Searching Visual Spaces

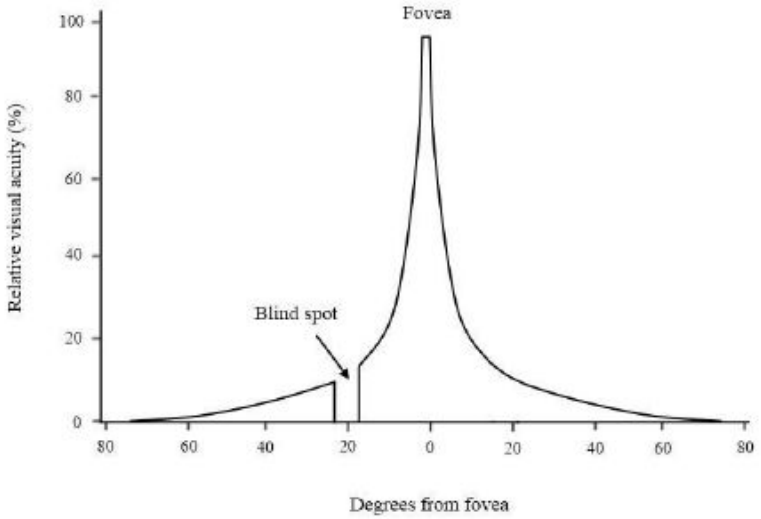
Cajal QABVR 2024

Visual acuity

Good visual acuity in humans is restricted to a limited range of the visual field.

> Fovea: 1 - 5 degrees of visual angle

That’s approximately size of your thumbnail held at arm’s length.



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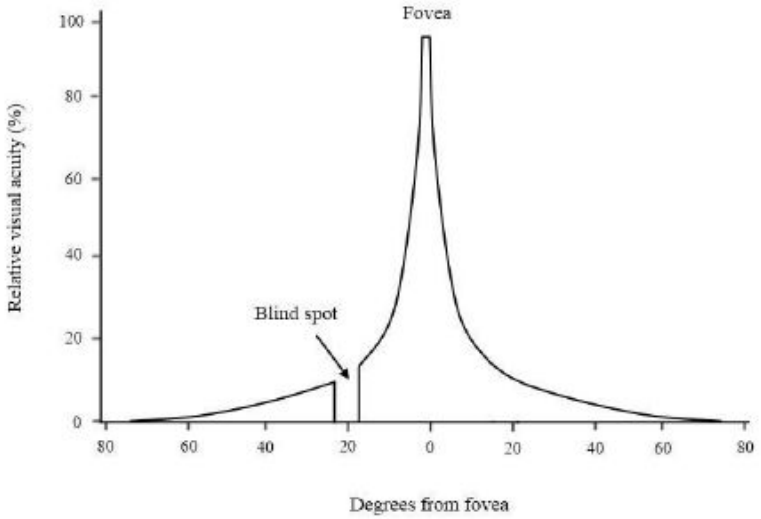
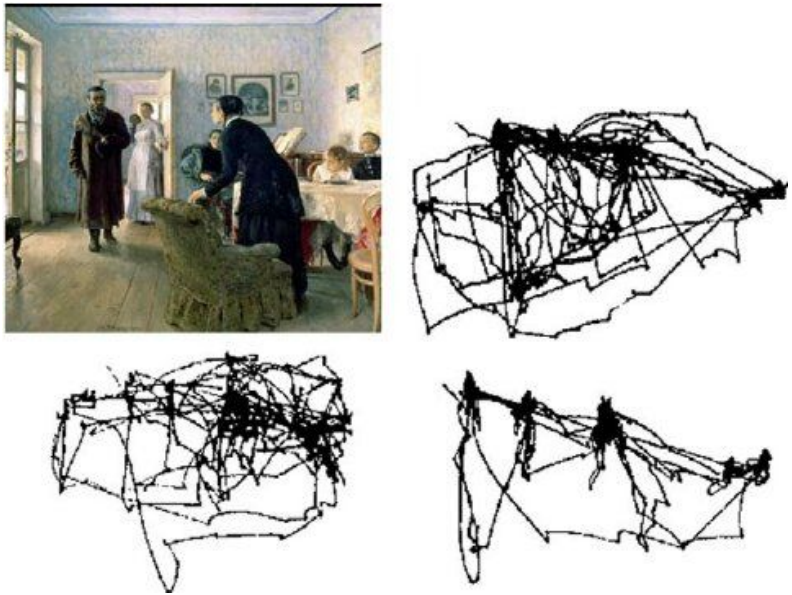


Visual search

Humans make **eye movements to sample visual information** from a scene in a **task-dependent** manner.



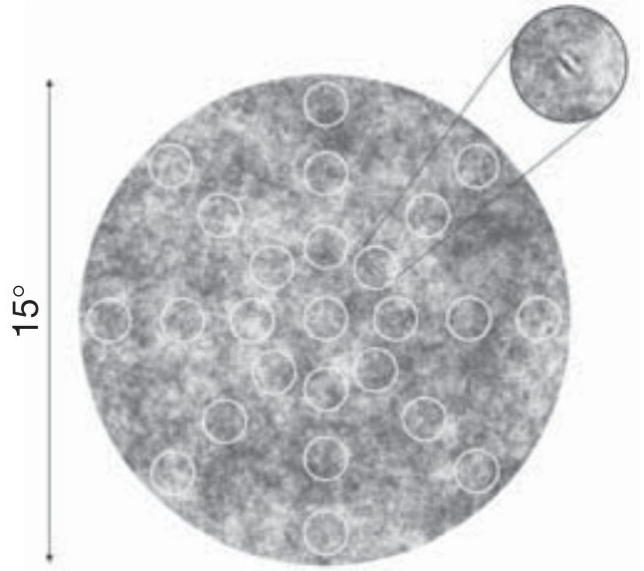
Yarbus (1967)

How do humans search for a target?

Today we will be performing and analyzing data from a visual search task.

Optimal eye movement strategies in visual search

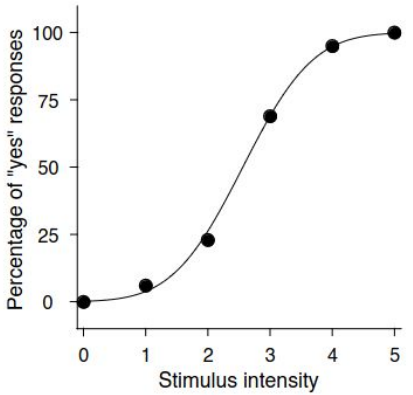
Jiri Najemnik & Wilson S. Geisler



Najemnik & Geisler (Nature, 2005)

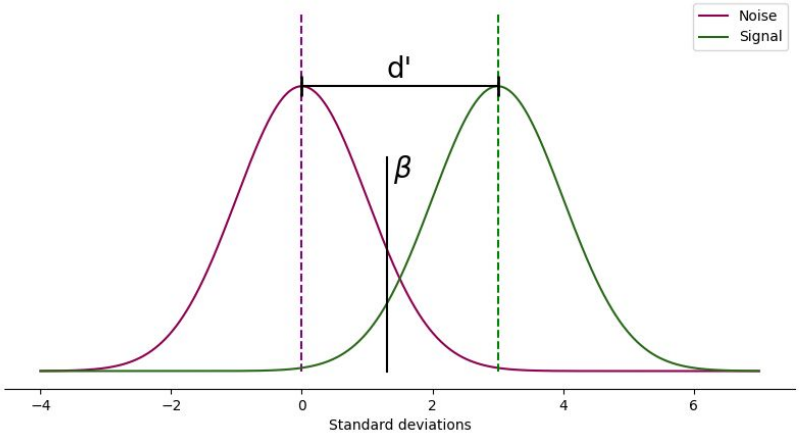
How do we know if a target has been seen?

Psychometric functions



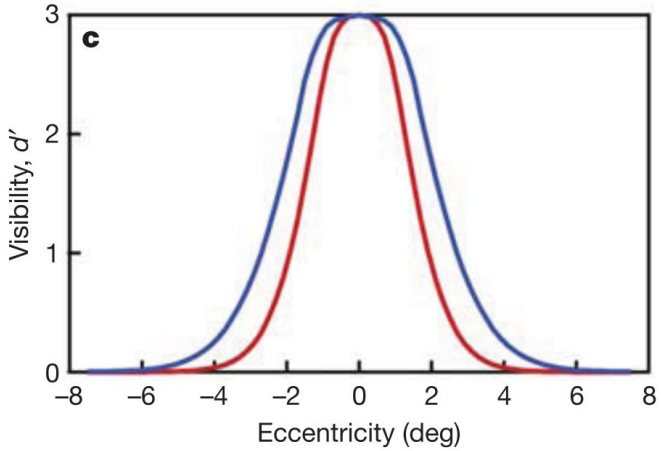
$$\psi = \gamma + (1 - \gamma - \lambda) \cdot F(x; \alpha, \beta)$$

Signal detection theory

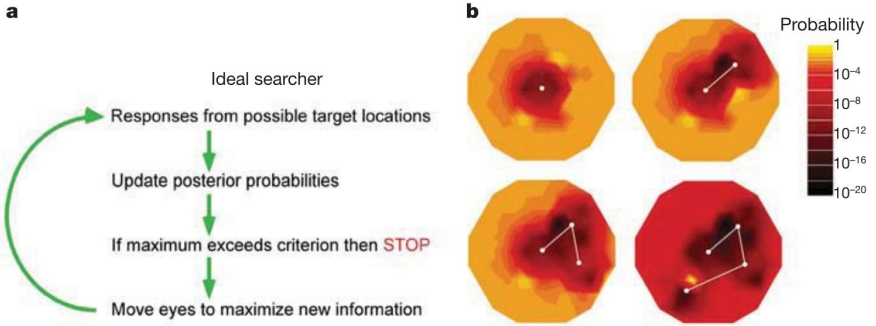


How do humans search for a target?

1) Extract a visibility map



2) Simulate a Bayesian searcher



3) Compare simulated searchers to your own data

Najemnik & Geisler (Nature, 2005)

Objectives

1) Analyze human visual search data and compare to a simulated searcher
    - Learn some basic psychophysics
2) Generate your own visual search data (PupilLabs eye tracker)

Bonus content:

- Learn how to build your own psychophysics experiment (Psychopy)
- Learn how to build your own eye tracker (Bonsai + Hugo)