Analytic implementation of the guided search model allows comparisons to signal detection models in target-localization accuracy tasks

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In the last 10 years, models of visual search have moved away from the original serial/parallel search dichotomy (Treisman & Gelade, 1980). Recent work has been divided in broad terms into two groups. A first group of experiments measuring response times as a function of set-size have been consistent with a two stage model where a parallel system guides a serial search stage (guided search model; Wolfe, 1994). A second group of experiments measuring search accuracy in briefly presented displays has been quantitatively predicted by signal detection theory (SDT) based models that consist of noisy-parallel processing. These two types of models are fundamentally different; however, progress towards achieving a consensus in the field has been hampered by the difficulty associated with directly comparing these two models. Firstly, the two models have been developed for different experimental paradigms: SDT models for search accuracy and the guided search model for response time studies. Secondly, current implementations of the guided search models generate predictions with the use of computationally time-consuming Monte Carlo simulations, a method that precludes fitting the model quantitatively to human data.

We present an extension of the guided search model to generate predictions for a target localization accuracy task as a function of set-size. Our implementation consists of analytic mathematical expressions that allow quantitative fitting of the model (with four free parameters) to the human data in a time-efficient manner.

The development of explicit analytic expressions for the guided search model comparable to those for the SDT model will allow the direct and quantitative comparison of the ability of the two models to explain human search performance in target localization tasks.

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