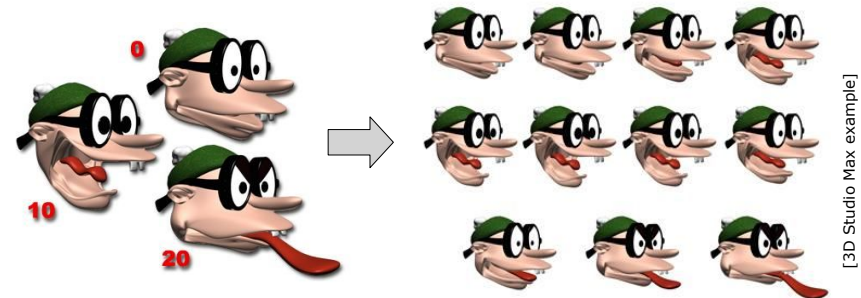


## Real-time geometric deformations

### Lecture 12

## Blend shapes



[3D Studio Max example]

## Blend shapes



[Benson, GPU Gems]

Figure 4-2. Emotional Blend Targets (Blend Shapes)

## Free-form deformations

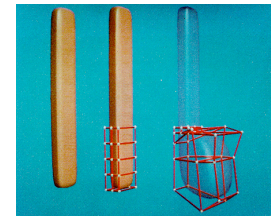


Fig. 14 Local FFD

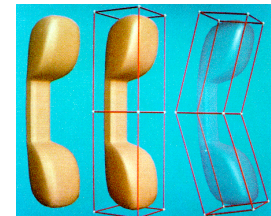
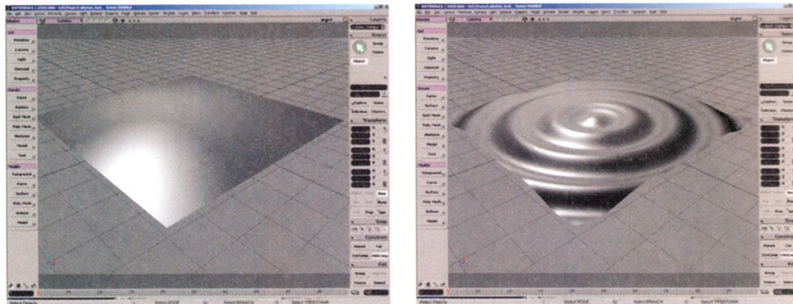


Fig. 15 Global FFD

[Sederberg & Parry 1986]

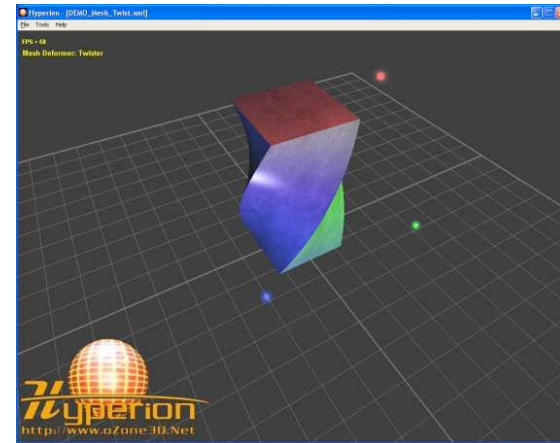
## Procedural deformation



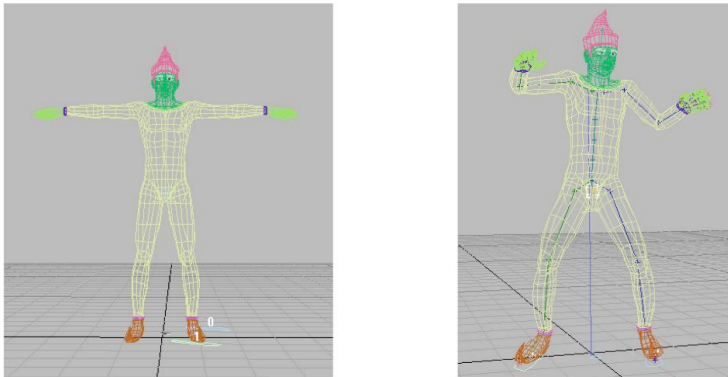
[d'Eon, GPU Gems]

Figure 42-1. A Circular, Vertical Displacement Wave Deformer Applied to a Plane

## Twist deformation

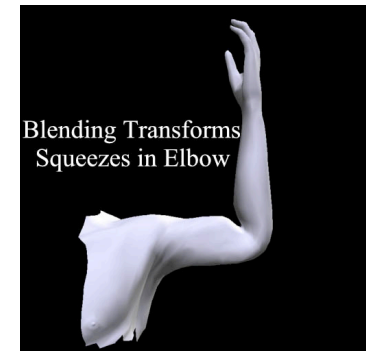


## Mesh skinning



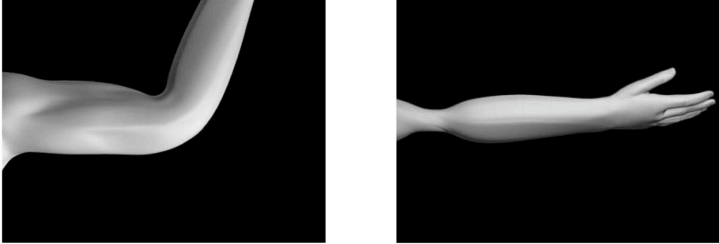
[Sébastien Dominé | NVIDIA]

## Skinning artifacts



[Sloan, Ross, & Cohen 01]

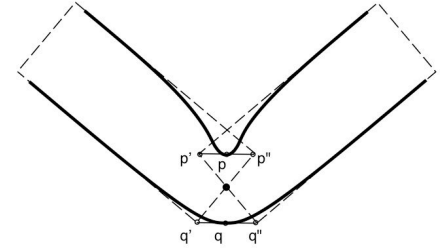
## Skinning artifacts



[Lewis et al., SIGGRAPH 2000]

## Skinning artifacts

$$\mathbf{p}'_i = \sum_j w_{ij} M_j \mathbf{p}_i$$



[Lewis et al., SIGGRAPH 2000]