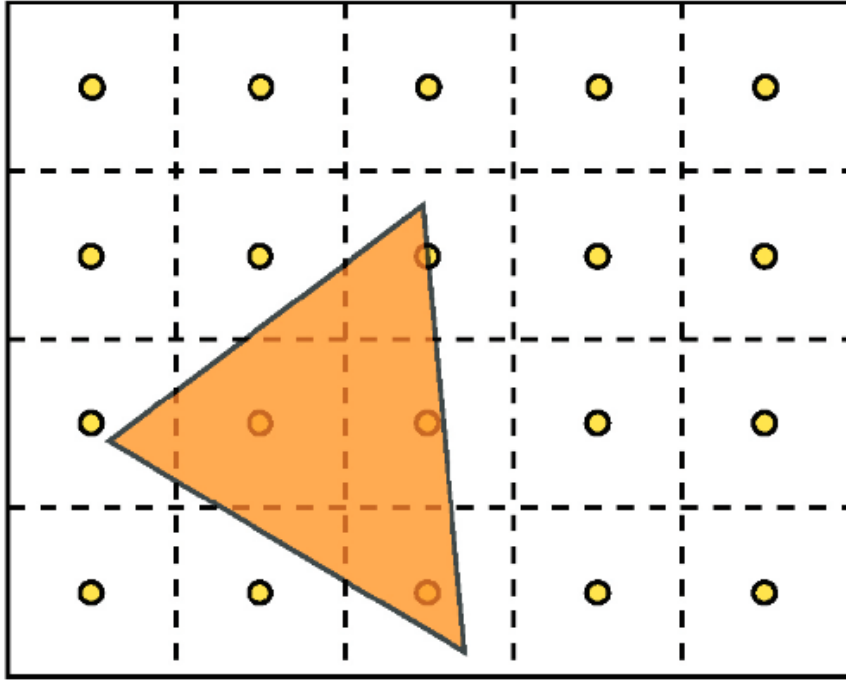
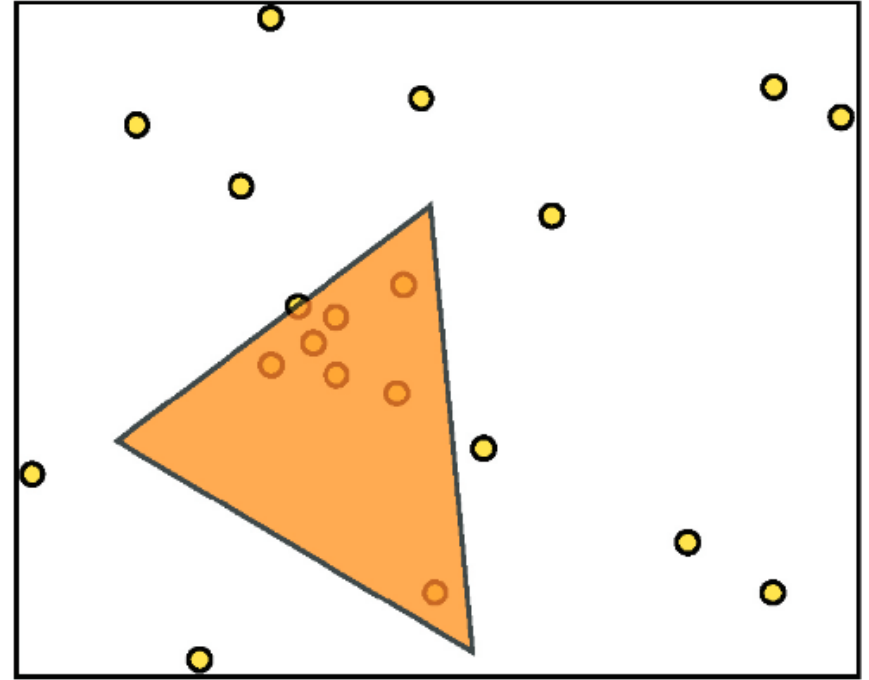


Übung: Interaktive Computergrafik

- ▶ Besprechung des zweiten Übungsblatts (Schattenvolumen)
- ▶ Schattenberechnung mittels *Irregular Z-Buffer*
- ▶ Konservative Rasterisierung

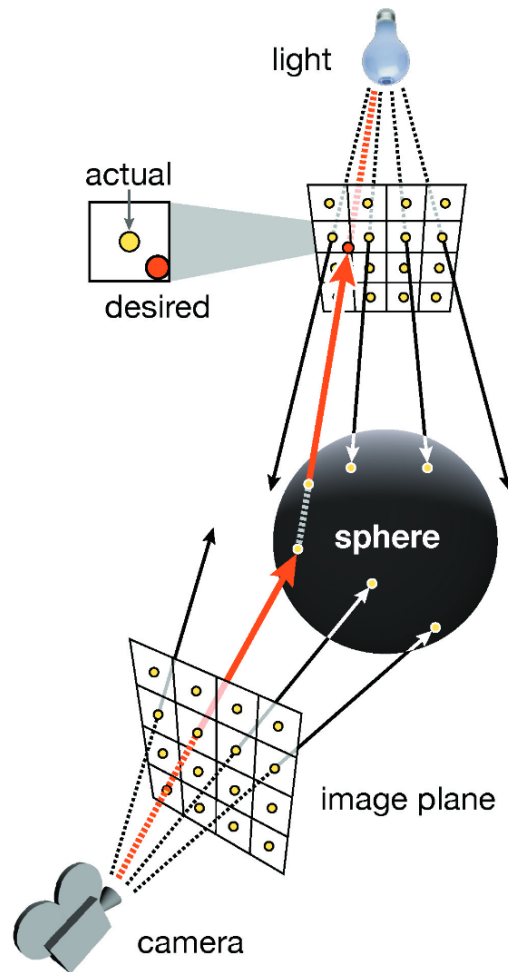


(a) Conventional Z-buffer

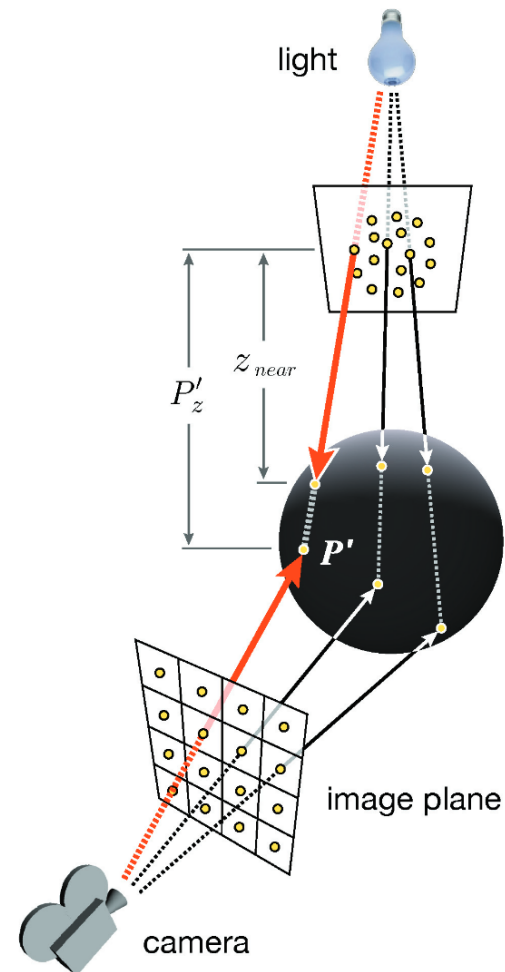


(b) Irregular Z-buffer

(Irregular-) Shadow Mapping

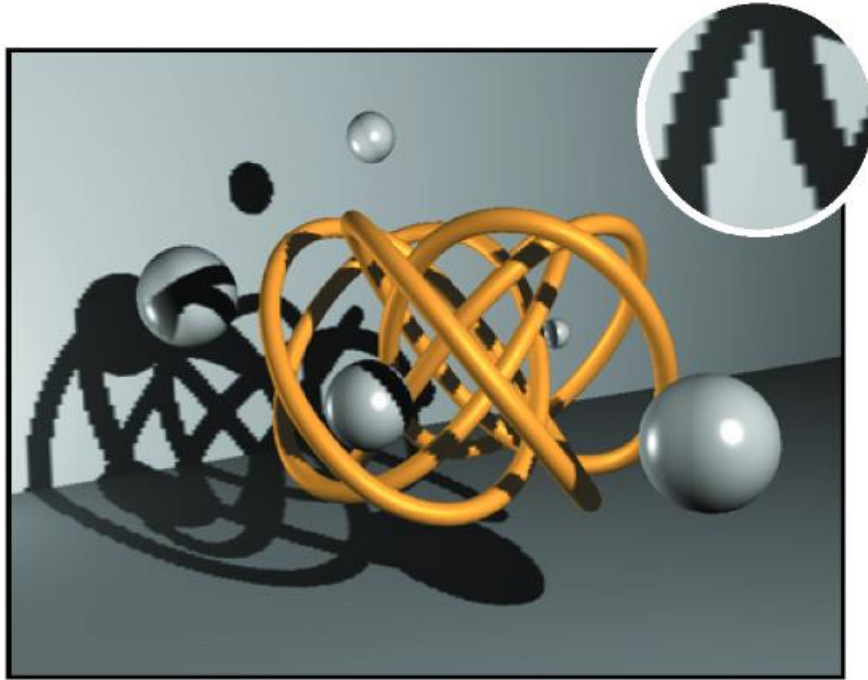


(a) Conventional shadow mapping

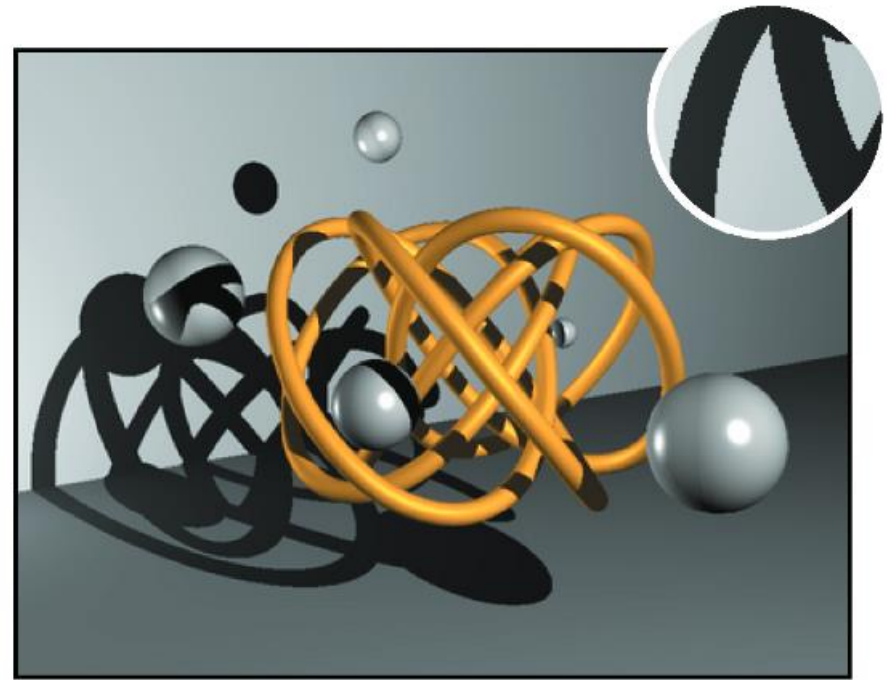


(b) Irregular shadow mapping

(Irregular-) Shadow Mapping

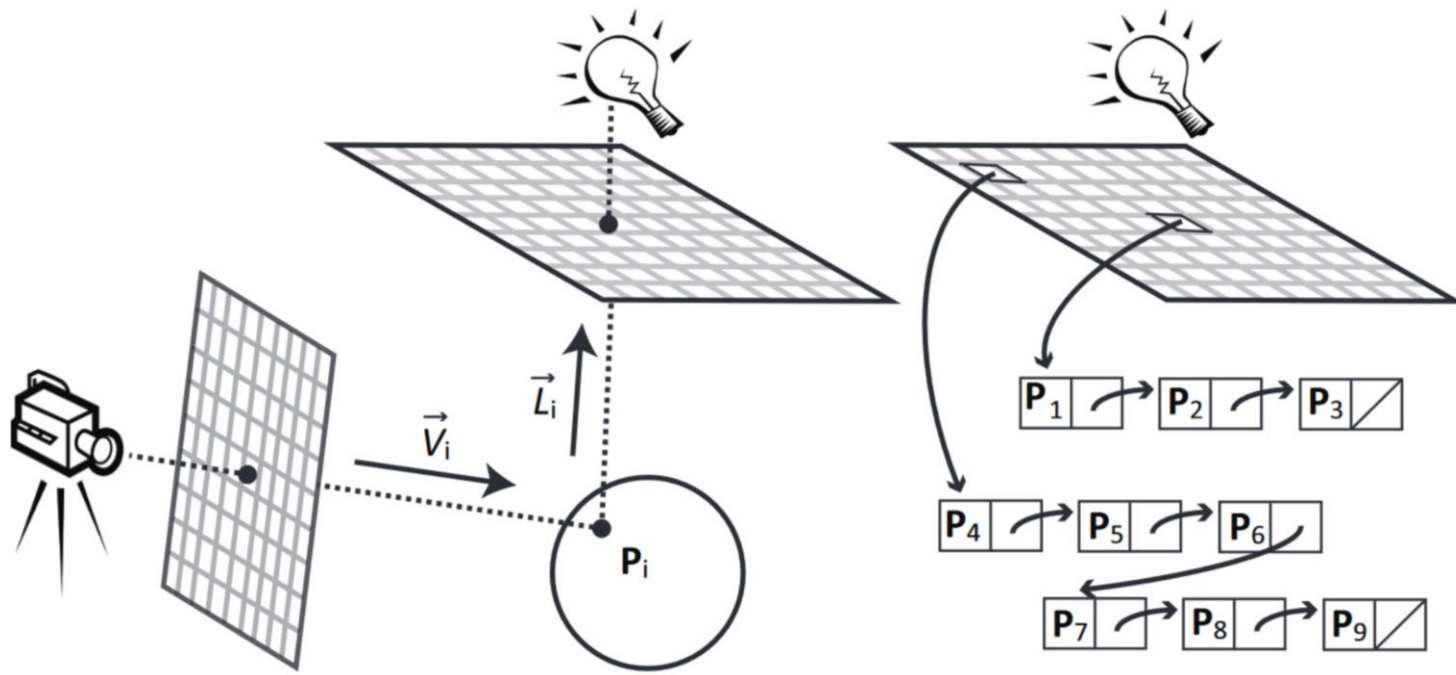


(c) Conventional shadow mapping



(d) Irregular shadow mapping

- ▶ Problem: Hardware-Rasterisierung nur auf regulärem Gitter
- ▶ Speichere per-Texel Listen (in „Shadow Map“) von Kamera-Pixeln die getestet werden sollen

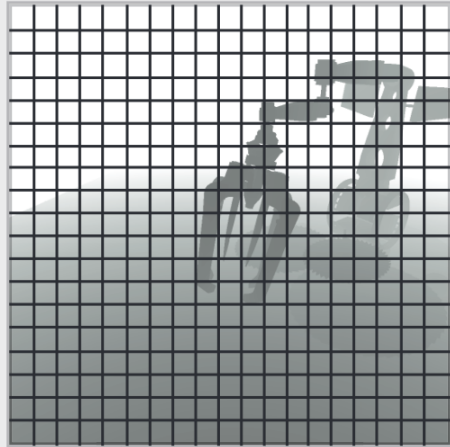


Implementierung Schattentest mit IZB



Irregular Z-buffer input

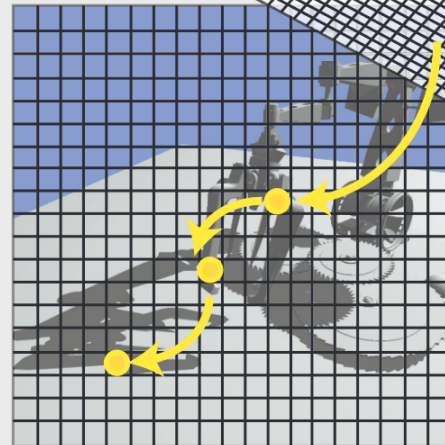
Eye space z-prepass + triangle soup



IZB creation: apply shadow map transform to project pixels to light space. Add each pixel to corresponding light space list.

Irregular Z-buffer data structure

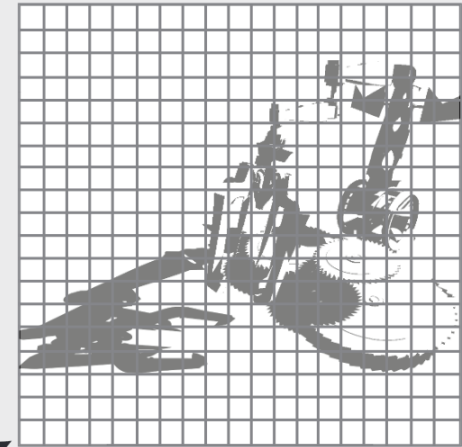
IZB head pointers: on light space grid



IZB nodes: stored on eye space grid

Irregular Z-buffer output

Visibility mask on eye space grid



Rasterize triangles in light space. Traverse list in each covered texel. Test shadow visibility for each listed pixel. Update shadow visibility mask.

- ▶ Nur Pixel deren Mittelpunkte in Primitiv liegen erzeugen Fragmente und somit Schattentests
 - ▶ Es entstehen Löcher da Schattentests fehlen
- ▶ Konservative Rasterisierung benötigt

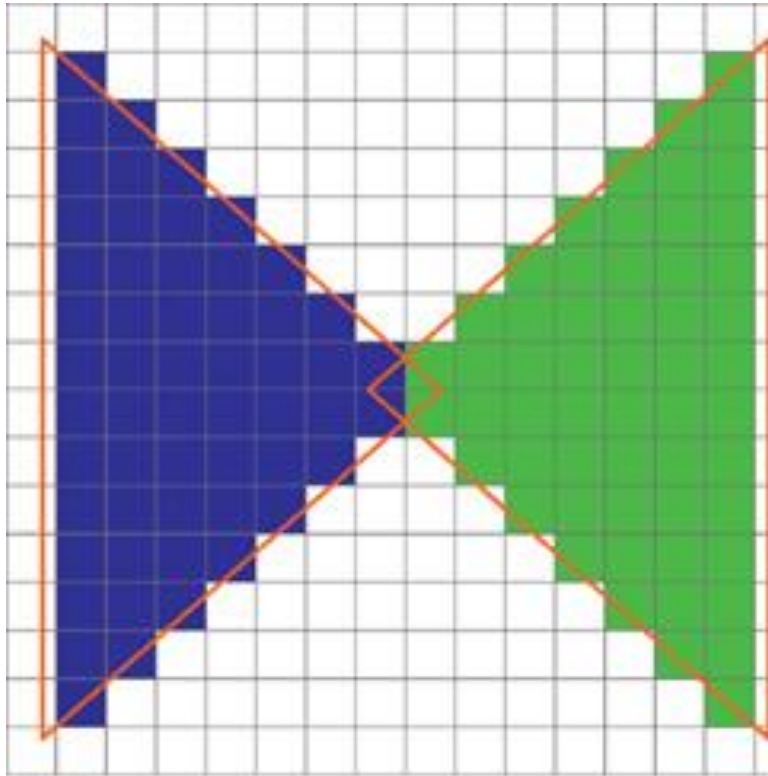


Standard



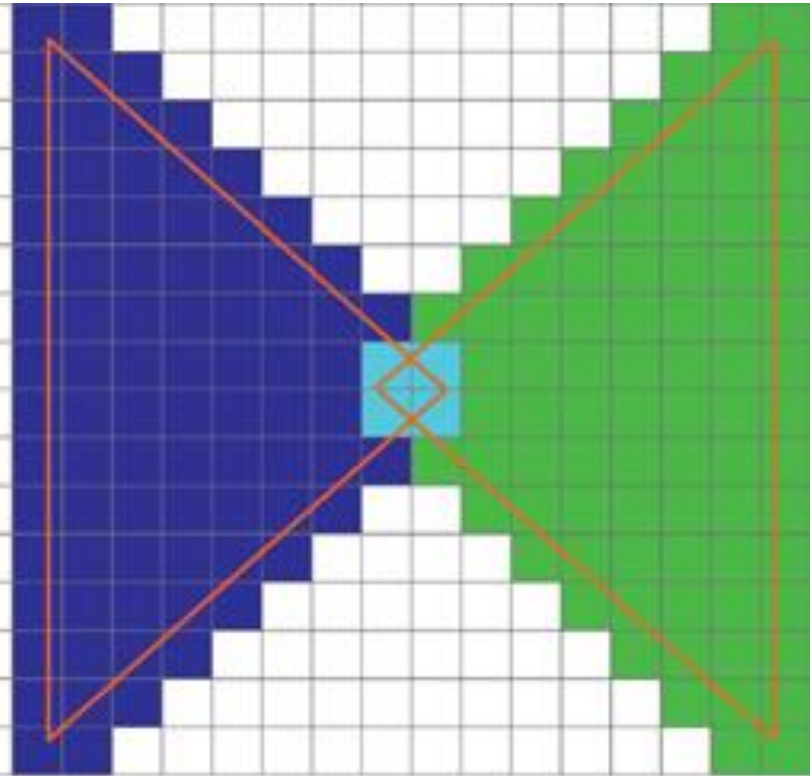
Konservativ

Standard



Primitiv überdeckt Pixel-Mittelpunkt

Konservativ



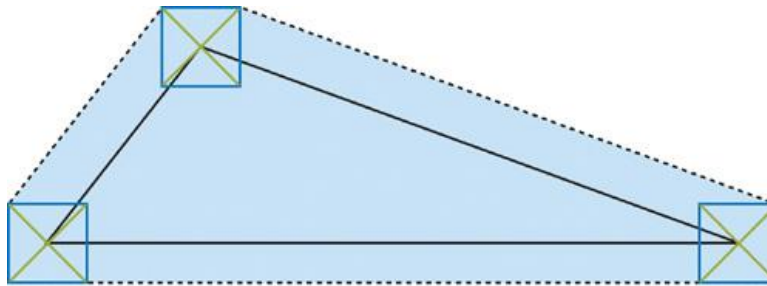
Primitiv berührt Pixel

► Anwendungen:

- Binning
- Voxelisierung
- Kollisionserkennung
- ...

► Dilatation von Primitiven im Geometry-Shader

- https://developer.nvidia.com/gpugems/GPUGems2/gpugems2_chapter42.html



- Auf modernen Grafikkarten in Hardware umgesetzt (Direct3D 12)
 - (bisher nur Intel und NVIDIA)