Towards Understanding and Editing the Appearance of Translucent Materials

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Research Question

Computer Graphics and **Material Editing** are two fundaments of modern visual storytelling in films, video games and architectural visualization. While the goal of the former is the generation of physically plausible images, the task of the latter is a flexible and intuitive editing of the materials that compose the scenes. This is a key process, since it allow artists to bring their imagination to life. Unfortunately, the **physical properties poorly correlates with human perception**, making the editing phase frustrating for novice users. In this context, we study the perception of translucent materials, a category of materials that scatter the light that refracts inside the volume, creating a characteristic glowing and blurring effect. It is known, that **translucent objects looks different** when **light conditions are changed**, at least when viewed in a static image [1], however motion often is used to infer extra clue, especially for glossy materials [2], therefore our research question is the following: **How the perception of translucent material is affected by light motion?**

Our Approach

Our study is based on an **asymmetric matching task**, where each participant has to **match** the **optical density** of the **Match** image to the corresponding **Reference** stimulus, which could be an image (**static** condition) or a video (**dynamic** condition) (Fig 1).

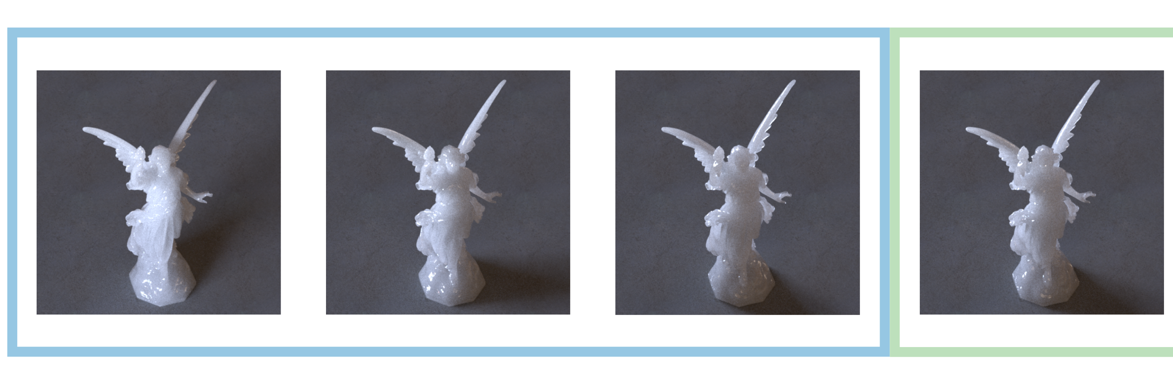

Figure 1: Left: Selected frames of a dynamic reference stimulus (video) used in our experiment, illustrating the changes in appearance as the illumination moves. Right: Example of a static reference stimulus used.

Reference and Match stimuli are presented side by side, and they both show the same object (Fig 2). The experiment is performed for a variety of optical parameters of the material and lighting conditions.

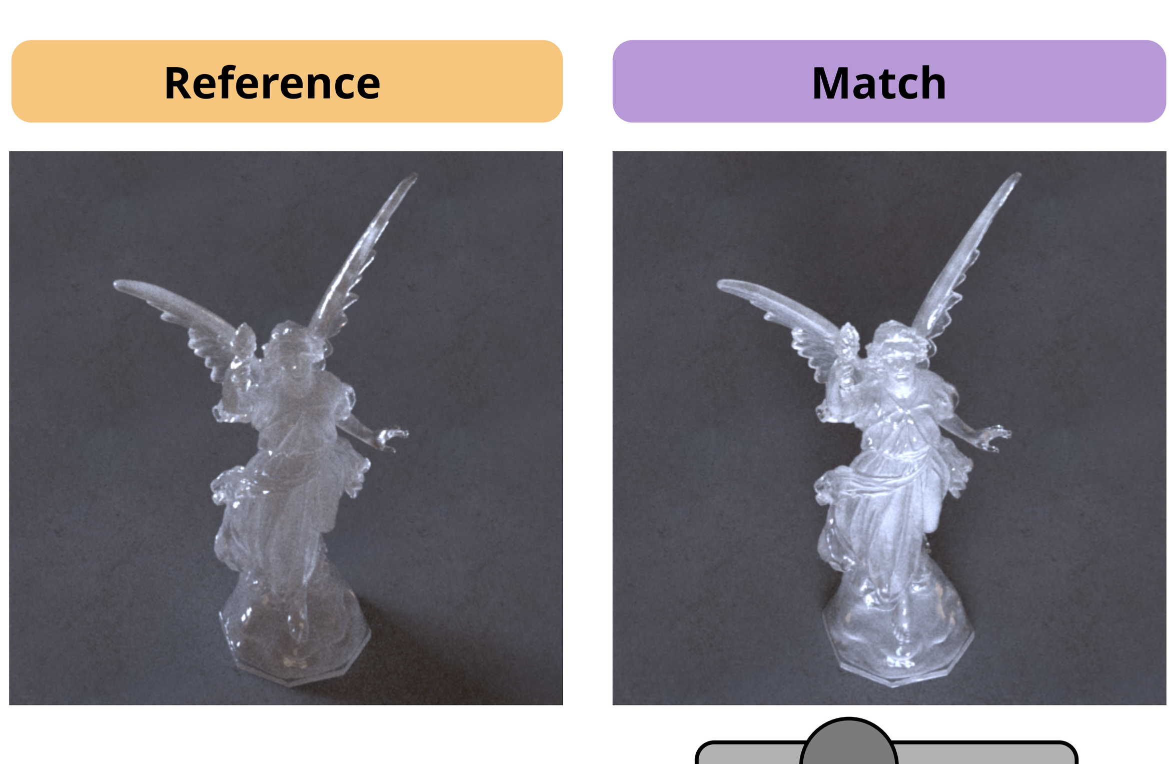

Fig 2. Experiment design. We show the user two images, or a video and an image, side-by-side. The user is asked to edit the Match image density (right), using a slider, until it visually matches the Reference (left).

Method

The experiment is carried out in two separate sessions, one for the static condition, and another one for the dynamic condition. The order of the two conditions is randomized. We then compare users' error between the two sessions and see if there are different behaviours (Fig 3).

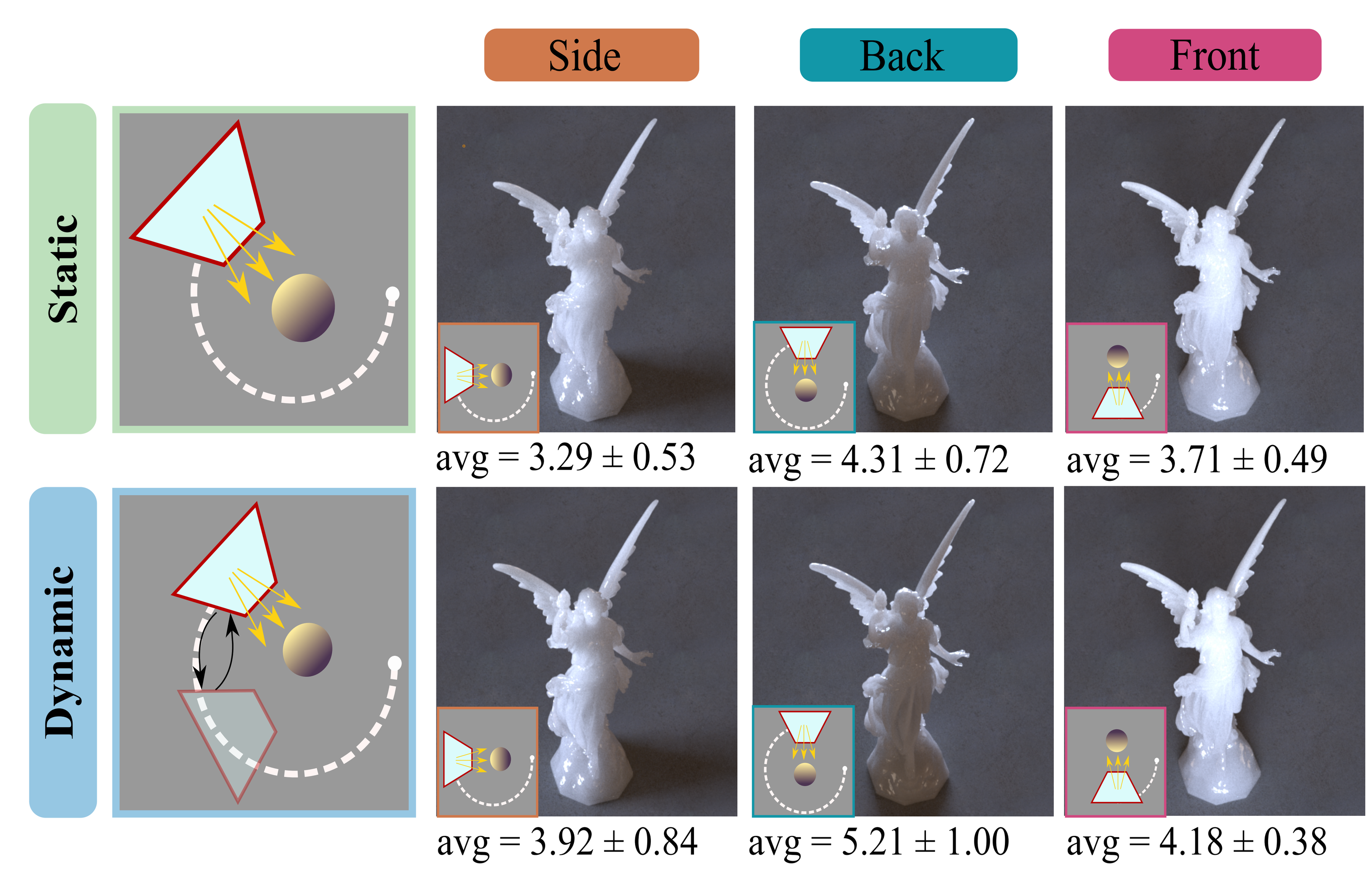

Fig 3. The images depict our test object, rendered with the average density estimated by participants for each condition, for a fixed reference optical density σ = 4.0 (below we report the average estimated mean along its standard deviation).

Results and Discussion

We analyze our data using a repeated measures ANOVA. Surprisingly, we find **no statistically significant differences** ($p > 0.05$) between the **static** and **dynamic** illumination of the Reference (Fig 4).

A possible explanation is that users are not able to leverage the extra information provided by the dynamic motion of an uncontrolled light source.

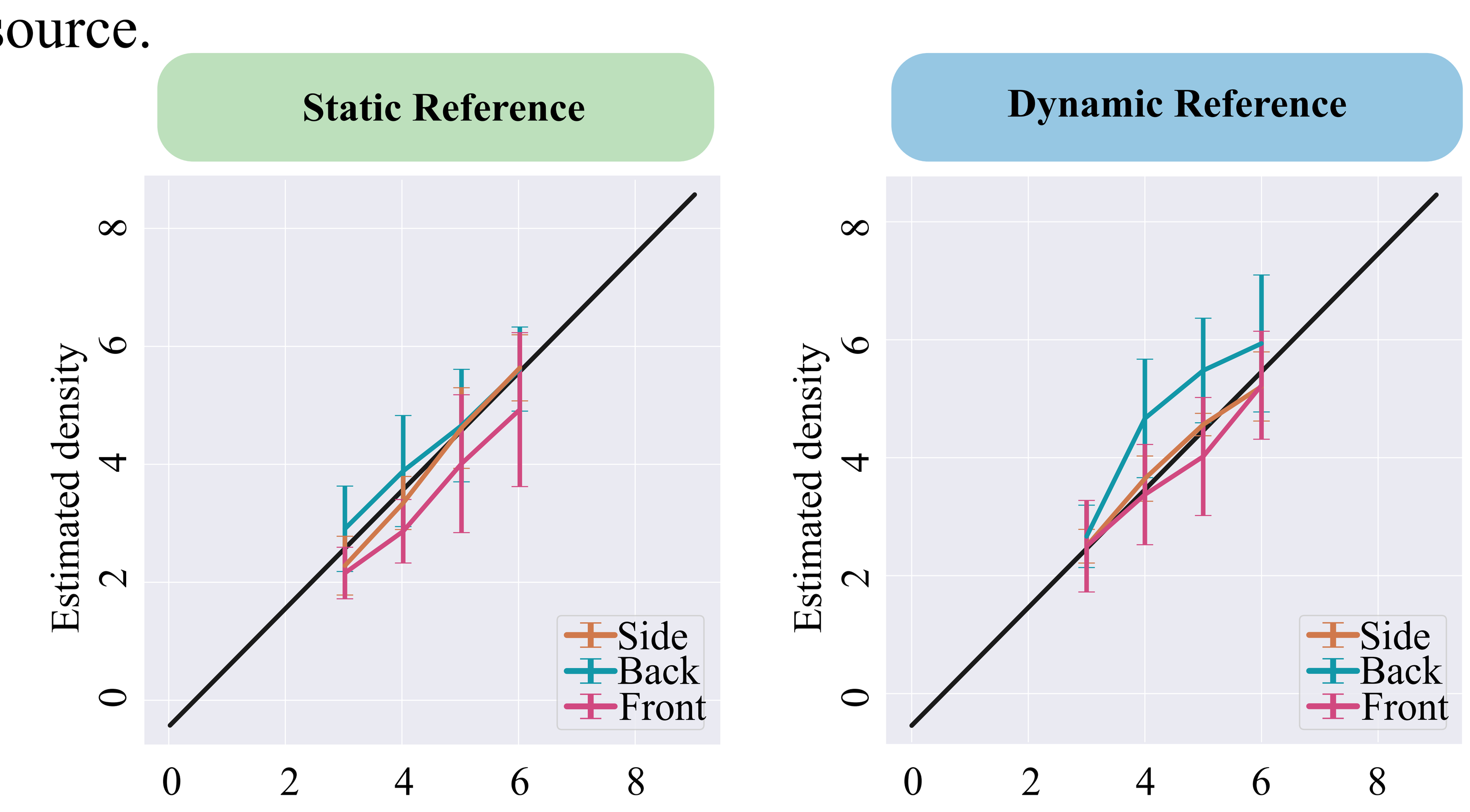

Fig 4. Mean estimated optical density with respect to the groundtruth reference density for each match light position, for both the static (left) and dynamic (right) illumination configurations.

References

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