

Posted with permission of the American Academy of Optometry:

A. Lit and A. Hyman

"The Magnitude of the Pulfrich Stereophenomenon as a Function of Distance of Observation",

American Journal of Optometry and Archives of the

American Academy of Optometry,

Monograph No. 122 of November 1951, pages 1 - 17.

Copyright (c) The American Academy of Optometry

1951

AMERICAN JOURNAL OF OPTOMETRY
AND ARCHIVES OF
AMERICAN ACADEMY OF OPTOMETRY
November, 1951

MONOGRAPH

No. 122

THE MAGNITUDE OF THE PULFRICH STEREOPHENOMENON AS A FUNCTION OF DISTANCE OF OBSERVATION*

Alfred Lit† and Aaron Hyman‡
School of Optometry, Columbia University
New York, New York

SUMMARY

(1) The present experiment is concerned with a stereoscopic effect first described and analyzed by Pulfrich: an oscillating target appears to rotate out of its plane of oscillation when binocularly observed under conditions of unequal retinal illumination. The oscillating target appears nearer than it really is for one direction of stroke and farther than it really is for the return stroke. The apparent displacements are attributed to differences in the visual latent periods for the two eyes resulting from the differential retinal illumination. Geometric analysis of the theory of the Pulfrich effect allows for calculation of the corresponding latency differences when the near and far displacements in the vertical median plane are determined experimentally.

(2) The magnitudes of the apparent near and far displacements (C_N and C_F) and the corresponding latency differences (Δt_N and Δt_F), produced by differences in retinal illumination [expressed as $\log(I_L/I_R)$], are measured as a function of the distance of the oscillating target from the subject's eyes. Data are obtained for seven differences in retinal illumination between the two eyes produced at each of six distances of observation (d) ranging from 30 cm. to 150 cm.

(3) The apparatus used to obtain the data is described. It provides for an oscillating target which is free to execute constant linear motion in a frontal plane at any specified distance from the subject. The magnitude of the linear velocity varies with distance from the subject, but its angular velocity (18.91° per sec.) remains identical for all target distances. The angular extent of stroke of the oscillating target (20.5° of visual angle) and the angular size of the oscillating target (8.7 min. of arc) are maintained constant for all distances of observation. The angular extent of the rectangular field of view ($21.6^\circ \times 4.2^\circ$) remains constant at all observation distances.

(4) The obtained experimental results are consistent with those predicted from the theory and geometric analysis of the Pulfrich stereophenomenon: for any of the given differences in retinal brightness, the magnitude of the stereoeffect varies with distance of observation to produce a constant calculated latency difference. Minor discrepancies between theoretical and experimental results are discussed.

(5) A program of research is proposed, designed to determine the influence of several basic stimulus variables upon the magnitude of the stereoeffect. In addition to providing data for theories concerned with some of the most basic visual processes, the results of the proposed research program should offer many useful clinical and industrial applications.