Hi everybody, thanks for coming today. I'm Professor Ted Kim from Yale, and we're here today to talk about bias in computer graphics research. Specifically, how bias shows up in the mathematical formulations of computer graphics algorithms.

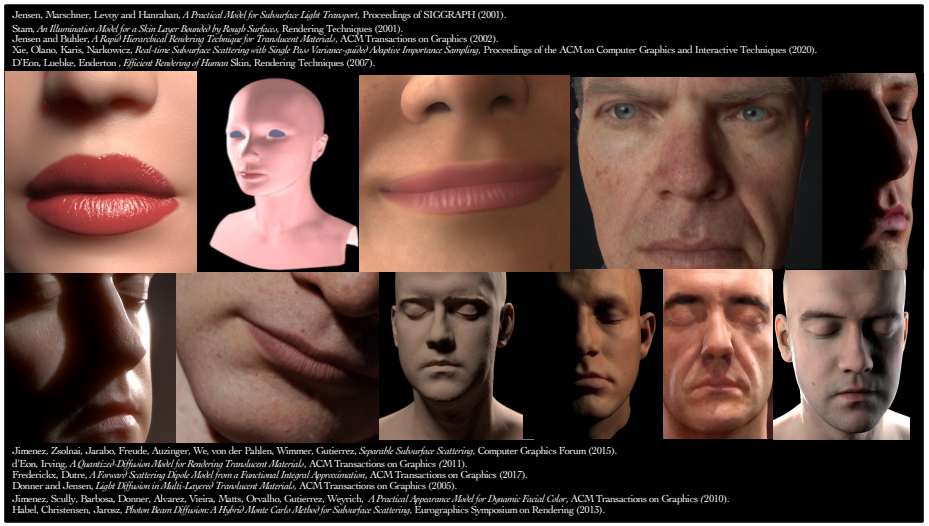
This meeting is co-organized with many people from across academia and industry. Me and professor Rushmeier from Yale, Prof. Darke for UCSC, Prof. Jarosz from Dartmouth, Prof. Jacobson for U of T and Adobe, Dr. Sellan from Toronto and MIT, Dr. Petikam from Microsoft, and Curtis

Andrus from Animal Logic.

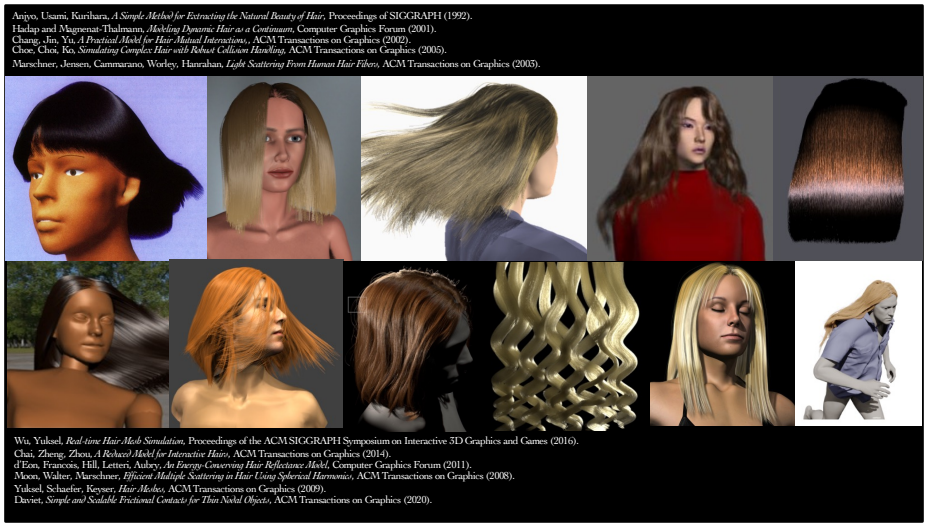
Just to set expectations, this meeting isn't about how there aren't enough under-represented minorities in graphics. That is important, and we'll actually have one speaker talk about it, but it's not the main focus this meeting.

This meeting isn't about bias in machine learning data sets. That's important, but it's not this meeting.

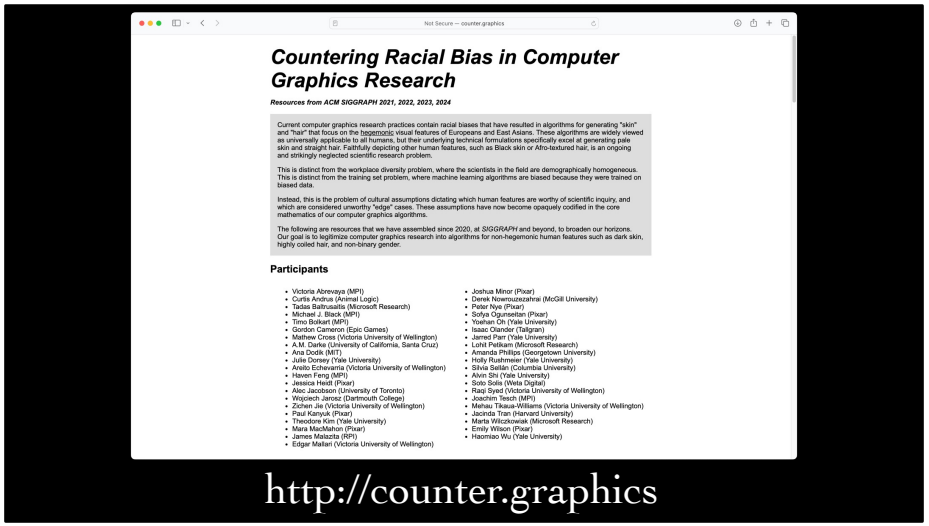
This meeting is about how graphics algorithms that are widely perceived as universally applicable to all computer-generated humans are in fact custom-made for pale skin and straight hair. That means white and East Asian people, the same people who invented these algorithms.



If you don't believe me, here's a tableau of figures from skin papers between 2001 and 2019. They claim to be algorithms for "skin" rendering, but just look. These are white skin rendering algorithms.



Here it is for hair. These algorithms for “hair”, are really algorithms for straight. Or if you’re lucky, slightly wavy hair.



We've been looking at this problem since 2020, and we built a webpage with all the stuff we've done on this front since 2020. I'll show it again during the discussion period.

One thing has been glaringly obvious from the beginning: there has never been technical paper on Black skin or kinky hair into SIGGRAPH.

Analysis of Human Faces using a Measurement-Based Skin Reflectance Model

Tim Weyrich * Wojciech Matusik † Hanspeter Pfister † Bernd Bickel * Craig Donner ‡ Chien Tu †
Janet McAndless † Jinho Lee † Addy Ngan § Henrik Wann Jensen ‡ Markus Gross *

Photograph Rendering Original Model Appearance Change

Figure 1: *Photograph compared to a face rendered using our skin reflectance model. The rendered image was composited on top of the photograph. Right: Changing the albedo and BRDF using statistics of measured model parameters from a sample population.*

Not just a paper that proves itself on white skin

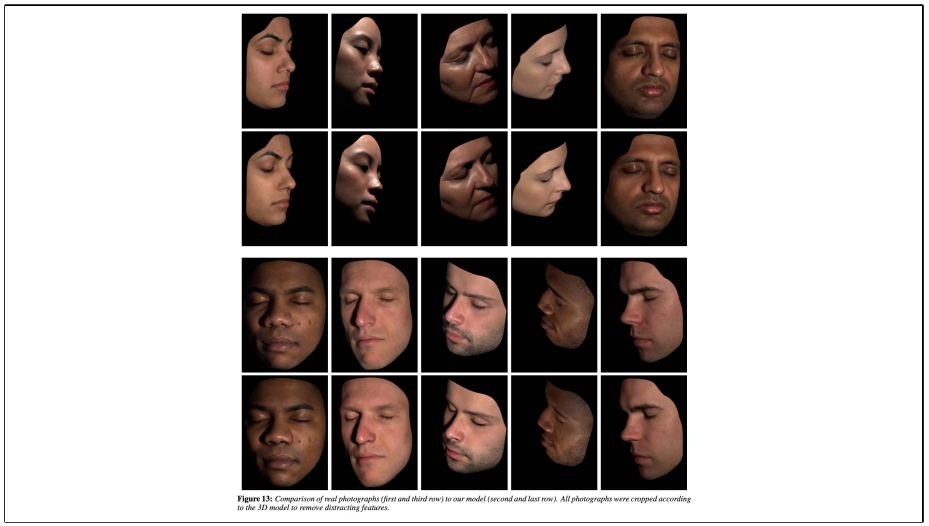


Figure 13: *Comparison of real photographs (first and third row) to our model (second and last row). All photographs were cropped according to the 3D model to remove distracting features.*

And then throws in some Black skin examples afterwards.

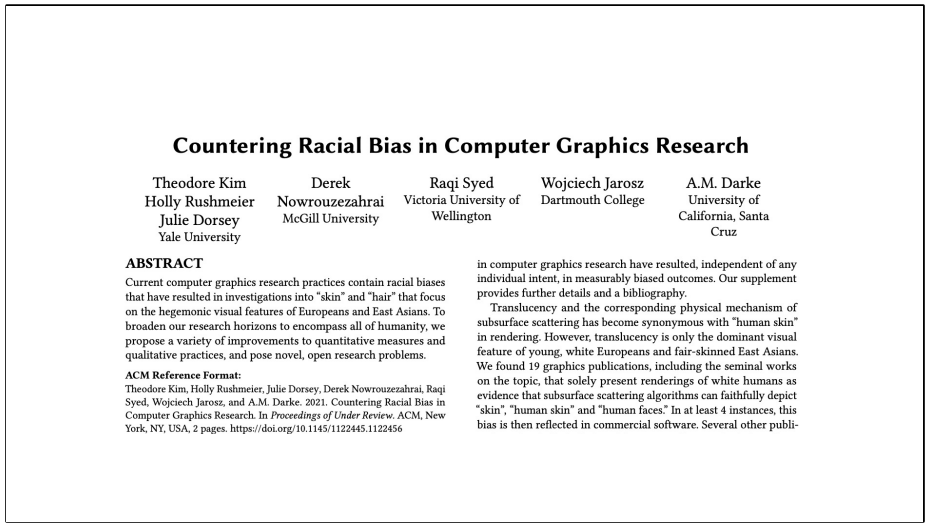
I mean a paper on just Black skin. Black skin is itself a challenging research topic, and is just as deserving of all the scientific attention we've lavished on white skin. But, there's never been a paper on it.

Same deal with hair: there's never been a technical paper on Afro-textured hair into SIGGRAPH.

Again, I'm not talking about curly hair getting included in some huge table of hair. (Even this hair is *really* far from Afro textured.)

A paper on just Afro-textured hair. It is just as deserving of focused scientific attention as straight hair.

In 2021, we tried to take a first step at addressing this problem. A full technical paper was too tall a mountain



Countering Racial Bias in Computer Graphics Research

Theodore Kim, Holly Rushmeier, Julie Dorsey (Yale University); Derek Nowrouzezahrai (McGill University); Raqi Syed (Victoria University of Wellington); Wojciech Jarosz (Dartmouth College); A.M. Darke (University of California, Santa Cruz)

ABSTRACT

Current computer graphics research practices contain racial biases that have resulted in investigations into "skin" and "hair" that focus on the hegemonic visual features of Europeans and East Asians. To broaden our research horizons to encompass all of humanity, we propose a variety of improvements to quantitative measures and qualitative practices, and pose novel, open research problems.

ACM Reference Format:

Theodore Kim, Holly Rushmeier, Julie Dorsey, Derek Nowrouzezahrai, Raqi Syed, Wojciech Jarosz, and A.M. Darke. 2021. Countering Racial Bias in Computer Graphics Research. In *Proceedings of Under Review*. ACM, New York, NY, USA, 2 pages. https://doi.org/10.1145/1122445.1122456

in computer graphics research have resulted, independent of any individual intent, in measurably biased outcomes. Our supplement provides further details and a bibliography.

Translucency and the corresponding physical mechanism of subsurface scattering has become synonymous with "human skin" in rendering. However, translucency is only the dominant visual feature of young, white Europeans and fair-skinned East Asians. We found 19 graphics publications, including the seminal works on the topic, that solely present renderings of white humans as evidence that subsurface scattering algorithms can faithfully depict "skin", "human skin" and "human faces." In at least 4 instances, this bias is then reflected in commercial software. Several other publi-

So a bunch of us wrote a a 2-page Talk that broached the possibility that maybe, just maybe, graphics algorithms for representing humans aren’t universal as we thought.

Countering Racial Bias in Computer Graph[illegible] Researc[illegible]

Theodore Kim, Holly Rushmeier, Julie Dorsey — Yale University
Derek Nowrouzezahrai — McGill University
Raqi Syed — Victoria Univer[illegible] Wellington
[illegible]ech Jarosz — [illegible]th College
A.M. Dar[illegible] — Un[illegible]sity of [illegible]alifornia, Santa Cruz

ABSTRACT

Current computer graphics research [illegible]tices co[illegible] Eu[illegible] biases that have resulted in investigations in[illegible]kin" and[illegible] that focus on the hegemonic visual features of Eu[illegible]ns and[illegible] Asians. To broaden our res[illegible]rizons to encom[illegible]s all of [illegible]anity, we propose a[illegible]ty of improvements to qu[illegible]tative [illegible]ices and qualitative [illegible]ices, and pose novel, open research problems.

Reference Format:

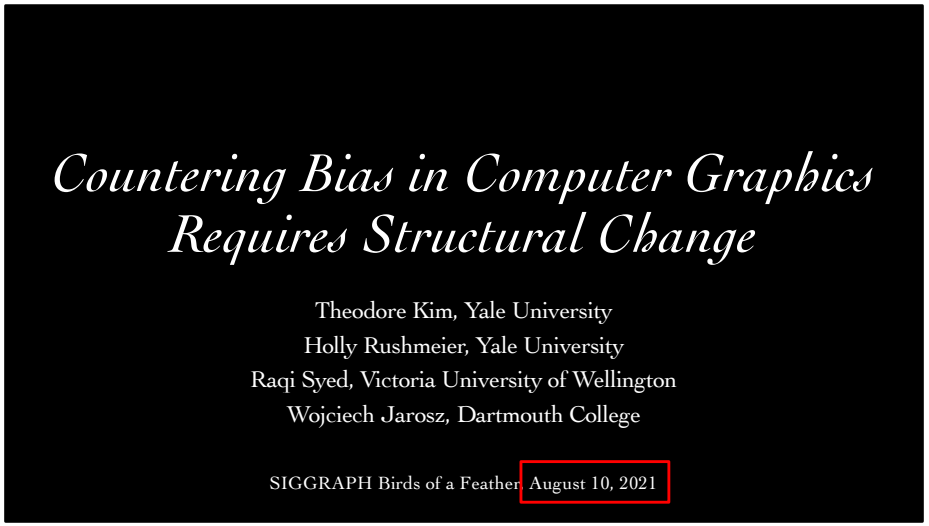
Th[illegible]e Kim, H[illegible] Rushmeier, [illegible]e Dorsey, Derek Nowrouzezahrai, Raqi Sy[illegible] Wojciech J[illegible] and A[illegible] Darke. 2021. Countering Racial Bias in [illegible]er Graphi[illegible]rch. In *Proceedings of Under Review*. ACM, New Yor[illegible] [illegible] pages. https://doi.org/10.1145/1122445.1122456

[illegible] in computer [illegible]raphics research have resulted, independent of any individual [illegible]ent, in measurably biased outcomes. Our supplement [illegible] further details and a bibliography.

Translucency and the corresponding physical mechanism of subsurface scattering has become synonymous with "human skin" in rendering. However, translucency is only the dominant visual feature of young, white Europeans and fair-skinned East Asians. We found 19 graphics publications, including the seminal works on the topic, that solely present renderings of white humans as evidence that subsurface scattering algorithms can faithfully depict "skin", "human skin" and "human faces." In at least 4 instances, this bias is then reflected in commercial software. Several other publi-

REJECTED

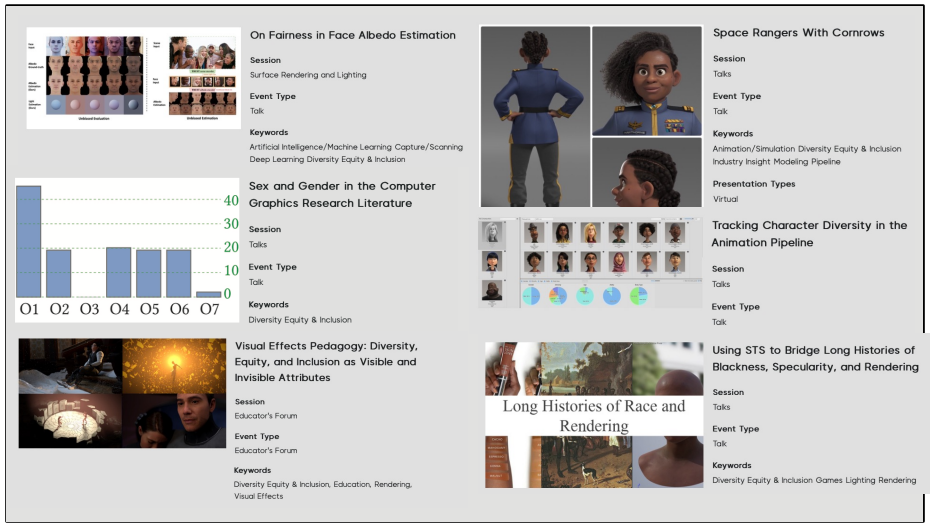
That Talk got rejected, with racist comments from the reviewers.



We regrouped at a Birds of a Feather that year, the exact event you're sitting in right now, almost exactly three years ago. We described the racist rejection, and called on all of you

To submit a fleet of short papers to SIGGRAPH 2022 on any and all forms of algorithmic bias. Doesn't have to be just racial bias. Anything that connects the social to the technical.

Many of you stepped up, and next year, we saw the polar opposite.



There were six Talks on not just racial bias but gender bias in graphics algorithms.

Many of these Talk authors are in this room right now. Silvia, Ana, Haven, Michael, Sofya, Mara, thank you again for stepping up.

These topics are beginning to gain technical legitimacy, but we still have never seen a technical paper on Black skin, kinky hair, or non-binary gender at SIGGRAPH.

That’s the context for today. Some of you are trying to keep the momentum going in the Talks program by continuing to publish short papers on how the social intersects with the technical, or by working on these problems within your companies.

Schedule

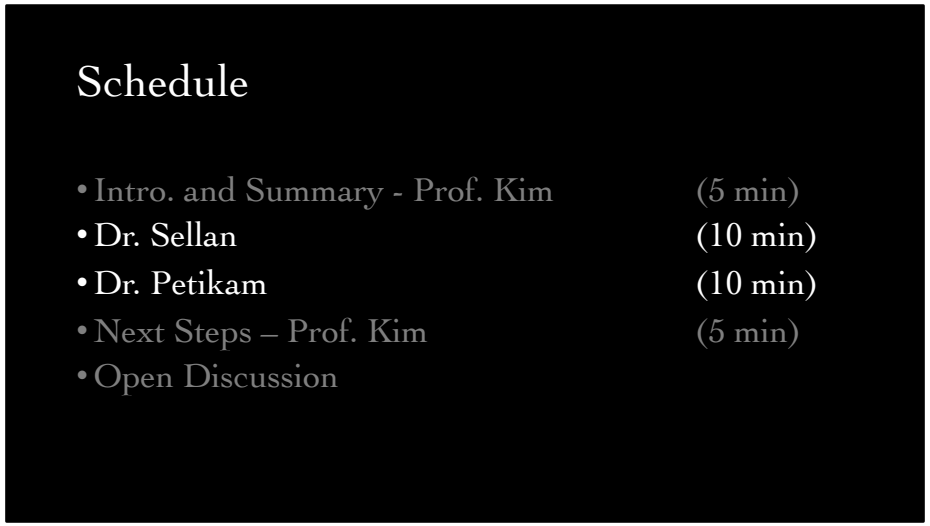
- Intro. and Summary - Prof. Kim (5 min)
- Dr. Sellan (10 min)
- Dr. Petikam (10 min)
- Next Steps – Prof. Kim (5 min)
- Open Discussion

We’re going to hear about two such efforts today.

Schedule

- Intro. and Summary - Prof. Kim (5 min)
- Dr. Sellan (10 min)
- Dr. Petikam (10 min)
- Next Steps – Prof. Kim (5 min)
- Open Discussion

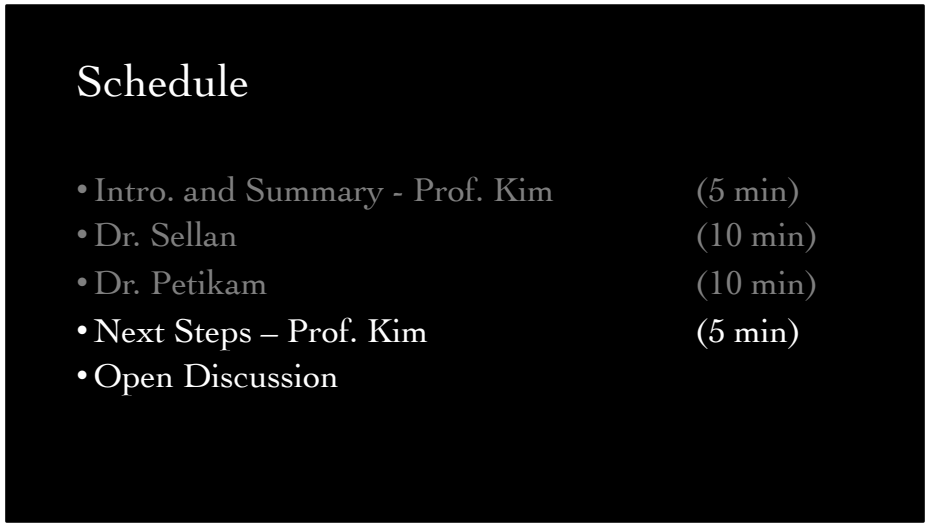
I just finished this part



We have two great speakers/

Dr. Sellan from Toronto, and Dr. Petikam from MSR, who will talk about various aspects of these issues today.

They'll both talk for about 10 minutes,



then I'll wrap up with another 5 minutes. That leaves half hour for the most important part, a discussion period with all of you.

5:30 so far.