The Magic Lens: Refractive Steganography (Supplemental Material)

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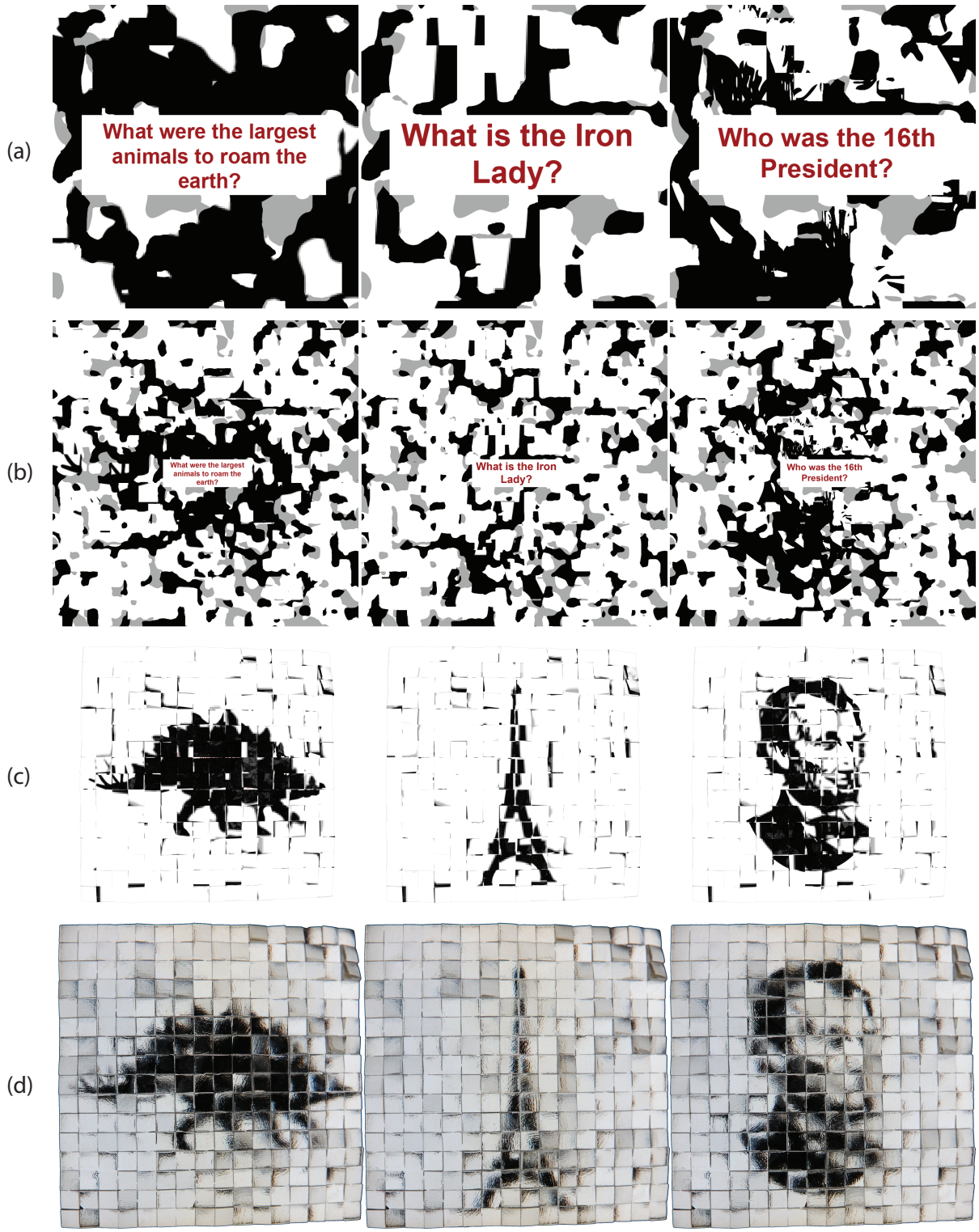


Figure 1: *A single magic lens warps the the source images in (b) (zoom-ins in (a)) to the target images (simulated results in (c); photos of a 3D printed lens in (d)), revealing pictographic answers to the questions in the source images. The region where there question text appears in the sources is masked and, thus, not accessed by the lens.*

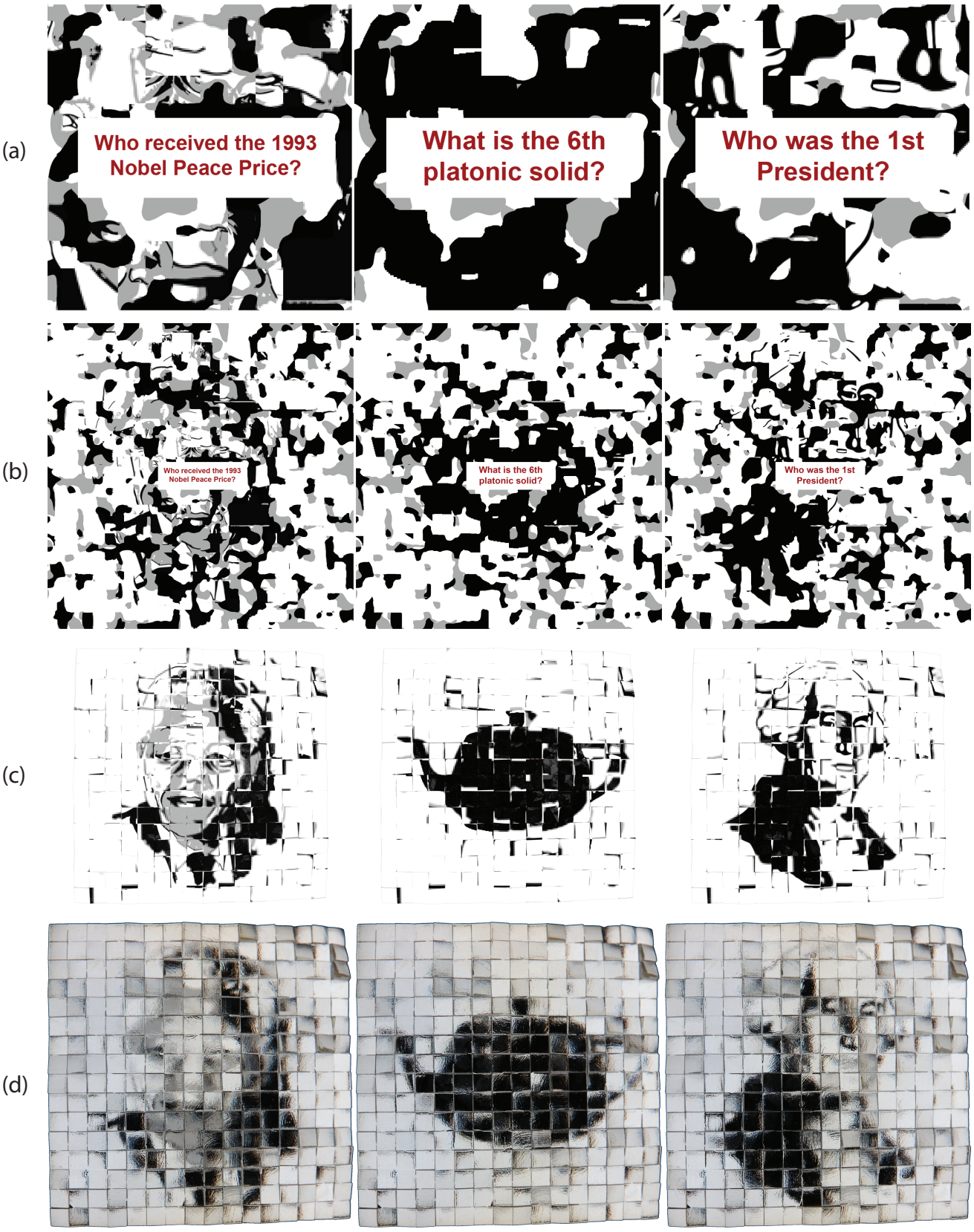


Figure 2: *A single magic lens warps the the source images in (b) (zoom-ins in (a)) to the target images (simulated results in (c); photos of a 3D printed lens in (d)), revealing pictographic answers to the questions in the source images. The region where there question text appears in the sources is masked and, thus, not accessed by the lens.*

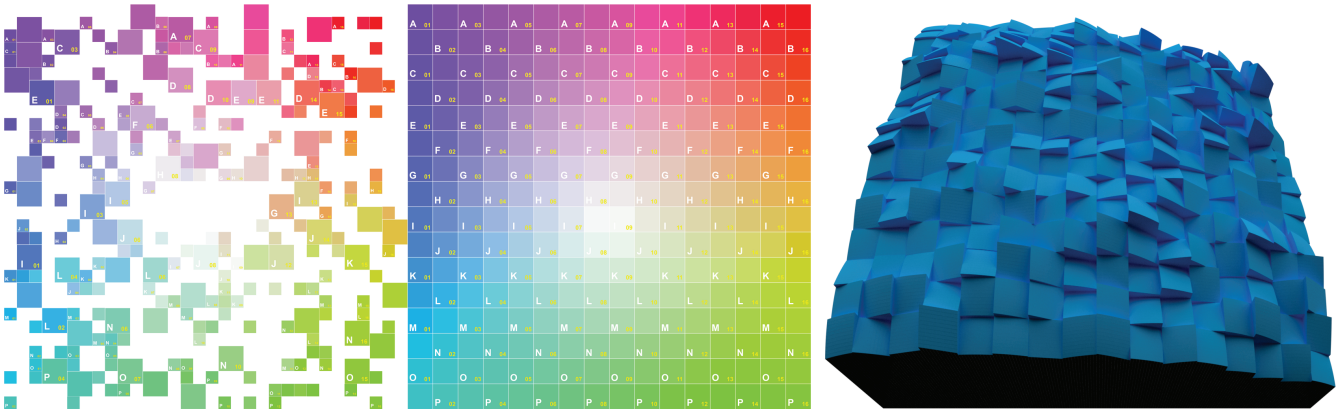


Figure 3: *Visualization of the warping behavior of a universal lens (*16×16 *facets with* 11×11 *micro-facets, place* 1*cm above the source and viewed at* 50*cm from the lens): Given the target image (b) and lens geometry (c), we compute the source image (a) using our inpainting method.*

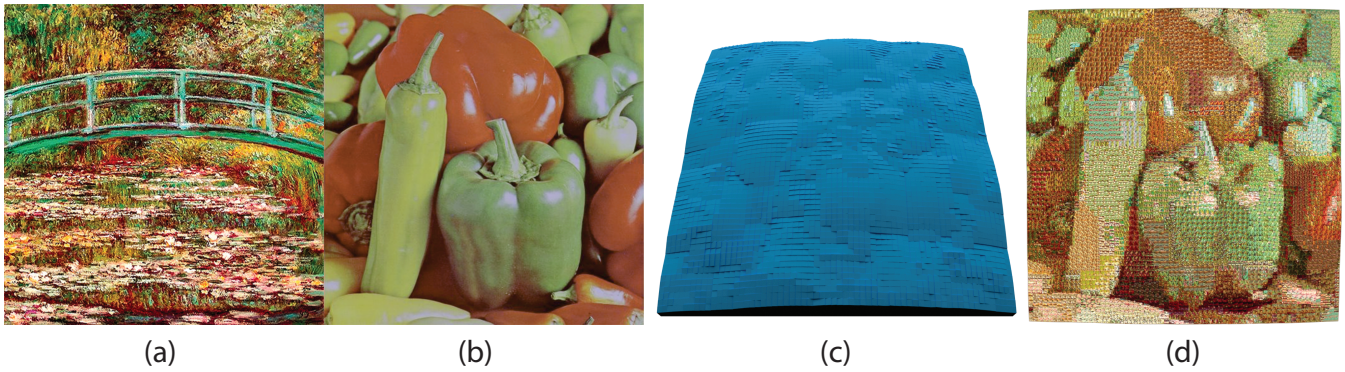


Figure 4: *Morphing one image to another: with the source image (a) and target image (b) specified to our approach, the smooth lens (c) is generated and warps the source (a) to (d). This is a simulated result.*

Figure 5: *Two more examples of morphing one image to another: for each row, the source image (a) and target image (b) are specified to our approach, the smooth lens (c) is generated and warps the source (a) to (d). These are also simulated results, however in this case the source and target images are of much higher-resolution. The resulting lens has 128 × 128 facets with 11 × 11 micro-facets, illustrating the scalability of our approach.*

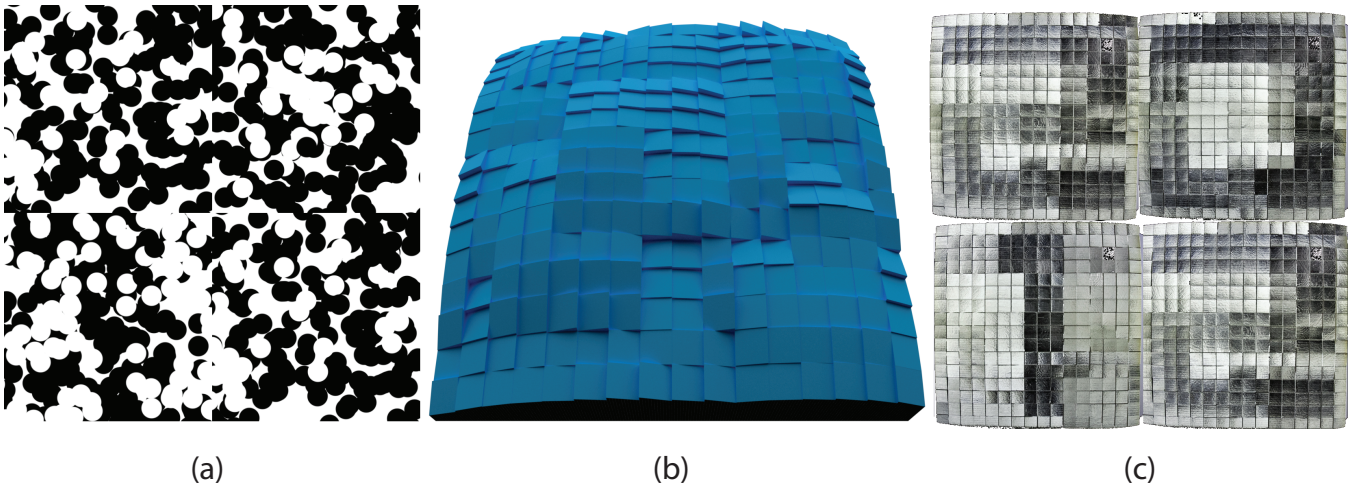
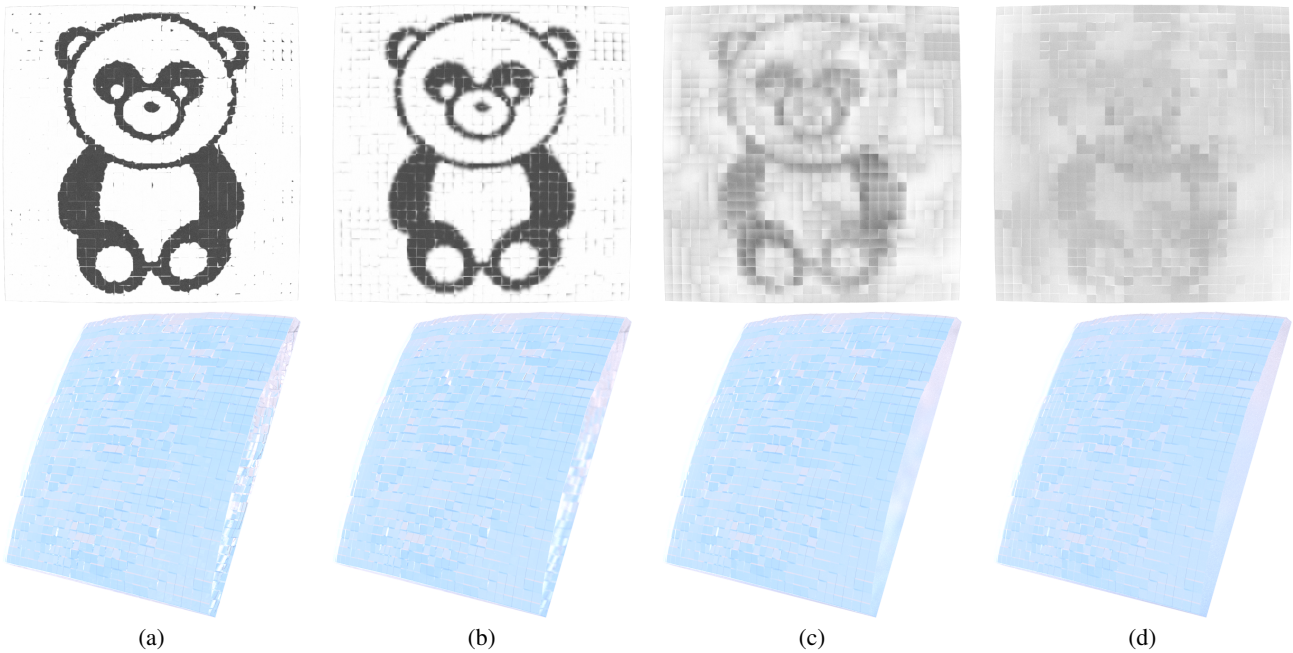


Figure 6: *A single manufactured lens (middle;* 16×16 *facets with* 11×11 *micro-facets) warps four source images (left) to four target images (right; photographs).*



(a) (b) (c) (d)

Figure 7: *We simulate the effects of surface roughness on the expected output of our lenses' refraction. Using Walter et al.'s model [2007], with the* `GGx` *micro-facet probability distribution function* α_g *roughness values of (left to right) 0, 0.01, 0.05, and 0.10 during simulation/rendering. These simulated results illustrate the type of degradation observed in our manufactured results, validating our observations (see discussion in the paper).*