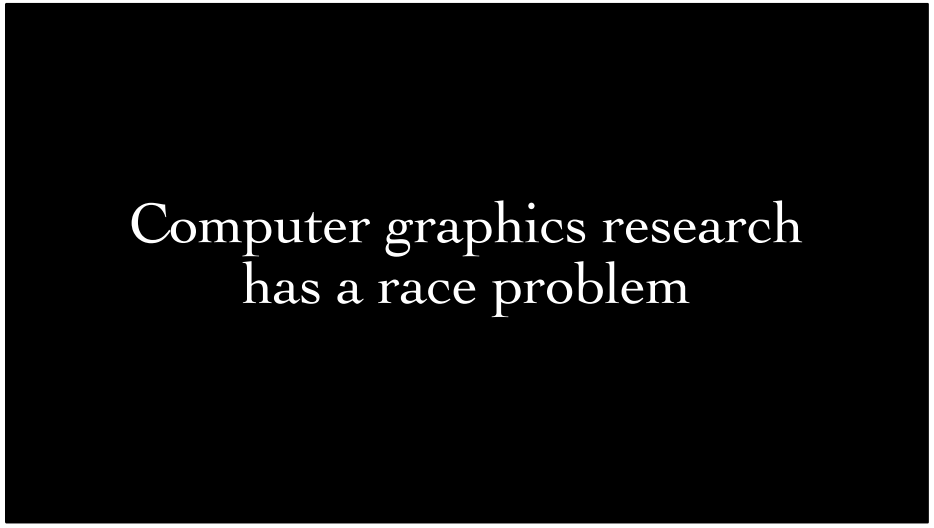
Anti-Racist Graphics Research

Theodore Kim, Yale University

August 9, 2021

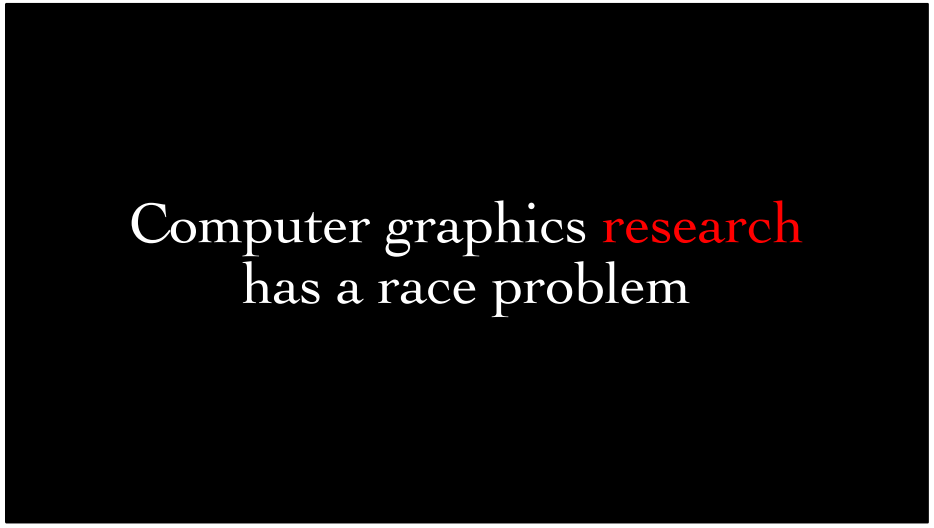
Good afternoon everybody, and thanks for coming to my talk, “Anti-Racist Graphics Research.”

There’s going to be a lot of pictures in this talk, but before we get to that, let’s get the concepts down.

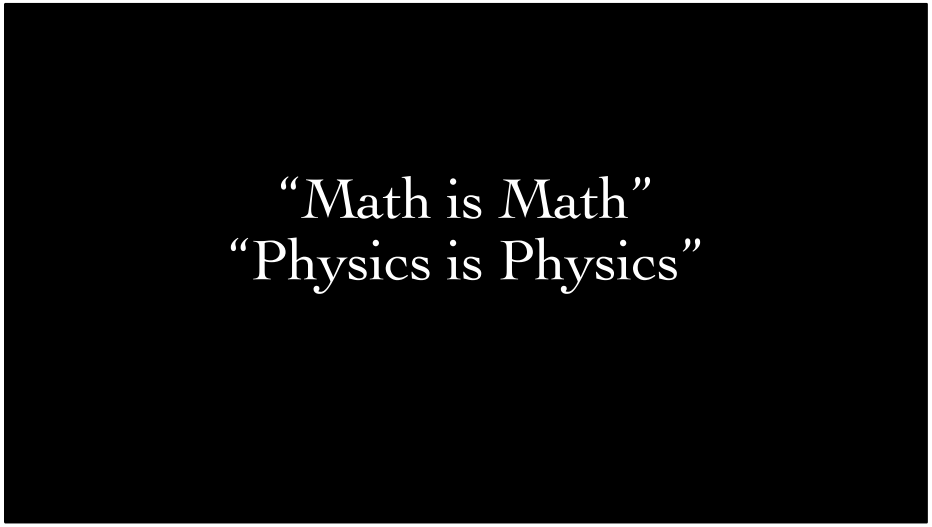


Computer graphics research has a race problem.

Now we'll see many dimensions of this problem at the SIGGRAPH DEI Summit this week, many of which grapple with the idea that our hiring and promotion practices are not equitable. This is a big problem, but it would be a mistake to think that this is the whole picture.

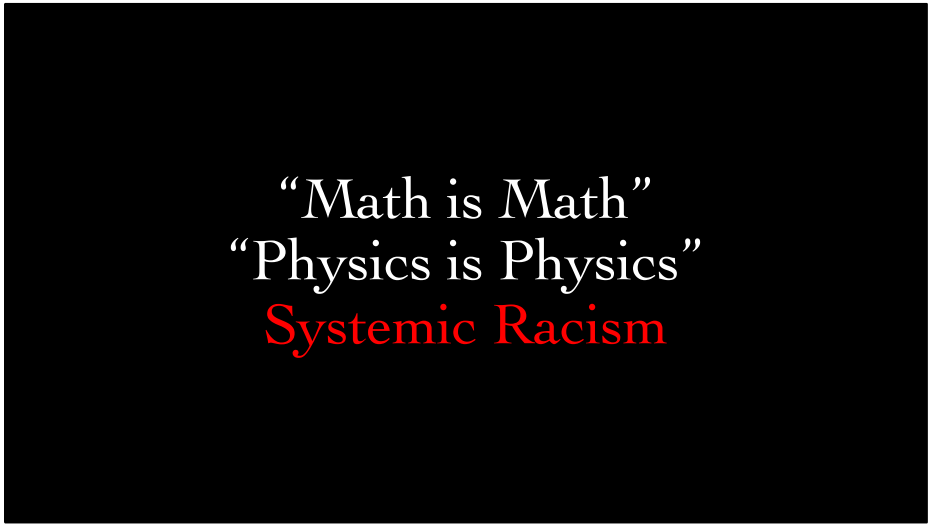


I'm going to talk about how this is a problem in research. I'm not talking about these other versions.



Instead, what I mean is that our basic scientific formulations have insidious biases built into them.

This is a very uncomfortable and disturbing version, because many of us in are used to thinking that “math is math” and “physics is physics” and resist the idea that science could contain any kind of bias. In fact, that’s what attracted many of us to research to begin with. We get to look at these clean, neutral problems all day don’t get all tangled up in the ugly politics of the real world.



Unfortunately, it doesn’t look like this is the case. The term “systemic racism” has been appearing a lot lately, and the point is that historically racist assumptions have been baked into many of our everyday institutions, whether we like it or not.

Science is no exception, and computer graphics is no exception.

You may have heard a related term, “unconscious bias”, which is intimately connected.

If we don’t consciously think about the racial implications of our work, we end up just reproducing all the existing inequalities that exist in the systems around us.

If we don't believe that these biases and these inequalities reflect the world we want to live in, then we need to take deliberate, concrete steps that counter this bias.

That's the anti-racist part of the title. We recognize the pull of historical inertia, and make the deliberate decision to step in the opposite direction.

Summary

- What Racial Bias?
- Where Did It Come From?
- What Do We Do About It?

Okay, that was actually a quick, text-only outline of this entire talk. Let's delve into each component I mentioned in order.

Summary

- What Racial Bias?
- Where Did It Come From?
- What Do We Do Now?

First we'll look at Racial Bias in Research. Bias in science? What's he talking about? Isn't math just math? Only up to a point.

How did we formulate the research problems to work on? How does the problem formulation influence the solution? How does the math come to encode our assumptions? From this perspective, I'll show you that yes, this bias is real.

Summary

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Second, where did this bias come from? Has there been some evil, secret society of racists working in our field? If that were the case, the solution would be easy – just expelled the racists, and be done with it. Unfortunately, that's not the case. So where did it come from?

Summary

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Once we have some understanding of these two pieces, what can we do about it?

Summary

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- Where Did It Come From?
- What Do We Do Now?

Alright, let's get to the first part, Racial Bias in Research.

What is “human skin”?

Let’s start with a seemingly basic question.

What is “human skin”? More specifically, when we talk about human skin in computer graphics, what are we talking about?

There’s a bunch of ways to go about looking at this, and we’ll look at it from several directions.

But since this is SIGGRAPH, let’s look at what SIGGRAPH does best. University research gets transferred into industry, which then spills over into pop culture.

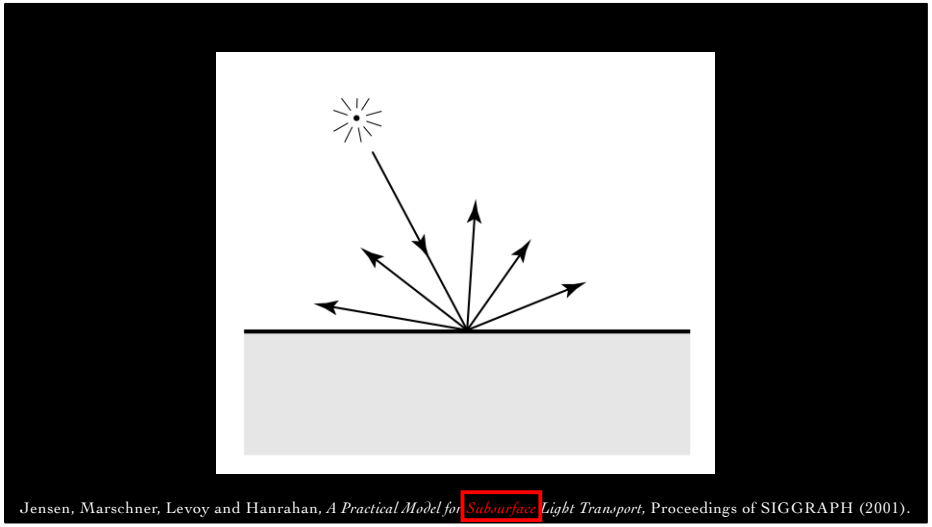
Here's a SIGGRAPH paper from 20 years ago, Jensen et al's "A practical model for subsurface light transport" from SIGGRAPH 2001

This was a blockbuster paper when it was first published. As of today, it has 1162 citations on Google Scholar which is pretty high as rendering papers go.

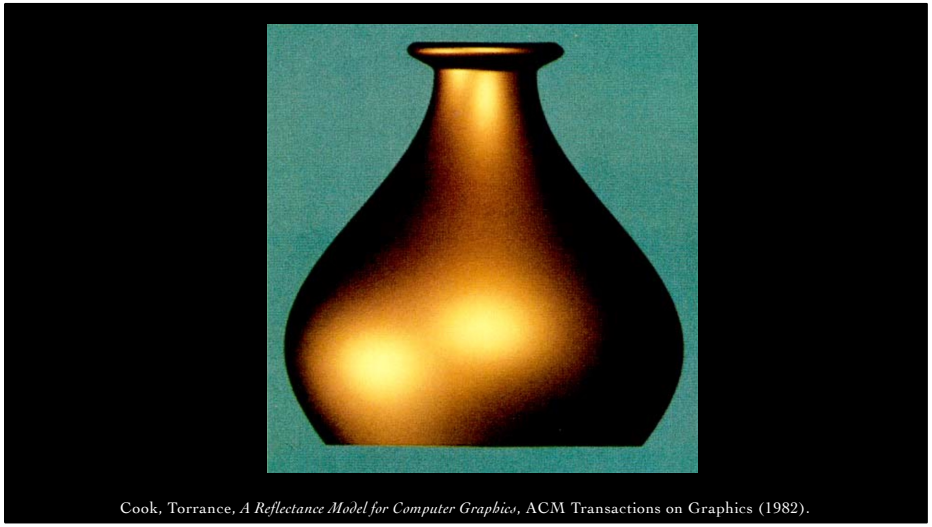
The reason for this popularity was that it one of the first papers to show how to get subsurface scattering right.

And if you could get subsurface scattering right, you get a much more realistic-looking human face.

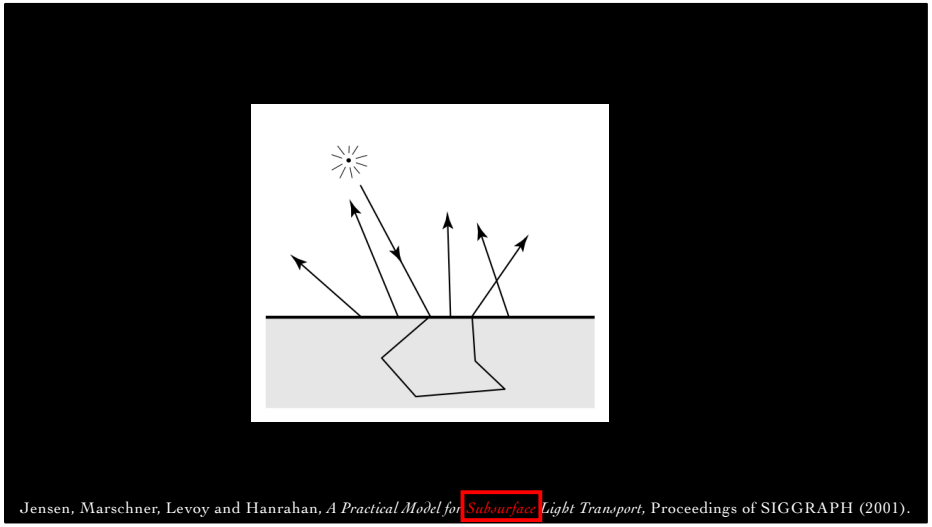
It wasn't the first paper to try its hand at this, Hanrahan and Krueger for example has tried previously, but it was the first algorithm for computing this phenomenon that experienced widespread commercial success.



There's a diverse set of backgrounds in the audience here, so let's review the nuts and bolts of subsurface scattering. The first thing we usually learn in a computer graphics class is how to ray trace hard surfaces. Light rays hit objects, bounce off from the same place they hit, and some of them eventually enter your eye or hit some film plane. If you simulate this right, you get an image.



This model is pretty good at representing hard, shiny surfaces, like metals. So we can even go back to classic graphics papers like Cook-Torrance from 1982, and it see that it looks pretty good.



Subsurface scattering is subtly different. Light gets emitted again on the upper left, but the ray actually enters the medium, like milk, soap, or skin, bounces around a few times and eventually exits the medium from a different place than where it first hit.

This has the effect of spreading the light out to give the object a softer look, a “glow”.

This is the skin glow that you get in famous paintings, like these from Vermeer.

Now we get to the difficult part.

All skin does this to some extent, but it's the most important in white skin.

Here's a Britney Spears ad from around the time that paper was published, and you can bet there's a lot of subsurface scattering in her face.

Same with Gisele Bunchen on the right here, on the cover of Vogue also from around 2001. Lots of subsurface.

What about in black skin?

But here's a shot of Delroy Lindo from the same era, in the Spike Lee movie Clockers.

Look at the white highlights on his brow, and along his nasolabial folds.

Subsurface is not the dominant light transport mode here, specular reflection is. It is not his glow, it is his shine.

For Black skin, subsurface is dramatically less important. Specularities are what gives Delroy Lindo's face all of its expressive character.

Final Fantasy: The Spirits Within, (2001).

But, if you were working in graphics around 2001, it's easy to remember people snapping up subsurface scattering as a technique.

Virtual humans in movies looked really terrible back then. Remember this movie "Final Fantasy: The Spirits Within" from 2001? Probably not.

This is the main character from the film, and one of her glamorous intro shots.

The humans looked terrible, and it tanked at the box office.

Lord of the Rings: The Two Towers, (2002).

Then Lord of the Rings: The Two Towers came out the next year, won an Oscar for its visual effects, and even got nominated for best picture.

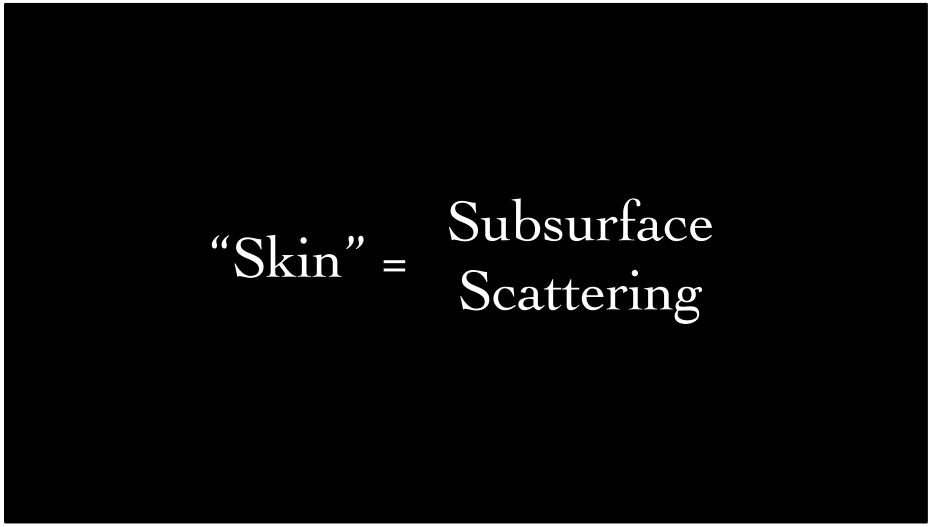
The enduring image from that movie is Gollum. He is whiter than white. He's a subterranean being that has not seen the sun in years and years. Peter Jackson had to get his fish-belly translucency just right.

And he did get it right, because Weta Digital snapped up the Jensen 2001 paper and applied it to Gollum. You're not going to find anybody with whiter, more transculent skin than Gollum.

On a personal note, I was working at Rhythm and Hues studios in 2001

Even before the Two Towers came out, and everybody at there wanted this technique as soon as the pre-print was posted.

We wanted it for rendering human skin, specifically for a secret James Cameron project called *Brother Termite* that they were bidding on.



So in graphics, when we're talking about skin, we're talking about subsurface scattering

And that's only the dominant visual component of white skin.

When we talk about skin in graphics, we're talking about white skin.

We can see this in the technical literature if we start going forward in time from the Jensen paper.

Here's the caption from that image I showed earlier. It is labelled as "face" and "skin". Not white face, and white skin, but face and skin.

Let's look at the papers that came after this, and see how the language rolls forward through time.

Here's a paper, the same year, for rendering "skin"

Figure 6: A textured face model lit by three light sources (key, fill, and rim). The left image shows the result using the skin shader that was used in the movie "Shrek", and the right image shows the result after adding our simulation of translucency to

Jensen and Buhler, *A Rapid Hierarchical Rendering Technique for Translucent Materials*, ACM Transactions on Graphics (2002).

Next year, here's a "skin shader" on a character from Shrek

Here's a 2005 paper dealing specifically with "human skin".

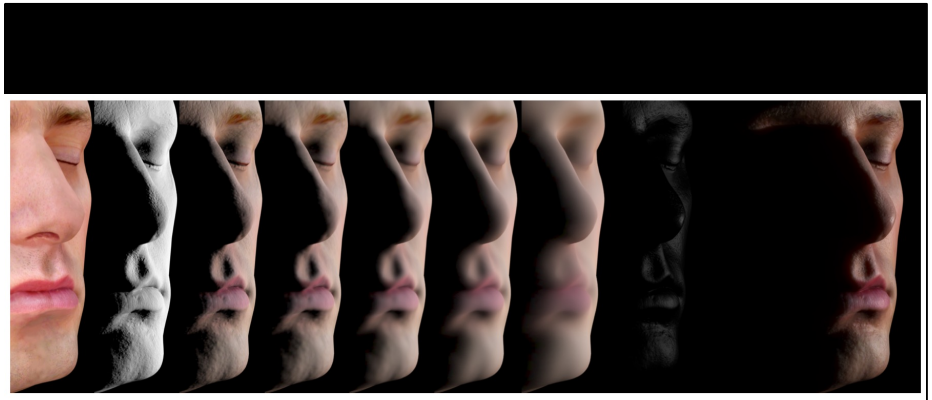


Figure 1: *We project multi-layer diffusion profiles onto a sum-of-Gaussians basis to enable realistic rendering of human skin.*

D'Eon, Luebke, Enderton , *Efficient Rendering of Human Skin*, Rendering Techniques (2007).

Here we see the term again in 2007, human skin, it's even in the title.

Figure 1: *Our model approximates heterogeneous light transport in skin through the inter-scattering of light between layers. Shown are*

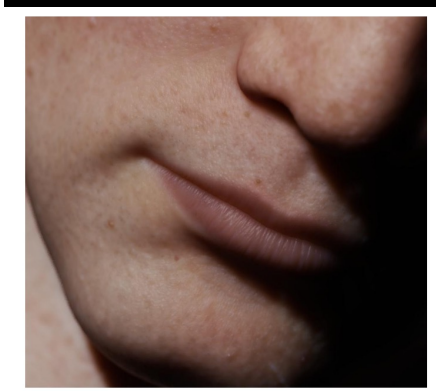
Donner, Weyrich, d'Eon, Ramamoorthi, and Rusinkiewicz,
A Layered, Heterogeneous Reflectance Model for Acquiring and Rendering Human Skin, ACM Transactions on Graphics (2008).

Again in 2008, "human skin". Again, it's even in the title

Figure 1: *Example results of our automatic changes in skin appearance predicted by our method. Changes are due both to mechanical*

Jimenez, Scully, Barbosa, Donner, Alvarez, Vieira, Matts, Orvalho, Gutierrez, Weyrich,
A Practical Appearance Model for Dynamic Facial Color, ACM Transactions on Graphics (2010).

2010, here's a paper on skin appearance



(a) Dipole (Jensen et al. 2001)

(b) Quantized-Diffusion

Figure 1: *Rendering a human face using a single-layer skin model. The classical dipole model (a) is frequency-limited and results in a*

d'Eon, Irving, *A Quantized-Diffusion Model for Rendering Translucent Materials*, ACM Transactions on Graphics (2011).

2011, a human face

Figure 9: *The classic dipole model (left) can lead to an overly waxy appearance for human skin. Our PBD model (middle)*

Habel, Christensen, Jarosz, *Photon Beam Diffusion: A Hybrid Monte Carlo Method for Subsurface Scattering*, Eurographics Symposium on Rendering (2013).

2013, human skin

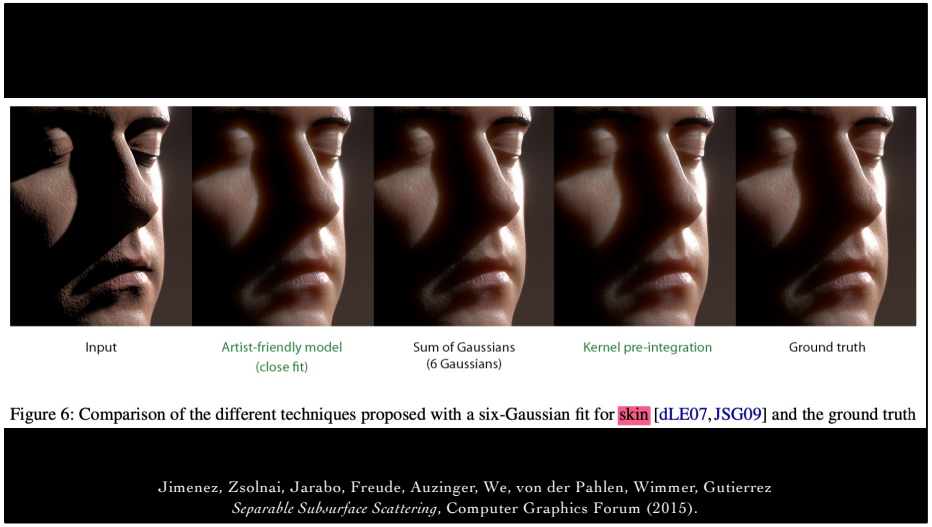


Figure 6: Comparison of the different techniques proposed with a six-Gaussian fit for skin [dLE07, JSG09] and the ground truth

Jimenez, Zsolnai, Jarabo, Freude, Auzinger, We, von der Pahlen, Wimmer, Gutierrez
Separable Subsurface Scattering, Computer Graphics Forum (2015).

2015, skin

(a) Our model (b) Reference (c) Frisvad et al. [2014] (d) d'Eon [2014] (e) Jensen et al. [2001]

Fig. 7. Comparison of dipole methods for a realistic spectral skin material with a Gaussian phase function of moderately high anisotropy $g = 0.75$ (see the

Fredericksx, Dutre, *A Forward Scattering Dipole Model from a Functional Integral Approximation*, ACM Transactions on Graphics (2017).

2017, skin

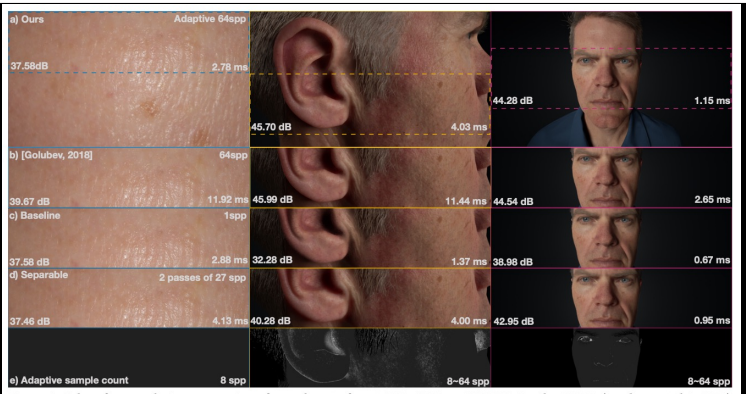
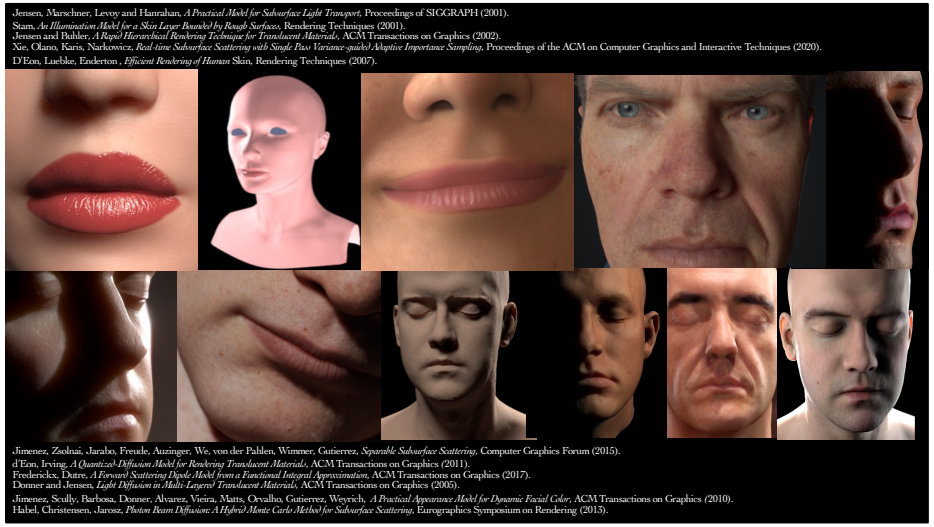


Figure 1: Subsurface rendering comparison from close to far at 1920x1080 on NVIDIA Quadro P4000 (implemented in UE4). (a) our adaptive sampling algorithm ($\sigma_0^2 = 0.001$, $\kappa = 0.2$, $b_{min} = 8$ spp, $b_{max} = 64$ spp), (b) Golubev [2018]'s sampling model in our framework with 64spp, (c) a *Baseline* fixed 64-sample implementation without our proposed acceleration techniques, (d) *Separable* screen-space diffusion. (e) Visualization of our adaptive sample count for each view. Our quality is higher than Baseline in all three scenarios (close skin patch, ear, and front). Moreover, our algorithm runs faster on the close skin patch

Xie, Olano, Karis, Narkowicz, *Real-time Subsurface Scattering with Single Pass Variance-guided Adaptive Importance Sampling*, Proceedings of the ACM on Computer Graphics and Interactive Techniques (2020).

Skin, just from last year, 2020.

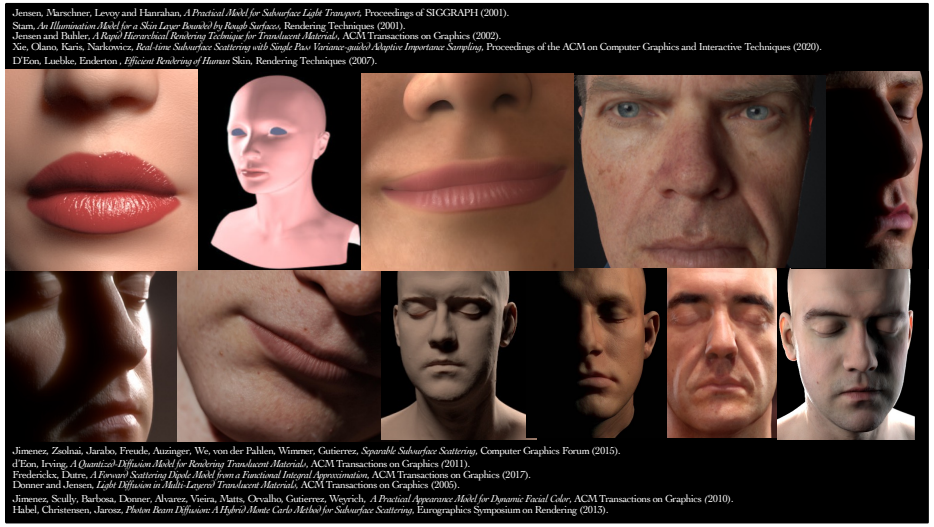


So, again, we come back to the same point. When we talk about skin in graphics, we're talking about white skin.

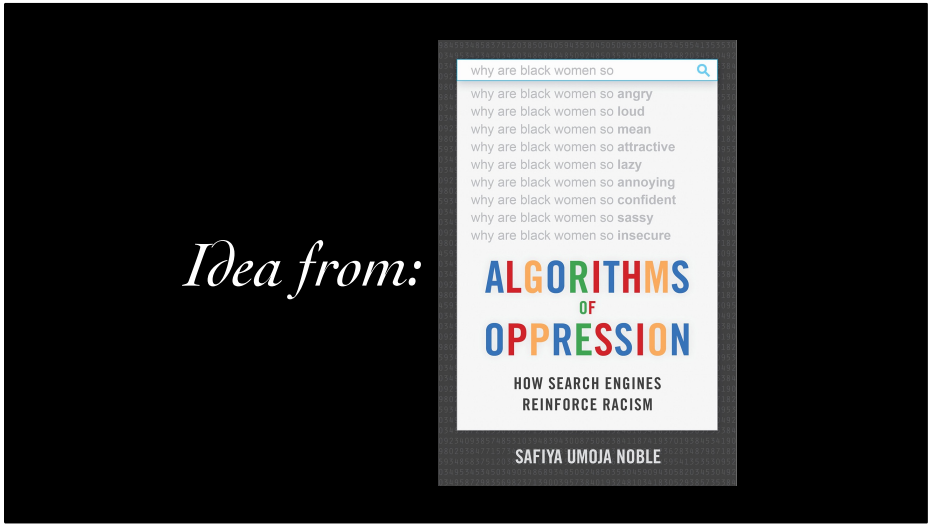
You can go back look at all these papers, and it's not like I cherry picked the white images and didn't show you the renderings of Black or brown people. These are the only images of humans in those papers.

Now there are some papers that try to hit different skin tones, like this one from 2006

And this other one from the same year.

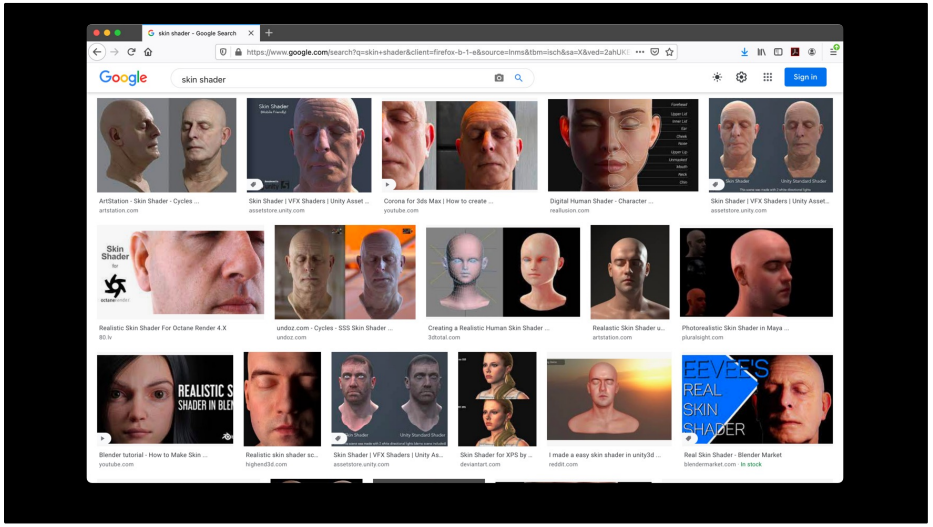


Unfortunately this is the exception, not the rule. In graphics, when we talk about skin, we're overwhelmingly talking about white skin.

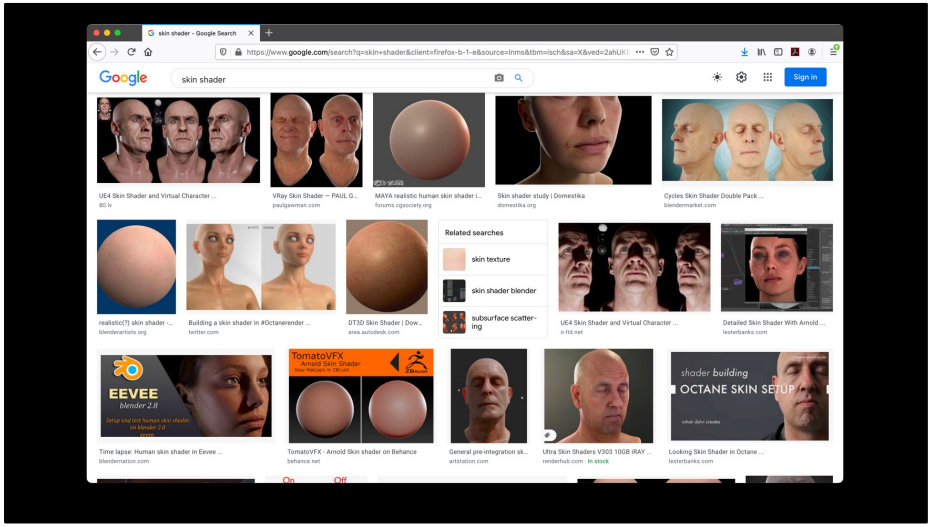


Let's see this same thing from another perspective. Professor Safiya Noble at UCLA is one of the leading scholars on bias in technology, so let's borrow one of the techniques from her book "Algorithms of Oppression"

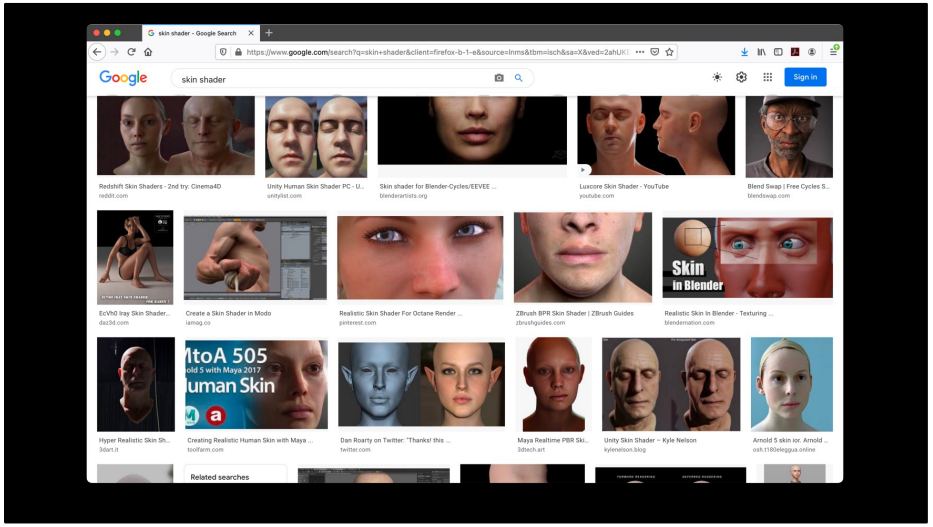
What do we see when we do a Google Image search for “skin shader”? This is a different way to measure what we in graphics mean when we say skin.



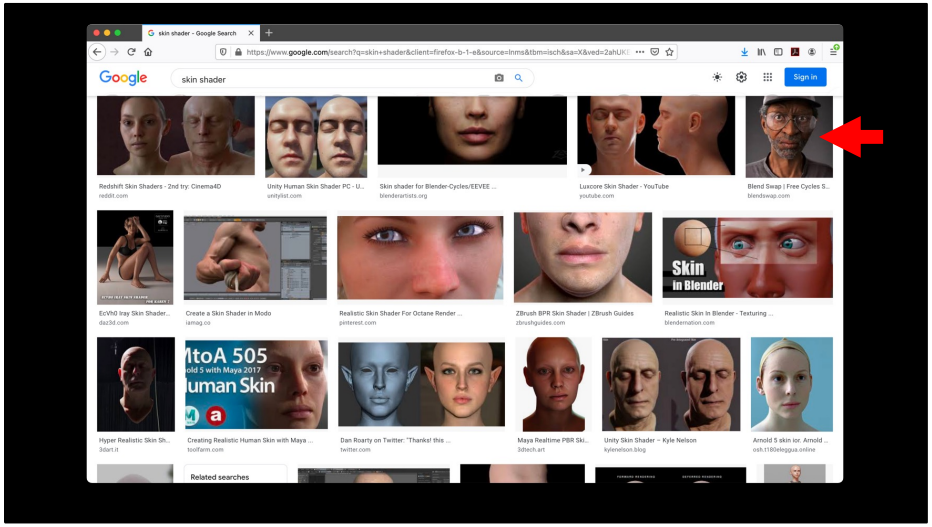
Again, it’s overwhelmingly white.



Here’s the next page



And the next. Ah! Here's a homeless-looking black dude. So that's one.



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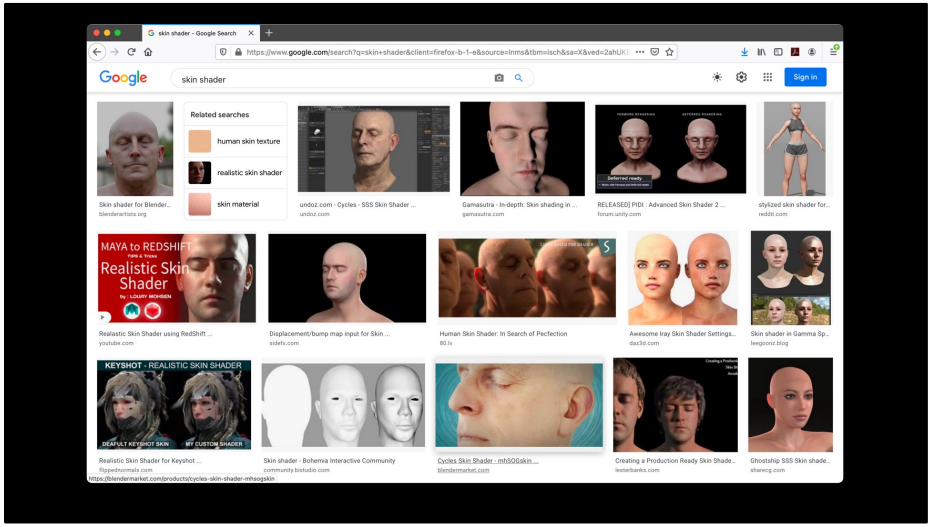
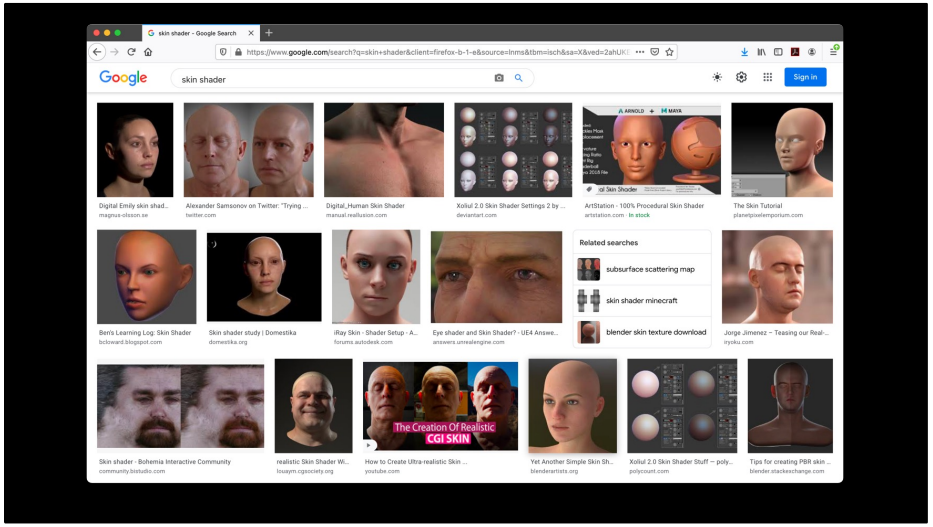
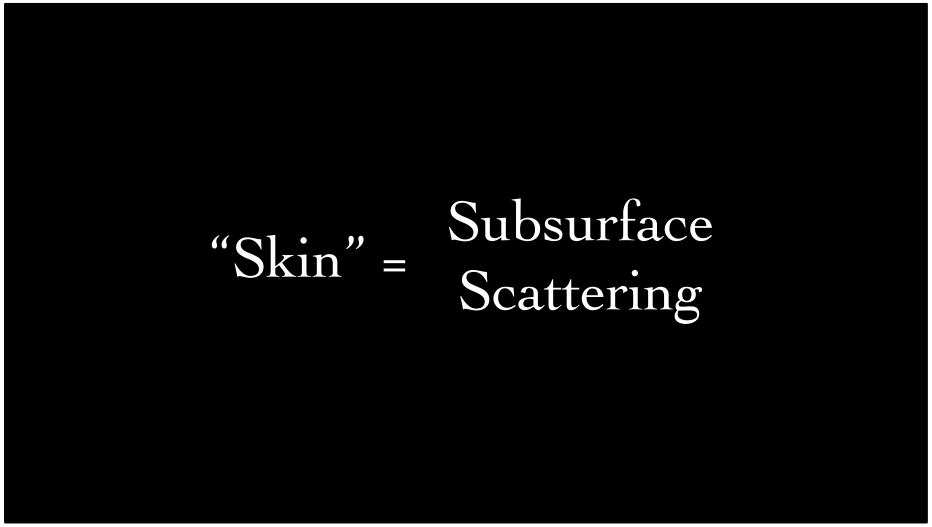


That’s about it though. Here’s the next page



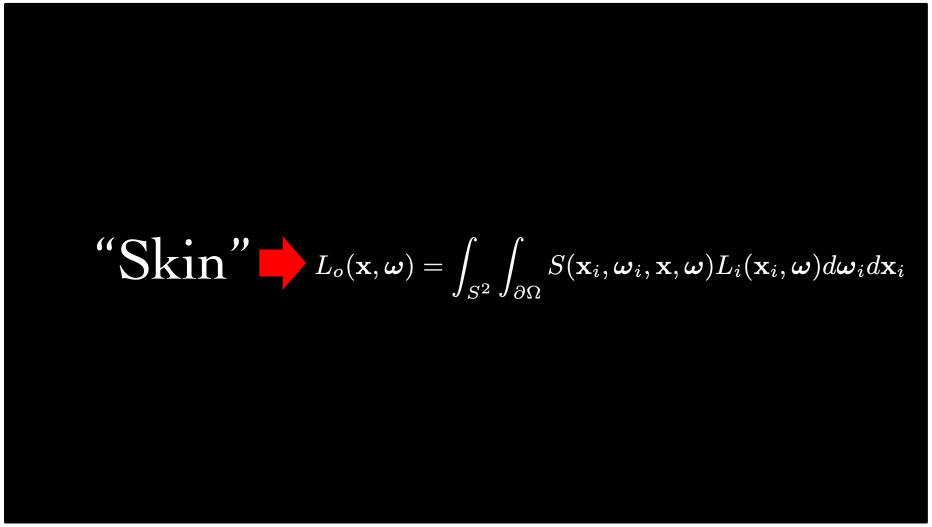
That’s about it though. Here’s the next page

In graphics when we talk about “skin” we’re talking about white skin.



And when we're talking about white skin, we're talking about subsurface scattering

This relation has then been codified in the math.



so we can now write it down as a double integral, isolate the BSSRDF term, and start developing numerical methods for it.

$$L_o(\mathbf{x}, \boldsymbol{\omega}) = \int_{S^2} \int_{\partial\Omega} S(\mathbf{x}_i, \boldsymbol{\omega}_i, \mathbf{x}, \boldsymbol{\omega}) L_i(\mathbf{x}_i, \boldsymbol{\omega}) d\boldsymbol{\omega}_i d\mathbf{x}_i$$

Now something very difficult happens.

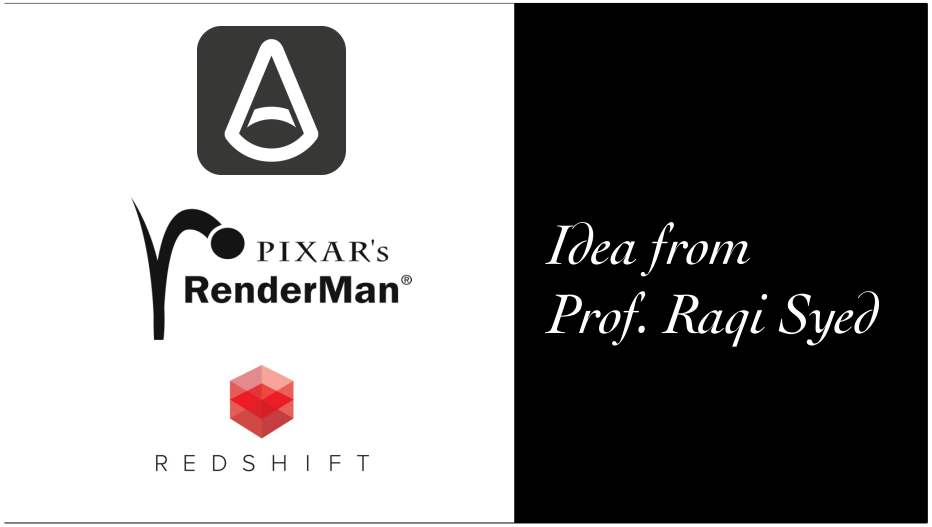
It looks like we've used the rigorously isolated skin appearance in the mathematical physics sense.

Once you have a scary equation like this, wrapped in a double integral, it is set in stone.

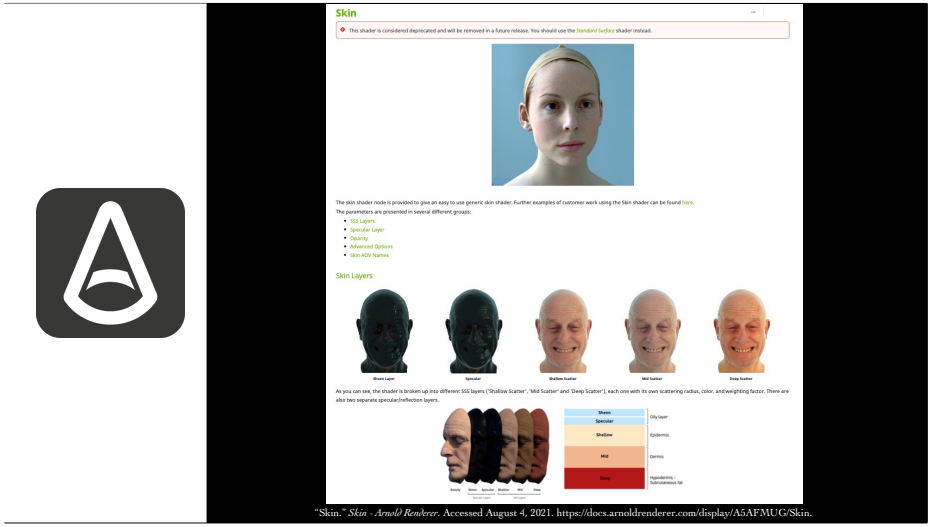
Nobody outside of an extremely small specialist community has the standing to dispute it.

But really we carved out the piece of physics that's most important to white skin.

This is not all skin. We're trying to do is emulate the types of skin that dominated ads and magazines in the late 90s.



Let's look at this from a third direction, commercial renderers. I can't take credit for this approach, my brilliant Professor Raqi Syed from Victoria University in Wellington suggested this perspective



"Skin." *Skin - Arnold Renderer*. Accessed August 4, 2021. https://docs.arnoldrenderer.com/display/A5AFMUG/Skin.

Here's the Skin tutorial for the Arnold renderer. Up until recently here's their skin shader, you can see that it's all geared towards a specific type of skin.

PIXAR's RenderMan®

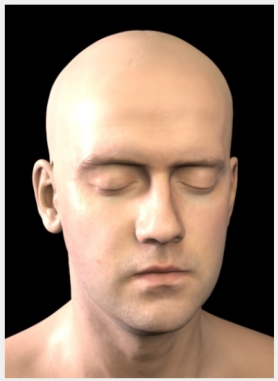
PxrSkin

The **PxrSkin** shader utilizes the advances in physically-based subsurface scattering combined with efficient multiple importance sampling techniques for path tracing efficiency and low noise.

The subsurface scattering uses a close approximation to the ground-truth solution as determined by Monte-Carlo simulation. It includes both single- and multi-scattering. The advantage of this BSSRDF model over the more common dipole diffusion BSSRDF model is that it better represents high frequency details, whereas the dipole model often suffers from an overly smooth "waxy" look. The skin color defaults to smooth caucasian skin color but is most often specified by a texture map.

The subsurface scattering is divided into three components: near, mid, and far. It is common to assign a different color for each component, for example for skin one would choose pale yellowish pink for near-range color, pink for mid-range color, and deep red for far-range color.

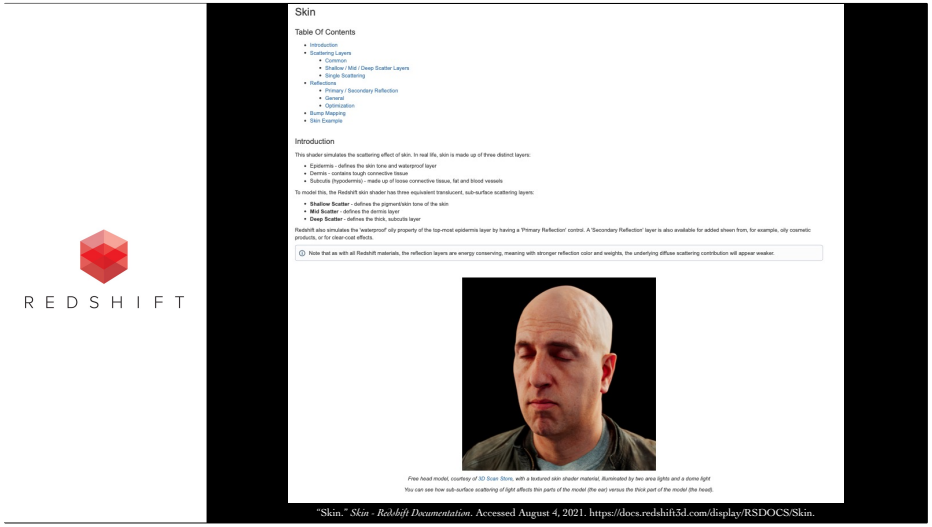
In addition to subsurface scattering, the `PxrSkin` shader also has specular/glossy reflection to represent surface reflection from skin oils and sweat. The image at right is an example of a head rendered with the `PxrSkin` shader (thanks to Lee Perry-Smith for making this data set freely available). This material is deprecated and succeeded by PxrLMSubsurface.



PxrSkin is not just for skin. It is a good basis for any material that has similar basic characteristics, e.g. wax, marble, onyx, or jade.

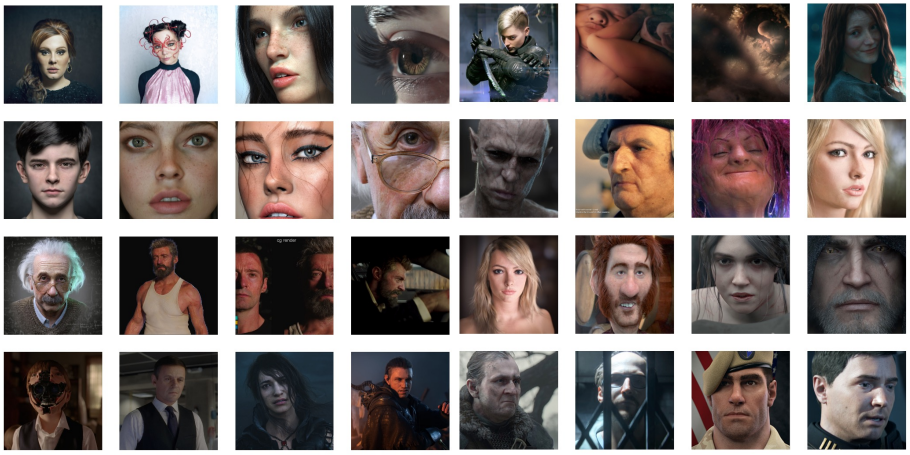
"PxrSkin." *Renderman Documentation*. Accessed August 4, 2021. https://renderman.pixar.com/resources/RenderMan_20/PxrSkin.html.

Here's Pixar's skin shader, the picture here is the only one in the doc. There's not another one if you scroll down. So, yeah, this is what we're talking about when we talk about skin.



Here's Redshift's documentation for skin shading. Again, it's quite clear what you mean when we say "skin".

If scroll down in this doc, you'll see this one dude repeated over and over. Sixty-three times. I counted. Not another single human being in this whole document.



"Gallery." *Arnold Renderer | Autodesk | Gallery | Skin*. Accessed August 4, 2021. https://www.arnoldrenderer.com/gallery/?q=skin.

Arnold also has a galeery of results users have generated from their software, you can see it here.

Yup, so we see what users are using it for. There's an element of curation here as well. Clearly somebody at Solid Angle also believes that their tech has been well-used in these shots.

All right, so we’ve now seen three instances of skin = white skin

First, the technical papers at SIGGRAPH and related conferences

Second, the popular understanding of it, as catalogs by Google

Third, the commercial understanding of it, as evidenced by the documentation of widely used renderers.

At this point, I hope we can agree that this bias does in fact exist.

There's more to be explore here, but I'll leave that to the next section, because skin isn't the only time this has happened.

Summary

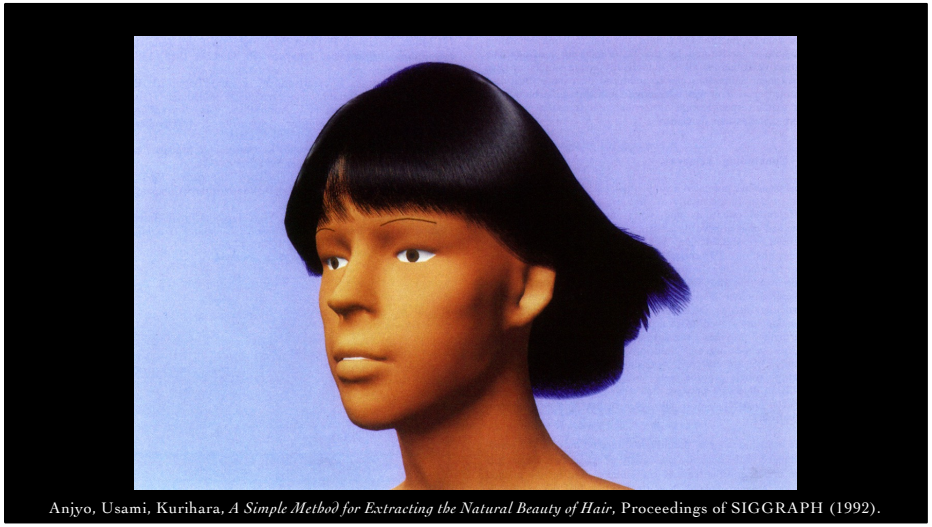
- What Racial Bias?
- Where Did It Come From?
- What Do We Do Now?

Okay, we're still in this first part. What racial bias?

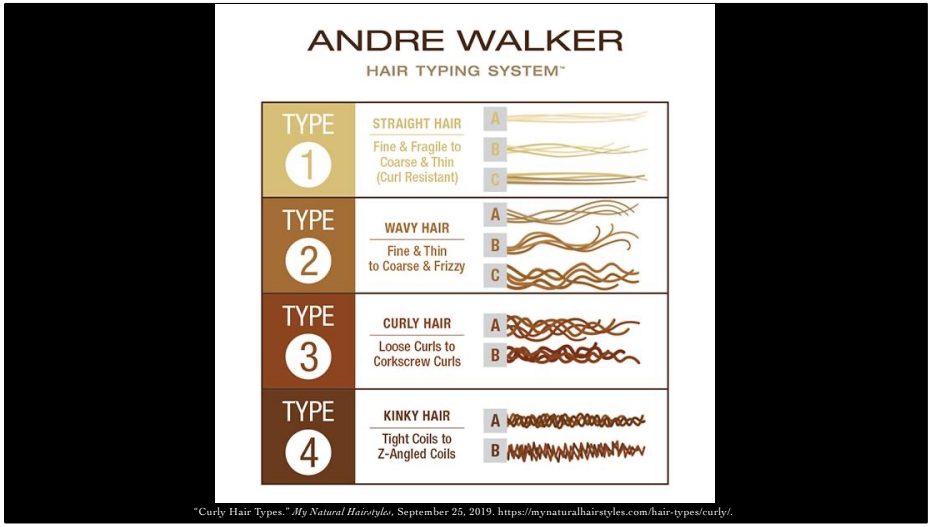
We're going to switch gears slightly, because it's not all about skin. Everything that I just talked about, it happened with hair too.

What is “human hair”?

What is “human hair”? Let’s do it again. In computer graphics, when we talk about human hair, what are we talking about?

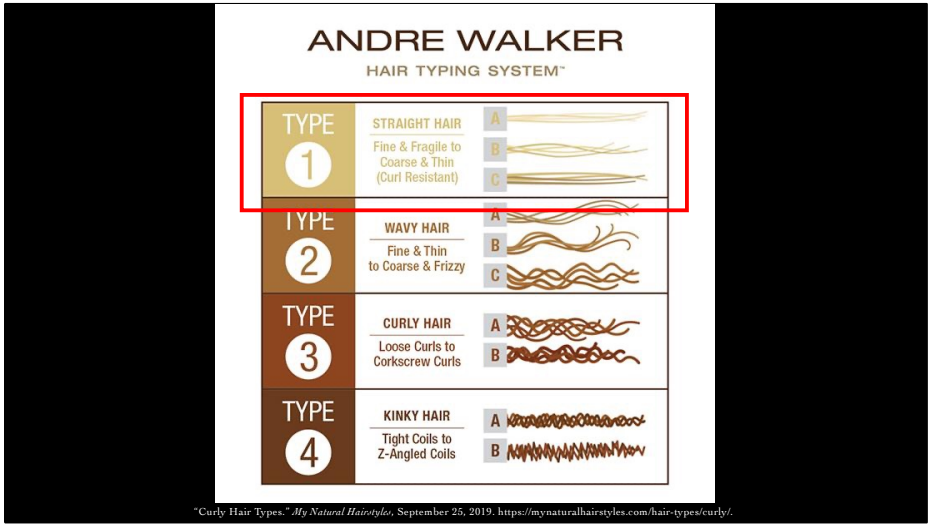


We can go way back, stuff like this early paper from Ken Anjyo in Japan. Straight black hair.

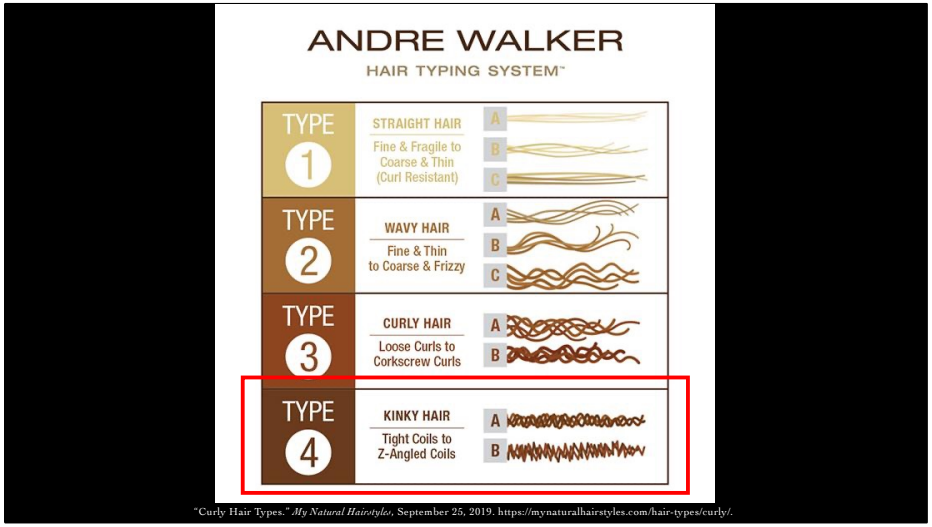


"Curly Hair Types." *My Natural Hairstyles*, September 25, 2019. https://mynaturalhairstyles.com/hair-types/curly/.

This is one type of hair. But the thing is, there's lots of different types of hair out there. There's even a type system for them. Here we have one that's popular among professional stylists called the Walker system.

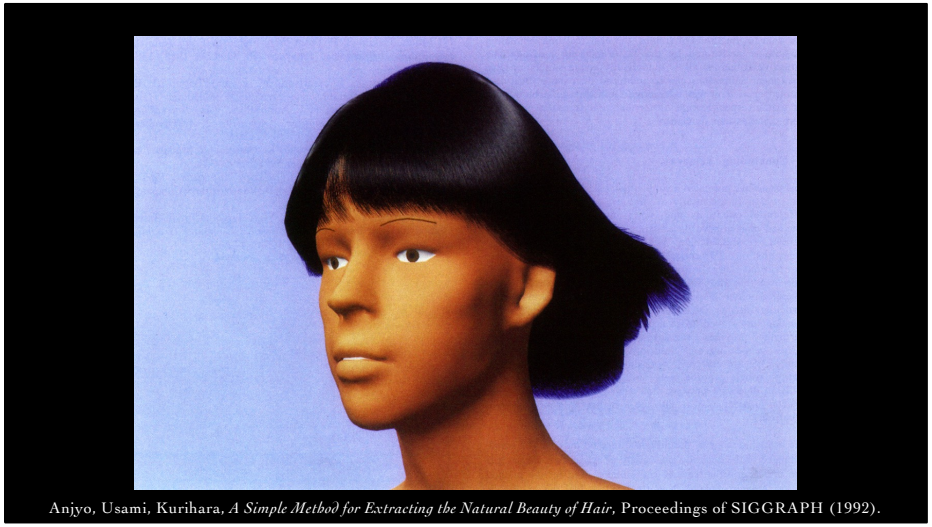


Straight hair is only one type of hair, there's a whole bunch, and according to the Walker system, Type 4c is on the other side.



Straight hair is only one type of hair, there's a whole bunch, and according to the Walker system, Type 4c is on the other side.

Here's what Type 4 hair looks like. It's really, really curly. People refer to this as afro-textured hair, or kinky hair, or coiled hair because it's so curly that each follicle actually contains lots of kinks.



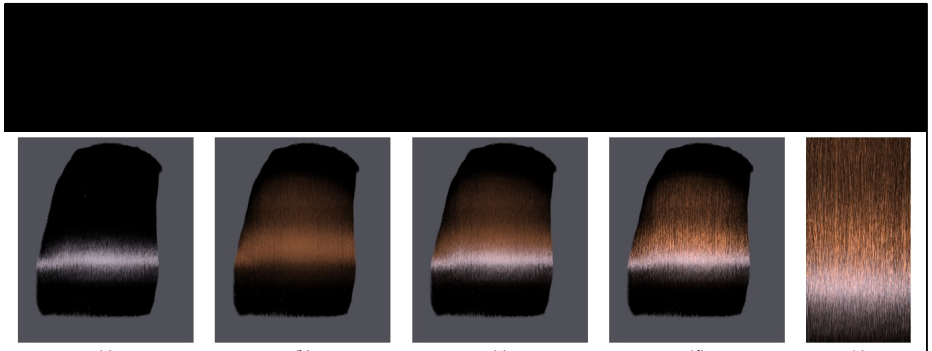
Let's step through the hair literature in graphics. What kind of hair do we see?

Let's step through the hair literature in graphics. What kind of hair do we see?

Figure 8: Two synthetic renderings of animated hair.

Chang, Jin, Yu, *A Practical Model for Hair Mutual Interactions*,, ACM Transactions on Graphics (2002).

This counts as hair.



(a) (b) (c) (d) (e)

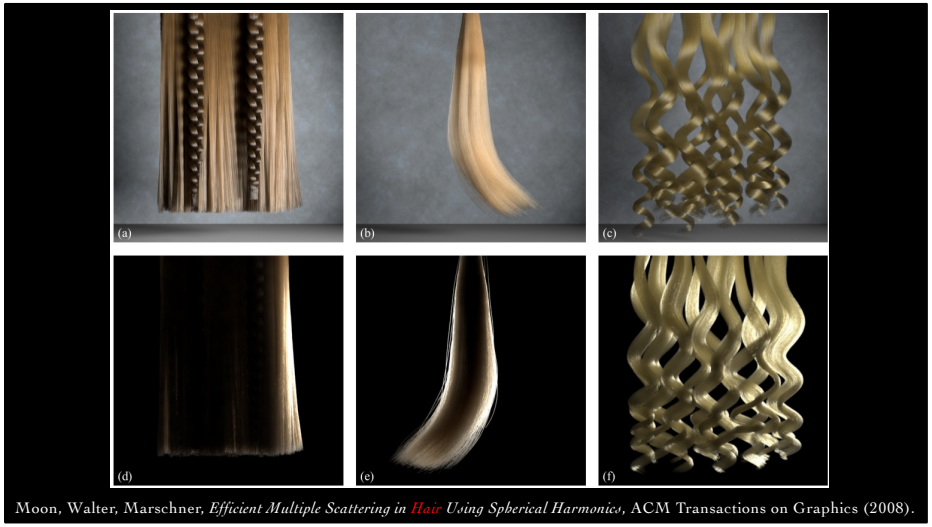
Figure 14: (a–c) The components of our model for circular hair ($a = 1$): (a) the R component (primary highlight) alone; (b) the TRT

Marschner, Jensen, Cammarano, Worley, Hanrahan, *Light Scattering From Human Hair Fibers,* ACM Transactions on Graphics (2003).

This is human hair.

Choe, Choi, Ko, *Simulating Complex Hair with Robust Collision Handling*, ACM Transactions on Graphics (2005).

This is human hair.



This is human hair.

Figure 1: *An example hair mesh model and the final hair model generated using this hair mesh and procedural styling operations.*

Yuksel, Schaefer, Keyser, *Hair Meshes*, ACM Transactions on Graphics (2009).

This is human hair.

This is human hair.

This is human hair.

Wu, Yuksel, *Real-time Hair Mesh Simulation*, Proceedings of the ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games (2016).

This is human hair.

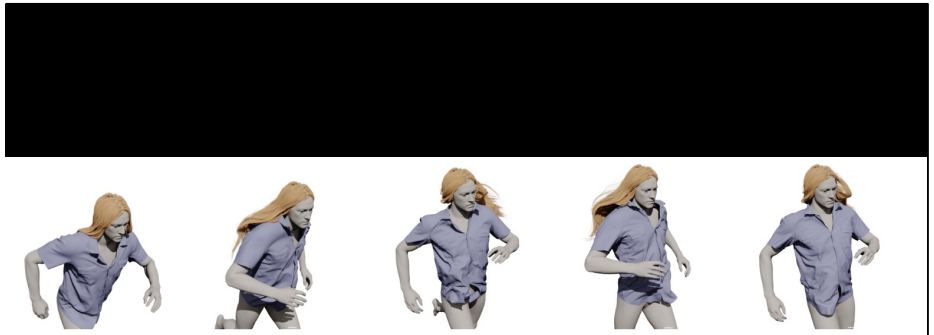
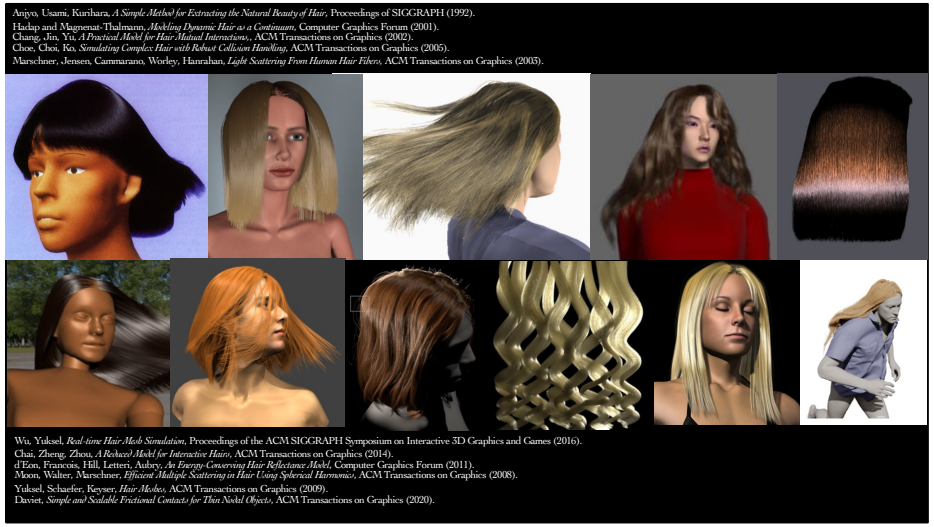


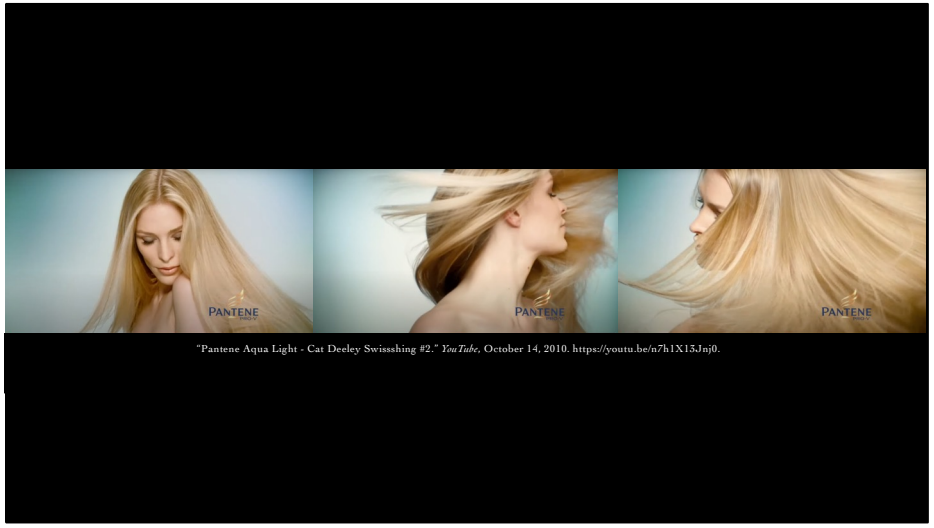
Fig. 1. A virtual character going through a running cycle, letting his hair impact repeatedly the back and neck of his shirt. The groom consists of 54, 450

Daviet, *Simple and Scalable Frictional Contacts for Thin Nodal Objects*, ACM Transactions on Graphics (2020).

This is human hair.

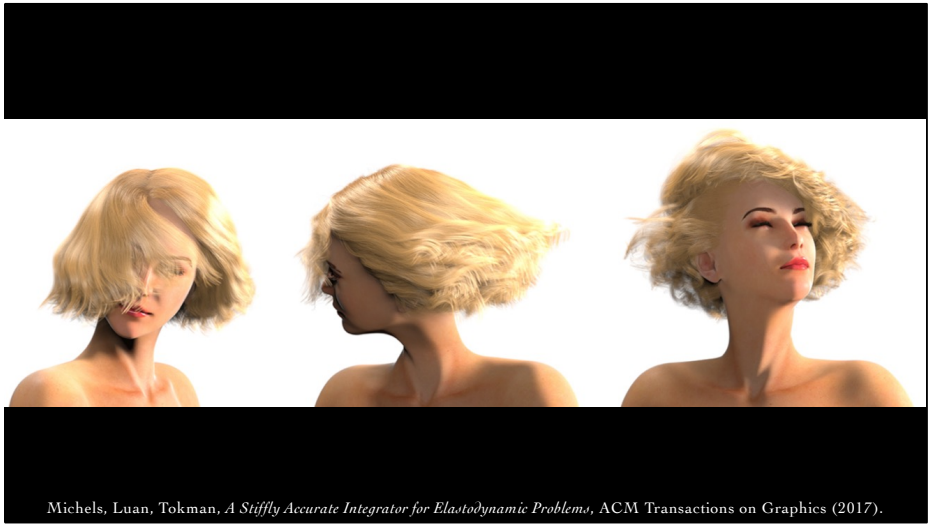

Anjyo, Usami, Kurihara, *A Simple Method for Extracting the Natural Beauty of Hair*, Proceedings of SIGGRAPH (1992).
Hadap and Magnenat-Thalmann, *Modeling Dynamic Hair as a Continuum*, Computer Graphics Forum (2001).
Chang, Jin, Yu, *A Practical Model for Hair Mutual Interactions*, , ACM Transactions on Graphics (2002).
Choe, Choi, Ko, *Simulating Complex Hair with Robust Collision Handling*, ACM Transactions on Graphics (2005).
Marschner, Jensen, Cammarano, Worley, Hanrahan, *Light Scattering From Human Hair Fibers*, ACM Transactions on Graphics (2003).
Wu, Yuksel, *Real-time Hair Mesh Simulation*, Proceedings of the ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games (2016).
Chai, Zheng, Zhou, *A Reduced Model for Interactive Hairs*, ACM Transactions on Graphics (2014).
d'Eon, Francois, Hill, Letteri, Aubry, *An Energy-Conserving Hair Reflectance Model*, Computer Graphics Forum (2011).
Moon, Walter, Marschner, *Efficient Multiple Scattering in Hair Using Spherical Harmonics*, ACM Transactions on Graphics (2008).
Yuksel, Schaefer, Keyser, *Hair Meshes*, ACM Transactions on Graphics (2009).
Daviet, *Simple and Scalable Frictional Contacts for Thin Nodal Objects*, ACM Transactions on Graphics (2020).

Alright, let's go back to the Britney Spears and Gisele ads. When we talk about hair in computer graphics, we're trying to reproduce these ads.



"Pantene Aqua Light - Cat Deeley Swissshing #2." *YouTube*, October 14, 2010. https://youtu.be/n7h1X13Jnj0.

This comparison is not that idle. Here's some screen grabs from a recent Pantene ad.



Here's the images from a recent paper. Really, we've been trying to get the hair flip from shampoo ads this whole time.

Sometimes fiber assemblies that resemble Type 4 hair do in fact appear in technical publications

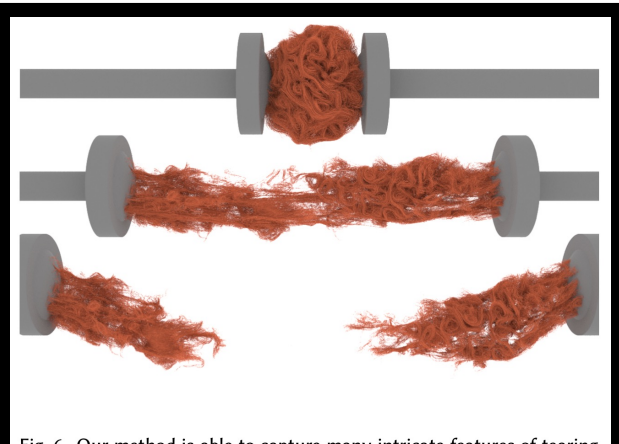


Fig. 6. Our method is able to capture many intricate features of tearing apart a fibrous material consisting of 2.15M particles.

Jiang, Gast, Teran, *Anisotropic Elastoplasticity for Cloth, Knit and Hair Frictional Contact*, ACM Transactions on Graphics (2017).

But these are not recognized as hair. Here's a paper from 2017, hey that ball of stuff is pretty close to Type 4 hair! But viewing this as hair is just not in our technical vocabulary. Look at the caption – it's called a ball of "fibrous material".

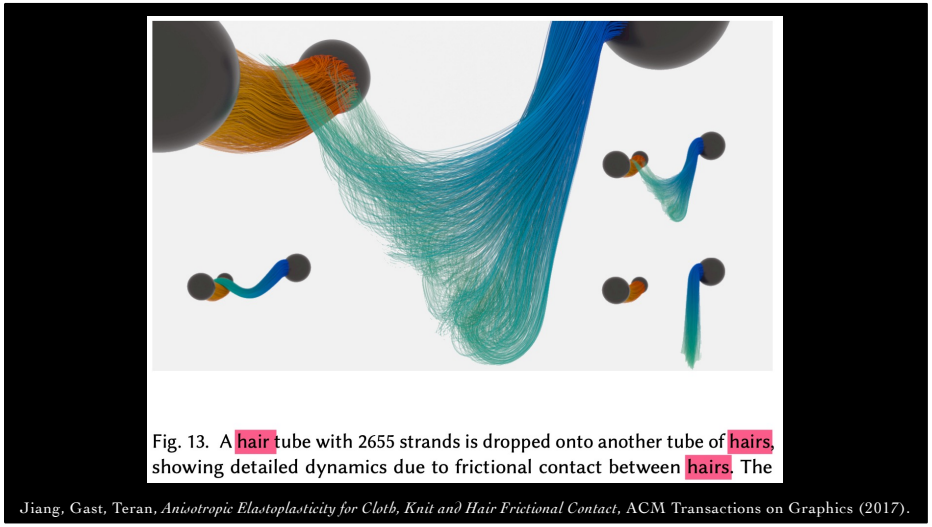
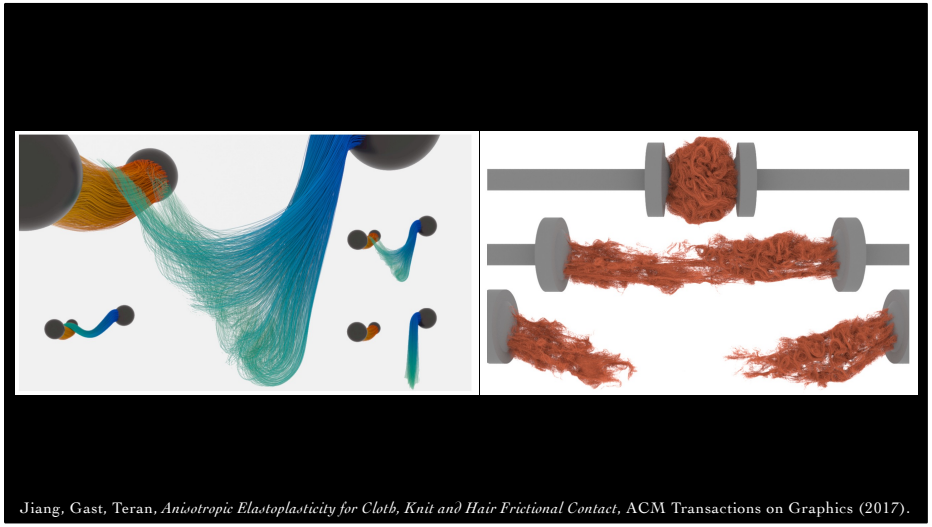


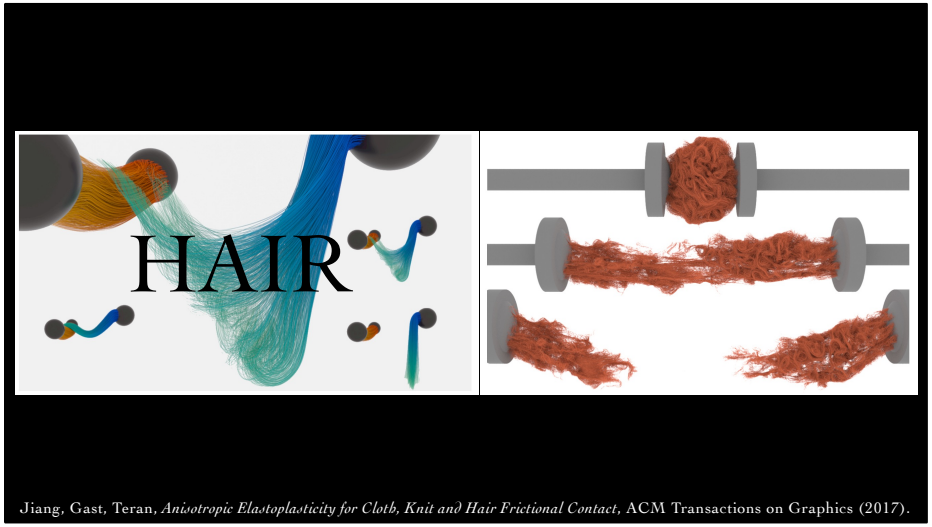
Fig. 13. A hair tube with 2655 strands is dropped onto another tube of hairs, showing detailed dynamics due to frictional contact between hairs. The

Jiang, Gast, Teran, *Anisotropic Elastoplasticity for Cloth, Knit and Hair Frictional Contact*, ACM Transactions on Graphics (2017).

Later on in that paper though, hair does make an appearance. They're doing a test where they collide two "tubes of hair".



If we look at these two side by side, they're both super-abstract! It's really weird that



This one gets called hair

And this one is not hair. And yet that's where we are with the technical language.

In our technical vocabulary

“Hair” = Straight Hair

When we talk about hair we mean straight hair, which is characteristic of Europeans and East Asians. Even with curly hair, we say “curly hair”. It’s implicitly understood that “hair” = “straight hair”.

Pixar published a paper a few years ago on the curly hair system for Merida in Brave. They even had to say it in their title. “Curly hair”. If they said “hair”, it would have read as “straight hair”.

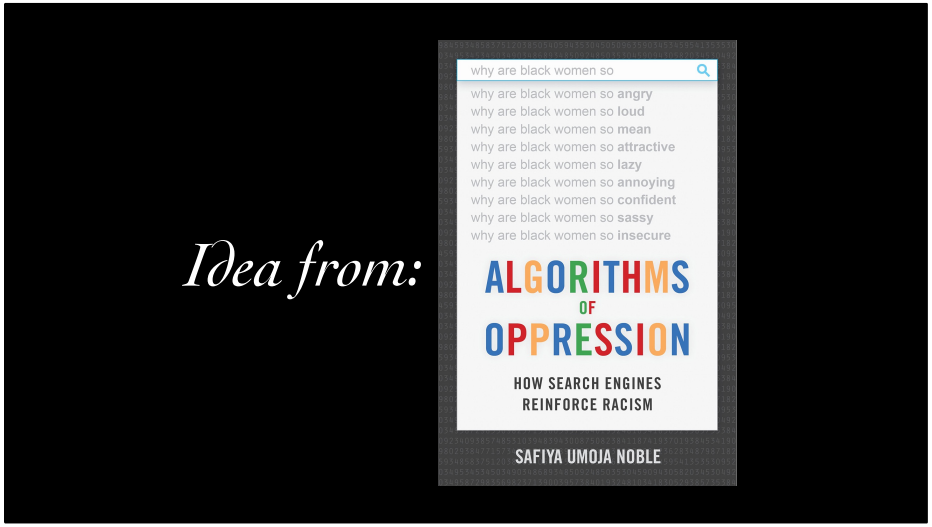
This is a phenomenon pointed out by my brilliant colleague Professor A.M. Darke. What we're seeing here is specific form of bias,

"anti-Blackness". The point here is slightly different from the skin example.

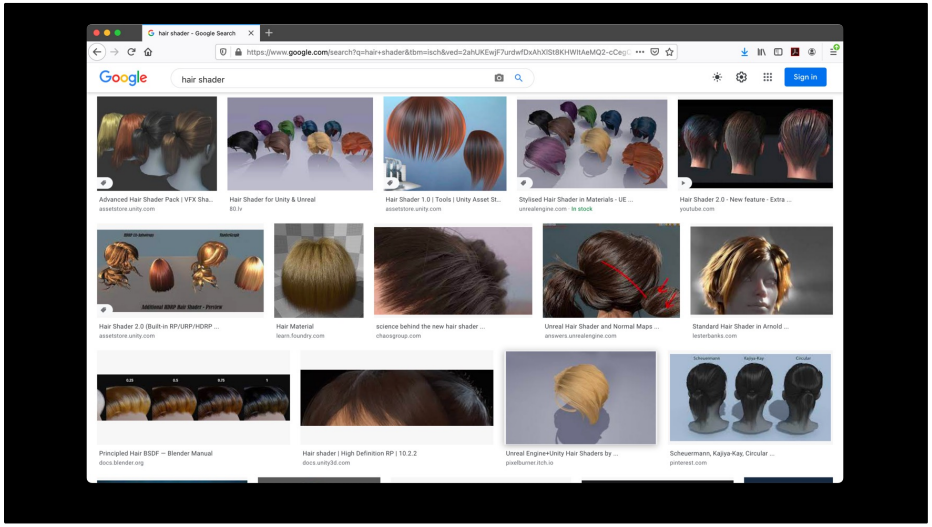
We're not favoring white features

We're explicitly avoiding Black features

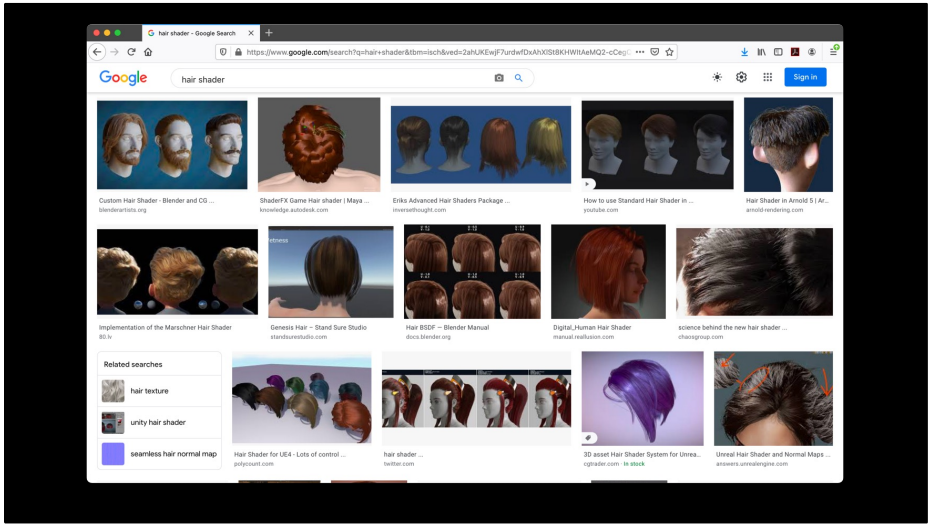
Black features bad, doesn't count as hair.



Again, let's borrow a page from Professor Noble's methodology and google "hair shader".



It’s all super-straight hair. Last time we were lucky and hit at least one or two Black people. No luck here.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Eriks Advanced Hair Shaders Package ...
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How to use Standard Hair Shader in ...
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Hair Shader in Arnold 5 | Ar...
arnold-rendering.com
Implementation of the Marschner Hair Shader
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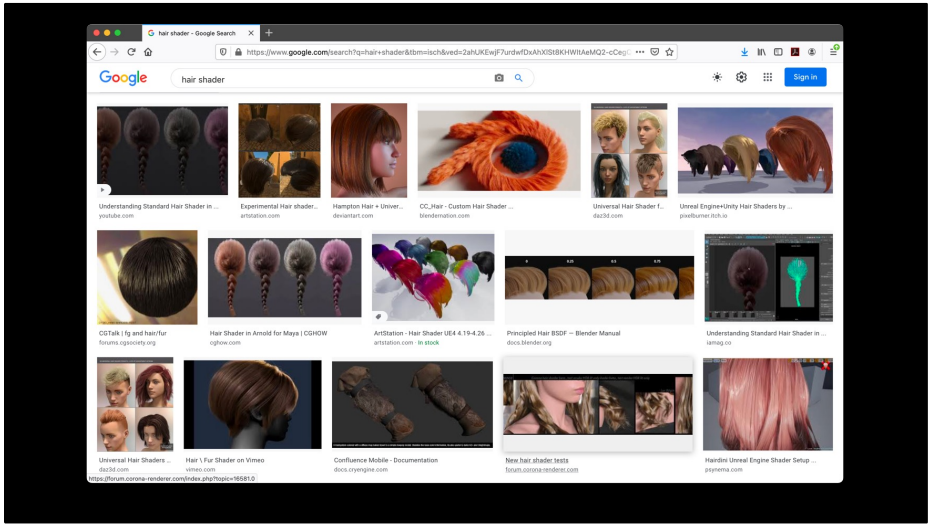
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Hampton Hair + Univer...
deviantart.com
CC_Hair - Custom Hair Shader ...
blendernation.com
Universal Hair Shader f...
daz3d.com
Unreal Engine+Unity Hair Shaders by ...
pixelburner.itch.io
CGTalk | fg and hair/fur
forums.cgsociety.org
Hair Shader in Arnold for Maya | CGHOW
cghow.com
ArtStation - Hair Shader UE4 4.19-4.26 ...
artstation.com · In stock
Principled Hair BSDF — Blender Manual
docs.blender.org
Understanding Standard Hair Shader in ...
iamag.co
Universal Hair Shaders ...
daz3d.com
Hair \ Fur Shader on Vimeo
vimeo.com
Confluence Mobile - Documentation
docs.cryengine.com
New hair shader tests
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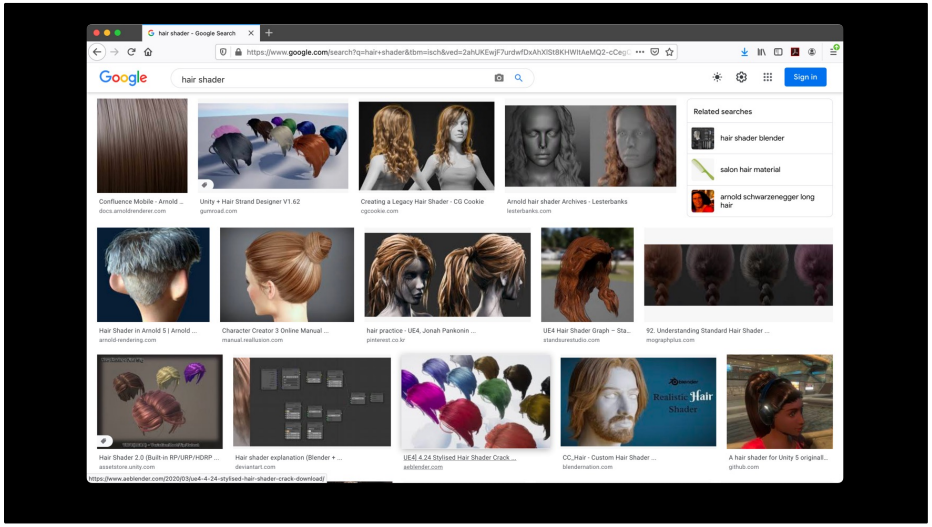
Hairdini Unreal Engine Shader Setup ...
psynema.com
https://forum.corona-renderer.com/index.php?topic=16581.0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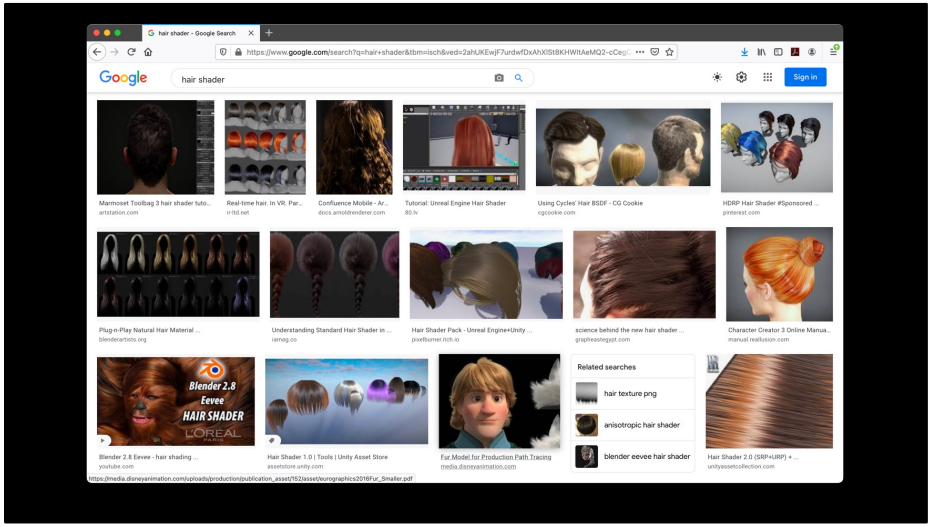
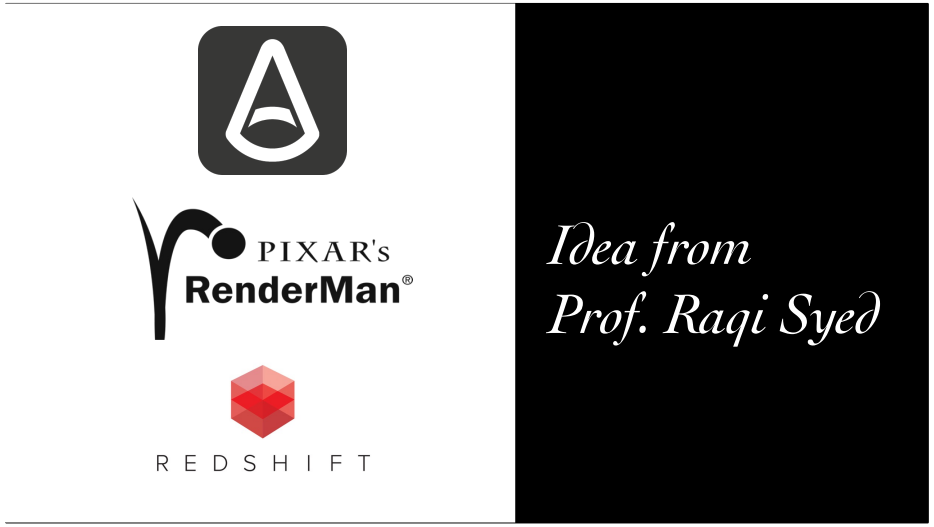
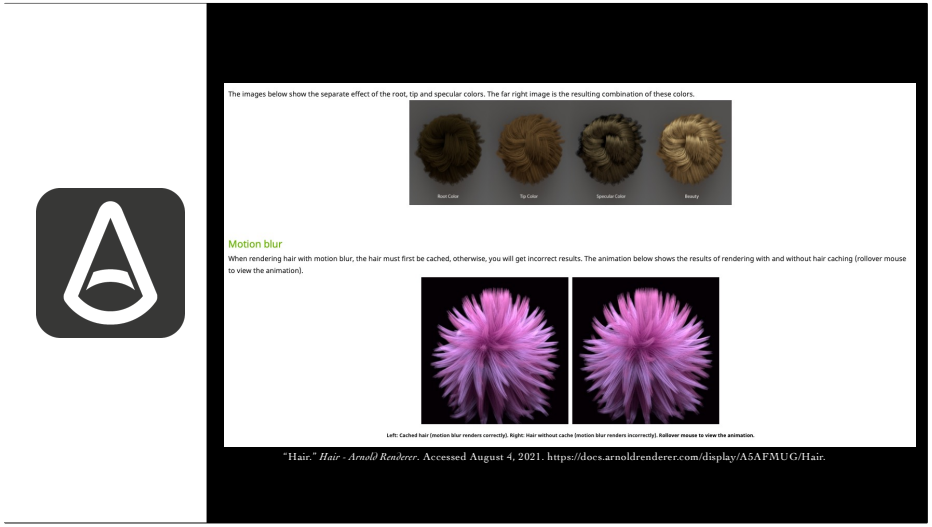
gumroad.com
Creating a Legacy Hair Shader - CG Cookie
cgcookie.com
Arnold hair shader Archives - Lesterbanks
lesterbanks.com
Hair Shader in Arnold 5 | Arnold ...
arnold-rendering.com
Character Creator 3 Online Manual ...
manual.reallusion.com
hair practice - UE4, Jonah Pankonin ...
pinterest.co.kr
UE4 Hair Shader Graph – Sta...
standsurestudio.com
92. Understanding Standard Hair Shader ...
mographplus.com
Hair Shader 2.0 (Built-in RP/URP/HDRP ...
assetstore.unity.com
Hair shader explanation (Blender + ...
deviantart.com
UE4| 4.24 Stylised Hair Shader Crack ...
aeblender.com
CC_Hair - Custom Hair Shader ...
blendernation.com
Realistic Hair Shader
A hair shader for Unity 5 originall...
github.com
https://www.aeblender.com/2020/03/ue4-4-24-stylised-hair-shader-crack-download/



There is nothing that even approaches Type 4c hair. I scrolled for a really long time. I didn't find a Type 4 example.

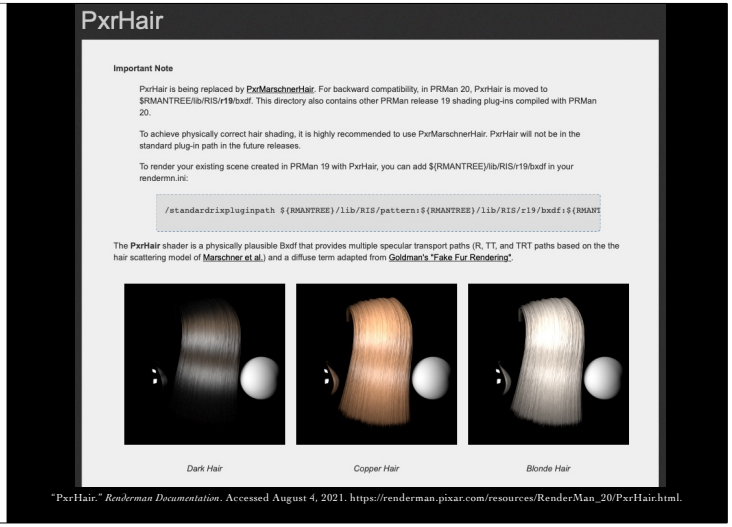


Again, let's look at the problem using the methodology of my colleague Professor Syed, we see this all reflected in the commercial software.



Here's the hair from Arnold. Straight hair.

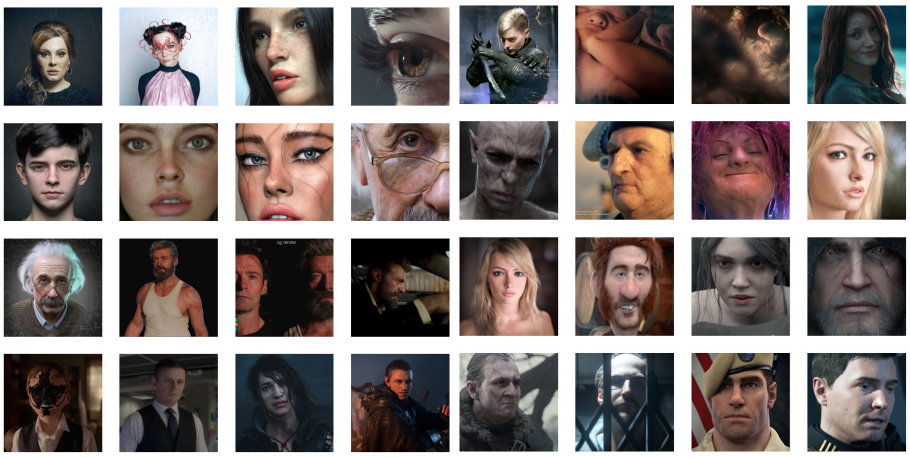
PIXAR's RenderMan®



"PxrHair." *Renderman Documentation*. Accessed August 4, 2021. https://renderman.pixar.com/resources/RenderMan_20/PxrHair.html.

Here's the hair from RenderMan. Straight hair.

Here's the hair from Redshift. Straight hair.



"Gallery." *Arnold Renderer | Autodesk | Gallery | Skin*. Accessed August 4, 2021. https://www.arnoldrenderer.com/gallery/?q=skin.

Let's look at Arnold's feature gallery again, but look at the hair. All straight hair. Or rather, no Type 4 hair.

In graphics, when we talk about skin, we’re talking about white skin. When we talk about hair, we mean everything except for Black hair.

Summary

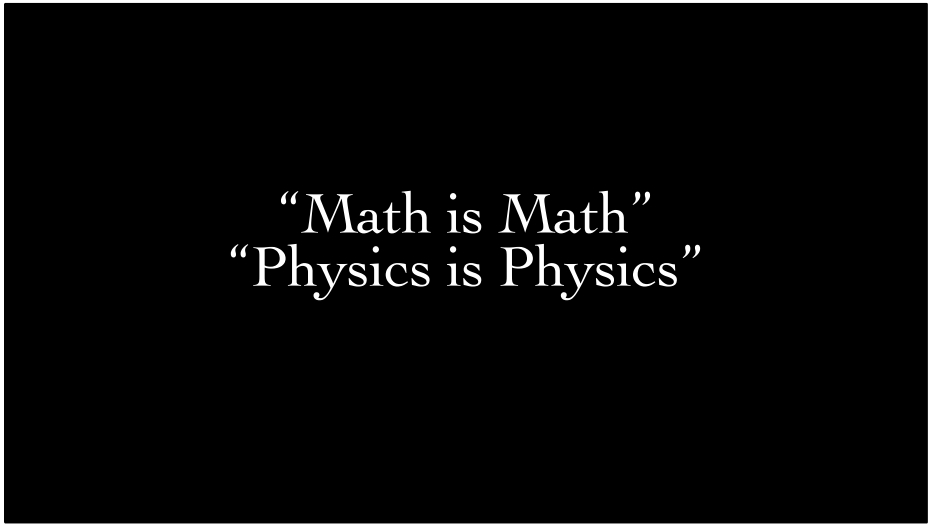
- What Racial Bias?
- Where Did It Come From?
- What Do We Do Now?

Where did this come from? Was there some evil cabal of researchers at the beginning of graphics who said let's just focus on the features of white people?

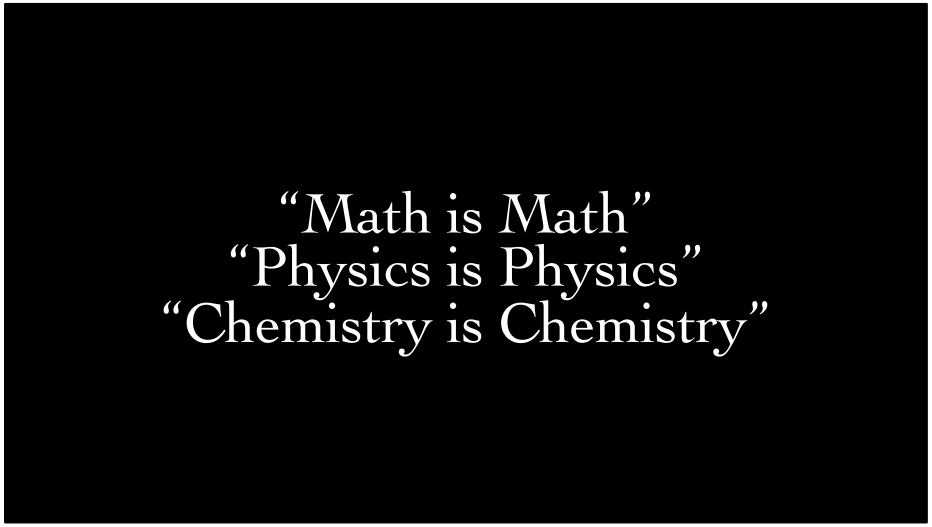
Again, the answer there is no, because that would just be too easy. We could just expel the racists, think a little harder in the future, and have more inclusive algorithms for graphics.

We live in a world shaped by history, and all of this has happened before. All the patterns that we see here predate computer graphics, and happened in both analog photography and analog film. When we all entered when things went digital, did it all over again.

This is all cyclical, so it's hard to know where to start, but let's start with the development of color film.



Now again, to non-specialists, math is math, physics is physics



And in this case Chemistry is chemistry, right? Color film was developed to capture the colors of the world right?

The Golden Coach, (1952).

Here's a shot from Renoir's 1952 movie "The Golden Coach", which was shot in Technicolor. This isn't Renior the famous painter, it's his son, Renoir the famous filmmaker. Look at the difference between the white actor and the black actor. You can't even see the black actor's eyes or teeth! Is he in shadow? He is not.

The Golden Coach, (1952).

Here's another shot from the movie, a small child is offering treats to a white audience watching a play. You can't see his face at all. It's astonishing.

It looks like I photoshopped all of their faces out.

The Golden Coach, (1952).

Here's one last one. These you can see their faces just a little bit because there's literally a light source a few inches from their face. Still, you can't even see his eyes.

What's going on here?

The entire color film process was calibrated to capture "skin tones". Which skin tones? White skin tones.

Leader Ladies Project

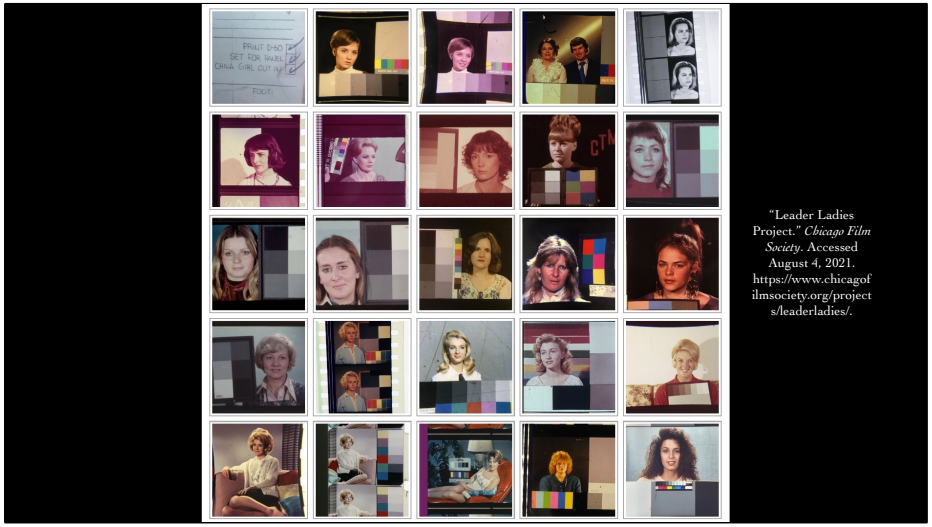
Get updates and see more images from this project via Instagram!
Submissions welcome, send to: info@chicagofilmsociety.org.

Started in 2011, the Leader Ladies Project presents a collection of "China Girls" (or "Leader Ladies," as we've heard at least one person call them) – the test images of (most often) women that sometimes appear in the countdown that begins every reel of motion picture film meant for exhibition, often accompanied by color bars and gray patches. Their images were used by film lab workers setting color timing or black and white density – and they were sometimes film lab workers themselves. These images are a mix from-the-rewind-bench snapshots we've taken ourselves, as well as scans and photos from archivists, projectionists, and film collectors from around the world. Normally not visible to anyone outside a fairly small subset of the film industry, this is the largest publicly viewable collection in the country.

The origin of the term "China Girl" is debated, but theories abound. One popular theory connects the term to a "Chinese-style" garment (most often a colorful shirt) worn by the model in some test frames. Another suggests that early test frames used porcelain ("china") mannequins instead of live women. Regardless of origin, "china girl" is by far the most common American term for them. (Others recorded include "lady wedge", "china doll", "girl head", and "leader lady"). In France, they're called "Lili," perhaps after the traditional name of the slate used in Technicolor shoots.

"Leader Ladies Project." *Chicago Film Society*. Accessed August 4, 2021. https://www.chicagofilmsociety.org/projects/leaderladies/.

For this we can look at the concept of Leader Ladies, otherwise known as China Girls. A big thanks to my esteemed colleague Claudia Davis for introducing me to the Chicago Film Project's repository for this concept.



"Leader Ladies Project." *Chicago Film Society*. Accessed August 4, 2021. https://www.chicagofilmsociety.org/projects/leaderladies/.

The analog film development process was literally calibrated to capture the appearance of white skin. A few frames of a white woman were always attached to the beginning of a film, otherwise known as the "leader lady". The Chicago Film Society has compiled all the remaining ones of these they can find.

In the lab, you knew you'd gotten your chemical balances right if the flesh tones of the leader lady looked right.

"Leader Ladies Project." *Chicago Film Society*. Accessed August 4, 2021. https://www.chicagofilmsociety.org/projects/leaderladies/.

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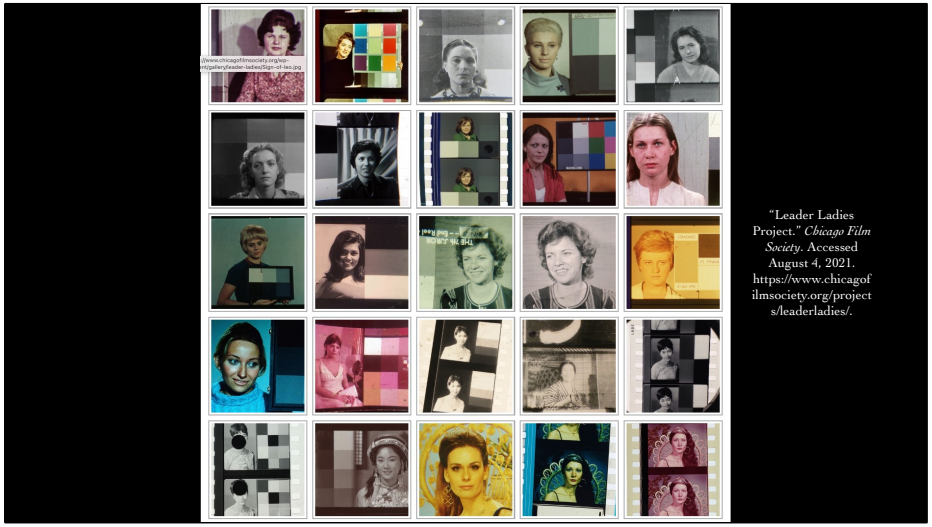

"Leader Ladies Project." *Chicago Film Society*. Accessed August 4, 2021. https://www.chicagofilmsociety.org/projects/leaderladies/.

By flesh tone, we of course mean white skin. The chemical process was calibrated for white skin.

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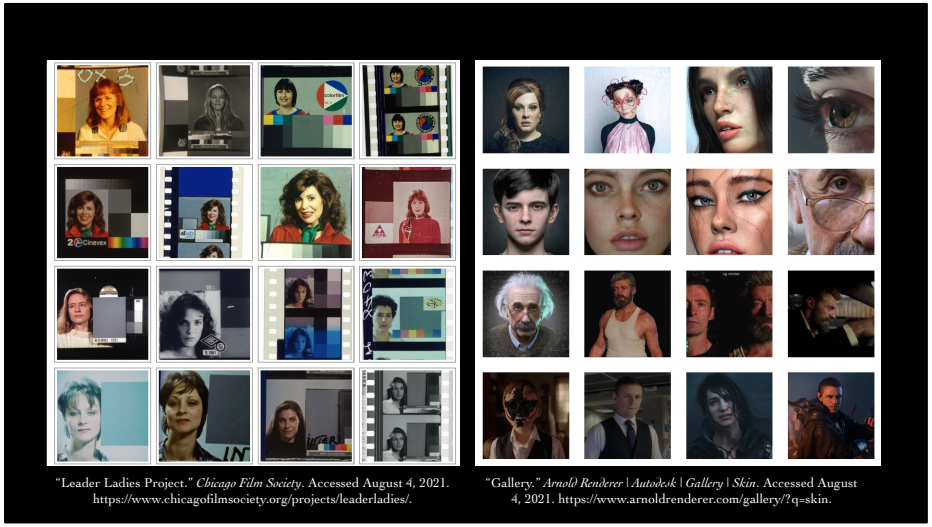


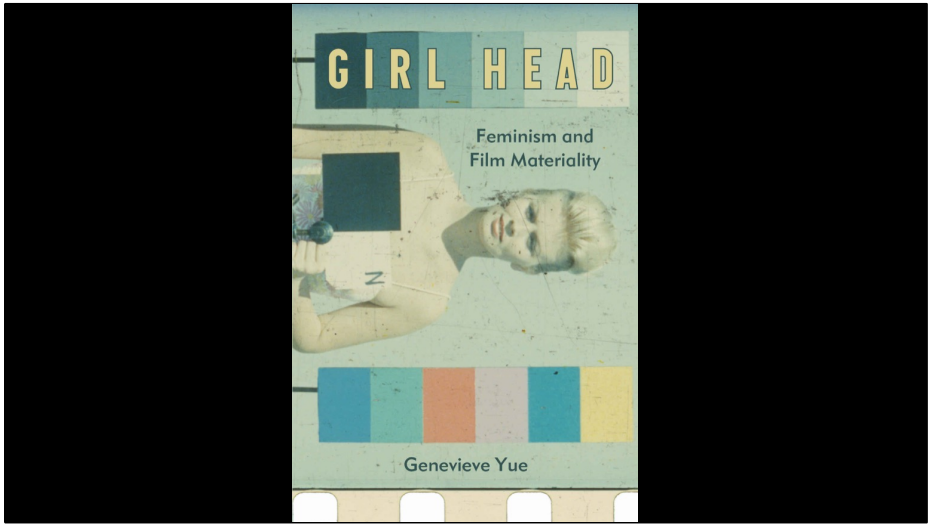
"Leader Ladies Project." *Chicago Film Society*. Accessed August 4, 2021. https://www.chicagofilmsociety.org/projects/leaderladies/.

"Gallery." *Arnold Renderer | Autodesk | Gallery | Skin*. Accessed August 4, 2021. https://www.arnoldrenderer.com/gallery/?q=skin.

This historical echo here is striking. Here's the tableau of Leader Ladies compiled by the Chicago Film Society.

Here's the tableau of human faces from the Arnold Renderer. This is systemic racism. It's baked into the history of our medium.

We didn't think about these biases when we were developing these algorithms, so we unconsciously reproduced them.

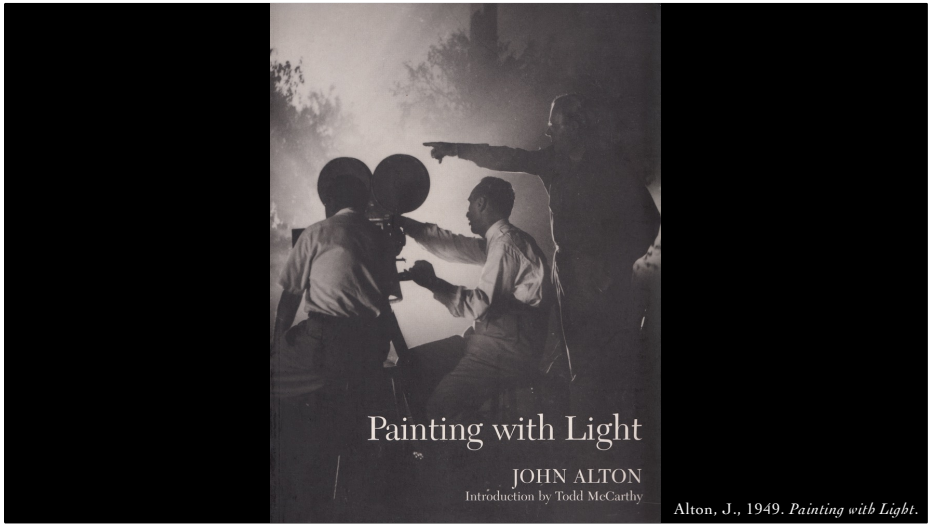


If you're interested in this history there's a great book on this called Girl Head by Genevieve Yue called Girl Head. It particularly delves into the gender dynamics of this phenomenon, as well, which I'm not doing justice to here.

The Golden Coach, (1952).

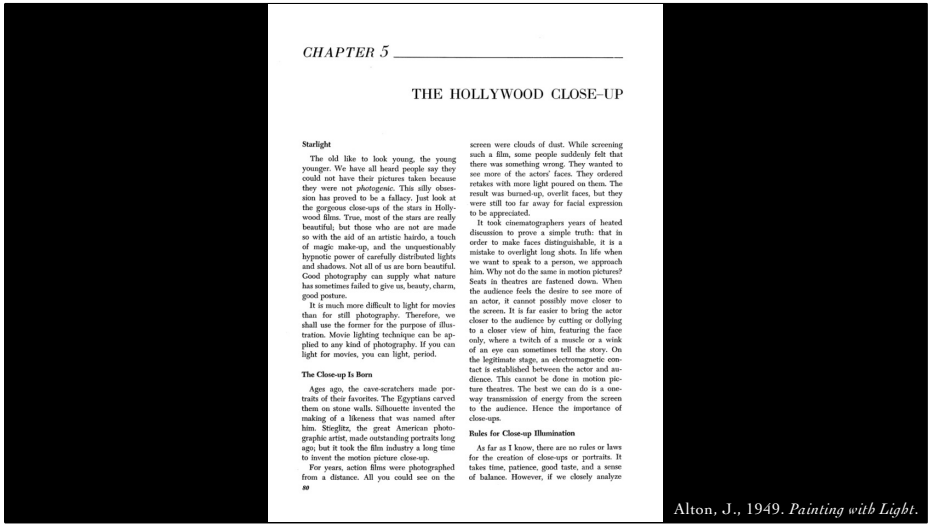
Going back to the Golden Coach, you might say, well you lit the Black actors differently, and fussed with the shutter speed on the camera, maybe they would show up just fine.

The film is definitely not the only piece of technology that is at work here. There's tons of lighting, costuming, and makeup that goes into making everything show up on film, and more precisely, to make sure that it shows up in the preferred color and brightness ranges of the film.



Alton, J., 1949. *Painting with Light*.

So let's look at the manuals for movie lighting. One of the classics is still John Alton's 1949 book "Painting With Light". I'm not just pulling this out of nowhere, this is well known enough in graphics that people write papers with the exact same title, or even cheeky rewritten titles like "Lighting with Paint" and people are in on the pun.



CHAPTER 5

THE HOLLYWOOD CLOSE-UP

Starlight

The old like to look young, the young younger. We have all heard people say they could not have their pictures taken because they were not *photogenic*. This silly obsession has proved to be a fallacy. Just look at the gorgeous close-ups of the stars in Hollywood films. True, most of the stars are really beautiful; but those who are not are made so with the aid of an artistic hairdo, a touch of magic make-up, and the unquestionably hypnotic power of carefully distributed lights and shadows. Not all of us are born beautiful. Good photography can supply what nature has sometimes failed to give us, beauty, charm, good posture.

It is much more difficult to light for movies than for still photography. Therefore, we shall use the former for the purpose of illustration. Movie lighting technique can be applied to any kind of photography. If you can light for movies, you can light, period.

The Close-up Is Born

Ages ago, the cave-scratchers made portraits of their favorites. The Egyptians carved them on stone walls. Silhouette invented the making of a likeness that was named after him. Stieglitz, the great American photographic artist, made outstanding portraits long ago, but it took the film industry a long time to invent the motion picture close-up.

For years, action films were photographed from a distance. All you could see on the screen were clouds of dust. While screening such a film, some people suddenly felt that there was something wrong. They wanted to see more of the actors' faces. They ordered retakes with more light poured on them. The result was burned-up, overlit faces, but they were still too far away for facial expression to be appreciated.

It took cinematographers years of heated discussion to prove a simple truth: that in order to make faces distinguishable, it is a mistake to overlight long shots. In life when we want to speak to a person, we approach him. Why not do the same in motion pictures? Seats in theatres are fastened down. When the audience feels the desire to see more of an actor, it cannot possibly move closer to the screen. It is far easier to bring the actor closer to the audience by cutting or dollying to a closer view of him, featuring the face only, where a twitch of a muscle or a wink of an eye can sometimes tell the story. On the legitimate stage, an electromagnetic contact is established between the actor and audience. This cannot be done in motion picture theatres. The best we can do is a one-way transmission of energy from the screen to the audience. Hence the importance of close-ups.

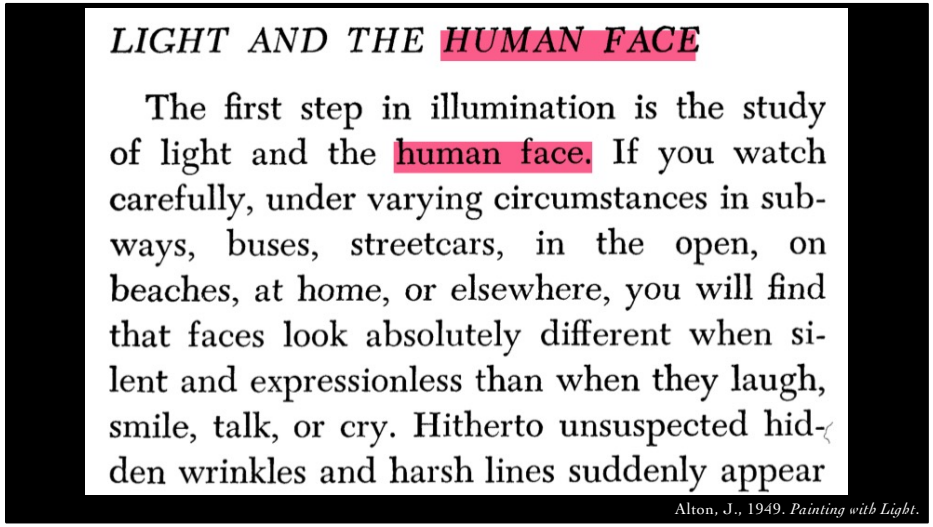
Rules for Close-up Illumination

As far as I know, there are no rules or laws for the creation of close-ups or portraits. It takes time, patience, good taste, and a sense of balance. However, if we closely analyze

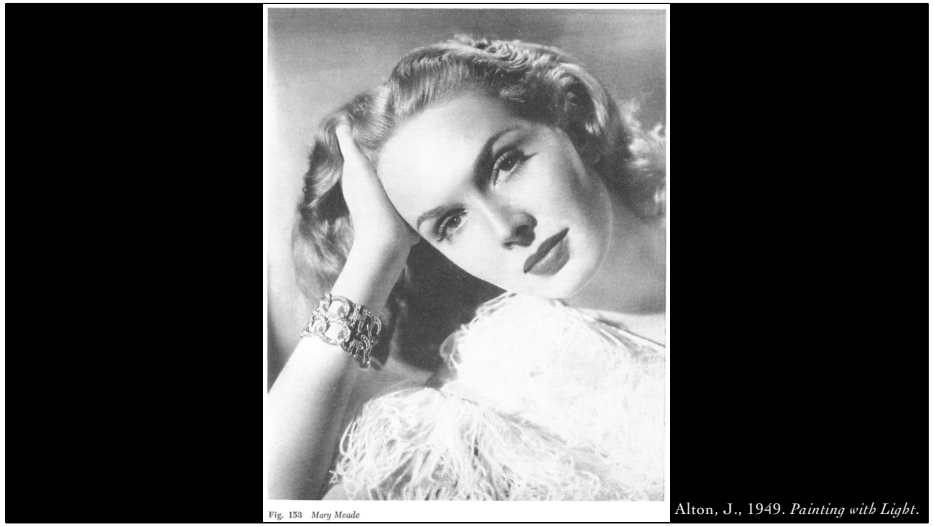
80

Alton, J., 1949. *Painting with Light*.

If you want to know how to light a face, you look at chapter 5: The Hollywood Close-Up.



All right, so we're going to see the same phenomena as before. He's talking about how to light a human face. What does he mean when he says "human face"?



Alton, J., 1949. *Painting with Light*.

Human face

Fig. 163 *Spanish Beauty, Mary Inclan*

Alton, J., 1949. *Painting with Light*.

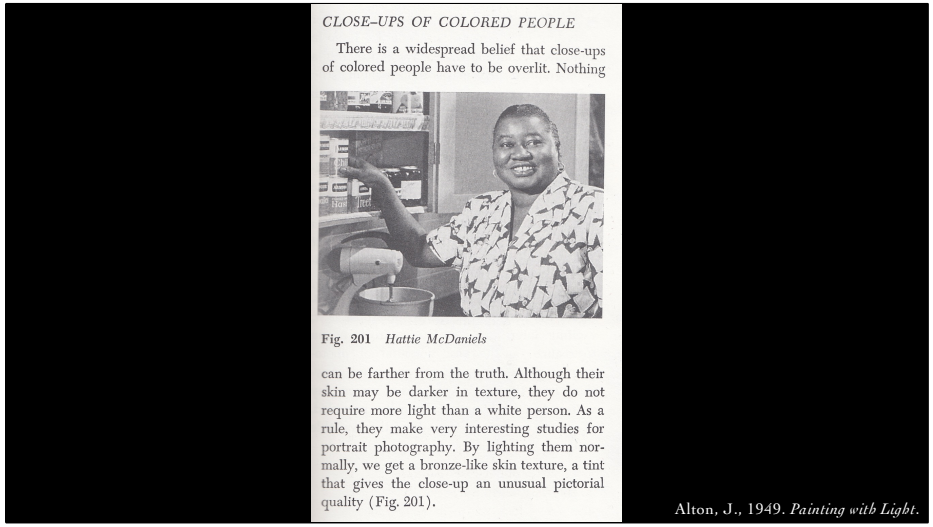
Human face

Human face

Human face

You scroll through this chapter, and you see the same thing. When we say face, we mean white face. Now we’re looking at a book from the 40s, so of course this is what he showed.

But, we’re living in 2021. Let’s not use the 1940s standard



CLOSE-UPS OF COLORED PEOPLE

There is a widespread belief that close-ups of colored people have to be overlit. Nothing

Fig. 201 *Hattie McDaniels*

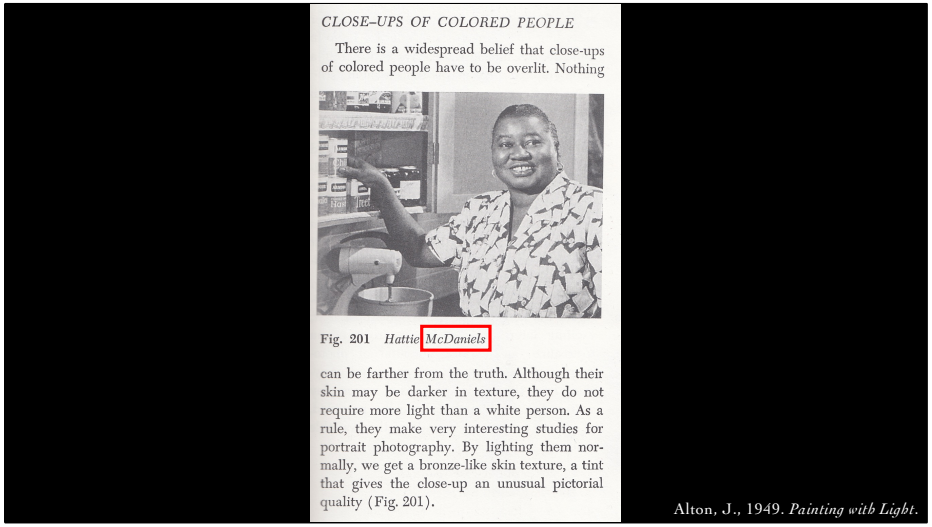
can be farther from the truth. Although their skin may be darker in texture, they do not require more light than a white person. As a rule, they make very interesting studies for portrait photography. By lighting them normally, we get a bronze-like skin texture, a tint that gives the close-up an unusual pictorial quality (Fig. 201).

Alton, J., 1949. *Painting with Light*.

To be fair, in this chapter he does have one paragraph at the end about lighting colored people.

The summary here is “well, it’s just light it the same as white skin.”

And, to his credit, it’s a shot of Hattie McDaniel, the first African American to ever win an Academy Award.



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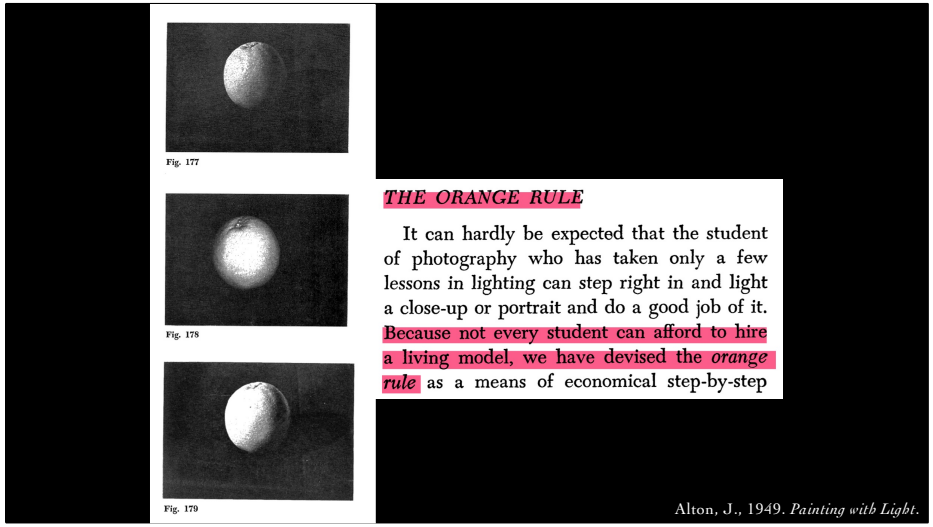
Alton, J., 1949. *Painting with Light*.

But, also as reflection of how much care went into this section, I do need to point out that he spelled her name wrong.

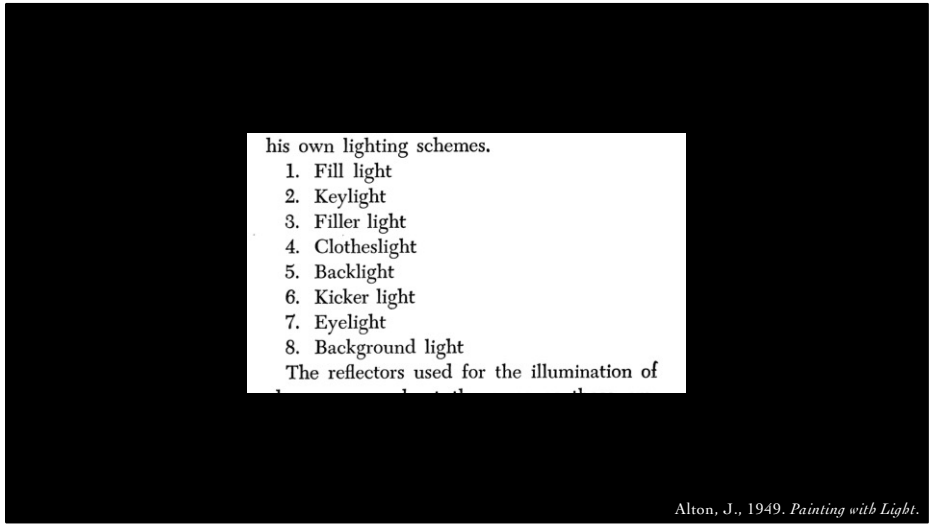
It is McDaniel, not McDaniels.

We're not living in the 1940s. Let's exercise a little more care in 2021.

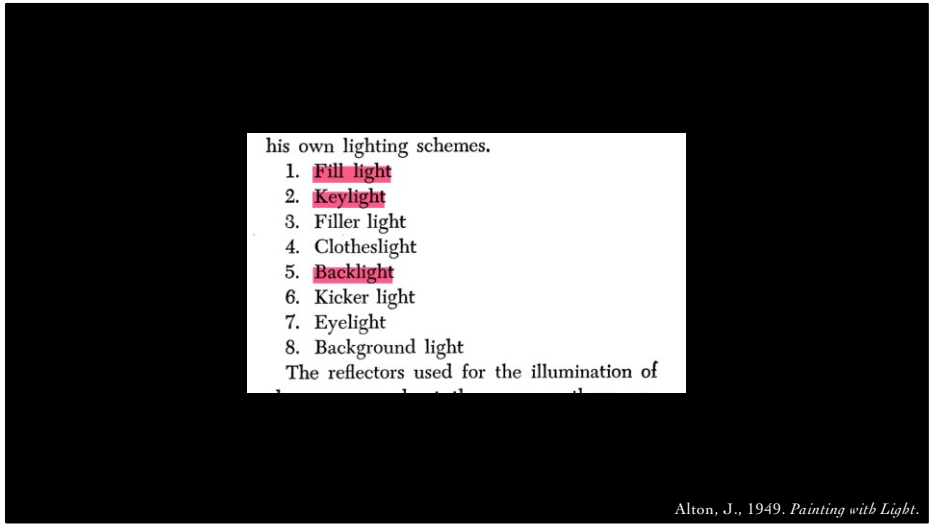


When you're first starting out, you can't pay a model to sit still while you light, so Alton's bargain basement suggestion is to just get an orange and light that instead. It's got a "warm color" and "exaggerated porous skin texture", so if you can light an orange appealingly, you're on your way to a "human head".

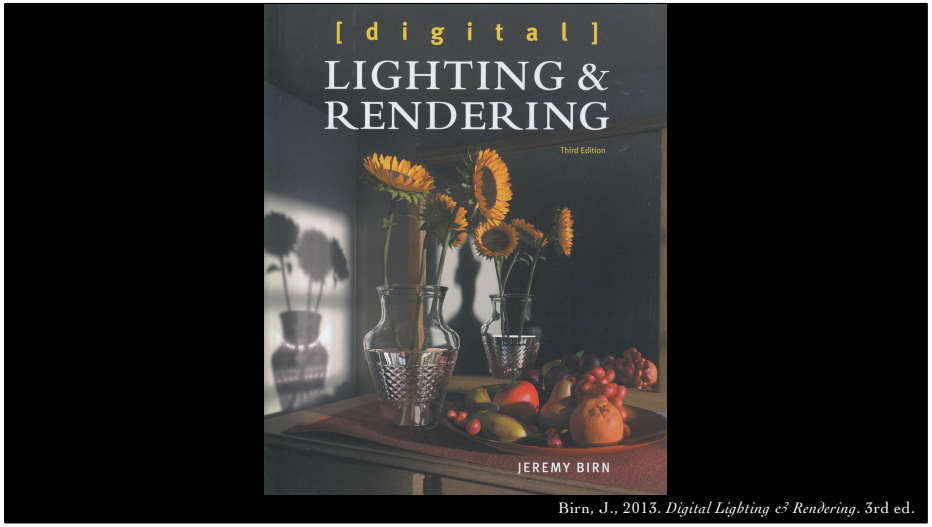
Remember we're dealing with black and white film here, so orange shows up as white. He's talking about lighting a white face.



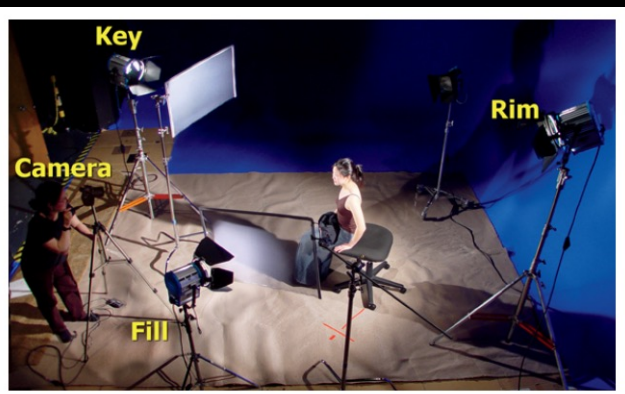
In order to light this orange, he describes an eight-point lighting system, listed here, which is almost exactly the same system we use today. Nowadays when you crack open a book on film lighting, people use a simpler method call three-point lighting,



if you look closely, it's these three, so it's a subset of Alton's eight lights.



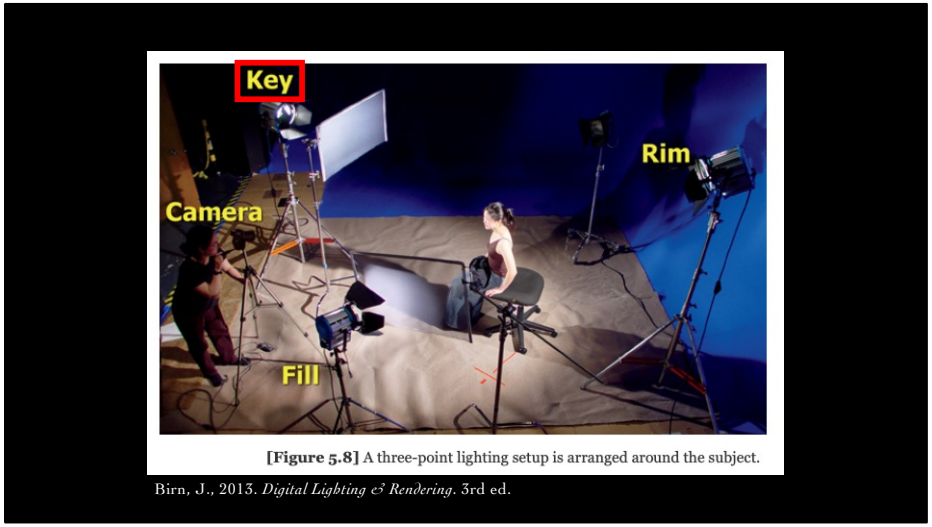
We inherited all of this into the digital age. There's lots of books on Digital lighting, but I'm going to go ahead and say Jeremy Brin's Lighting and Rendering is one of the big ones.



[Figure 5.8] A three-point lighting setup is arranged around the subject.

Birn, J., 2013. *Digital Lighting & Rendering*. 3rd ed.

Here's a figure from Chapter 5 of that book, you can see the three-point lighting system



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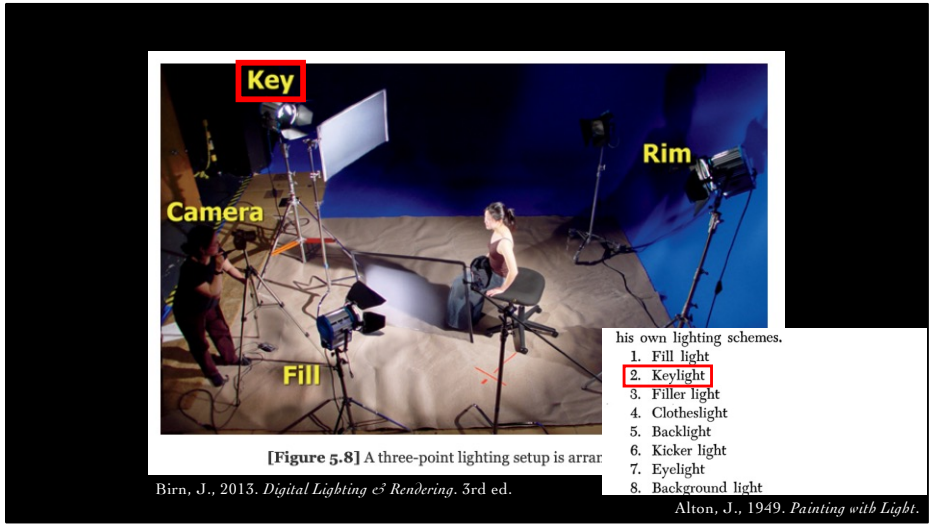
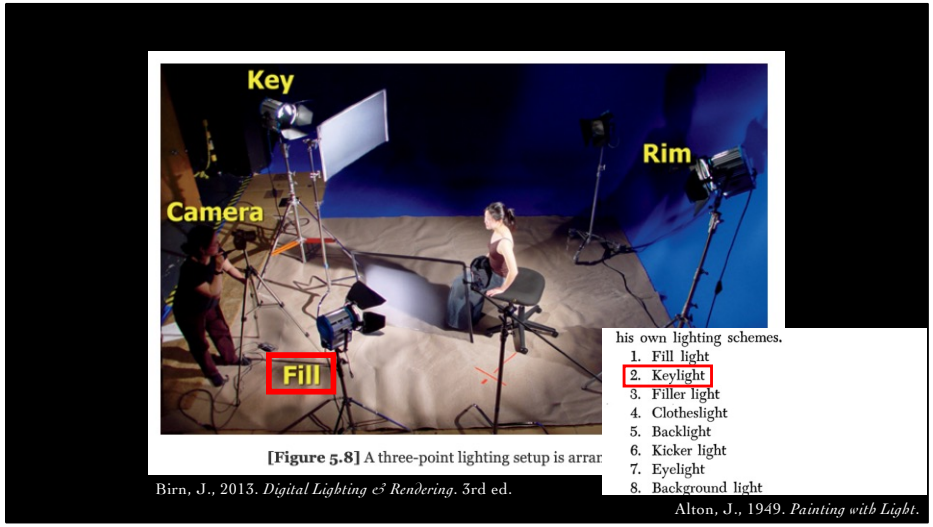
Birn, J., 2013. *Digital Lighting & Rendering*. 3rd ed.

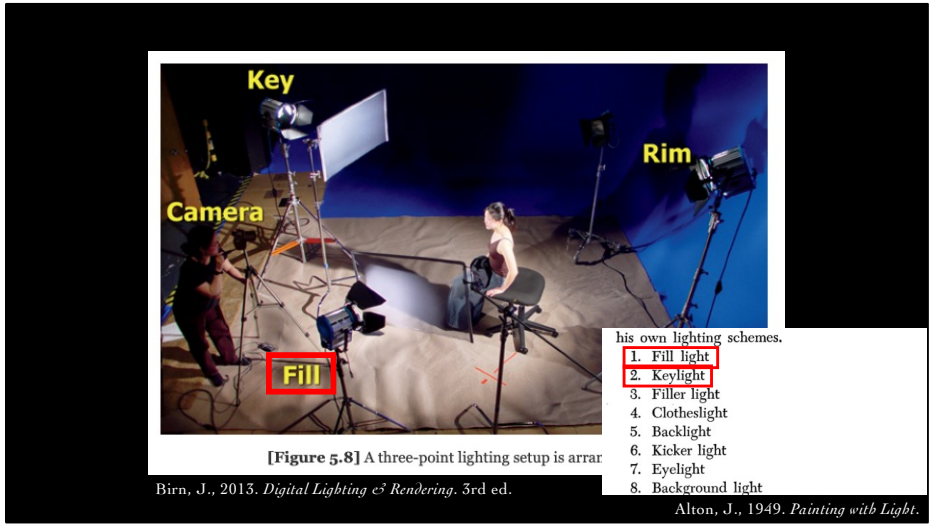
We've got Keylight, and



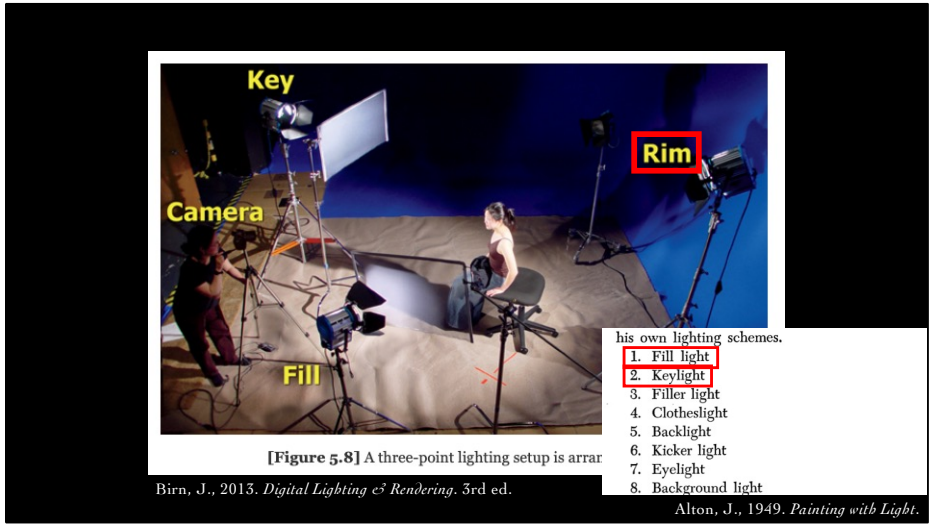
Yup, Alton has a Key light



We've got the fill light

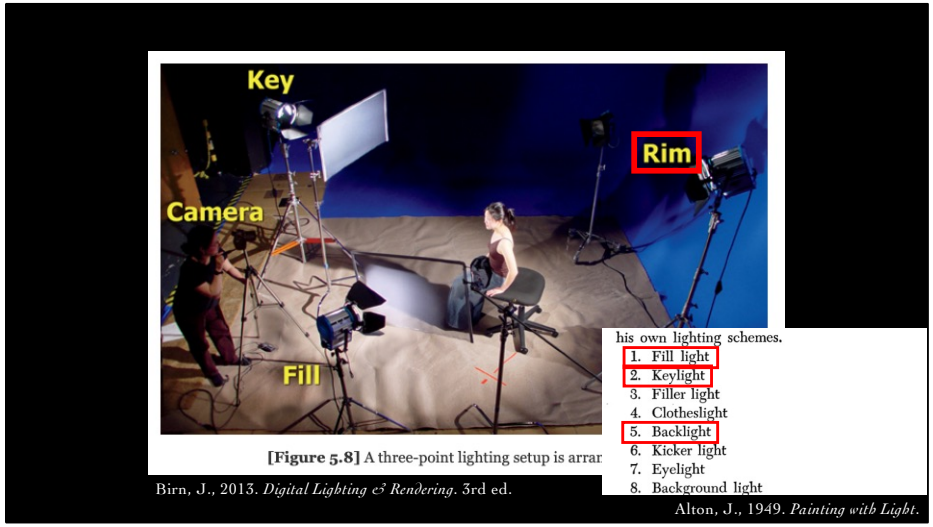


We've got the fill light



And we've got the backlight here.

But wait, in modern language, this is called the Rim light. Why the naming switch?



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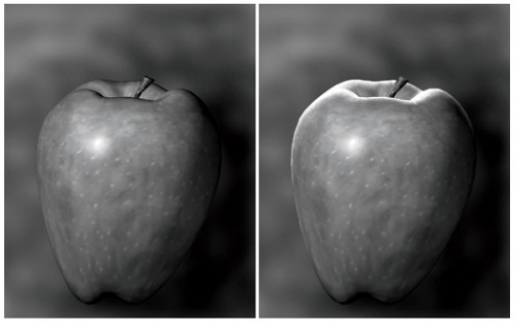
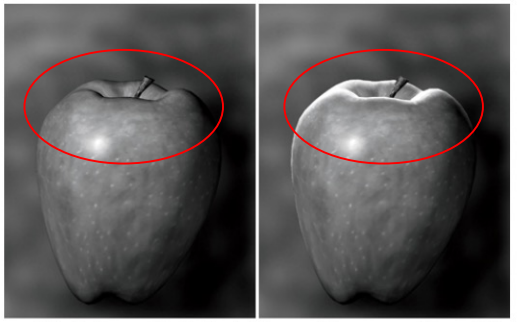


[Figure 5.20] Rim lights are added in the right images. They are especially useful in black and white imagery but can add punch to color images as well.

Birn, J., 2013. *Digital Lighting & Rendering*. 3rd ed.

Brin does describe this in the book.

The original intent of the backlight, especially in Black and White film, is to separate the background from the foreground.

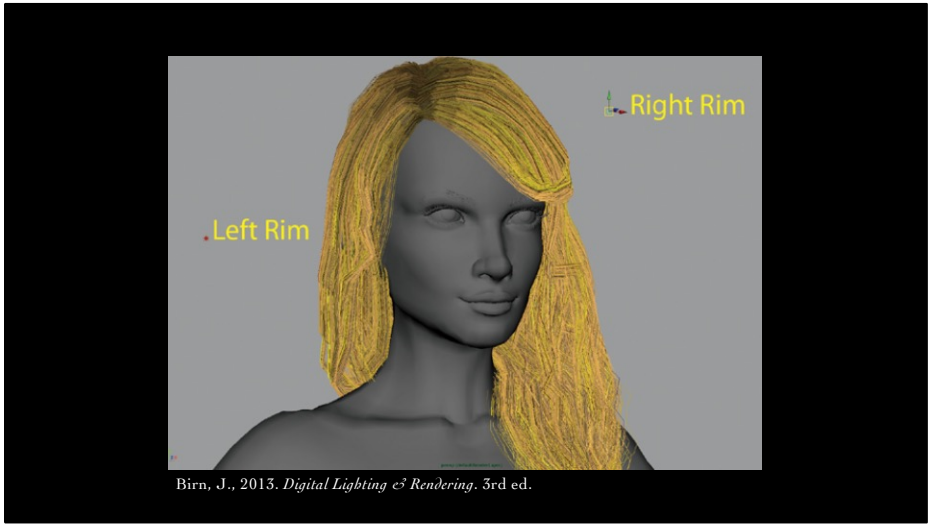


[Figure 5.20] Rim lights are added in the right images. They are especially useful in black and white imagery but can add punch to color images as well.

Birn, J., 2013. *Digital Lighting & Rendering*. 3rd ed.

It's especially visible here, where the white highlight on top of the apple is now much more distinct from the background.

So that's why it's called backlight. Why is it also called the rim light?



Birn, J., 2013. *Digital Lighting & Rendering*. 3rd ed.

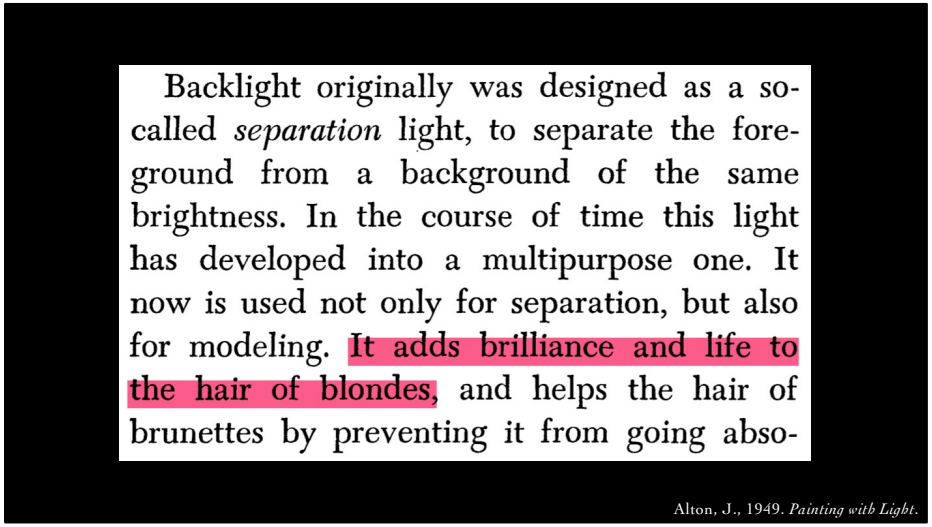
Well, if you have a model with blonde hair

It will give her hair a glowing rim.

That's the rim light. It's there to make the blonde hair glow.

Let's look at that ad with Gisele again.

Her hair's really glowing, isn't it? It's not a mistake. There is some hardcore rim lighting going on here.



I'm not just speculating here.

Alton says this directly. Yeah, it sure it was developed to separate background from foreground, but hey, you know what it's also great at? Adding "brilliance and life to the hair of blondes".

And apparently a bunch of people over the last 70 years have agreed, because we don't call it the backlight anymore. We call it the rim light.

So here we are again. In the analog era, when people talked about skin, they meant white skin.

“Skin” = White Skin

“Leader Ladies Project.” *Chicago Film Society*. Accessed August 4, 2021. https://www.chicagofilmsociety.org/projects/leaderladies/.

We see it in the Leader Ladies used as development benchmarks

“Skin” = White Skin

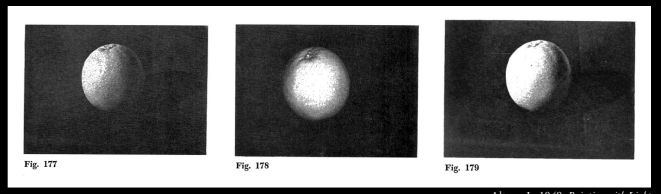


Fig. 177 Fig. 178 Fig. 179

Alton, J., 1949. *Painting with Light.*

We see it in the stand-ins used for a “human face”

When we talk about hair, we are definitely not talking about Type 4 hair.

“Hair” ≠ Type 4 Hair

“Leader Ladies Project.” *Chicago Film Society*. Accessed August 4, 2021. https://www.chicagofilmsociety.org/projects/leaderladies/.

Not Type 4

Not Type 4

“Hair” ≠ Type 4 Hair

Alton, J., 1949. *Painting with Light*.

Even with the great Hattie McDaniel, we can see that her hair has been straightened, and pulled back into a bun, out of the shot.

The Golden Coach, (1952).

And we saw the result here. You can barely see where the servant's hair ends and skin begins.

As far as film technology is concerned, it was not made for dark skin and coiled hair.

Summary

- What Racial Bias?
- Where Did It Come From?
- What Do We Do Now?

So, at least in part, that's where some of this racial bias came from. It's our inheritance from the analog era.

Summary

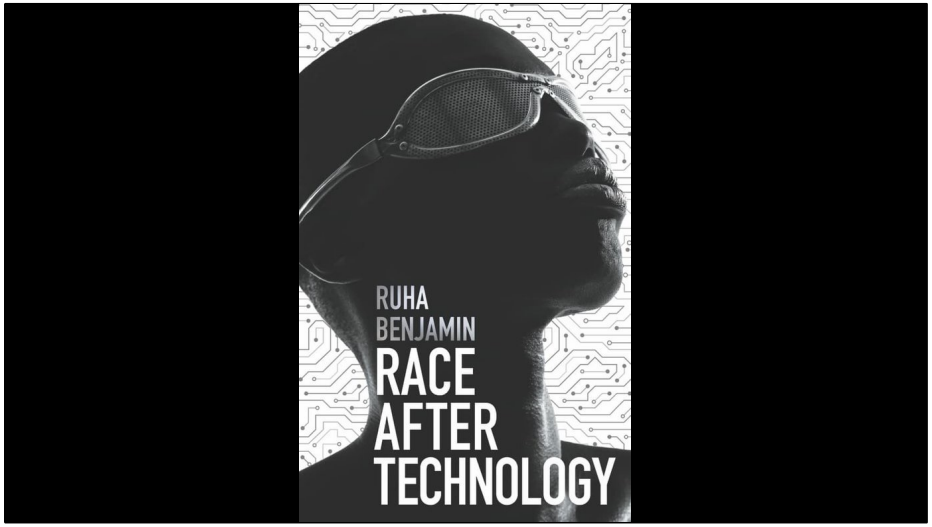
- What Racial Bias?
- Where Did It Come From?
- What Do We Do Now?

Alright, so the wheel of history turned again, except this time we were the ones who turned it. What do we do now?

This is the anti-racist part. We recognize the problem, we see what happens when we just go with the flow. Go against the flow. Do something that's not just a repeat of the same racist system as before.

There's lot of ways to do this. If you have an idea, great, go ahead and try it. Especially if you're a tenured professor. Basically nobody else in our society has more protection than you.

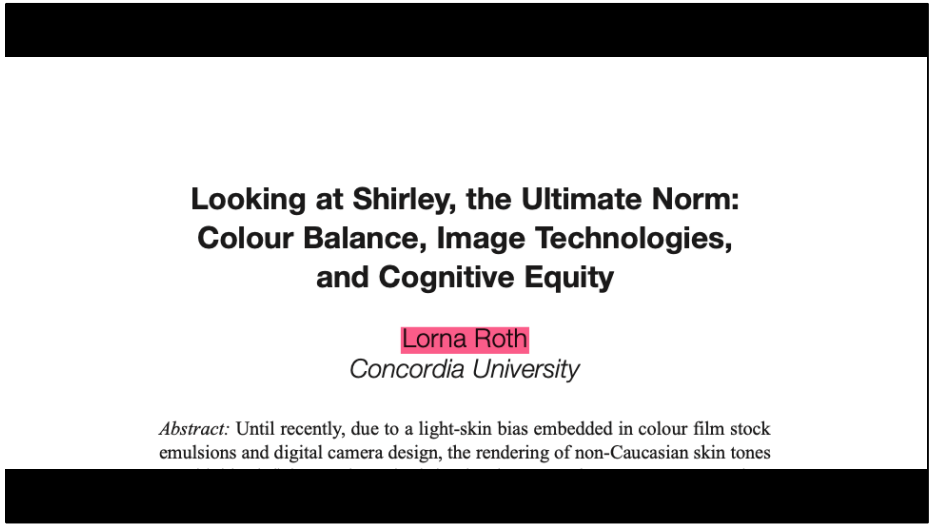
I'm going to propose one thing, which is going to sound like a pretty obvious repeat of history up front, but bear with me.



Another one of the leading scholars on racial bias in technology is Professor Ruha Benjamin, particularly her book Race After Technology.

Kodak, 1976

In that book, she talks about this important concept called a Shirley Card.



Looking at Shirley, the Ultimate Norm: Colour Balance, Image Technologies, and Cognitive Equity

Lorna Roth
Concordia University

Abstract: Until recently, due to a light-skin bias embedded in colour film stock emulsions and digital camera design, the rendering of non-Caucasian skin tones

The core scholarly publication that talks about this is actually by Professor Lorna Roth, I highly recommend reading both of these works

Kodak, 1976

What's a Shirley Card?

This is the same as concept of Leader Ladies, which we just saw, but for photo development. Kodak starting issuing these in the 1950s as baselines, just like with Leader Ladies.

The story here is the same. The chemistry of photos was calibrated to white skin.

Kodak, 1996

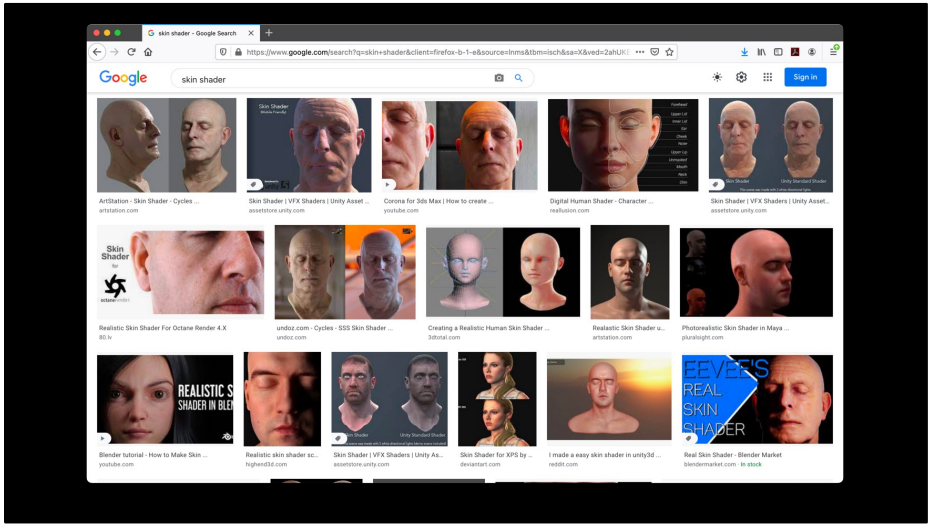
There's an interesting story behind Shirley cards diversifying, which I won't get into here. I refer to you to the Roth's article for that. She has interviews with the actual scientists who were working at Kodak, and it's fascinating.

The point is, these did start to diversify in the 1990s. This image is directly from Prof. Roth's article.

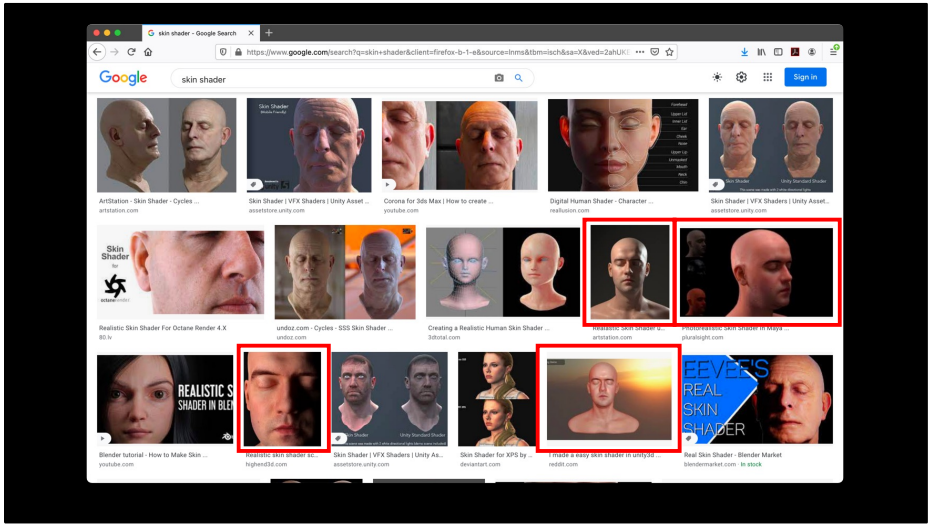
We need to do this too. Computer graphics needs the equivalent of diversified Shirley Cards.

Kodak, 1976

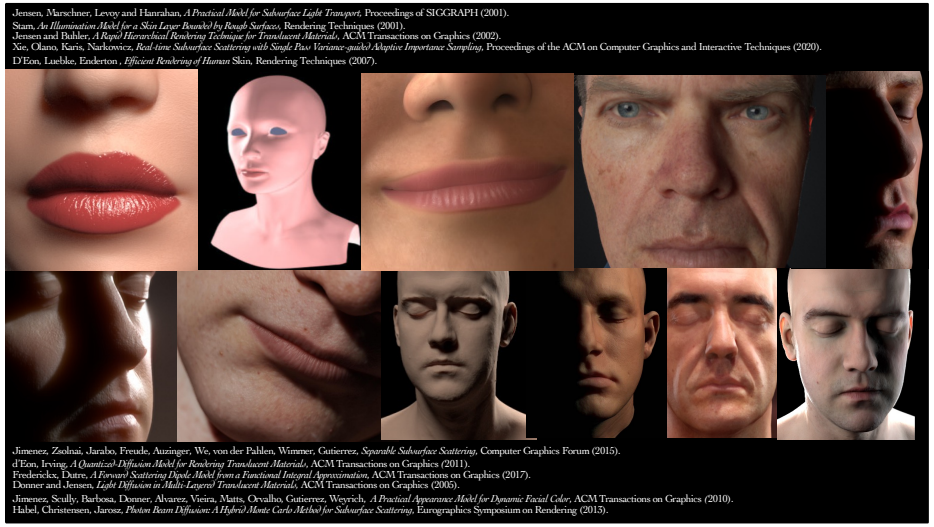
We're actually already doing something that's really close to the 1970s version of this. Let's go back to that Google search that I did before for "skin shader".



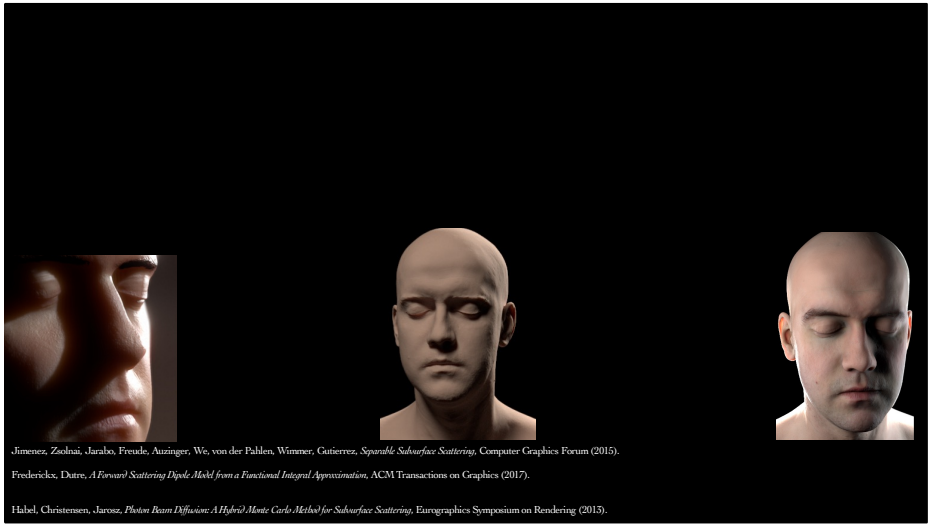
Not only are these all images of white people, they're actually all images of the same white person.



A bunch of them are actually images of the same white person.



If we go back to all the white people in the rendering paper, we see it again.



Hey it's the same guy!

PIXAR's RenderMan®

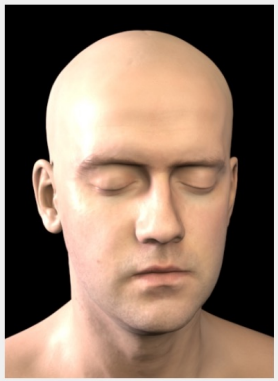
PxrSkin

The **PxrSkin** shader utilizes the advances in physically-based subsurface scattering combined with efficient multiple importance sampling techniques for path tracing efficiency and low noise.

The subsurface scattering uses a close approximation to the ground-truth solution as determined by Monte-Carlo simulation. It includes both single- and multi-scattering. The advantage of this BSSRDF model over the more common dipole diffusion BSSRDF model is that it better represents high frequency details, whereas the dipole model often suffers from an overly smooth "waxy" look. The skin color defaults to smooth caucasian skin color but is most often specified by a texture map.

The subsurface scattering is divided into three components: near, mid, and far. It is common to assign a different color for each component, for example for skin one would choose pale yellowish pink for near-range color, pink for mid-range color, and deep red for far-range color.

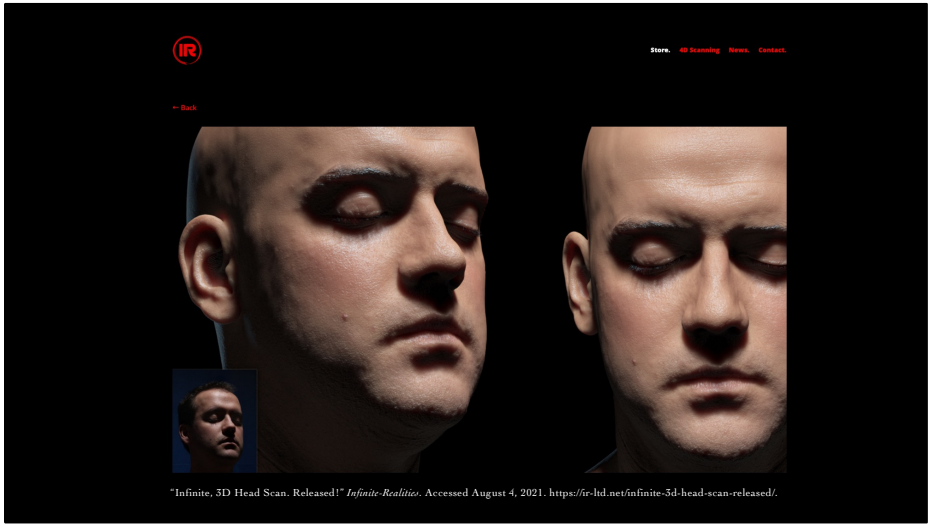
In addition to subsurface scattering, the `PxrSkin` shader also has specular/glossy reflection to represent surface reflection from skin oils and sweat. The image at right is an example of a head rendered with the `PxrSkin` shader (thanks to Lee Perry-Smith for making this data set freely available). This material is deprecated and succeeded by PxrLMSubsurface.



PxrSkin is not just for skin. It is a good basis for any material that has similar basic characteristics, e.g. wax, marble, onyx, or jade.

"PxrSkin." *Renderman Documentation*. Accessed August 4, 2021. https://renderman.pixar.com/resources/RenderMan_20/PxrSkin.html.

We look at the Pixar documentation. Hey it's the same guy! Who is this guy???

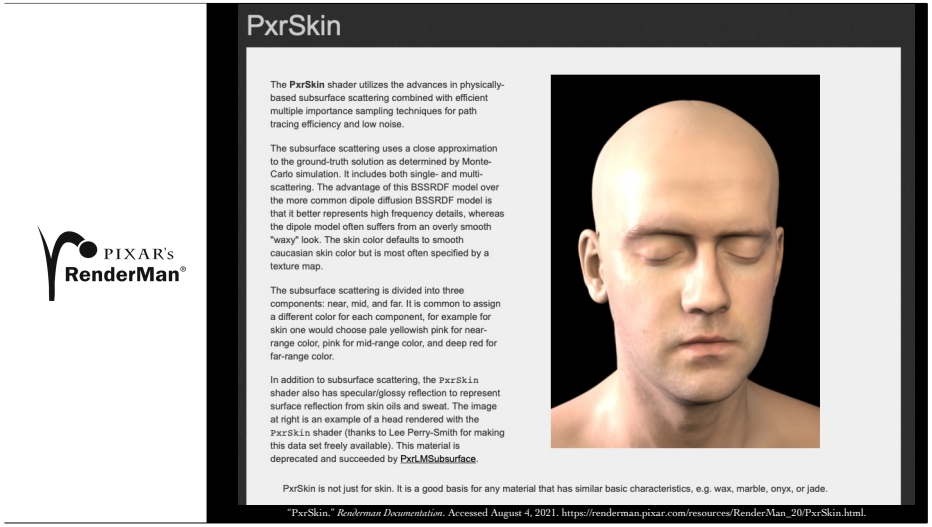


This is the scan of Lee Perry-Smith's head, which was released into the public domain back in 2010, which explains why everybody uses it.

Free, high-quality data is hard to come by.

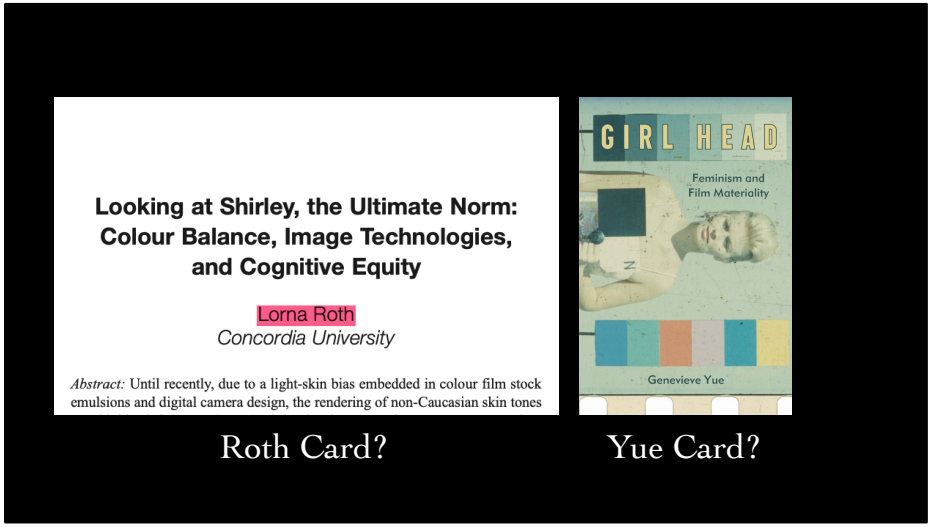
Kodak, 1976

So we don’t have Shirley cards in computer graphics



But we're doing something very similar, we're just rendering the same head over and over.

There's one key difference here though. There's no ground truth. You look at all these different papers, and the head looks really different across all of them. It's not quite doing what a benchmark is supposed to do.

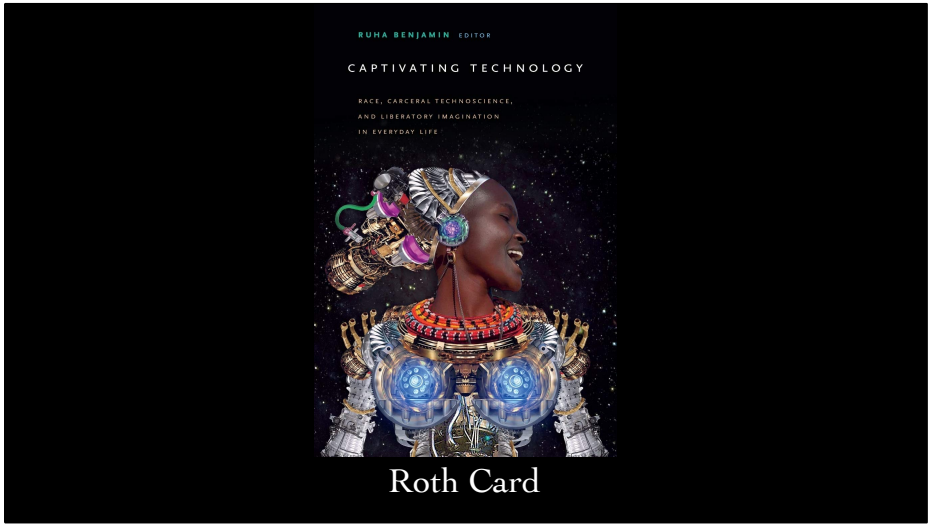


We should come up with an actual benchmark, and if we want this thing to catch on, we should come up with a catchy name.

Now we have Shirley cards, where the name Shirley was used as the name of some generic woman whose true identity has been erased from history.

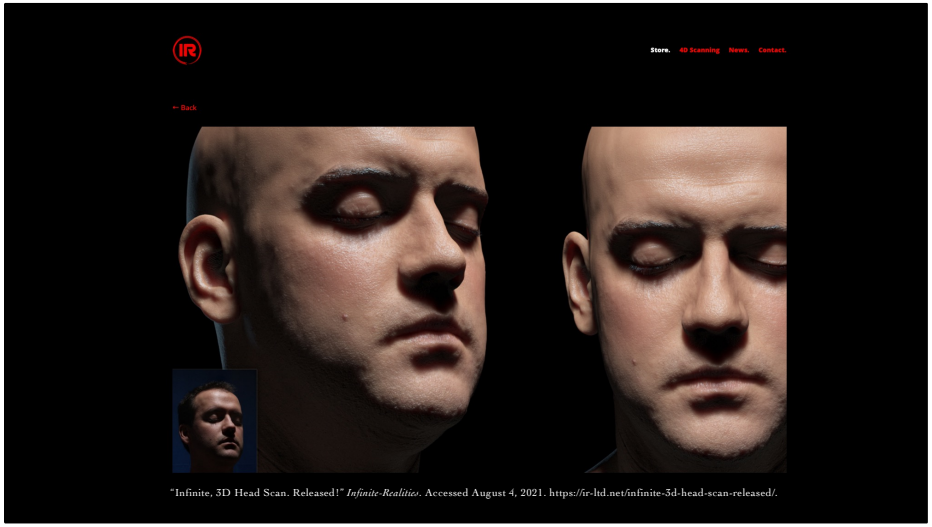
I think it would be really beautiful if we came up with a 21st century version of this, we did the opposite and named it after the scholars who did the actual groundbreaking reseach on this topic.

Why don't we come up with a Roth Card? Or maybe a Yue card?



Let's go with Roth card. Benchmark development is in line with the "liberatory design" principles that Professor Roth advocates in this recent book.

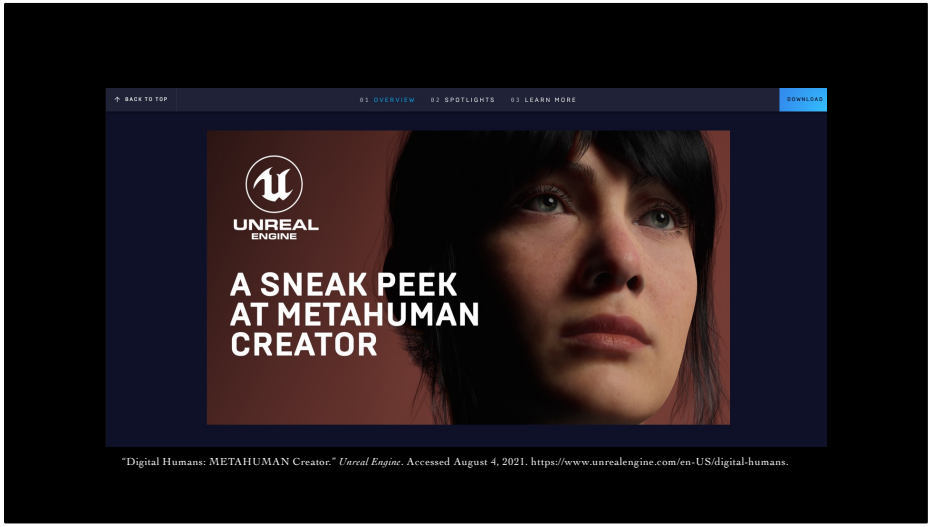
So for the sake of argument: Roth Card.



First we need a **complete** Roth card, even for the white skin case. What are the measurements needed for such a complete Roth card, and to make it useful for research? I don't know. This is an open research problem. Sure sounds like the old Cornell Box experiment though, doesn't it?

Once you have a white Roth card, you can make a diverse Roth card, but you run into the same measurement problems.

Let's just imagine that those problems were solved though. Having a benchmark like this would be super valuable.



"Digital Humans: METAHUMAN Creator." *Unreal Engine*. Accessed August 4, 2021. https://www.unrealengine.com/en-US/digital-humans.

Some of you might be thinking, "has this guy heard of Epic's MetaHuman creator? I'm pretty sure Epic has already solved all the problems he is talking about."

For those of your who don't know, Epic released a demo for MetaHuman Creator earlier this year, which is a package for creating virtual humans.

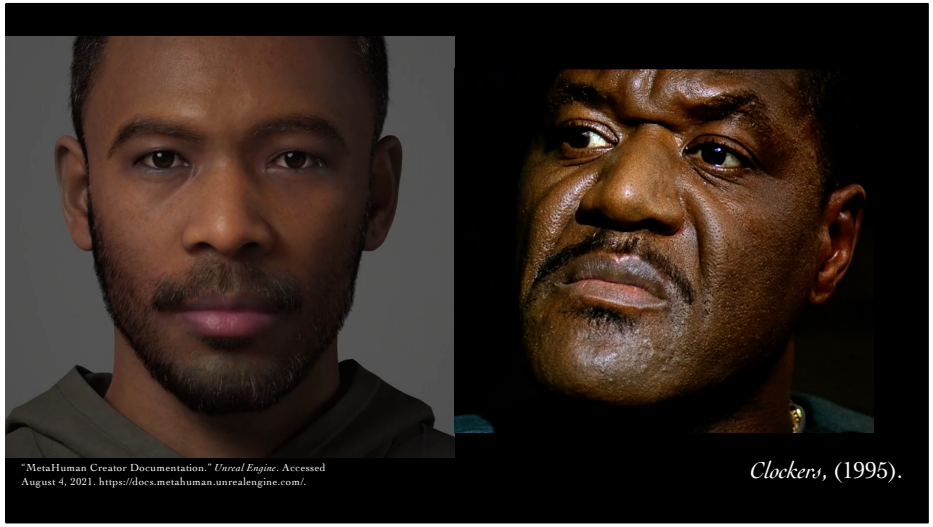
"MetaHuman Creator Documentation." *Unreal Engine*. Accessed August 4, 2021. https://docs.metahuman.unrealengine.com/.

prominently featuring a Black man and woman as the kinds of humans it can create.

And, if we're being fair – hey Type 4 hair! Finally, there's at least one.

That's just the first step though. If we're being scientists, we ask: is this actually doing a good job?

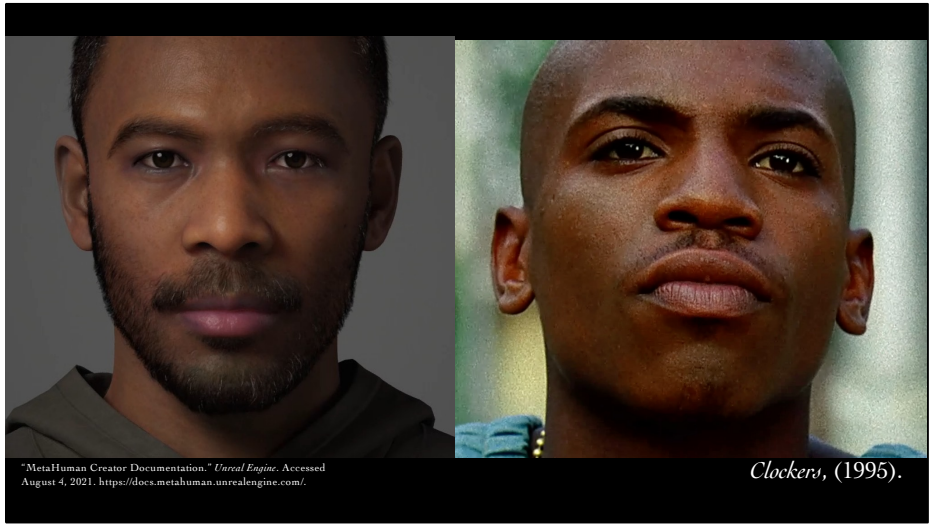
There's no benchmark to compare against, so instead we're stuck with "yeah that looks plausible I guess."



Imagine we had some Roth cards though. I'm going to just show some screengrabs from movies as stand-ins for these fictional Roth cards.

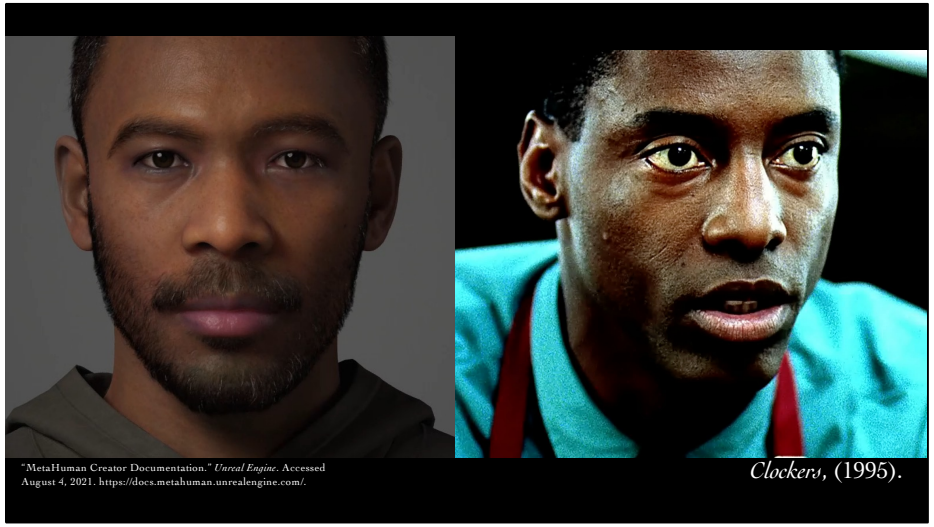
Here's that shot of Delroy Lindo from Clockers again.

Well gee that's way off. Who deleted all the highlights? All the specularities that bring out the character of his face are gone.



Here's Mekhi Phifer from the same movie, he's the main character Strike.

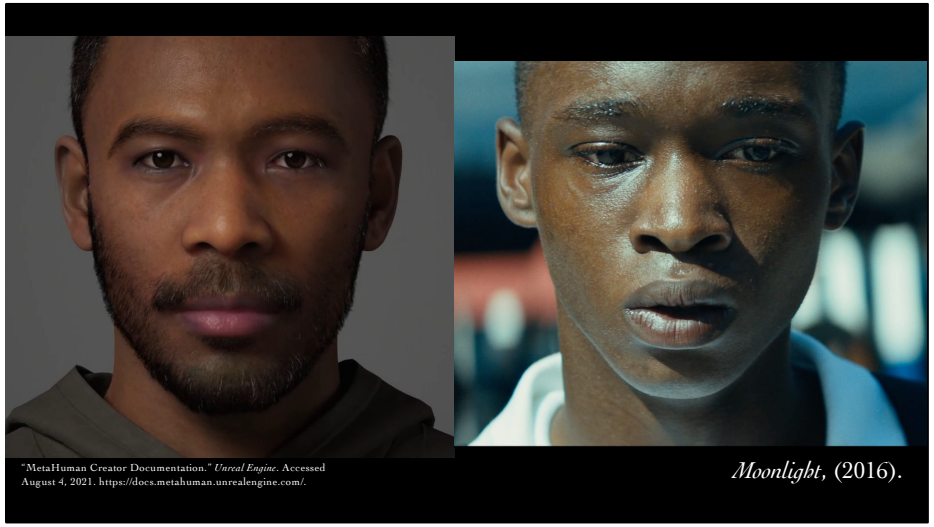
Closer? Maybe? Maybe MetaHuman Creator is better at creating younger Black men?



There's a young Isaiah Washington in that movie too.

We look at him, same problem as Delroy Lindo. Half of his face is a highlight here! Who deleted all the highlights?

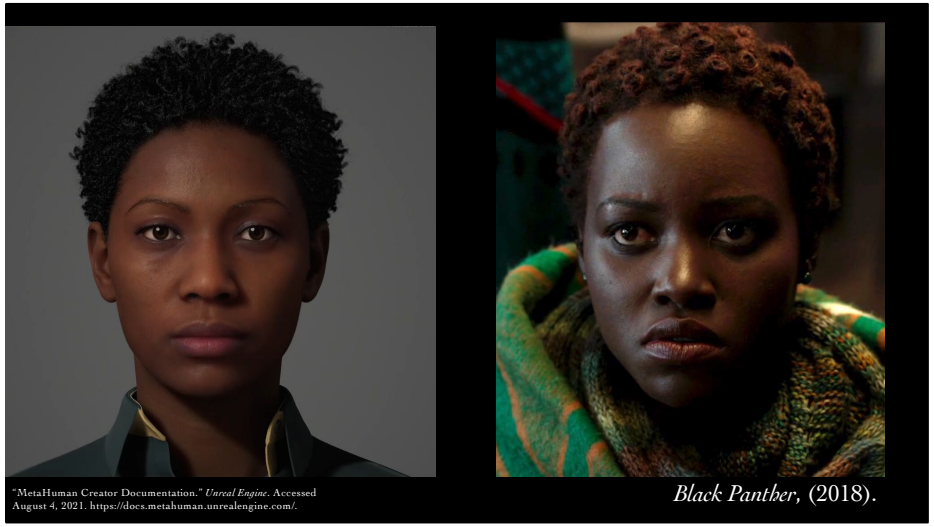
Maybe it's just this movie? The cinematographer for this movie was Malik Sayeed. Maybe this is just his look?



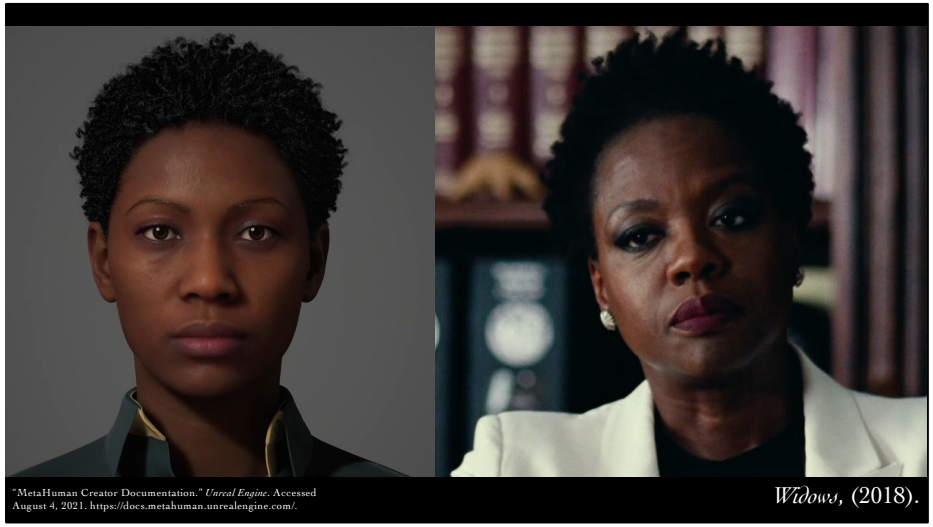
Here's a shot from Barry Jenkin's Moonlight, the 2016 Best Picture Oscar winner totally different cinematographer.

Same thing. Who deleted all the highlights?

Why's the subsurface all jackup to look really pink?



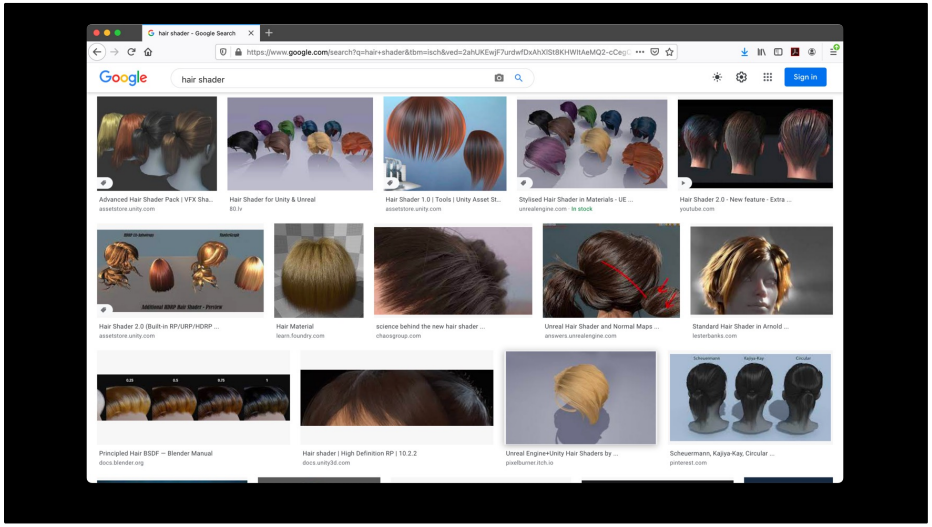
Same thing with women. Here's Lupita Nyong in Ryan Coogler's Black Panther. Who deleted all the highlights and jacked up the pink?



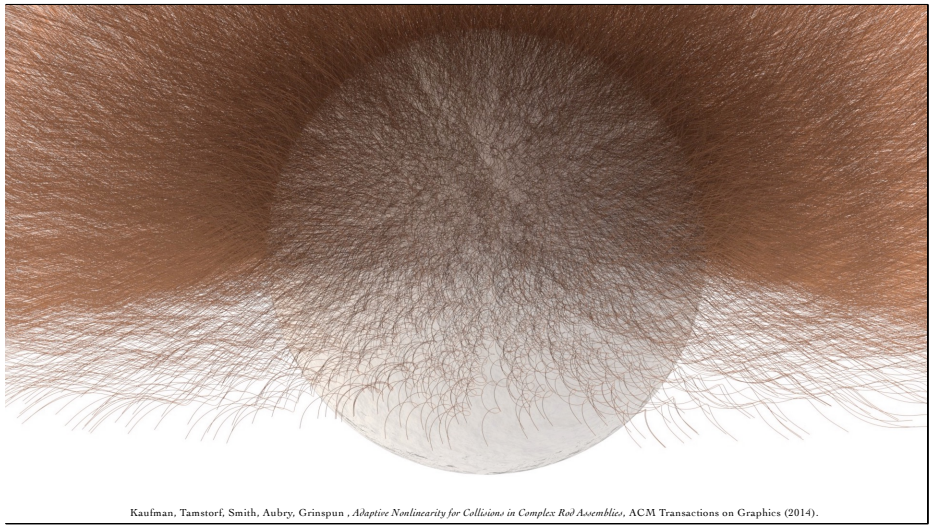
Here's Viola Davis in Steve McQueen's Widows. Same problem.

The point here is: it sure looks like there's some really juicy under-investigated visual pheonmena associated with Black skin.

If we make the actual Roth cards for these with measurements and everything, then we can make progress on the rendering front.

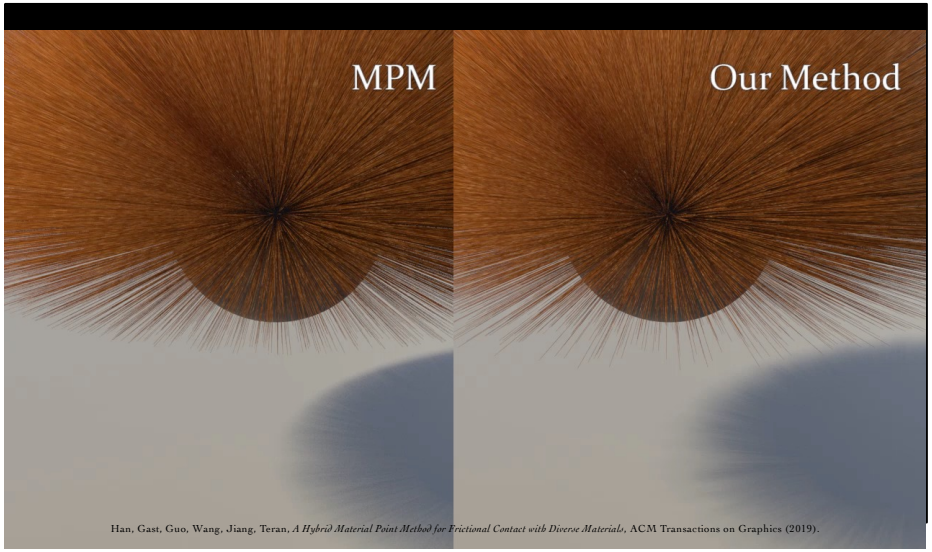


What about hair? I think I've beat up on rendering folks enough, so I'll punch myself now and look at the simulation community.



Kaufman, Tamstorf, Smith, Aubry, Grinspun , *Adaptive Nonlinearity for Collisions in Complex Rod Assemblies*, ACM Transactions on Graphics (2014).

We don't have anything as standard as that one guy's head for hair simulation, the closest thing I can find is this Hair Ball from the ADONIS system from SIGGRAPH 2014. This was out of the Columbia group.



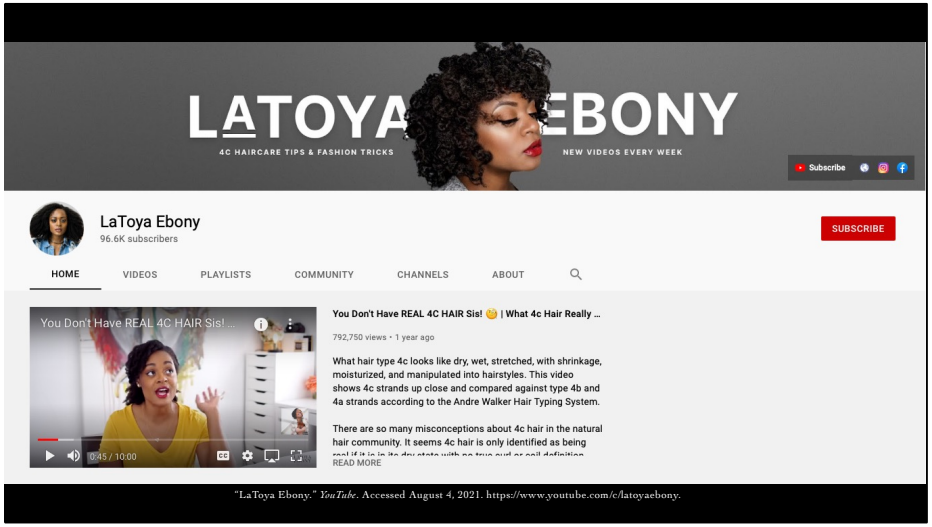
The UCLA group picked it up a few years later

And Weta Digital used it again as a test case last year.

Again, we're in the same boat there where it's almost to the point of being a benchmark, but something's a little missing. What's the ground truth?

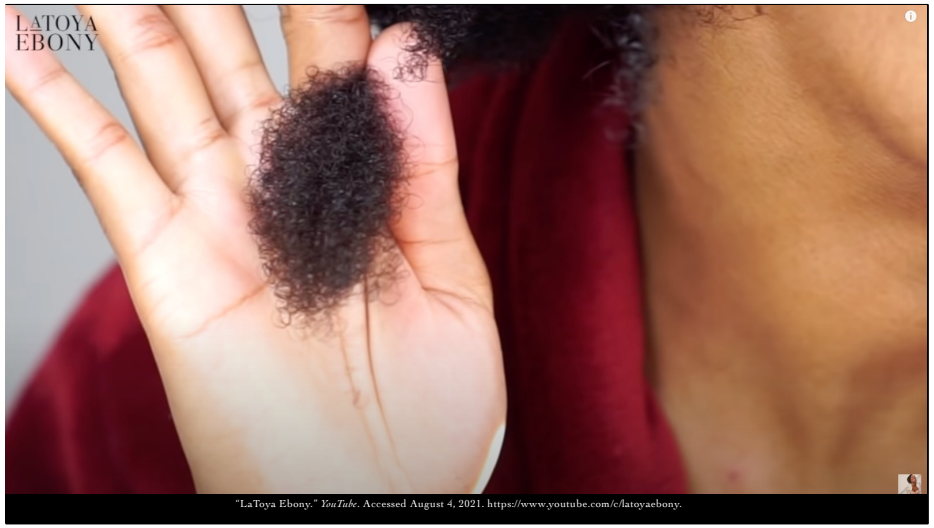
So we have one potential Roth card for Type 1 hair. Again, an exact quantitative definition is an open research problem.

What's the right Roth card for Type 4 hair? The whole thing seems wide open, but here's one proposal.



Once again, my brilliant colleague A.M. Darke pointed me to a whole bunch of Type 4 hair care videos on YouTube. There's *tons* of these, and they're all fascinating.

Now when you hold a ponytail of type 1 hair, it just sort of hangs down straight like this, right?



"LaToya Ebony." *YouTube*. Accessed August 4, 2021. https://www.youtube.com/c/latoyaebony.

With Type 4 hair, other interesting things can happen. This is from YouTuber LaTonya Ebony. She pinches her hair just like a ponytail, but instead you get this beautiful elliptical shape.

What are the exact dimensions of this ellipse? How curly does your hair have to be before this starts to happen? Again, lots of interesting research questions here.

Summary

- What Racial Bias?
- Where Did It Come From?
- What Do We Do Now?
  - Benchmark Creation: Roth Cards

So, that's one thing we can do, benchmark creation.

We can give them an interesting name like Yue Cards and Roth Cards, in recognition of the people who did the groundbreaking scholarship on these topics.

What else can we do? First off, as reviewers and community members, we need to all agree that benchmark creation is a 100% legit thing to publish research on.

Otherwise, we're just going to end up with another decade of this.

Summary

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That part's pretty dry, but hopefully the next part isn't.

Summary

- What Racial Bias?
- Where Did It Come From?
- What Do We Do Now?
  - Benchmark Creation: Roth Cards
  - Do the research!

Do the actual research! Come up with new math and new models for all different types of skin and hair! This is the fun part of science!

These are all worthy of investigation, and the lack of models here is actually holding all of us back.

There's a high-melanin skin paper just waiting to be written here, there's a Type 4 hair simulation paper waiting to be written.

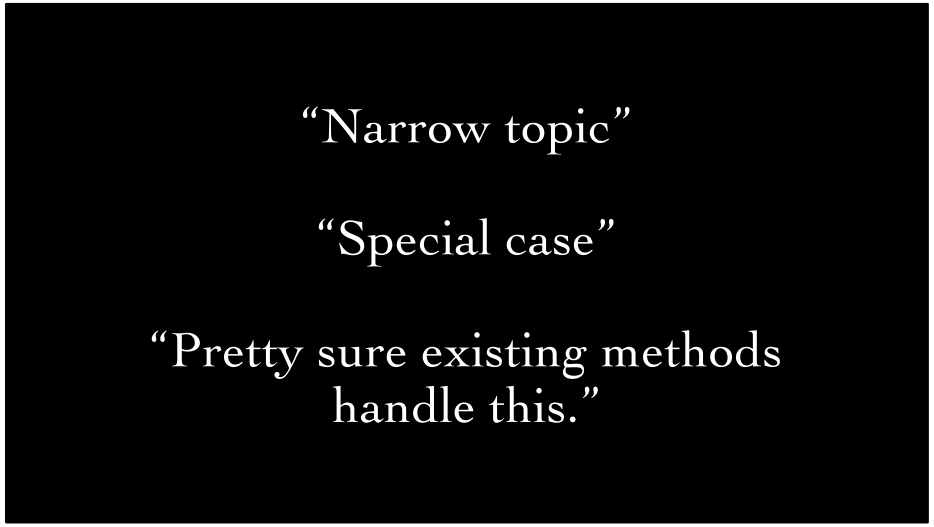
Summary

- What Racial Bias?
- Where Did It Come From?
- What Do We Do Now?
  - Benchmark Creation: Roth Cards
  - Do the research!
  - Counter Reviewer Prejudice

Now more difficult things happen

When we're dealing with this kind of research, we're going to have to be on high alert for prejudice

We'll have to be on alert for our own internal prejudices, but unfortunately, there's going to be external ones as well.



I can guarantee you that if somebody submits a technical paper on this to SIGGRAPH, it will be accused of just trying to solve some “narrow topic” that nobody cares about.

Or, it will be called a “special case” that is to specialized for SIGGRAPH.

And, we’ve all been there, we should be on the lookout for “I’m pretty sure existing methods handle this.” A claim that is then backed up by NO citations, or totally irrelevant citations.

We’ve all gotten reviews like this, even when the topic didn’t have extreme social baggage.

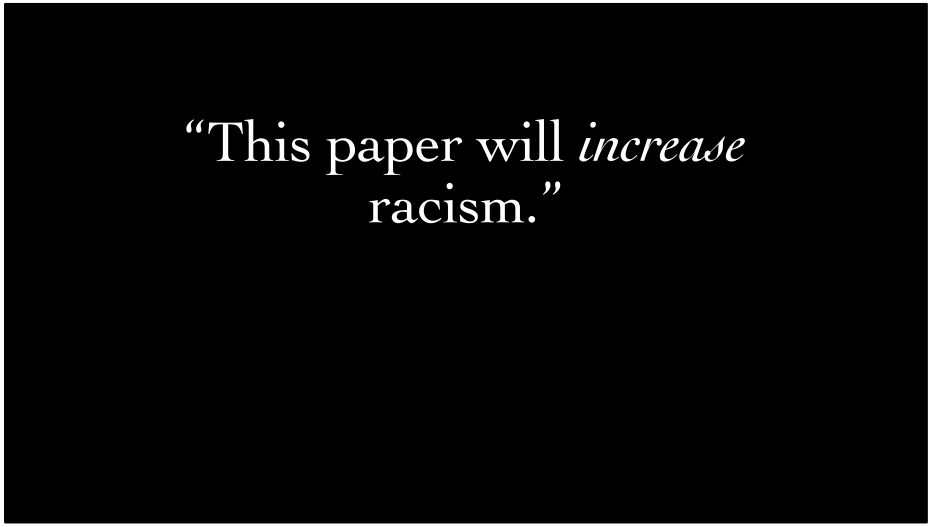
When papers on this topic get submitted, this phenomena will increase by an order of magnitude.

Don’t write these reviews, and if you see somebody else making these arugments. push back. This is the inertia of systemic racism in action.

This counts as skin. This counts as hair.

There are over a billion people worldwide with this kind of skin and hair.

This is not a niche topic. If somebody says otherwise, push back.

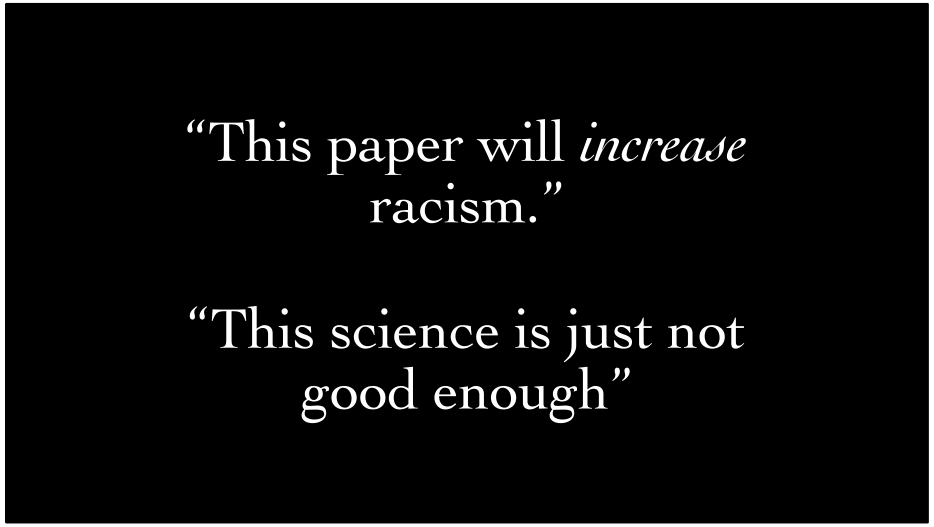


Unfortunately, trying to publish on this topic will also trigger explicit racism.

Nobody is dumb enough to verbalize their bias out loud. Instead, they will use dog whistles.

For example:
"Acknowledging that different people have different types of hair will only INCREASE racism. Therefore, in the name of anti-racism, we must reject this paper."

People get uncomfortable when talking about race, and they will do anything to stop talking about it. The explicit purpose of this argument to is make sure that this speaker never has to think about this topic ever again.



Finally, there's going to see goalpost moving.

Again, we've all been there before. Reviewers start demanding that your work meet some impossibly high standard of science, a standard that their work does not meet.

This gets ugly, even without controversial issues like race get introduced. Again, once you introduce race, things will get ten times worse.

The goal of this argument is not to advance science, the goal is to halt research in this direction. Again, they are saying "This topic makes me uncomfortable, so in the name of science, I order you to stop."

Unfortunately, people wrapping their prejudices in the mantle of science has a long and ugly history. Don't let it keep happening.

Call them out directly. "No paper has ever had to meet the standard you are proposing. This paper must get published."

Summary

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  - Benchmark Creation: Roth Cards
  - Do the research!
  - Counter Reviewer Prejudice

In doing so, you'll be accused of trying to lower standards.

If for example, you've ever tried to make sure that women job applicants get treated fairly in the hiring process, you've heard this argument. "So we're just going to start lowering out standards?"

No, we're trying to ensure that every human being is treated equally.

This is why it can't be just you. It's not enough for one person to push back.

It has to be everybody. Everybody involved in the stewardship of that paper needs to push back against this prejudice. In order for all of this to work, it has to be all of us.

Summary

- What Racial Bias?
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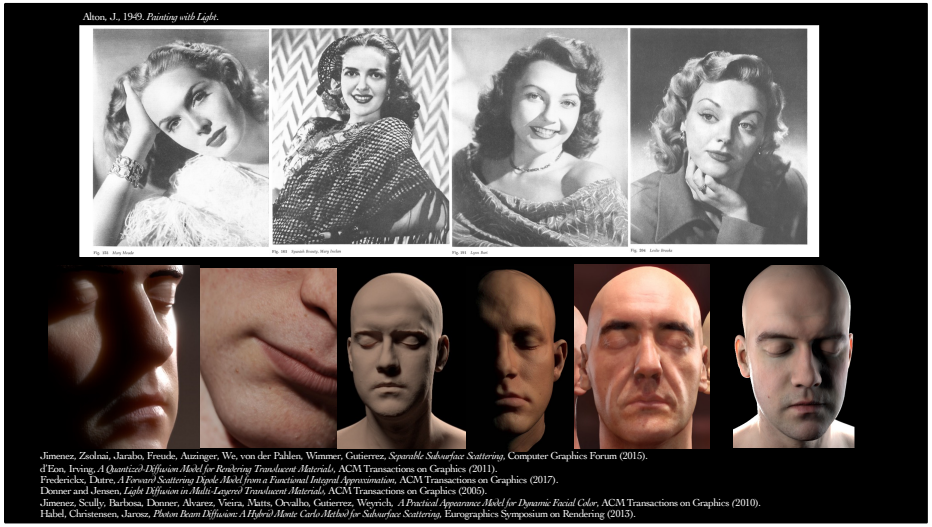
  - Benchmark Creation: Roth Cards
  - Do the research!
  - Counter Reviewer Prejudice
  - Organize

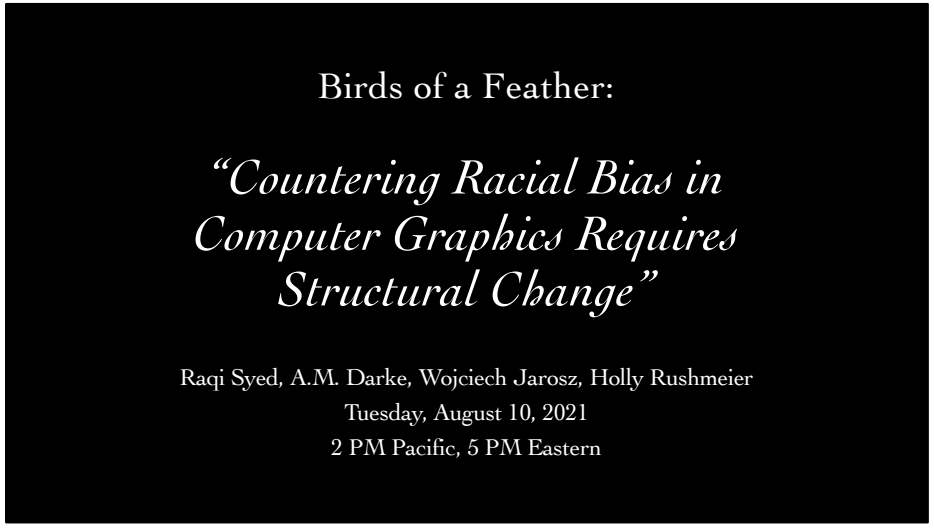
And that's why the last piece of this is organizing. We have to organize.



Our field is freighted with a racial legacy that predates the invention of the modern computer.

It's part of a historical cycle that extends back over a hundred years.

Breaking this pattern will take more than the good intentions of well-meaning individuals. It will take a collective action.



If you want to be a part of such action, I will be co-hosting a Birds of a Feather tomorrow.

A bunch of the scholars that I've mentioned in this talk, including Raqi Syed, are co-organizing this event, as well as rendering pioneers like Holly Rushmeier and Wojciech Jarosz

We'll be meeting on Tuesday at 2 PM PST, 5 PM EST.

I hope to see you there.