

《终极格斗冠军》 (EA Sports FC) 游戏中可信的人物对战

Richard Burgess-Dawson
Jenny Freeman
Daniel Sewell
Electronic Arts加拿大



GAME DEVELOPERS CONFERENCE™ CHINA
SHANGHAI INTERNATIONAL CONVENTION CENTER
SHANGHAI, CHINA · OCTOBER 19-21, 2014

可信的人物



Jenny Freeman
美术总监, Electronic Arts



Daniel Sewell
高级软件工程师, Electronic Arts



Richard Burgess-Dawson
技术美术总监, Electronic Arts

**MAY CONTAIN CONTENT
INAPPROPRIATE FOR CHILDREN**

Visit www.esrb.org
for rating information

This video is intended for promotional purposes only, and may not be sold, rented or reproduced by any party.
Any unauthorized use of this video is prohibited by applicable law.

The game or games shown in this video may not be available for all platforms nor in all countries.

new

新团队



新系列



新硬件

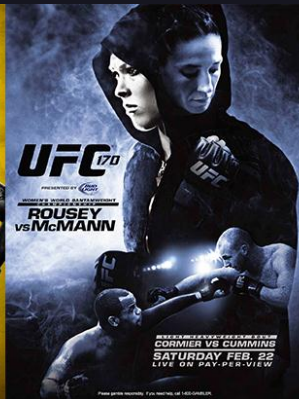
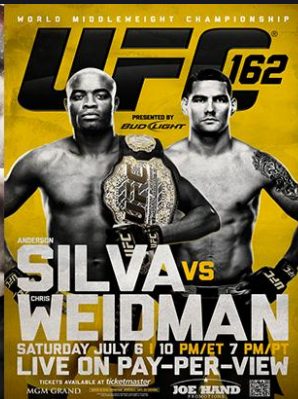


新引擎



UFC[®]

ULTIMATE FIGHTING[®]
CHAMPIONSHIP[®]





FIGHT

JOHNSON VS
BAGAUTINOV

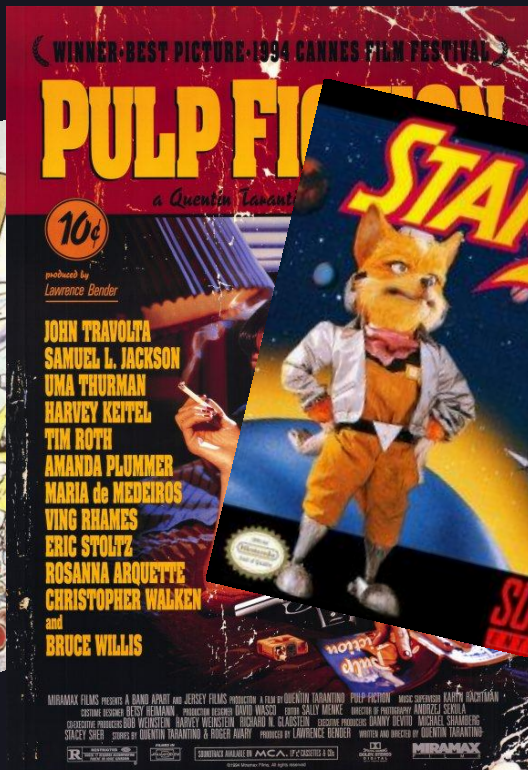
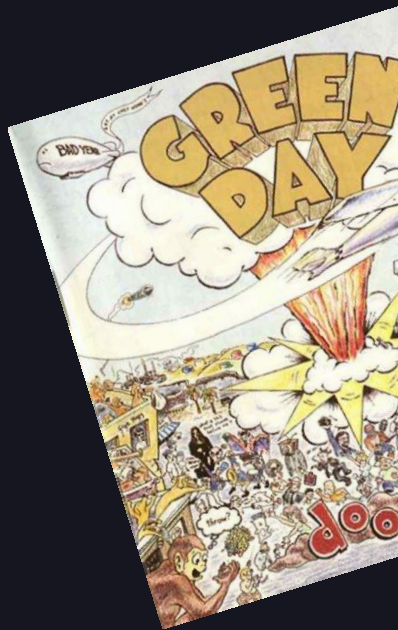
FC174





硬件

1994



第零代* - 3D



《星际火狐》（Star Fox），任天堂 - 1993年2月 - SNES

*使用EA术语

第一代 - 几何图形



《GT赛车》（Gran Turismo），索尼电脑娱乐公司 - 1997年12月 - PlayStation

第二代 - 纹理



《合金装备2》（Metal Gear Solid 2），科乐美 - 2001年11月 - PS2

第三代－着色器



《拳击之夜4》（Fight Night Round 4），Electronic Arts – 2009年6月 – Xbox360

第四代



《NBA 2K14》，2K Sports – 2014年10月 – PlayStation 4

第四代



《NBA 2K14》，2K Sports – 2014年10月 – PlayStation 4

第四代



第四代 - 动态运动



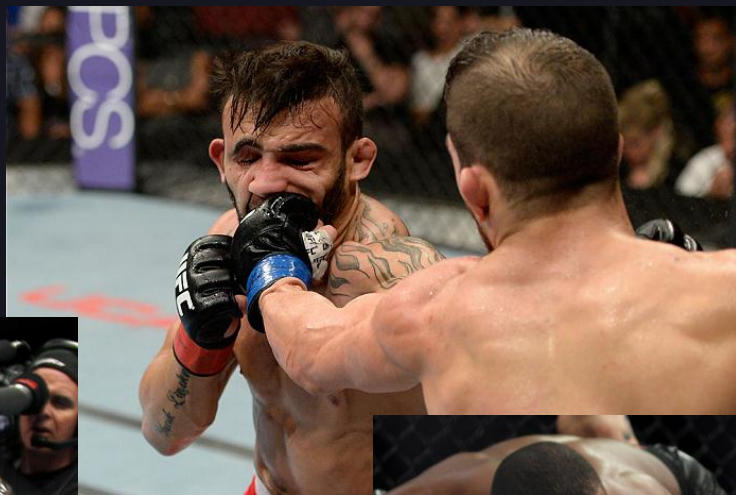
《侠盗猎车手》 (Grand Theft Auto V) , Rockstar Games 《超凡双生》 (Beyond: Two Souls) , 索尼电脑娱乐公司
《黑色洛城》 (L.A. Noire) , Rockstar Games 《刺客信条4: 黑旗》 (Assassin's Creed IV: Black Flag) , 育碧

创意支柱

创意支柱

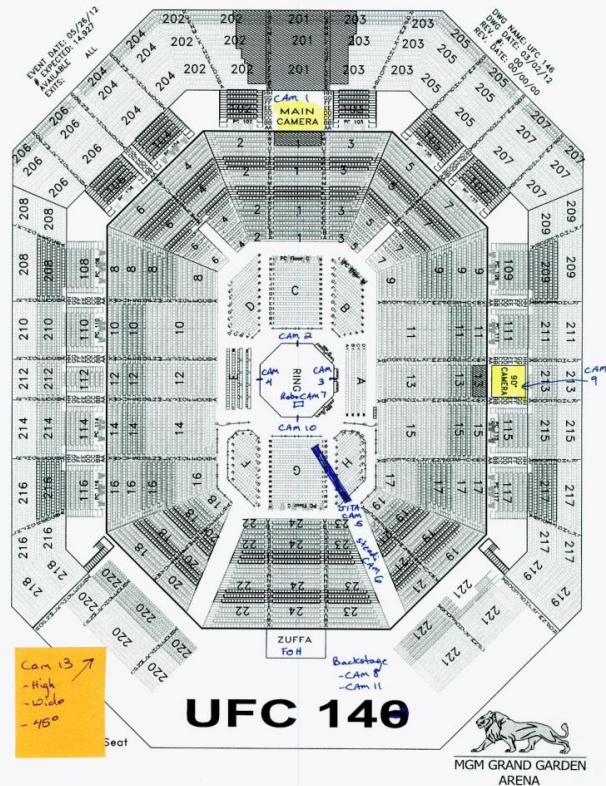
• 动作

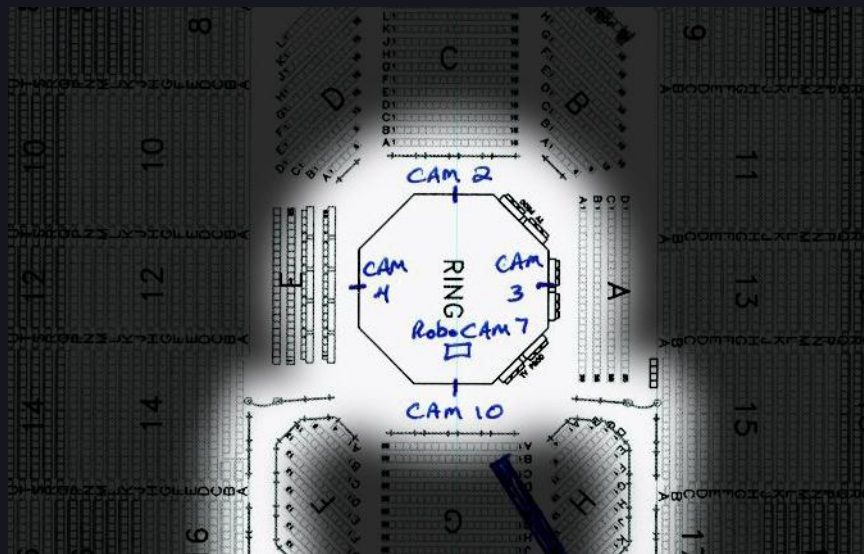
- 冲击与情感
- 图像逼真度
- 令人信服的碰撞，柔软的身体



功能列表

最重要的事







直播的形式与感觉







Spot-lights
moving across
cheering crowds

聚光灯在欢呼人
群中穿过



Many colour changes

许多颜色变化

The Octagon is
the focus

Octagon是焦点
所在



Light Shows





Focus on highly detailed characters
with unique animations

利用特殊动画将
焦点放在详细刻
画的人物上



'Cheat' with everything
else in the background

在背景中的其他
事物上“偷懒”

Intro sequences



Picture-in-picture
jumbotrons



Keep crowd in
the back-ground

使人群保持在背
景范围中



The main characters
are the focus
主要人物是焦点

Intro sequences
介绍场景





Show off differences
in fighter physiques

表现出拳击手体
型的差别

Make iconic moments
of top quality

标志性时刻应以
高品质制作

Intro sequences

介绍场景

CHARLES "MAY" LEWIS

HARLEY-DAVIDSON.COM

BUD LIGHT BUD LIGHT

metroPCS.

PHARM.

MGA GIGI

ULTIMATE
POKER.com

BUD
LIGHT

Fresh fighters:
focused facial anims.
'Dry' skin
Energetic motions

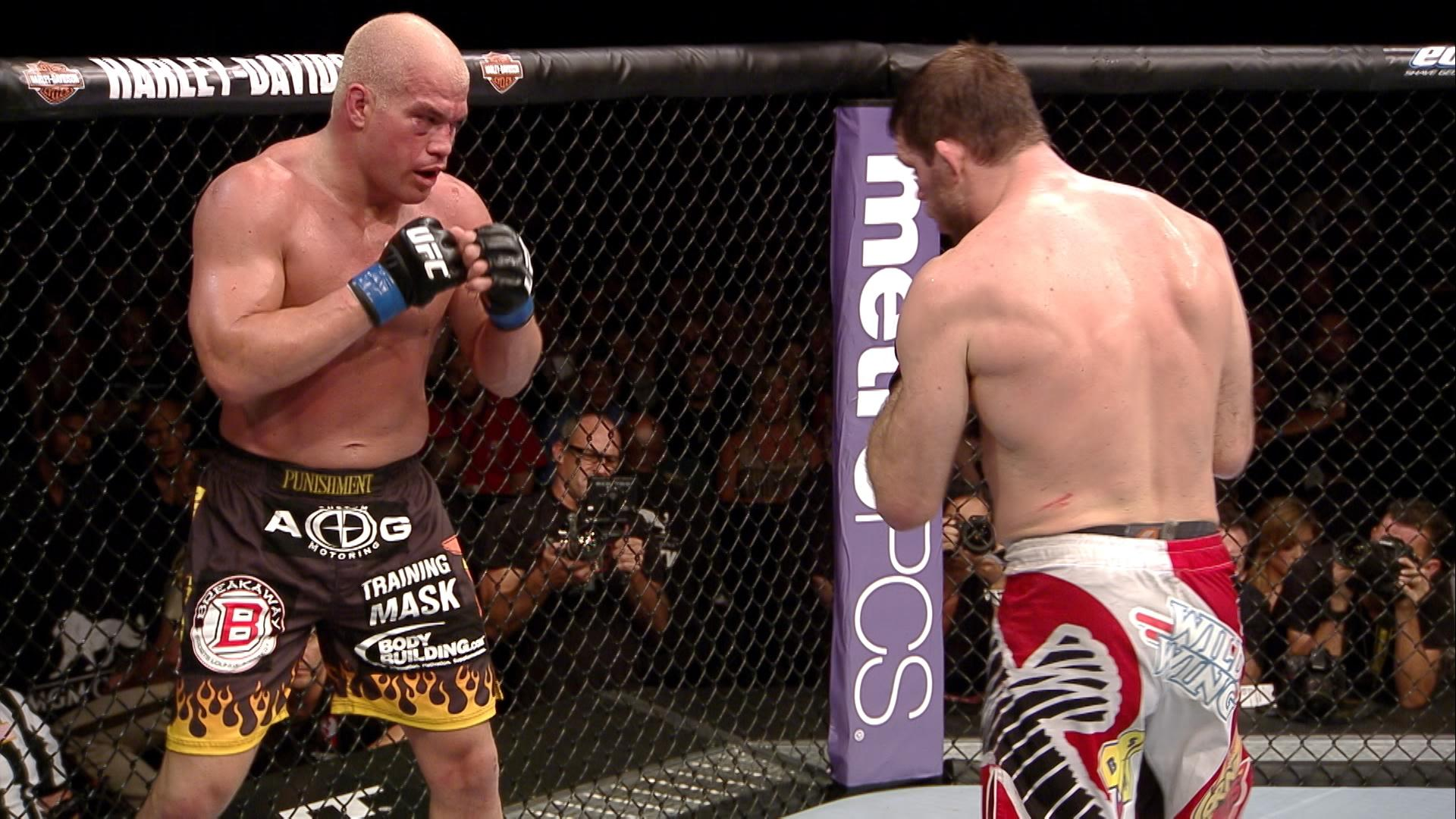


新拳击手:
将重点放在脸部动画
“干燥”的肌肤
充满活力的动作

Motion blur
动态模糊 emphasizes speed
强调速度



Gameplay
开始比赛





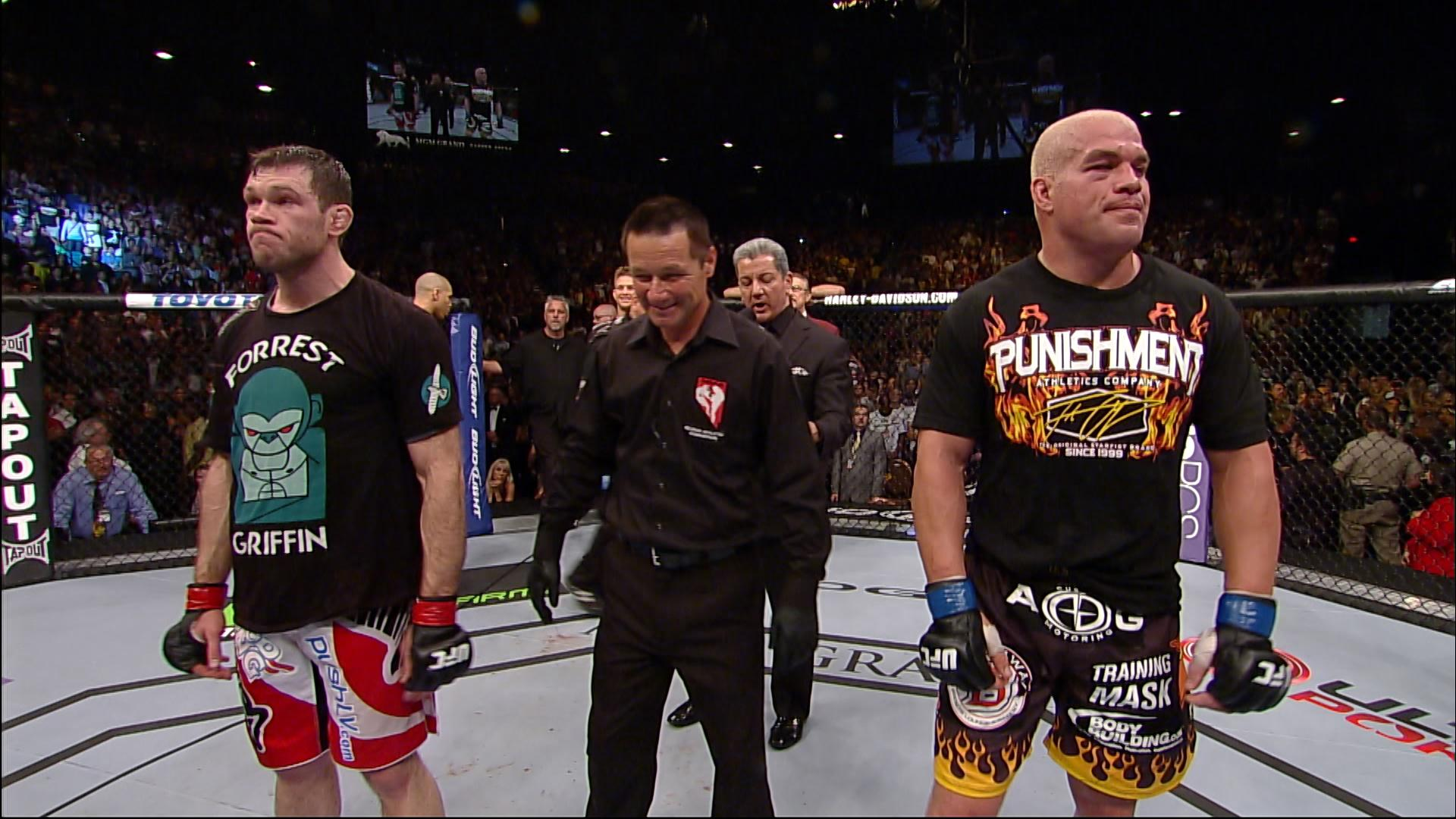
The bounce and jiggle
of fat helps create
a soft human feel

脂肪的弹跳和晃动
有助于营造柔软的人体感



Fleshiness

肉感



使用独特的动画详细刻画

许多人物

Many highly detailed characters
with unique facial animation



Post Fight

赛后

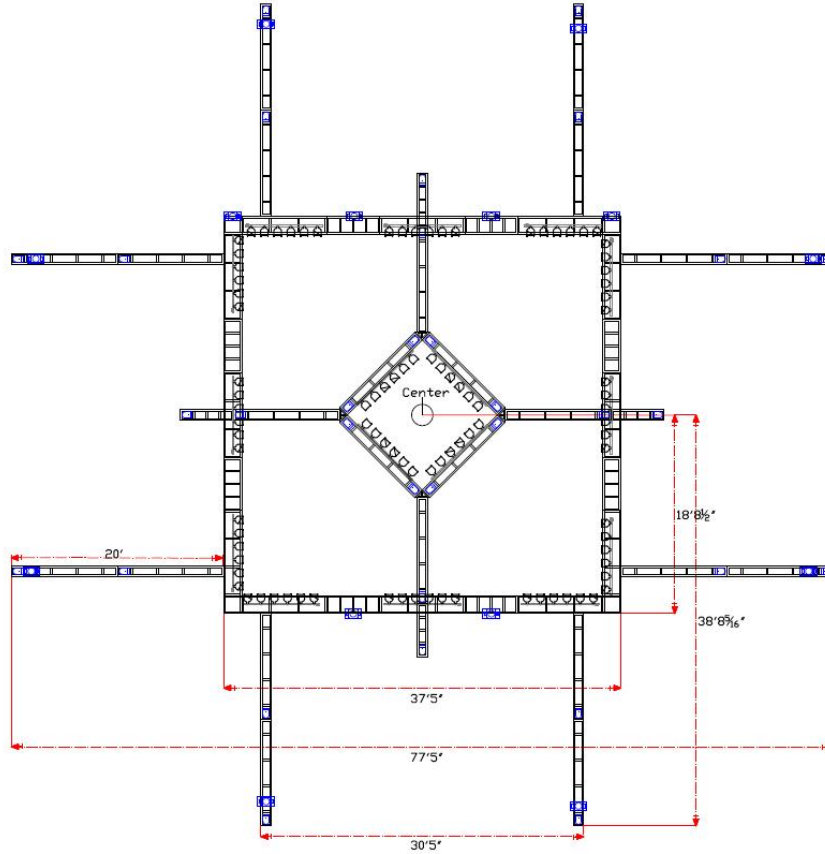
ETARs & VTARs — 照明



灯光照明



ULTIMATE FIGHTING CHAMPSHIP



DRAWING TITLE:
LIGHTING PLAN, ELEVATION
AND CAMERA POSITION PLAN

LIGHTING LEGEND	
SYMBOL	DESCRIPTION
	PARAL BEAM LIGHT
	SOURCE PAR WIDE
	SOURCE PAR MEDIUM
	SOURCE PAR NARROW
	SOURCE ELLIPTICAL
	HOME (RED ORANGE)
	HOME (YELLOW)

- NOTES:
1. FIXED DIMENSIONS ARE NOT TO ANY SCALE.
 2. ALL PAR LIGHTS TO HAVE RIGGED TIE OR DIM IS OFF-TOUCH.
 3. ALL AUDIENCE LIGHTS TO HAVE RIGGED TIE.
 4. RING TRUSS TIE HEIGHT IS 38'.
 5. CONSOLE TO BE LOCATED SYMMETRIC OF RING.
 6. PLACE/HEIGHT AND SPACING OF LIGHTS & INSTRUMENTS ON LOW STAGE TRUSS TIE ON SITE (BASED AT CENTER OF RING).

THE ENTIRETY OF THIS DRAWING IS THE PROPERTY OF PRIMA PRODUCTIONS, INC. AND IS NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE WRITTEN PERMISSION OF PRIMA PRODUCTIONS, INC.

© 2004 PRIMA PRODUCTIONS, INC. AND ASSOCIATES INC.

DATE: 11/10/04 SCALE: 1/4" = 1'-0"

SHEET NO.: 1 OF 1

照明理解





Lee Rosenbaum,
技术美术师
EA加拿大

UFC LIGHTING AND CROWD



Warm lit crowd falling into shadow.
Sharp focus not appealing.



Crowd fall off into shadow & DOF works here. Cage acts as a separation layer.
The black shorts are the darkest value in the scene. A good thing.



Great separation when foreground crowd is not in view.



Out of focus cool light sources in bkgd read well avoiding pure blacks
Foreground blurred out cage adds a nice abstract depth to image



Pockets of light (many colored) from spot lights break up crowd & bkgd.

NOTE- that this lighting effect only occurs between rounds and before & after fights

Leveraging this treatment "slightly" might break up bkgd and add interest. But do not over apply. Treatment on left is authentic.

ETARs & VTARs — 人物



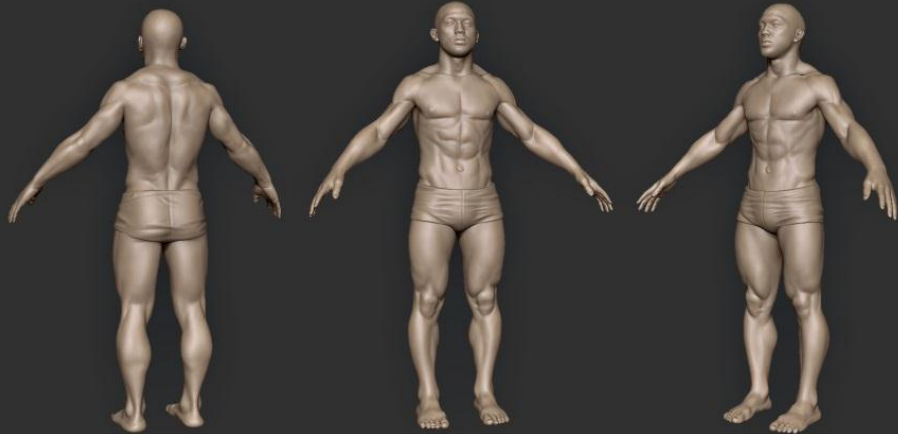














WIP Hendo — 《street》 前8个月





BENSON HENDERSON

BORN: COLORADO SPRINGS, CO, USA



BENSON HENDERSON

ALL-AMERICAN WRESTLER

FORMER WEC LIGHTWEIGHT CHAMPION

VERY FAST

基础



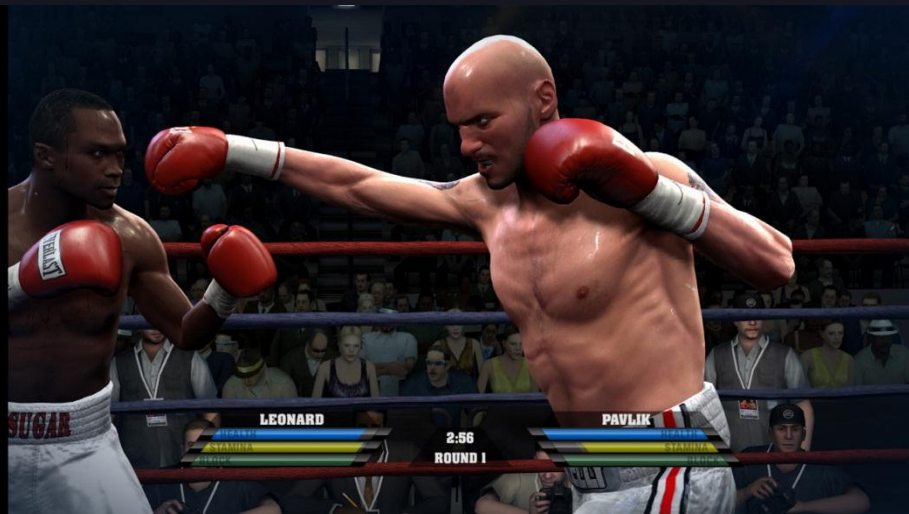
挑战



挑战



挑战





ETARs & VTARs — 动作

反应性动作：拳击波纹、肌肉变形



“环境”的动作：呼吸、摇晃、弹性

UFC
ULTIMATE FIGHTING
CHAMPIONSHIP

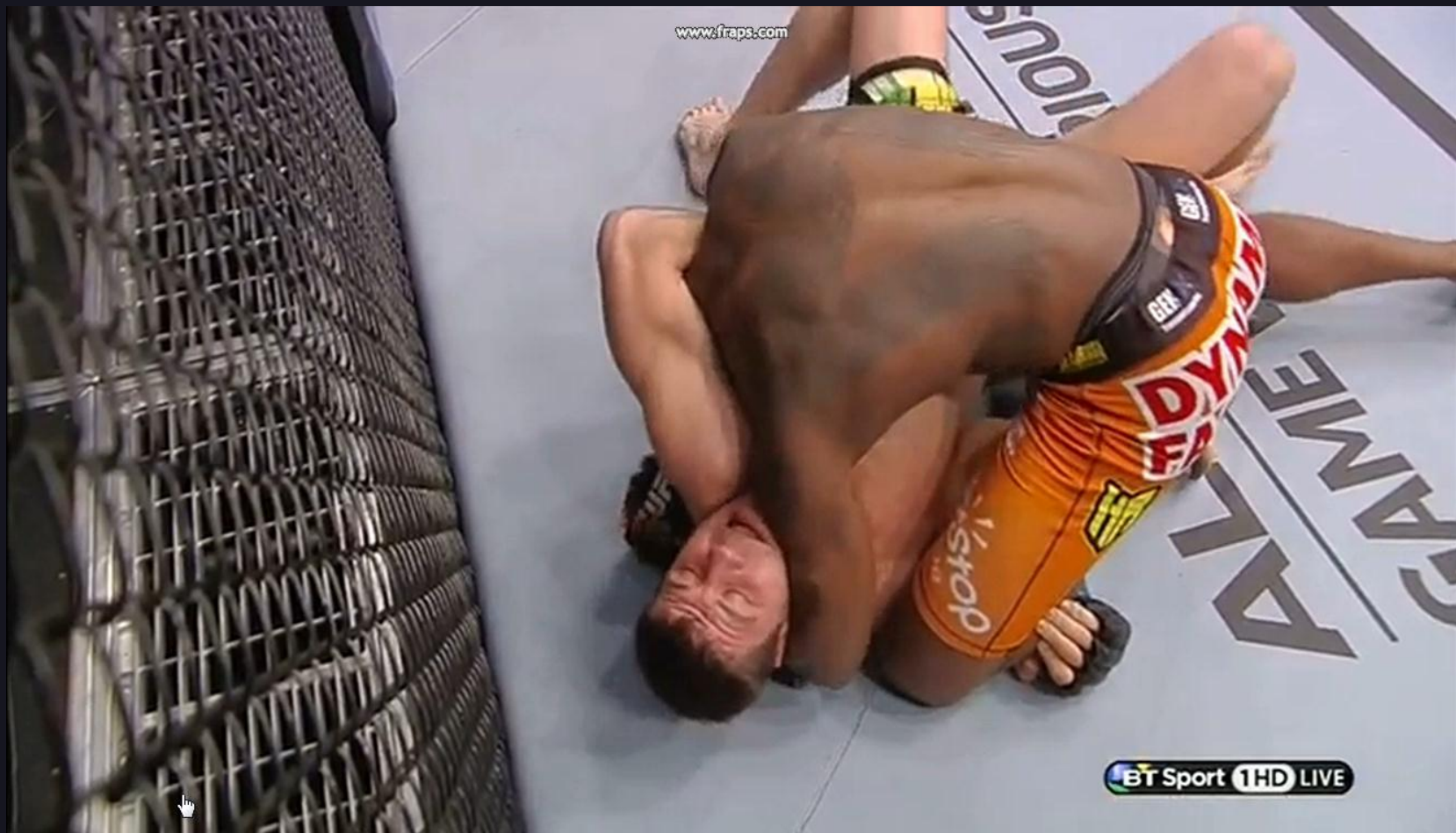


窒息时刻



www.fraps.com

BT Sport 1 HD LIVE



Status: CONNECTED | Type: ACTIVE | TargetName: game.pc64.render
Status: CONNECTED | Type: ACTIVE | TargetName: game.pc64.sim

www.fraps.com

LoopSimulation: 19.4 FPS 31.5 ms
LoopRender: 21.3 FPS 34.5 ms
GPU: 20.4 FPS 40.1 ms
Uptime: 000:03:49:568

Anthony Pettis

UFC 04:36 1st

Game Modes Info

CL 385607 Windowsd+ Mar 7 2013 10:33:01 hd

情感

Extreme expressions
Organic feel

极端的表现形式
自然的感受







UFC - Facial Wrinkle WIP/Prototype



PRE-ALPHA
UFC
FIGHTER EMOTION DEMO

结合全部



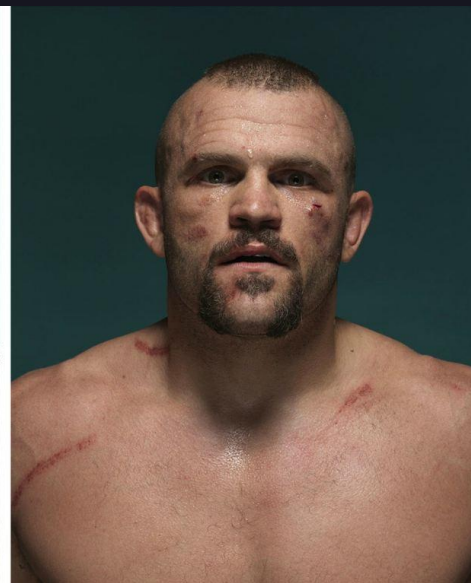
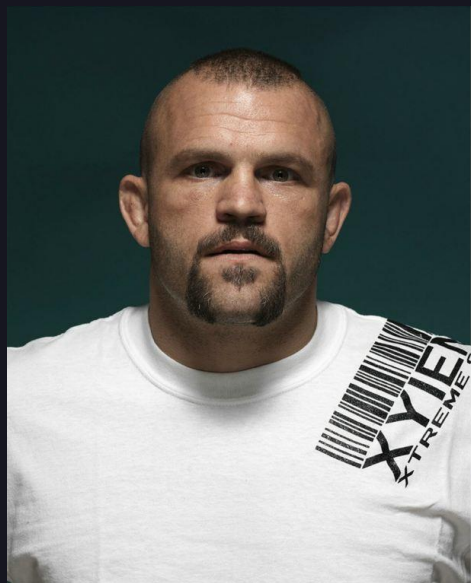
ETARs & VTARs — 损伤



讲述故事



由Kevin Lynch拍摄







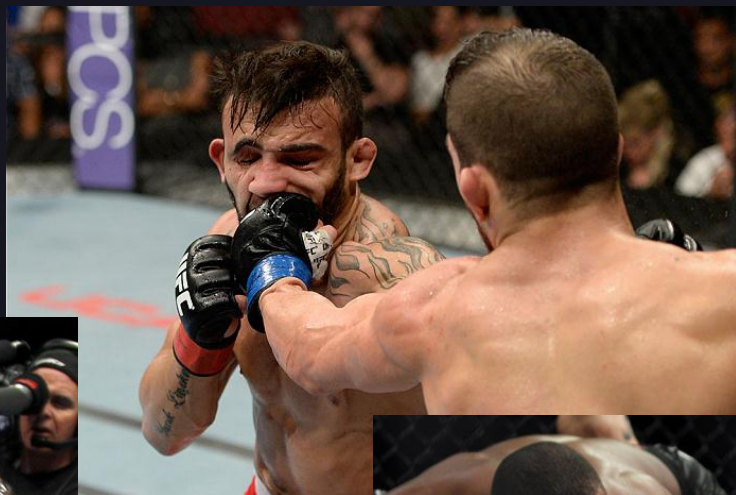
Photography by Kevin Lynch



创意支柱

- 动作

- 冲击与情感
- 图像逼真度
- 令人信服的碰撞，柔软的身体



互动与变形技术

互动与变形

- 人物的接近和互动对《终极格斗冠军》来说非常重要
- 动画之外：创造更好的可操纵人物
- 我们新的图形处理器不仅仅能够进行着色，还能实现更多功能...



搭载了新图形处理器的新平台

- 《拳击之夜》系列的旧作（PS3和XBox360）
- 新的PS4、新的XBoxOne、有限的访问 – 不完整
- 功能更强大？还不清楚
- 新功能 – 更新的图形处理器不仅更快，而且更灵活
- 抵制诱惑，重写一切

全身体接触



挑战

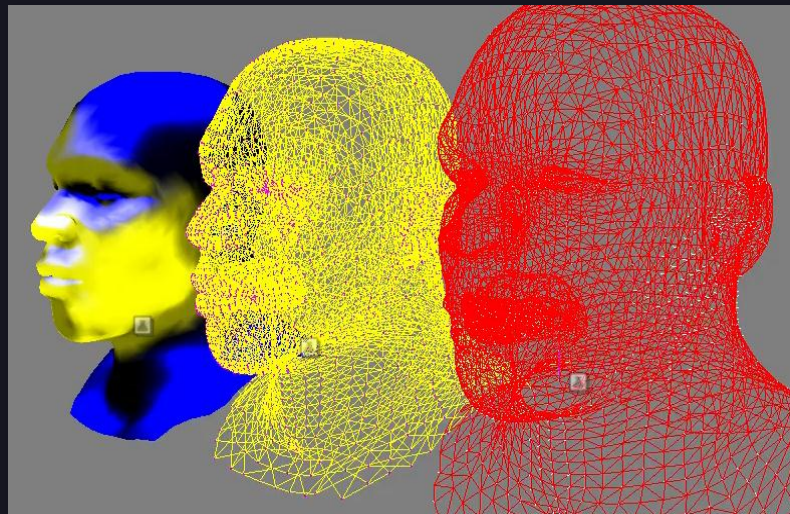
- 在每个角色的脸部进行~30k的独特渲染
- 动态角色 - 变形形状, 200+ 骨头
- 网格与网格的碰撞本质上是昂贵的
- 太多的姿势、位置和动态结果可用于预烘焙变形
- 计算极端*

迂回

图形处理器和计算

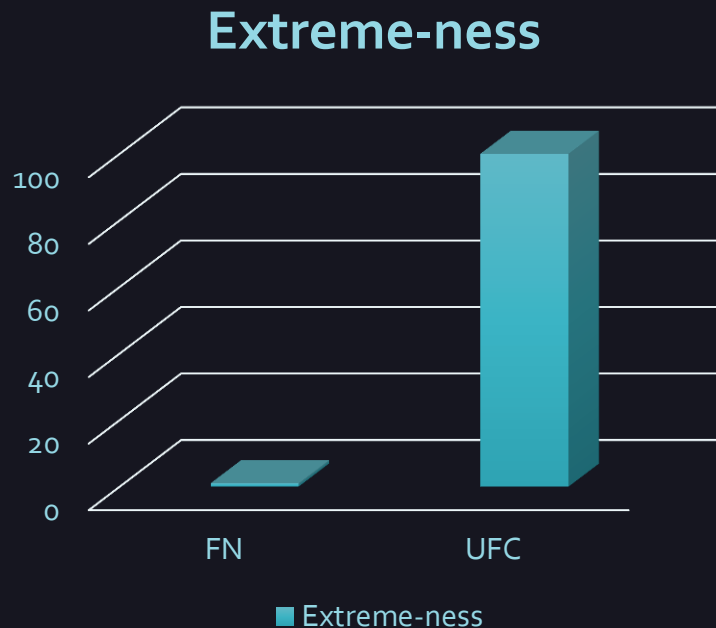
“计算极端”？

- 《拳击之夜》是极端
 - 密集的网格
 - Xbox360 CPU 6个内核中的3个
 - 4个PS3 SPU（协同处理器）
 - 用于皮肤变形、布料和脸部模拟
- 《拳击之夜》的开发在角色上花费了大量成本



计算极端!

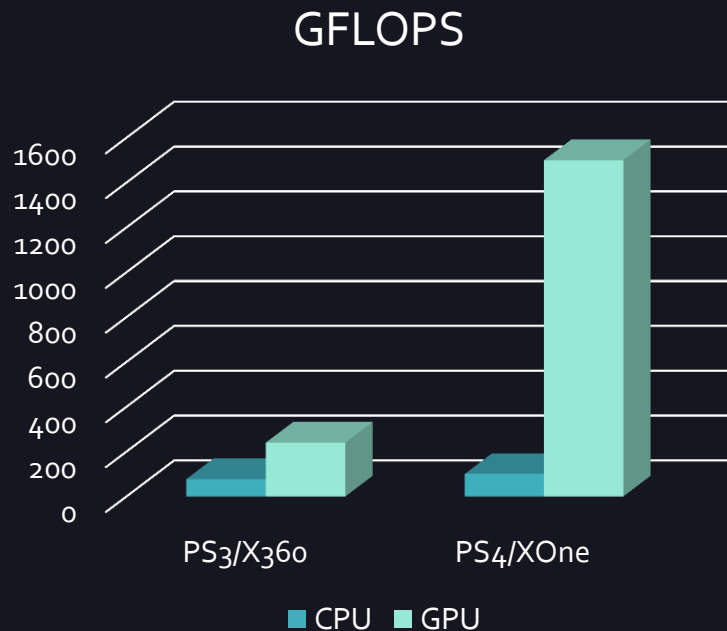
- 全身体接触的解决方案可以总结为一种简化的、构成网格与网格碰撞的算法
- ...并且由于这是一种搜索算法, 很轻易地就比《拳击之夜》中所用的线性处理要贵100倍



各代比较

- 适度的CPU性能提高*
- 可观的GPU性能提高**
- 但SPU性能没有提高
- 处理速度也没有加快100倍

那么为什么我们能够接受？



Graphics Core Next (GCN)

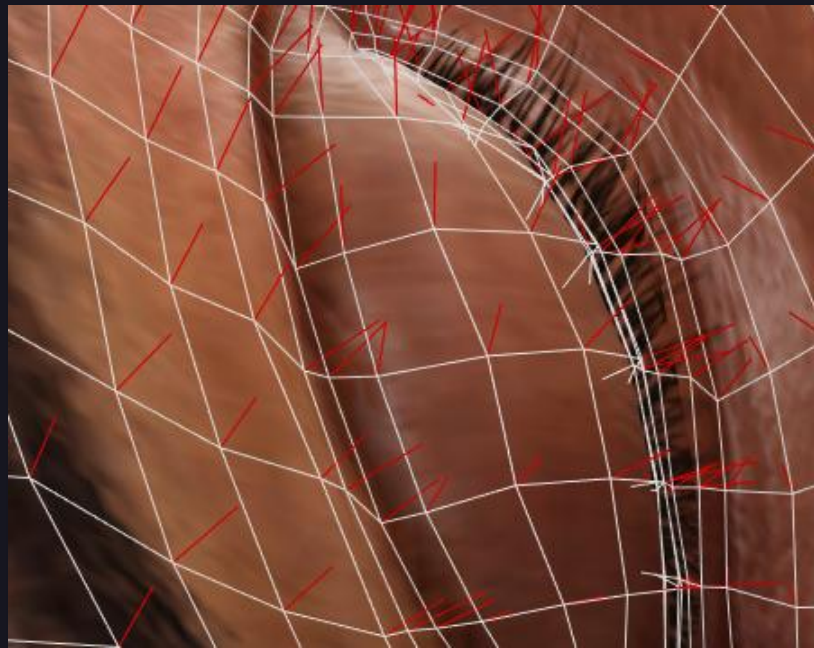
- 不仅仅只是一个图形处理器，不仅仅提高了运算速度
- 先进的通用计算引擎
- 用于执行任何程序的语言和应用程序接口 (API)
- 利用延迟缓解可达100到170GB/s的速度
- 原生并行，可实现
- 768到1152个线程
- 易于使用
- (但仍然是像素着色的唯一硬件)

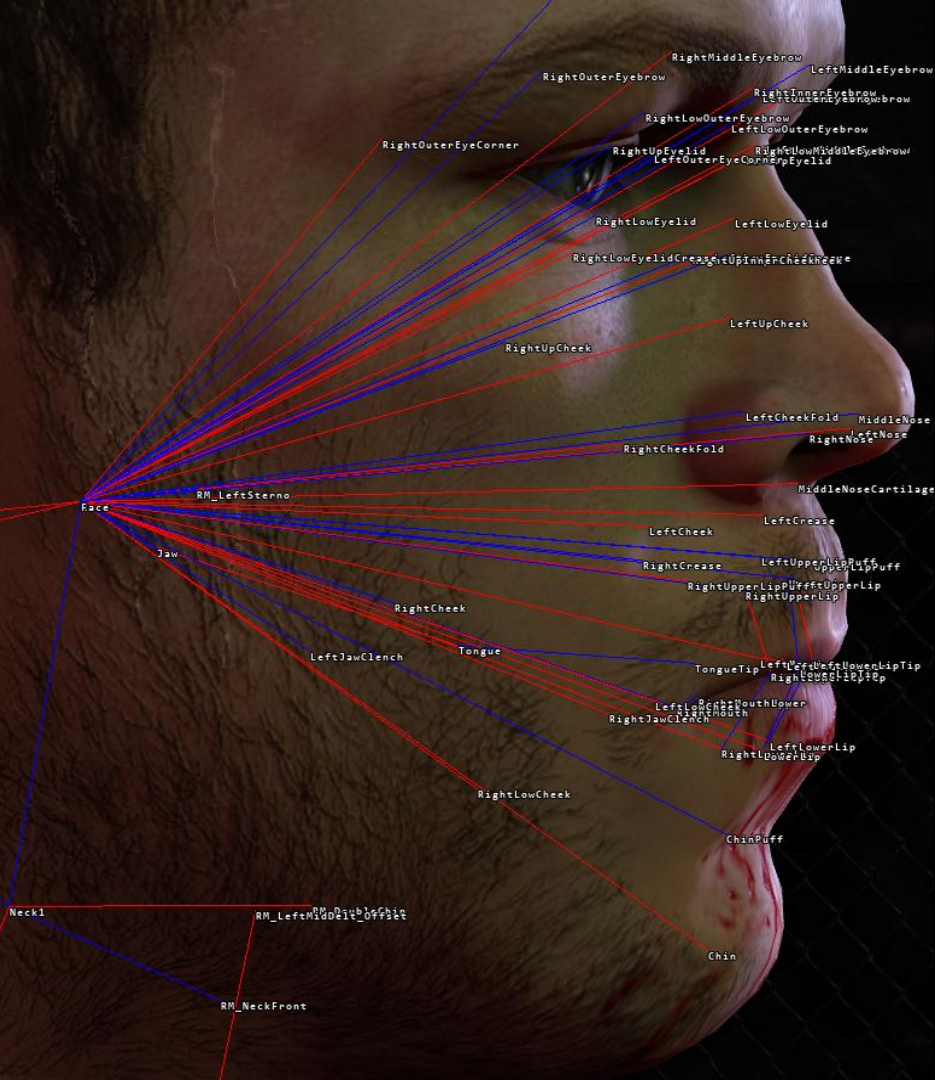
不只是着色

GPGPU应用

动态网格法线

- 从多个渲染网格合并和焊接顶点数据
- 生成脸部邻接
- 从动态表面形状生成精确的顶点法线





复杂的骨架处理 (Rigging)，许多骨骼和重量。
 加总转换。
 加总法向量上的变换。

法线变得歪斜。
在极端的情况下，比如这个脸部骨架，法线方向几乎没有受到极端脸部位置的影响。

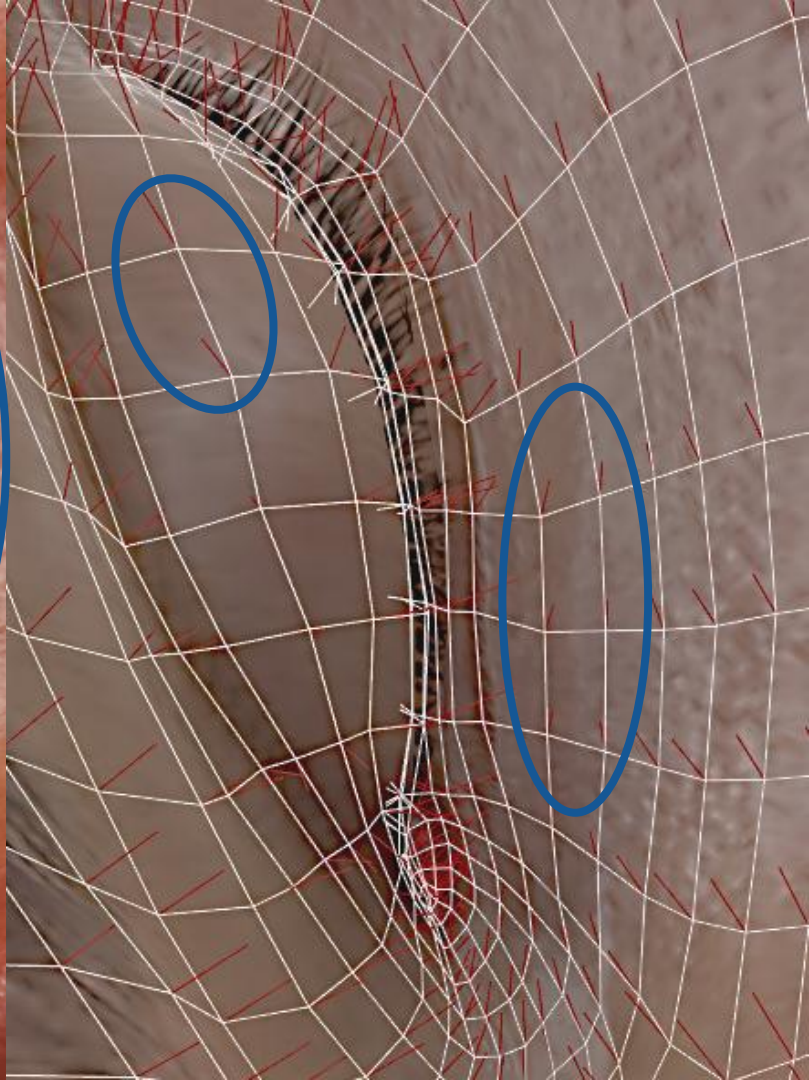
利用线性法线混合重叠变性目标。

法线

重新计算



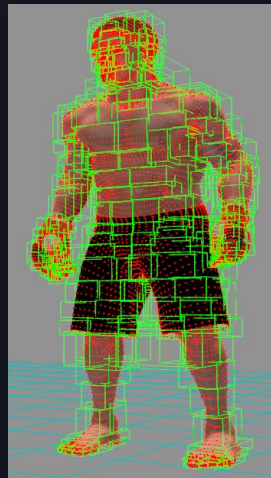
法线

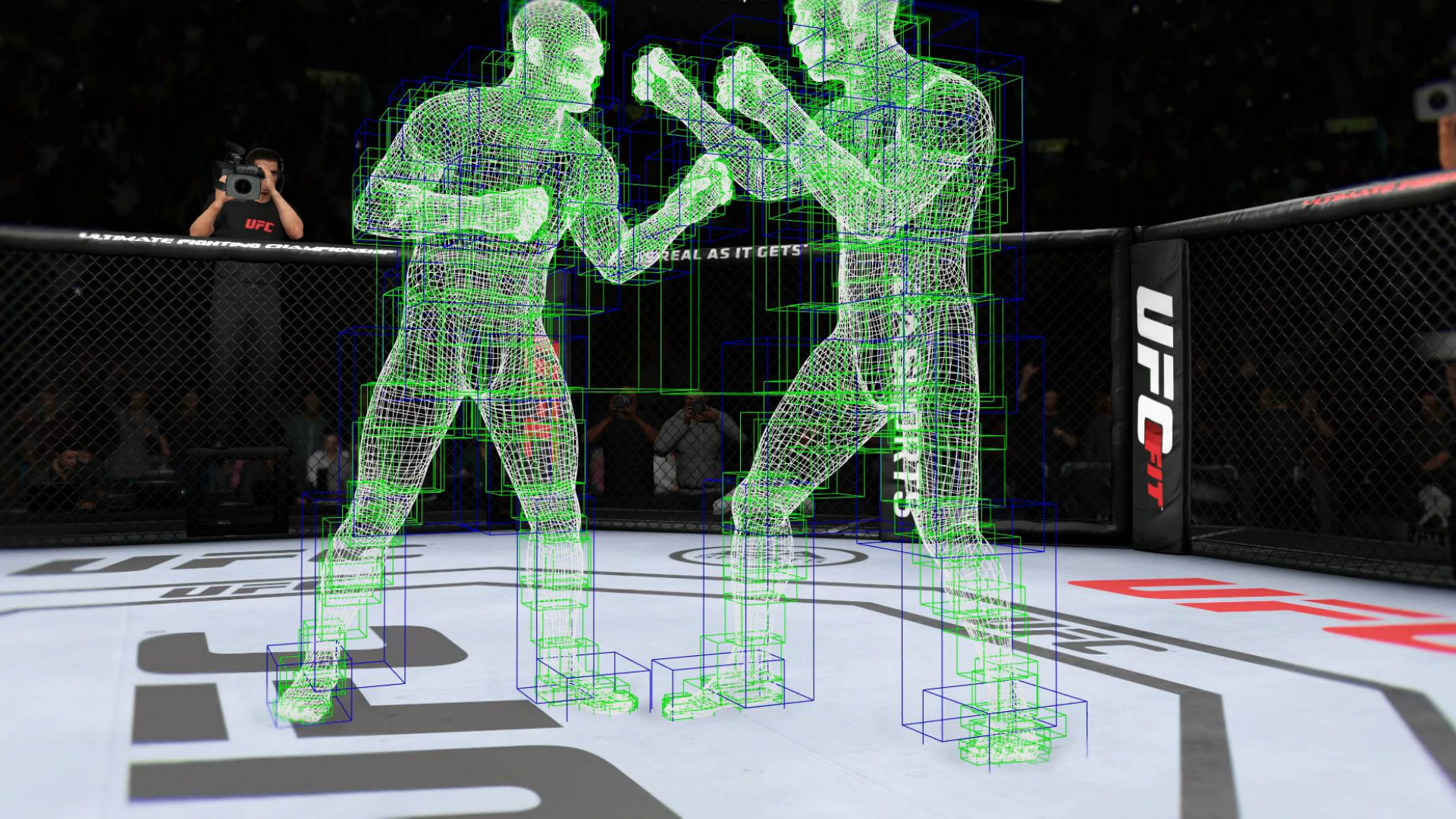


GPU加速

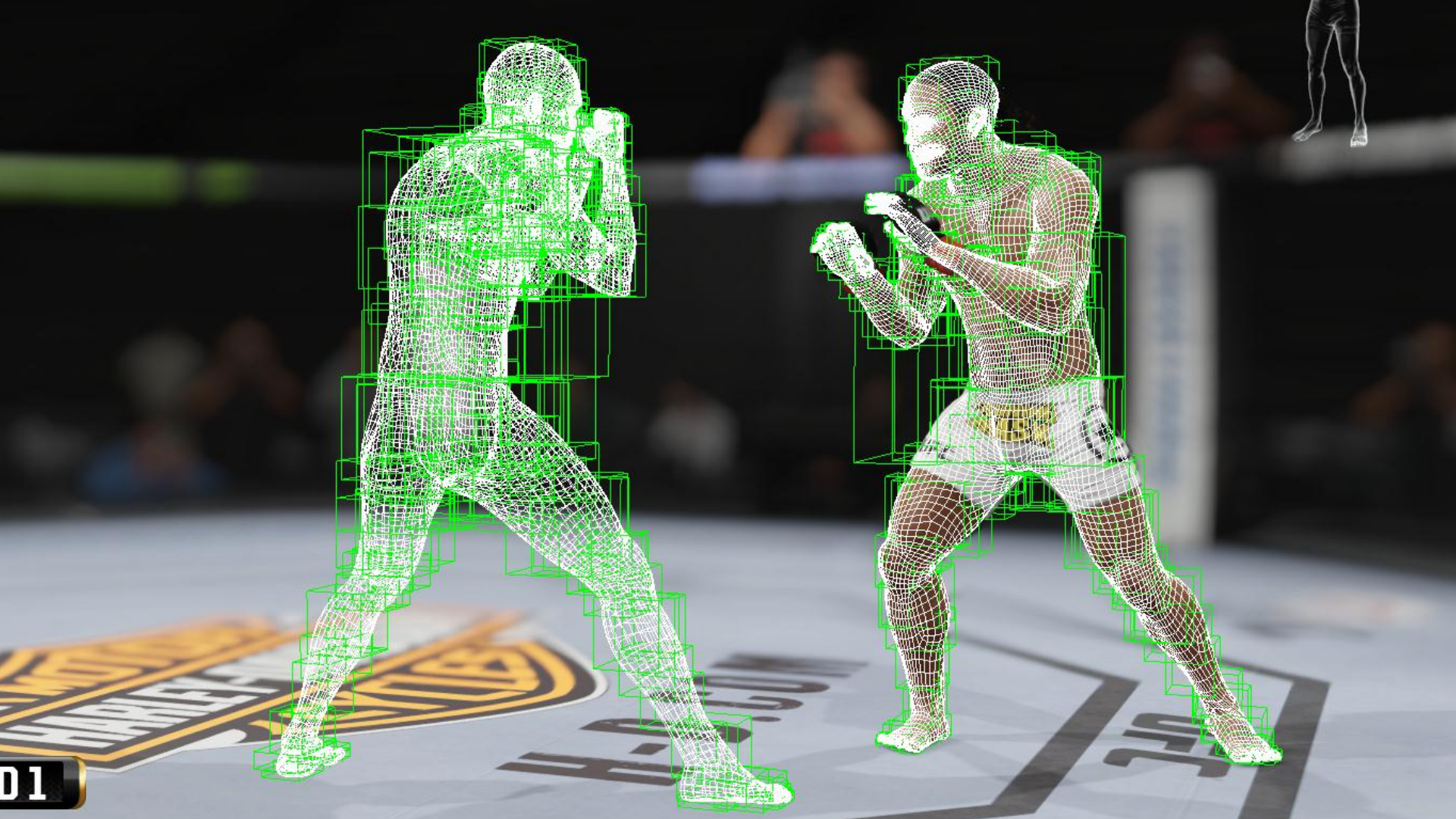
碰撞

- 在加载合并的角色网格上建立平衡的AABB树
- 修改每一帧以便进行快速宽泛阶段碰撞
- 明确的物理应用

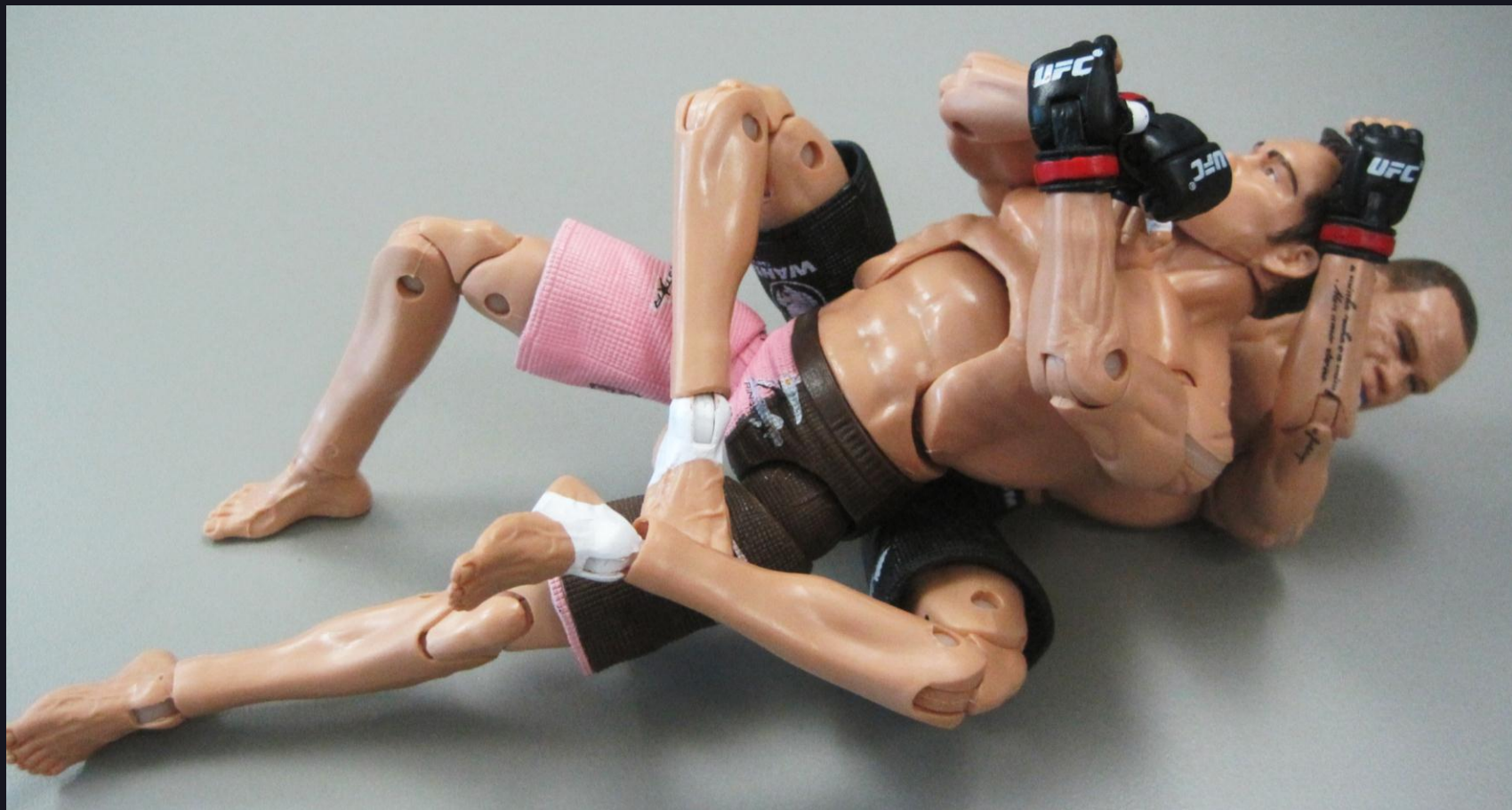








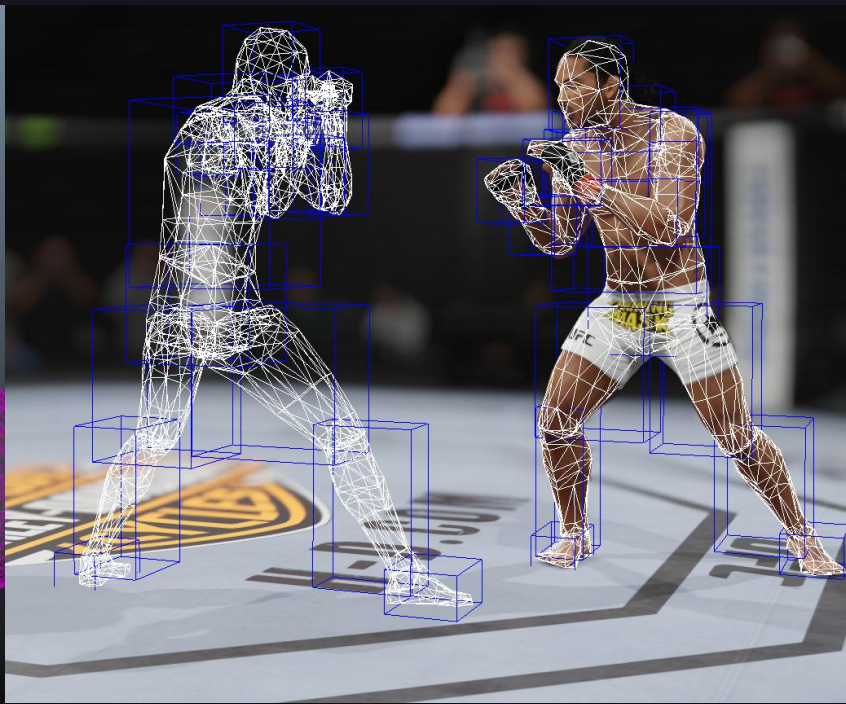
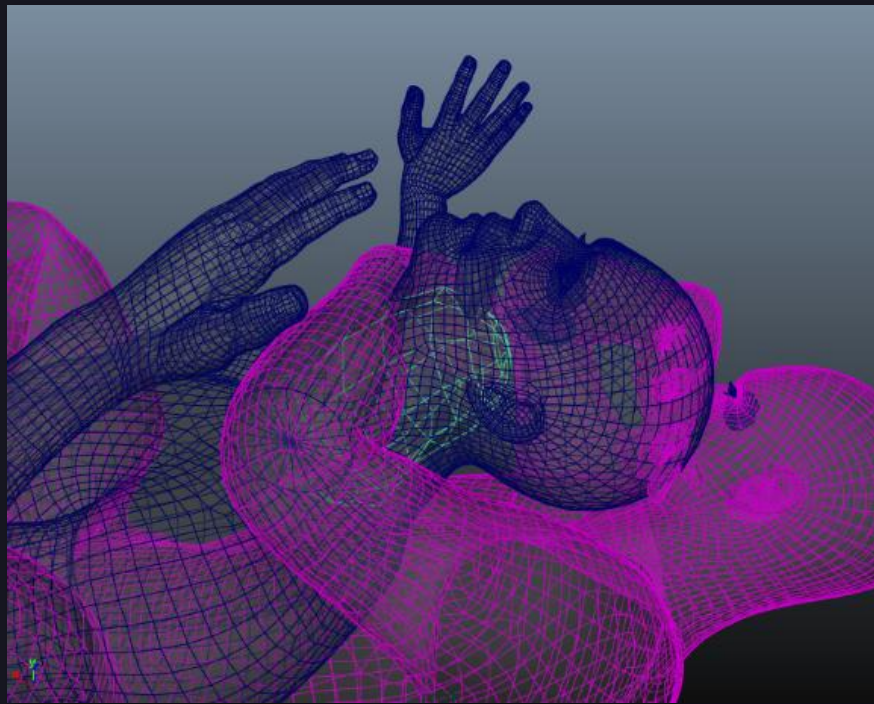
接触变形

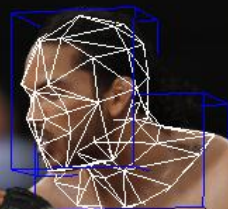
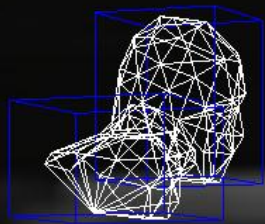


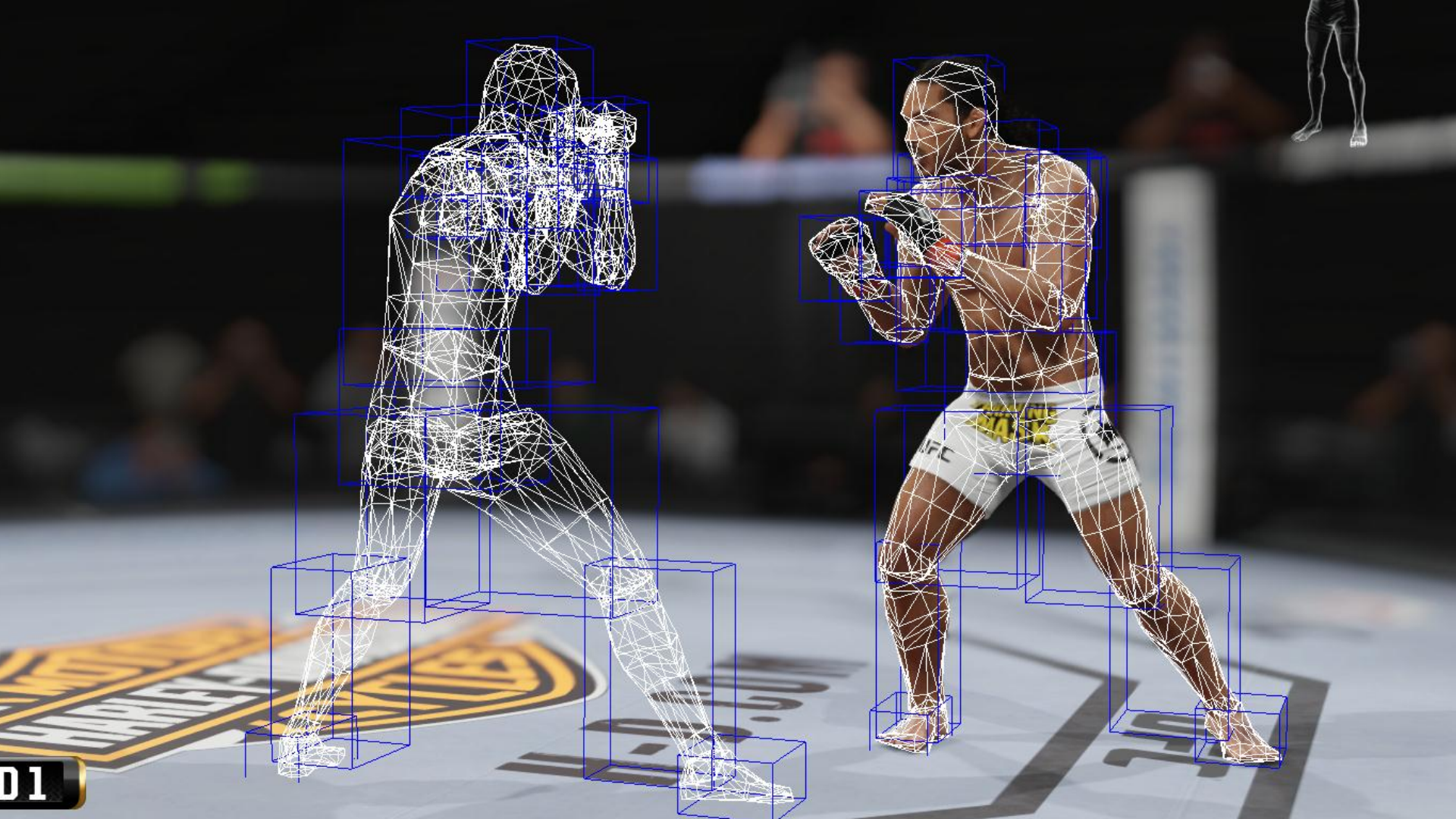




接触变形



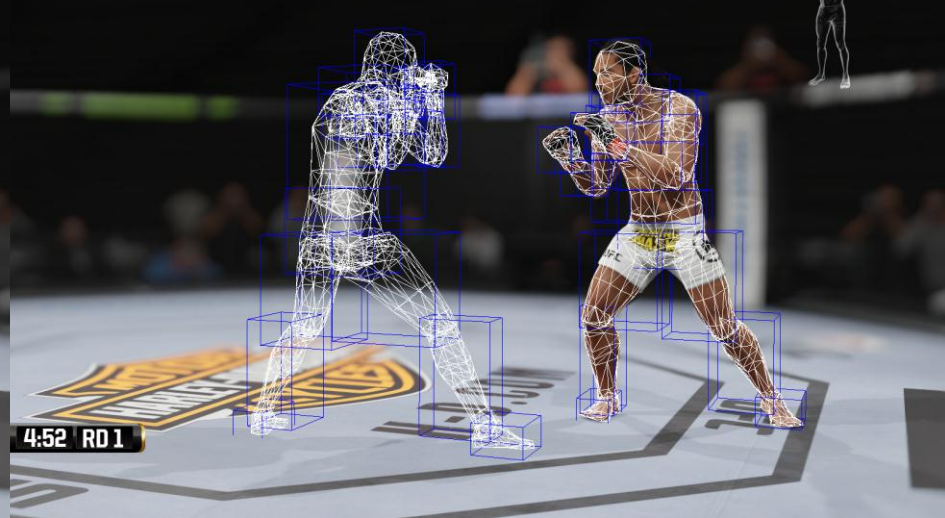






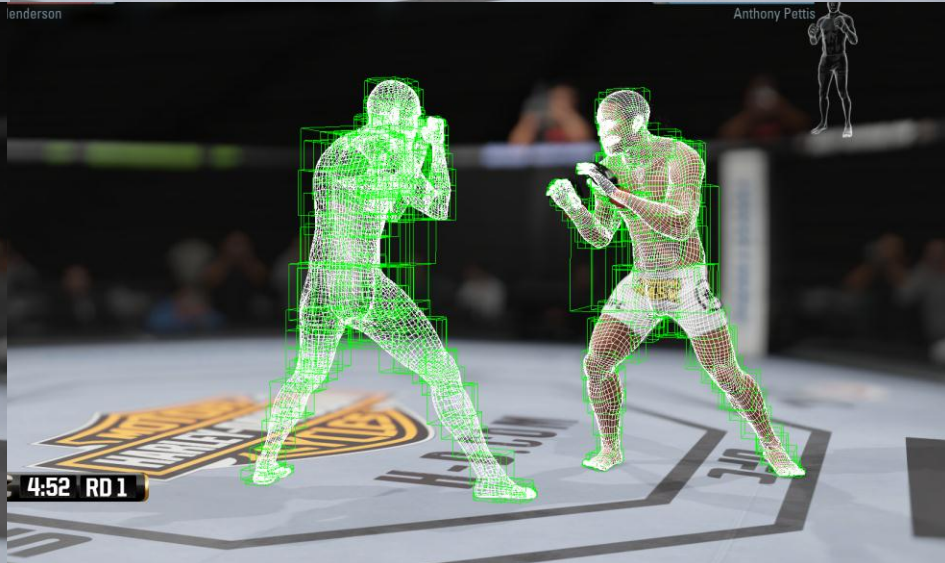
son Henderson

Anthony Pettis

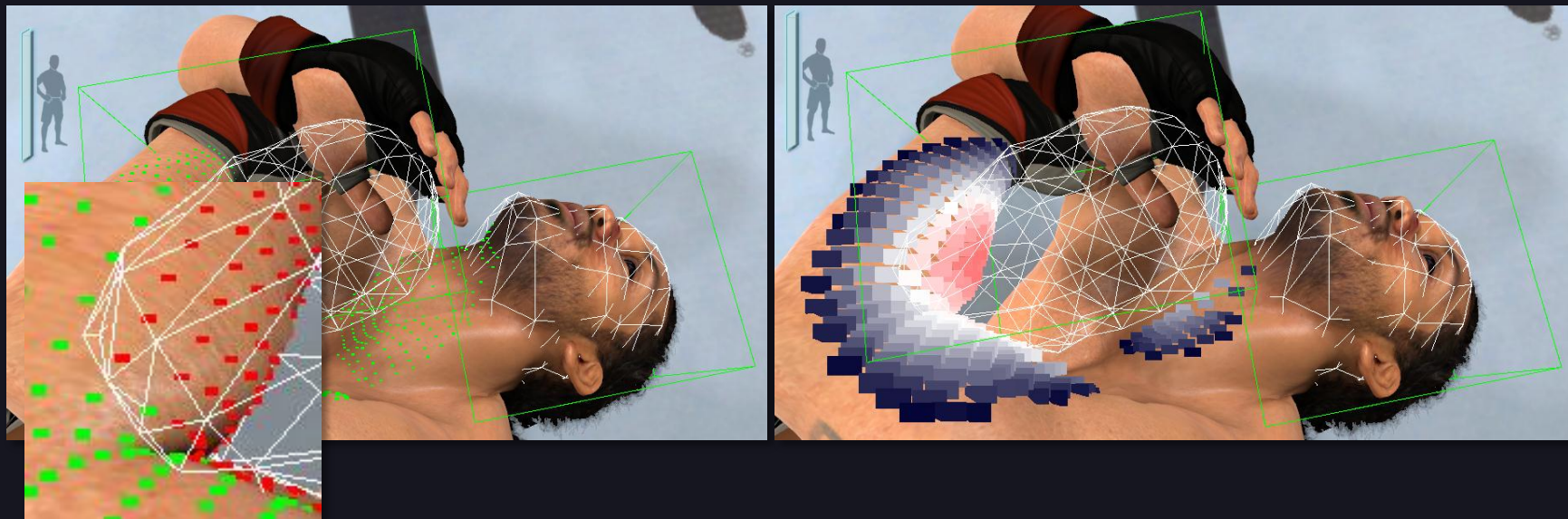


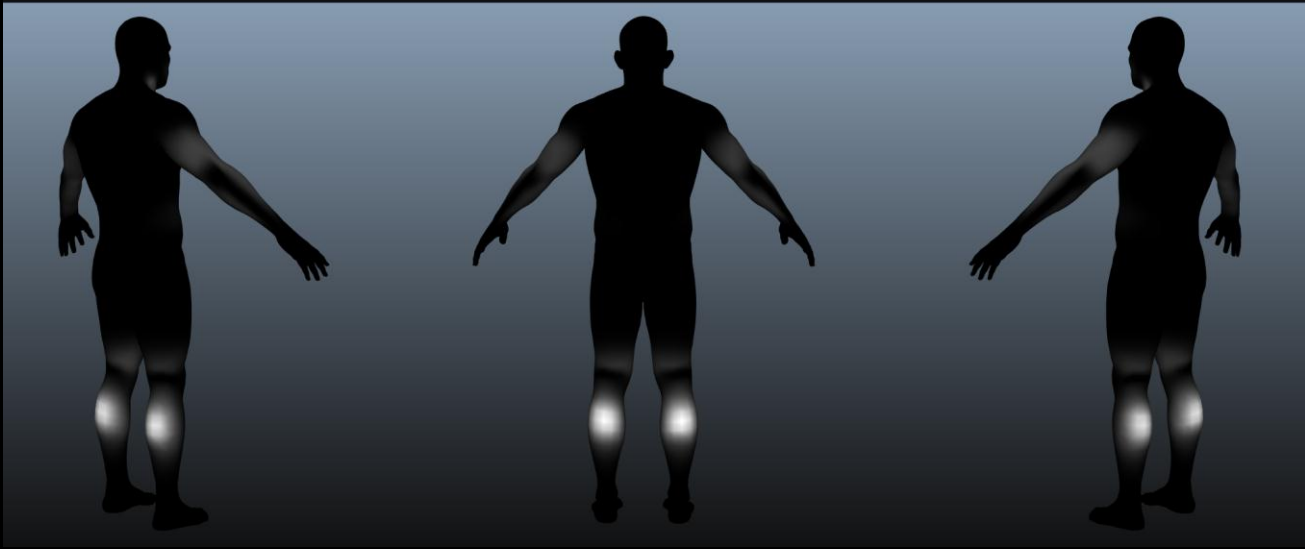
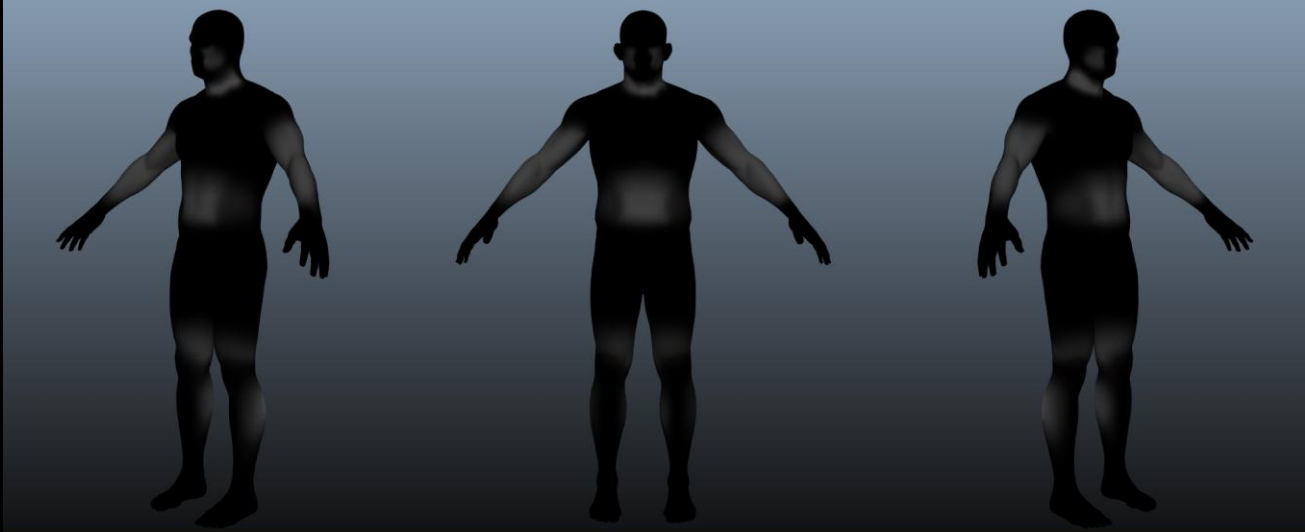
lendereson

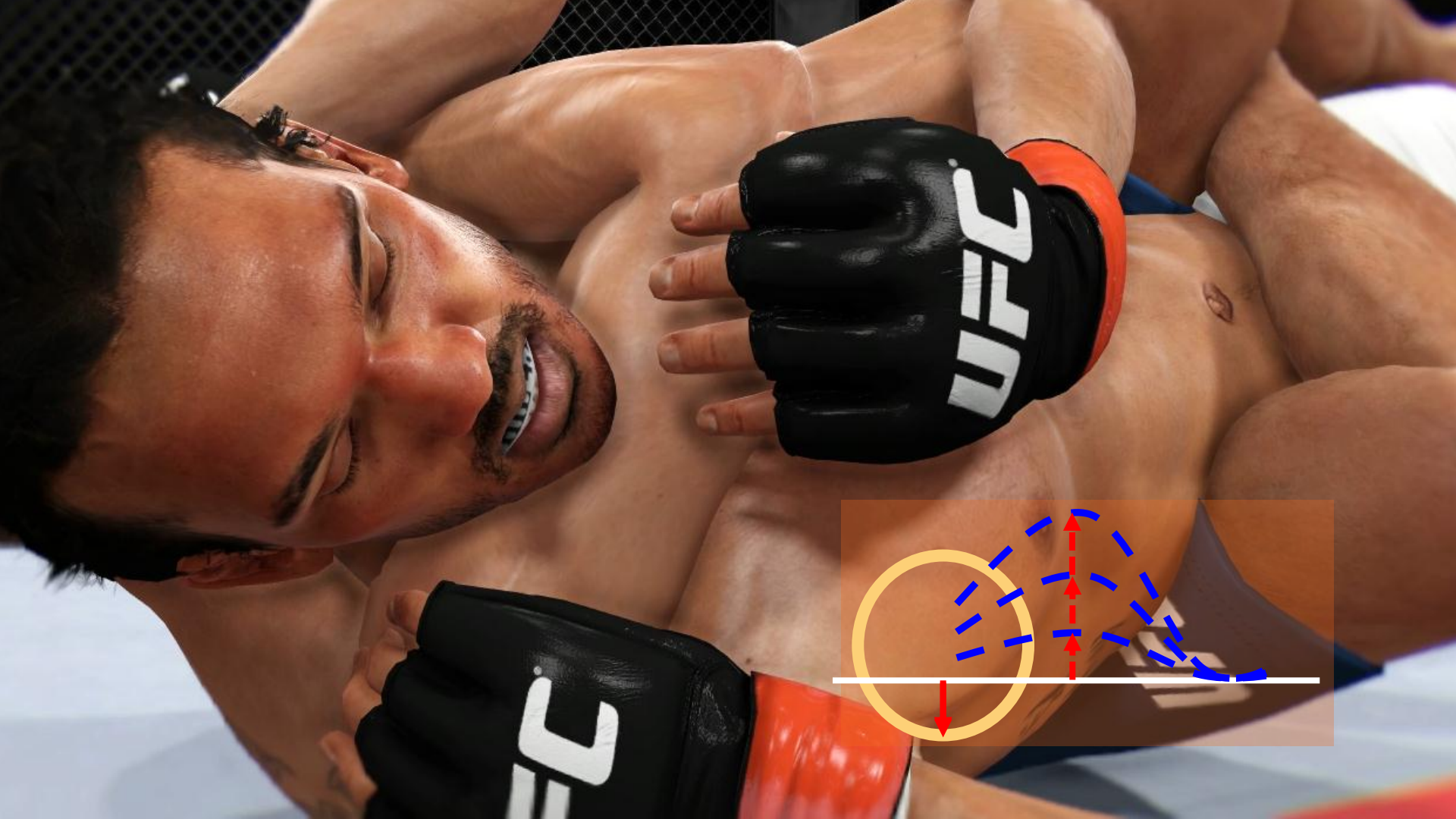
Anthony Pettis

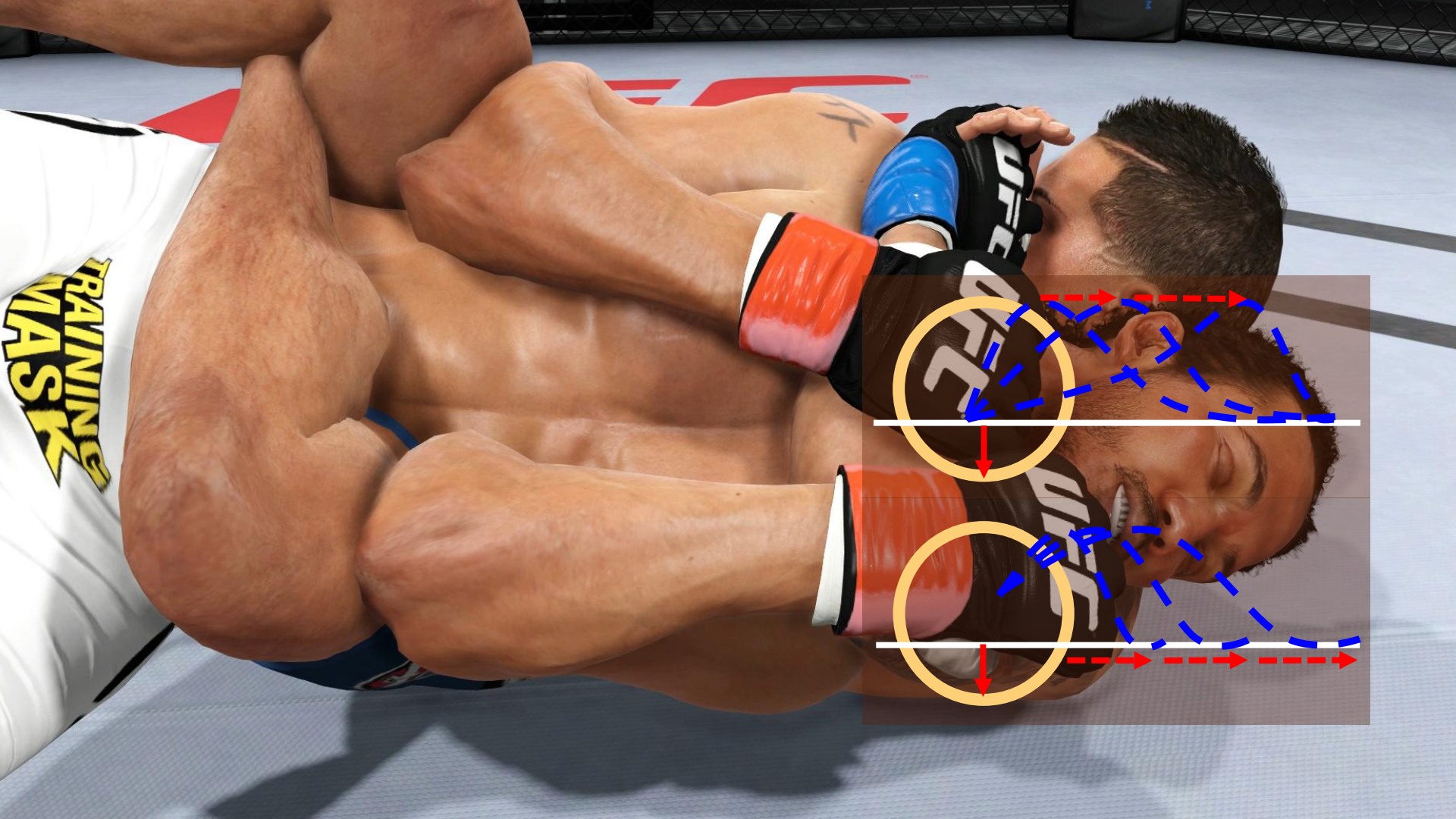


接触变形







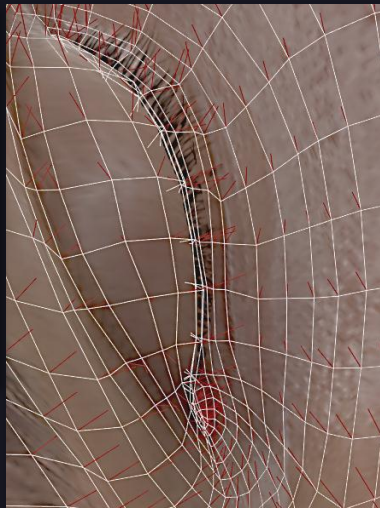






GPGPU小结

- GPU不仅仅只是用来着色
 - 它可用于任何大数据集
 - GPGPU提供的能力，即使是在现有的低性能设备上，也能改变整个游戏
 - 把它放在你的游戏开发工作中最重要的部分





5分钟休息

进入下一代，动态照明

照明和材质

照明和材质目标

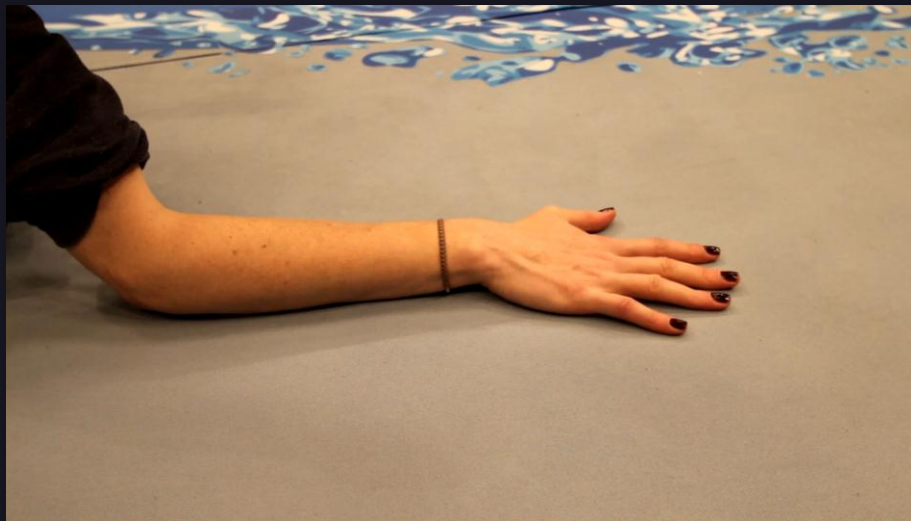
- 在《拳击之夜》之上构建
- “下一代”的照明和材质
- 克服旧方法的局限性

羡慕其他游戏如《战地》（Battlefield）的复杂的多灯光设置，但对分块式延迟方法的常见局限性抱持怀疑。



照明和材质目标

- 多个遮光源
- 高像素品质



Jenny' 真实的手, 真实的Octagon和真实的战斗
照明,

Examples



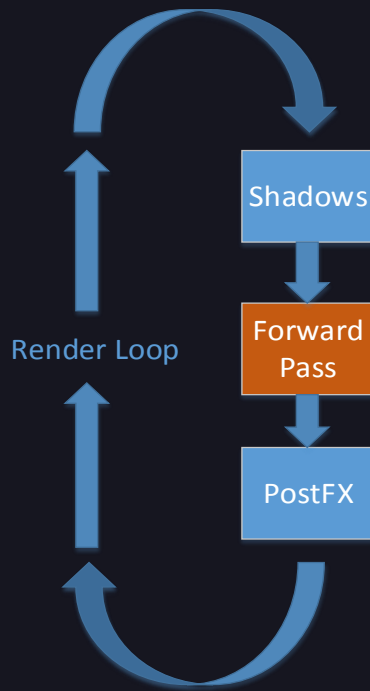
进入下一代，动态照明

运行时间策略



传统的前向渲染

- 《拳击之夜》系列
- 大多数PS3、Xbox360和手机游戏



传统的前向渲染

优点

- 持大多数的硬件
- 多重采样抗锯齿 (MSAA)
- 单程 (低带宽)
- 任意双向反射分布函数 (BRDF)
- 无限制着色器编辑
- 所有的材质和照明性能的合并通路
- 容易优化单一照明环境

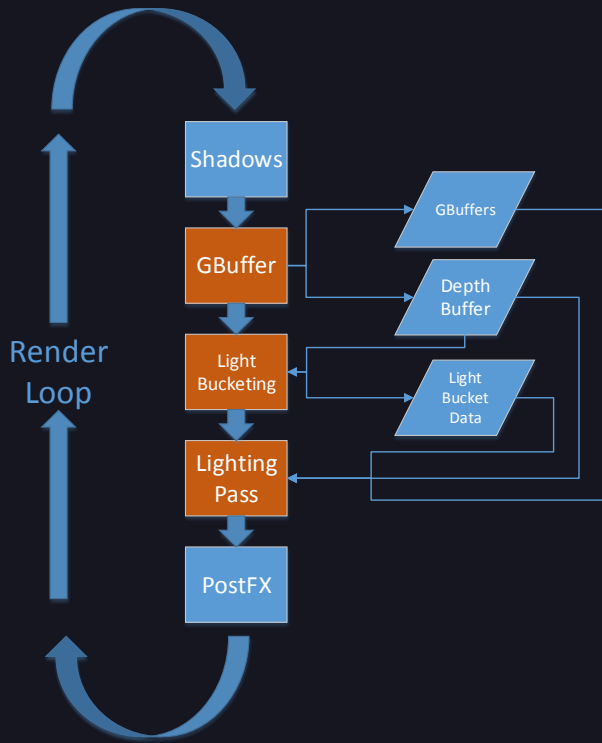
缺点

- 无限制着色器编辑
- 通常光线数量有限
- 材质和光照结合
- 难以更换照明设置而不重新调整材质
- 难以执行一致的照明模式



延迟/分块渲染

- Modern技术
- 多灯光
- 照明环境的动态变化
- 大世界



《死亡空间》 (Dead Space)



《战地》 (Battlefield)

延迟/分块渲染

优点

- 光数没有硬性限制（或高限制）
- 照明环境很容易改变或动画化
- 每个灯光都可以进行遮蔽
- 低超量绘制：有效属性缓存更新的作用类似depth-pre-pass
- 照明只消耗应用的地方
- 固定属性缓存的设计有助于规范形成一致的双向反射分布函数

缺点

- 大属性缓存需要高带宽
- 多重采样抗锯齿只支持最新的硬件，占用大量内存
- 需要先进的后处理抗锯齿
- 难以支持双向反射分布函数的多样性—多层材质存在问题
- 透明度，如果进行处理，是一个单独的解决方案

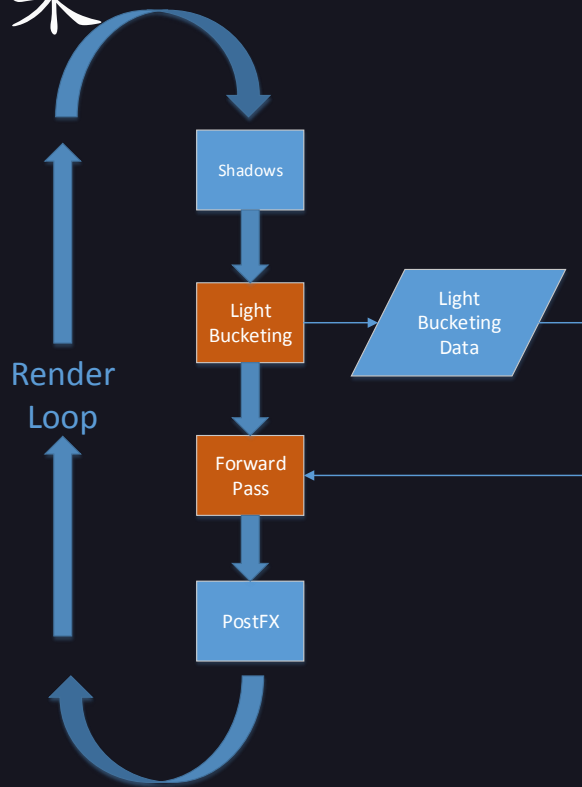
Forward+渲染



见：Jay McKee，MTS工程师，AMD – GDC 2012 “Leo”

Forward+渲染

- 试图实现两全其美
- 大动态灯光集
- 独立的照明阴影
- 任何双向反射分布函数或特效 (VFX) 着色器



Forward+渲染

优点

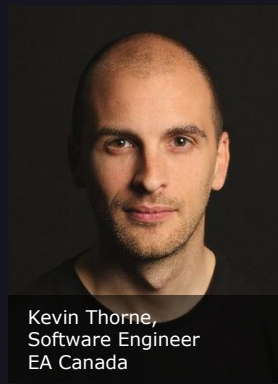
- 单通道材质和照明
- ... 启用复杂的反射分布函数或特效着色器
- 容易支持多重采样抗锯齿和A2C功能
- 最传统的前向着色器应易于更新
- 只对简单的前向渲染进行交叉编译
- 所有灯光都可以是动态的，没有硬性限制
- 每个照明阴影

缺点

- 超量绘制需要进行管理
- 微三角，浪费四路片段
- 更长的着色器结合照明和材质。
GPR压力
- 有可能使照明Bucketing变得复杂
- 损失一些分块渲染的效率*
- 每个片段的照明查找*
- 只支持Modern GPU
- 渐变ddx/ddy

《终极格斗冠军》采用Forward+渲染

- 降级到简单的第三代/手机前向渲染
- 可扩展 - 添加/删除/修改飞行照明
- 重用现有材质 (《FIFA》、《拳击之夜》、《NHL》)
- 一致的全场景照明数据
人群、世界、拳击手
- 拳击场 - 图形失真和透明度
- 皮肤 - 多层材质



Kevin Thorne,
Software Engineer
EA Canada

《终极格斗冠军》 Forward+: Bucketing

- 在着色片段时生成使用灯光列表的过程
- 对性能来说直观重要
- 许多策略

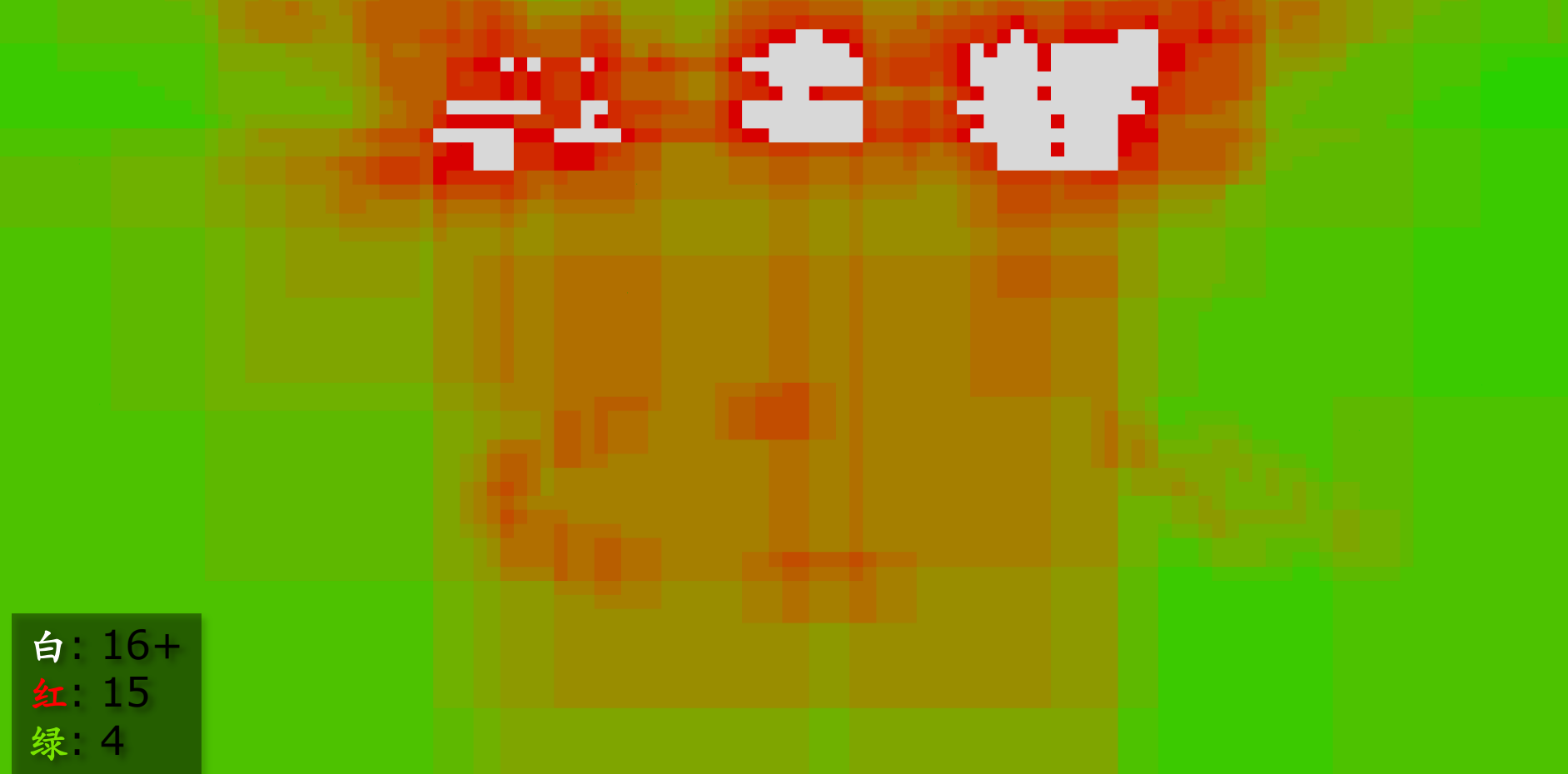


场景

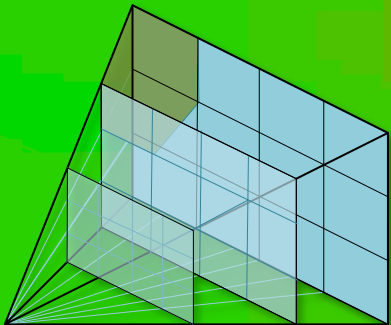


2D分块的
光数（热贴图）

分块的16x16像素



分块的64x64像素
16深度分割



白: 16+
红: 15
绿: 4

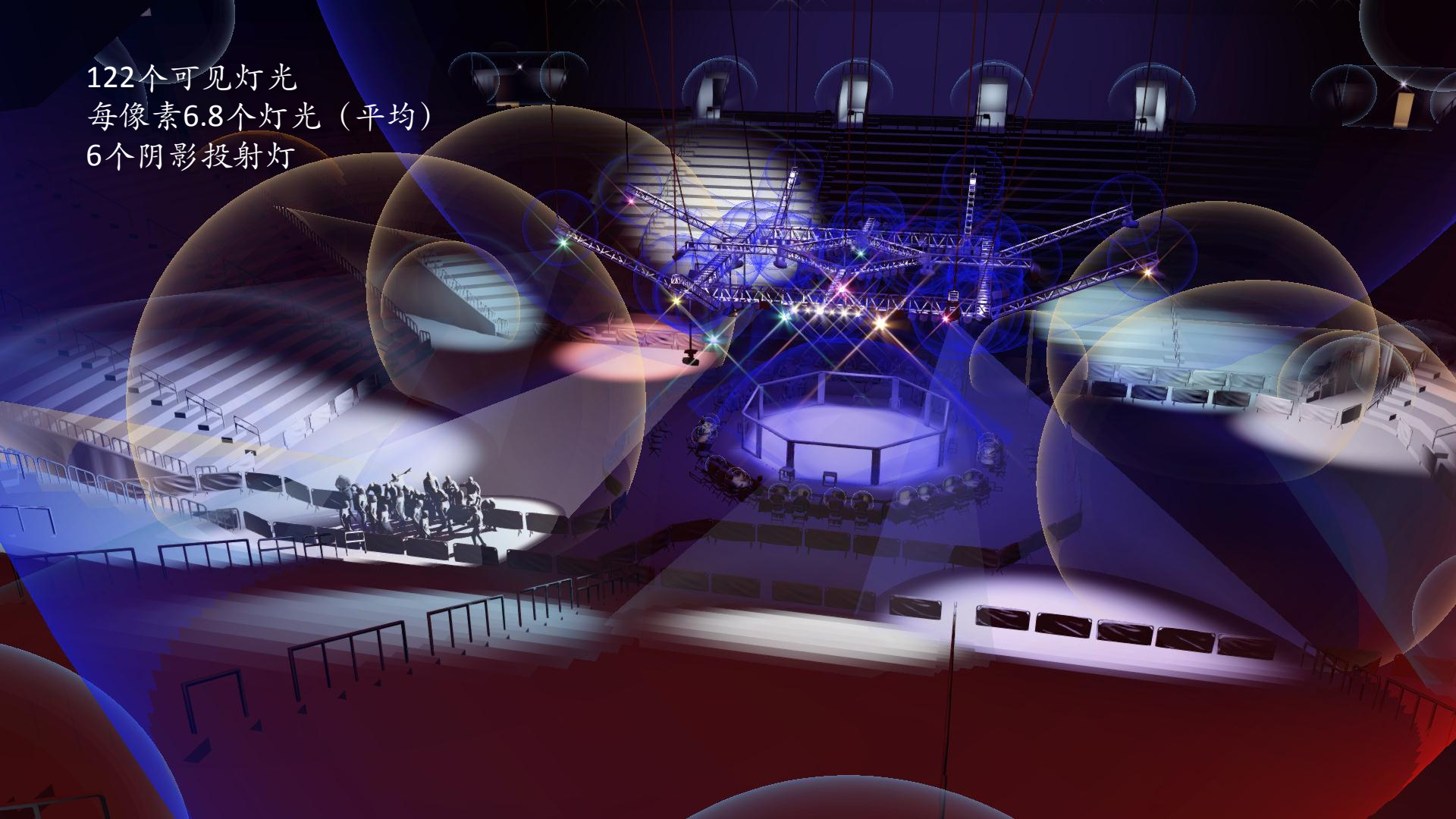


分块的64x64像素
16 深度分割
清楚的人物bucket



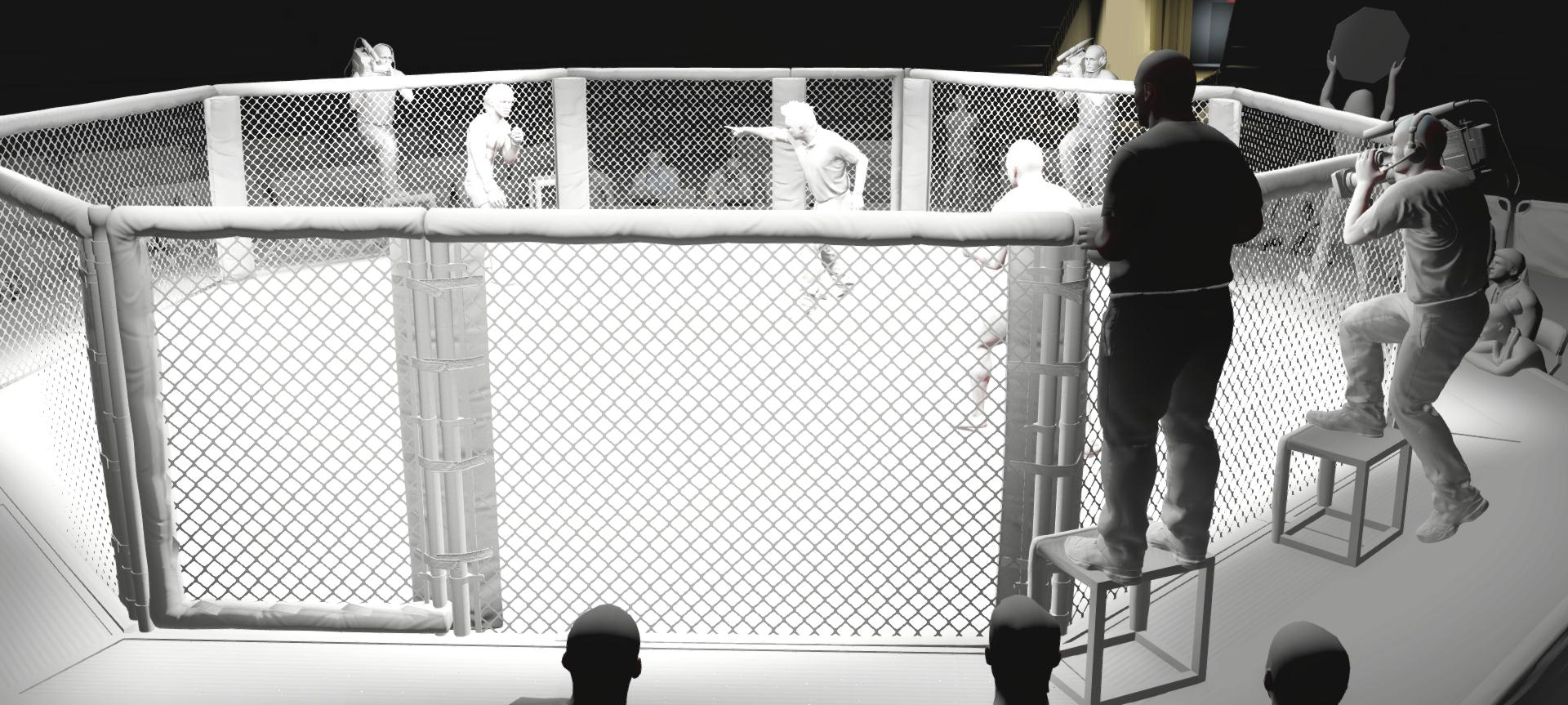
白: 16+
红: 15
绿: 4

122个可见灯光
每像素6.8个灯光（平均）
6个阴影投射灯

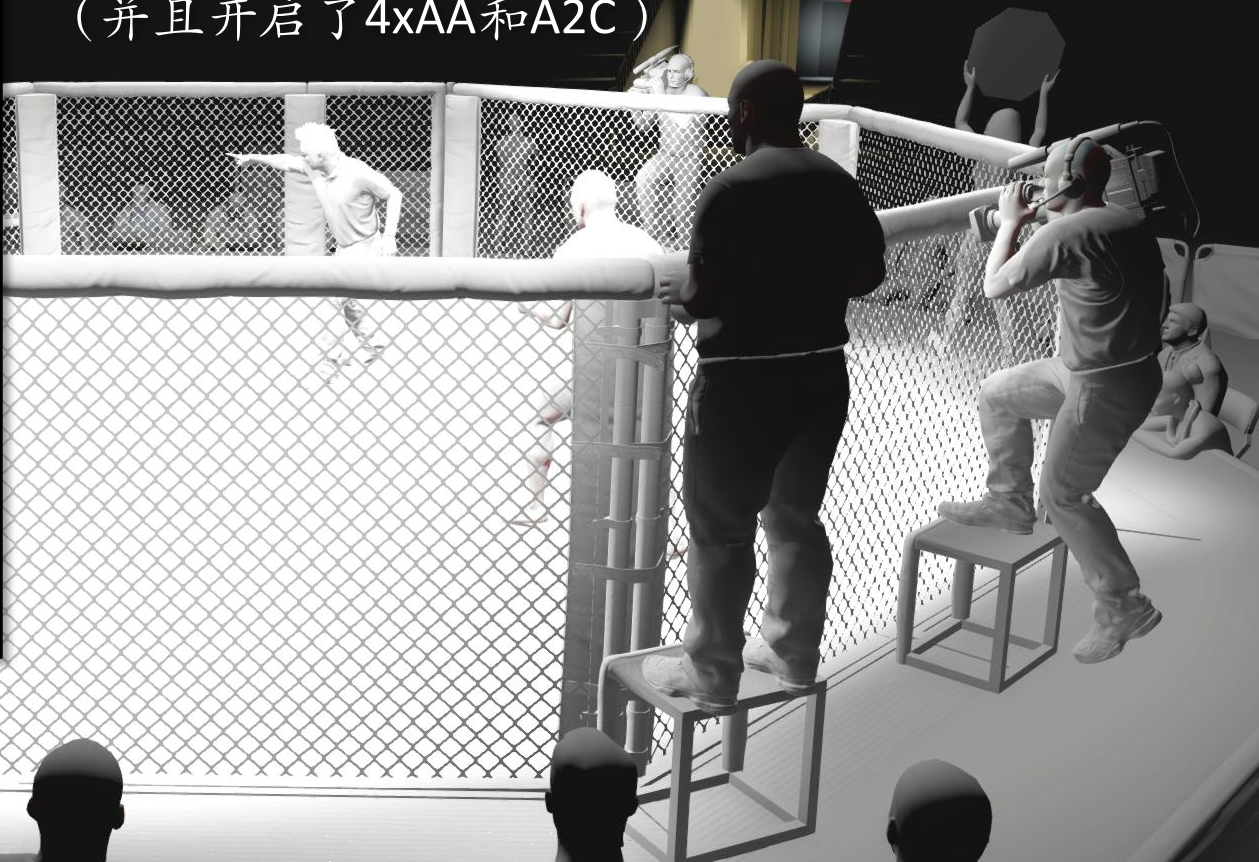
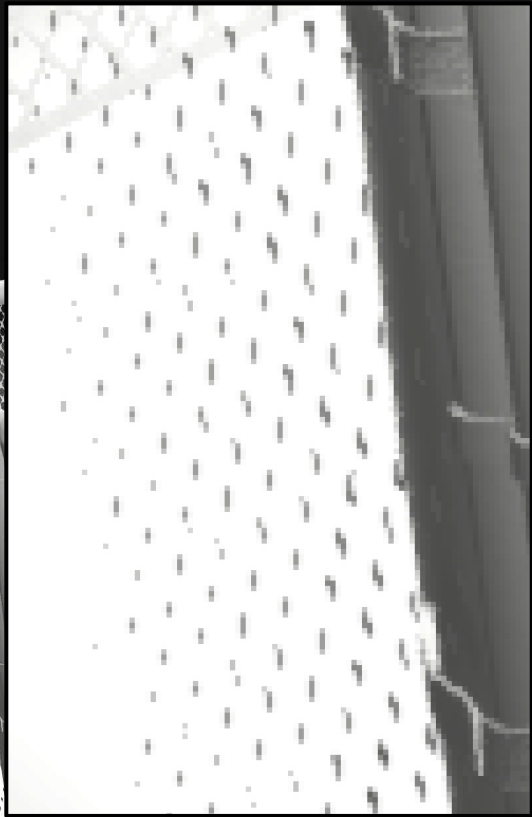


Alpha/MSAA对《终极格斗冠军》很重要

Opaque only遮光例子



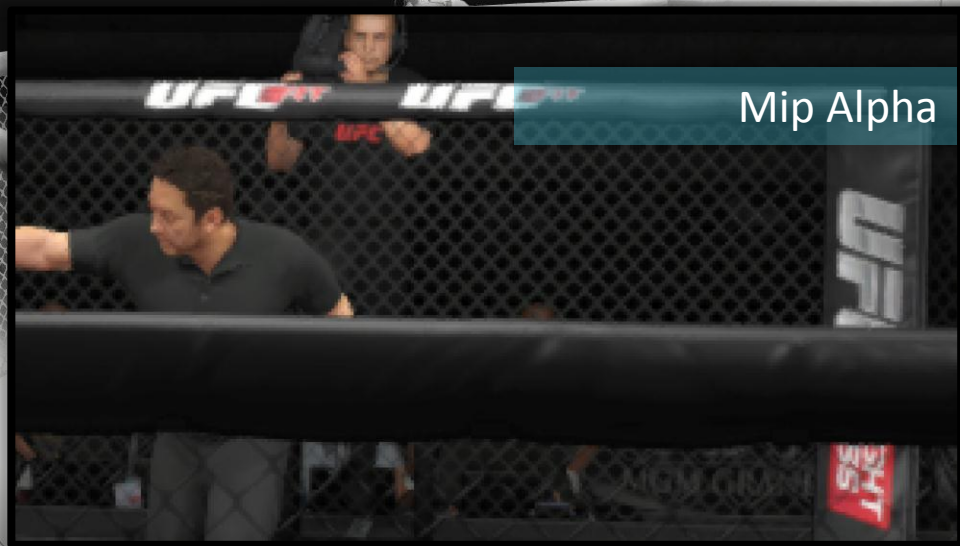
锐角微光
掉落像素
(并且开启了4xAA和A2C)



远距离Mip Swimming
对角线上的锯齿阿尔法测试边缘

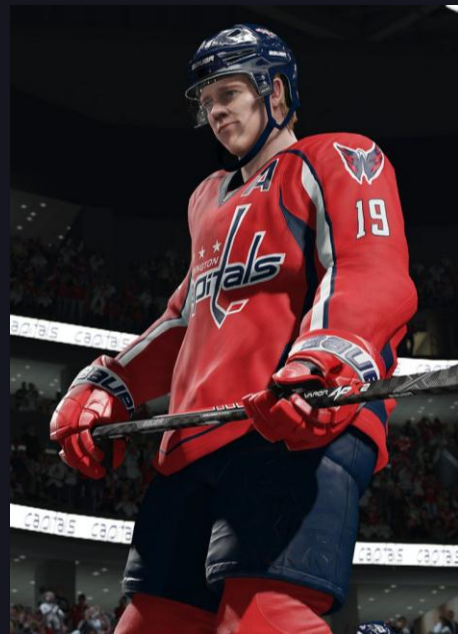
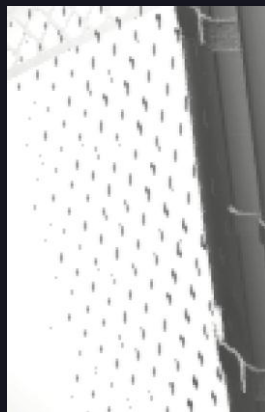


帶有4倍多重采样
抗锯齿的Forward+
渲染

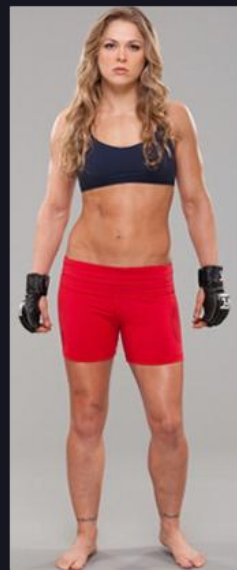
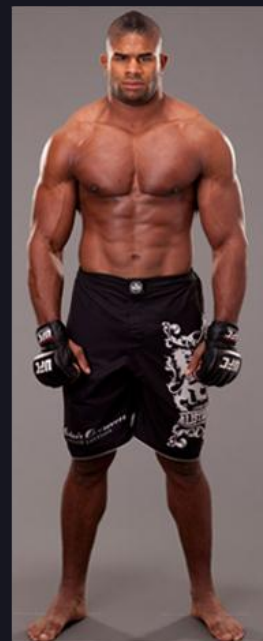
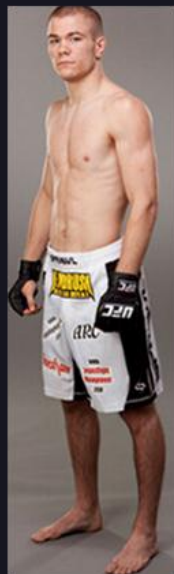
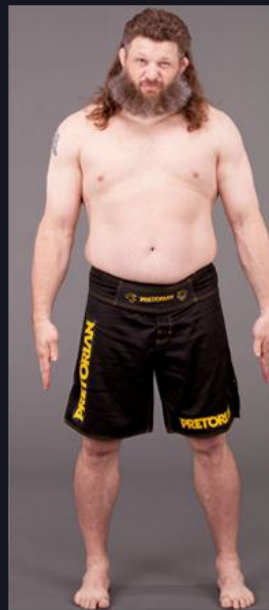
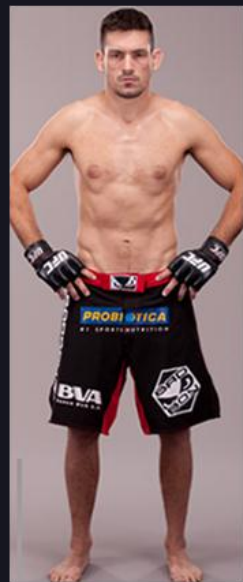


Forward+小结

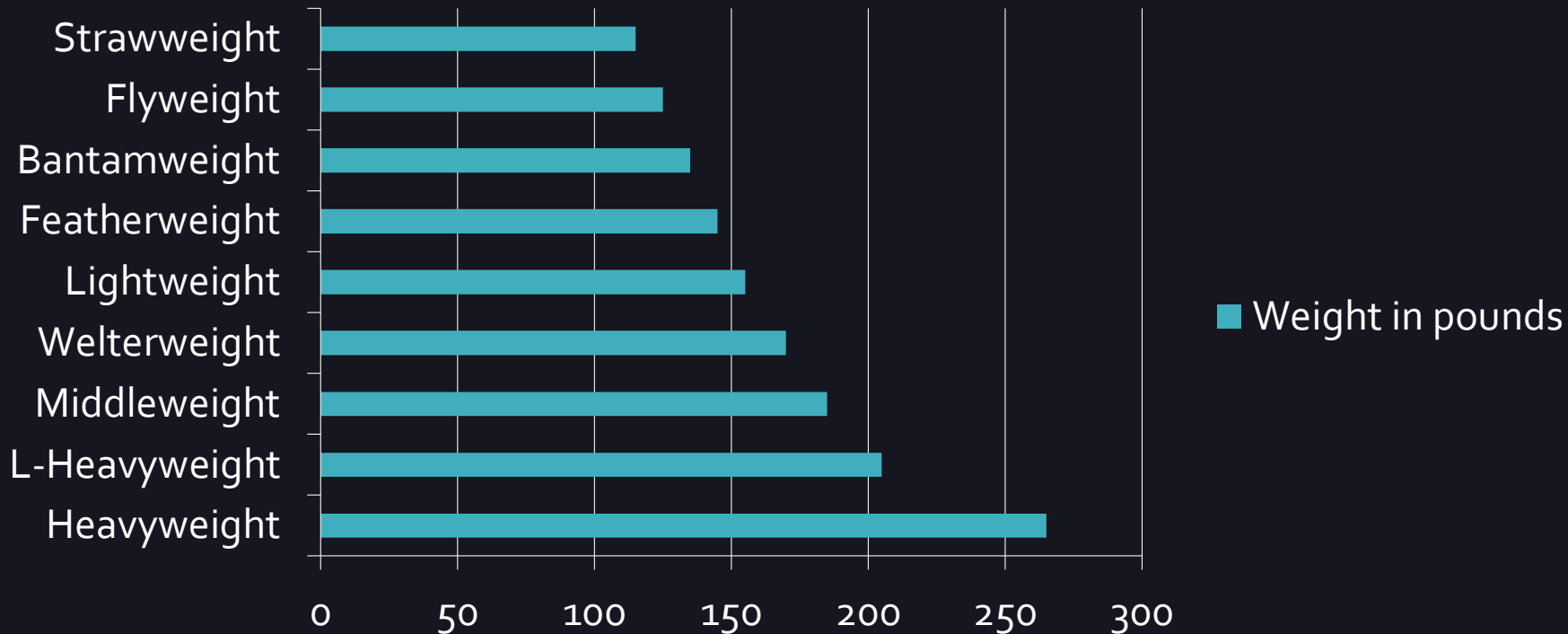
- Forward+是一种在某些硬件上具有显著优势的可行技术
 - 还是一个有待完善的新方法



拳击手创建



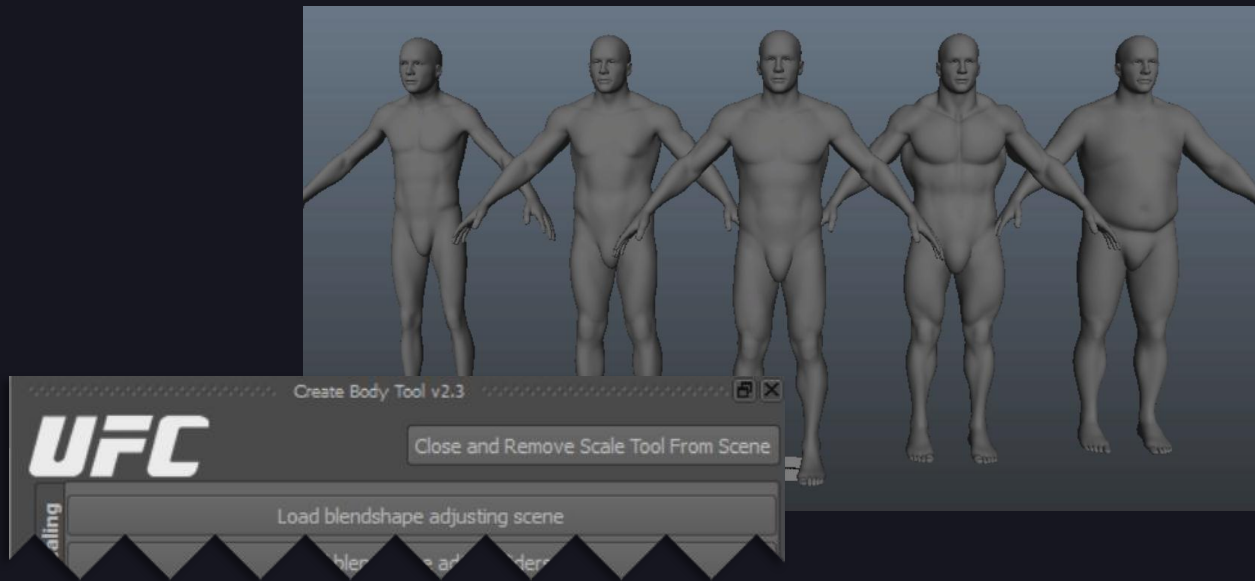
《终极格斗冠军》中的选手重量级





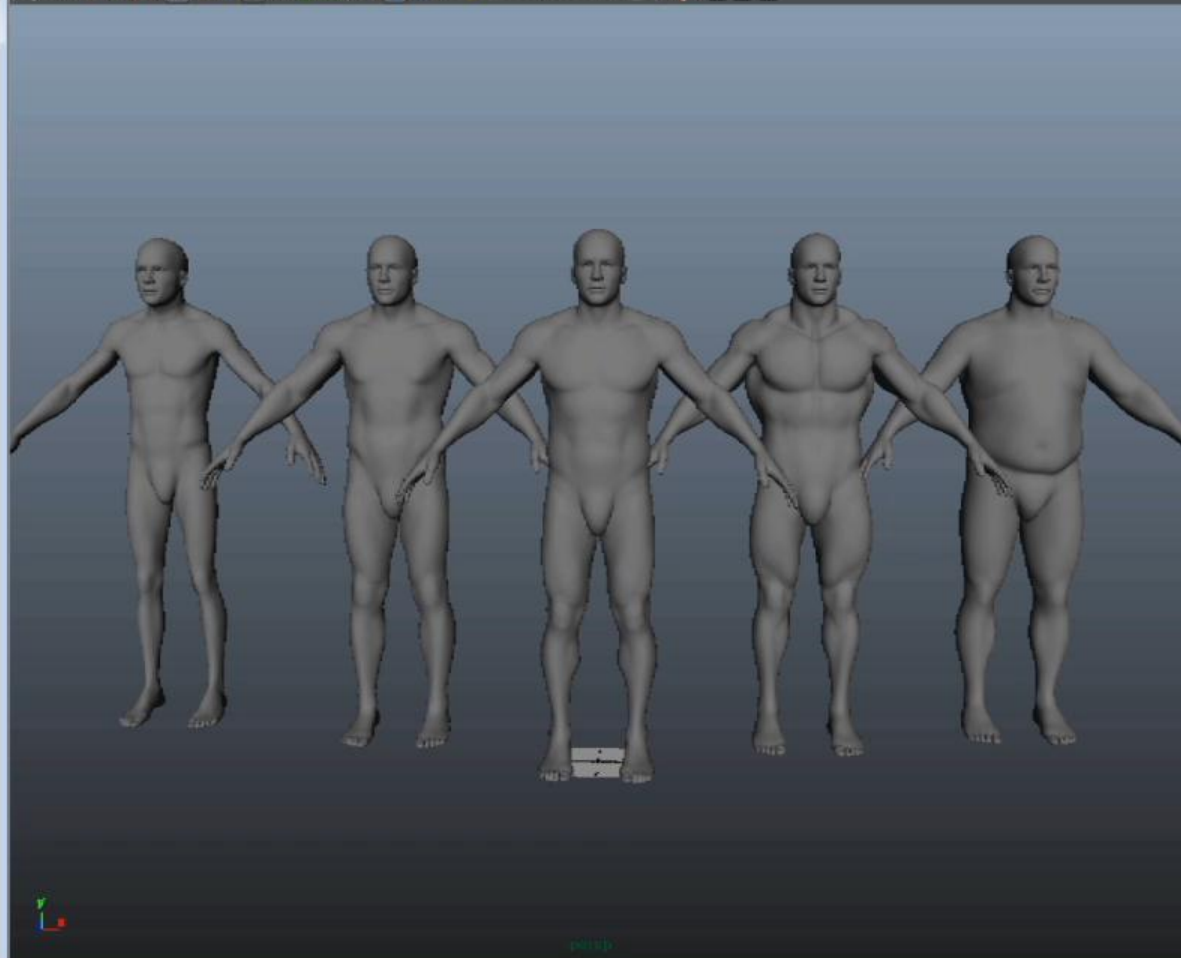


身体工具



Darren Rudy
Senior Rigger





UFC

Close and Remove Scale Tool From Scene

Joint Scaling

Load blendshape adjusting scene

Build blendshape adjust sliders

Belt Scaling

Blendshape Adjusting

EA Physics/hit Targets

Export To Zbrush

Blendshape Splitting

head		
head_thin	0.00	Reset
head_soft	0.00	Reset
head_built	0.00	Reset
head_overweight	0.00	Reset
neck		
neck_thin	0.00	Reset
neck_soft	0.00	Reset
neck_built	0.00	Reset
neck_overweight	0.00	Reset
traps		
traps_thin	0.00	Reset
traps_soft	0.00	Reset
traps_built	0.00	Reset
traps_overweight	0.00	Reset
chest		
chest_thin	0.00	Reset
chest_soft	0.00	Reset
chest_built	0.00	Reset
chest_overweight	0.00	Reset
shoulders		
shoulders_thin	0.00	Reset
shoulders_soft	0.00	Reset
shoulders_built	0.00	Reset
shoulders_overweight	0.00	Reset

Randomize Shape Sliders

Reset All Sliders

Import Shape Values

Export Shape Values

Attach Player Head



相似性与独特性

参照收集



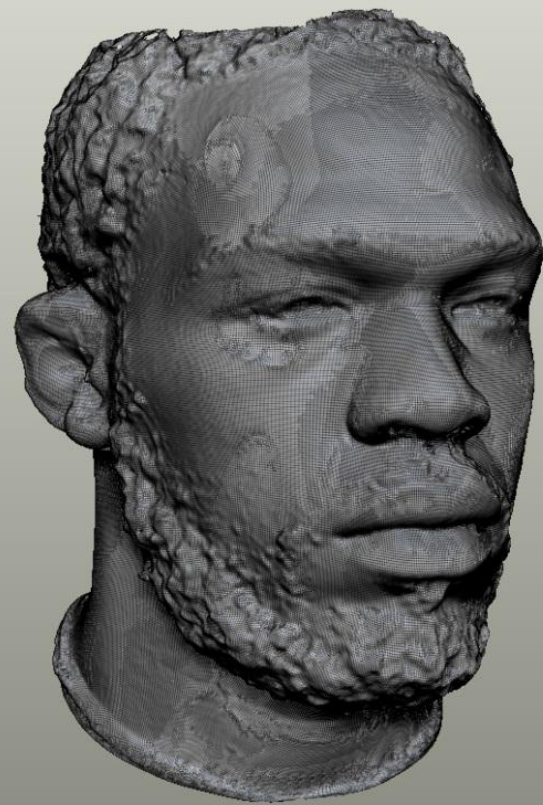
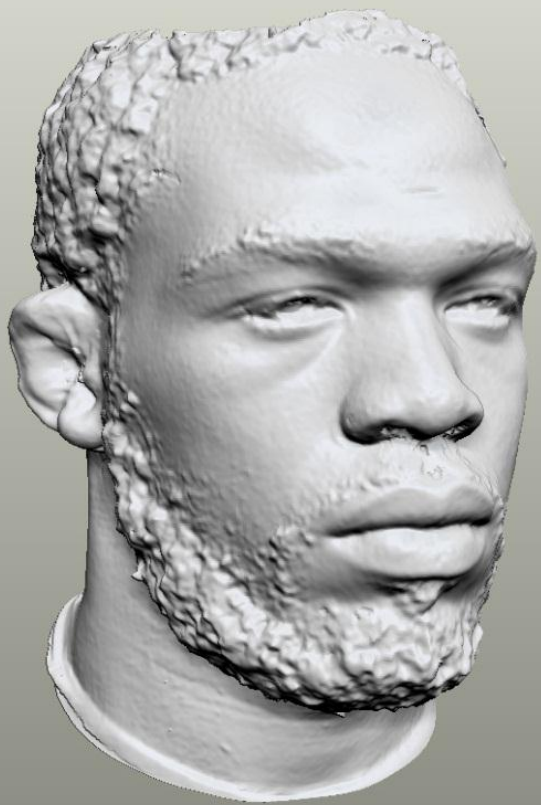
Mike Christensen
美术总监
EA Canada

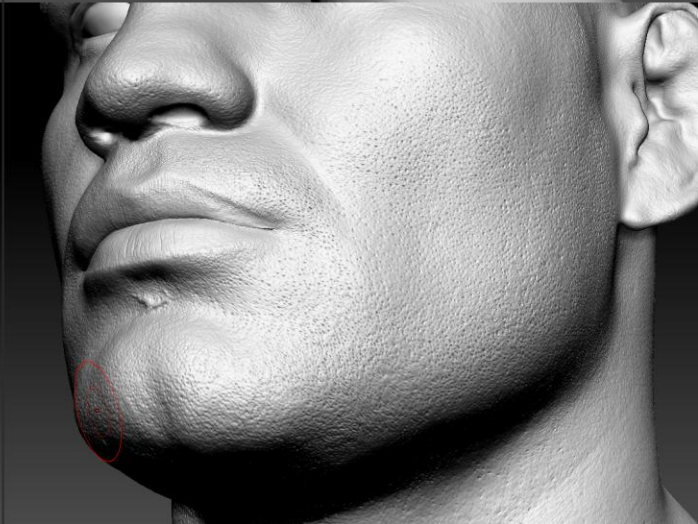
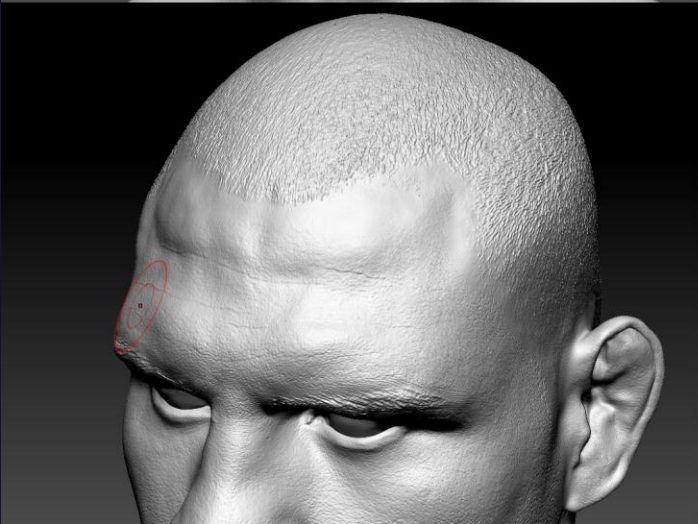
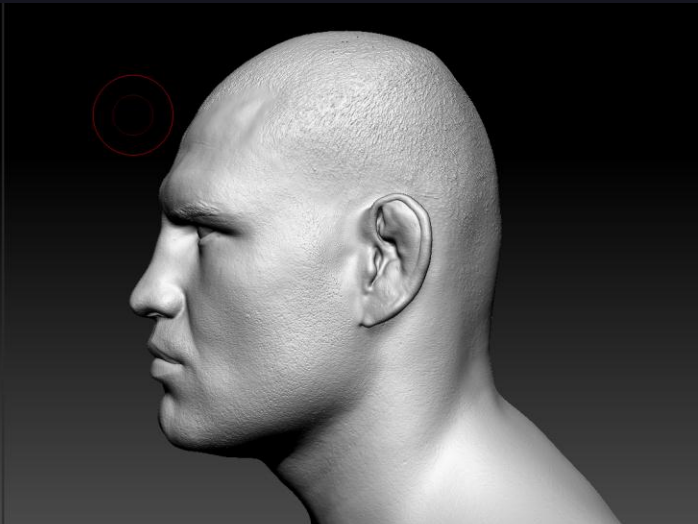
拳击手参照



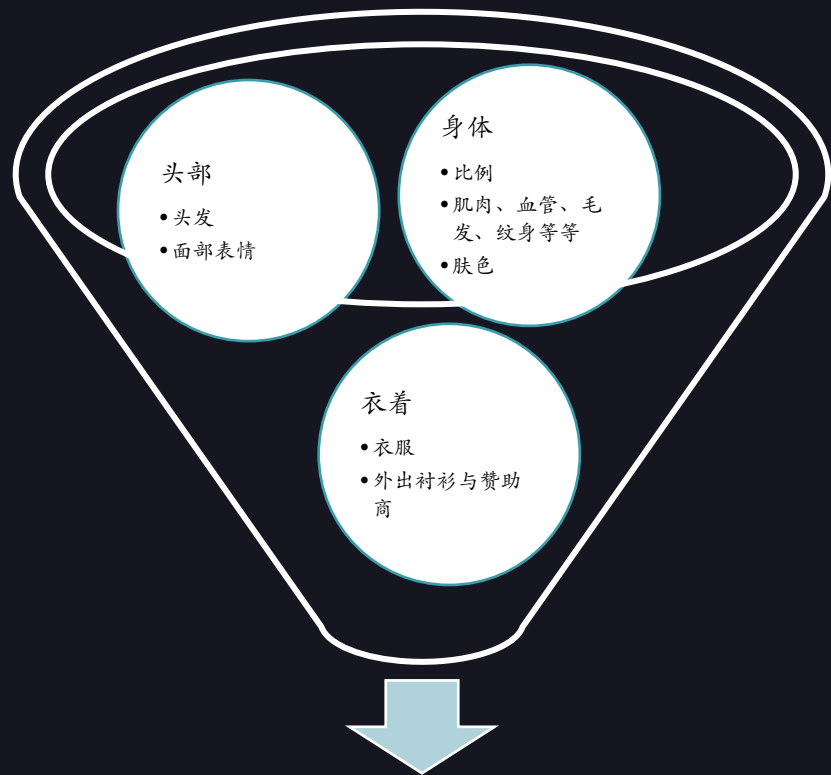
拳击手参照



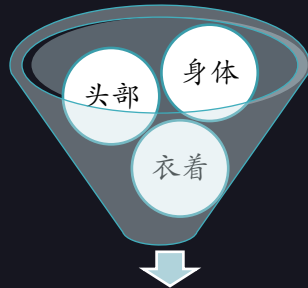




参照收集



头部资产生产



每个拳击手参照

头部扫描过程

头部几何
形状与纹
理

传统的头部过程

头发与头发运动

口腔内部与口腔防护器

损伤与表现混合形式

常见的头
部资产

Wrinkles

Texture cleanup, sweat,
damage textures

头部准
备好进
行审查

身体资产生成

身体拍摄

身体分配与身体构建工具
工作

纹理创建-独有或者共享

身体定义和柔性雕塑

合身的服装和配件上身

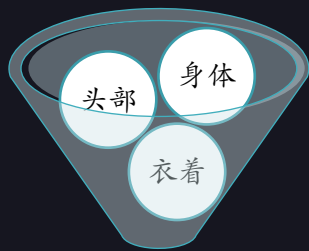
赞助商标志

纹理创建

抗皱贴图

身体资
产开发

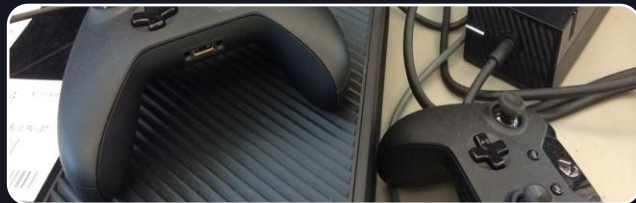
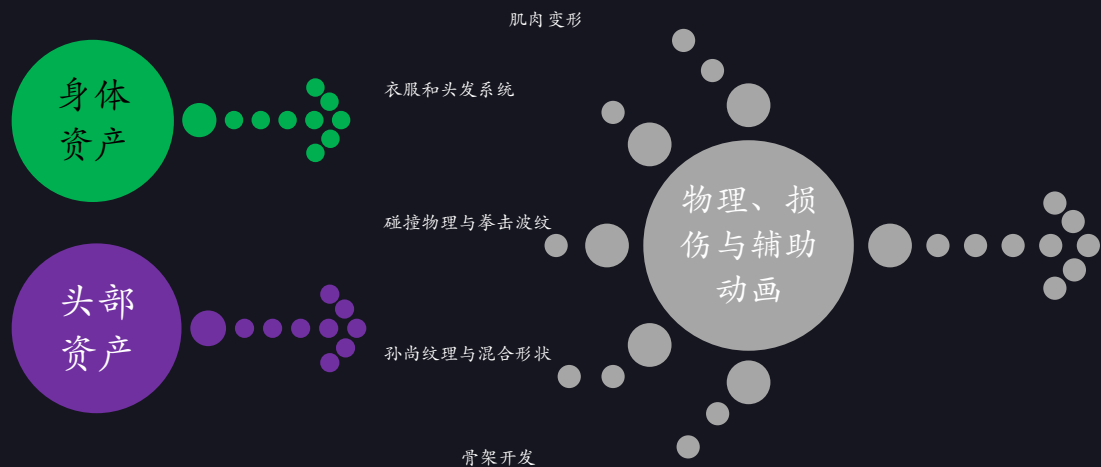
服装与配
件资产



每个拳击手参照

身体准备
好进行审
查

最后成果



审查

- 图像质量
- 运动

最终审查和通过



损伤系统

头发和衣着
运动

身体与头部
运动

- 包括:
- 健美测试
- 摇晃
- 肌肉变形
- 骨架
- 弹性
- 拳击波纹

外部认可

- UFC
- 官方赞助商

最终游戏品
质

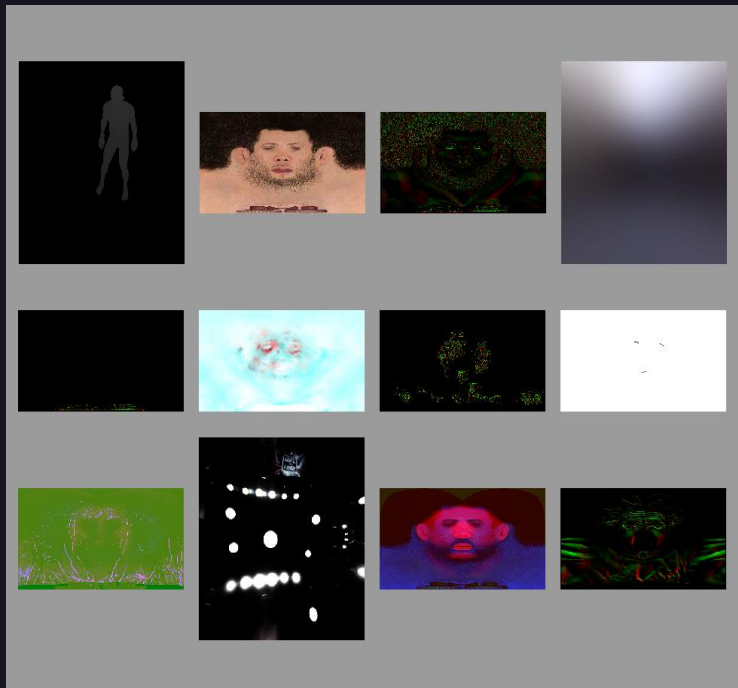


Ian Lloyd,
Art Director
EA Canada

《终极格斗冠军》人物着色

静态贴图

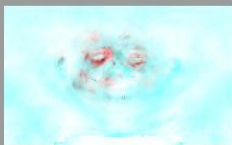
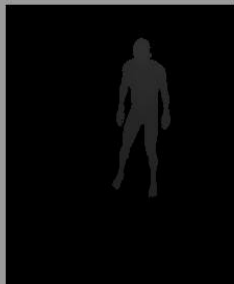
贴图

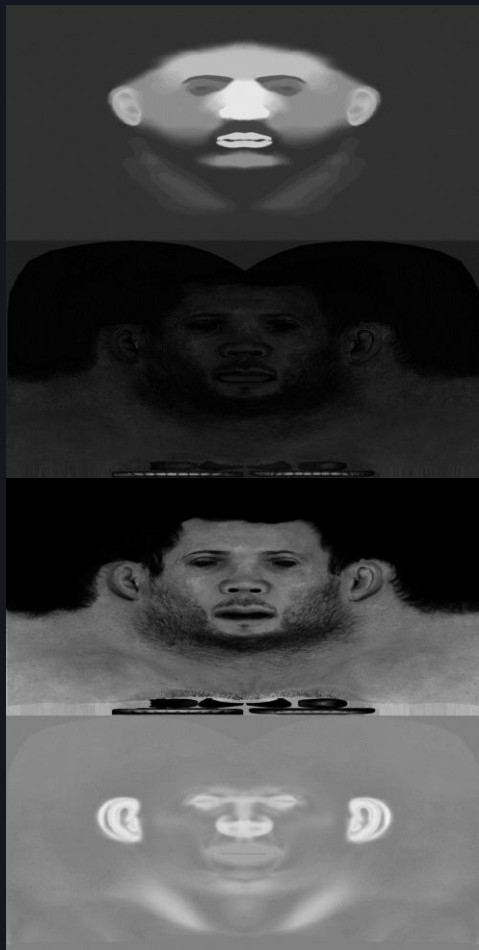
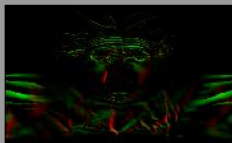
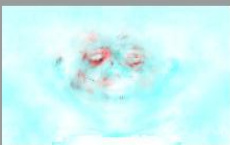
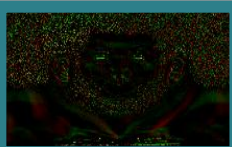
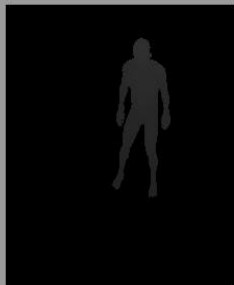


*Raw Channel Packed textures

- 6 个静态贴图
- 9 个动态贴图
- 包括5个不同的法线贴图
- 对拳击手来说最为独特





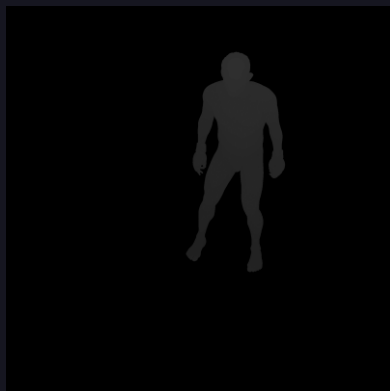
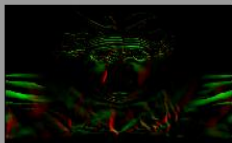
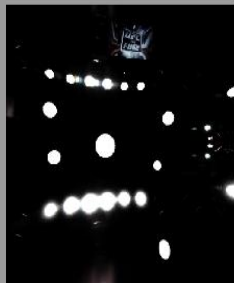
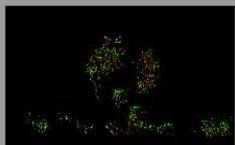
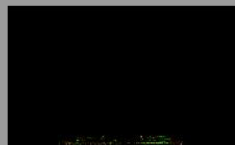
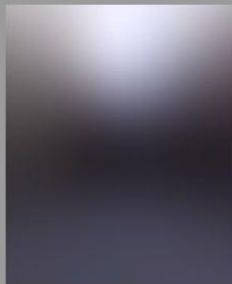


特殊

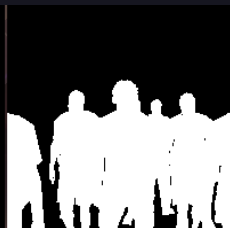
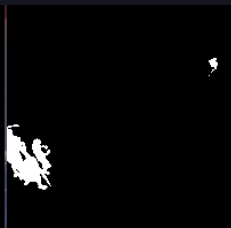
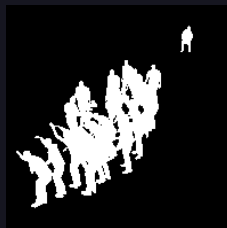
粗糙

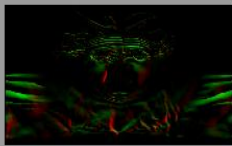
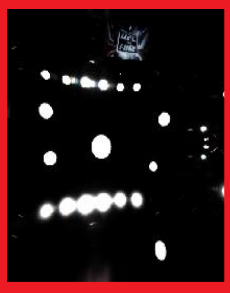
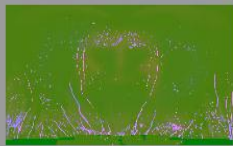
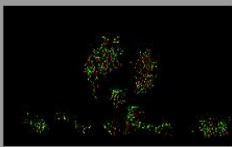
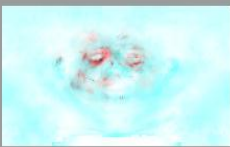
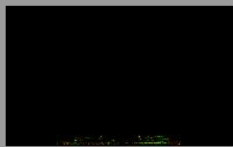
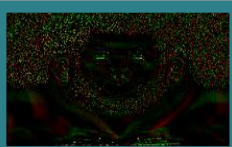
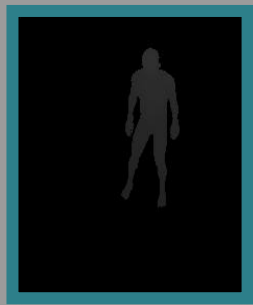
反射面罩

几何弯曲



阴影深度
列





卷积立方



反射立方



《终极格斗冠军》人物着色

受伤

(非常早期的作品)

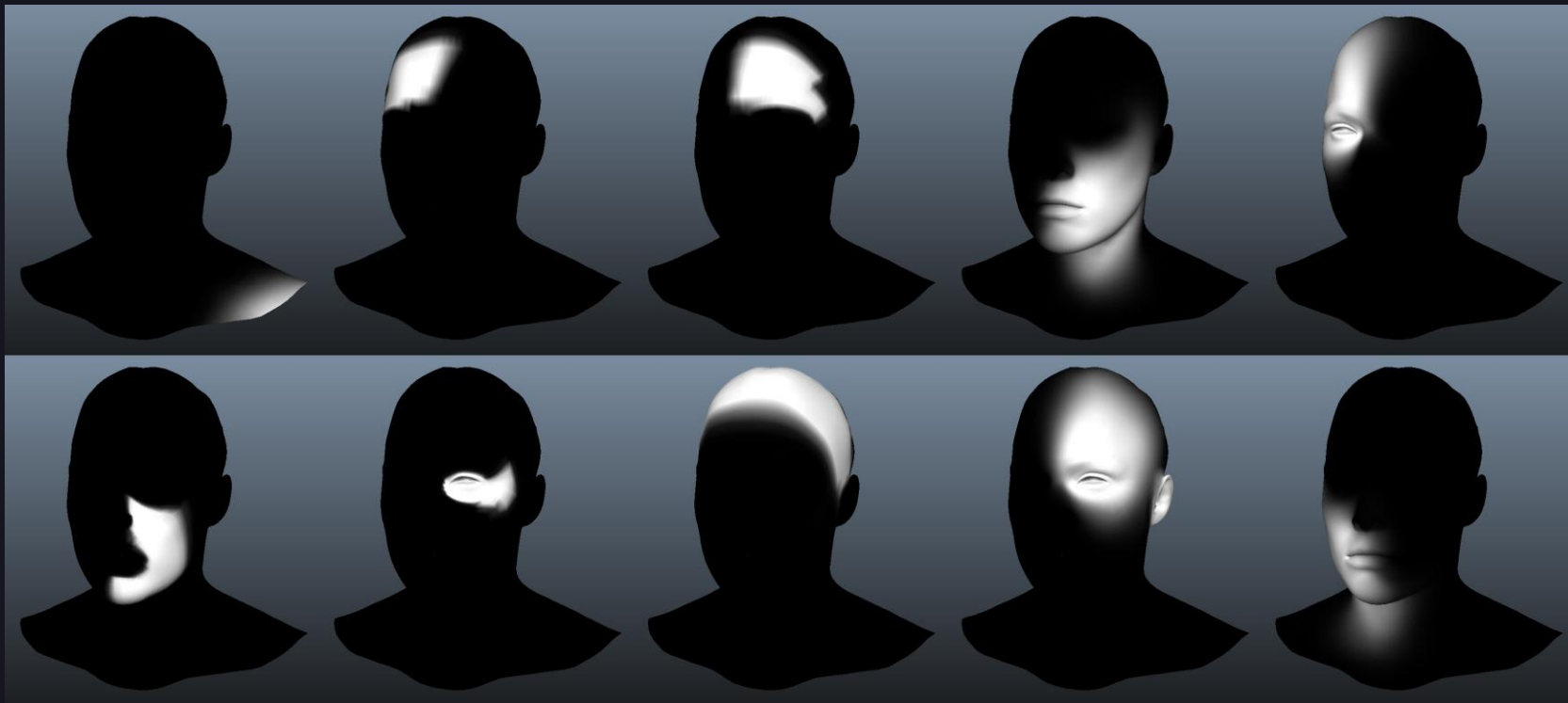




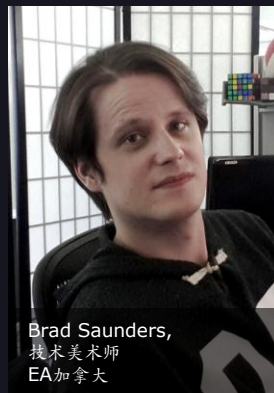
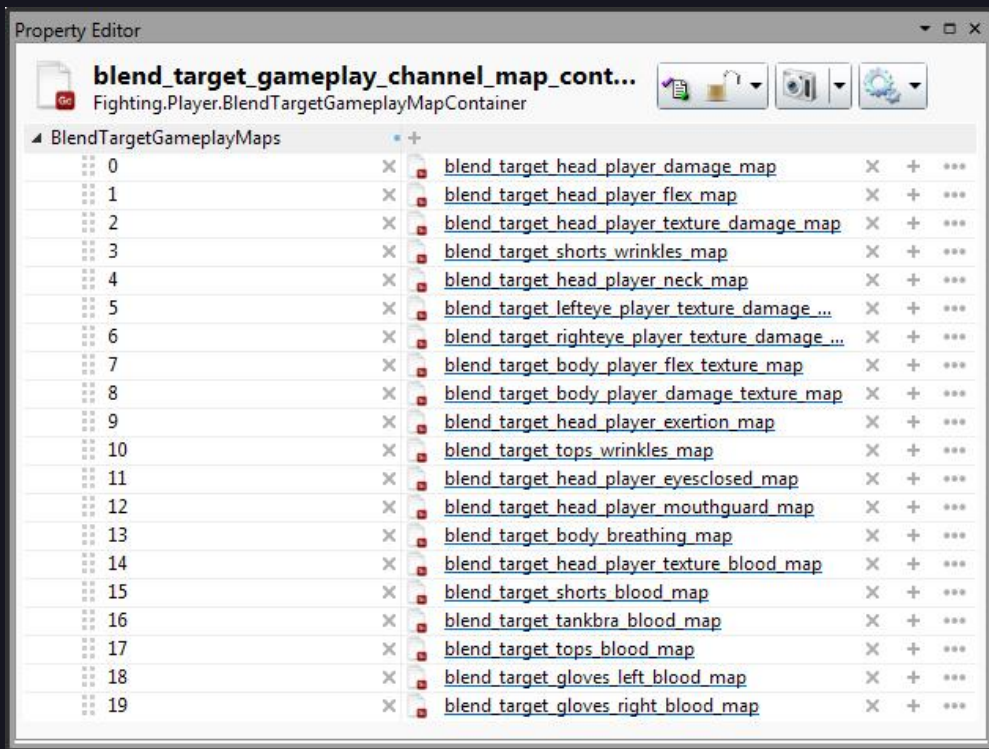




混合区域和形状



混合区域和形状



混合形状

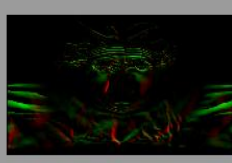
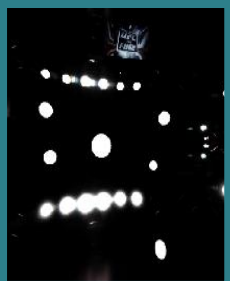
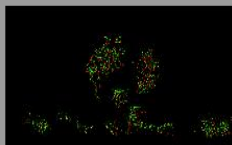
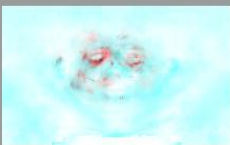
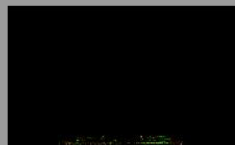
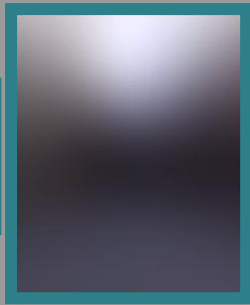
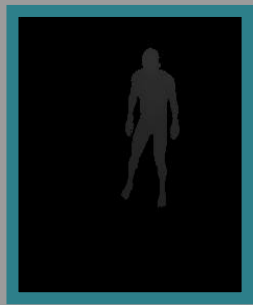


100种混合效果

区域淤青。
伤口开裂。
血液流动。
表情细纹。
红肿/斑点。
血管质（窒息）。
肿胀 - 每一种大小形状和位置。

肌肉弹性。
纠正变形。

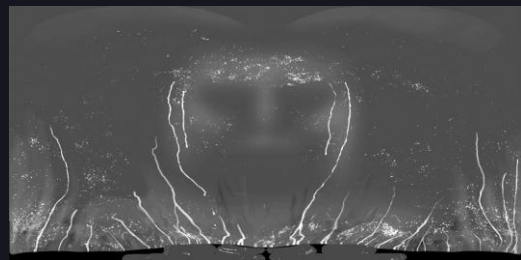




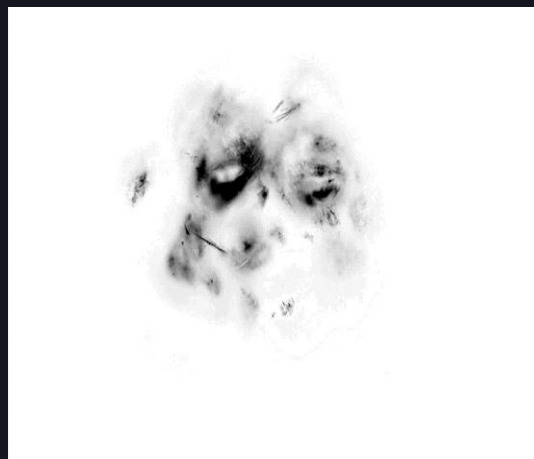
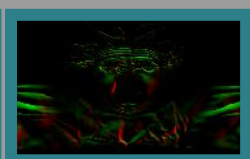
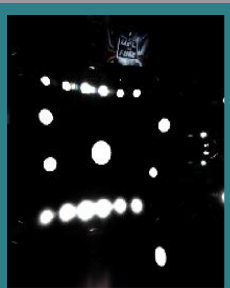
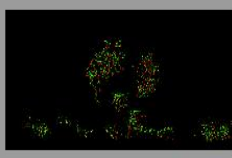
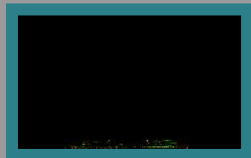
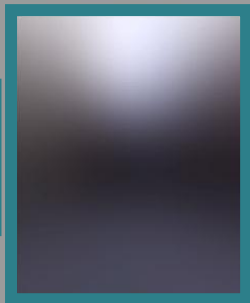
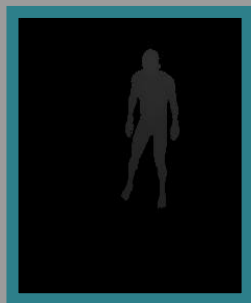
流汗
遮罩



流汗
正常



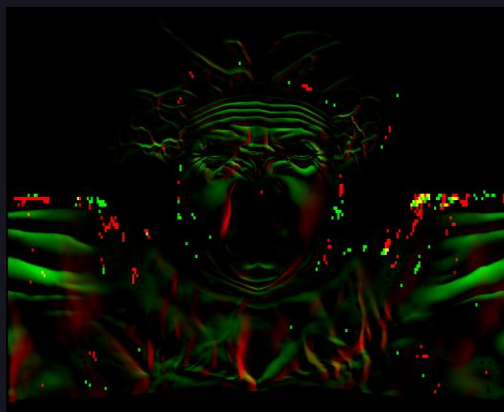
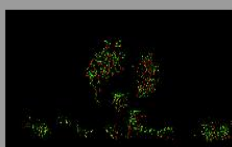
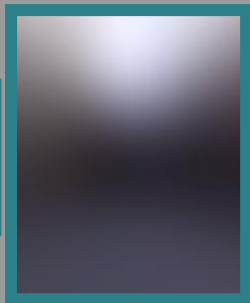
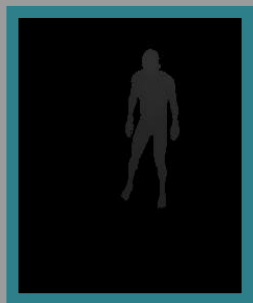
流汗
特殊



淤青



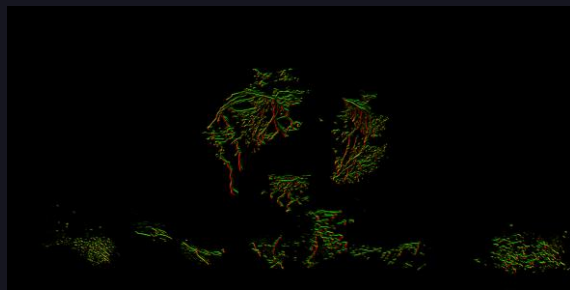
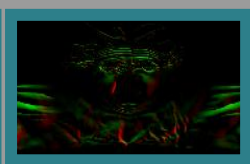
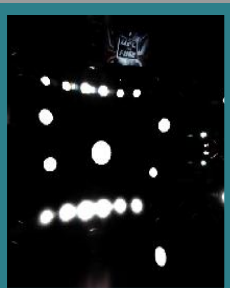
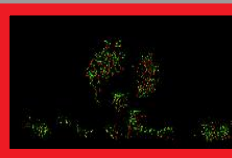
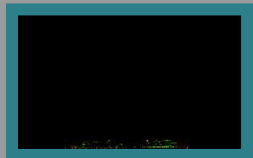
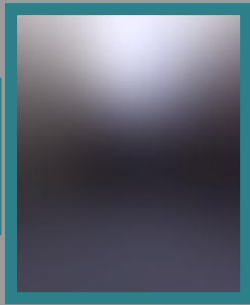
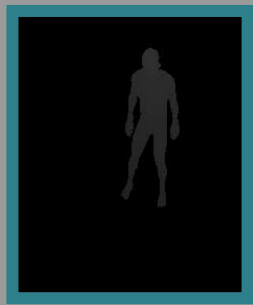
发红/泛红



弹性/抗皱



血管
正常



血液
正常



血液遮罩
列



衣着与头发



Miesha Tate



Clay Guida

UFC 1:28 RD 1





Miesha Tate



UFC



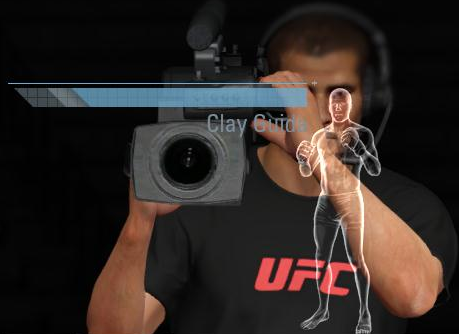
Clay Guida

TOYO TIRES

UFC 1:28 RD 1



Miesha Tate



Clay Guida

UFC

UFC 1:28 RD 1





Miesha Tate



Clay Guida

UFC 2:52 RD 1



Miesha Tate



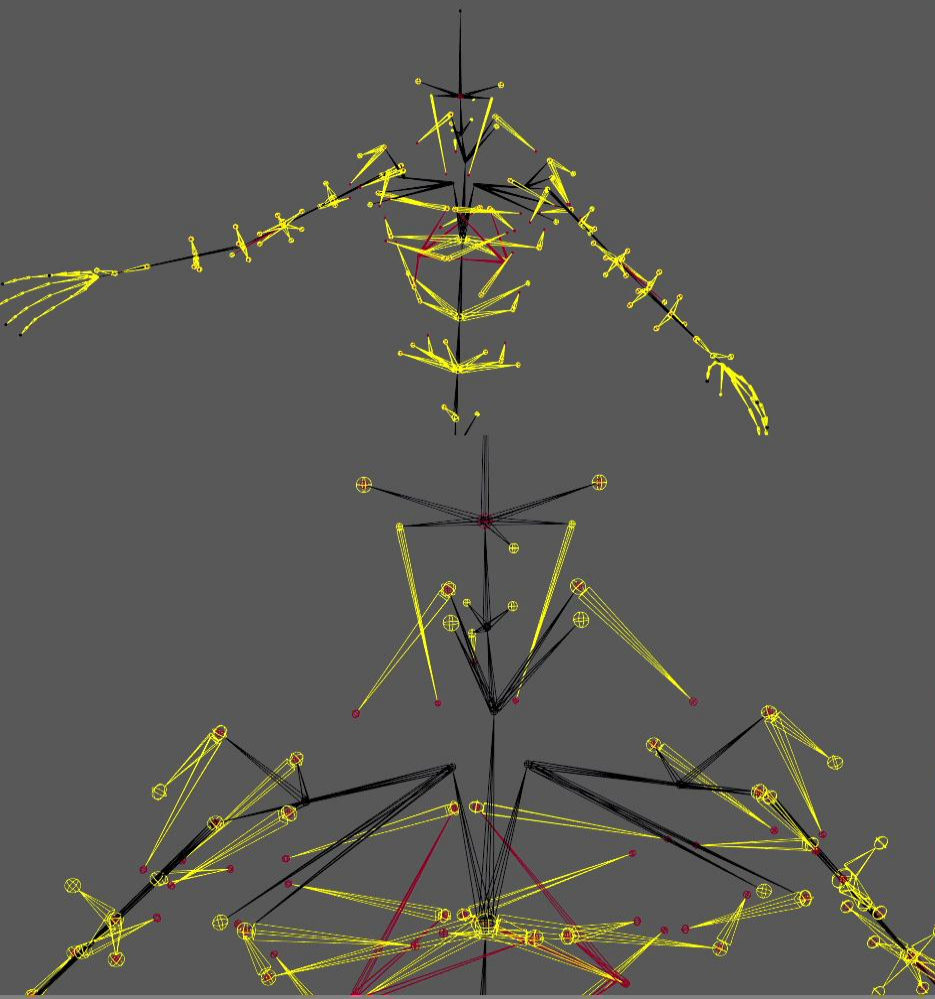
Clay Guida

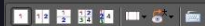
UFC 3:00 RD 1

数量

《拳击之夜冠军》 《终极格斗冠军》

头部顶点	4,319	5,084
身体顶点	5,077	13,694
蒙皮骨骼	166	215
...脸部	36	65





Perspective



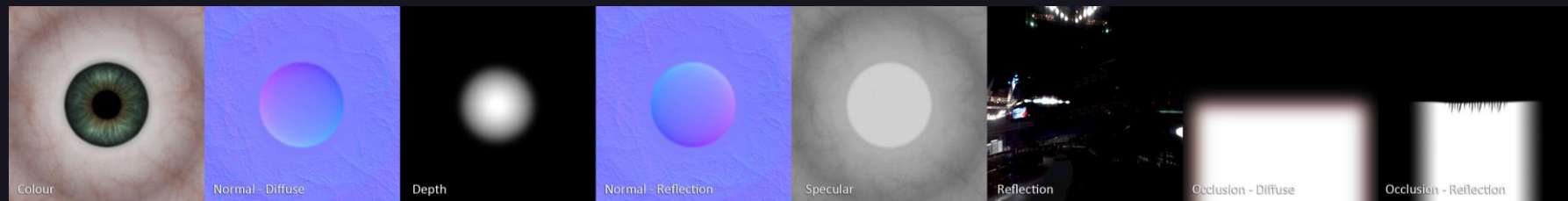
1868.5



actor_fighter_roy_nelson

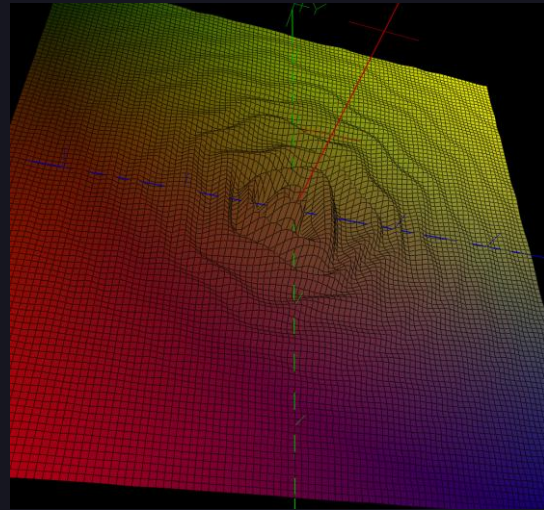
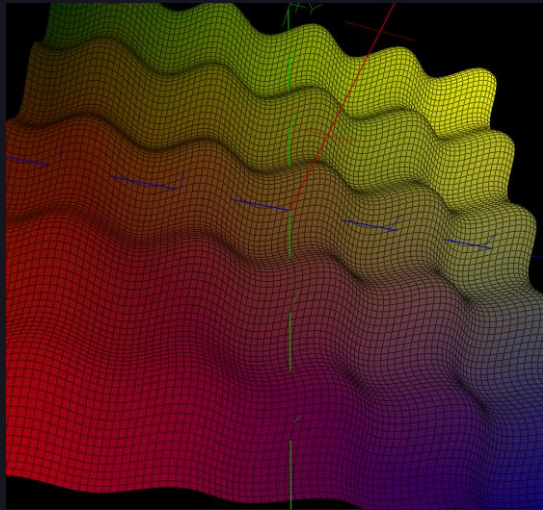
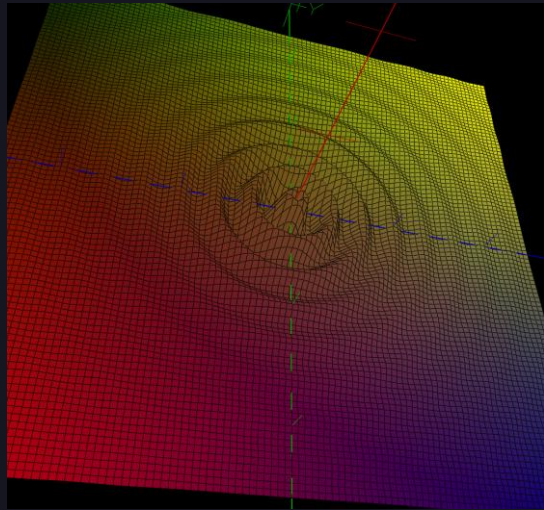


眼睛





冲击波纹







UFC.COM

U



有问题吗？

EA SPORTS

UFC

EA GAMES