Supplementary Physical Material: Near-Eye Light Field Displays

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The supplementary physical materials, which were provided during the reviewing process, facilitate a simple demonstration of near-eye light field displays: viewing a high-resolution film through a properly-positioned microlens array. This document was provided to reviewers as an instruction manual for the demonstration kit. Section A explains how to assemble the kit. Section B describes the test scenes. Section C includes close-up photographs of the prototype.

A How to Use the Demonstration Kit

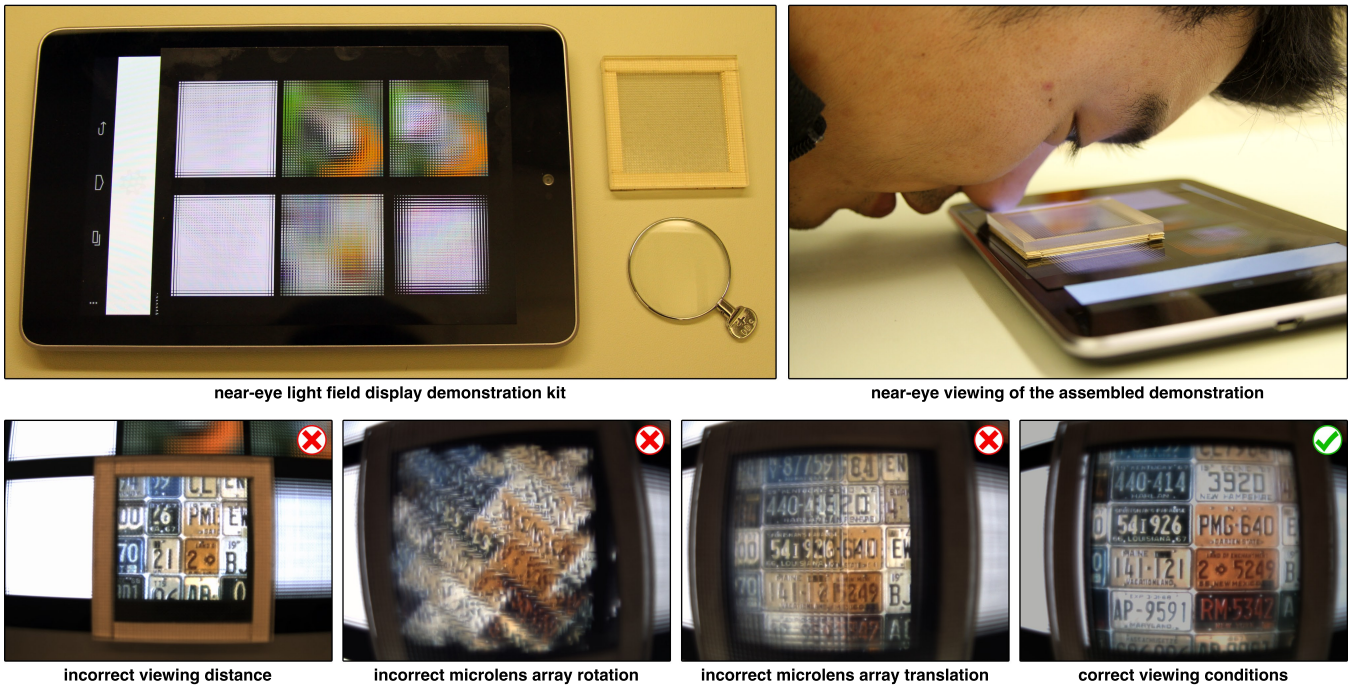

Figure S.1: *Assembling and viewing the demonstration kit. (Top Left) The unpackaged kit, containing an LVT film, a microlens array, and a trial lens. (Top Right) The assembled demonstration with an appropriate viewing distance. (Bottom) The microlens array must be manually rotated and translated relative to the LVT film.*

The unpackaged demonstration kit contains: an LVT film, a plano-convex microlens array with an affixed plastic standoff, and a +5.0 diopter spherical trial lens. The film includes six sample scenes and must be illuminated by a backlight for viewing; as shown above, a mobile phone or tablet can be used as a backlight with freely-available "flashlight" applications or by viewing a blank webpage (e.g., http://www.blankwebsite.com). Alternatively, place a white piece of paper behind the film. To view a given scene, center the microlens array above the corresponding set of elemental images, with the standoff against the film and the planar microlens surface facing your eye. Since the films could not be customized, you must wear corrective eyewear, if required. Close one eye and center the other above the microlens array. As shown at the bottom of Figure S.1, the image will appear strongly distorted if viewing at too great a distance (here showing multiple, periodic eye boxes). Rotate and translate the microlens array, while holding the film fixed, until the image appears aligned. Finally, move your eye to within 2–6 cm of the aligned microlens array to view the sample scene. As you approach the microlens, the eye box should appear to "grow" until it fills your field of view without repetition. However, when viewing too closely, repetition will again appear.

Since shipping may damage the plastic standoff or bend the film, try pushing the microlens array tightly against the film. This will reduce bumps in the film and may optimize the microlens-film separation. Alternatively, slightly raising the microlens array may be helpful. Examine the lower lines of the eye charts to judge the optimal separation.

B Descriptions of the Sample Scenes

Figure S.2: *Sample scenes with annotated target separations from the eye. The sample scenes are, clockwise from the top left: ETDRS eye chart, a Blue-and-Yellow Macaw, a three-layer scene, a five-layer scene, an array of license plates, and the ETDRS eye chart (positioned at a closer distance for addressing myopic viewers.)*

The demonstration kit depicts six multiplanar scenes, with the target eye-plane separations above. (Due to calibration errors in printing, the planes may appear at altered, scaled distances.) Descriptions of the samples scenes follow.

Scene 1: ETDRS Eye Chart at 100 cm
Reading the lower lines may require pushing the microlens array against the film or pulling it slightly away.

Scene 2: Blue-and-Yellow Macaw
Note the appearance of the fine black lines near the eye, as well as the detailed structured visible in the feathers.

Scene 3: Three-Layer Scene
Three depth layers are depicted. Move your head slightly to observe motion parallax across the eye box.

Scene 4: Five-Layer Scene (SIGGRAPH Text)
Five depth layers are depicted with equal separations between the planes (evaluated in diopters).

Scene 5: License Plates
Fine structures can be observed, similar to the Blue-and-Yellow Macaw.

Scene 6: ETDRS Eye Chart at 20 cm
The eye chart is positioned close to the eye, increasing legibility for uncorrected myopic viewers (see Section C).

C Close-Up Photographs of the Demonstration Kit

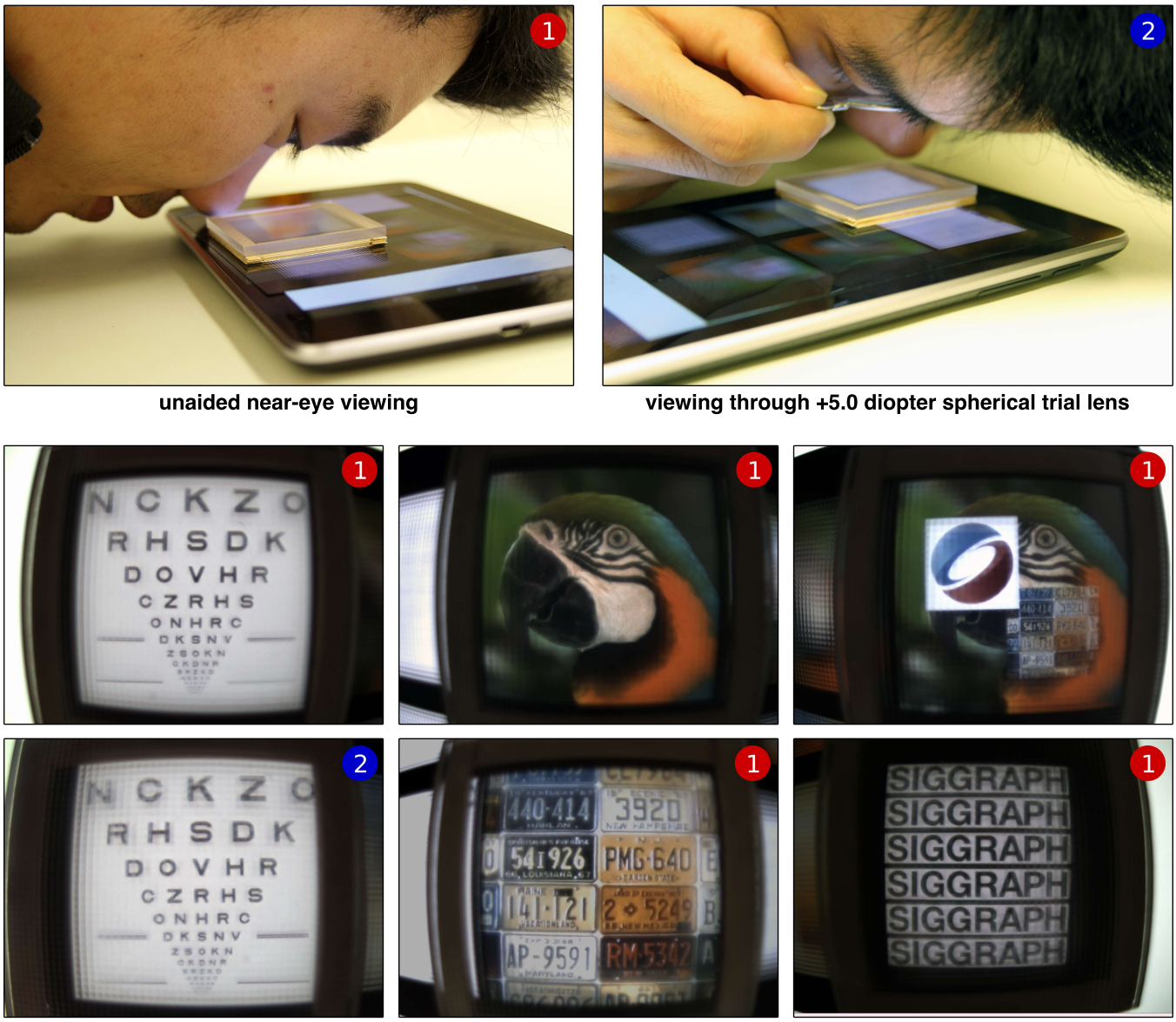

Figure S.3: *Viewing the assembled demonstration kit. (Top) The kit supports unaided near-eye viewing, as well as simulated myopia (using a +5.0 diopter trial lens). (Bottom) A wide-angle lens is placed 3 cm from the microlens array, emulating the experience of near-eye viewing. (Barrel distortion results from the wide-angle lens.)*

The images above illustrate how a correctly assembled and properly viewed demonstration kit should appear. To appreciate the improvement rendered by this near-eye light field display, the demonstration kit also contains a printed image, similar to Figure S.2, that depicts the sample scenes, subtending similar fields of view as for the near-eye demonstrations, but without the use of a microlens array. Hold this sheet of paper close to your eye to observe the degree of retinal blur that would occur with a bare microdisplay.

We intend the viewer to observe the sample scenes using any necessary correction (e.g., contact lenses or eyeglasses). However, the ETDRS eye chart at 20 cm is designed to assist uncorrected myopic individuals. To simulate myopia, place the +5.0 diopter trial lens near your eye (or against your eyeglasses) and view this scene.