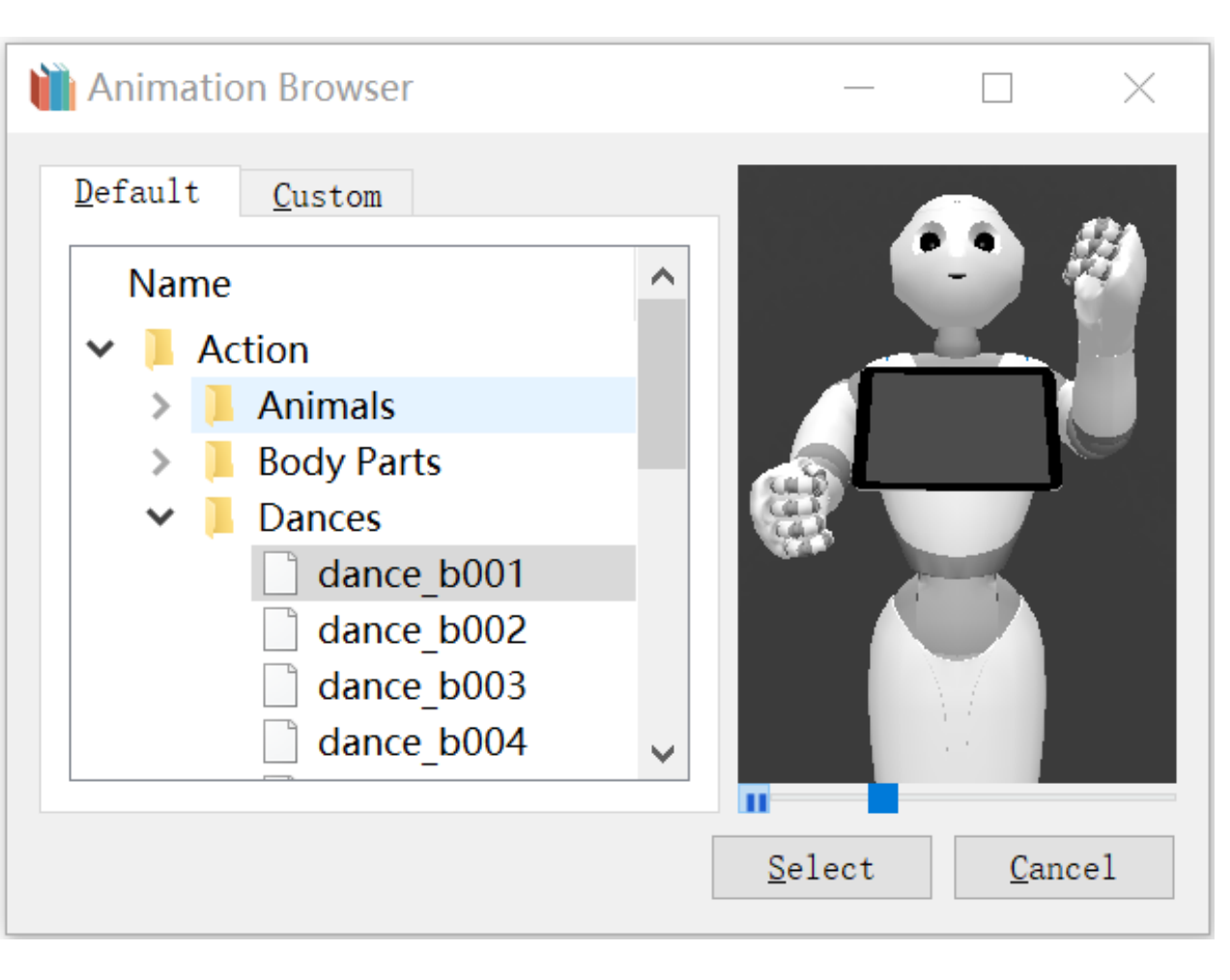
1.2 How to create a qianim file

The Pepper SDK provides some sample animations to create animations for the robot. In Android Studio, choose File > New > Import animation.…

The Animation Browser window will appear


Animation Browser
Default
Custom
Name
Action
Basic movements
Emotion
Expression
Select
Cancel

When you select an Animation, a preview of the Animation is displayed in the robot view on the right.


Animation Browser
Default
Custom
Name
Action
Animals
Body Parts
Dances
dance_b001
dance_b002
dance_b003
dance_b004
Select
Cancel

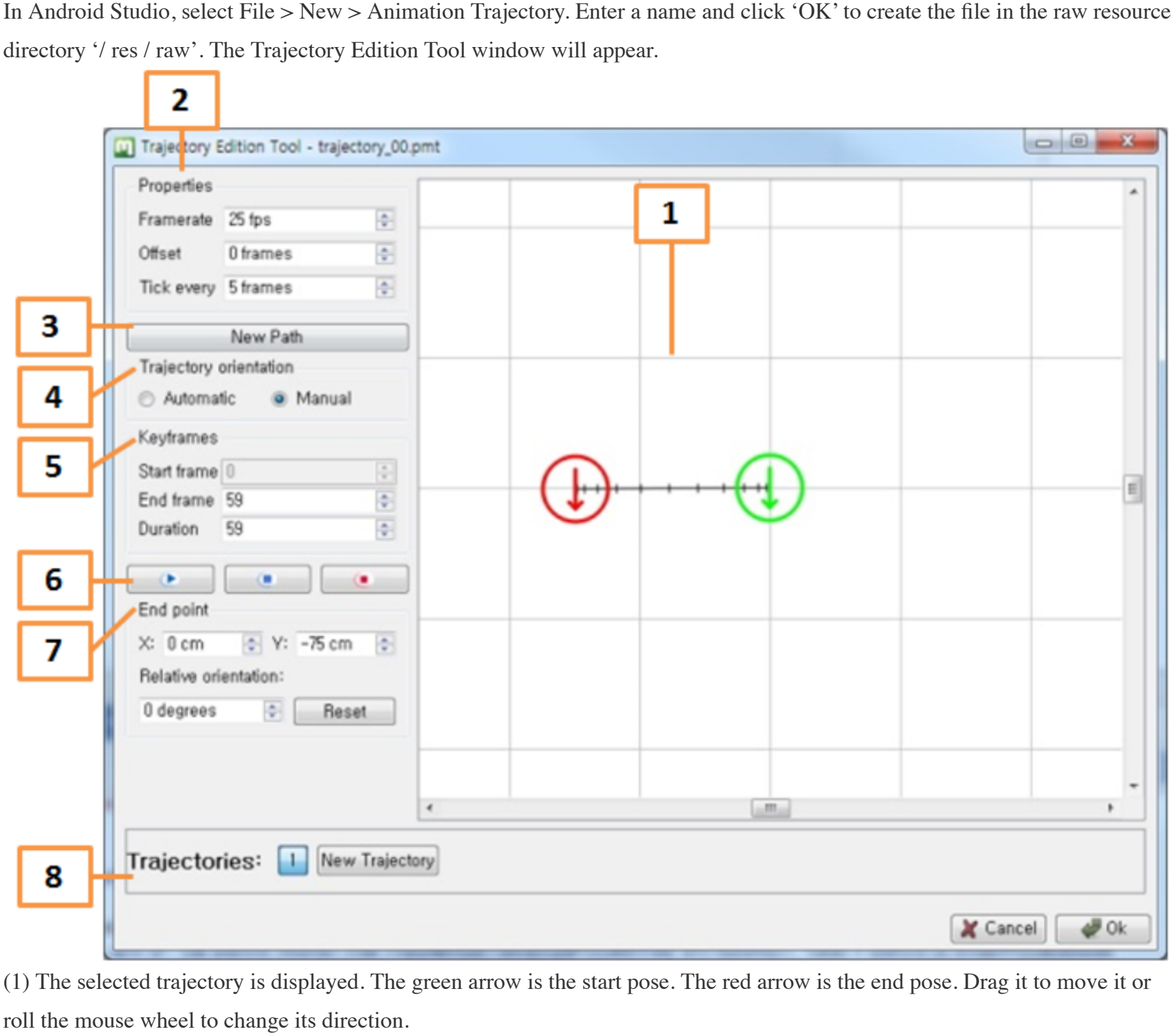
Select the desired Animation and click 'Select', then you can import the Animation into the project: / res / raw.

1.3 What is a pmt file

The pmt file represents the Pepper's trajectory. You need to create this file if you want to set the path along which Pepper will move.

1.4 How to create a pmt file

In Android Studio, select File > New > Animation Trajectory. Enter a name and click 'OK' to create the file in the raw resource directory '/ res / raw'. The Trajectory Edition Tool window will appear.


2
Trajectory Edition Tool - trajectory_00.pmt
Properties
Framerate 25 fps
Offset 0 frames
Tick every 5 frames
3
New Path
4
Trajectory orientation
Automatic
Manual
5
Keyframes
Start frame 0
End frame 59
Duration 59
6
7
End point
X: 0 cm
Y: -75 cm
Relative orientation:
0 degrees
Reset
8
Trajectories:
New Trajectory
Cancel
Ok
1

(1) The selected trajectory is displayed. The green arrow is the start pose. The red arrow is the end pose. Drag it to move it or roll the mouse wheel to change its direction.

(2) Set the properties of the plane movement. framerate: indicates the frame rate, how many frames per second. offset: indicates the delayed trajectory. tick every: modifies the distance between each tick shown in the trajectory.

(3) New Path button. Allows you to add intermediate points to the current trajectory. When clicked, moving the final pose extends the trajectory from that intermediate point. It generates arcs to ensure continuous movement.

(4) Trajectory Direction. Allows you to change the editing mode to automatically calculate or manually set the orientation of the pose based on the direction of its guide path.

(5) Keyframes. Allows you to fine-tune the amount of time it takes to execute a trajectory.

(6) Preview Button. Previews/pause the trajectory.

(7) End Point Properties. Enables you to fine-tune the last pose of the trajectory.

(8) All Tracks. Allows you to add and select trajectories. All trajectories associated with planar motion are shown here, each behind an index button. Click on the New trajectory button to add a trajectory to the current Planar move. Click an index button to select a trajectory and display it in the edit area. Click and hold Shift or Ctrl + A to select multiple trajectories to display them in series in the editing area.

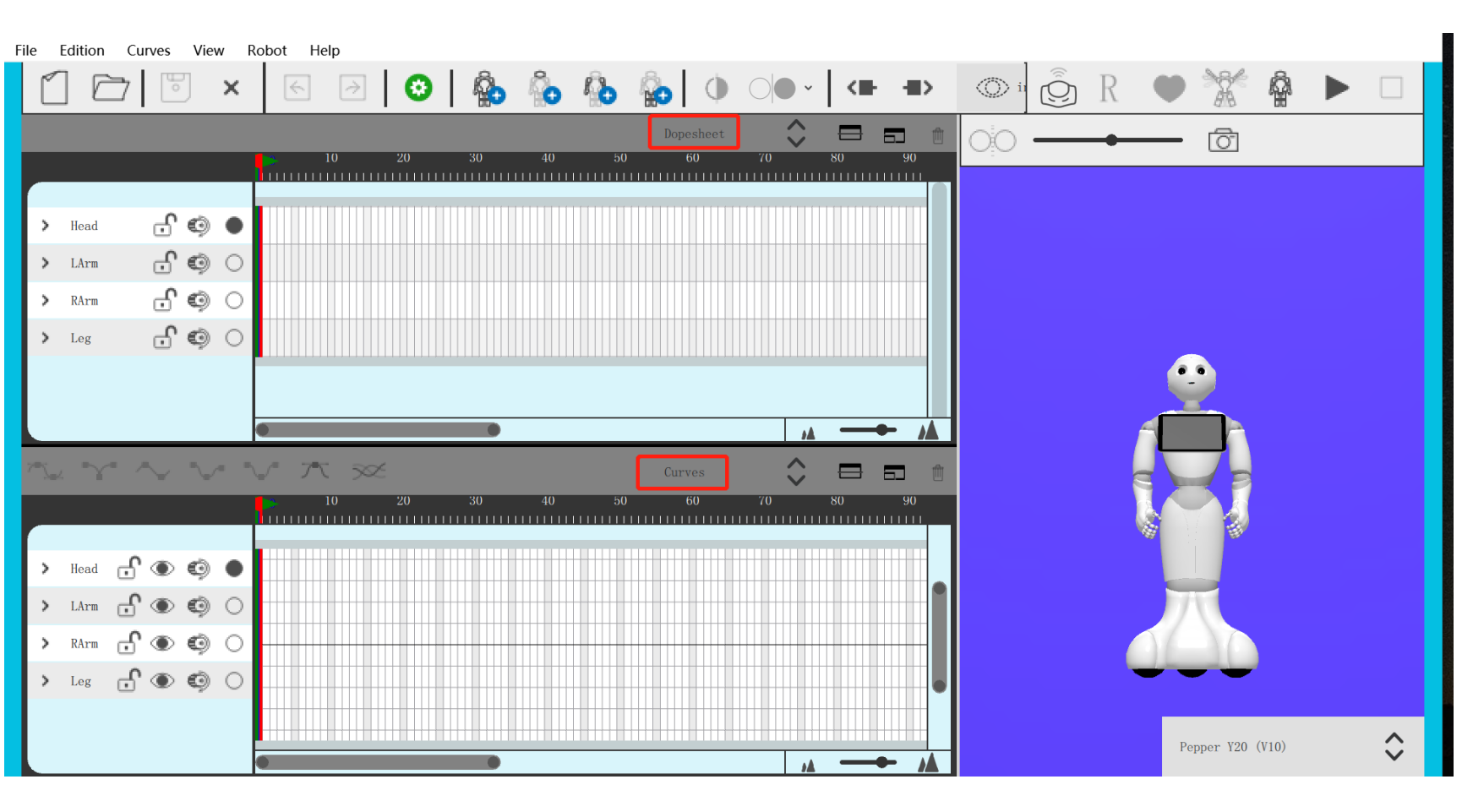
2 Customising Animation

What if the actions in the sample Animation don't meet the needs of the scene? Don't worry, we can still customise the Animation.

2.1 Create a new Animation Timeline

In Android Studio, select File > New > Animation Timeline.

Enter a name and the Animation Editor window with a blank Animation file will appear.



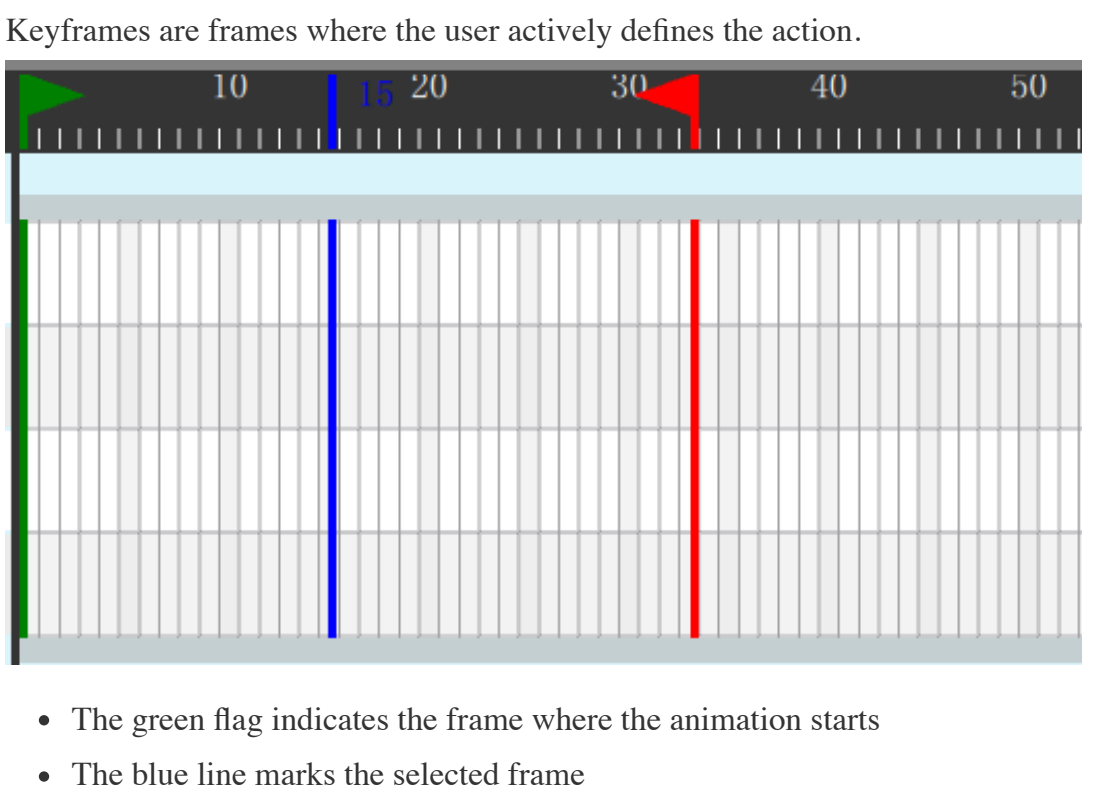
By default, the Dopesheet and Curves views are displayed.

2.2 Getting to know the Animation Timeline

2.2.1 Frame View

The concept of frames is involved here. Frames are the basic components of Animation, equivalent to each frame of a film. For Pepper, a frame holds an action, and consecutive frames form Animation. keyframes are frames where the user actively defines the action.

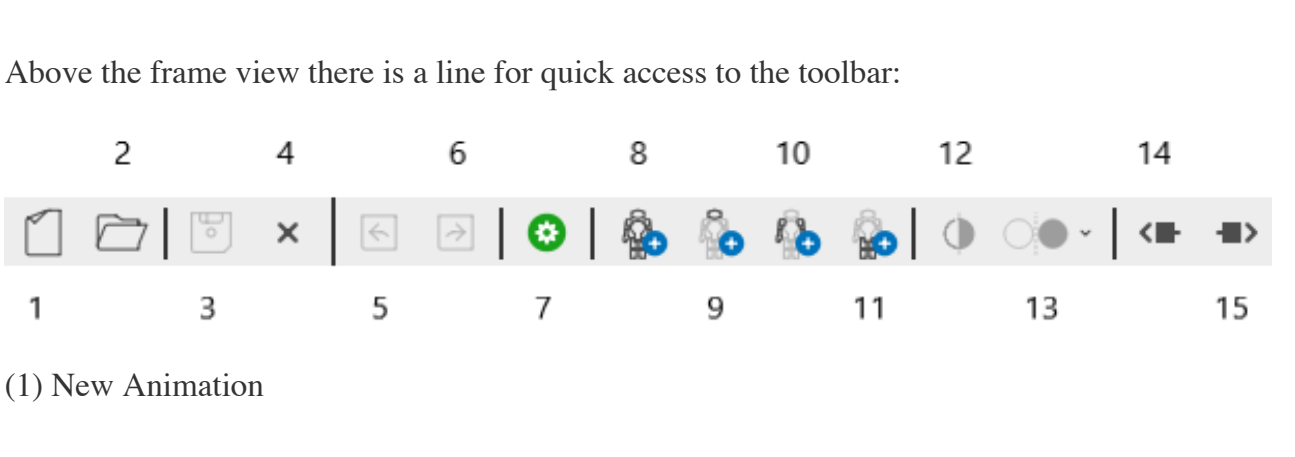
Keyframes are frames where the user actively defines the action.


10
20
30
40
50

- The green flag indicates the frame where the animation starts
- The blue line marks the selected frame
- Red flag indicates the frame where the animation ends

2.2.2 Shortcut Access Toolbar

Above the frame view there is a line for quick access to the toolbar:


2
4
6
8
10
12
14
1
3
5
7
9
11
13
15

(1) New Animation

(2) Open Animation

(3) Save Animation

(4) Close Animation

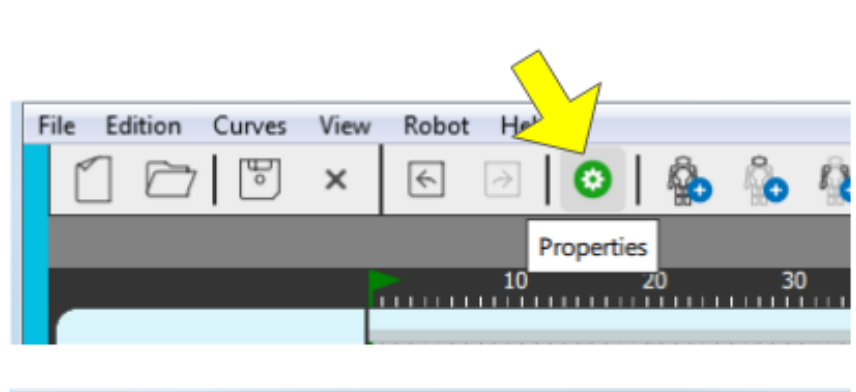
(5) Undo

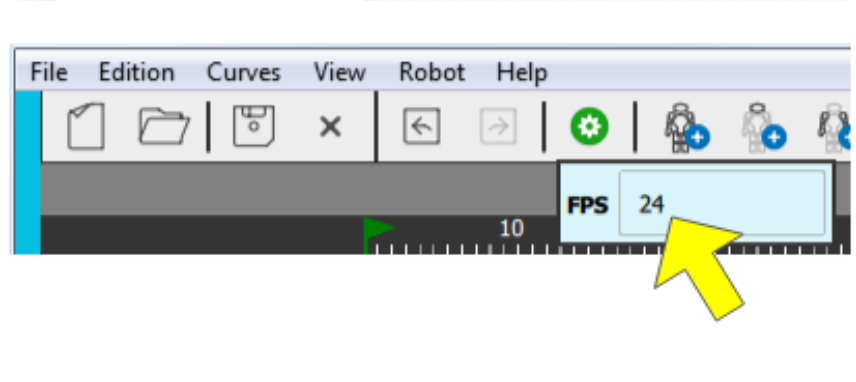
(6) Resume Undo

(7) Set the global speed of Animation.

The standard speed of execution is 24 FPS (frames per second).

To modify the global execution speed of Animation, modify the value of the FPS property:


File
Edition
Curves
View
Robot
Help
Properties


File
Edition
Curves
View
Robot
Help
FPS
24

- The higher the value, the faster the Animation will play.
- The smaller the value, the slower the Animation plays.

(8) Creating keyframes for the whole body

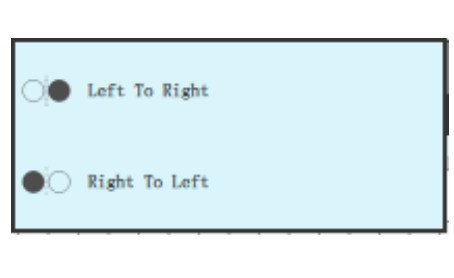
(9) Create the keyframe for the head

(10) Create keyframes for the arms

(11) Create keyframes for legs

(12) Move the selected keyframe to the other side.

(13) Copy the selected keyframes to the other side (left to right/right to left)

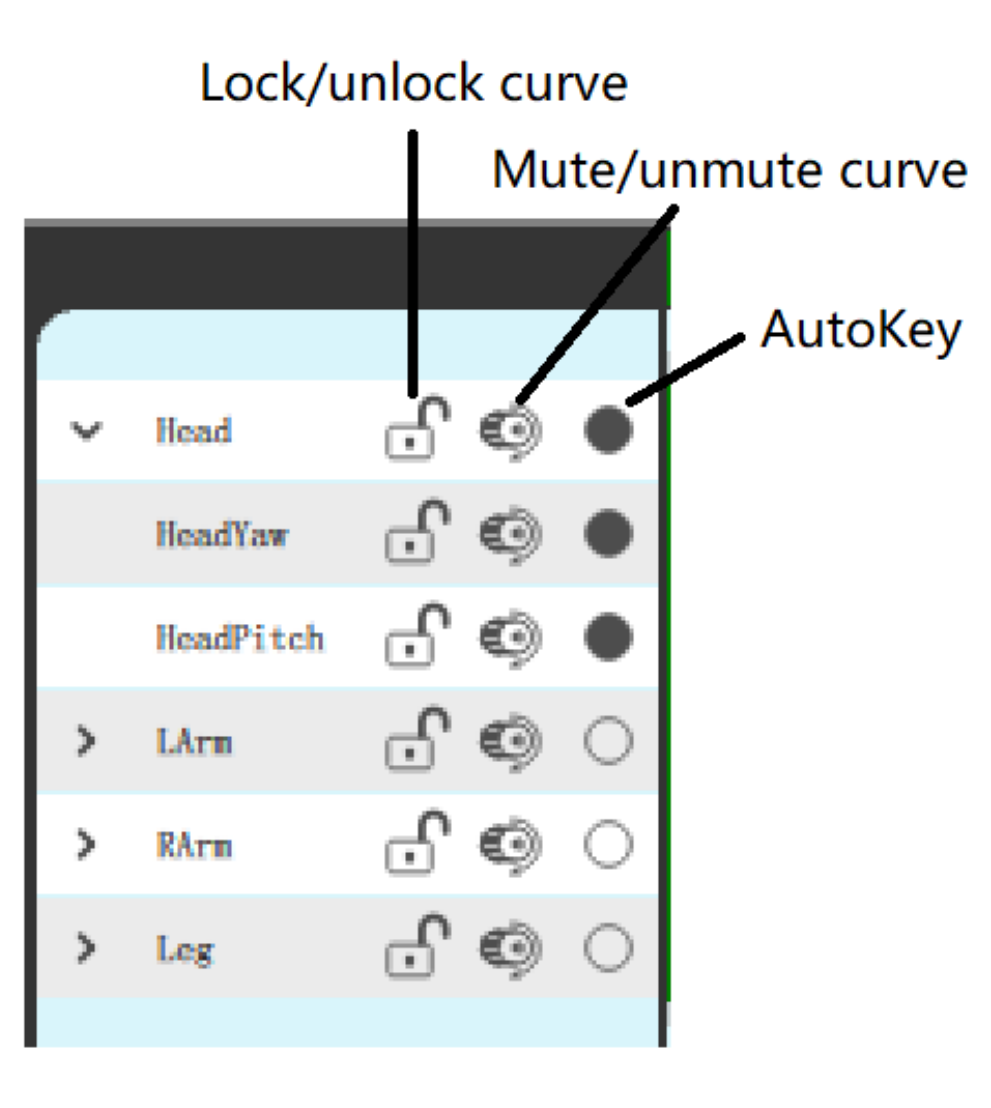

Left To Right
Right To Left

(14) jump to the previous keyframe

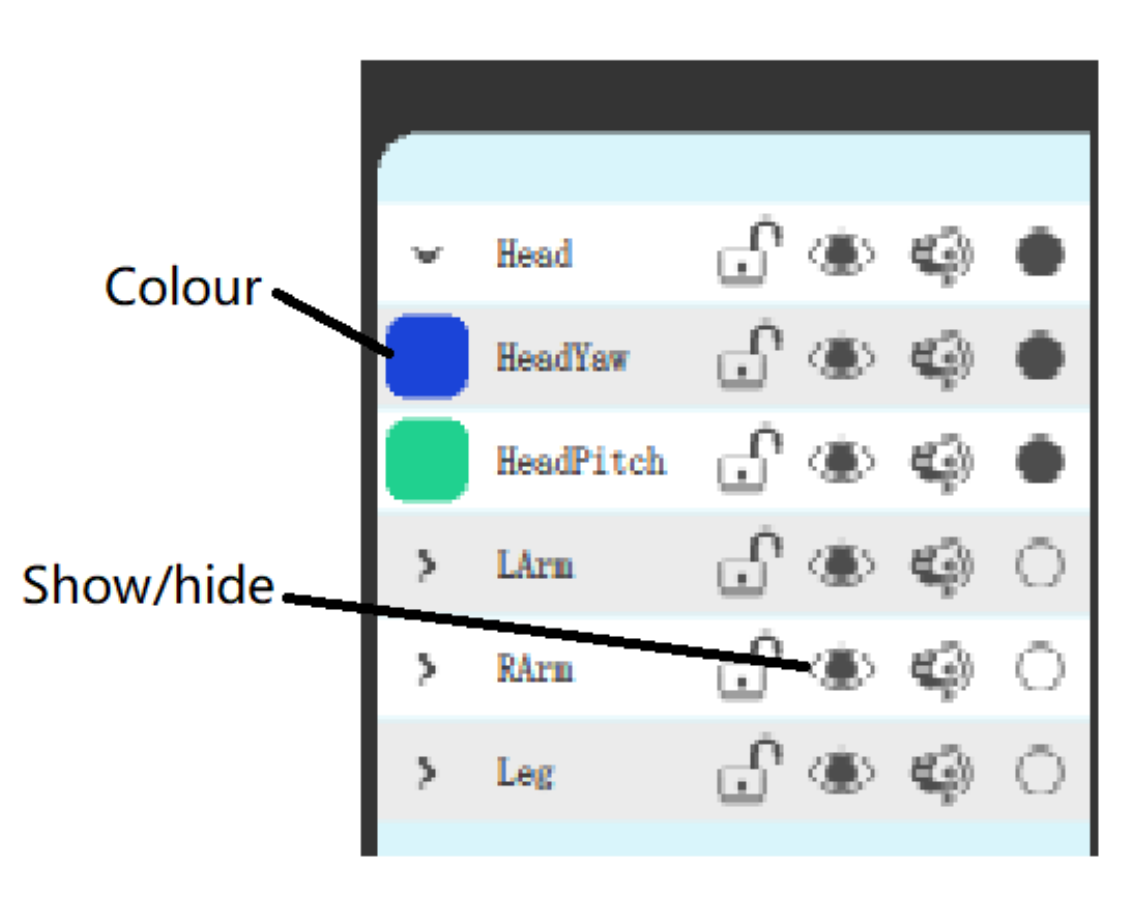
(15) jump to the next keyframe

2.2.3 Executor List

On the left is the list of actuators, consisting of Head, LArm, Rarm, Leg, which can be expanded or collapsed.


Lock/unlock curve
Mute/unmute curve
AutoKey
Head
HeadYaw
HeadPitch
LArm
RArm
Leg

'Dopesheet' view ####


Colour
Show/hide
Head
HeadYaw
HeadPitch
LArm
RArm
Leg

'Curves' view

For both views:

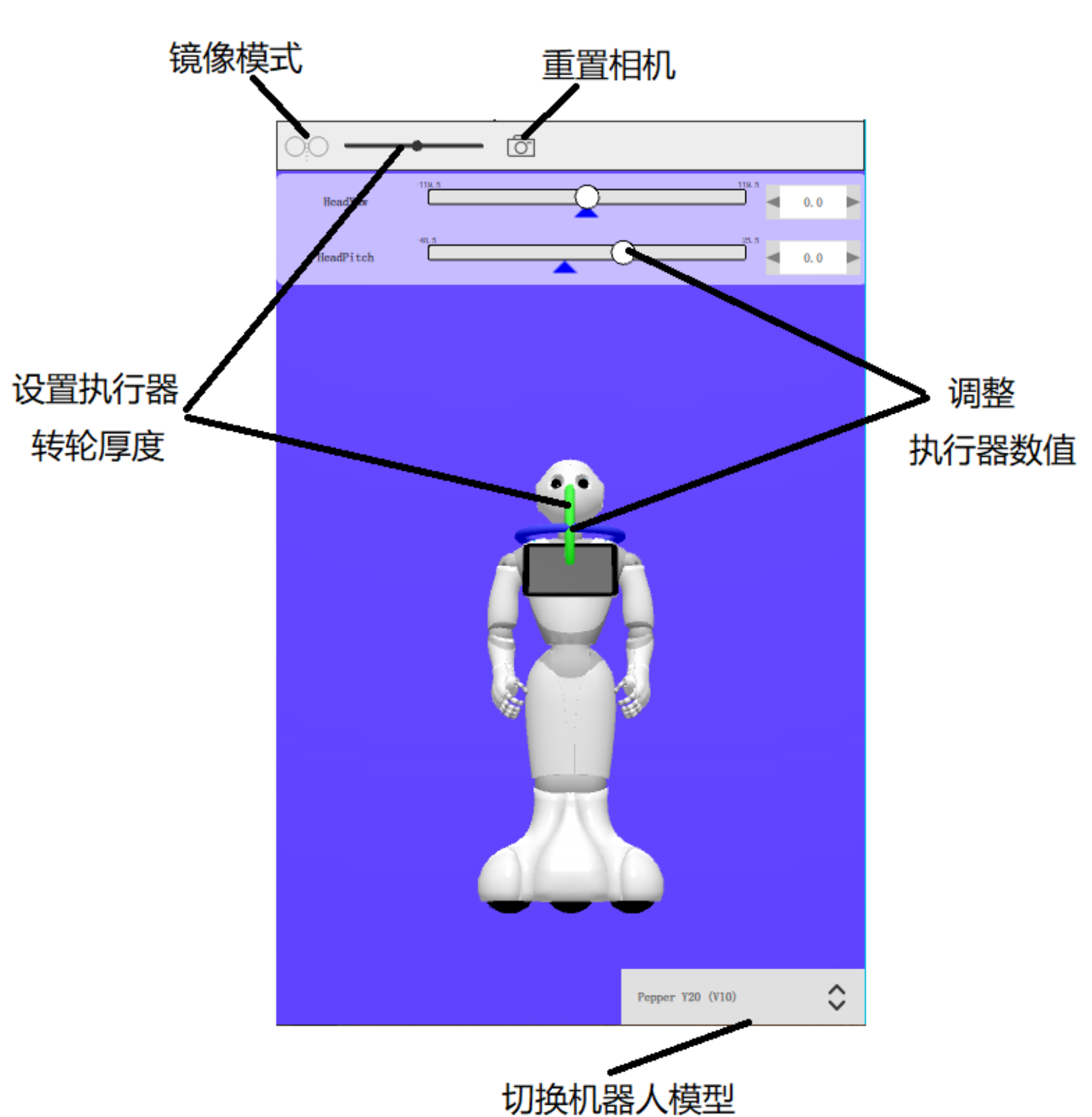
- **Lock curve**: prevents unwanted changes on the curve. When activated, the colour of the curve will change to grey and keypoints cannot be edited.
- **Mute curve**: when Animation is played, the edited action of the part will not be executed.
- **AutoKey**: allows to create frames by editing the actuator on the Robot 3D view.

Only for 'Curves' view:

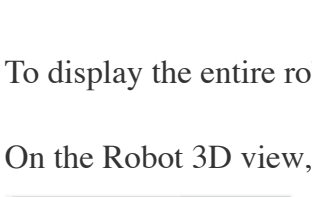
- **Colour**: The colour of each curve is shown next to the actuator name. Click it to select another colour.
- **Hide**: Hiding curves allows you to simplify the curves view to focus on specific actuators.

2.2.4 Robot 3D View

On the right side is the 3D view of the robot, you can preview the current Animation and modify it. Left mouse button drag: move up, down, left, right; Right mouse button drag: rotate. Mouse wheel: zoom in and out.


镜像模式
重置相机
设置执行器
转轮厚度
调整
执行器数值
切换机器人模型

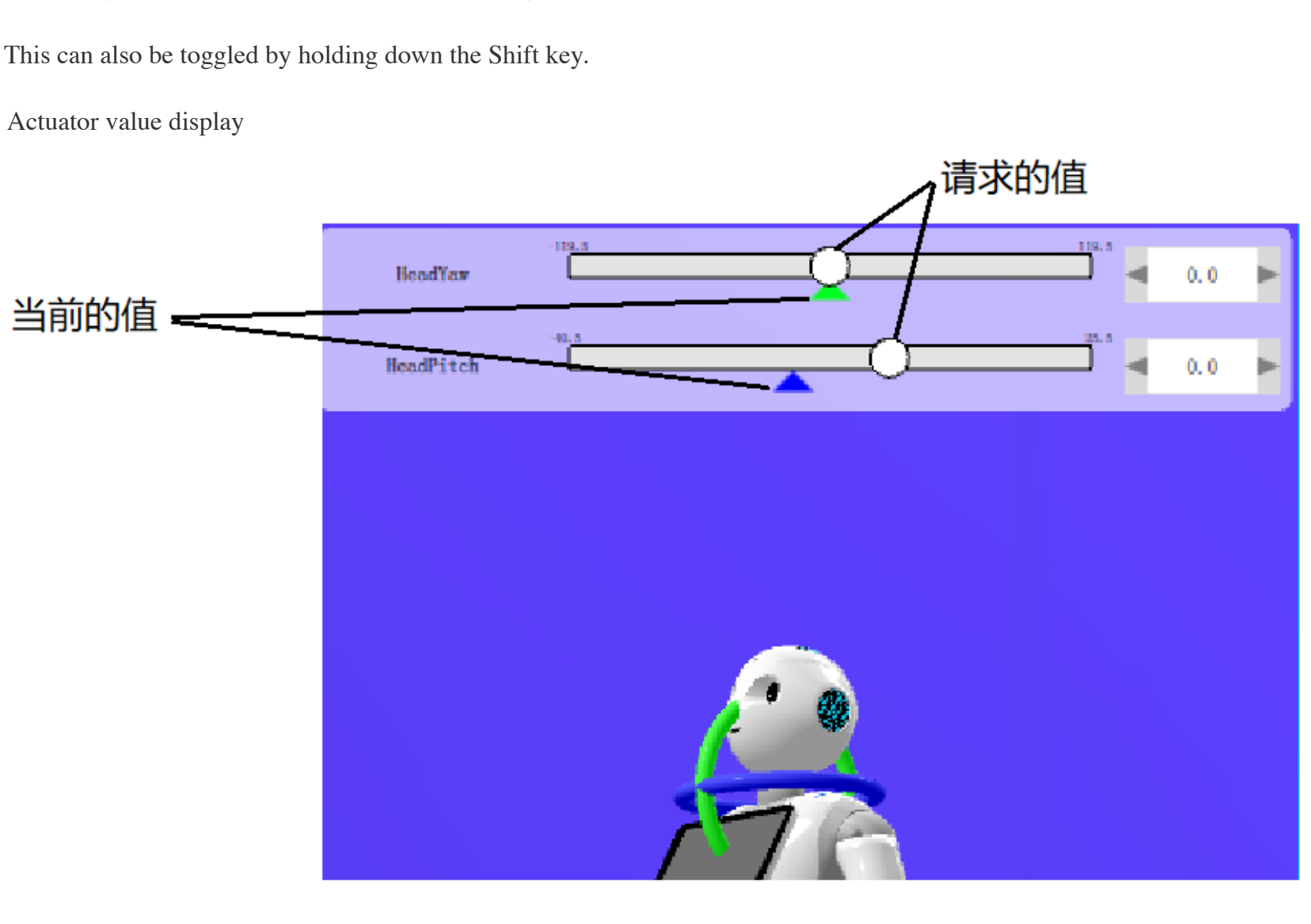
- To display the entire robot head-on, use the Reset Camera button on the front of the robot.
- On the Robot 3D view, mirror mode can be activated/deactivated:


Switch Mirror Mode (M)

When enabled, if the slider RShoulderRoll is modified, the value of LShoulderRoll is also modified.

Tip: This can also be toggled by holding down the Shift key.

- Actuator value display


当前的值
请求的值
HeadYaw
HeadPitch
0.0
0.0

The requested values can be adjusted by dragging the slider, by typing the values in the text box on the right, or by dragging the actuator wheel directly.

The colour of the arrow of the current value indicates whether the requested value has been reached or not: **Green** means that the current value is equal to the last requested value; **Blue** means that the current value is not the requested value. A blue arrow may be coloured because (a) the command is being executed; (b) the joint cannot reach the requested value, e.g. there is an obstacle.

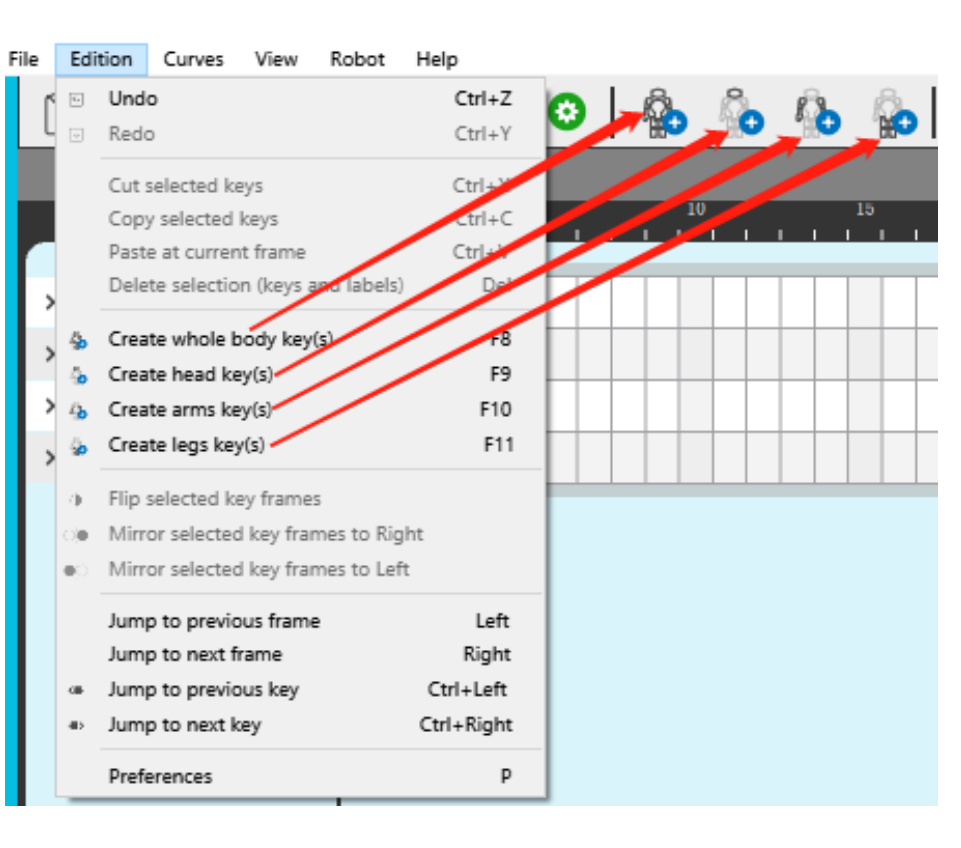
2.3 Creating the first Animation

The following creates a simple Animation: a head nod.

Define an initial pose.

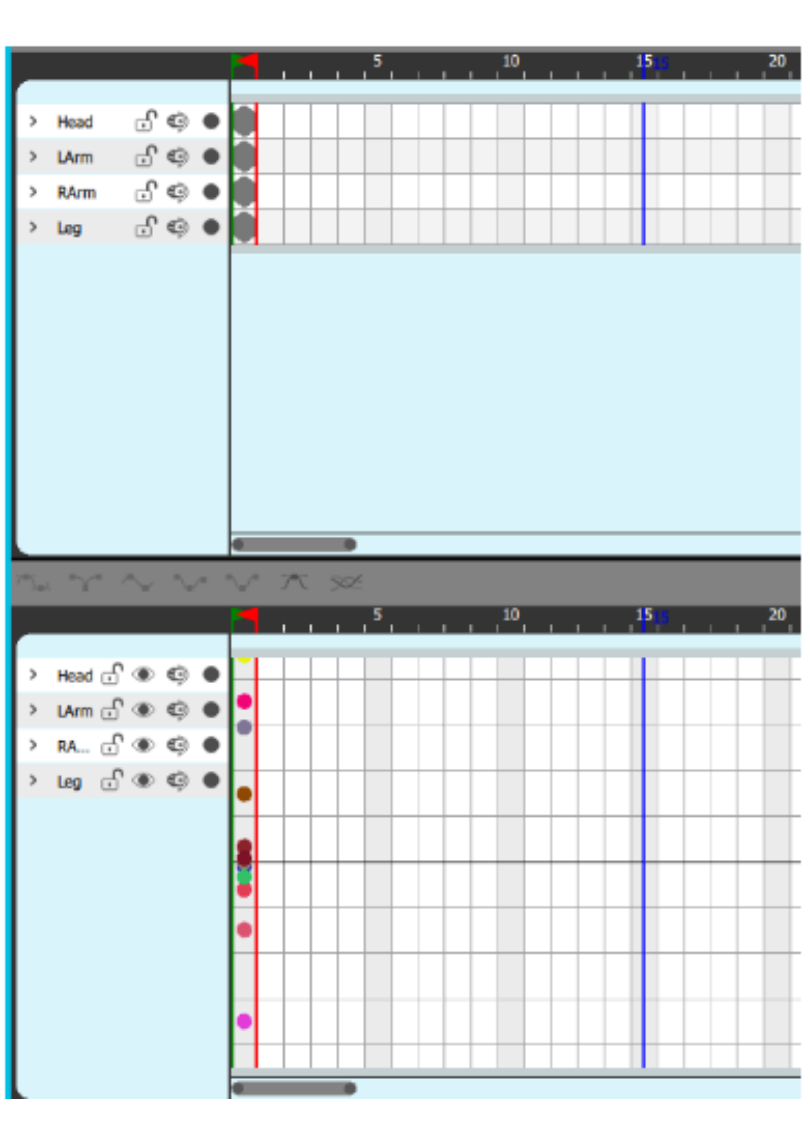
(1) Select Robot > Postures > Stand. this is an initial pose.

(2) Choose Edition > Create whole body key(s). The created key(s) will be displayed in the Dopesheet and Curves view. You can also create them by clicking on the shortcut buttons for the different parts of the body.

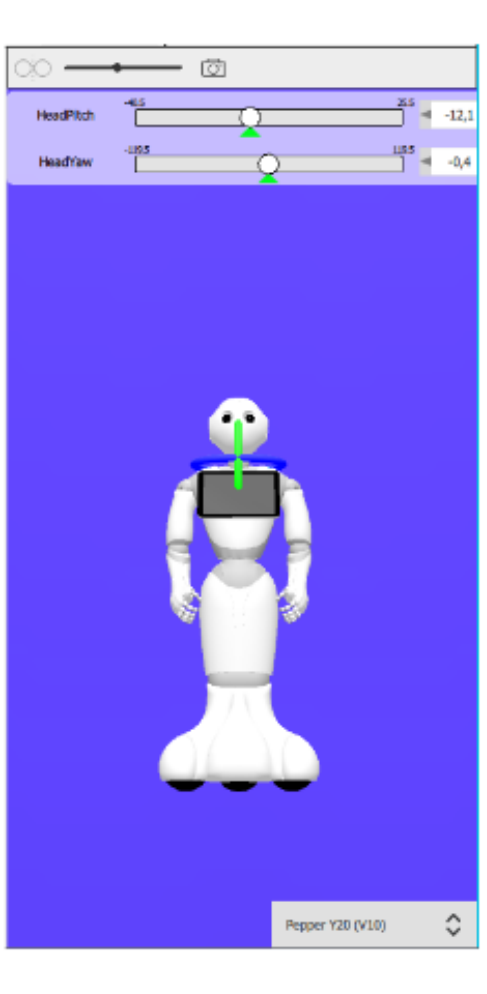

File
Edition
Curves
View
Robot
Help
Undo Ctrl+Z
Redo Ctrl+Y
Cut selected keys
Copy selected keys
Paste at current frame
Delete selection (keys and labels)
Create whole body key(s) F8
Create head key(s) F9
Create arms key(s) F10
Create legs key(s) F11
Flip selected key frames
Mirror selected key frames to Right
Mirror selected key frames to Left
Jump to previous frame Left
Jump to next frame Right
Jump to previous key Ctrl+Left
Jump to next key Ctrl+Right
Preferences P

Add a new keyframe to create the head down action.

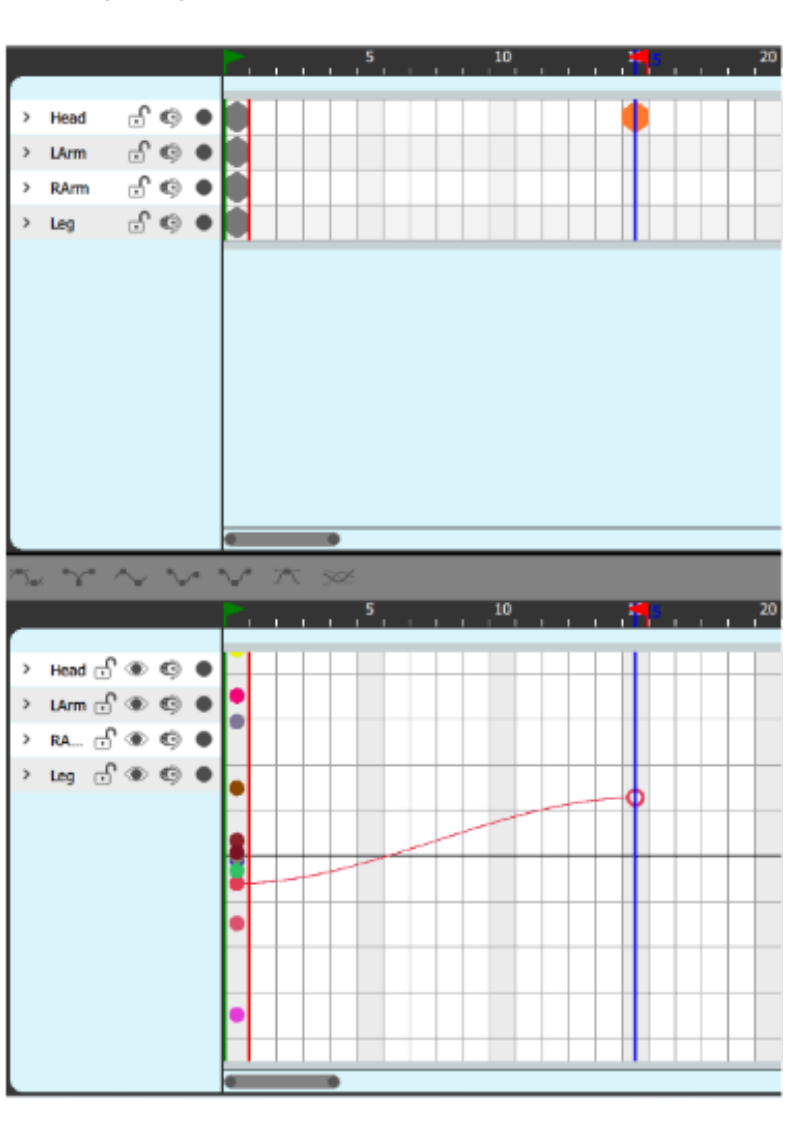
(1) Click the new frame according to the number of frames corresponding to the time needed to execute to the new action, for example, frame 15. The blue line indicates the selected frame.



(2) On the Robot 3D view, select the head. Sliders and wheels appear, allowing you to move the head.



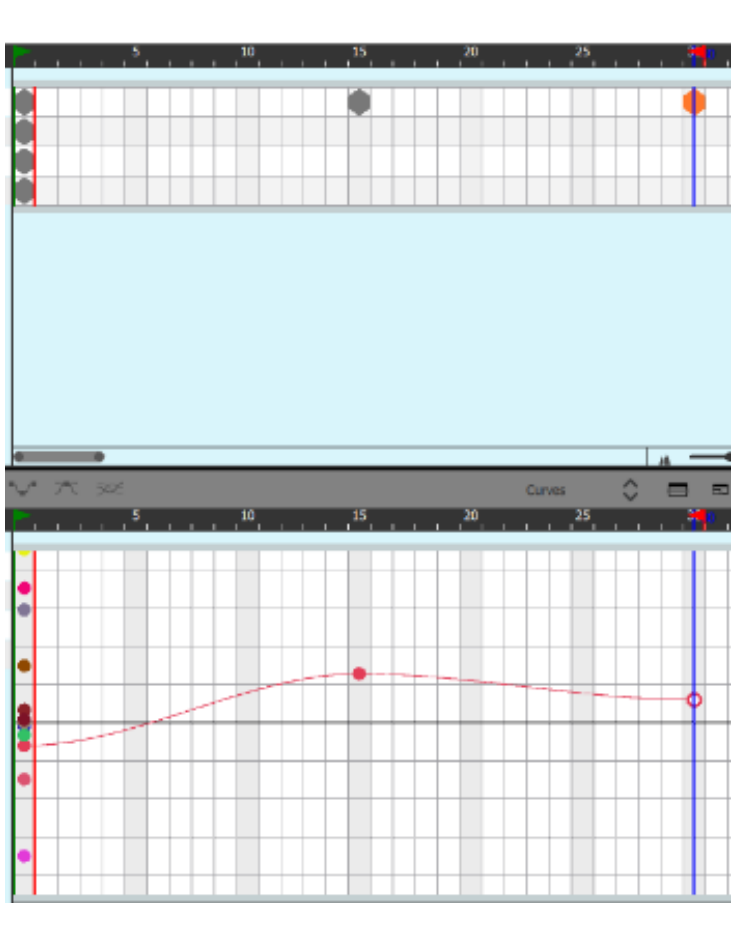
(3) Drag the green wheel or HeadPitch slider to lower the head. Select Edition > Create head key(s) to create the head action.



Add a new keyframe to create the head up action.

(1) Select another frame, say frame 30, drag the green wheel or HeadPitch slider to raise the head.

(2) Create the head action.



Test Animation.

Choose Robot > Play animation to see the defined Animation on the Robot 3D view.

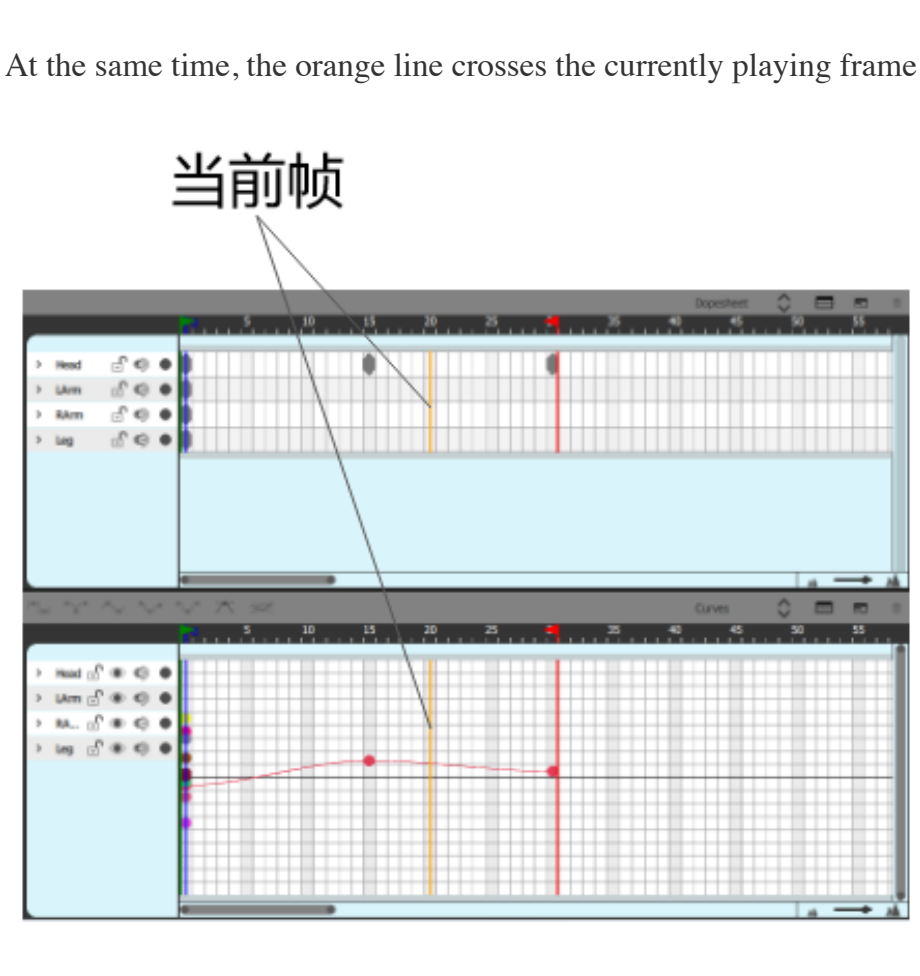
If we want to test the effect of Animation on real machine:

(1) The real robot is connected (#connect) and in wake-up state.

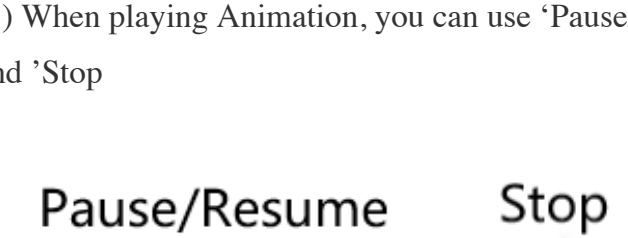
(2) Choose 'Robot' > 'Play animation', or click the ' Play' button on the "Robot" toolbar.

You can see the real robot playing the animation.

At the same time, the orange line crosses the currently playing frame.



(3) When playing Animation, you can use 'Pause/Resume' and 'Stop' commands in 'Robot' menu and toolbar. Pause/Resume' and 'Stop


Pause/Resume
Stop

Save the Animation.

Select File > Save.

2.5 Animation Mode

In addition to creating Animation by setting the actuator values as described above, there is a more intuitive way to create Animation by adjusting the pose of a real robot, which is called Animation Mode. In this mode, the robot behaves like a puppet that can be manipulated, allowing you to record its pose in the Timeline.

2.5.1 Enabling Animation Mode

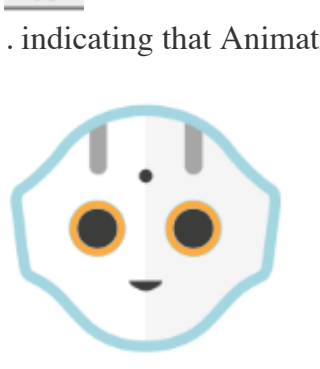
(1) Make sure the Animation Editor is connected to a real robot.

(2) Click

'Enable Animation Mode' button.

This button will change:

. indicating that Animation Mode is on. At this time, Pepper's eye colour changes to:



2.5.2 Defining and Storing Poses

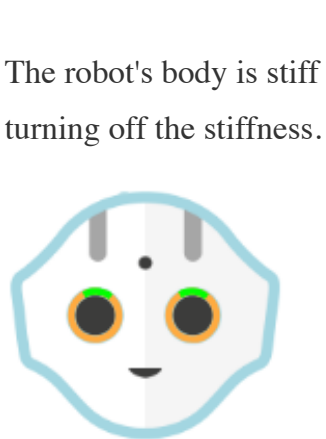
To define and store poses, repeat the following steps for each pose:

(1) Select a frame.

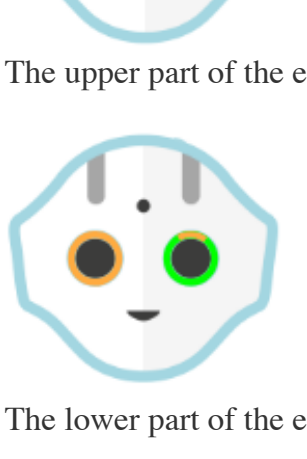
(2) Manipulate the robot's limbs one by one by following the rules below to keep the robot in the pose you want to store.

- **Head**: switch the stiffness by touching the touch sensor in the middle of the head once.
- **Arms**: switch off the stiffness by **all the way** Press and hold the touch sensor on the **back of the hand**.

The robot's body is rigid when it maintains stiffness and cannot adjust its posture. Posture adjustment is possible only after turning off the stiffness. Determine if the robot is maintaining rigidity by looking at Pepper's eye LED colour.

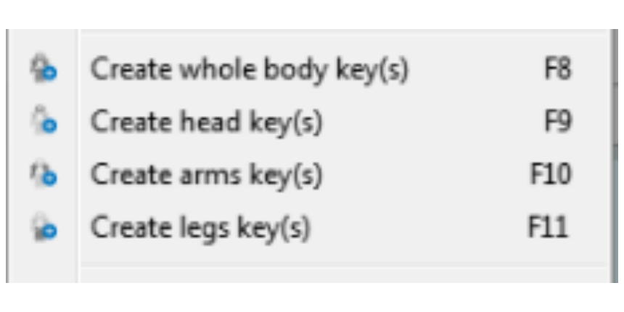


The upper part of the eye shows green to indicate that the head turns off the stiffness and the pose can be adjusted.



The lower part of the eye turns green, it means that the arm of the side closes the stiffness, and you can adjust the pose.

(3) Use the 'Edition' menu in the toolbar to create keys:


Create whole body key(s) F8
Create head key(s) F9
Create arms key(s) F10
Create legs key(s) F11

2.5.3 Exit Animation Mode

Click the

button , or place your hand on the head touch sensor for 3 seconds. The button changes to:

, indicating that the Animation Mode is off.

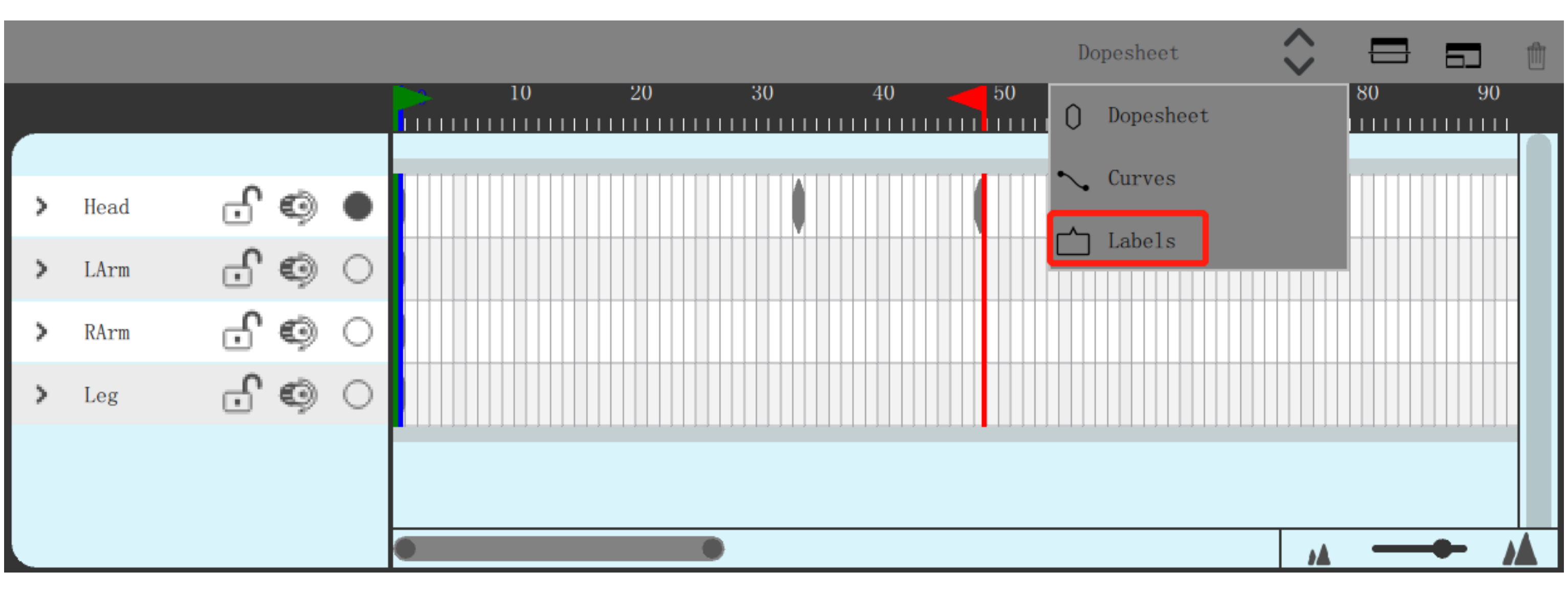
Note: If the Animation Editor disconnects from the robot, Animation Mode will exit automatically.

2.6 Adding Tags

If you want the robot to do something else while executing an Animation, you can define labels through the Label interface. The labels will be saved in the Animation file, and callback events will be triggered by the labels. To add a label, follow the steps below.

Open the Animation file.

Display the Label view.

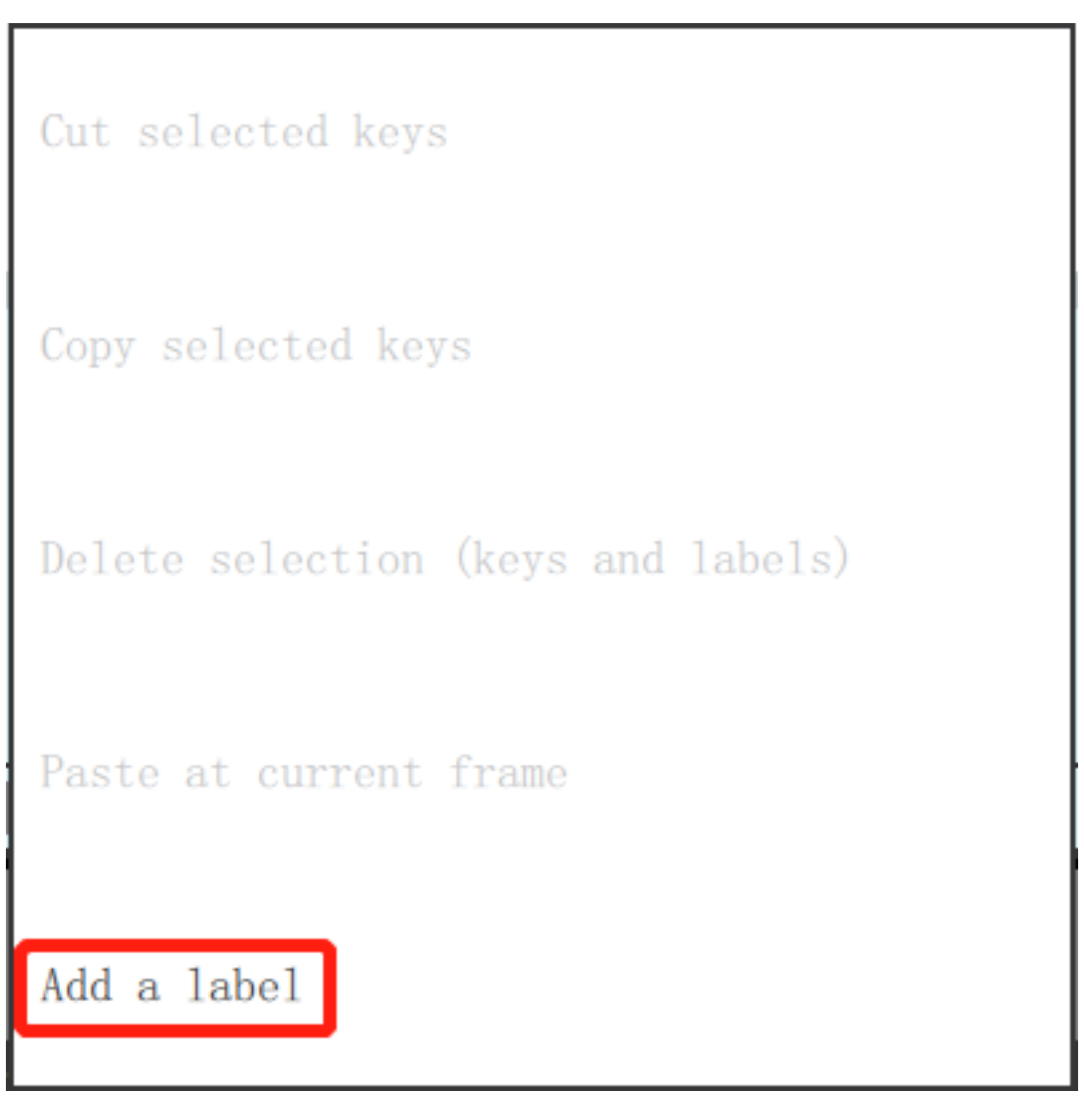

Dopesheet
10
20
30
40
50
80
90
Head
LArm
RArm
Leg
Dopesheet
Curves
Labels

Click the 'Add group' button. Click the default group name to rename it.

Click on the default group name to rename it. rename_group_name

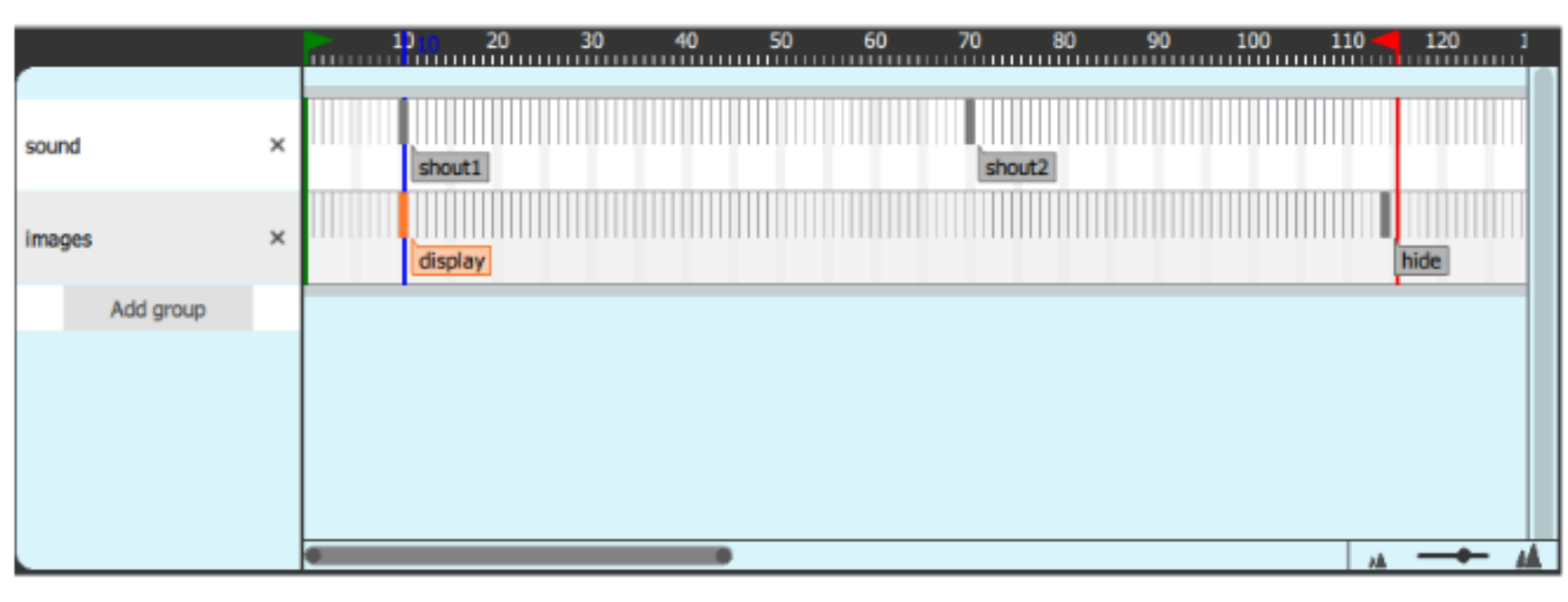
4, in the timeline, right-click a frame, and then in the menu, select 'Add a labe'.

Add a labe' in the menu.


Cut selected keys
Copy selected keys
Delete selection (keys and labels)
Paste at current frame
Add a label

5, click on the label name can be renamed.

Click on the label name to rename it.


sound
images
Add group
shout1
shout2
display
hide

- To delete a label, select the label and press the Delete key.
- To move the label, mouse-click and drag it.

Add the event listener for arriving at the label in the code.

```
animate.addOnLabelReachedListener(new Animate.OnLabelReachedListener() {
    @Override
    public void onLabelReached(String label, Long time) {
        // Called when a label is reached.
        Log.d("TAG", "label name:" + label + ";the label time of occurrence:" + time);
    }
});
```

3 Building an animation

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3.1 Call the created Animation file and execute Animation

```
Animation myAnimation = AnimationBuilder.with(qiContext)
.withResources(R.raw.dance_b001)
.build();

Animate animate = AnimateBuilder.with(qiContext)
.withAnimation(myAnimation)
.build();

Future<Void> animateFuture = animate.async().run();
animateFuture.thenConsume(future -> {
    if (future.isSuccess()) {

    } else if (future.isCancelled()) {

    } else if (future.hasError()) {

    }
});
```

Where: dance_b001 is the name of the resource file (qianim file or pmt file), which can be changed according to the name of the file you created.

3.2 Listening to Animation events ### When we want to start an Animation, we need to listen to the events of the Animation.

When we want to talk or play music when the Animation starts executing, we need to add an event listener for the Animation to start executing, so that we can execute the talk or play music in the callback.

```
animate.addOnStartedListener(new Animate.OnStartedListener() {
    @Override
    public void onStarted() {

    }
});
```

3.3 Stopping Animation

```
animateFuture.requestCancellation();
```

4 Connecting to a real robot

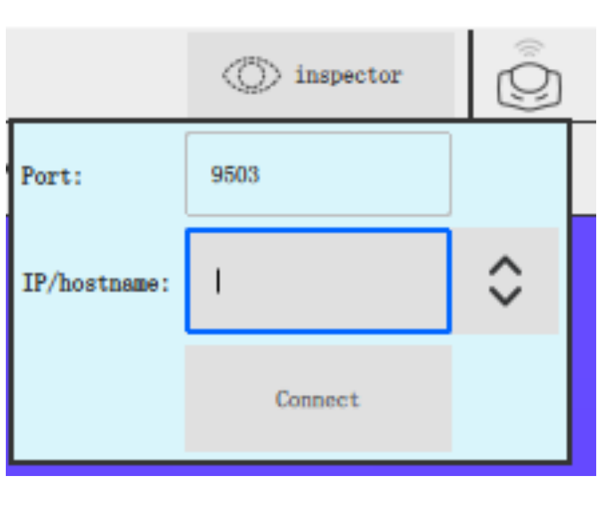
If the Animation Editor is already connected to a real robot, the connect button is displayed as

instead of

.

(1) If you are not connected to the real robot, make sure the robot is turned on, select 'Robot' > 'Connect to/disconnect from Robot', or click

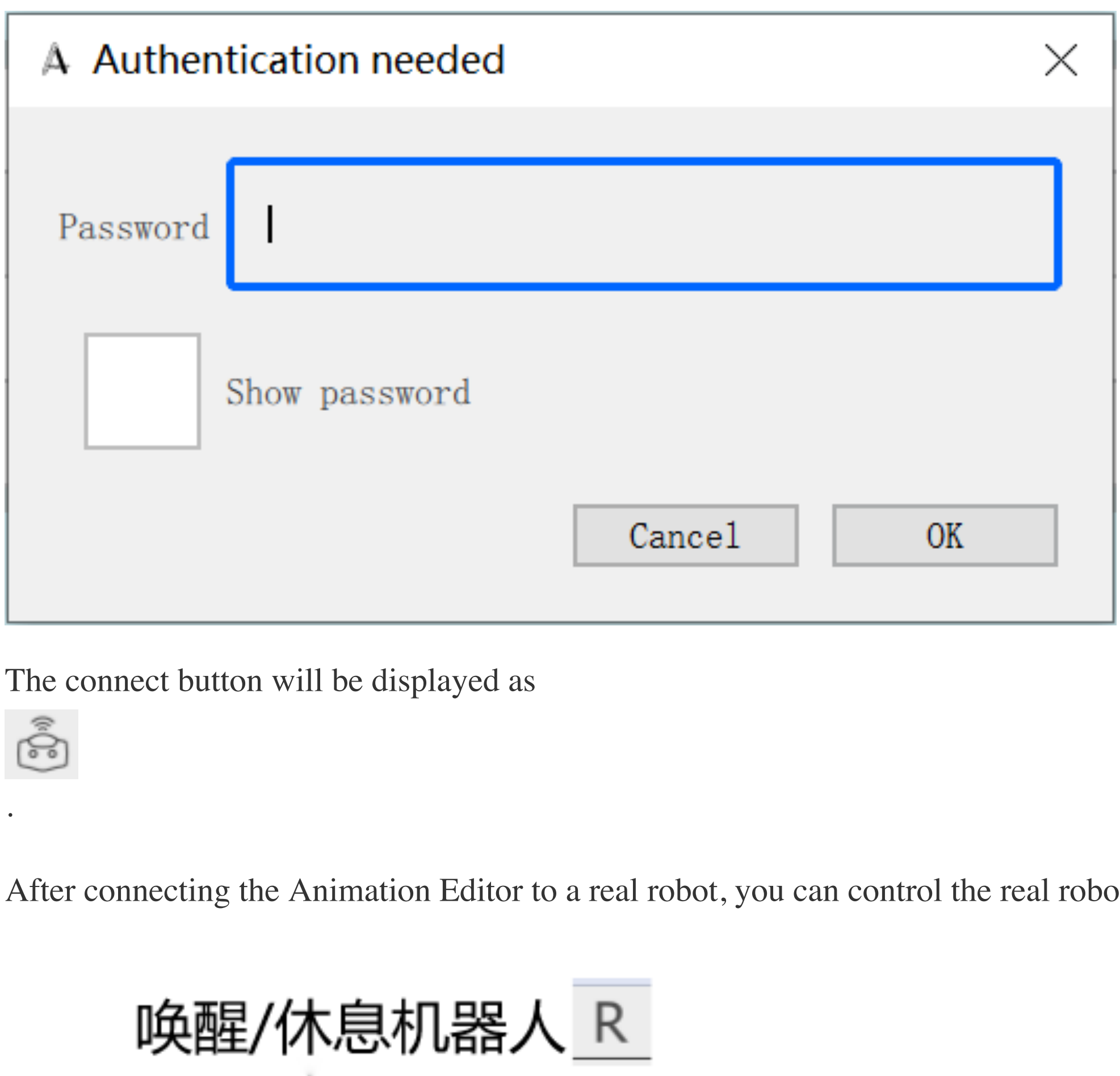
button.


inspector
Port:
9503
IP/hostname:
Connect

(2) Make sure the port is **9503**.

(3) Enter the IP address of the robot (clicking the Pepper chest button will broadcast the IP address) and click 'Connect'.

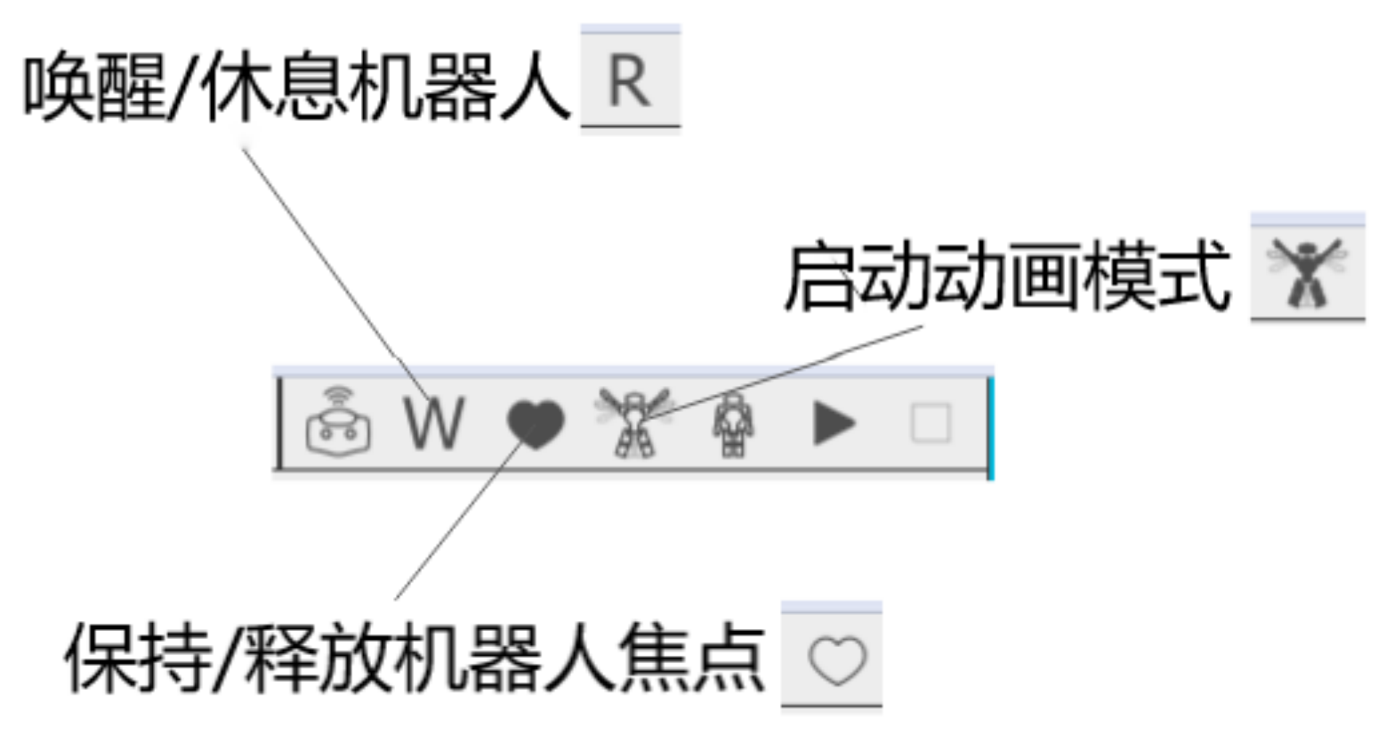
(4) Enter the robot password and click 'OK'.


Authentication needed
Password
Show password
Cancel
OK

The connect button will be displayed as

.

After connecting the Animation Editor to a real robot, you can control the real robot from the Animation Editor:


唤醒/休息机器人 R
启动动画模式
W
保持/释放机器人焦点

5 Precautions for using Animation

Pepper will automatically avoid obstacles when executing Animation, and if an obstacle prevents him from safely completing the entire Animation, the Animation will be partially executed. If Pepper encounters an obstacle along the way while executing a trajectory, he will avoid the obstacle and try to execute the trajectory as accurately as possible, but the total time of the Animation remains the same.

2、When there is already an Animation running, it can't run another Animation at the same time, Pepper has many APIs related to Animation, such as Say (BodyLanguageOption is not disabled by default), LookAt, so it can't execute an Animation when calling these APIs. Animation.