Chapter 10
Recommendations for Stereoscopic Display Design

We have covered a lot of material in this book, so here is a summary:

1. *Interocular cross talk*. Limit interocular cross talk to a value less than 2 %. This is an issue of the physics of display design and its solution lies in the ability to keep separate the information delivered to the two eyes.
2. *Interocular differences in luminance and contrast*. Keep both interocular luminance differences and interocular contrast differences less than 25 %, ideally less than 5 % each.
3. *Accommodation–vergence mismatch*. View stereo displays from a distance of 1 m or greater if possible. Present the stereo depth of the fixated virtual object such that its displayed images fall within the depth of field of the human eye (by combining calculations for perceived depth with calculations for depth of field, equal to a 0.5 diopter tolerance for average display luminance).
4. *Brightness*. Brighter display luminance 'stops-down' pupil size, which in turn expands the depth of field, thus expanding the tolerance zone for comfortable 3D viewing (where accommodation/vergence mismatch would not interfere).
5. *Stereoanomaly*. In certain situations, there may be a need to screen for stereoanomaly and stereoblindness. To enhance the chances for veridical depth perception, imagery should be displayed under non-degraded conditions and binocular disparity bolstered with other congruent depth and distance cues.
6. *Spatio-temporal frequency effects*. Human sensitivity across a wide range of disparity magnitudes in crossed and uncrossed directions can be predicted from knowledge about the spatio-temporal luminance modulation of the displayed imagery. For displayed imagery with fine details, the total effective disparity range can be 80 arcmin, centered on fixation (horopter), and stereoacuity can be as low as 20 arcsec. For imagery with coarse details, the total effective disparity range can be 8 arcdeg (centered on fixation), and stereoacuity can be 5 arcmin (which can improve to 20 arcsec with transient stimulation). To prevent the appearance of disruptive peripheral flicker, the field of view should be limited with time-multiplexed displays or a high frame rate should be used.

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7. *Distance scaling of disparity*. Viewing distance is important for determining the amount of depth that is perceived in stereo displays. To perceive stereo depth, the visual system re-calibrates binocular disparity in accordance with changes in viewing distance. Changes in viewing distance affect the amount of perceived depth with stereo displays differently than perceived depth in the real-world, which may complicate the use of mixed-reality or augmented-reality displays.
8. *High-level cue conflict*. Depth and distances cues should be congruent in stereo display viewing, including binocular parallax, motion parallax, and perspective cues. Stereo displays can be divided into *analytical reasoning-inducing stereo displays* (alphanumeric symbology presented with disparity), and *intuitive reasoning-inducing stereo displays* (immersive geophysical stereo imagery). High-level cue conflict likely occurs primarily with the latter type of display, stereo displays that depict a simulation of the physical world without congruent motion parallax (e.g., 3D movies).