It is possible that what the observer initially learns is a strategy of vergence movements to bring disparate portions sequentially into register. As the observer becomes more skilled, overt eye movements are eliminated and the 'perception' of global stereopsis may simply involve a subliminal activation of the 'phase sequence' of sensory and motor elements that were originally driving the vergence system. This is equivalent to saying that vergence is replaced by 'cortical shifts' or that the Panum areas are permanently 'extended' by training. This line of reasoning is similar to that used by Hebb[6] to explain form perception.

Visual memory is generally invariant with respect to location in the visual field[7,8]; some authors have pointed out analogies between holograms and memory and suggested that the brain may store spatial Fourier transforms of visual inputs[9]. From my finding, however, that stereo learning is position specific, as well as from the observations of Wallach and Austin[10], it may not be too fanciful to suggest that at least some forms of visual memory are encoded and stored in specific brain areas in such a way as to become unavailable to neighbouring areas.

There is obviously considerable scope for further experiments in this field. Most conventional learning paradigms—such as massed compared with distributed practice, 'forgetting', relearning, and so on—could be fruitfully studied using Julesz patterns as stimuli. Such studies could provide novel insights into mechanisms underlying perceptual memory and learning.

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Counter-intuitive property of effective population size

CONSIDER an organism with both autosomal and X-linked loci. The effective population sizes for an autosomal (N_{ea}) and an X-linked (N_{es}) locus can be shown[1] to be

$$N_{ea} = 4MF/(F+M) \tag{1}$$

$$N_{es} = 4.5MF/(F+2M) \tag{2}$$

where M and F are, respectively, the numbers of reproducing males and females in a random-mating population.

The ratio of the X-linked effective population size to that for autosomal loci is, from equations (1) and (2)

$$N_{es}/N_{ea} = 9(F+M)/8(F+2M) \tag{3}$$

From (3), X-linked loci have only 75% of the effective population size that autosomal loci have when males and females are equally abundant, and the discrepancy increases when males outnumber females, as seems intuitively obvious. When there are seven females for every male, however, the two types of loci have the same effective population size; when the proportion of females is increased further, X-linked loci have the greater effective population size. The asymptotic values approached by the ratio N_{es}/N_{ea} are 9/8, as the number of

females per male increases, and 9/16, as the number of males per female becomes infinitely large.

The biological significance of the above observation is hard to evaluate, but two points can be made. First, many insects, particularly parasitoids, have extremely female-biased sex ratios, and these species are mostly male haploids[2]. Second, it is now possible to test the influence of effective population size on genic diversity, in that preliminary evidence[3] indicates that male haploid and X-linked loci have fewer polymorphisms than autosomal loci. If this difference is general and effective population size differences are the major cause for it, then it should be still greater in male-biased male diploids, but in highly female-biased such species' X-linked loci should be more polymorphic than autosomal ones.

I thank the referee for suggesting inclusion of the asymptotic values.

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Geography of photoperiodic response in diapausing mosquito

IN temperate latitudes, many arthropods rely on photoperiod to cue their seasonal development. Although the relationship between critical photoperiod and latitude is well illustrated, that between critical photoperiod and altitude remains obscure[1,2]. I wish to consider photoperiodic control of dormancy in the pitcher-plant mosquito, *Wyeomyia smithii*, and quantify the relative effects of altitude and latitude on the photoperiodic response of an organism.

W. smithii is found from the Gulf coast to Labrador and northern Manitoba[3–6] where it confines its breeding site to the water-filled leaves of a single species of plant, *Sarracenia purpurea*. The larvae overwinter in the pitchers in a state of developmental arrest. Short days evoke and maintain, while long days avert or terminate this diapause[7,8]. The photoperiod which promotes 50% development and initiates or maintains 50% diapause is known as the critical photoperiod[2,7,9,10]. In *W. smithii*, the critical photoperiod is the same for the initiation and termination of diapause among larvae reared in the laboratory and for the termination of diapause among larvae collected during early autumn[7]. I have collected larvae north of 38°N latitude only during the autumn (autumn larvae) and south of this latitude only during the winter (winter larvae). I packed the autumn larvae in ice on the day of capture and maintained them on ice until they reached the laboratory where I stored them in an ordinary refrigerator at 4 ± 2 °C until the start of experiments. All experiments were begun within 45 d of capture. Since the winter larvae received unknown chilling in nature which might have affected the critical photoperiod[11,12], I reared them in the laboratory and determined the critical photoperiod for the initiation of diapause in the F_1 generation. Whether considering the maintenance of diapause among autumn larvae or the initiation of diapause among the F_1 of winter larvae, I exposed them to a range of LD 10 : 14 to LD 17 : 7 in 30-min increments at 25 ± 1 °C. Rearing procedures and the criteria for diapause and development were the same as in previous studies[7,13].

I determined the critical photoperiod for 22 populations