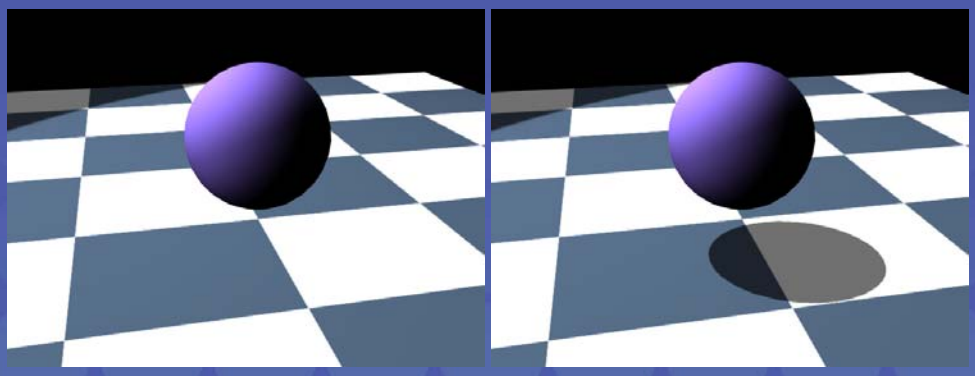

SIGGRAPH2004
Real-Time Shadowing Techniques
Course #26, Tuesday, Full Day

Why Shadowing?



Why Shadows?

- Intuition about lighting / objects
  - Position of the light (e.g. sundial)
  - Depth cue
  - Spatial relationship between objects
    - Contact points
  - Realism

Classification of Shadowing Techniques

- Hacks
  - No Shadows, projected blobs, projective shadows
- Shadow Maps
  - Using texture maps
- Shadow Volumes
  - Using geometry to represent shadows
- Shadows with Radiance Transfer
  - Precompute light-object interaction

Comparison – Hard Shadows

Projective Shadows/Blobs	Shadow Maps	Perspective Shadow Maps	Silhouette Maps	Shadow Volumes
+ Very Fast + Simple + Easy to add soft shadows	+ Fast + Less BW than SV	+ Fast + Reduces aliasing + Less BW than SV	+ Fast + Sharp silhouettes + Less BW than SV	+ Accurate
- Separate caster and receiver - No self-shadowing	- Aliasing problems - Bias problems - Resolution	- Still problems with aliasing - Bias problems	- Overhead for silh. generation - Only *one* edge per texel ⇒ problems - Undersampling still possible	- High fill-rate - Need silhouettes of objects - Problems with overlapping frustum

Comparison – Soft Shadows

Linear Light Sources	Smoothies	Soft Shadow Volumes	Precomputed Radiance Transfer
+ High-quality penumbra + Few samples needed	+ Fast + Low overhead + Hides shadow maps artifacts	+ Accurate + Allows for complex light sources	+ Extremely fast + Accurate for large area light sources
- Only linear light sources - No inner penumbra - Potential undersampling artifacts	- Not geometrically correct - No inner penumbra - Needs object-space silhouettes - Overlapping shadows incorrect	- Difficult implementation - Does not scale well - Artifacts from: > overlapping geometry > single silhouettes	- Only static objects - Only for self-shadowing - Small light sources are more expensive

Recommendations

- Which algorithm should I use?
  - Hard shadows
    - Few artifacts ok?
      ⇒ Perspective shadow maps
      ⇒ Silhouette maps
    - Artifacts not acceptable?
      ⇒ Shadow volumes
  - Soft shadows
    - Speed important?
      ⇒ Smoothies
    - Accuracy important?
      ⇒ Soft shadow volumes
    - Objects are static?
      ⇒ Precomputed radiance transfer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Thank you for listening…
We are happy to answer further questions…