



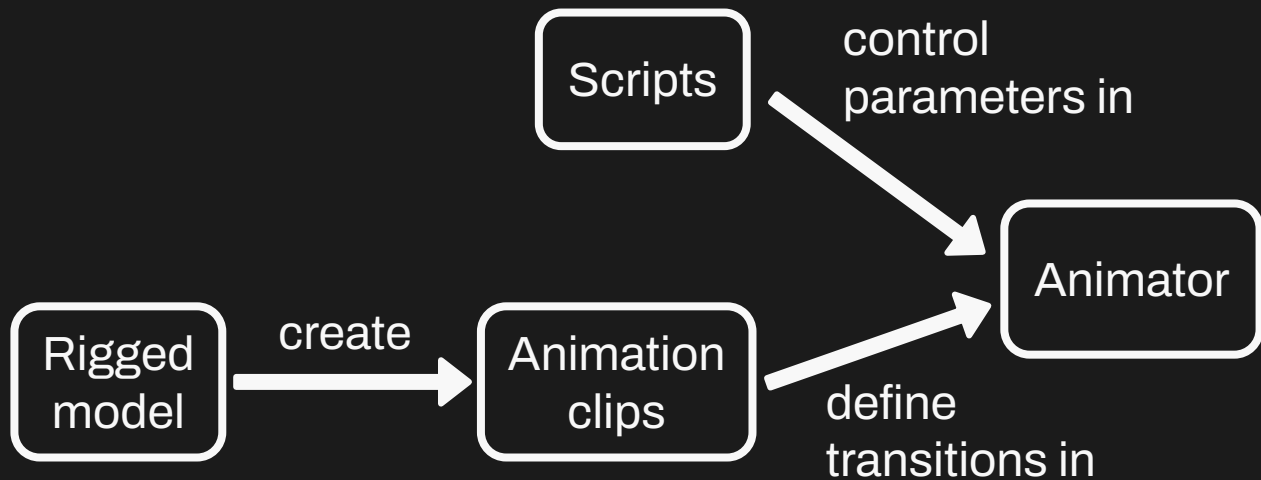
Procedural Animation

Introduction to Game Development in Unity
Spring 2026, 98-127, Lecture 9

Instructors: Jingxuan Chen, Dario Quintero, Shangyi Zhu, Jeffrey Wang

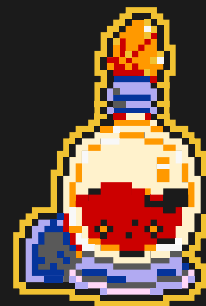
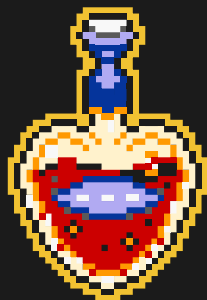


Recall animation pipeline



What if we want more interactivity?

Feet clipping through the ground? Attacks not quite connecting? Can't turn your head to look at that shiny thing?





What is procedural animation?

Procedural animation automatically generates animations based on a set of rules or algorithms.



Breaking it down...

"set of rules"



Constraints

Constraints define how transforms should react to the source transform a.k.a. effector

"automatically"

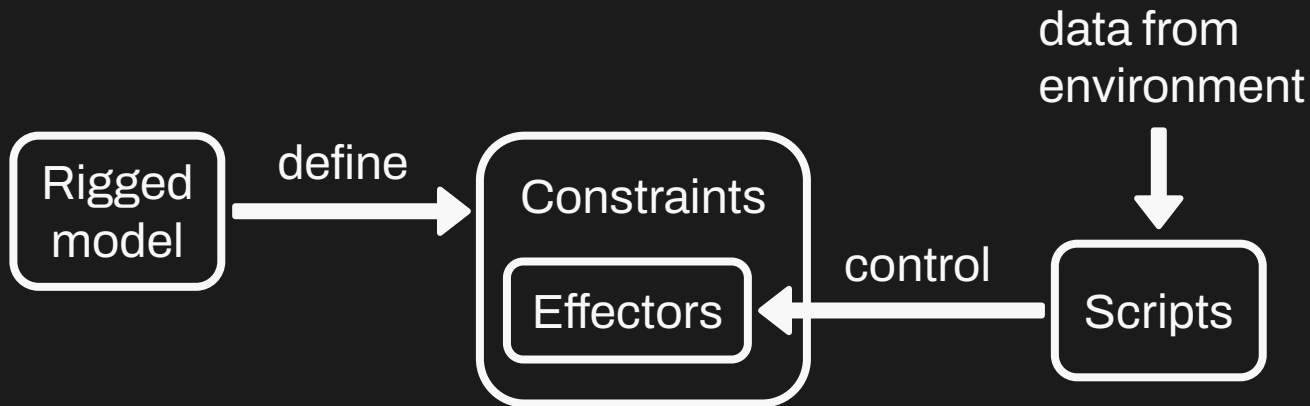


Effectors

Effectors are controlled by runtime scripts that can define how they behave in response to dynamic variables



New pipeline



Animation Rigging Package

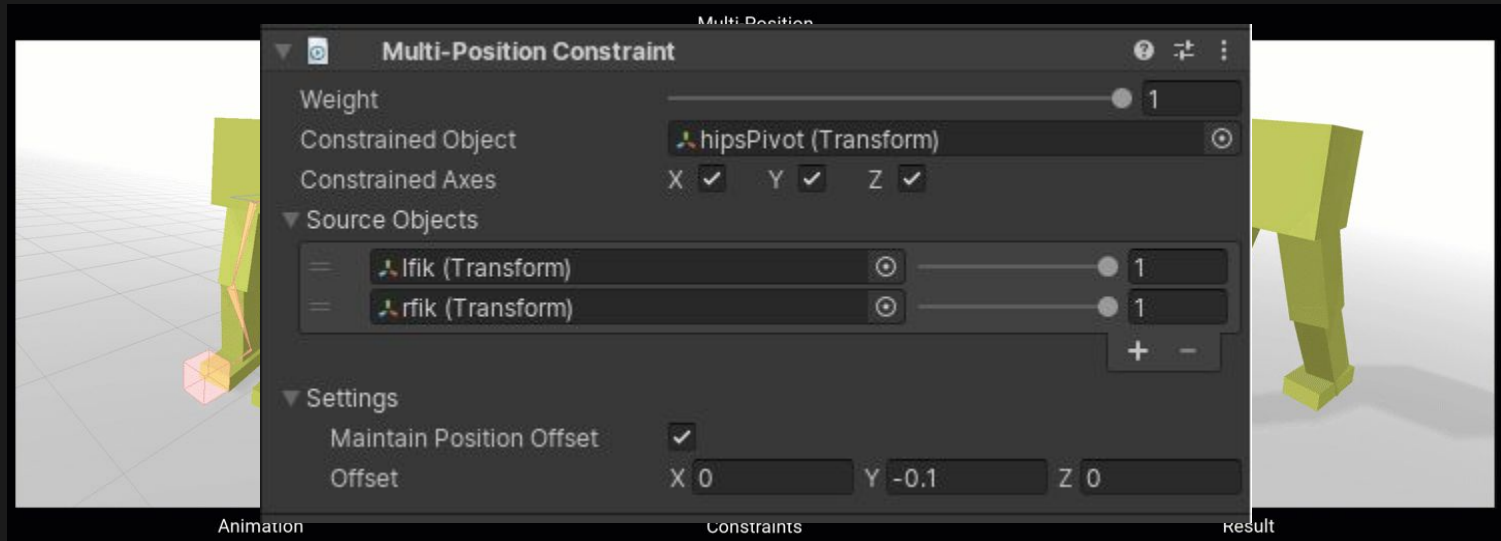
The Animation Rigging package provides a powerful set of tools to create real-time rigs in Unity, which can be used for procedural animation.

Features:

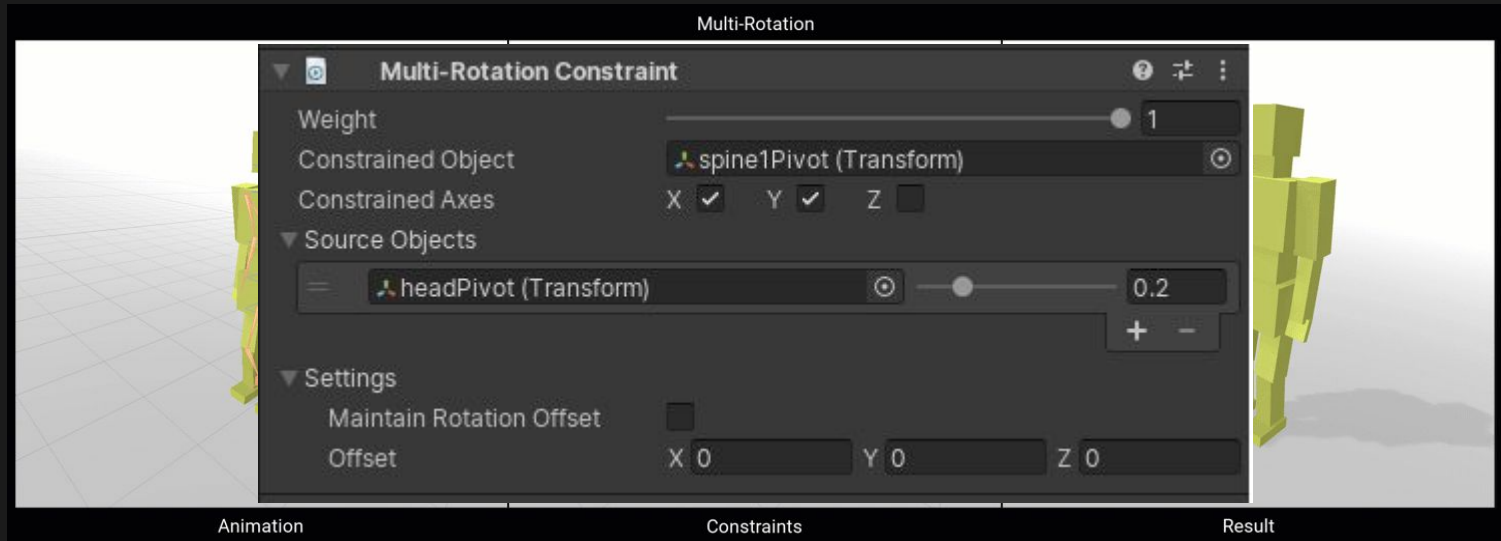
- Predefined constraints, ready to use
- **Easily blend with standard animation clips**
- Extendible with custom constraints



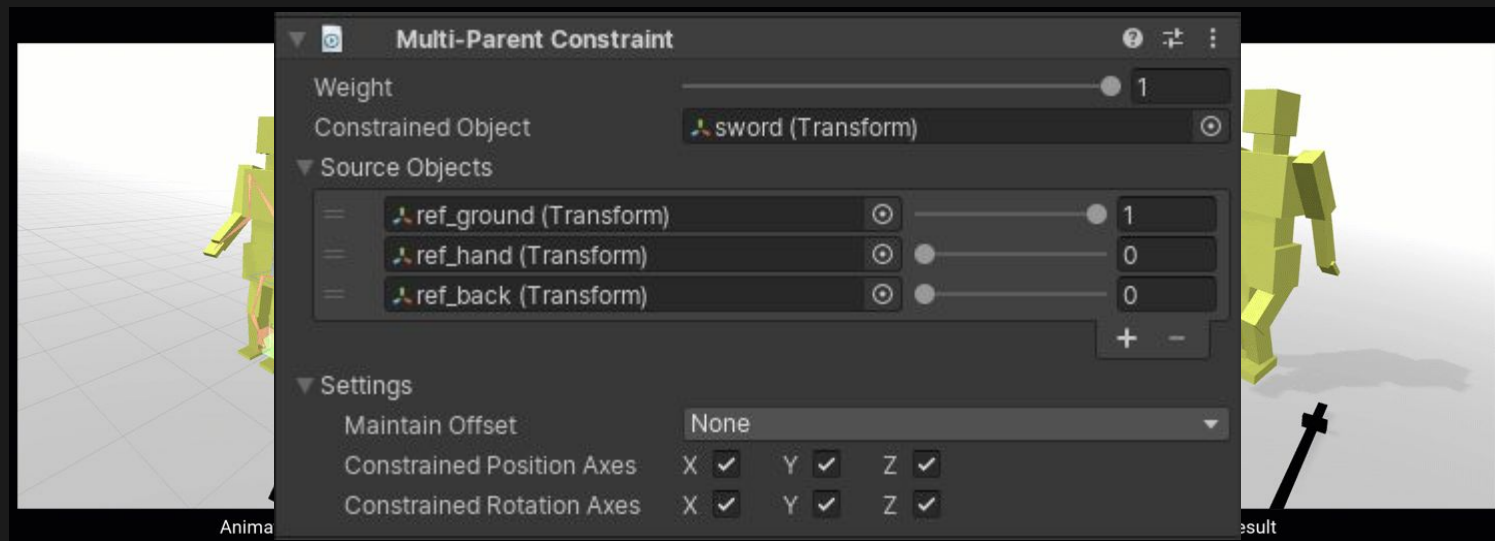
Multi-Position Constraint



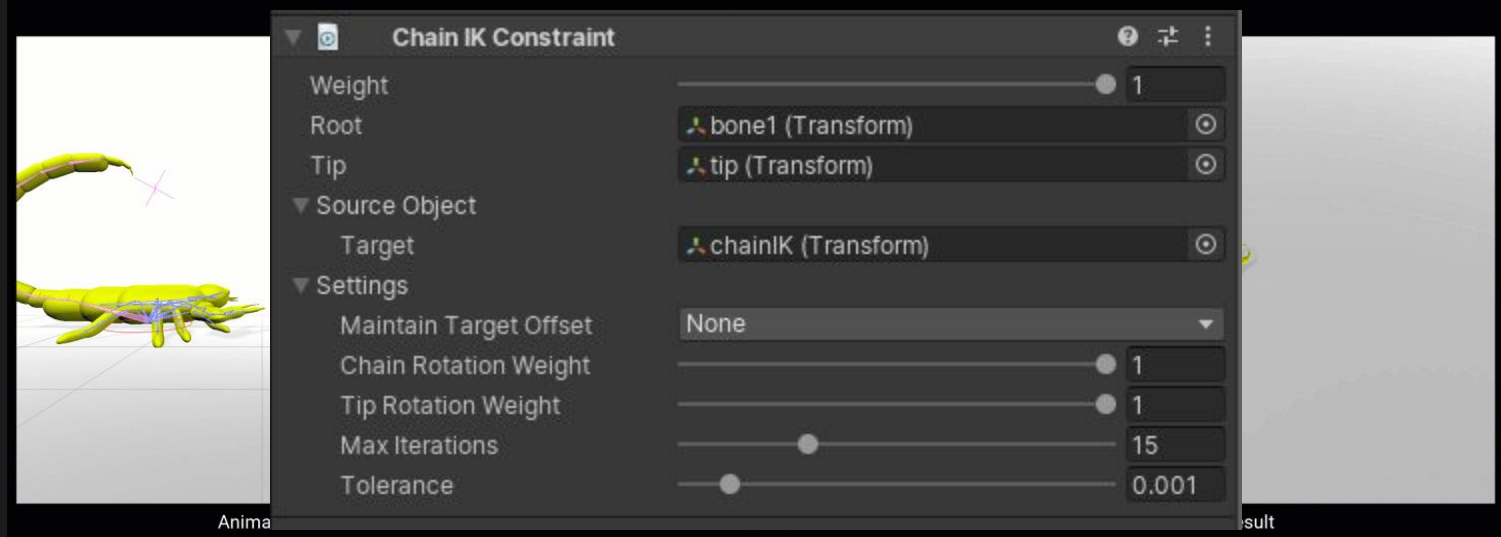
Multi-Rotation Constraint



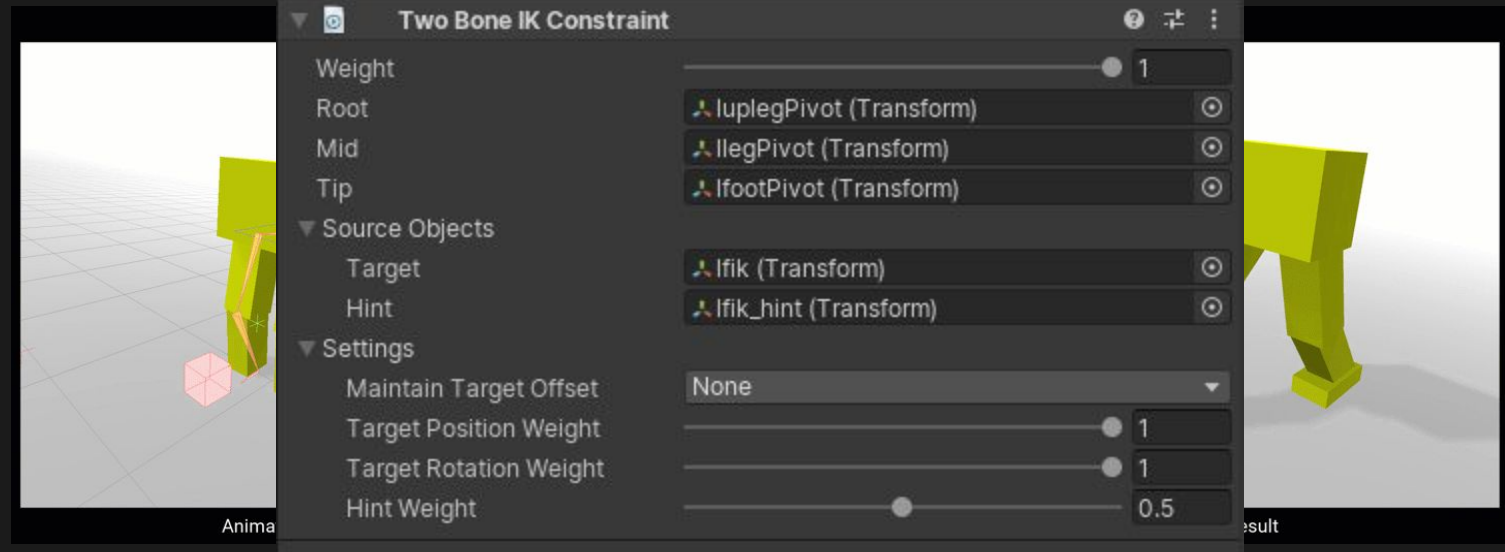
Multi-Parent Constraint



ChainIK Constraint

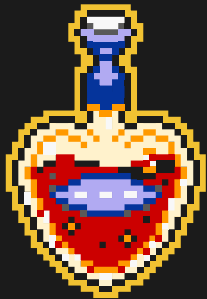
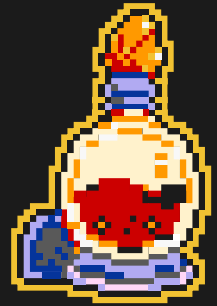


Two Bone IK Constraint



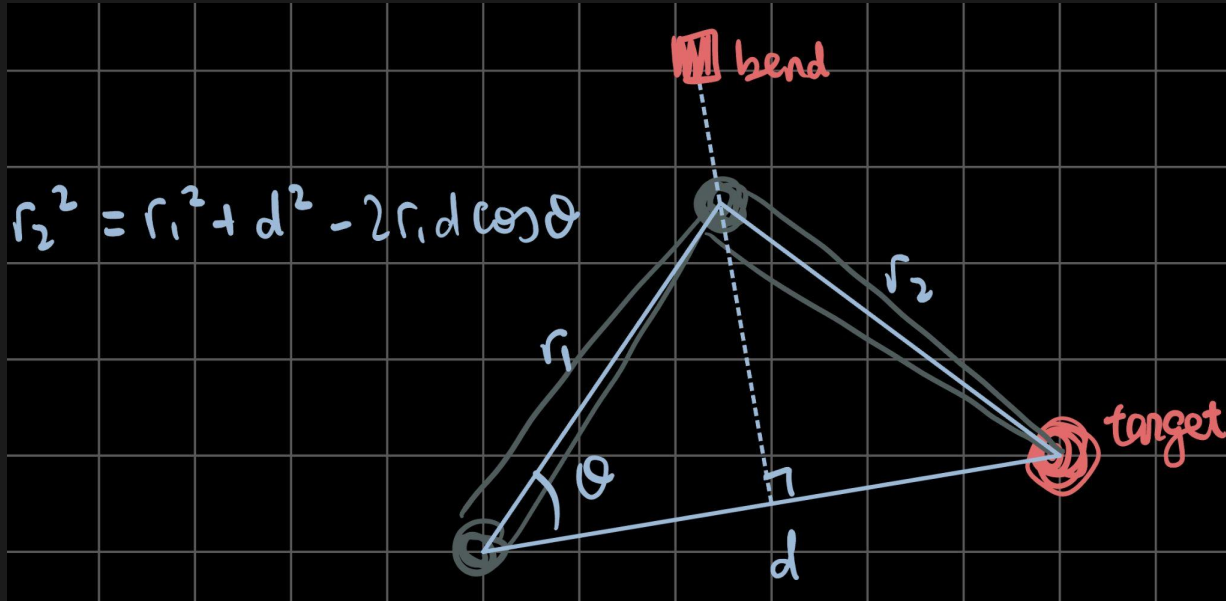
What is inverse kinematics?

The process of calculating joint positions to place the
end of a chain at a target position/rotation
We present a few common IK solvers.



Trigonometry

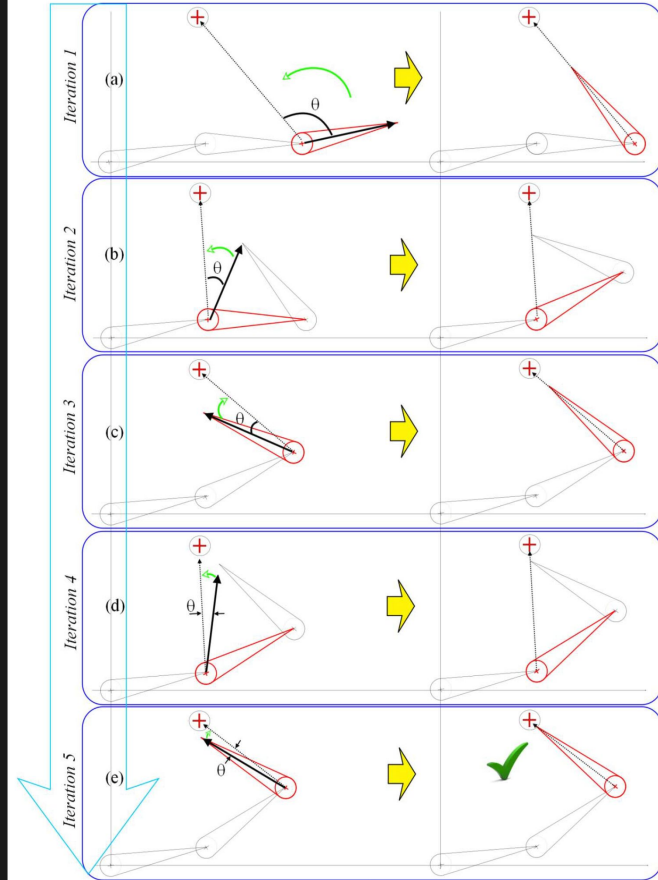
When we only have 2 bones in our chain, we can directly compute desired joint positions if we add an additional effector to indicate desired bend direction



Cyclic Coordinate Descent

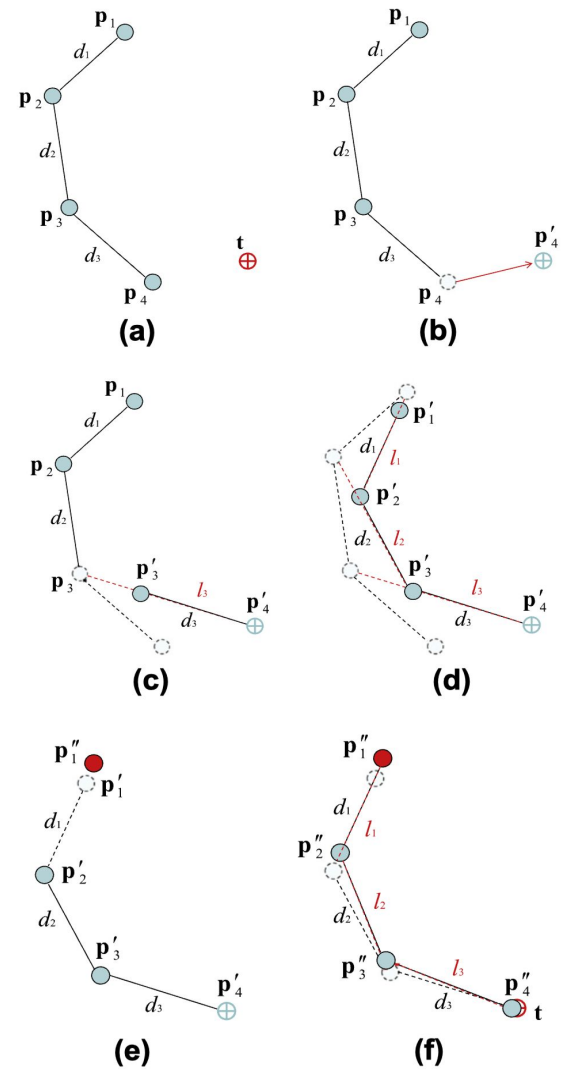
Iteratively rotate each joint in chain to be as close to target as possible

Stop when close enough or reached max iterations



FABRIK

Repeatedly “pull” end node to target position, then “pull” start node back to root position



Resources

Animation Rigging [Manual](#) and [API](#)

The Unity Asset Store has quite a few packages helping with IK solving and more, however the best packages are quite pricey. For those interested, [this video](#) provides a decent overview of the most popular ones.

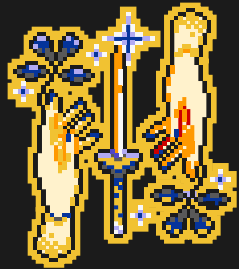
[Extending the Animation Rigging package with C#](#) (refer to 11:00-17:00 for how to write a custom constraint)



End of Lecture

Attendance taking and break time

:v



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