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On the Depth Cue Weights in the Integration Process of Binocular Disparity and Perspective for the Perception of Surface Slant

The human visual system is assumed to integrate different cues for depth perception. Although the weighted linear combination rule can account for many properties of the cue integration process, how the weight of each cue is determined is not clearly known yet. Thus, the purpose of this study was to clarify how the weight of each depth cue is determined. In the first experiment, we measured the relative weights of binocular disparity and monocular perspective for perceiving slants of the random-dot patterns presented at different distances. The results showed that the relative weight of disparity decreased as the viewing distance increased and that there were large individual differences in the relative weights of the cues. In the second experiment, we compared the weights of disparity with the indices of the bias in the past observing distances, which were the accommodative far points and reading distances, for many subjects. The results showed that the subjects with the large weights of disparity tend to have the near accommodative far points and near reading distances. In the third experiment, we measured the relative weights of disparity and perspective just before and after the learning phases in which the subjects adjusted the apparent slant of the stimulus containing only one of the cues to the frontal plane. This procedure was repeated for seven or eight days for each learning cue. The results showed that the relative weight of perspective increased after the perspective learning period of seven days while it decreased just after each learning phase of each day. These results suggest that the weight of a depth cue is affected by the physical precision and the past biased use of the cue. The weight of a cue is large when the physical precision of the cue is high. It also increases after the long period of dominant use of the cue, while it decreases just after the overuse of the cue.

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