Non-disparity based 3D depth perception: A review of stereopsis"; "An introduction to monocular occlusions." By Linda Colpa

Abstract: Stereopsis is the primary binocular due to depth. In a clinical setting, stereopsis is broadly categorized into contour (local) and random dot (global) stereopsis. Another categorization of stereopsis is attributed to Ogle, who felt there was a fine versus coarse dichotomy; fine stereopsis involves a modest disparity range, provides quantitative depth which we know as stereoacuity, and is what is tested on most of our clinical stereotests. Coarse stereopsis, also referred to as diplopic stereopsis, encompasses large disparities that produce double vision and thus results in mainly qualitative forms of depth. First and Second order stereopsis is another dichotomy, where the use of luminance-based in the former and contrast-based in the latter depth information is used. The difference in the vantage points between the two eyes not only gives us the positional disparity that is used to compute stereopsis, it also creates areas of a scene which are visible to only one eye. These areas arise due to the physical occlusion of objects by other objects and are called Monocular Occlusions (MOs). There is no positional disparity available to be computed, yet MOs also produce robust 3D depth perception. MOs are a relatively recent addition to the depth perception literature, and their neural underpinnings are not well understood. Some feel that the process that computes depth from MOs is simply a by-product of disparity detectors, while others feel it is accomplished by its own separate mechanism. This lecture will first review how disparity is processed, and then introduce Monocular Occlusion stimuli – how they are constructed and the types of depth (both quantitative and qualitative) they elicit. Using a stereo-deficient subject population, I will present data that shows that those with strabismus and amblyopia can not only perceive 3D depth perception in MO stimuli, but can quantify it as well as visually normal controls. The role of MO-based depth perception in those with compromised/absent disparity-based depth perception will be discussed.