



What You See Is What You Get: Cross-Platform Rendering Consistency

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Good Day!

I am Leonard Daly, an independent consultant specializing in 3D Systems Architecture. Ashleigh Miller from Amazon and I co-chair of the Certification and Validation subgroup of the 3D Commerce WG at Khronos.

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Topics

- **Khronos 3D Commerce**
- **Certification Program**
 - Goal
 - Where we are
 - What is not covered
- **Current Results**
- **Next Steps**

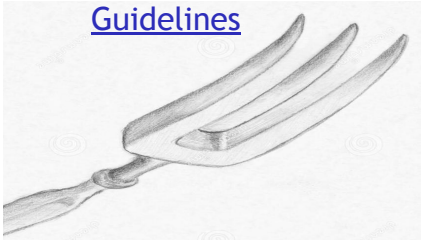
I will be covering the topics listed here during this presentation showing where the industry started at 2 years ago to where we are now. After this presentation I will be in the panel “Spatial Computing for 3D Commerce – State of the Art and Open Challenges”



Khronos 3D Commerce

- 3D Commerce is Working Group for the development of standards, tools, and guidelines to support the use of 3D models in a commerce setting
- 3-pronged approach

[Asset Creation Guidelines](#)



Fork sketch - dreamstime

[Certification Program](#)



glTF Extensions

- [Materials Variants](#)
- [Metadata](#)

2-½ years ago Khronos formed the 3D Commerce WG in response to requests from the retail industry to 1) standardize the approach to creating 3D models and 2) standardize the process of viewing 3D commerce models.

The 3D Commerce WG developed a 3-pronged approach to solve these requirements

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The first was the development of the Realtime Asset Creation Guidelines. This is a collection of documents that describe the parameters that go into creating a good 3D glTF model for realtime rendering.

...

The second was the development of two extensions for glTF. These two extensions allow 1) a single glTF model to contain several different “skins” and 2) support for node-level metadata. As it turns out, these extensions are general enough to see their use in geospatial and other applications.

...

Lastly, 3D Commerce and Khronos instituted a 3D Viewer Certification Program. This

program provides certification of 3D Viewers that meet the certification criteria. The remainder of this talk will be on that program.



Lack of Visible Consistency

Same Object, Different Rendering Engines

- Babylon.js Sandbox (Microsoft)
- DSPBR (Dassault Systèmes)
- Filament (Google)
- <model-viewer> (Google)
- Sample Viewer (Khronos)

Renderer tone mapping
Scene lighting
Renderer calculation

The first big problem was that there was no visible consistency across different viewers when rendering the same model with the same lighting conditions. Google ran a comparison with the listed viewers and found...



Lack of Visible Consistency



User's environment lighting
Time degradation of display quality
Display technology
OS display handling

Renderer tone mapping
Scene lighting
Renderer calculation

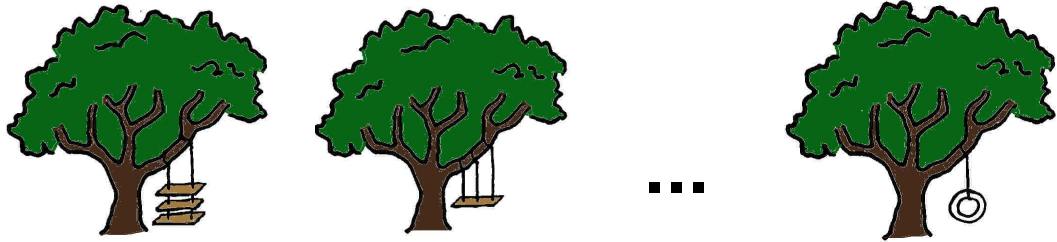
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Google found multiple reasons for the difference of the appearance of the models. Some of these were out of control of the viewer system (left column) and some (right column) were completely under control of the Viewer.

This release of the Certification Program is working with items in the right column. Tone mapping is specified, but in the initial release, that proved insufficient. That will be discussed a few slides from now. Scene lighting was supplied as an HDR image. The rendering calculation also generated some discussion and there is on-going work there with PBR subgroup of the 3D Formats (glTF) WG.



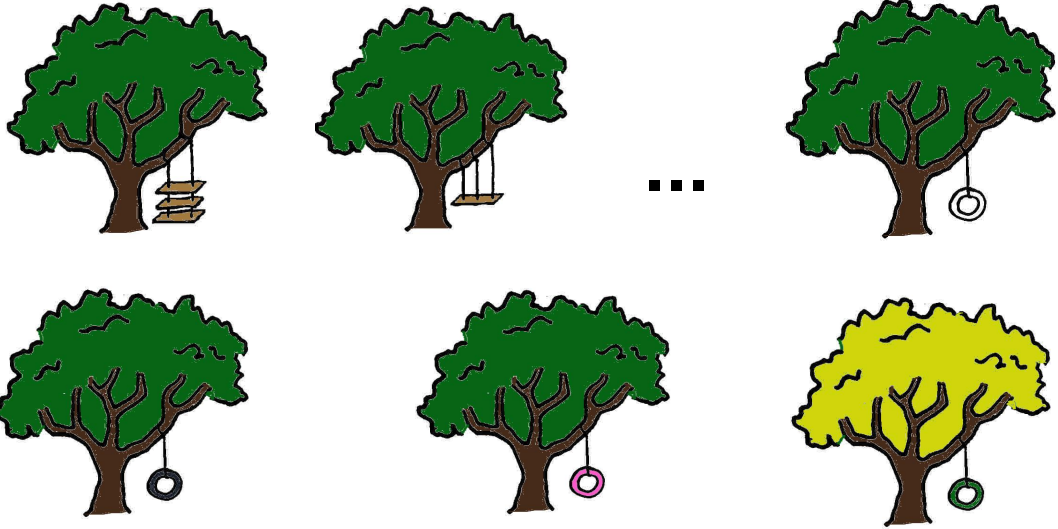
Goal



Many of you have seen this sequence. The labels vary, but it starts with something like the “Architects” design, then the “Engineer” creates an implementation design. There are a number of steps along the way getting to what the customer “wanted”.



Goal



Credits & Reference: ["Tree Swing Cartoon Pictures"](#)

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But perhaps the customer wanted a black tire

...

Or a pink one

...

Or maybe a green tire on a yellow tree...

Letting the customer see the real product (or at least a model of the real product) gives the best results



Goal

Want to customer to be satisfied that the product they previewed looks like the product that was delivered

What You See Is What You Get

The GOAL of the program is to improve the business aspects of providing 3D models to the customer. The retailers want the customer's view of the model to match as closely as possible the delivered item. This increases customer satisfaction and reduces return costs. It is very important that the model look the same across multiple different viewers. The product may be sold on the retailer's site, Amazon, Shopify, Google and Bing (through search result ads), and many other places. When all outlets use Certified Viewers, retailers feel comfortable that

...

What You See Is What You Get



Certification V1 Renderings



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KHRONOS
GROUP

Here are five different renderings of the same model from five different 3D viewers. The renderings are not identical but all convey the sense of the product and accurately reproduce model, especially the cushion and wicker enclosure.

Retailer feedback is critically important to the success of the program. All the retailers involved in 3D Commerce felt that all renderings properly represented the product (primarily based on studio photography). This result was typical of the results for the rendered models.



What's Not Covered

- Hardware display differences
- OS display mappings
- Animation
- Uncontrolled lighting
- Non-glTF models

This release of the Certification program explicitly does not cover the items listed here. Some were considered too difficult to address in the initial release (e.g., non-glTF models and animation), some are technically difficult (uncontrolled lighting), and some may not be able to address without some advances by other standards organizations (h/w display differences – including time degradation of display quality).



Current Results

- **Certification Program Initial Lessons Learned**
 - Operating/windowing system, web browser, and graphics API
 - HDR input images (texture, lighting, etc.) require display mapping
 - [Update on the Khronos 3D Viewer Certification Program and the Drive for Rendering Consistency](#) (Khronos blog)

5 Certificants

- **Babylon.js Sandbox [Microsoft]**
- **Gestaltor [UX3D]**
- **Sample Viewer [Khronos]**
- **Unity glTFast [Unity Technologies]**
- **Web Viewer [CGTrader]**



Several issues were found right after the initial release of the program. The Certification Subgroup suspended new submissions for four months while investigating and resolving these issues. The issues are discussed in a blog post on Khronos.org (News & Events → Khronos Blog). Technologies out of control of the Viewer developer, including OS, window system, web browser, and graphics API; had a significant impact on the appearance of the renderings. This even included the same code that ran on different browsers or Oses. The extent of the differences was unexpected. Certification is reaching out to the relevant standards groups so that these issues can be addressed in a future release.

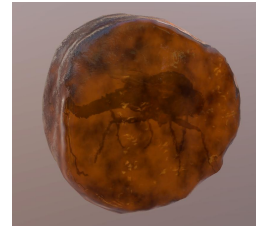
The entire process of converting the GPU rendering (floating point) to something that can be displayed on the screen (8-bit) is a challenge that is only partially solved. There are conditions where the human eye works really well that presents significant difficulties to computer rendering (e.g., outdoor lighting, especially sunlit and shadow) that need further investigation. Certification is working with PBR Subgroup to identify the solutions and implement them in a future release.

As of last week the five listed viewers are certified. The program is open for anyone to participate. The sample models and references images are open-source (CC BY 4.0 International) and are available for free. There is a nominal fee for applying for Certification and use of the Certification Mark.



Next Steps

- **glTF Advanced PBR**
 - Transmission & volume (glass)
 - Clear Coat (shiny hard surfaces)
 - Sheen (velvet)
- **Animation**
- **Augmented Reality**
- **Cloth & Textiles**
- **Lighting**
- **OS differences (desktop, phone, table, iPhone, Android)**
- **Metaverse / digital twin**



What's next...

There are six PBR extensions (clearcoat, ior, sheen, specular, transmission, volume) that have been ratified since the Certification project defined its limits plus one for texture compression (KTX2). These need to be included as many of them cover the material in important retail items (e.g., glass, finishes, etc.).

Animation is an important capability for many items so the customer can see how something can move. This is critical for space requirements and customer functionality

The remaining items on the list will need technical work. Cloth and textiles is really important to customers, especially when they are unable to get to physical retail outlets. All of these features are needed for various work in the metaverse. If one of these topics is important to you, please join Khronos and the Certification team to work on solutions.



Links

- Khronos - <https://www.khronos.org/>
 - Membership - <https://www.khronos.org/members/>
- 3D Commerce Certification Program - <https://www.khronos.org/3dcommerce/certification/>
- Other 3D Commerce Material - <https://www.khronos.org/3dcommerce/>
 - Asset Creation Guidelines
 - Materials Variants
 - Metadata
- Daly Realism - <https://realism.com/>
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