Does geometric sharpness affect perception of translucent material?

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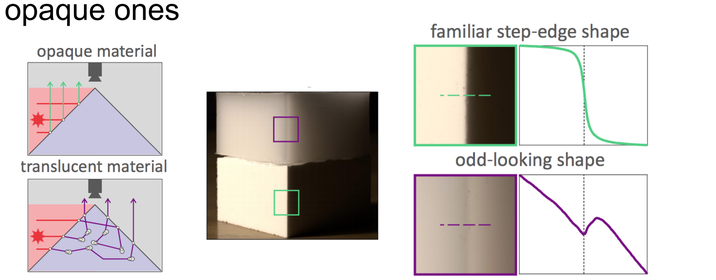
Motivation

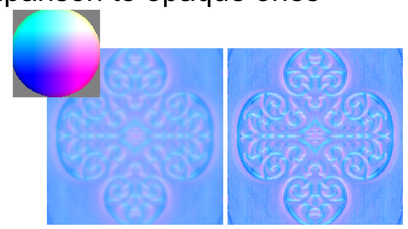
Edges and fine geometric details are important for perception of translucency.

Edges of translucent materials look different from opaque ones



Gkioulekas et. al.(2016)

Surface normals are blurred for translucent objects in comparison to opaque ones

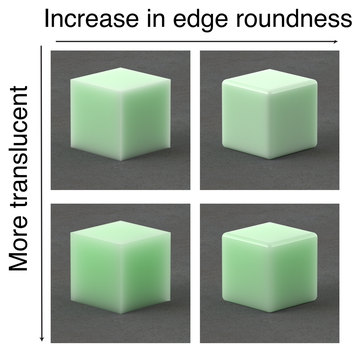


surface normal of simulated translucent material

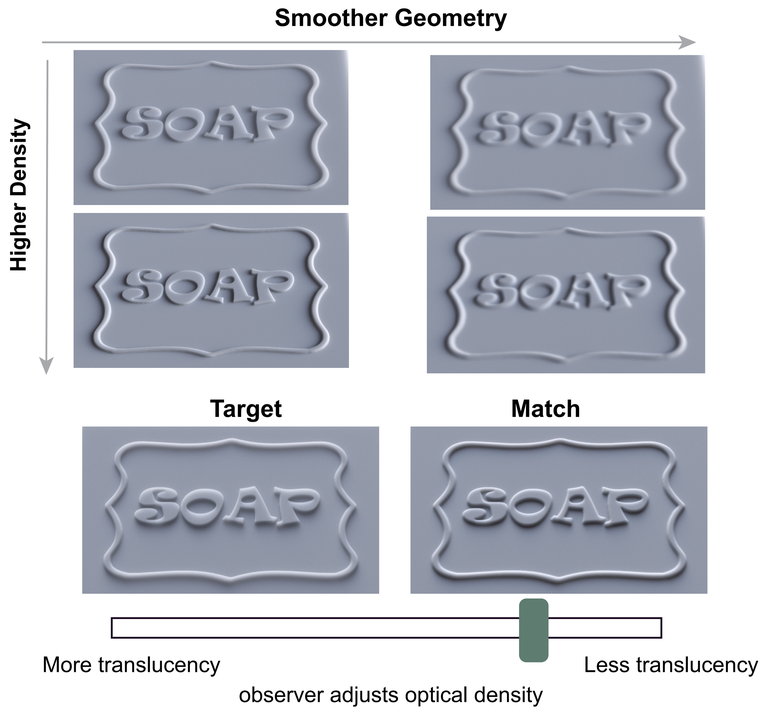
ground-truth surface normal

Dong et. al. (2014)

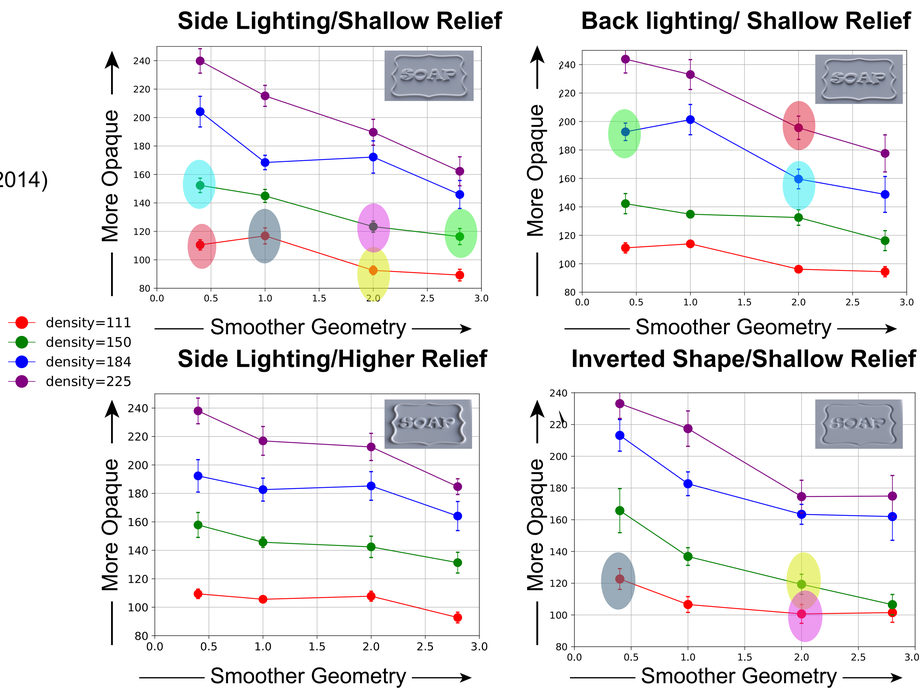
Hypothesis: Reducing geometric sharpness increases perceived level of translucency.



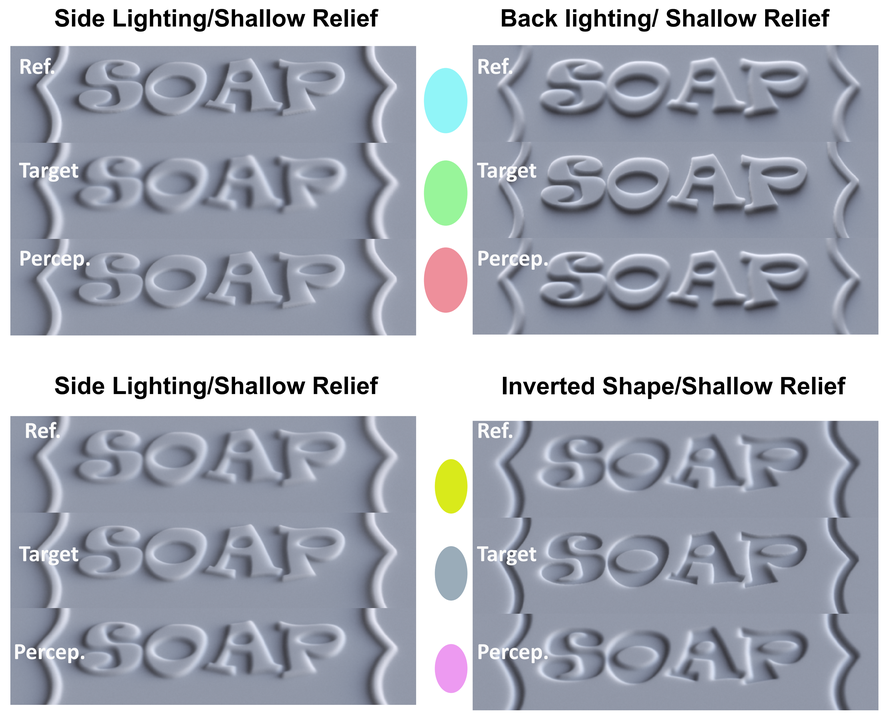
Stimuli and Task



Results

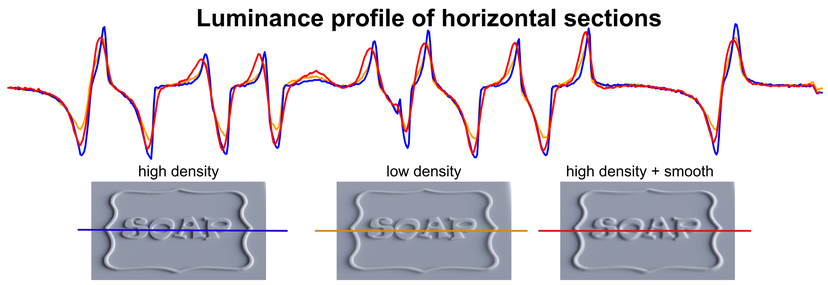


Geometric sharpness affects perceived translucency



Smoothing the geometry results in more translucent appearance.

Effect of geometric smoothness on luminance profile



Similar to lowering optical density, smoothing translucent objects' geometry shrinks their luminance ranges.

Conclusion

3D geometry interacts with physical material properties in translucent perception. Relief objects with blurry height fields appear more translucent than relief objects of the same material and sharp height fields.

[1] Perception and misperception of surface opacity, Marlow P. Kim, J. and Anderson BL. (2017) PNAS.
[2] On translucent edges. Gkioulekas I. Walter B. Adelson, EH, Bala,K and Zickler, T. (2016) CVPR.
[3] Scattering Parameters and Surface Normals from Homogeneous Translucent Materials Using Photometric Stereo. Dong, B, Moore, K, Zhang, W. and Peers, P. (2014). CVPR