

Sketching complex material and lighting effects in 2D drawings

Masters or Engineering Internship (6 months)

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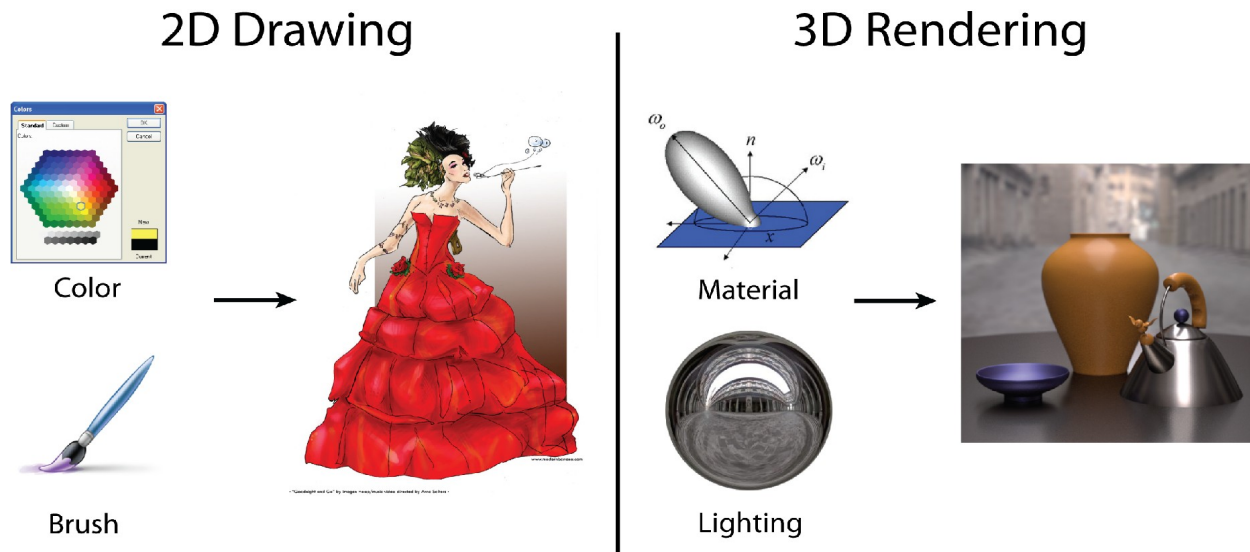


Figure 1: Our goal is to bridge the gap between 2D drawing tools and 3D rendering by leveraging the recent advances in measured material and illumination data. While existing drawing tools rely on simple color palettes and virtual brushes, we aim at developing sketching interfaces to directly draw complex material appearance.

Research Goal

Our goal in this project is to bring the visual richness of 3D rendering to 2D drawing applications. In particular, we will focus on novel drawing tools to sketch material and lighting effects.

In current 2D drawing applications, users rely on virtual brushes to draw color strokes on the image and depict object appearance. This approach requires significant expertise since users need to identify the color variations that will suggest a given material and lighting setup. In addition to selecting the appropriate colors, users need to precisely draw color strokes to suggest shading and highlights. As a result of these limitations, very few drawings depict complex material and lighting effects.

3D rendering is a popular alternative to create images with complex material and lighting. In particular, measured material and illumination data allow users to directly select the properties that would give a desired appearance to an object [Debevec98, Matusik03]. The downside of 3D rendering is that it requires the modeling of 3D scenes, which remains a tedious and time consuming process for many users. In addition, physically-based rendering offers less freedom and flexibility than direct sketching, which is why sketching is still popular in the early phases of design and prototyping.

Our Approach

We plan to leverage the recent advances in captured material and illumination data in order to provide novel interfaces to sketch object appearance in 2D drawings. We will rely on existing work to factorize complex materials into 1D functions representing various material components, such as highlights or Fresnel effects [Ben-Artzi06, Lawrence06]. We will then propose new drawing interfaces so that users can sketch the parameters of these 1D functions over the image. In addition, we plan to explore how

highlights and shading variations in a drawing can be related to measured environment lighting in order to facilitate the sketching of rich lighting effects.

Our approach will necessitate the definition of novel user interfaces to specify material variations over the image. A first research direction will be to extend our previous work on Diffusion Curves [Orzan08] for drawing complex color gradients. To do so, we will take inspiration from books on sketching complex material effects [Robertson03].

Requirements

The successful candidate should have taken courses in computer graphics and have experience in computer graphics programming, with knowledge of OpenGL or DirectX, and some experience with shading languages such as GLSL/HLSL/Cg.

INRIA provides a student stipend for living expenses.

Bibliography

[Ben-Artzi06] Aner Ben-Artzi, Ryan Overbeck, Ravi Ramamoorthi. *Real-Time BRDF Editing in Complex Lighting*. ACM TOG 2006 (Proceedings of SIGGRAPH 2006).

[Debevec98] Paul Debevec. *Rendering Synthetic Objects Into Real Scenes: Bridging Traditional and Image-Based Graphics With Global Illumination and High Dynamic Range Photography*. Proceedings of SIGGRAPH 98.

[Lawrence06] Jason Lawrence, Aner Ben-Artzi, Chris DeCoro, Wojciech Matusik, Hanspeter Pfister, Ravi Ramamoorthi, Szymon Rusinkiewicz. *Inverse Shade Trees for Non-Parametric Material Representation and Editing*. ACM TOG 2006 (Proceedings of SIGGRAPH 2006).

[Matusik03] Wojciech Matusik, Hanspeter Pfister, Matt Brand, Leonard McMillan. *A Data-Driven Reflectance Model*. ACM TOG 2003 (Proceedings of SIGGRAPH 2003).

[Orzan08] Alexandrina Orzan, Adrien Bousseau, Holger Winnemöller, Pascal Barla, Joëlle Thollot, David Salesin. *Diffusion Curves: A Vector Representation for Smooth-Shaded Images*. ACM TOG 2008 (Proceedings of SIGGRAPH 2008).

[Robertson03] Scott Robertson. *How to Draw Cars the Hot Wheels Way*. 2003.