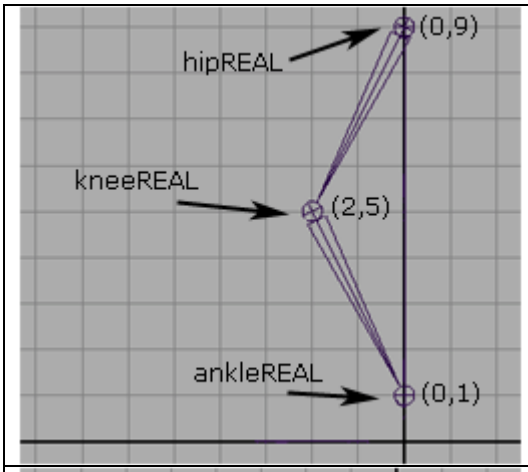
Elastic Foot Set-Up

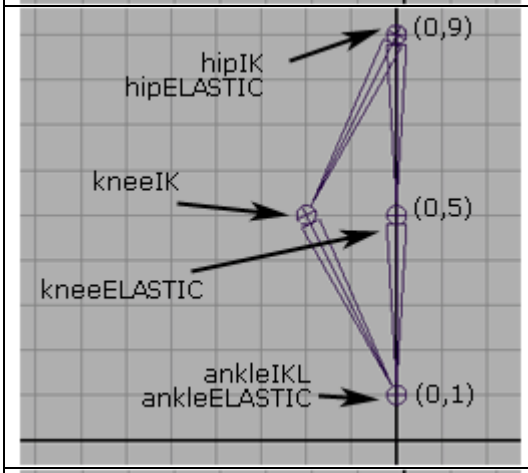
Cartoon animation looks great with some squash and stretch. To be able to 'stretch' bones you need a set-up that can handle 'elasticity'.

This tutorial shows how to build an elastic foot using expressions.
You need a fair knowledge of Maya and how to work with the hypergraph



Bones
Create the ***REAL*** bones using the grid.

hipREAL->kneeREAL->ankleREAL
in position (0,9 – 2,5 - 0,1) relative to the grid.



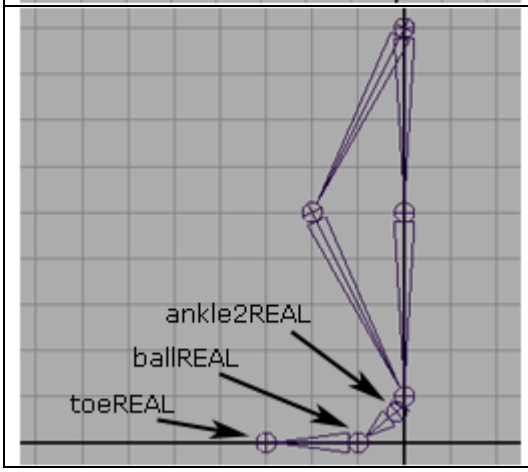
IK and ELASTIC Bones
Create ***IK*** bones by duplicating the ***REAL*** ones.

hipIK->kneeIK->ankleIK

Create the ***ELASTIC*** bones using the grid.

hipELASTIC->kneeELASTIC->ankleELASTIC
in position (0,9 – 0,5 – 0,1)

Create an ikRPsolver form hipIK to anleIK
Name the IK handle:
ikHandle

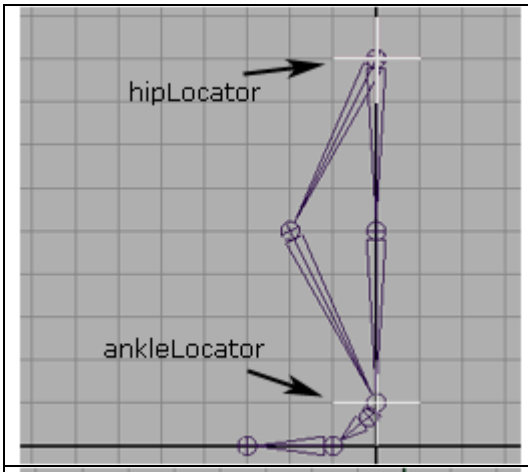


More Bones
Create the ***REAL*** foot

ankle2REAL->ballREAL->toeREAL

The ***ankle2REAL*** is used for skinning purposes so that the foot doesn't stretch when it's in elastic mode. That's why it should be close to the ***ankleREAL***.

Parent ***ankle2REAL*** to ***ankleREAL*** to connect the foot to the leg.

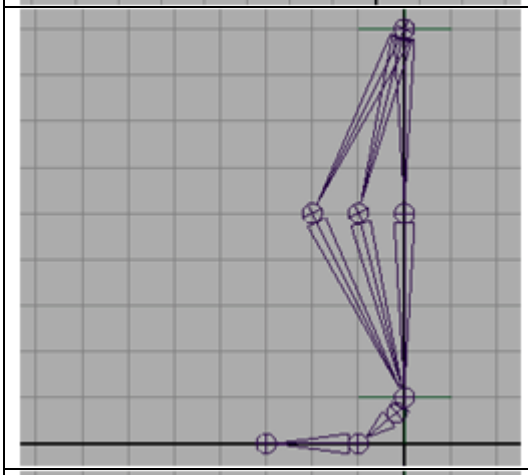


Locators
Create a locator and place it on the same position as the hips (0,9).

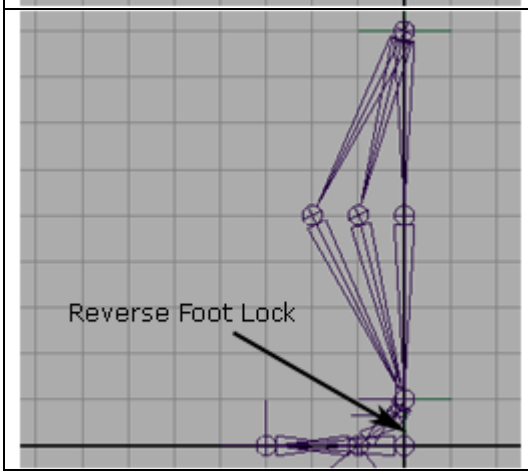
locatorHip

Create another locator and place it on the same position as the ankle (0,1).

locatorAnkle



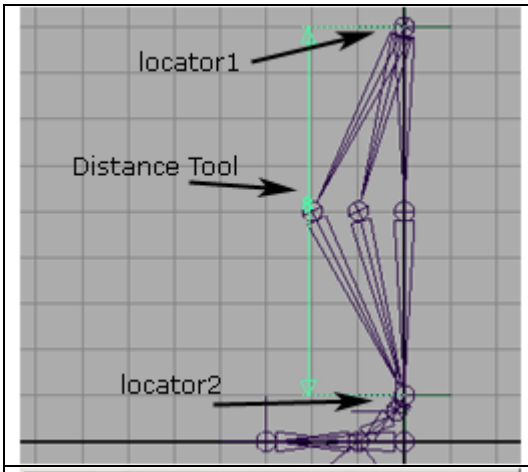
Constrains
Point constrain all the hips to ***locatorHip***.
Point constrain ***ankleREAL***, ***ankleELASTIC*** and ***ikHandle*** to ***locatorAnkle***.
Point constrain ***kneeREAL*** to both ***kneeIK*** and ***kneeELASTIC***.
Point constrain ***kneeELASTIC*** to both ***hipLocator*** and ***ankleLocator***. (this way the ***kneeELASTIC*** will always be half way between the locators).
Orient constrain ***hipREAL*** to ***hipIK*** and ***kneeREAL*** to ***kneeIK***.



Reverse Foot Lock

Create a reverse foot lock. (see Reverse Foot Lock tutorial)

Compensate by creating an additional ***ankle2RF*** for the extra ankle joint.

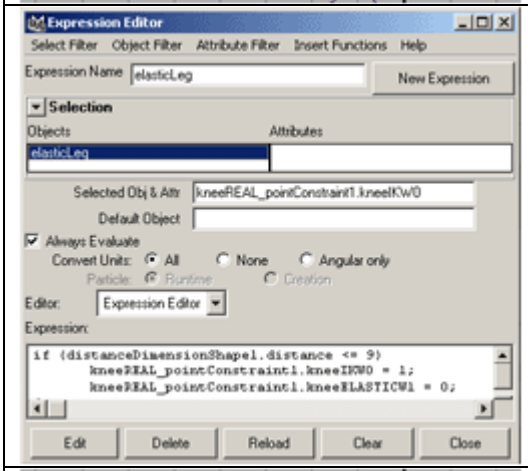


Measure Distance
Create a distance tool.

Point constrain ***locator1*** (from the distance tool) to ***hipLocator*** and ***locator2*** to ***ankleLocator***.

Because we used the grid to create the bones, the distance tool show measure 8 units.
When the knee is straight, the distance will be 9 units long.

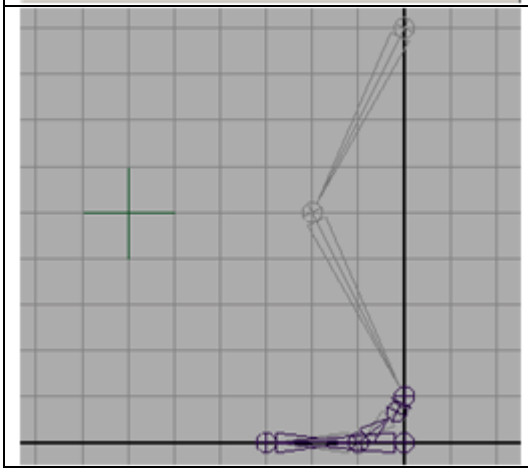
(If you didn't use the grid, you must find out what the distance is when the leg is stretched)



Expression
If the distance between the ***hipLocator*** and ***ankleLocator*** is less than 9, then the IK leg should be driving the ***REAL*** leg, otherwise the ***ELASTIC*** leg should be driving the ***REAL*** leg.

For this we need an expression:

```
if (distanceDimensionShape1.distance <= 9) {
    kneeREAL_pointConstraint1.kneeIKW0 = 1;
    kneeREAL_pointConstraint1.kneeELASTICW1 = 0;
} else {
    kneeREAL_pointConstraint1.kneeIKW0 = 0;
    kneeREAL_pointConstraint1.kneeELASTICW1 = 1;
}
```



Done
What's left to do is just clean the hypergraph so that everything is nice and tiddy.

Now, grab the Reverse Foot Lock and move the foot around.