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Visibility Equalizer

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Abstract

In scientific illustration and visualization, cutaway views are often employed as an effective technique for the occlusion management for densely packed scenes. We propose a novel data-centric method for authoring cutaway illustrations of mesoscopic biological models. In contrast to the existing cutaway algorithms, we take advantage of the specific nature of the biological models, i.e., consisting of thousands of instances but of a comparably smaller number of different molecular types. Our method constitutes a two stage process. In the first step, culling objects are placed in the scene, creating a cutaway visualization of the model. During this process, the user is informed about the amounts of visible instances for each individual molecular type represented in the scene through histograms of their visibility distributions. In the second step, the visibility is fine-tuned through these histograms, which at this point act as interactive visibility equalizers. The technique has been evaluated by domain experts in scientific illustration.

Categories and Subject Descriptors (according to ACM CCS): I.3.3 [Computer Graphics]: Picture/Image Generation—Viewing algorithms

1. Introduction

2. Related Work

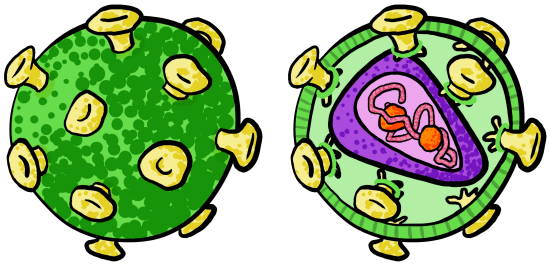
[VKG05] [BHW*07] [BF08] [LRA*07] [LHV12] [MAPV15]

3. Overview

3.1. Design Principles for Cutaway Illustrations

[here we write what principles are there, and how is our system fulfilling them] [LHV12]

There are several issues with using cutaway views in illustrations. First one is that it has to be clear from the visual representation of the cut that the given part of the object has been removed artificially for the sake of illustration. Otherwise the viewers might believe that the hole created by the cut is in fact inherent part of the object. This is commonly solved by using specific shapes of the cuts which significantly differ from the shapes naturally occurring within the object (e.g., using circular cut on object which only have straight edges).



(a) (b)

Figure 1: (a) Illustration of a HIV virus. Here, outside membrane of the virus particle is visible. (b) Cutaway view of the HIV virus. Despite the cutaway, some of the glycoproteins (yellow molecules) are kept in the view to provide adequate context.

Another issue is that the information about the part of the

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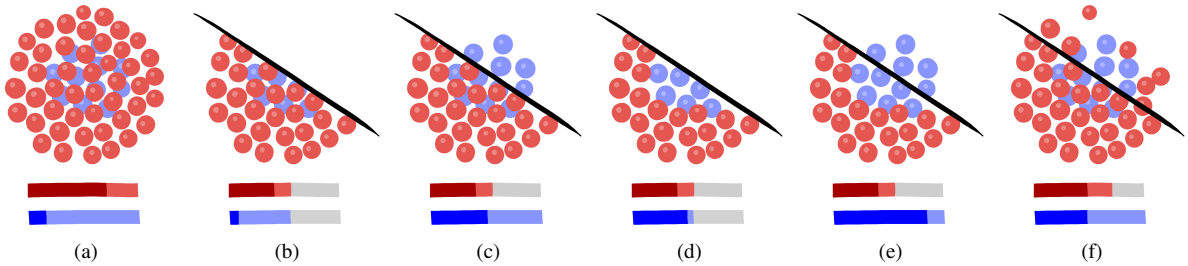

Figure 2: Visibility Equalizers.

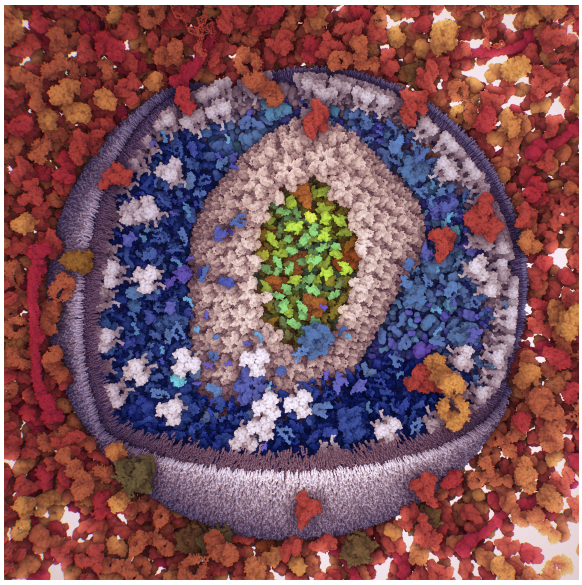

Figure 3: An illustration of the HIV virus in the blood serum utilizing cutaways created with our approach.

object that is being cut away is lost. In technical illustration, this issue is often circumvented by displaying contours of the cutaway part of the object. Alternatively, small portions of the cutaway parts can be reintroduced into the scene. These graphical elements are not occluding the objects of interest, but at the same time they help to convey the overall shape of the cutaway part.

4. Fuzzy Cutaways

5. Equalizing Visibility

6. Evaluation

7. Results and Discussion

8. Conclusions

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