when the dominant disk was white, the perceptual change would be white to white. Results showed that the magnitude of the pupillary response was more associated with the perceptual change; the pupil became smaller when apparent brightness increased more, even if the stimulus sequence was identical. In the eye-switching condition, a large contrast increment produced by the black-to-white stimulus change in one eye seemed to make the white disk dominant after the switching. However, the percept-related changes were still observed. Overall, the present findings support the thesis that the pupillary response could be used to objectively investigate the visual processing underlying perception.

◆ **Depth of binocular-rivalry suppression reduces with time of suppression: Electrophysiological evidence**

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During binocular rivalry one of two dissimilar monocular images is alternately suppressed (invisible), while the other is dominant (visible). Depth of suppression is measured by comparing the threshold to detect a change to one of the stimuli when it is invisible (giving a high threshold) with when it is visible (giving a low threshold). Intriguingly, depth of suppression appears to be constant over time during an episode of suppression. We tested this electrophysiologically by measuring event-related potentials (ERPs). Participants pressed keys to record their perception of orientation during rivalry between orthogonal gratings. Either early (0 – 200 ms) or late (600 – 800 ms) after a key press—which indicated a stable percept of one of the orientations—we changed the orientation of one of the rival stimuli to be the same as the other. Depending on the perceptual state, this change was either visible or invisible. When the change happened early, visible changes yielded a larger positive deflection of the ERP at about 100 ms (P1) than invisible changes. When the change happened late, we found no such difference in P1 amplitude. We conclude that—on a neural level—suppression depth declines with time of suppression.

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◆ **Eye-of-origin biases in onset rivalry and dichoptic masking**

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When the stimuli presented to each eye cannot be fused, observers report a fluctuation of awareness between each eye's image. Little is known about how one image initially overcomes the other (onset rivalry), and it is plausible that this process shares mechanisms with dichoptic masking. We tested this idea by comparing eye preferences in onset rivalry and monocular contrast thresholds, with and without simultaneous dichoptic masking. First, we measured monocular contrast detection thresholds (75% correct) with a staircase procedure using Gabor patches (45°, 4 cycles deg^{-1}, 1° aperture) randomly presented to left and right fovea in a forced two-interval procedure. Interocular differences were minimal. Then, we repeated the procedure with a simultaneous orthogonally oriented mask (contrast 30% higher than average baseline thresholds) in the other eye. Now, threshold was differentially elevated for each eye. In the third experiment, dichoptic Gabor patches (±45°, contrast as in the previous experiment) were presented in forty 10-s observation periods. Interocular differences in onset rivalry were larger than 40% in six out of eight subjects and negatively correlated with interocular differences in threshold elevations. No other correlation was significant. Our findings suggest that dichoptic masking and onset rivalry are mediated by the same inhibitory mechanisms.

◆ **Perceptual quality of reconstructions of digital holograms: extending depth of focus by binocular fusion**

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Reconstructions of digital holograms have a very shallow depth of focus. In order to obtain a perceptually greater depth of focus, we explored a computationally simple approach, suggested by Lehtimaki and Naughton [*Proceedings of the 3-DTV Conference 2007, Kos, Greece* (New York: IEEE Press)], where the perceptual depth of focus is obtained by dichoptic viewing of near focused and far focused holographic reconstructions. In particular, we sought an answer to the question of to what extent does each dichoptically presented image contribute to the perceived sharpness. At the upper half of the display the subjects saw the near and far focused images dichoptically, which by binocular fusion produced a perceptually increased depth of focus. At the lower half of the display they saw a computationally fused image, which consisted of locally weighted averages of the near and far focused images. The extent to which sharp parts in each image was blended to the computationally fused image could be varied in real time by using a graphical slider on the display. The task of the observers was to match the computationally fused image to the binocularly fused image with respect to sharpness. The results suggest that in the perception of the binocularly fused image, the in-focus areas of each image, ie, sharp parts, had a relatively greater contribution than the out-of-focus areas, ie blurred parts. However, the dominance of in-focus areas was not complete. The fused perception seemed to be a point-wise weighted mean of the dichoptic image pair where the weighting is dependent on the local high spatial frequency energy of the near and far focused images.

◆ **The anatomical asymmetry of interhemispheric connections is retained in animals with impaired binocular vision**

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In cat cortical areas 17, 18 callosal fibers are connecting retinotopically corresponding but anatomically non-symmetric loci which receive projections from the retinal naso-temporal overlap zone (Olavarria, 1996 *Journal of Comparative Neurology* **366** 643–655). These data are confirmed by HRP injections into the single ocular dominance columns (ODCs). ODCs of areas 17, 18 receive inputs from callosal cells located in the transition zone 17/18, and the transition zone ODCs receive inputs from callosal cells located in areas 17 and 18 (Alexeenko et al, 2001 *Perception* **30** Supplement, 115). We investigated the pattern of interhemispheric connections of single ODCs in monocularly deprived cats and in cats with early convergent or divergent strabismus. It was revealed that the impairment of binocular vision does not change the asymmetric connectivity rule of eye-specific interhemispheric connections in areas 17, 18. However callosal cells zones were enlarged. The expansion was (i) more pronounced for ODCs located in areas 17, 18 than for transition zone ODCs and (ii) more variable in monocularly deprived cats. We suggest that expanded callosal connections may provide for more reliable binding of two visual hemifields. The influence of binocular rivalry process is proposed.
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◆ **Recognition of binocularly rival letters can be modulated by the prior presentation of one letter**

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When two letters are presented dichoptically for 200 ms or less, our recognition tends to change randomly trial by trial; at some trials one letter is recognized, at other trials, another letter or both letters. However, letter recognition can be modulated by monocularly presenting one of the rival letters prior to the dichoptic presentation. Our results using Japanese Kanji or Kana letters showed that a newcomer was seen at a very high rate: participants tended to recognize almost exclusively the letter not presented previously. Moreover, this effect was not affected by reducing the size of the prior letter. These findings indicate that the physical characteristics of letters alone could not account for the effect, and thus suggest that letter-level knowledge could be used to resolve binocular competition. But we also found that the effect was largely decreased by presenting a masking pattern during the interval between the prior and the dichoptic letters, or by displacing the prior letter upward relative to the dichoptic letters. Further investigation of the nature of this newly found recognition modulation effect might allow us to identify the processing stage where language information, like letter-level knowledge, could affect binocular rivalry.

◆ **Horizontal/vertical anisotropy in sensitivity to relative disparity depends on stimulus depth structure**

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Bradshaw and Rogers (1999 *Vision Research* **39**) showed that sinusoidal depth corrugations defined by horizontal disparity are easier to detect when the corrugations are horizontal than when they are vertical. We replicated their results for frequencies from 0.1–1.2 cycles $\deg^{-1}$. We also determined disparity thresholds for square-wave corrugations. As in sinusoidal corrugations, sensitivity differed as a function of the modulation spatial frequency but the anisotropy with respect to the orientation of the corrugation was now much weaker, with some subjects detecting vertical corrugations as easily as horizontal. In a second experiment we measured the sensitivity to the relative disparity between two rectangular (2×8 degrees) patches of random dots.