

The Psychophysics of Visual Search

John Palmer

University of Washington

Preeti Verghese

Smith-Kettlewell Eye Research Institute

Misha Pavel

AT&T Labs West

Send Correspondence to:

John Palmer
University of Washington
Psychology, Box 351525
Seattle WA 98195-1525
206-543-0706
jpalmer@u.washington.edu

Keywords: search, attention, conspicuity, psychophysics, signal detection theory

Draft of 30 November 1998

Abstract

Two principles are used to develop a framework for theories of visual search, one empirical and one theoretical. The empirical is to focus on conditions at the intersection of visual search and the simple detection and discrimination paradigms of spatial vision. The theoretical is to focus on the distinction between high and low threshold theory. While high threshold theory is largely discredited for detection and discrimination, it survives in the search literature. We compare the predictions of high threshold theory and three versions of low threshold theory based on signal detection to the observed effects of manipulating set size, number of targets, discriminability, response bias, external noise, and distractor heterogeneity. For all cases allowing a test, the results are inconsistent with high threshold theory and are consistent with low threshold theory. In discussion, we consider generalizing these simple theories to account for search asymmetry, multidimensional judgments including conjunction search, response time, search with multiple eye fixations and more general stimulus conditions. To conclude, low threshold theories based upon signal detection theory can account for simple visual search without evoking mechanisms such as limited capacity or serial processing.