

Motion Modelling

Prof Cengiz Öztireli

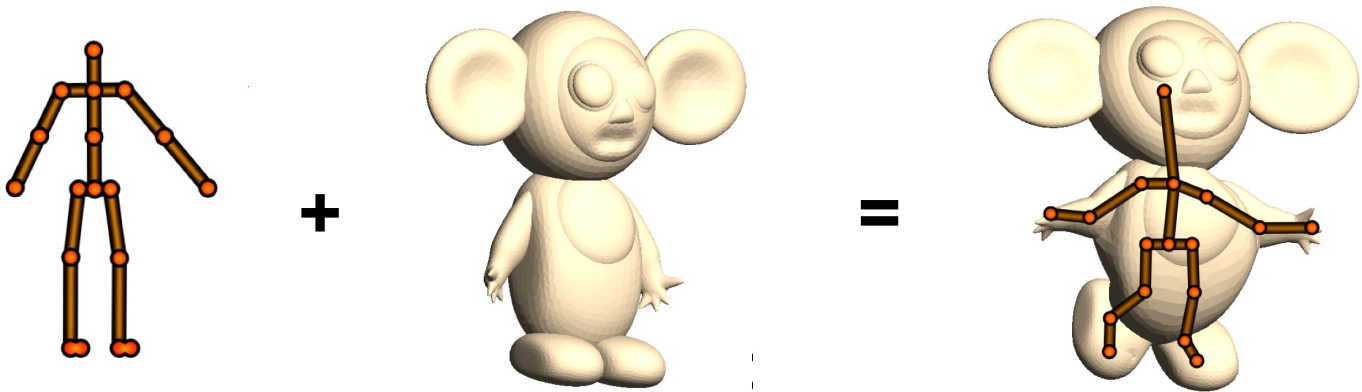




Modeling Human Motion

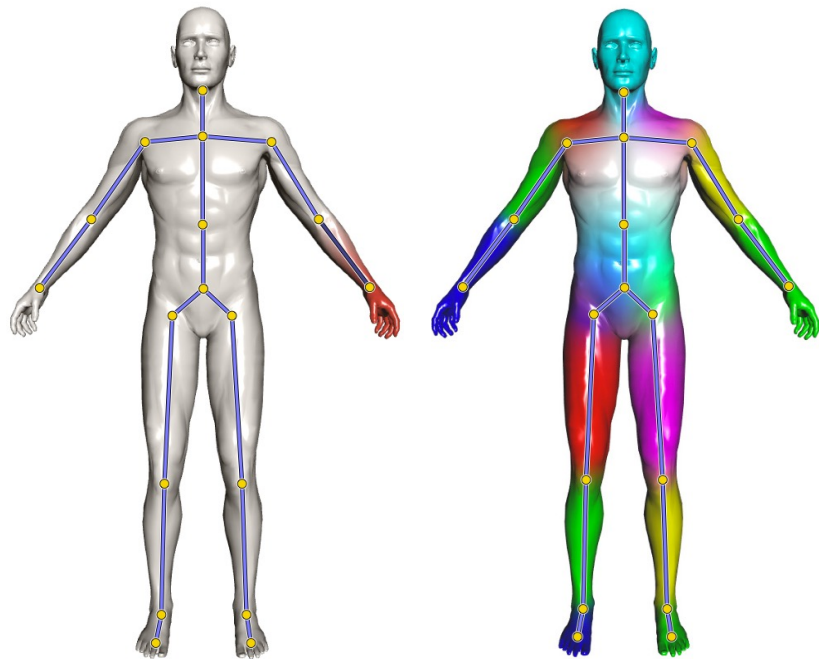
Articulated Motion

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



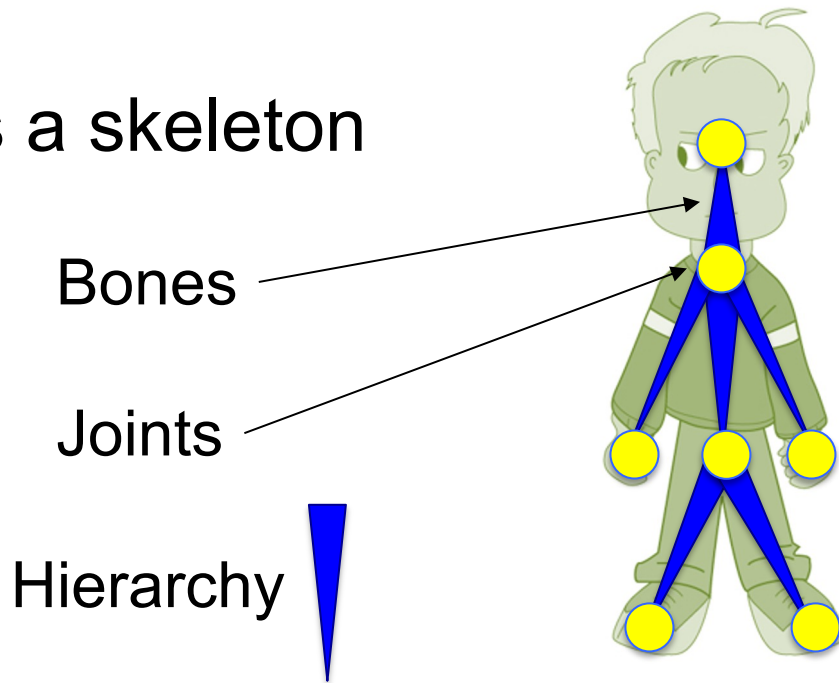
Articulated Motion

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



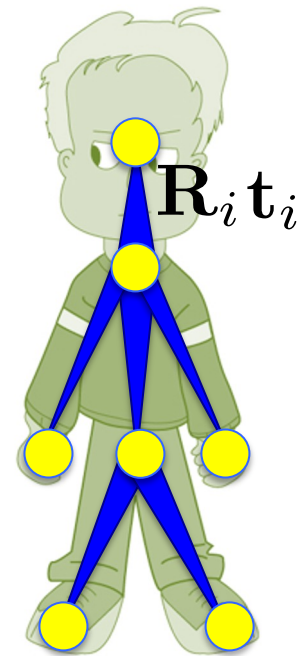
Articulated Motion

- Rigging
 - What is a skeleton



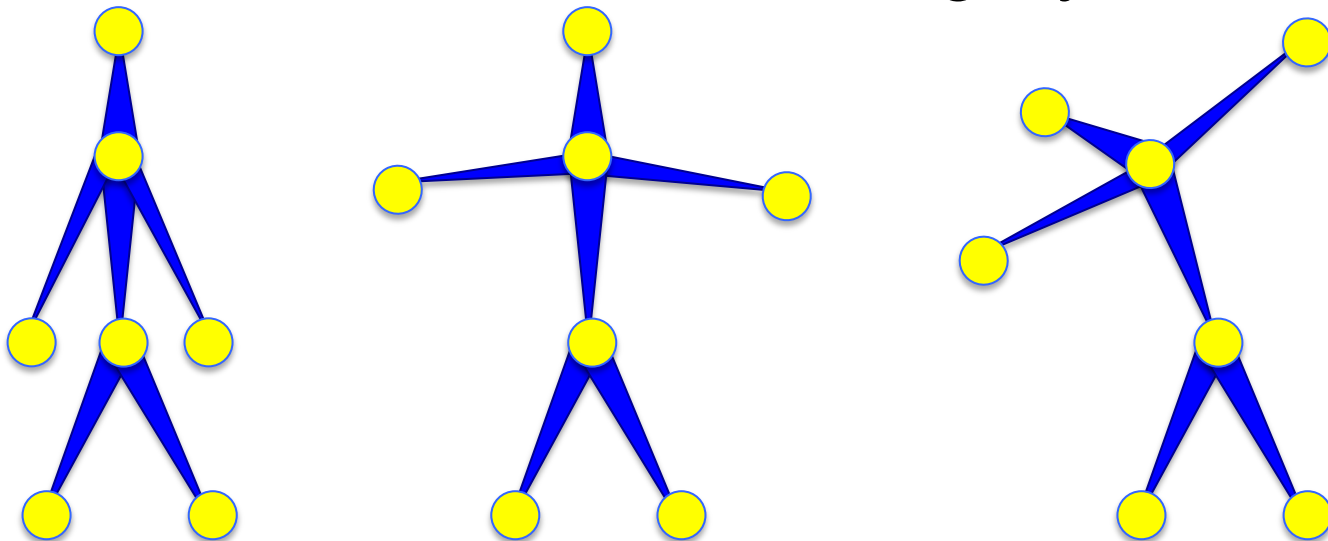
Articulated Motion

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



Articulated Motion

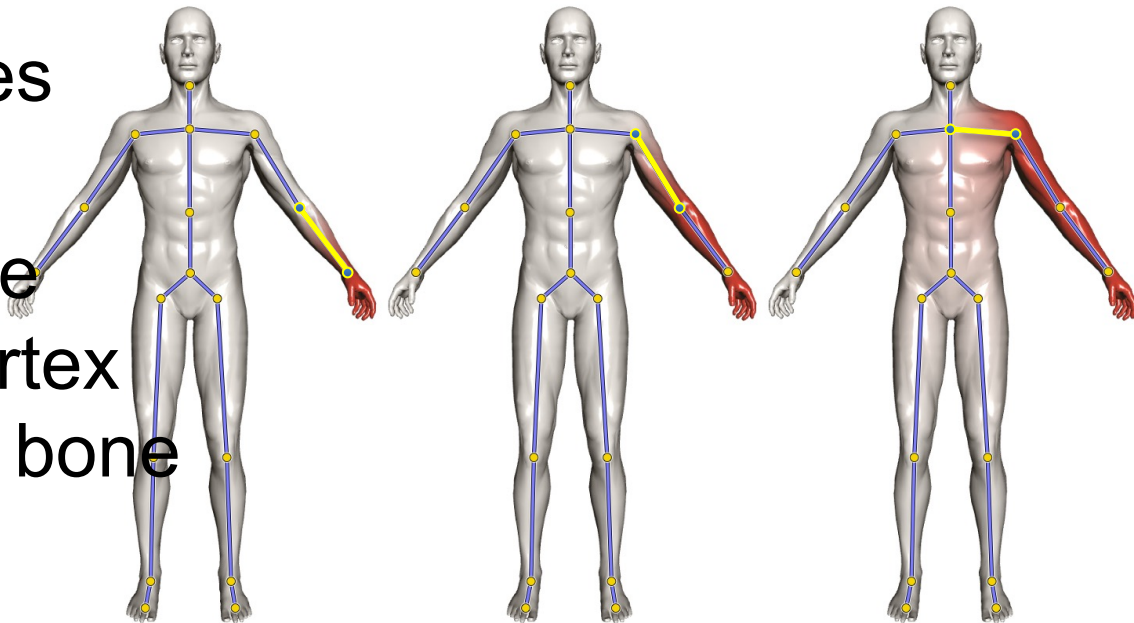
- Rigging
 - Bones can be transformed rigidly



Articulated Motion

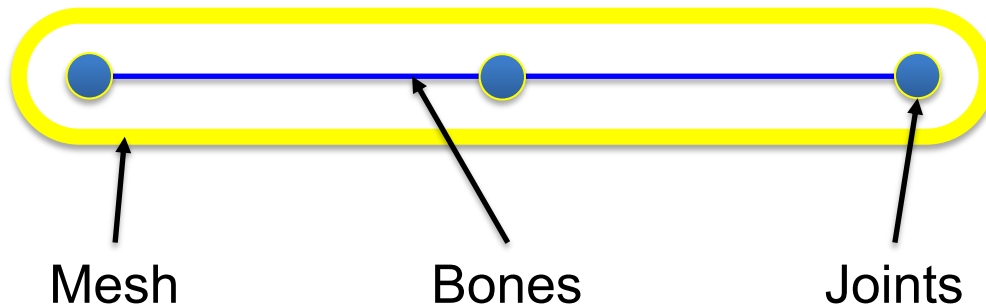
- Rigging

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



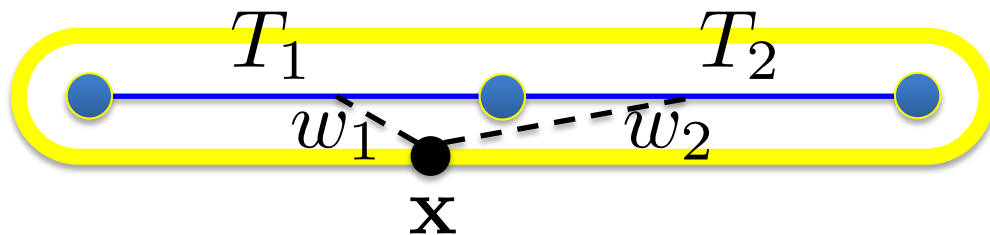
Articulated Motion

- 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

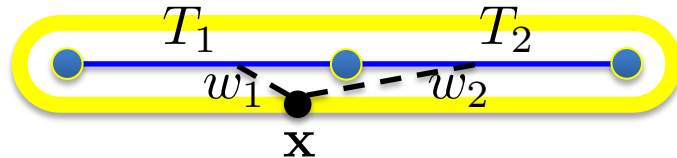
- Rigging
 - How to blend (average) transformations

Linear Blend Skinning

Represent T_i with \mathbf{T}_i
in homogenous coordinates

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

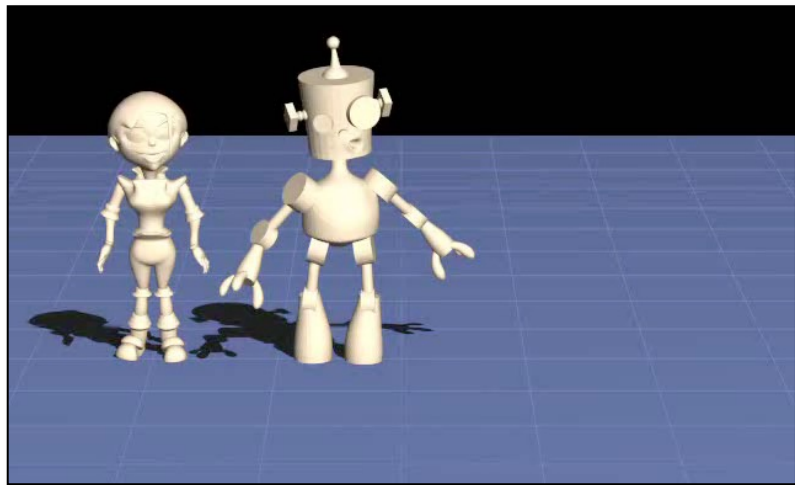
$$\mathbf{x}' = \mathbf{T}(\mathbf{x})\mathbf{x}$$



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

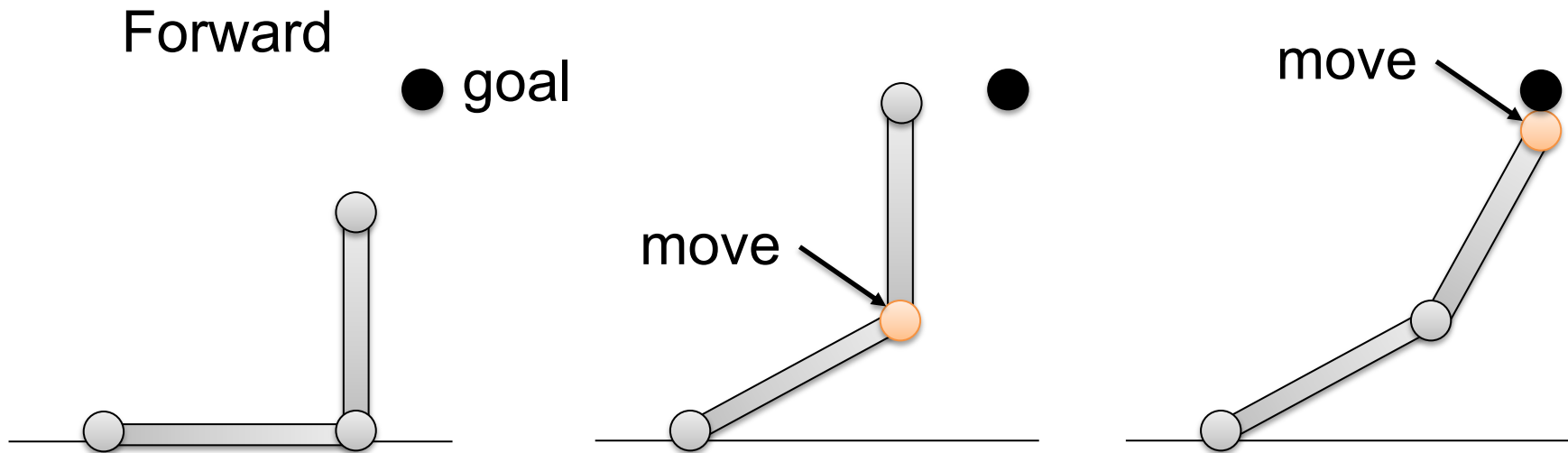
Articulated Motion

- Rigging
 - How to blend (average) transformations
- Linear Blend Skinning



Articulated Motion

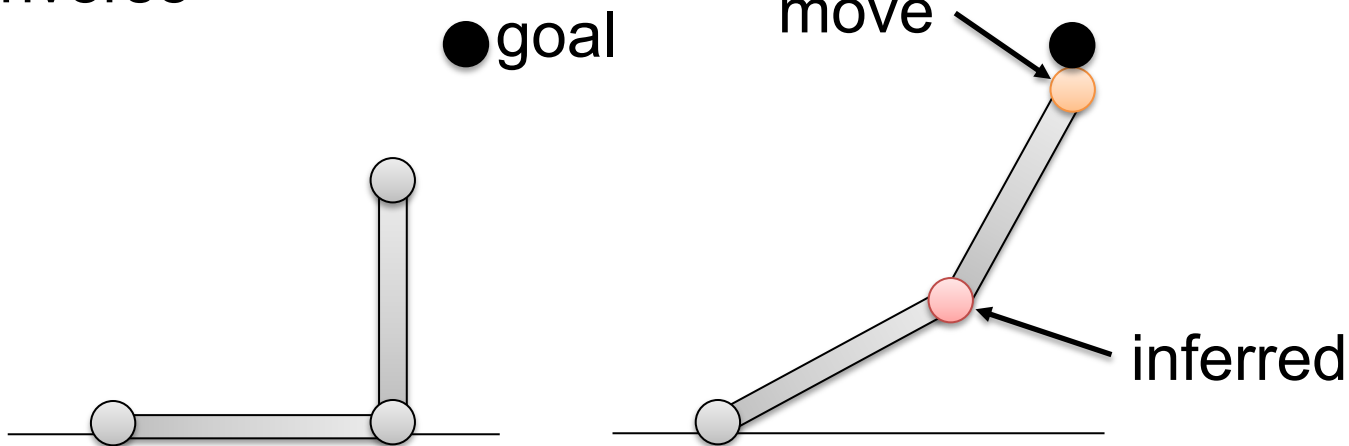
- Forward vs. inverse kinematics



Articulated Motion

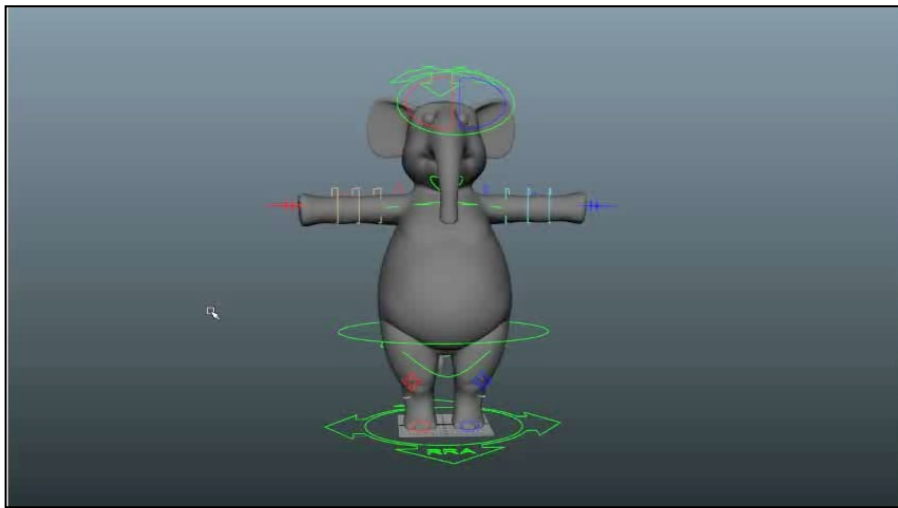
- Forward vs. inverse kinematics

Inverse



Articulated Motion

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



Motion Capture

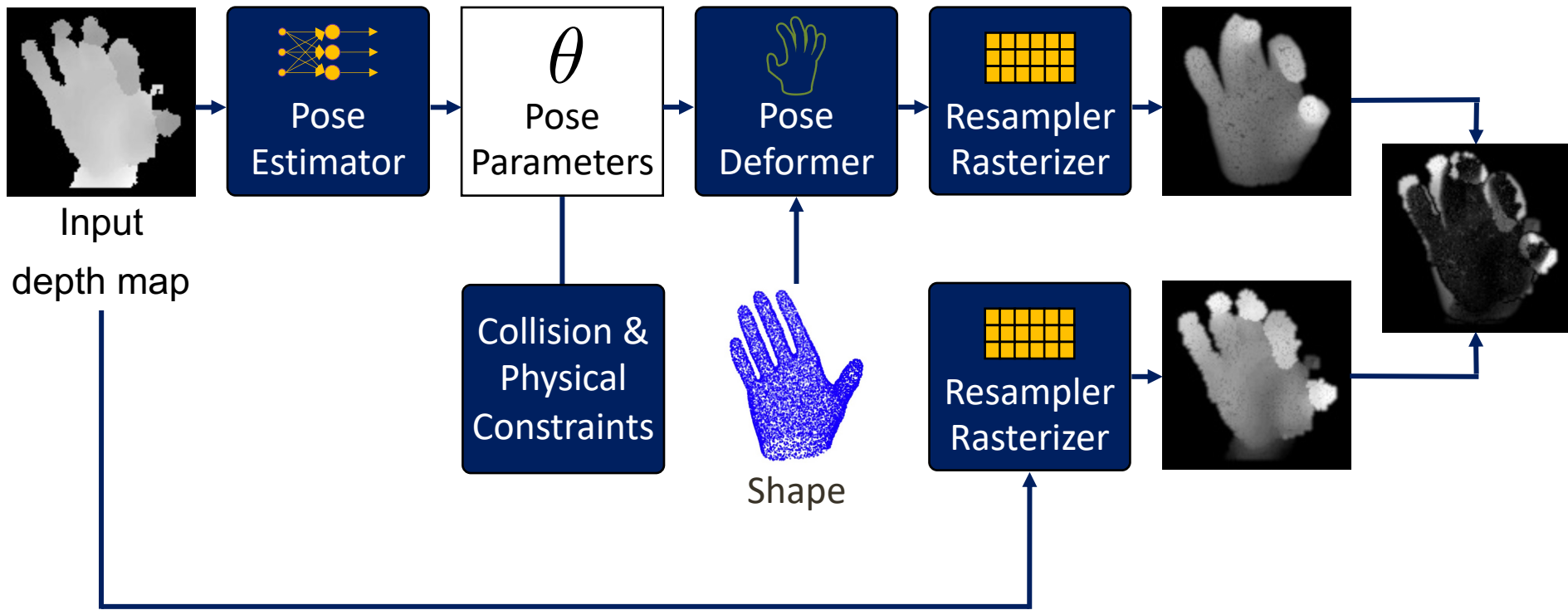
- Special suits with markers
- Controlled
 - Lighting
 - Cameras
- Track markers
- Real-time monitoring



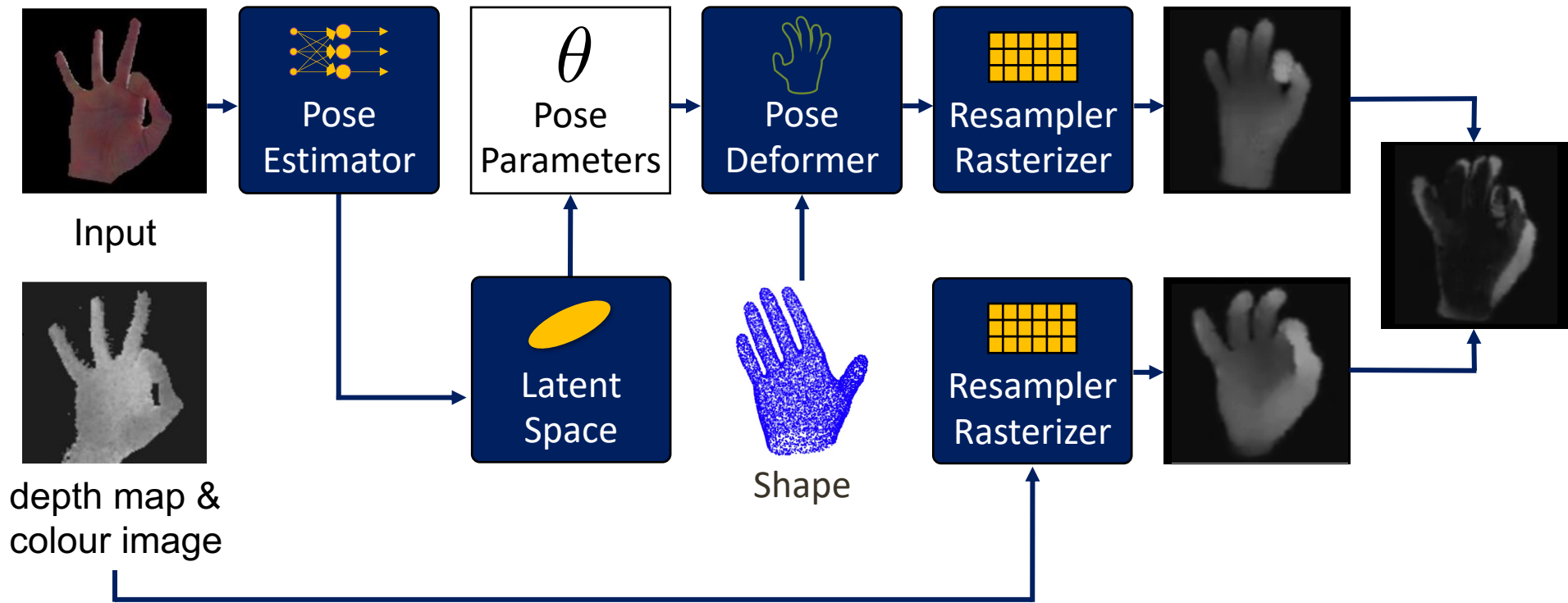
Motion Capture



Motion Estimation



Motion Estimation



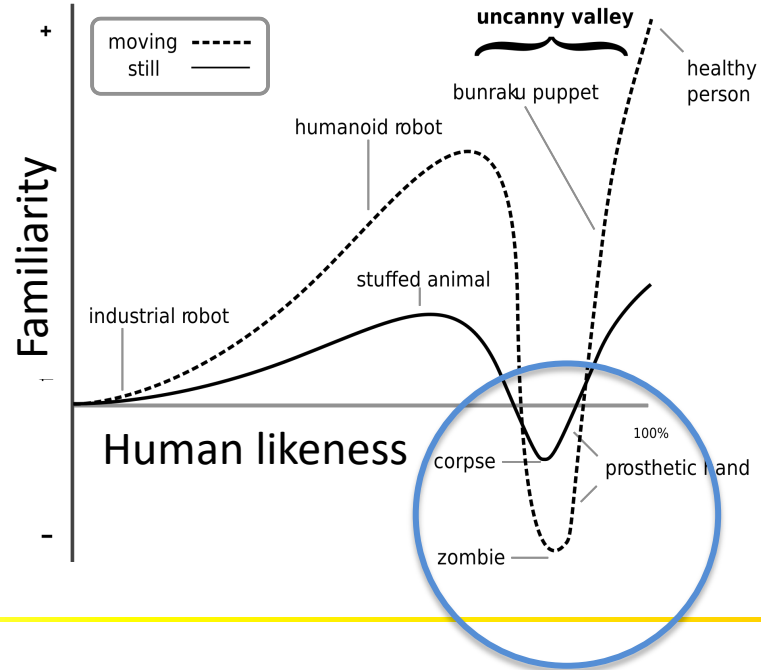
Facial Motion

- 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 expressions



Facial Motion

- How can we control facial animation

Blendshapes



F_1
 w_1



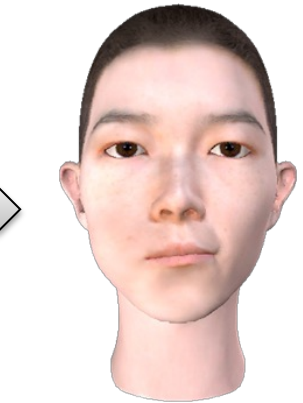
F_2
 w_2



F_3
 w_3



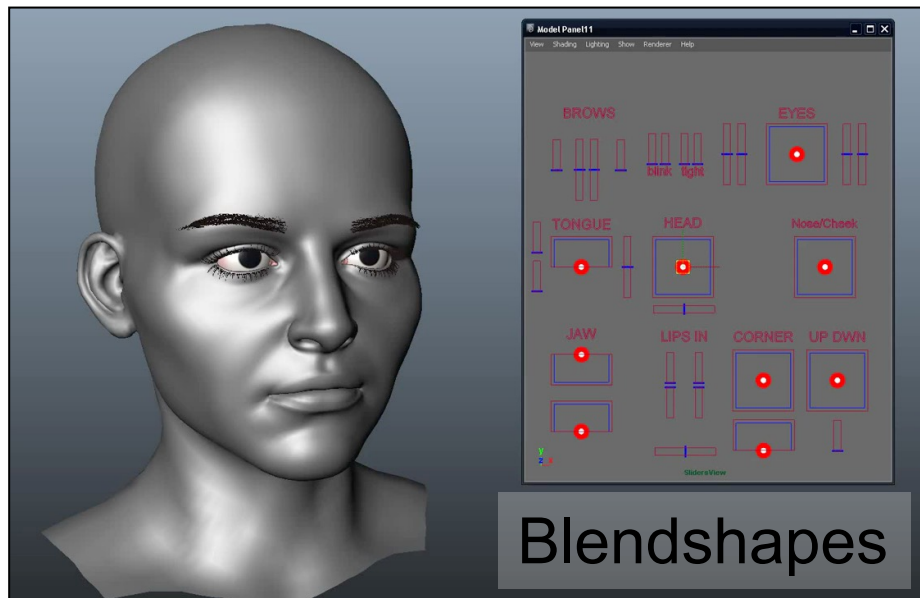
F_4
 w_4



$$\sum_i w_i F_i$$

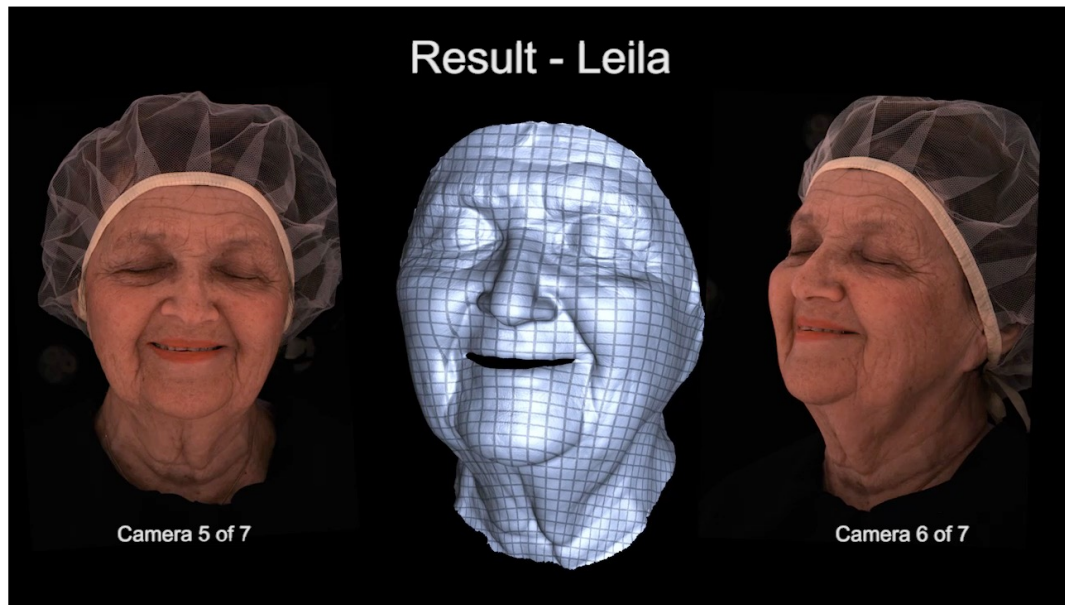
Facial Motion

- 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

