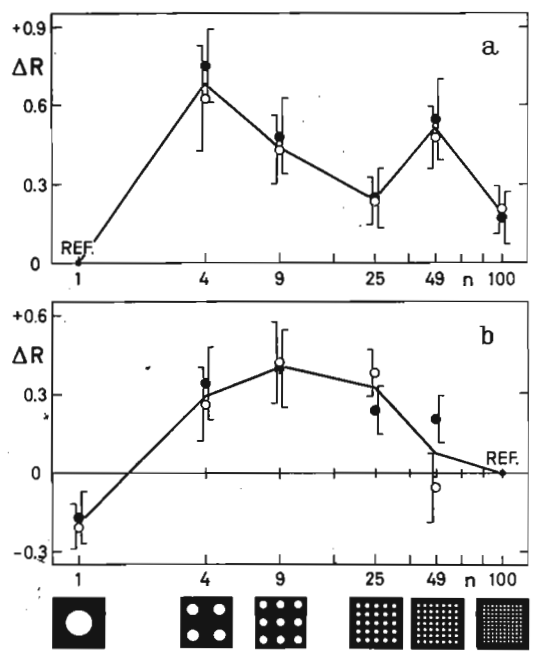
Götz, K.G. Max-Planck-Institut für biologische Kybernetik, Tübingen, Germany. Spontaneous preferences of visual objects in Drosophila.

Spontaneous preferences in a choice between two visual objects were established by the following experiments with Drosophila melanogaster. The test fly was allowed to walk for several hours on top of a ball, where it was maintained in stationary position and orientation to a 5x5 cm pattern on either side. The patterns were presented on a dark background in 10 cm distance to equivalent anterior regions of the left and the right eye. All patterns were equal with respect to the area and the luminance of the bright objects. The fly was mounted to a minute sledge, which prevented flight and monitored the translatory and rotatory displacements to a servo system. The servo system counteracted the displacements by appropriate rotations of the ball, which were then further evaluated.



The preferences ΔR in the two diagrams denote the revolutions per meter pathlength, which are made by the flies in the direction toward the n dots of the selected pattern if either 1 dot (a) or 100 dots (b) are used as the reference pattern. The means and the standard errors refer to experiments with 183 flies, which covered a distance of 7549 meters on top of the tread compensator. The following can be derived from the data:

1. The preference reaches a maximum at about n=4. The subsequent decrease correlates with the limited acuity of the visual system.

2. The spontaneous preferences are scarcely different during the initial (o) and the final (•) time period of the experiments.

3. The curves a and b coincide within the limits of error if allowence is made for the different origin of the ordinates. The third observation suggests that the additivity of the preferences is roughly accomplished in the present set of patterns. This is to say that the equation $\Delta R_{AB} + \Delta R_{BC} = \Delta R_{AC}$ holds for any three patterns A, B and C of the set. The underlying process of pattern discrimination appears to be simple, whenever the additivity of the preferences is established. Additivity cannot be expected if the spontaneous preference is a function of two or more independently variable parameters of the visual objects.

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In selection experiments with eyeless Drosophila melanogaster (ey^2) the frequency of flies with one or both eyes absent declines with increasing age of culture, (Guthrie 1925; Morgan 1919; Spofford 1956; Chester 1969). Morgan (1929) proposed this effect was due to an alteration of the medium by the larvae.

Hunt and Burnet (1969) found deficiencies of thiamine to produce a significant increase in eye size in ey^2 flies. However, Sang and Burnet (1963, 1964) observed that shortages of folic acid and biotin produced significant reductions of eye size, and that eye size increased with increasing amounts of caesin and RNA (up to 0.1%) in the diet.

These results of Sang and Burnet appear contradictory to the selection experiment results where possible medium deficiencies with culture age produce increases in eye size. Therefore, the following experiments attempt to resolve this apparent contradiction of results.

For the first experiment, eggs were collected within two hours of being laid by eyeless^2 flies from stocks which had been subjected to selection for eyeless expression for twelve generations. The eggs were placed in three sets of tubes of yeasted medium - one set containing 300-350 eggs per tube, another set containing 100-120 eggs per tube, while the third set con-