Title

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Making big things look small:
Blur combined with other depth cues affects perceived size and distance

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Abstract

Blur is commonly considered a weak distance cue, but photographic techniques that manipulate blur cause significant and compelling changes in the perceived distance and size of objects. One such technique is "tilt-shift miniaturization," in which a camera's lens is translated and slanted relative to the film plane. The result is an exaggerated vertical blur gradient that makes scenes with a vertical distance gradient (e.g., bird's-eye view of landscape) appear significantly nearer and therefore smaller. We will begin by demonstrating this compelling effect, and then describe how we used it to examine the visual system's use of blur as a cue to distance and size. In a psychophysical experiment, we presented computer-generated, bird's-eye images of a highly realistic model of a city. Blur was manipulated in four ways: 1) sharp images with no blur; 2) horizontal blur gradients were applied to those images; 3) vertical gradients were applied; 4) a large aperture (diameter up to 60m) was used to create an image with an accurate correlation between blur and depth for realizable, small-scale scenes. Observers indicated the perceived distance to objects in the images. Technique 1 produced a convincing impression of a full-sized scene. Technique 2 produced no systematic miniaturization. Techniques 3 and 4 produced significant and similar miniaturization. Thus, the correlation between blur and the depth indicated by other cues affects perceived distance and size. The correlation must be only reasonably accurate to produce a significant and systematic effect. We developed a probabilistic model of the relationship between blur and distance. An interesting prediction of the model is that blur only affects perceived distance when coupled with other distance cues, which is manifested in the tilt-shift effect we observed in humans. Thus, blur is a useful cue to absolute distance when coupled with other depth information.

Citation

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