What is rigging?

- Adding bones, setting up bone constraints
  - Limitations on bone movement
  - Automatic behaviours (aim-at, rotate-like)

- Setting up default “poses”
  - “muscles” (positions, effects)

- Setting up combined bone and muscle poses

- Setting up sliders to control poses

- NOTE: terminology varies with software
Why rig characters?

- Easier, faster animation
- Greater productivity
- More realistic/consistent animation
  
  e.g. knees don't bend backwards
- Less animator frustration

The work of a Technical Director (TD)
Facial rigging

- Facial “muscles” for facial control
  - Facial expressions - emotions
  - Lipsynch – speech

- Study facial muscles
- Study emotions and their expression

- Limited number of mouth positions used to speak
Facial rigging

- **Bone rigs** – bones deform the surface
  - For programs that doesn't have muscles/skin
  - To a 3D program, the head is a hollow balloon

- **Muscle rigs** – muscles deform the surface
  - May or may not be connected to bones

- **Skin rigs** – deform the surface directly

- **Morph targets** – whole face variations?

- **(Mathematical) Expressions** – algorithms
More rigging concepts

- Animation:Master Smartskin = trueSpace
  muscles – surface movement dependent on bone movement

- Multi-frame poses – multiple states controlled by a single slider – different parts/rates

- Rule of thumb: make the extreme position even more extreme than you imagine you'll ever need

- Cheating – imagination supplies tweens
Facial muscle poses

- May or may not include jawbone
- Eyebrows
- Eyelids
- Mouth
  - Lips
  - Tongue
  - Cheeks
  - Nose “wings”
- Emotion / lipsync
Body rigging

- Primarily skeletal
  - and related movement (e.g. bicep bulges)
- Some muscle / skin / morph targets
  - e.g. Breathing

Bone rigging

- Used for normal skeletal movement
- A study of anatomy is very useful
  - Especially when animating animals
Skeletal muscle pose

- Muscle / skin / expression / morph target
- Bicep muscle bulges as arm bends
- Bone and muscle actions may be combined or separate
- Like face, can be done with bones alone (plus constraint rigging)
Body rigging - bones

- Forward kinematics
- Inverse kinematics (IK)
- Locking (feet/hands)
- Constraints
  - Angle (relative to parent) - knees/elbows
  - Path constraint - walk
  - Surface constraint
- Degree of constraint
  - Percentage
Body rigging – more bone constraints

- Relative to other bones
  - Aim At - eyes
  - Orient Like - knees
  - Roll Like
  - Aim Roll At
  - Translate To - hold
  - Scale Like
- Joint stiffness
Rotational constraints

- Stop knee or elbow bending backwards or sideways
- Stop knee or elbow twisting, leading to serious surface (skin) deformation
Bone constraints: locking

- Hold bone in place (can affect other bones in Inverse Kinematic chain)
- Commonly used to anchor the feet or hands
Bone constraints: Path / surface

- Good for moving an entire character or object (e.g. Vehicle)
- Could also be used for e.g. moving a pupil over the surface of an unevenly shaped eye
High-tech bone constraints

- Dynamics/ragdoll – secondary bone movement based on movement of parent bone
  - Stiffness, damping

- Inter-object rigging
  - A light can move with a character
  - A light can move to follow a character
  - A character can pick up and put down objects
  - May be a different interface to rigging within a character
Rigging completed ...

... ready to animate!