WORTH'S THREE DEGREES OF FUSION

The Synoptophore is a haploscope that allows you to present separate slides to each eye in order to test and train various aspects of binocular vision. To test **sensory fusion**, pairs of **dichoptic** slides are presented to each eye. Controls on the instrument allow you to adjust the brightness of each eye's image, and they can be flashed together, separately, or alternately. To test **motor fusion**, it is possible to vary the horizontal, vertical and cyclo position of each eye's slide separately or together. The purpose of this exercise is to familiarize you with Worth's three degrees of fusion, which we studied in class. Table 3 summarizes the Worth's three degrees of fusion.

Table 3. Worth's three degrees of fusion.

Worth degree	Sensory fusion	Comment
0	none	suppression
1	simultaneous perception	diplopia, confusion or superposition
2	flat fusion	motor fusion maintains flat fusion when BI or BO is added.
3	stereopsis	ultimate binocular fusion (motor and sensory).

EXERCISE 2.

1. Test the various controls to see how they alter the stimulus presented to each eye. Notice which controls are designed to affect sensory fusion, and which are designed to test motor fusion.

2. Adjust the PD and set the Synoptophore for distance viewing of an object at infinity. The horizontal, vertical and cyclo position of each eye should be adjusted appropriately. Insert one pair of slides from Group A and view them binocularly. Repeat for the other slides in this group and notice their design features. What degree of sensory fusion do these slides stimulate?

Worth Grade 1. Two different targets with no common features.

3. Insert and view a pair of slides from Group B. What are the common design features of these slides that are different from the previous group? What degree of sensory fusion do these slides stimulate? While maintaining fusion, adjust the convergence and diverge until the person sees double. As you increase convergence or divergence, do you notice any apparent change in the size of the images?

Worth Grade 2. These slides have common features that can be fused, as well as something that is unique to each slide. This lets you detect suppression of either eye. You should note that the image appears to get smaller as the eyes converge (small-in, or SI), and larger as the eyes diverge (large-out, LO). This is referred to as the SILO effect. It is a size-constancy illusion, similar to the moon illusion. Your eyes normally converge as an object gets closer. Retinal image size usually gets bigger, but your brain compensates and the perceived size remains constant. Since the Synoptophore image stays the same, but your brain still compensates, it appears to get smaller. The opposite happens for divergence.

4. Insert and view the slides from Group C. What are the common design features of these slides that are different from the previous group? What degree of sensory fusion do these slides stimulate?

Worth Grade 3. Not only are there common fusible features, but come of the common features within the image are slightly offset to create disparity between the two images.