

# CRYTEK AAA STEREO-3D IN CRYENGINE 3

- CONFIDENTIAL -



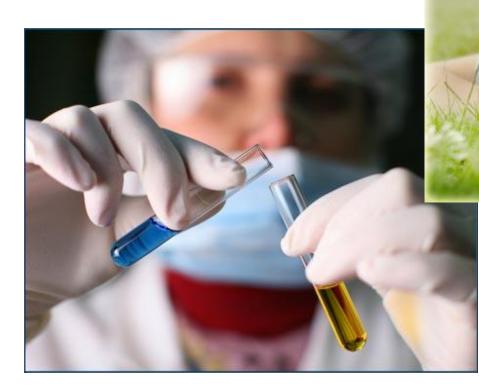
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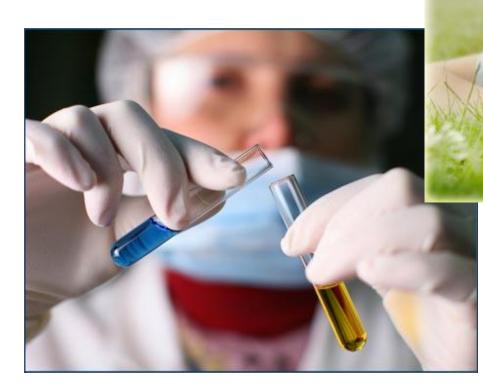
### Providing tools...

















### Popping out of the screen





**Window Violation** 



#### POPPING OUT OF THE SCREEN



## Your health is important





#### THE LACK OF STANDARDS

### DIFFERENT OUTPUT DEVICES, DIFFERENT STEREO INPUTS



#### THE LACK OF STANDARDS

### WE SUPPORT AS MANY AS POSSIBLE







#### **CASE STUDY: HUD**

#### WHERE DO WE PLACE IT?



#### **CASE STUDY: HUD**

#### INSIDE THE SCREEN

- Feels natural
- Depth violations



#### **CASE STUDY: HUD**

#### **OUT OF THE SCREEN**

- Feels cool
- More tiring for the eyes



#### CASE STUDY: CONVEYING MOOD

#### IN A 2D WORLD

- Color palette
- Depth of field
- Atmospheric effects



#### **CONVEYING MOOD**

#### IN A STEREO 3D WORLD

- Stereo effect strength
- Convergence distance



#### **CONVEYING MOOD**

#### IN A STEREO 3D WORLD

- Stereo effect strength
- Convergence distance
- Change depth perception



#### **CONVEYING MOOD**

## STEREO 3D AS A COMMUNICATION TOOL





VS





# 1.5%



### Bringing Stereo to Consoles

**Nicolas Schulz** 

**R&D** Graphics Engineer



#### **CHALLENGES**

- Stereo Image Generation
- Stereo Output
- Memory



#### STEREO IMAGE GENERATION

#### Rendering twice?

- 60Hz game
  - If 30Hz in stereo is fine, perfect
- Dramatically reduced quality
  - Lower resolution, less details, disabling effects, etc.
- > No feasible option for us



#### STEREO IMAGE GENERATION

#### **Screen Space Reprojection**

- Fully gather-based, no warped grid or point splatting
  - Works in single-pass pixel shader
- Reproject pixel into space of left/right eye cameras
  - Done in screen space by computing offset based on pixel depth and stereo parameters
- Resample backbuffer with bilinear filtering



#### STEREO IMAGE GENERATION

#### **Screen Space Reprojection**

- Works surprisingly well with sensible stereo strength
- Great quality with positive parallax
  - No major image artifacts for opaque objects
  - Transparent objects look acceptable
  - Slight stretching at screen edges (easy to overcome)
- Works with negative parallax (objects coming out)
  - Artifacts at depth discontinuities where parallax direction changes
  - Artifacts can be reduced by smoothing out depth and similar approaches



#### STEREO OUTPUT

#### Outputting left/right eye images

- Native HDMI 1.4 support on PS3
- Currently no native stereo support on 360
  - Use frame-compatible formats (side-by-side, line interlaced, etc.)
  - Encode output format in a final pass
  - Dashboard will look broken



#### **MEMORY**

#### Memory overhead for left/right buffers

- Reuse existing render targets
  - Change texture descriptor if required
- Use render target memory pool
  - Automatic allocation and deallocation of RTs based on usage in pipeline



