

CRYTEK

AAA STEREO-3D IN CRYENGINE 3

What is the biggest challenge in developing AAA 3D?

What is the biggest challenge
in developing AAA 3D?

Providing tools...

Research project



Depth Perception

Research project



Depth Violations

Research project



**Popping out of the
screen**

Research project



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**

