RATE OF CHROMATIC ADAPTATION AS A FUNCTION OF HUE IN NEAR-MONOCHROMATIC GANZFELDS

A Thesis

Presented to

The Faculty of the Department of Psychology

The University of Texas at El Paso

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts in Psychology

---

by

Melvyn E. Kalich

May 10, 1971

UMI Number: EP00747

ProQuest Information and Learning Company
300 North Zeeb Road
P.O. Box 1346
Ann Arbor, MI 48106-1346

RATE OF CHROMATIC ADAPTATION

AS A FUNCTION OF HUE IN

NEAR-MONOCHROMATIC GANZFELDS

APPROVED:

Director of Thesis

APPROVED:

Dean, Graduate School

RATE OF CHROMATIC ADAPTATION
AS A FUNCTION OF HUE IN
NEAR-MONOCHROMATIC GANZFELDS

An Abstract
Presented to
The Faculty of the Department of Psychology
The University of Texas at El Paso

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts in Psychology

---

by
Melvyn E. Kalich
May 10, 1971

Rate of chromatic adaptation varied as a function of hue (wavelength) in near-monochromatic ganzfelds of equal luminance, 0.4 ft.-L. 3 hues were tested: red, 649 nm; green, 517 nm; and violet, 405 nm. 15 naive Os were randomly assigned to 3 equal size groups, with each member exposed to 1 hue for a maximum time of 900 sec. Mean log adaptation time for Os in each group was: red, 1.32737 sec.; green, 2.19381 sec.; and violet, 2.81859 sec. All combinations of differences between treatment pairs were found to be significant, $p < .05$. These data showed a significant linear regression. Although further research is suggested to determine the generalizability of these results, a fruitful line of research using these variables is strongly indicated.

Table of Contents

List of Figures

List of Tables

List of Appendixes

Acknowledgements

The author would like to express his gratitude to Don Farrer, Ph.D. and the staff of the Aeromedical Laboratories at Holloman Air Force Base, who loaned the University of Texas at El Paso much of the equipment used in this study.

The author wishes to express very special love and appreciation to his wife, Judy Kalich, for her immeasurable support and encouragement.

The encouragement, patience and guidance of James V. Devine, Ph.D. made this research possible. He commands this author's greatest respect and admiration.

Guido Barrientos, Ph.D., Phillip Himelstein, Ph.D. and Randolph Whitworth, Ph.D. have all shown personal warmth and exceptional competance that has provided an enduring model for this author.

Special thanks is extended for the cooperation and efforts of participants in this study.

Two areas of increasing importance in recent color vision research are: (1) the isolation and response characteristics of color receptor mechanisms; and (2) the nature and degree of independent behavior of these receptor mechanisms. Alpern (1965) and Alpern and Rushton (1965) found complete independence of visual mechanisms in the case of metacontrast (the after-flash effect). Using orientation identification of a 4-minute acuity grating, Brown (1968) was able to separate rod and cone function in dark adaptation curves based on blue and yellow targets of equal luminance (1500 mL.). He found no scotopic suppression of photopic processes.

The purpose of this paper was to suggest a technique for exploration of the above problem areas that may allow for much greater generalizability than previously obtained. The experimental environment used for this end was the ganzfeld, and the related methods subsumed under chromatic adaptation.

Chromatic adaptation is, minimally, a heading for visual processes that are hue-time dependent (Burnham, Hanes, and Bartleson, 1963). The processes subsumed under this heading are varied and complex. They include hue-time dependent changes in: sensitivity

(Jameson and Hurvich, 1953; Wright, 1936; Yager, 1969), brightness (Hochberg, Triebel, and Seaman, 1951), perceived spectral saturation (Avant, 1965; Hunt, 1949; Jacobs, 1967), and perceived spectral hue (Helson and Judd, 1932; Hunt, 1950; Jacobs and Gaylord, 1967; MacAdam, 1963).

The ganzfeld is one of several types of experimental environments that has been used in the study of chromatic adaptation (Cohen, 1957, 1958; Helson and Judd, 1932; Hochberg, Triebel, and Seaman, 1951). A ganzfeld is a homogeneous target with respect to radiant energy that is bounded by no more than the facial features of an observer (O). A chromatic ganzfeld is a target producing the sensation of hue (Cohen, 1957, 1958; Hochberg, Triebel and Seaman, 1951). Exposure of an O to a chromatic ganzfeld implies the exposure of a very large portion of an O's retina(s) to a distribution of radiant energy that is almost constant over time, independent of eye motion. This does not necessarily imply that the intensity distribution over an O's retina(s) is constant nor that the phenomenal effects are homogeneous. The Stiles-Crawford effect, structure of the eye, and O reports (Hochberg, Triebel and Seaman, 1951; Sheppard, 1920) would all suggest that the appearance of such a target would not be homogeneous.

There are five major advantages in the use of the ganzfeld in vision research: (1) the target does not have to interrupt normal functioning of the eye; (2) it is a very flexible experimental environment that can be readily modified and adapted to experimental needs; (3) effects of contour and eye motion can be minimized as experimental variables ("contour" refers to those measureable aspects of a target that cause it to be inhomogeneous); (4) it lends itself to exceptional control of stimulus variables; (5) visual processes can be determined with the entire retina illuminated in a well-defined manner.

While the first advantage is fairly self-explanatory (by the very nature of "target") and will become clearer in following discussion, the meaning of the second requires further explanation. There are many techniques that can be used to produce a ganzfeld: illuminated translucent eyecaps (Hochberg, Triebel, and Seaman, 1951; Weintraub, 1964), illuminated inner surface of a sphere (Cohen, 1957; Tepas, 1962); or diffused illumination using contact lenses in a manner similar to that used by Pritchard (1961). Equally important in ganzfeld flexibility is the ability to modify it by introducing contours in a well-defined, systematic way using the ganzfeld as a standard reference (Cohen, 1958).