MODEL OF DEPTH INTERPOLATION USING A DISTRIBUTED REPRESENTATION OF DISPARITY

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We have previously fit stereoacuity data with a line-element model[1] based on a set of 17 broadly overlapping disparity-tuned units, similar in shape to those measured physiologically by G.F. Poggio. Disparity was represented in a distributed fashion by the pattern of activity in the set of units, analogous to color vision. Here we extend the model to deal with the alteration in perceived depth that occurs when two objects at different depths are located close to each other spatially. Westheimer[2] has reported that for small spatial separations (less than a few arc minutes), subjects perceive the objects as if they were attracting each other in depth, whereas for greater spatial separations the objects appeared to repel each other. We modeled these data by placing a set of disparity units at each spatial location. These were connected in a network, with mutual excitation between units at different spatial locations tuned to the same disparity and separated by a small distance, and mutual inhibition when the spatial separation was large. An algorithm was then used to assign a depth percept to the pattern of activity that results from these interactions. This localized depth warping may be an important process underlying depth interpolation, as occurs in sparse random dot stereograms. Working on a larger network, we found linear depth interpolation between two tokens having a small disparity difference. This interpolation broke down for large disparity differences, to a situation in which the pattern of activity fit equally well to two different depths, which could correspond to the percept of transparent surfaces. A limitation of the model is that it does not solve the correspondence problem, because responses to multiple false matches are confounded when they stimulate common, broadly-tuned disparity units. *Supported by the Sloan Foundation.* [1] ARVO 1987 [2] *J. Physiol.* (1986) **370** 619-629.