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Radiance-Based Blender Add-On for Physically Accurate Rendering of Cultural Heritage

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ABSTRACT

Despite the Cultural Heritage and Computer Graphics communities are increasingly joining forces to strengthen their collaboration, the study of how light interacts with monuments (e.g. weathering the surfaces or affecting the visitors' experience) is still an open problem in cultural heritage. A significant limitation is the lack of easy-to-use, open-source, physically-accurate tools allowing cultural heritage experts to perform lighting simulations on the increasing collection of 3D reconstructions. In this work, we present an open-source Blender add-on to facilitate such simulations. The add-on allows art historians to configure the properties (materials, lights, and camera) of the simulation, and uses as rendering back-end the Radiance software, a validated physically accurate light simulation tool.

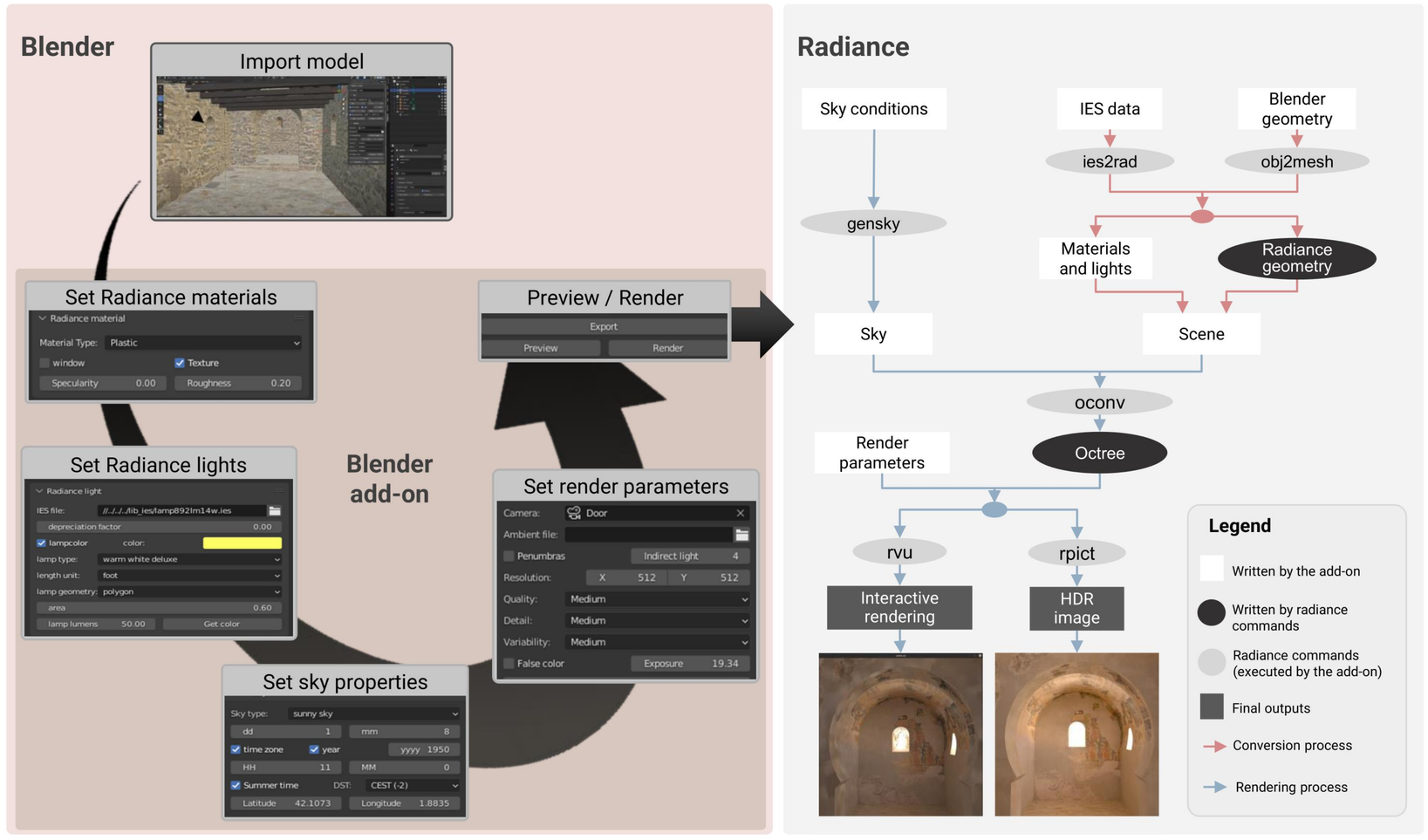
PROBLEM

An important area of study in cultural heritage is concerned with the study of the light in monuments [3]. Such lighting studies allow art historians to understand the effect of weathering processes, as well as to validate different hypotheses about the role of natural and artificial light in the monuments' design, decoration, and use. For example, recurrent problems in art history involve the diachronic analysis of how light might have influenced the experience of the clergy and the laity during liturgical ceremonies, or how monuments and mural decorations were designed to let the natural light highlight certain iconographic elements on specific dates. Despite the advances in photorealistic rendering, very few open-source tools provide physically accurate, predictive renderings fulfilling the strict color reproduction fidelity requirements commonly found in certain art history problems. Radiance [2] is a well-known, physically validated tool for light simulation. It is widely used in architecture and civil engineering to estimate surface irradiance [1]. Unfortunately, its design as a set of command-line programs poses a high-entry barrier for non-technical users.

OVERVIEW

We present a tool allowing users to define the main simulation parameters required by Radiance (materials, artificial light sources, skylight, camera) using a simple GUI within Blender. The tool automatically translates the 3D model, materials, and lights into Radiance internal formats, and manages the execution of the needed Radiance commands to obtain either an interactive preview or a high-quality HDR image. Our proposal simplifies the use of Radiance and thus lowers the entry barrier for the cultural heritage community.

METHODOLOGY



RESULTS

Light measurements on the surface (left) and HDR images (low-key, middle; high-key, right).

Physically accurate lighting simulations of a medieval church.

In the future, lighting tools for Cultural Heritage should allow users to test hypotheses (such as the influence of combustion materials or airflows). Moreover, they may be designed with very intuitive GUI's, should generate validated images (and its corresponding irradiance values) thinking on preservation. Finally, they should manage the combination of lighting and albedo in the textures of current Cultural Heritage models.

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