

# 3D Image Warping in Architectural Walkthroughs

Summary for CS334

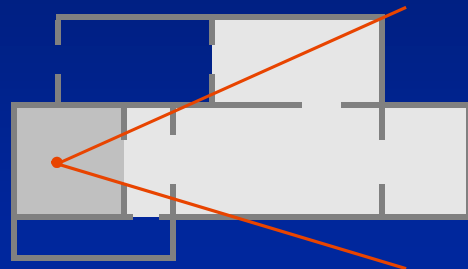
## The Goal

- Increase interactive rendering performance of architectural walkthroughs
  - Replace geometry behind portals (doorways and windows) with images warped to the current eye position
  - Reduce the rendering complexity with a small number of image samples

## Presentation Outline

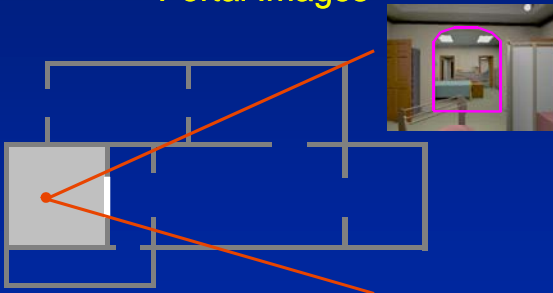
- Background
  - Cells & Portals
  - Improving Culling with Images
  - Image Warping
- Portal Images
  - Creating Portal Images
  - Exposure Events
  - Parallelization
- Results and Conclusions

## Cells and Portals



- Related: Airey90, Teller91, Luebke95

## Portal Images



## Portal Image Warping

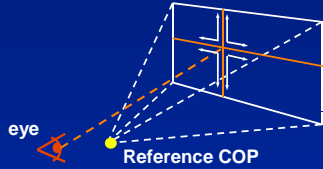
McMillan & Bishop Warping Equation:

$$x_2 = \underbrace{\delta(x_1) P_2^{-1} (c_1 - c_2)}_{\text{Move pixels based on distance to eye}} + \underbrace{P_2^{-1} P_1 x_1}_{\text{-Texture mapping}}$$

*Move pixels based on distance to eye*      *-Texture mapping*

- Per-pixel distance values are used to warp pixels to their correct location for the current eye position

## Portal Image Warping



- Projecting the eye onto the reference image partitions it into 1, 2 or 4 sheets
- A raster scan of each sheet produces a back-to-front ordering of warped pixels

## Video Segment

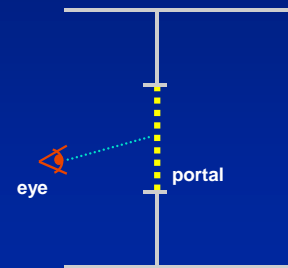
- Cells and Portals
- Our System

## Presentation Outline

- Background
  - Cells & Portals
  - Improving Culling with Images
  - Image Warping
- Portal Images
  - Creating Portal Images
  - Exposure Events
  - Parallelization
- Results and Conclusions

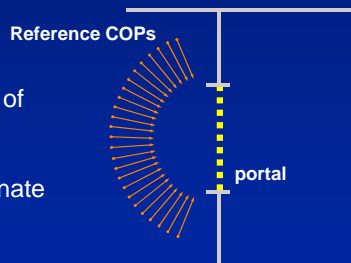
## Creating Portal Images

Ideal portal image would be one sampled from the current eye position



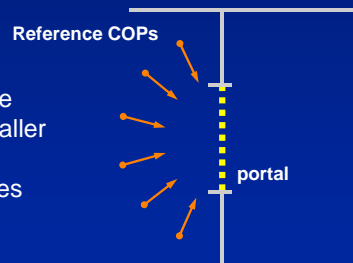
## Creating Portal Images

A large number of static reference images (~120) needed to eliminate *popping*



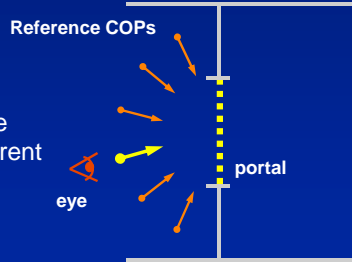
## Creating Portal Images

With warping we use a much smaller number of reference images



## Creating Portal Images

Choose closest reference image and warp to current eye position



## Problem: Exposure Events



We observe *tears* in regions with unknown visibility data

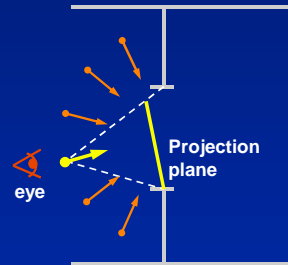
## Reducing Exposure Events



To address this we:

1. Render multiple reference images
2. Allow warped pixels to persist and fill-in minor tears

## Parallelization: Sheets

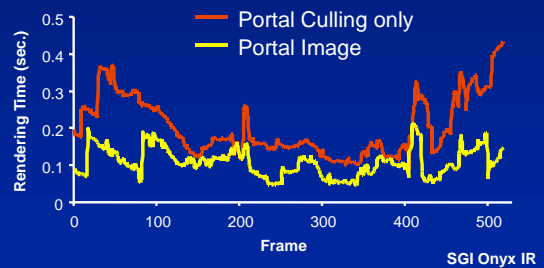


- Eye view direction similar to reference COP view direction
- Since the projection plane is perpendicular to the view direction, we usually have 4 sheets
- We warp each sheet on a different processor

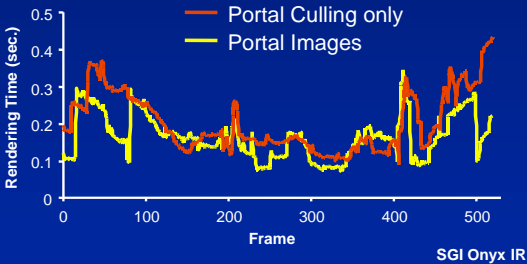
## Video Segment

- Portal Image Warping
- Exposures and Remedies
- Parallelization

## Sample Path: 1 Image/Portal



## Sample Path: 2 Images/Portal



## Ongoing and Future Work

- Reducing exposure events by using multiple layered depth images (LDI)
- More automatic scheme for selecting reference image locations
- Use inverse warping to fill in the tears
- Use deferred shading to allow for specular highlights

## Conclusions

- We accelerate architectural walkthroughs using a small-set of reference images and image warping
- We address exposure events by rendering multiple reference images
- We employ multiple processors to produce an interactive image-warping system

## Video Segment

## Acknowledgments

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