

CS475: Computer Graphics

Assignment 2: Hierarchical Modelling

Kumar Saurav (160050057), Yash Shah (160050002)

October 9, 2018

Primitives and Structure

In this assignment, we modelled three characters or objects. Before describing them, we would like to elaborate on the primitives and components used for their construction.

Primitives: The base primitive used was a *triangle*. We used the base primitive to build a *chain* of primitives, with each one being constructed using the ones at a lower level. Thus, using *triangles* we made *quads*, using *quads* we made conical *frustums*, and finally using *frustums* we made *spheres*. The speciality of this set of primitives is that a wide range of shapes could be generated using them - for example, cylinders and circles are just a special case of *frustums*, and ellipsoids of *spheres*.

Components: We built upon the framework of Tutorial 7 on hierarchical modelling which was provided to us earlier. We stuck with the idea of a *hierarchical node* for describing an entity of the hierarchical model, but we specialized it for different purposes. We extended the base *HNode* class to two derived classes - *Joint* and *Rigid_Node*. The *Joint* class was further extended to *Hinge_Joint* and *Ball_And_Socket_Joint*. These two classes were used to model joints with one and three degrees of freedom respectively, and the *Rigid_Node* class was used to model other static components, like upper arm, for example.

More specifically, each *Joint* class instance has a fixed axis/axes about which it can rotate. No translation is allowed on a *Joint*. For *Rigid_Node* instances, neither translation nor rotation is allowed about any axis.

Character Description

We would like to bring to note here that we are not following the meaning of the word “dance” in the normal sense. We have chosen to recreate a *kung-fu* scene as our topic of dance and our characters are thus based on this reference.

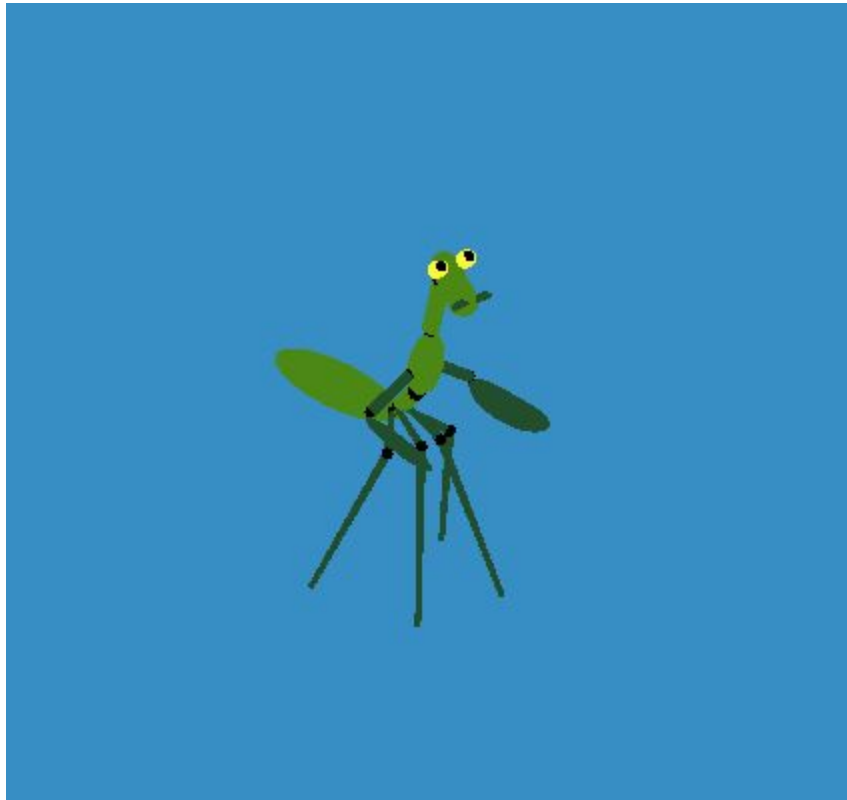
1. ‘Po’ (Kung Fu Panda character)



This character served the purpose of the *humanoid* model (primary *dancer*) that we needed to design for this assignment. As you can see in the image above, we have tried to make the model as realistic as possible, considering the scope of this assignment!

Accessories: The eyes and eye patches, nose, mouth, ears, shorts and shoes are all “accessories” which we created to impart realism to our character.

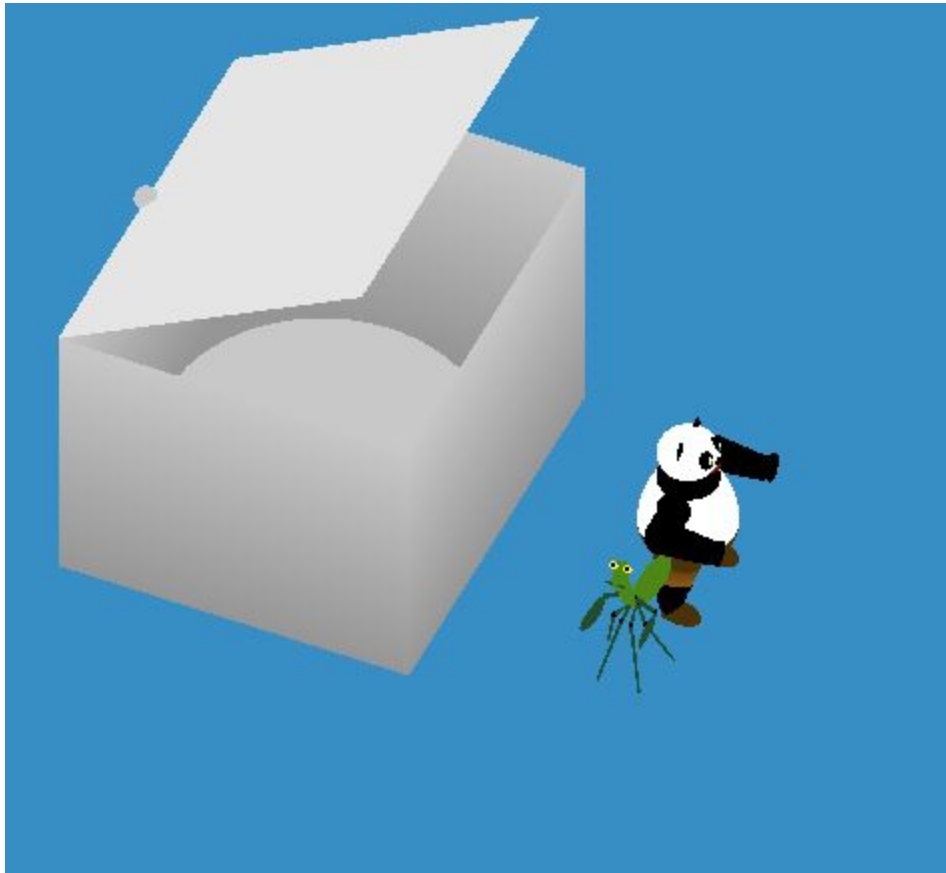
2. 'Mantis' (Again, a Kung Fu Panda reference)



Mantis serves as the secondary character. We deliberately chose this among the trope of Kung Fu Panda franchise since we wanted our second character to bear as little resemblance to human characters as possible.

Accessories: eyes, moustache

3. A Music Box

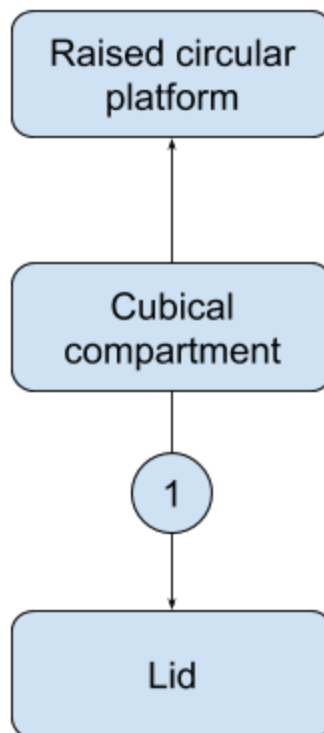


The music box is a simple object, with a cuboidal structure, a rectangular lid and a circular raised platform inside (this is where the characters will be ultimately placed!). Also, there is a hinge at the center of the joined edge (we have increased it in size for emphasis).

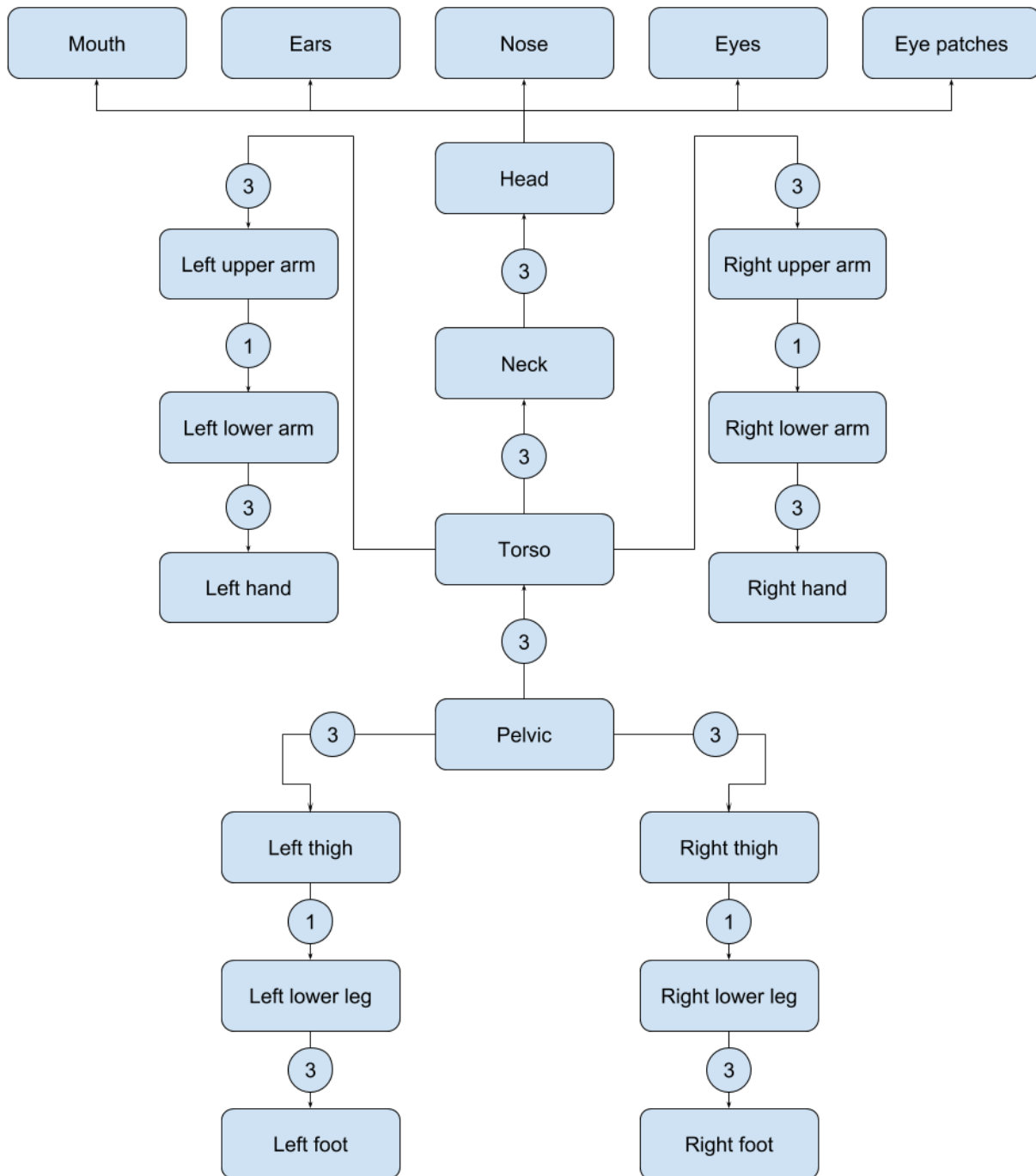
Model Hierarchies

It is to be noted that in these diagrams, we have represented each rigid node as a box, and each joint as a circle on the arrow joining those two boxes which represent the actual parts that are connected by that joint. The degree of freedom of that joint has been specified in that circle.

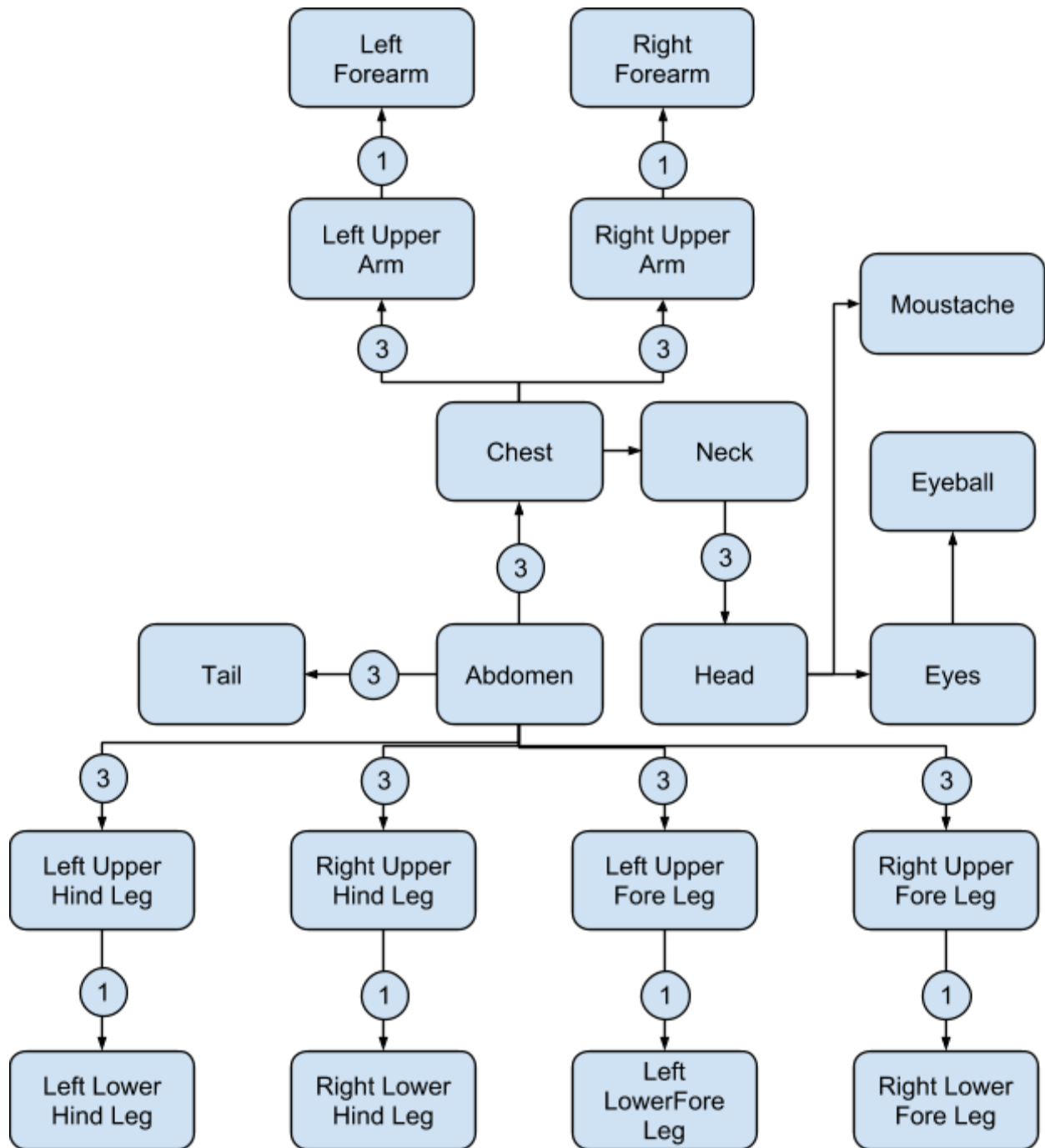
Music Box



'Po'



'Mantis'



Callbacks

Key	Corresponding Action
H	Display help
P	Change perspective mode
R	Select character
J	Select joint in character
Up/Down/Left/Right	Rotate camera about +X/-X/+Y/-Y axes
Scroll left/right	Rotate camera about -Z/+Z axis
Shift + Up/Down/Left/Right	Translate camera about +X/-X/+Y/-Y axes
Scroll up/down	Translate camera about +Z/-Z axis
W/S/D/A/E/Q	Rotate selected joint about +Z/-Z/+X/-X/+Y/-Y axes
Shift + W/S/D/A/E/Q	Translate selected joint about +Z/-Z/+X/-X/+Y/-Y axes
+/-	Zoom the camera in/out