

learn network inspire

GameDevelopers'
Conference

08



February 18-22, 2008
San Francisco

www.gdconf.com



폰트 렌더링 개론

Cameron Egbert
Software Development Engineer
XNA Developer Connection
Microsoft



Game Developers
Conference

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Who cares?

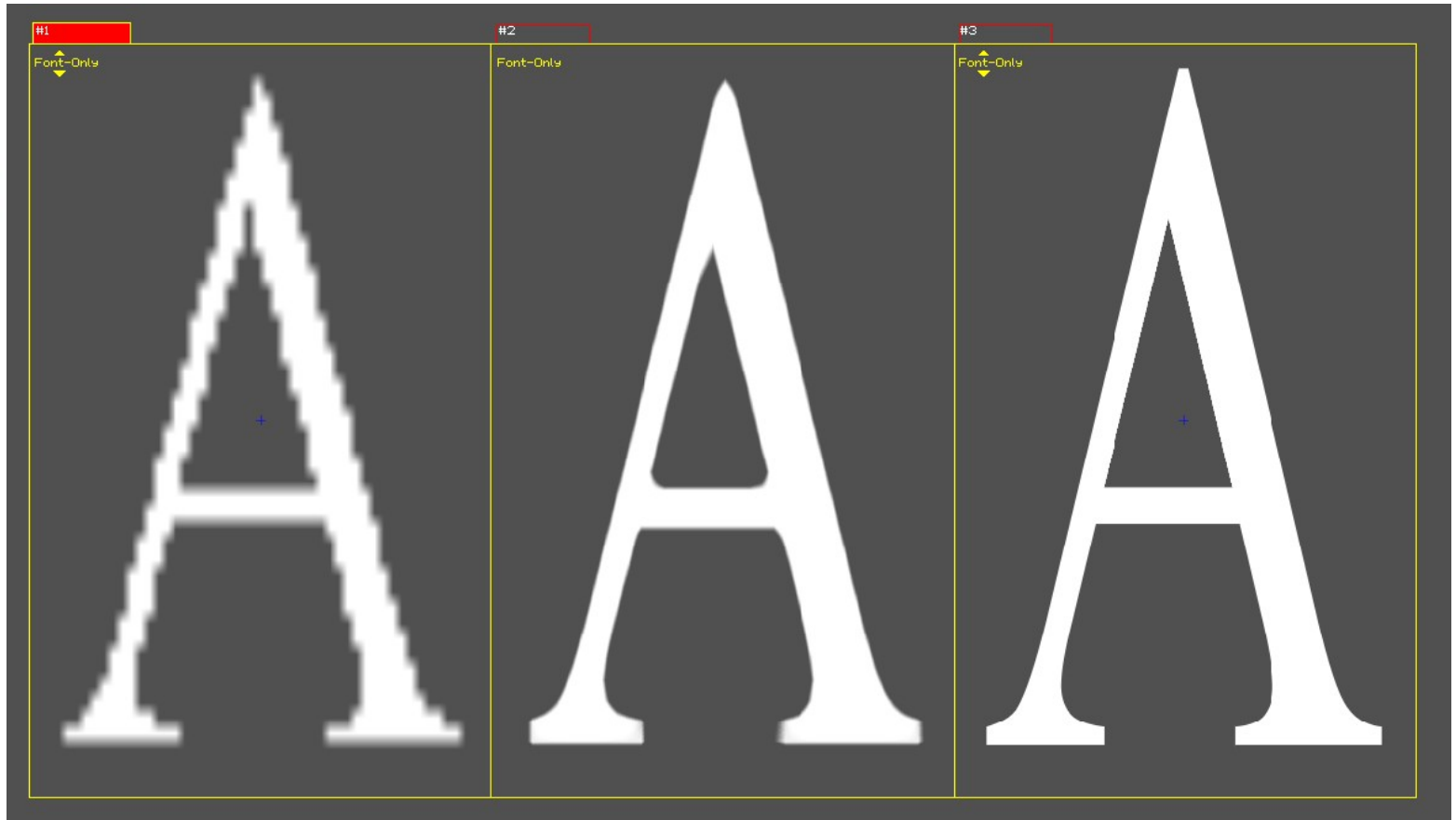


CMP

United Business Media

WWW.GDCONF.COM

Appetizer



텍스처

벡터 텍스처

GPU 벡터
그래픽



이미지 텍스처 기반 폰트

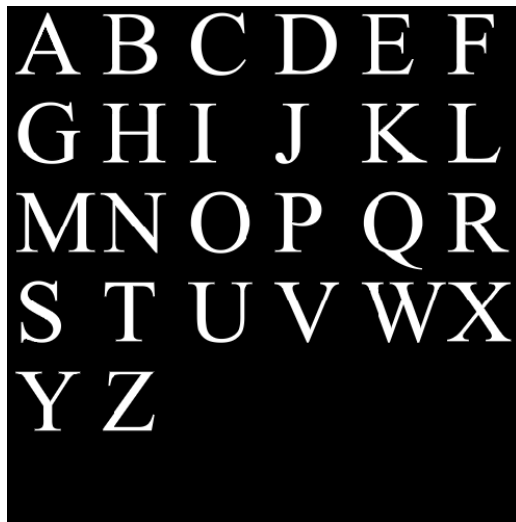
- ⊕ 텍스처를 사각형으로 그림
 - + 쉽다
 - + 텍스처로 표현할 수 있는 모든 것이 가능
 - 일반적인 뭉툭한 폰트 텍스처



벡터 텍스처

“Improved Alpha Tested Magnification for Vector Textures and Special Effects” - Chris Green 2007

- ④ distance field 를 사용
- ④ distance map과 한계치를 적용
- ④ 다양한 테두리 효과가 가능

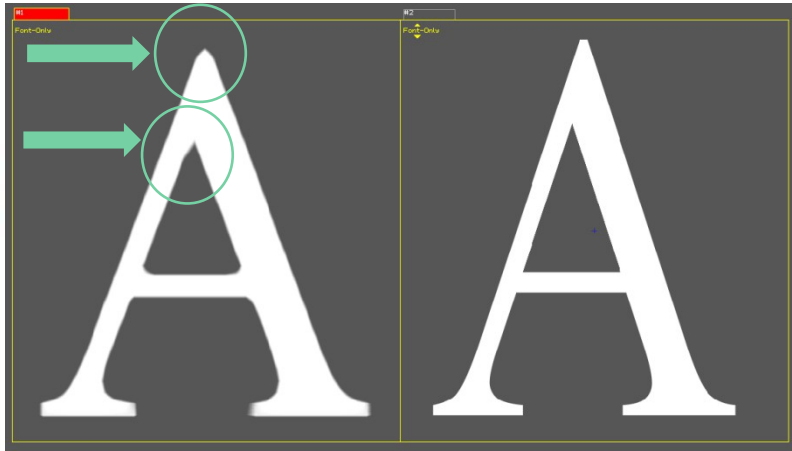


4096x4096 텍스처



256x256 Distance Map

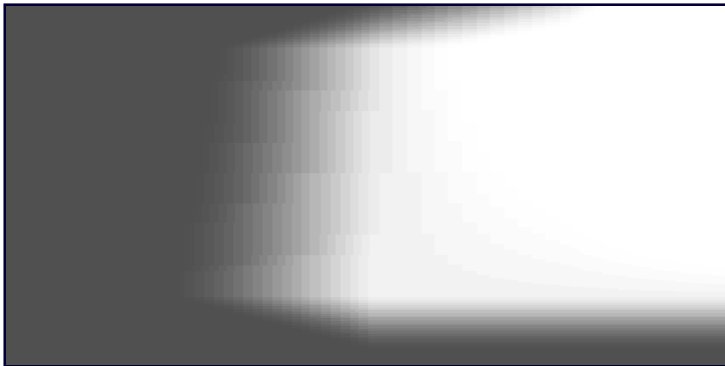
주의



벡터텍스처

참조

⊗ 모서리가 둥글게 보이는 특성



⊗ 크게 확대하면 깨짐

비교

- + 전통적인 텍스처만큼 단순
- + 시각적으로 더 우수
- + 셰이더 없이 알파테스트 만으로 가능
- + 테두리 효과 및 안티알리아싱 가능
(셰이더 사용시)
- 모서리가 깎여나가는 경향

As Seen in Team Fortress 2

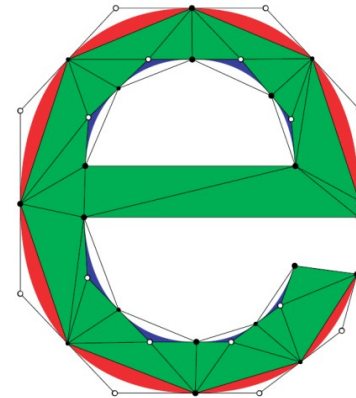
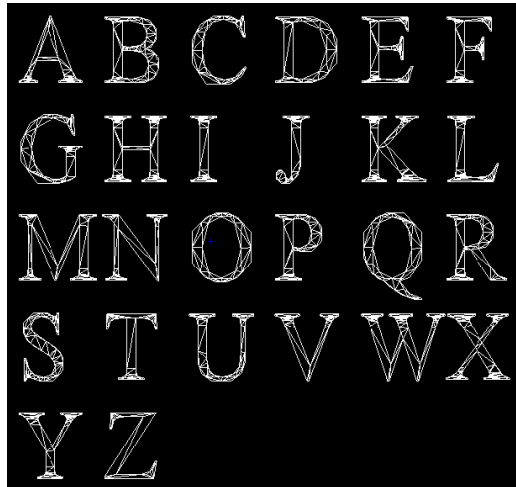


안티 알리아싱과 부드러운 그림자가 적용된 벡터 텍스트 (courtesy Valve Software)

GPU 벡터 그래픽

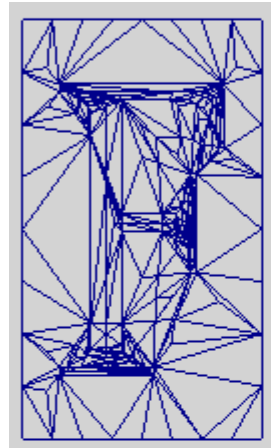
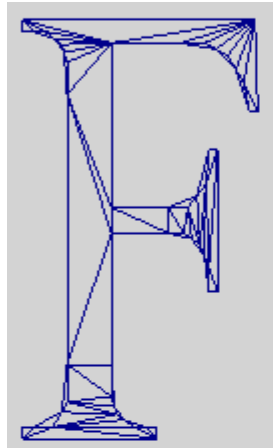
“Resolution Independent Curve Rendering Using Programmable Graphics Hardware” - Loop and Blinn 2005

- ③ 글자는 베지어 커브로 표현
- ③ 곡선을 폴리곤으로 표현
- ③ 테두리표화 및 안티알리아싱 효과 가능 (추가적인 폴리곤)



주의

- ⊙ 생성된 폴리곤이 다소 복잡
- ⊙ 복잡
- ⊙ 2차 방정식과 베지어 곡선으로 디자인
- ⊙ 안티알리아싱은 많은 수의 폴리곤을 증가





비교

- + 해상도 독립적
- + 완벽한 곡선 재현
- + 테두리 효과 및 안티알리아싱 (추가적인 폴리곤)
- 글자의 복잡도가 성능을 결정

Forza Motorsport 2의 예



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1	P. Muller	35
4	M. Weber	2
5	S Sandwich	---
6	G. Esposito	-10
PLACE		5 8

안티알리아싱된 GPU 벡터 그래픽

성능

Four score and seven years ago our fathers brought forth upon this continent a new nation conceived in liberty and dedicated to the proposition that all men are created equal

Now we are engaged in a great civil war testing whether that nation or any nation so conceived and so dedicated can long endure We are met on a great battle field of that war We have come to dedicate a portion of it as a final resting place for those who died here that the nation might live This we may in all propriety do But in a larger sense we can not dedicate we can not consecrate we can not hallow this ground The brave men living and dead who struggled here have hallowed it far above our poor power to add or detract The world will little note nor long remember what we say here; while it can never forget what they did here

It is rather for us the living we here be dedicated to the great task remaining before us that from these honored dead we take increased devotion to that cause for which they here gave the last full measure of devotion that we here highly resolve these dead shall not have died in vain; that the nation shall have a new birth of freedom and that government of the people by the people for the people shall not perish from the earth

- ⊕ Xbox 360 GPU
- ⊕ 1255 글자
- ⊕ 1280x720 A8R8G8B8 프레임 버퍼

	time (mS)
전통적인 텍스처	0.34
벡터 텍스처	0.57
벡터 텍스처 (AA)	0.57
GPU 벡터 그래픽	0.47
GPU 벡터 그래픽 (AA)	1.69

추천

- ③ 벡터 그래픽이 아니라면 전통적인 텍스처
- ③ 둥근 모서리가 상관없다면 벡터 텍스처
- ③ 높은 비주얼 품질에 투자한다면 **GPU** 벡터 그래픽

Questions?



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