# Real-Time Analytic Antialiased Text for 3-D Environments 



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## The Future of AR



Video see-through


## Text in AR



## IT'S DANGEROUS TO GO ALONE! TAKE THIS.



A New Hope

Episode 2

- Creates clean edges

Signed Distance Fields


- Texture indirection [Qin06]
- Alpha channel [Green07]
- Multi-feature issues
- Overly rounded appearance
- Authoring is not trivial
- [Rougier18] discusses issues

- Various types of guided sampling

Vector Textures


- Respecting silhouettes [Sen04]
- General Textures [Tumblin05]
- Resampling [Tarini05]
- Improved resampling [Reshetov16]
- Bound by texture resolution
- A bit complex
- Solving a harder problem

- Winding number based ray casting
- Precision issues [Esfahbod12]
- Faster precision issues [Dobbie16]
- Even faster w/o issues [Lengyel17]
- Somewhat sample bound


## TWUIR:DOFUHSE\#ERHSSHIPES

## OUCT \#a\%




Pixel-Shape Integration


- How much shape covers a pixel
- Pixel differentials are skewed
- This makes integration difficult
- Lot's of literal "corner cases"
- It is not done in general

Pixel Matrix


- Calculate pixel transform
- $\left(\begin{array}{ll}d U d x & d U d y \\ d V d x & d V d y\end{array}\right)$
- Map pixel to footprint
- Assume gaussian footprint
- Observe bulk is radial symmetric
- i.e. Rotation is not very important

Rotation is not very important $P \quad R$

- $P \Rightarrow Q R$
- $Q \Rightarrow\left(\begin{array}{cc}\cos & \sin \\ -\sin & \cos \end{array}\right)$
- $R \Rightarrow\left(\begin{array}{ll}a & b \\ 0 & d\end{array}\right)$ x shear

- $R^{-1} \Rightarrow x$ shear
- Discard Q
- Maintain x axis alignment!


## Transformation Pipeline








## Curve

Integration Kernels
x_apex
x_apex

x_apex
x_apex

x_apex


## Evaluation: Paper



## Implementation (As simple as possible)

- HVVR
- Cuda
- Uniform Textbox grid
- Uniform Glyph grid
- Titan Maxwell


## SSAA 1



## SSAA 4




```
Fto take armus against a sea of troubles
n<t by opposino end them. To die - to sleep.
```


## SSAA 16





```
O to take arms against a sea of troubles
nd by opposingend them.To die - to sleep.
```


## SSAA 1024



```
The slings amd arrows of outrageous formume,
Fr take armos against a sea of troubles
nd by opposino end them. To die - to sleep.
```


## Ours

$$
\begin{aligned}
& \text { The slings and arrows of outrageous formune. } \\
& \text { Or tu take armis against a sea of troubles } \\
& \text { nd by opposino end them. To die - to sleep. }
\end{aligned}
$$

## Ours [Top] vs 16x [Bottom]



## Ours [Top] vs 1024x [Bottom]



## Evaluation: Lengyel '17 (SLUG) vs Ours

SLUG
SS SLUG
Word


Perf vs SSAA

Performance in Microseconds


Perf vs SLUG


SSAA16
SSAA4
SSAA1
Sug AdpSS
Sug Default

| 0.4 |
| :---: |
| Ours |

DEMO TIME?

