Motion Modeling

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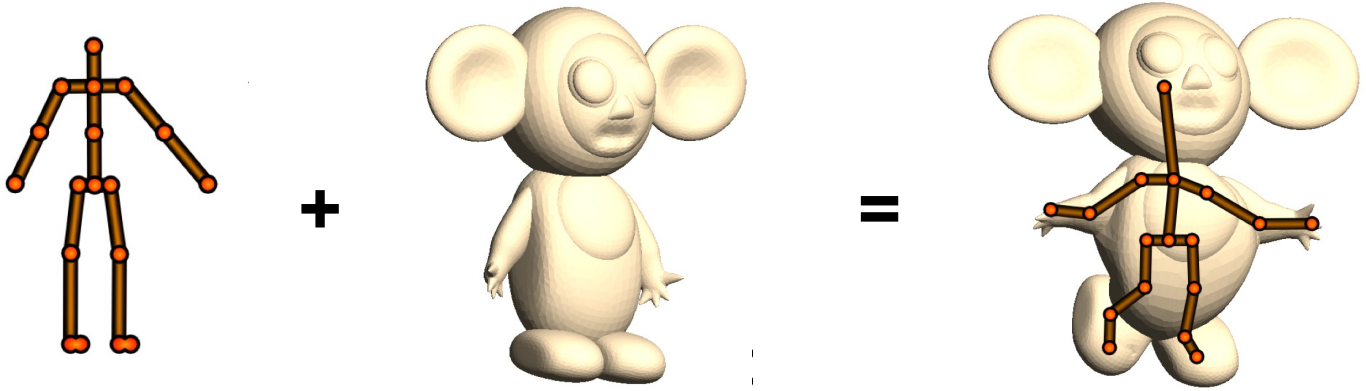
Modeling Human Motion

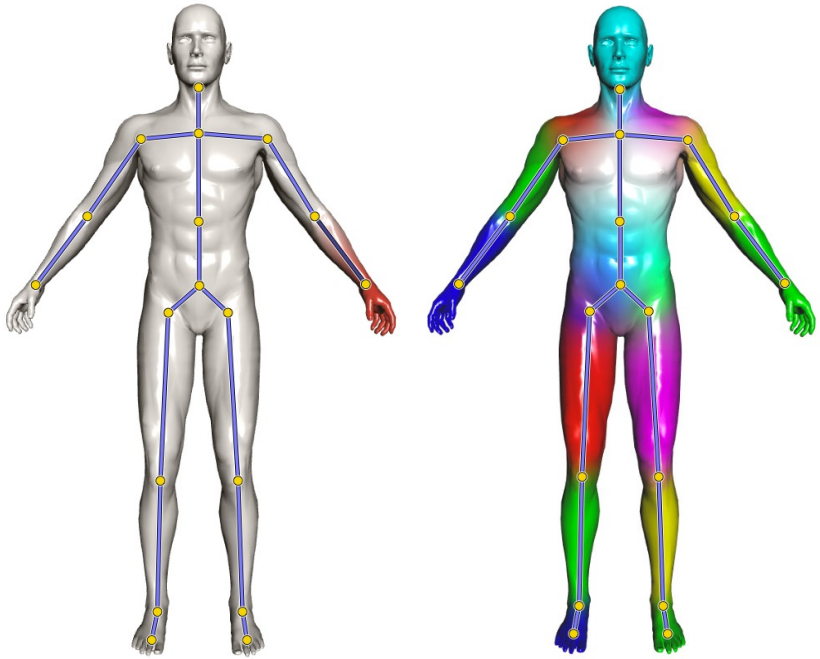
Articulated Motion

- Rigging
  - Attaching a skeleton to a model
  - Skeleton is key-framed to move the model



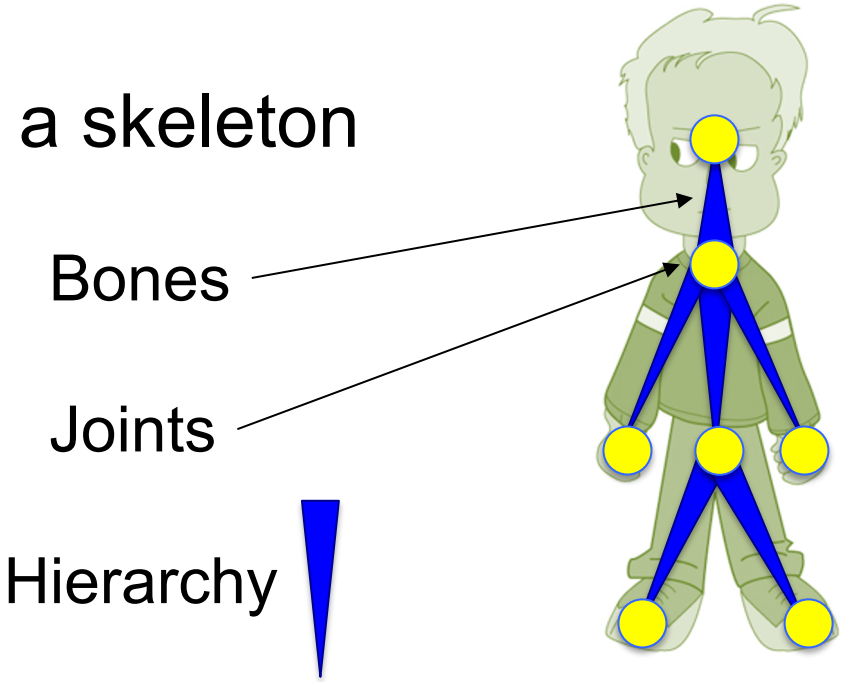
Articulated Motion

- Rigging
  - Embed the skeleton
  - Attach the bones to the model



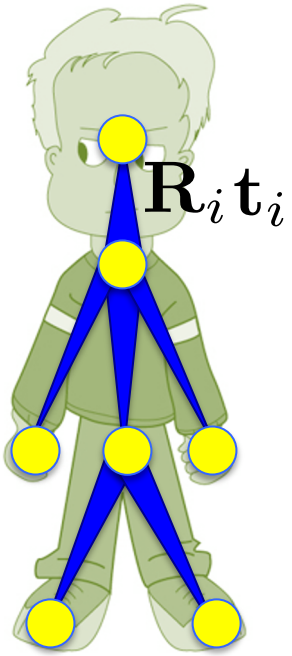
Articulated Motion

- Rigging
  - What is a skeleton



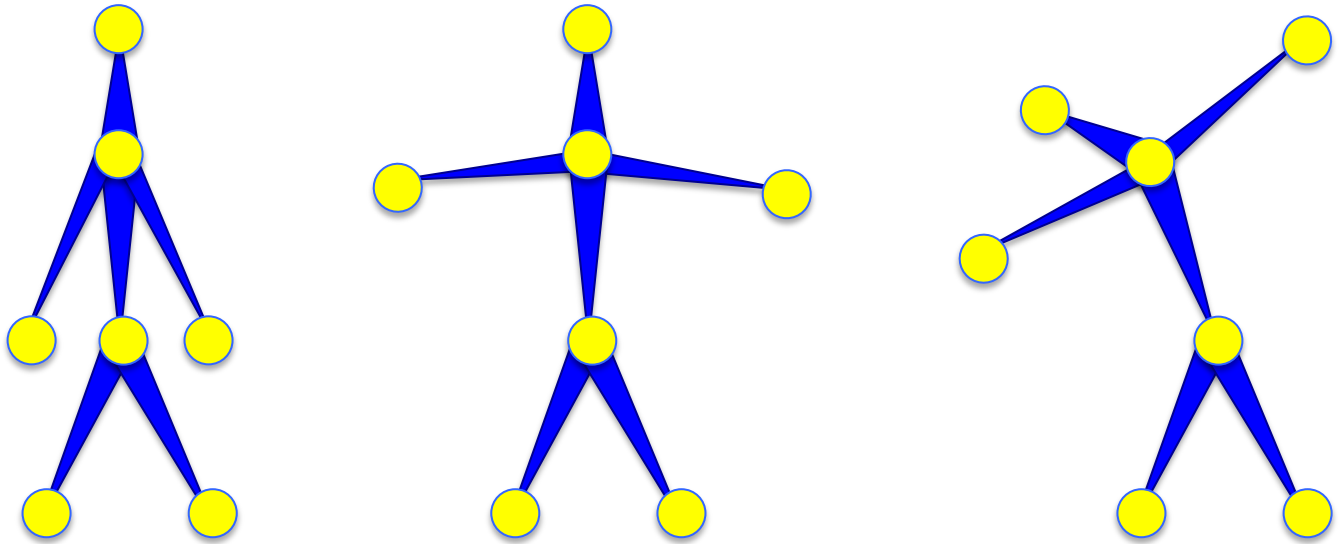
Articulated Motion

- Rigging
  - What is stored in a skeleton
    - Rigid transformations
    - On bones or joints
    - Bones can be transformed rigidly



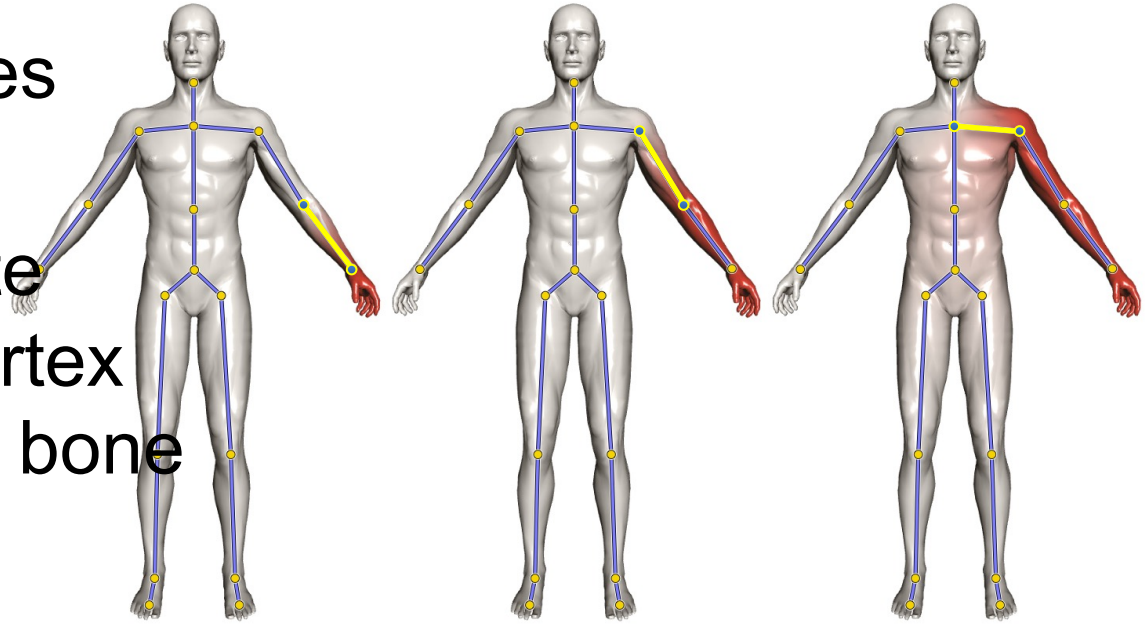
Articulated Motion

- Rigging
  - Bones can be transformed rigidly



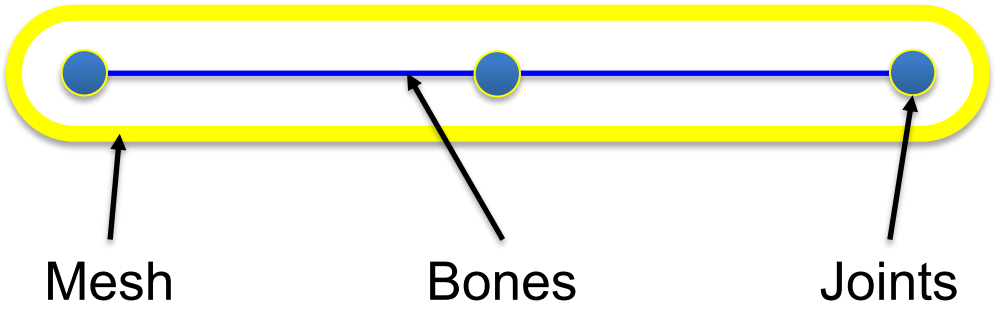
Articulated Motion

- Rigging
  - Attach the bones to the model
  - Weights indicate how much a vertex is effected by a bone



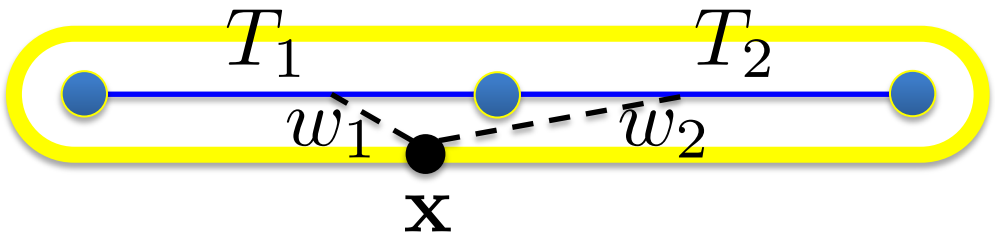
Articulated Motion

- Rigging
  - Attach the bones to the model



Articulated Motion

- Rigging
  - Attach the bones to the model



$$T(\mathbf{x}) = \text{avg}(T_1, T_2, w_1, w_2)$$

Articulated Motion

- Rigging
  - How to blend (average) transformations

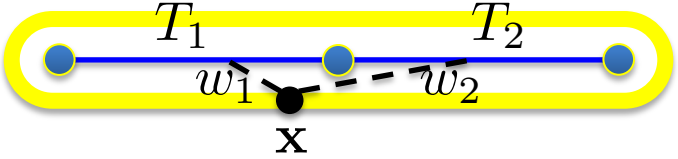
    Linear Blend Skinning

    Represent T_i with $\mathbf{T}_i$

    in homogenous coordinates

$$\mathbf{T}(\mathbf{x}) = w_1(\mathbf{x})\mathbf{T}_1 + w_2(\mathbf{x})\mathbf{T}_2$$

$$\mathbf{x}' = \mathbf{T}(\mathbf{x})\mathbf{x}$$



$$T(\mathbf{x}) = \text{avg}(T_1, T_2, w_1, w_2)$$

Articulated Motion

- Rigging
  - How to blend (average) transformations

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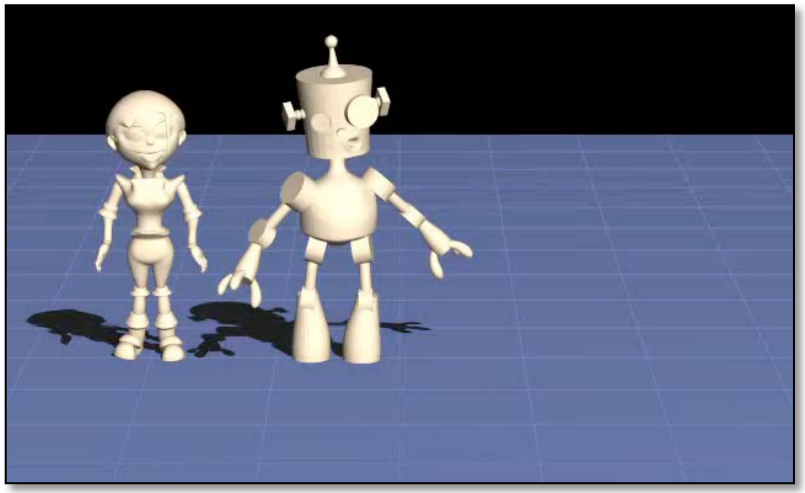
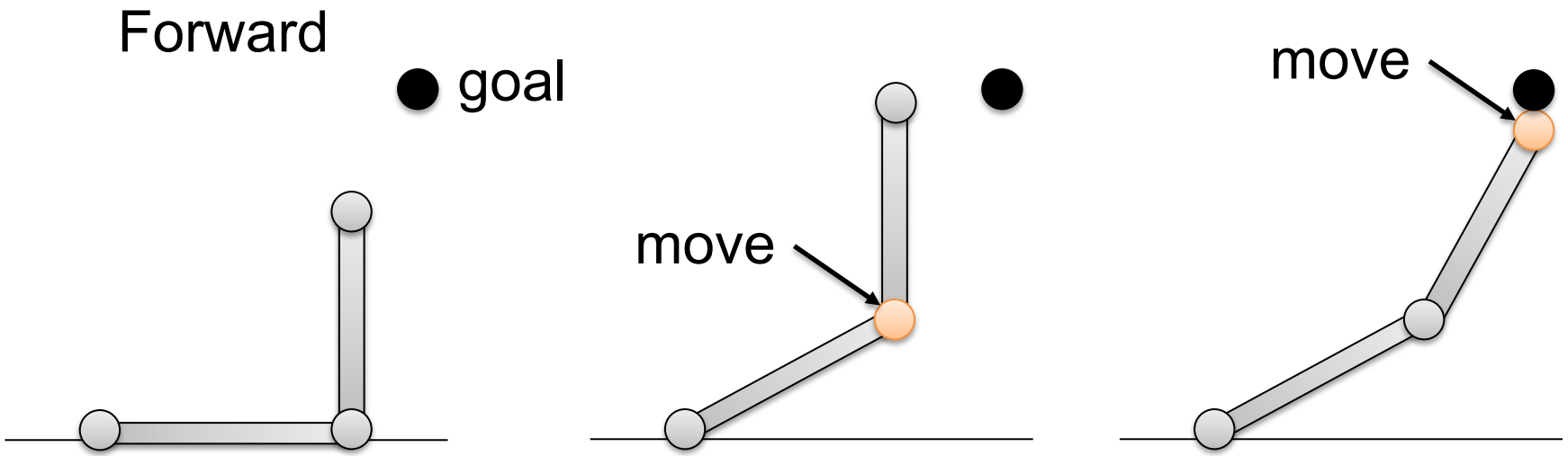


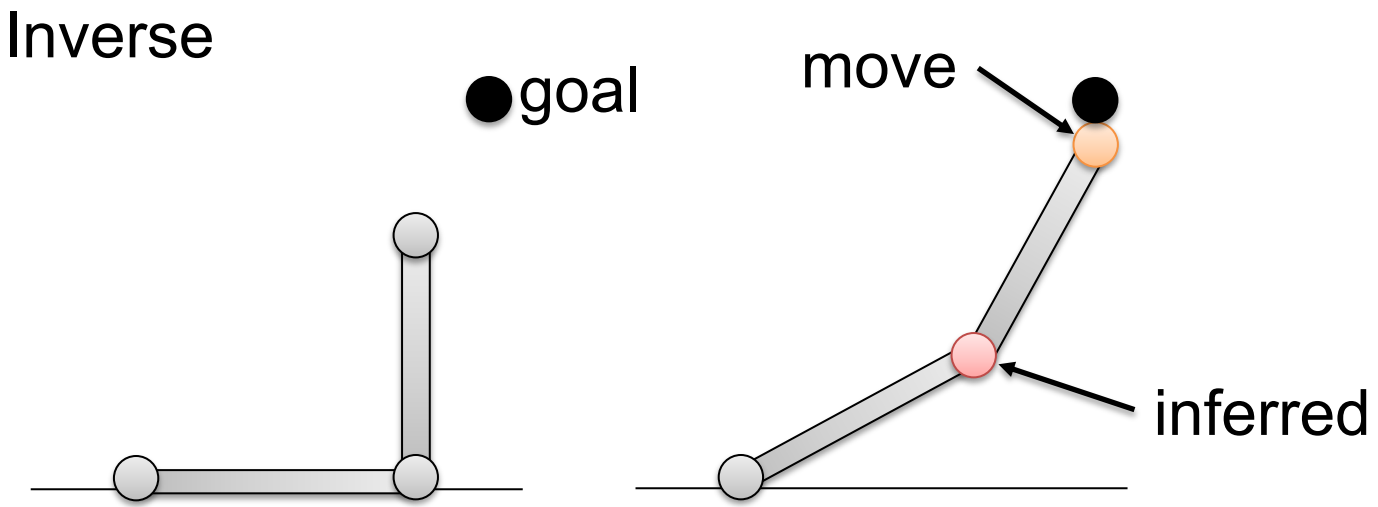
Articulated Motion

- Forward vs. inverse kinematics



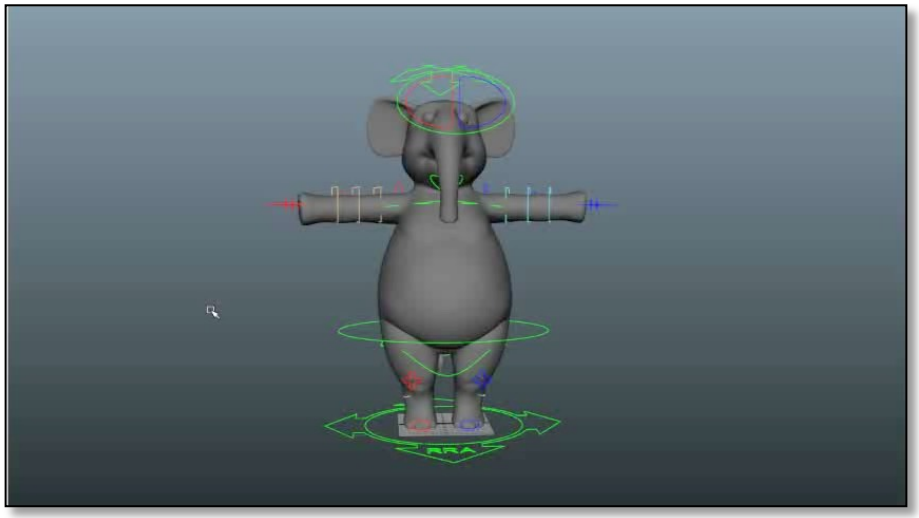
Articulated Motion

- Forward vs. inverse kinematics



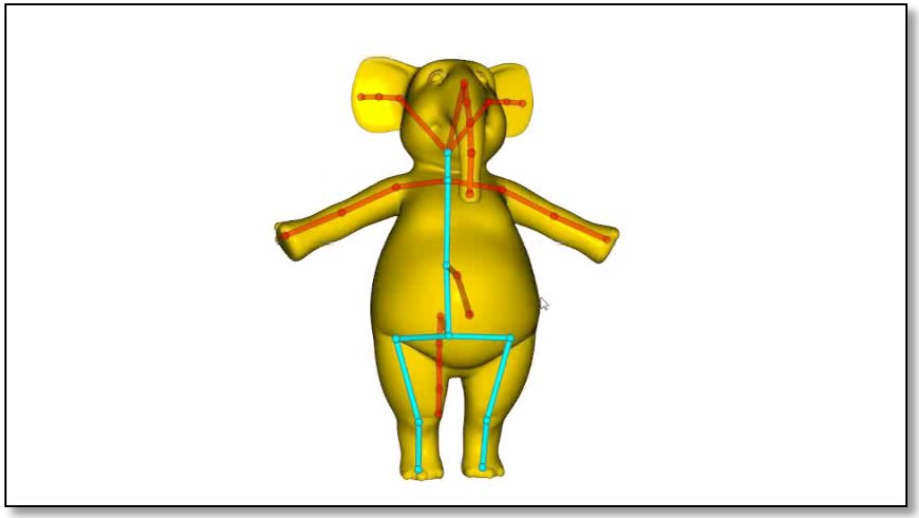
Articulated Motion

- Controllers
  - Classical controllers e.g. in Autodesk Maya



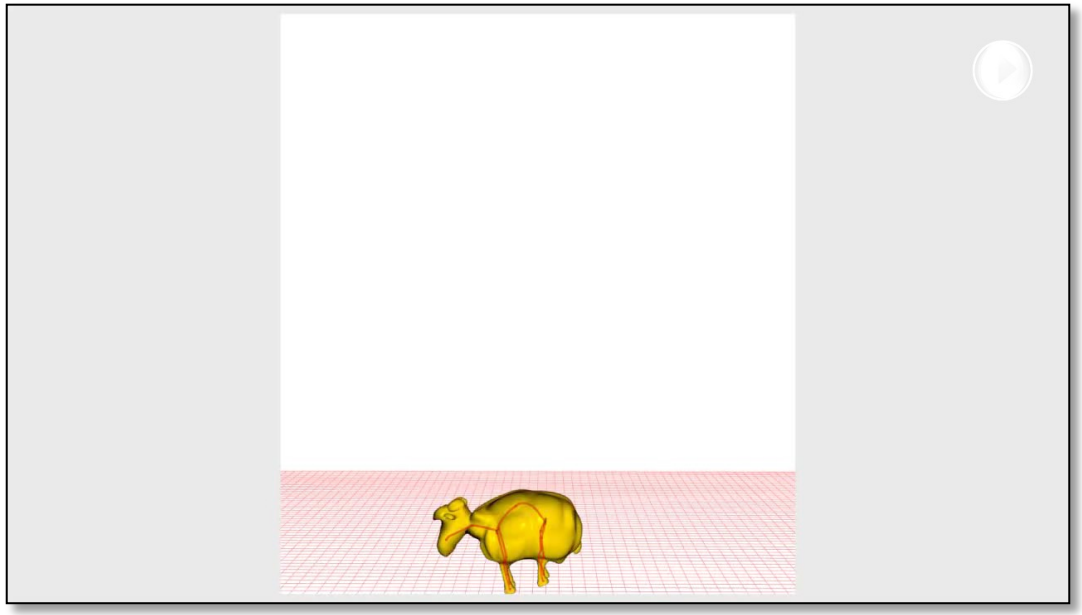
Articulated Motion

- Controllers
  - Sketch-based controllers



Articulated Motion

- Key-framing controllers



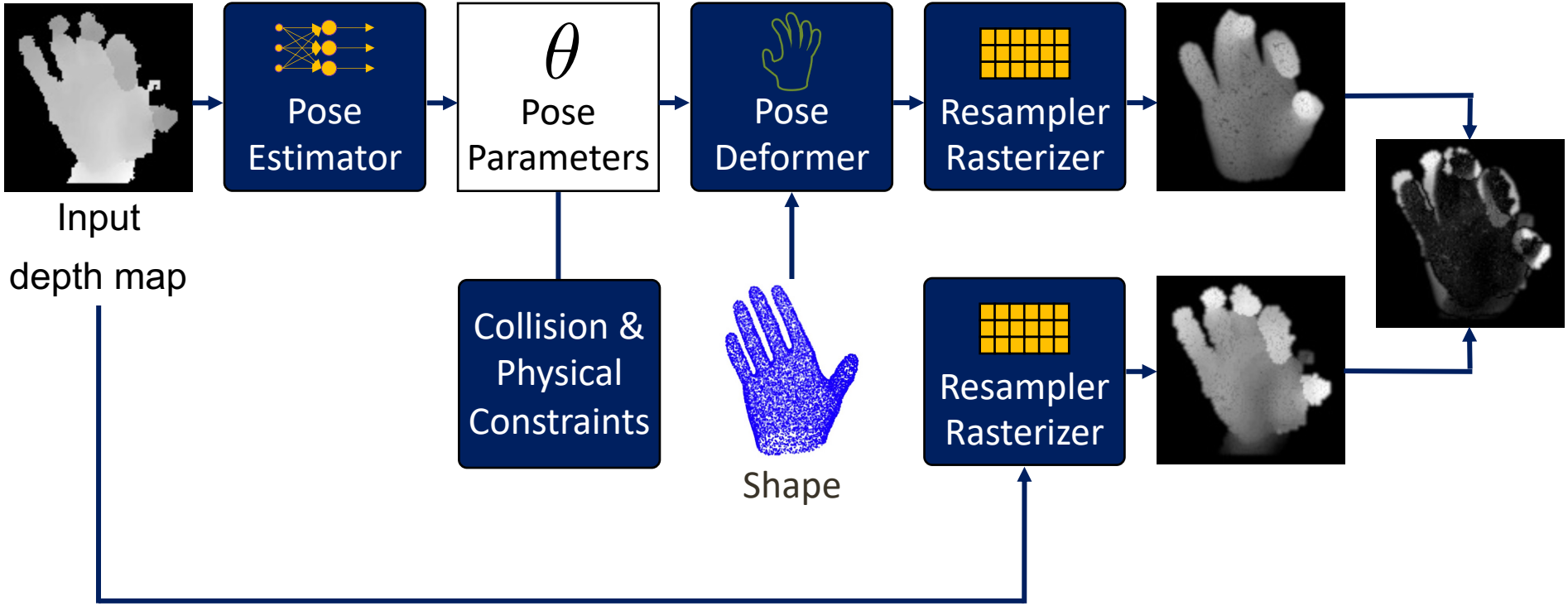
Motion Capture

- Special suits with markers
- Controlled
  - Lighting
  - Cameras
- Track markers
- Real-time monitoring

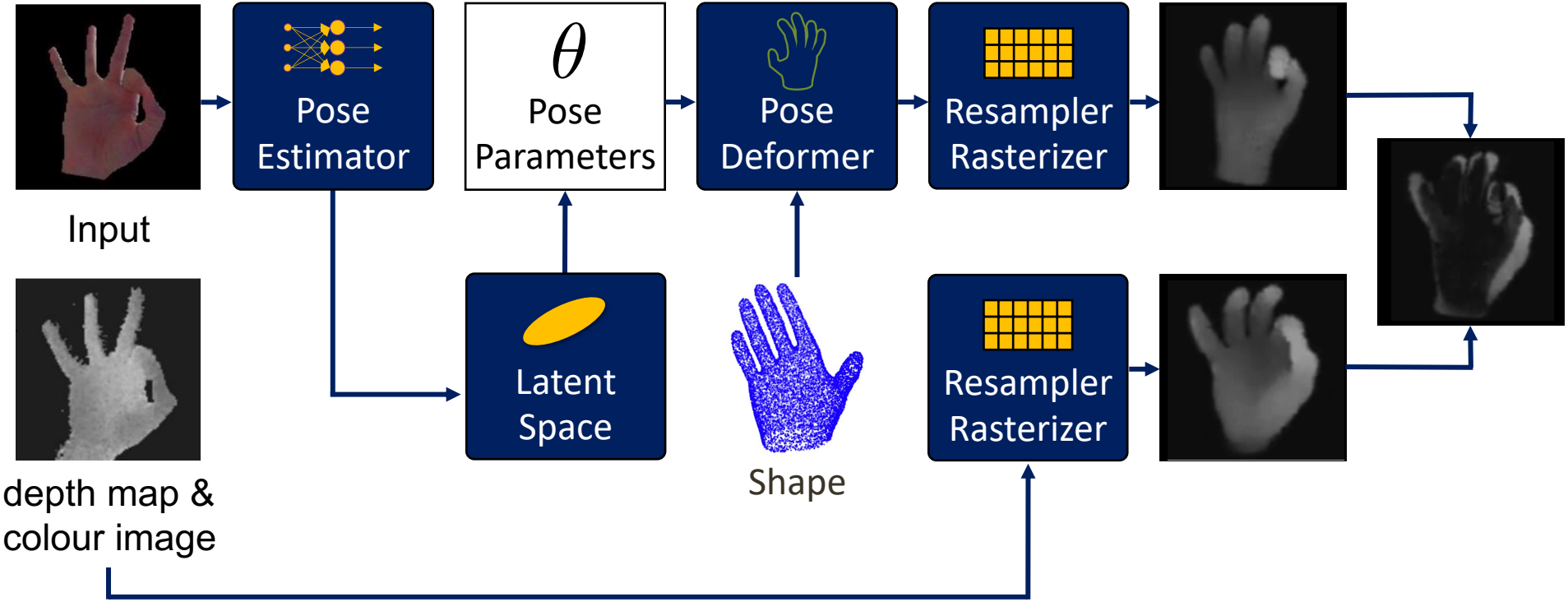
Motion Capture

- Motion capture

Motion Estimation

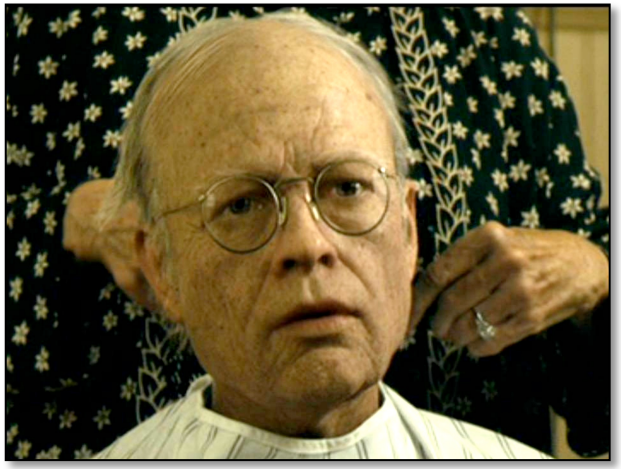


Motion Estimation



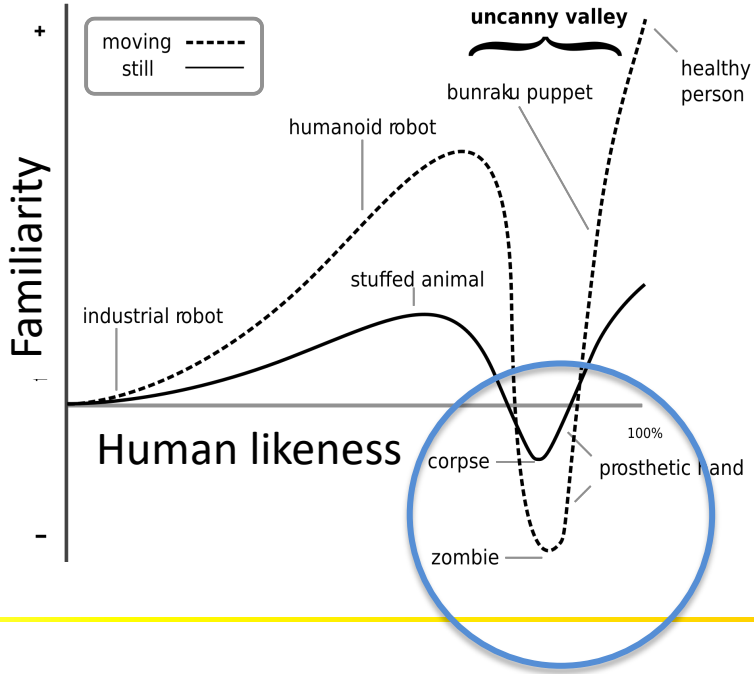
Facial Motion

- Face is the most delicate part of a character
- Hard not to fall into the uncanny valley



Facial Motion

- The uncanny valley: don't fall into it



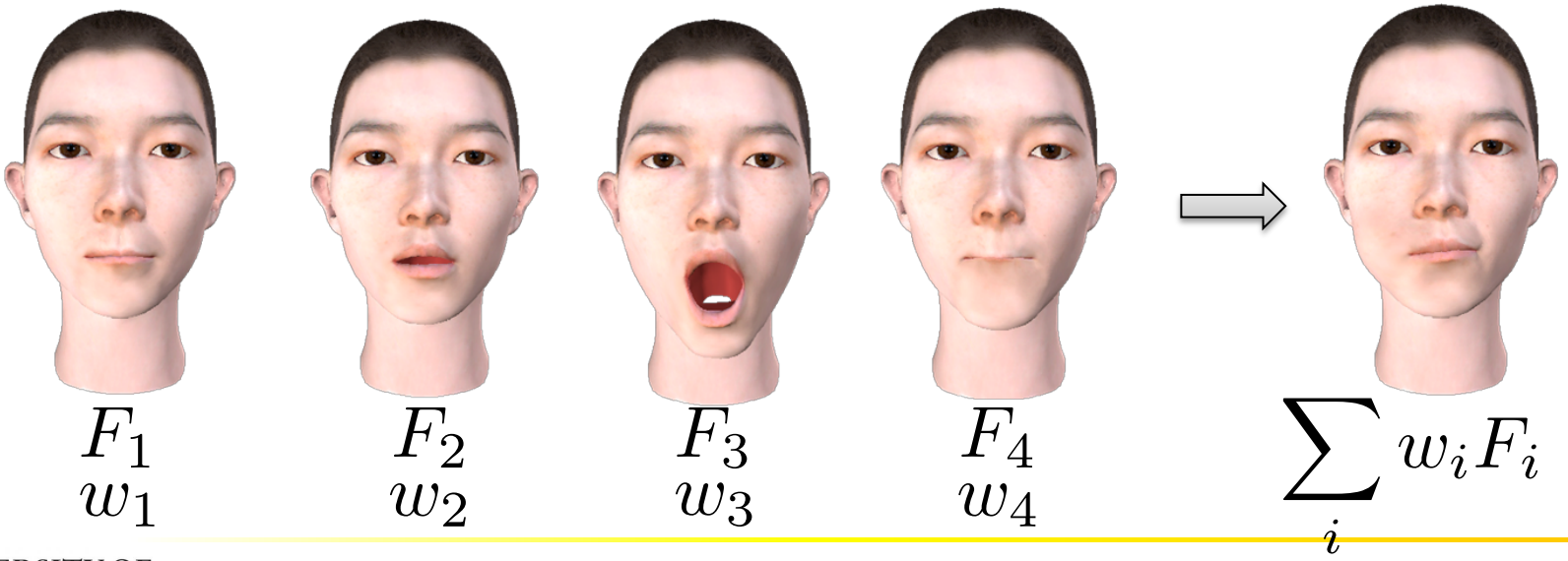
Facial Motion

- How can we control facial animation
- Blendshapes
  - Provides a linear space of facial expessions

Facial Motion

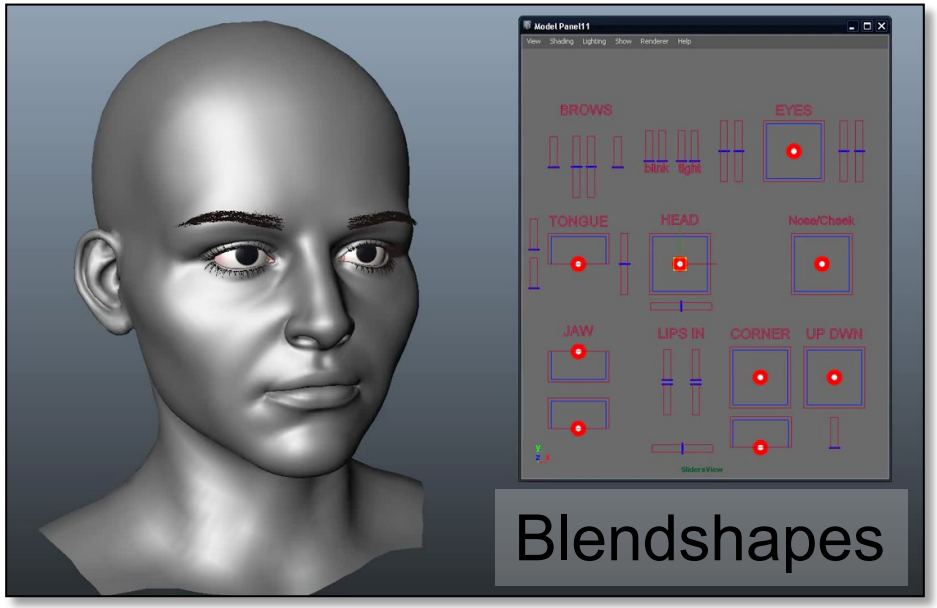
- How can we control facial animation

  Blendshapes



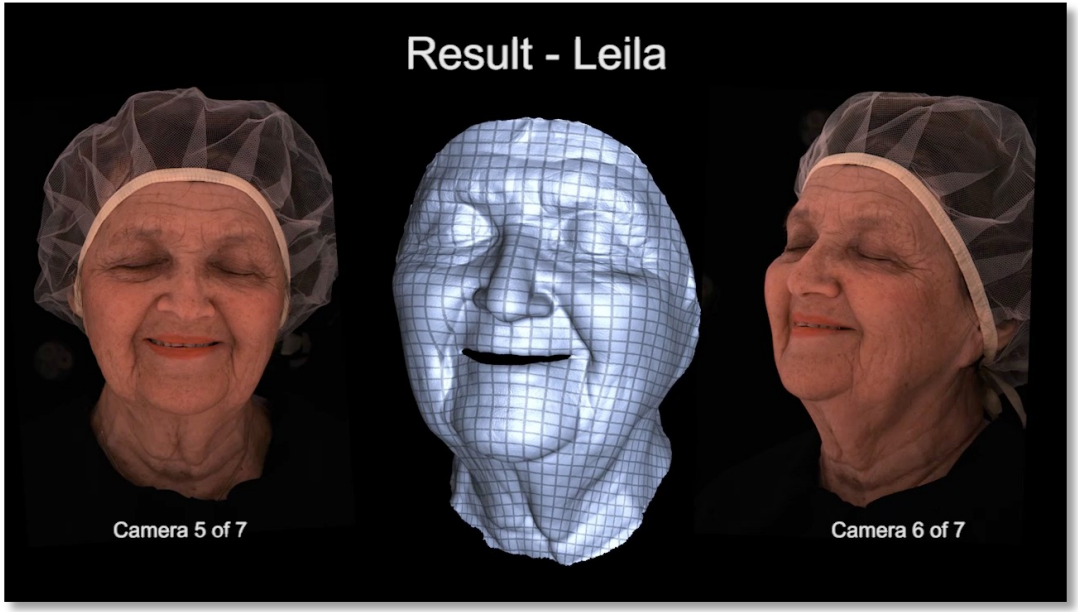
Facial Motion

- How can we control facial animation



Facial Motion Capture

- Fine scale details
  - Solution: Capture



Facial Motion Capture

- Fine scale details
  - Solution: Capture
  - Use as examples to define shape spaces, e.g. with blendshapes