

DATA VISUALIZATION

The Neurobiology of Vision, Color and Perception

HELLO THERE!

IF SEEING IS BELIEVING...



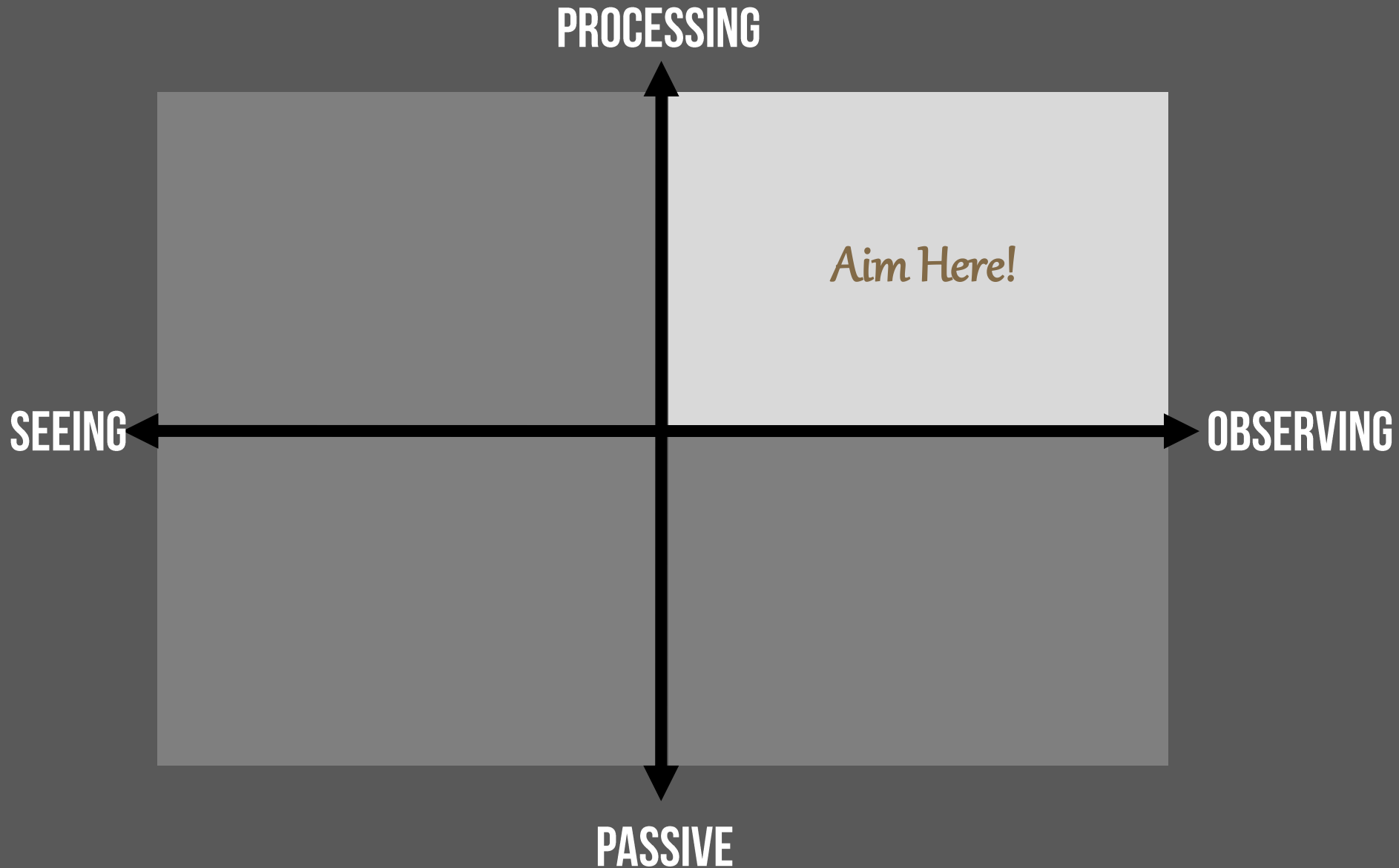
HOW DO WE SEE?

1 | **PHYSIOLOGY**

2 | **PSYCHOLOGY**

3 | **PERCEPTION**

TODAY'S LECTURE

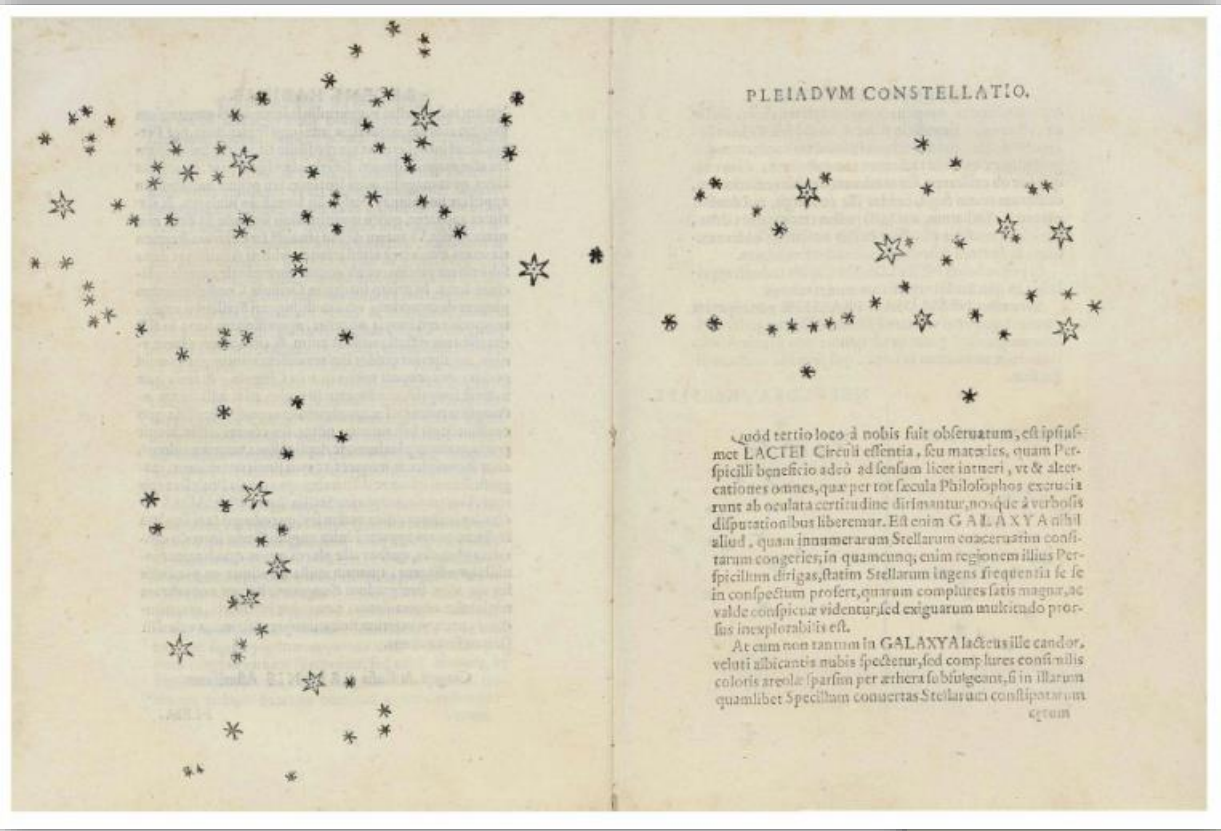


0 | FOUNDATIONS

2 3 4 5 6 7 8 9 1 2 3 4 5

1
10⁻³

WHY IS VISION IMPORTANT?



PLEIADVM CONSTELLATIO.



quod tertio loco à nobis fuit obseruatum, est ipsius-
 met LACTEI Circuli essentia, seu materies, quam Per-
 spicilli beneficio adeò ad sensum licet intueri, vt & alcer-
 cationes omnes, quæ per tot sæcula Philosophos exercua-
 runt ab oculata certitudine dirimantur, nosq; à verbolis
 disputationibus liberemur. Est enim GALAXYA nihil
 aliud, quam innumerarum Stellarum coacervatum confi-
 tarum congeries, in quamcumq; enim regionem illius Per-
 spicillum dirigas, statim Stellarum ingens frequentia se se
 in conspectum proferat, quarum complures satis magna, ac
 valde conspicua videntur, sed exiguarum multitudine pro-
 fus inexplorabilis est.

At cum non tantum in GALAXYA lætens ille candor,
 veluti albicansis nubis spectetur, sed complures consimilis
 coloris areolæ sparsim per æthera subiugent, si in illarum
 quilibet Spicillum conuertas Stellarum conspiciantur
 eorum

OBSERVAT. SIDEREAE

Ori * * * * * Occ.

Stella occidentalis maior, ambæ tamen valde con-
 spicua, ac splendida: vtraque distabat à Ioue scrupu-
 lis pennis duobus; tertia quoque Stella apparere cepit
 hora tertia prius minimè conspici, quæ ex parte
 orientali Iouem ferè tangebat, etatque admodum o-
 bliqua. Omnes fuerunt in eadem recta, & secundum
 Eclipticæ longitudinem coordinatae.

Die decimatercia primam à me quatuor conspice
 fuerunt Stellaræ in hac ad Iouem constitutione. Erant
 tres occidentales, & vna orientalis, lineam proximam



13 January

* * * * * Occ.

lineam; media enim occidentaliu pui-
 halum à recta Septentrionis vobis descendebar. Abo-
 ras orientalis à Ioue minoris diao; reliquarum, &
 Iouis intercapitales erant singule vnius tantum mi-
 nuti. Stellæ omnes eandem præ se ferebant magnitu-
 dinem; ac licet exiguum, latiditæque tamen erant, ac
 fixis eadem magnitudinis longispicidiores.

Die decimaquarta, hora noctis tertia in proximam
 lineam habundant quatuor Stellæ ad Iouem;



15 January

* * * * * Occ.

omnes; ac in eadem proximæ rectæ lineæ
 dispositæ; quæ enim tertia à Ioue numerabatur præ-
 bulum

sight

touch



computer network



USB key



hard disk

hearing/smell

pocket calculator



taste

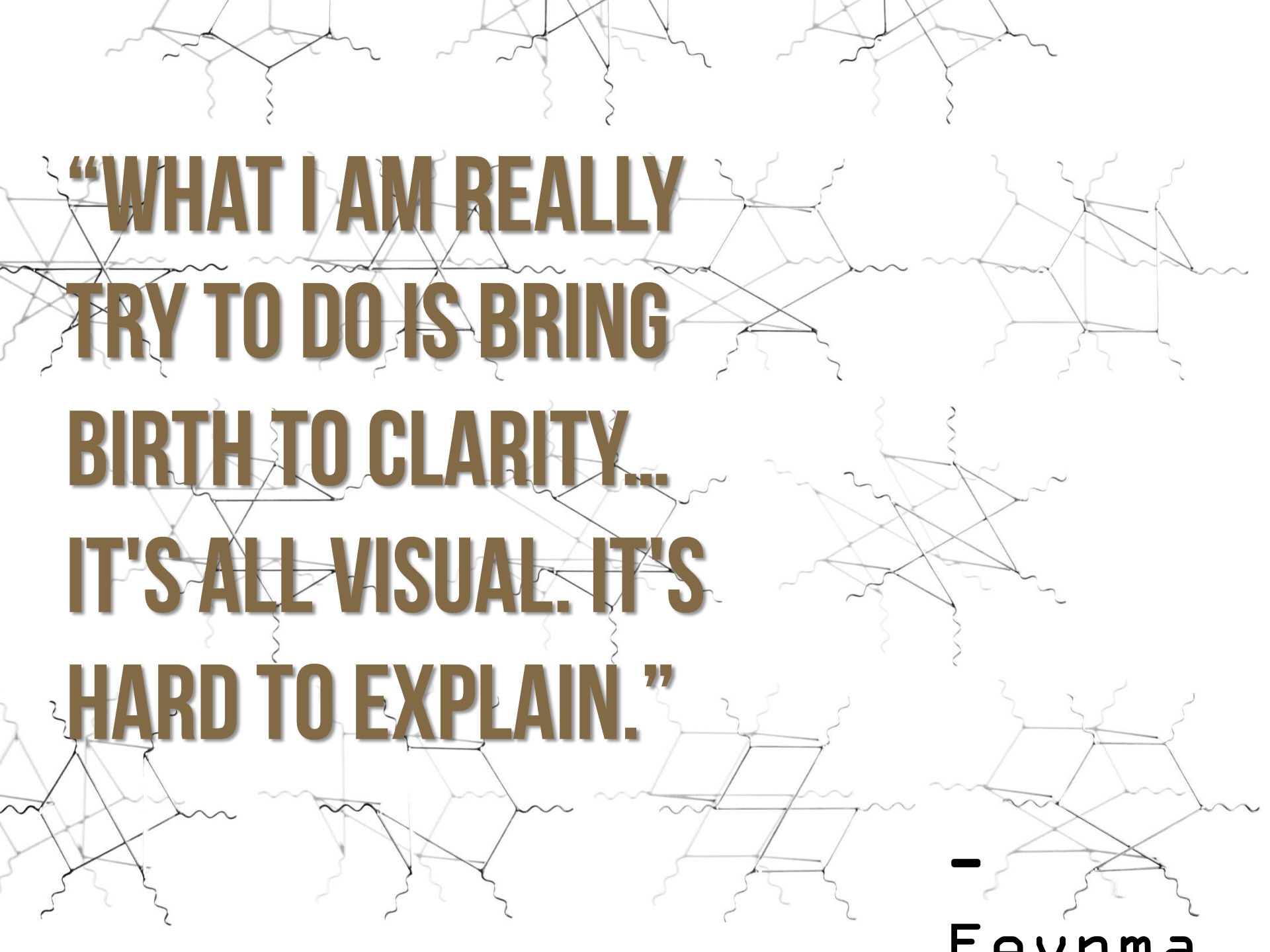
**“IF INFORMATION IS PRESENTED ORALLY,
PEOPLE REMEMBER ABOUT 10%... THAT
NUMBER GOES UP BY 65% IF YOU ADD A
PICTURE.”**

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PEOPLE REMEMBER ABOUT 10%... THAT
NUMBER GOES UP BY 65% IF YOU ADD A
PICTURE.”**



John Medina *



The background of the slide is filled with a repeating pattern of Feynman diagrams. These diagrams consist of solid lines forming various geometric shapes like triangles and hexagons, with wavy lines extending from the vertices, representing particle interactions in quantum field theory.

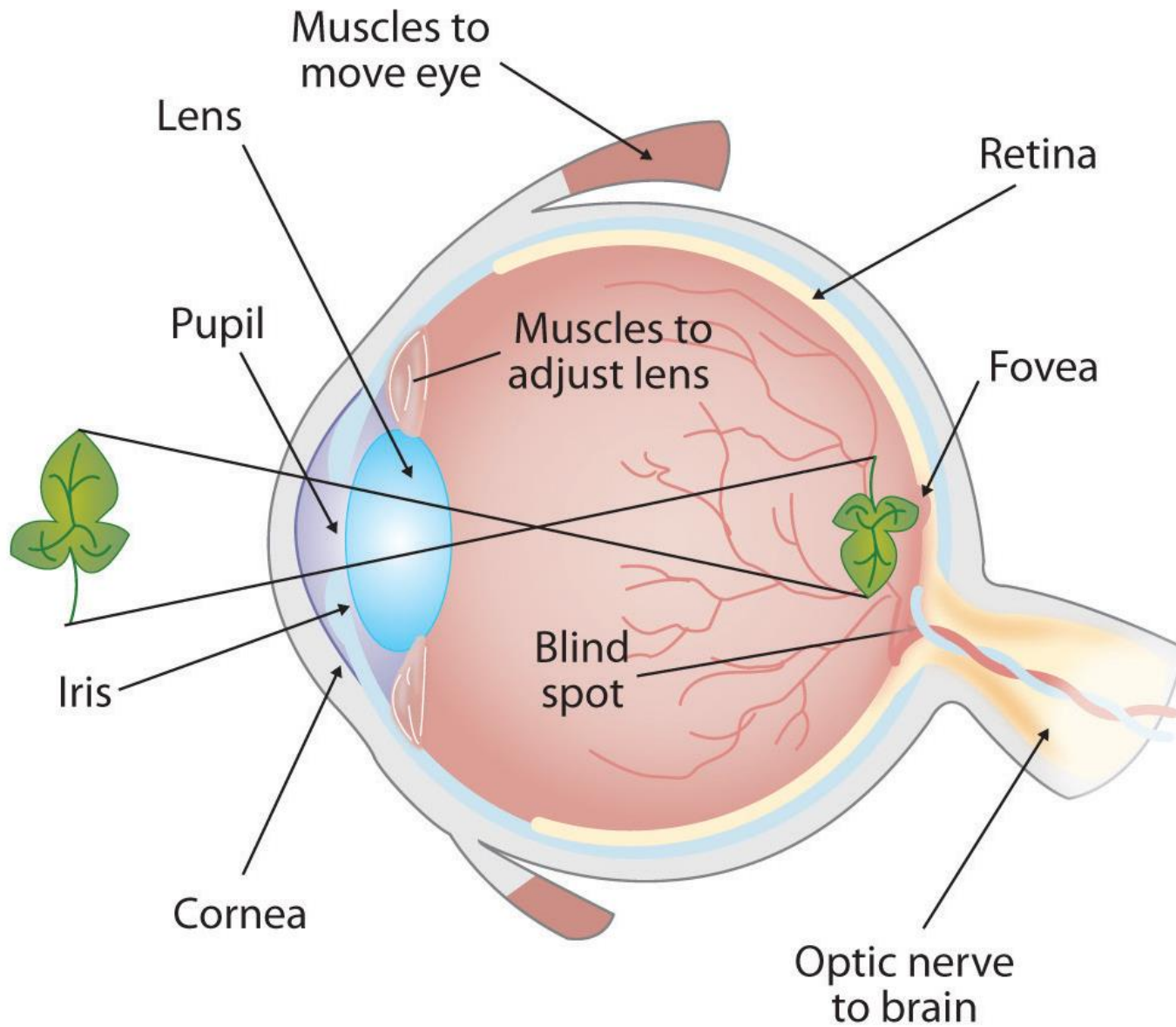
**“WHAT I AM REALLY
TRY TO DO IS BRING
BIRTH TO CLARITY...
IT'S ALL VISUAL. IT'S
HARD TO EXPLAIN.”**

-
Feynma

1 | PHYSIOLOGY



VISUAL BIOLOGY



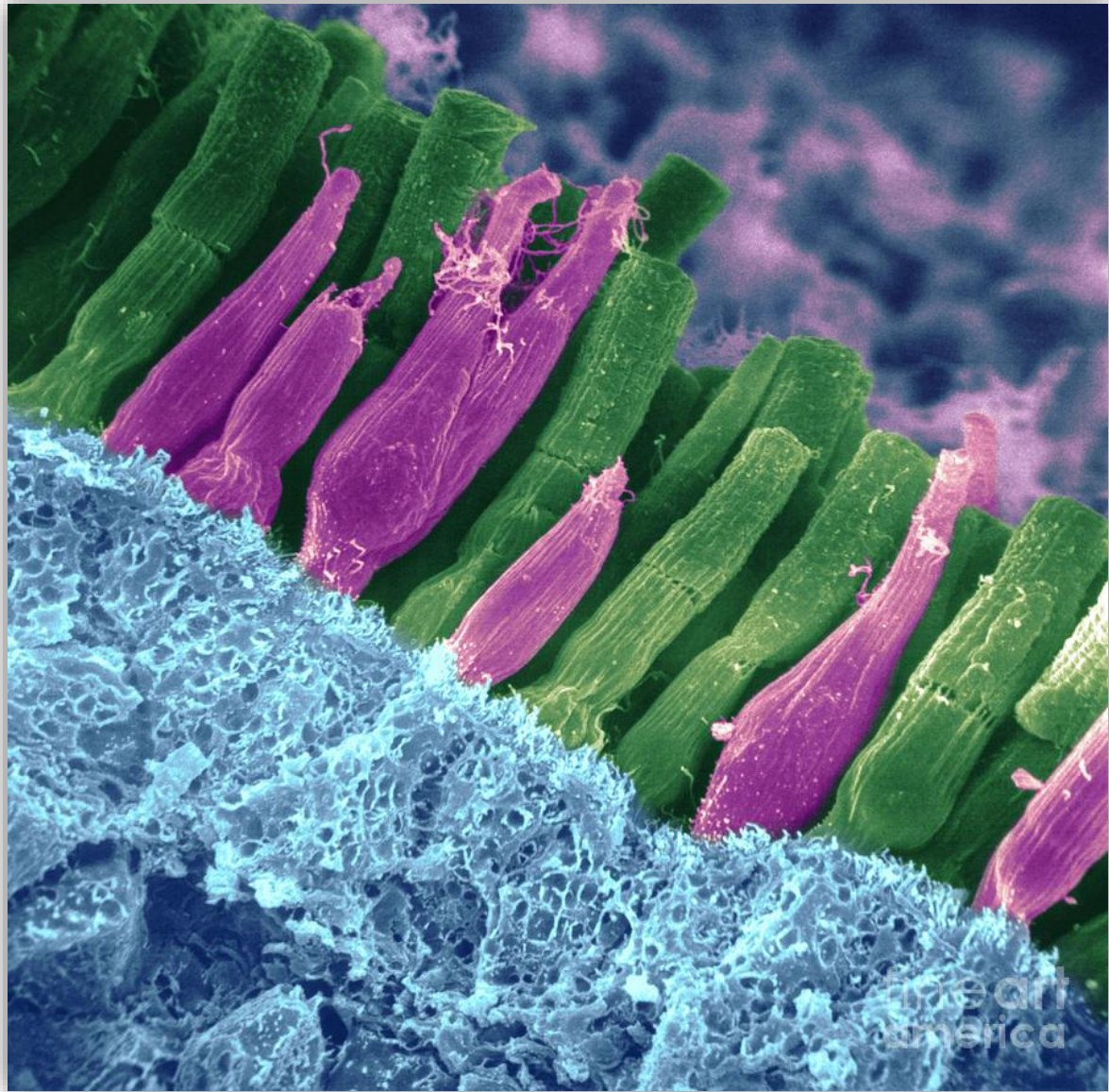
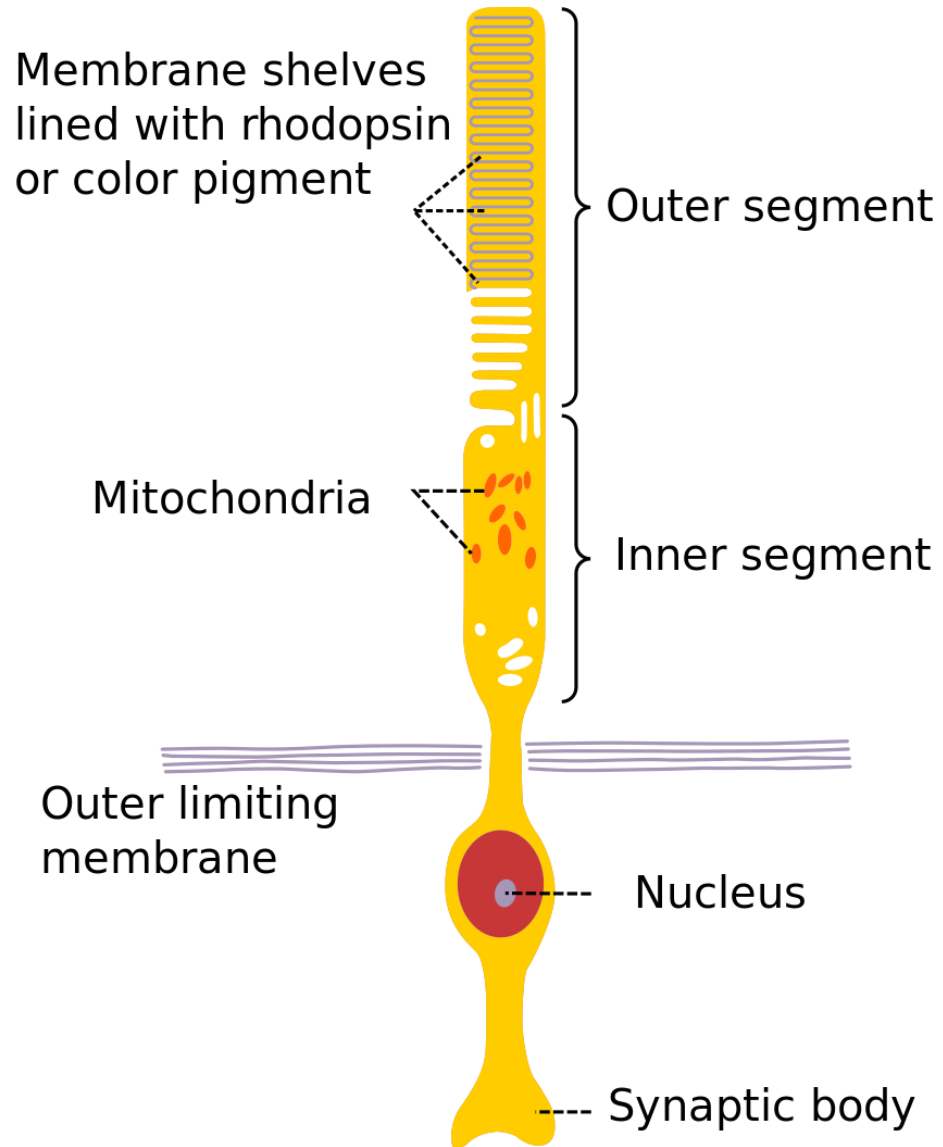
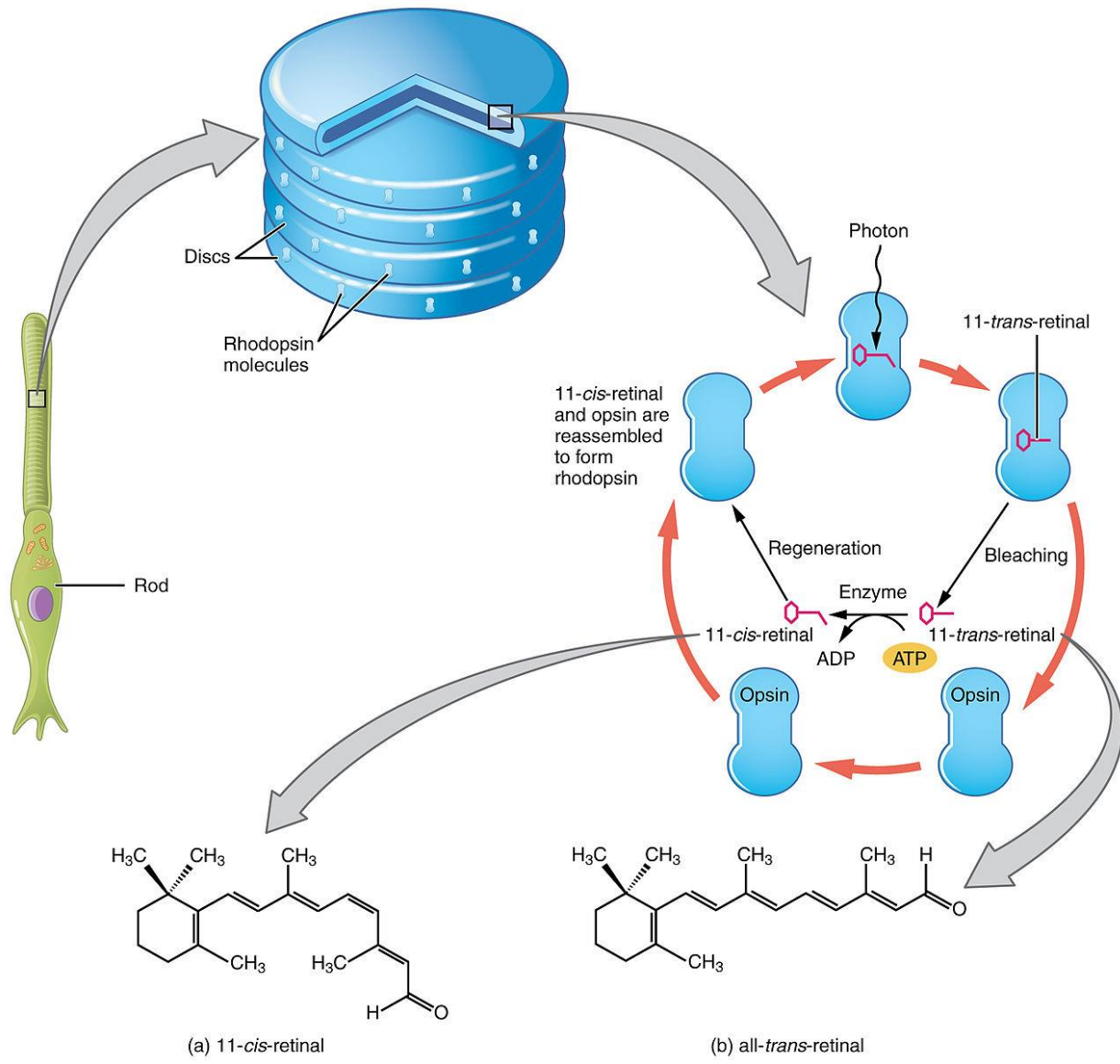
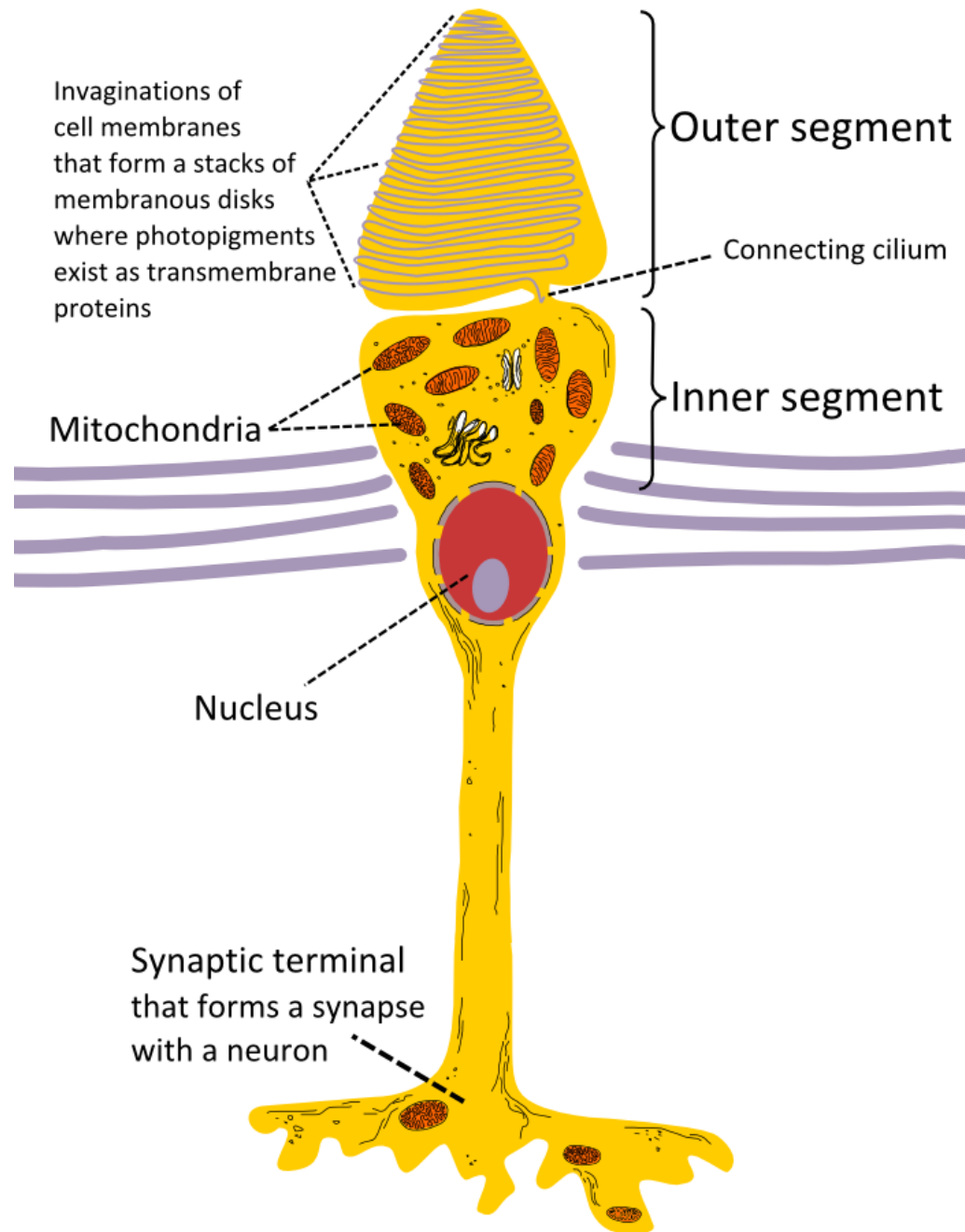
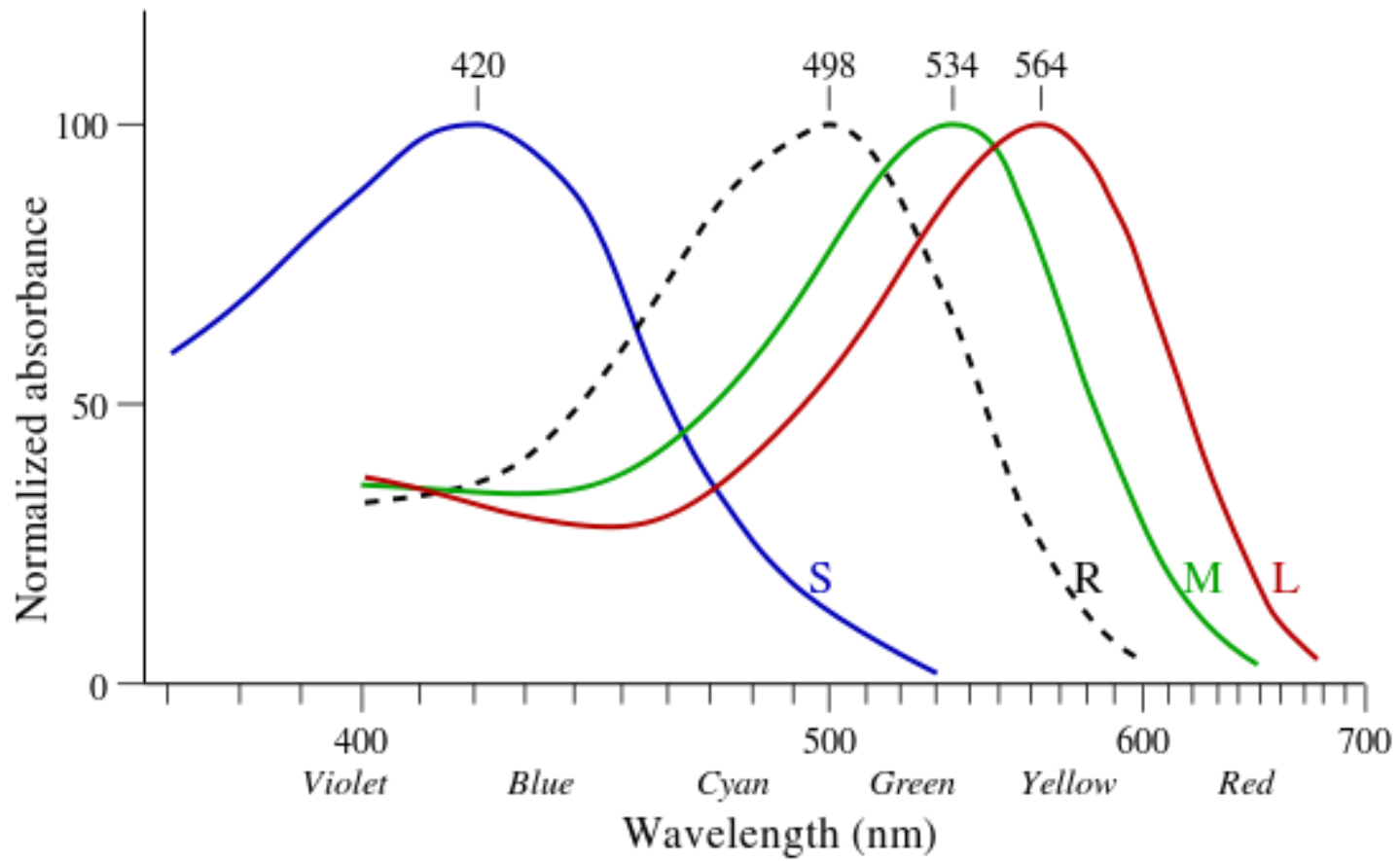


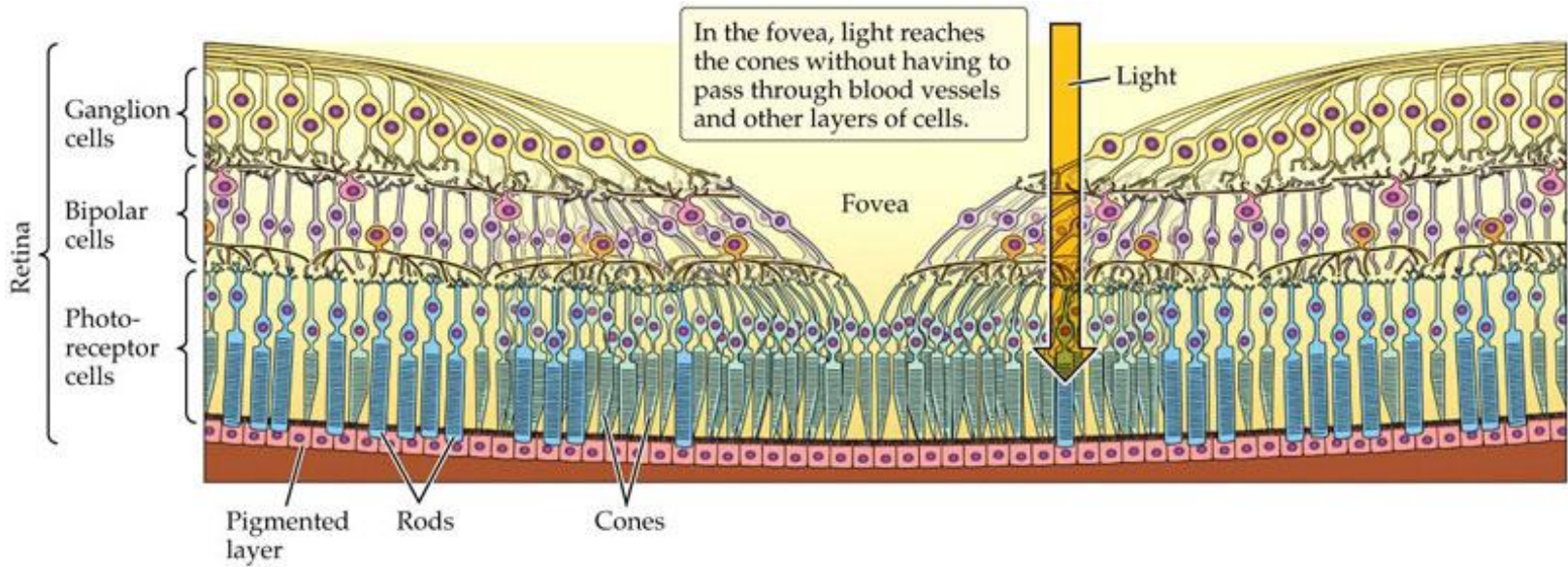
Image from [fineartamerica.com](https://www.fineartamerica.com)











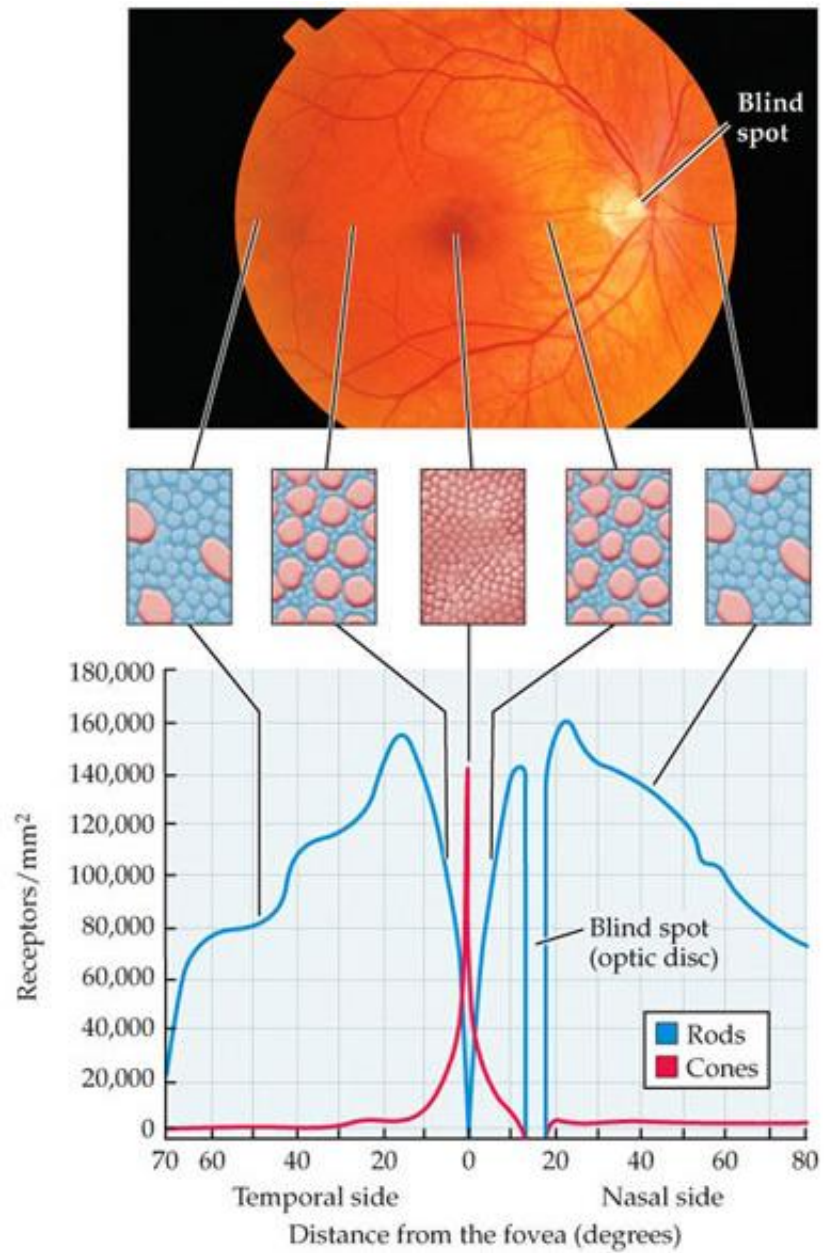
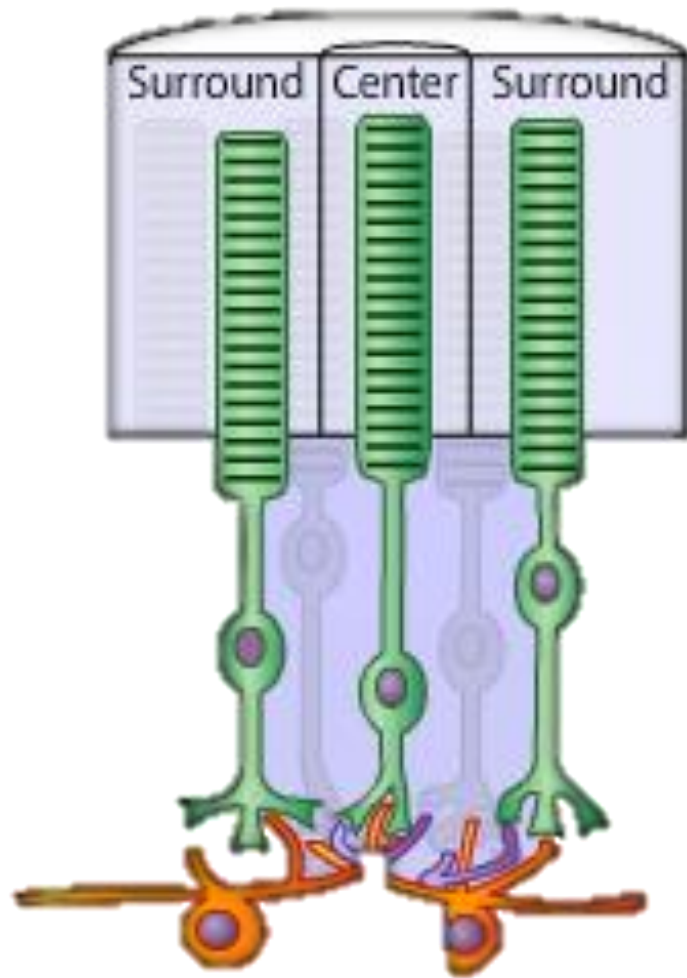
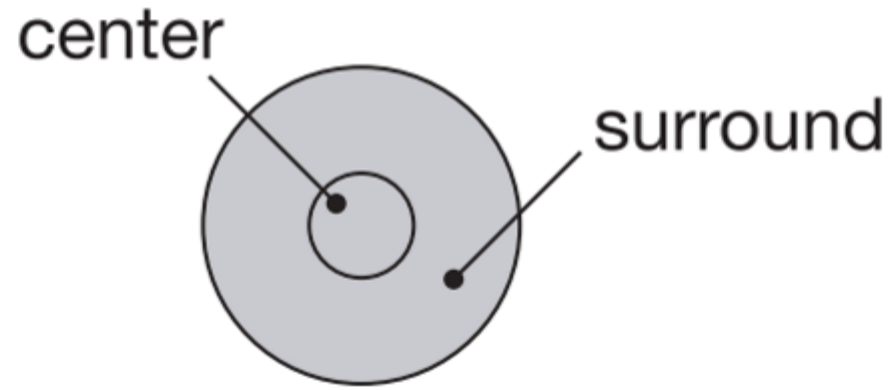
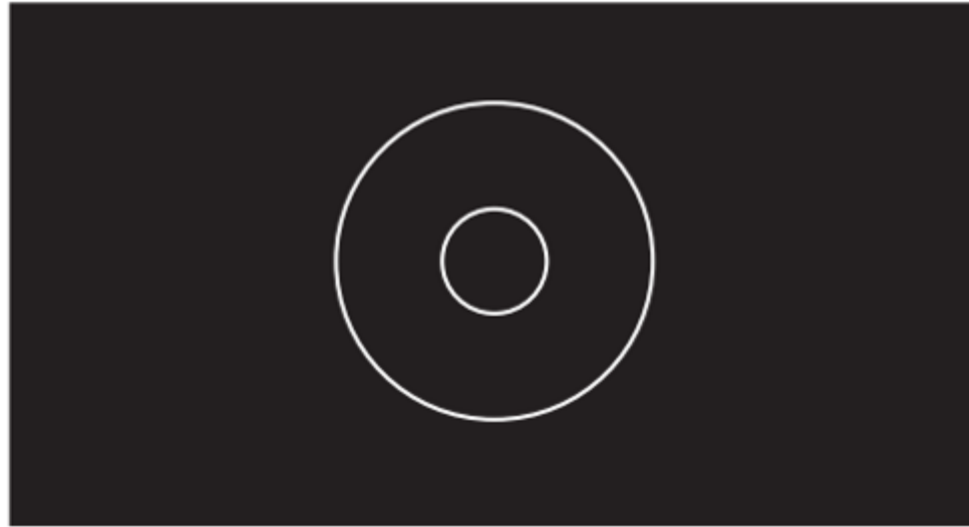


Image from Biological Psychology 7e, Breedlove & Watson

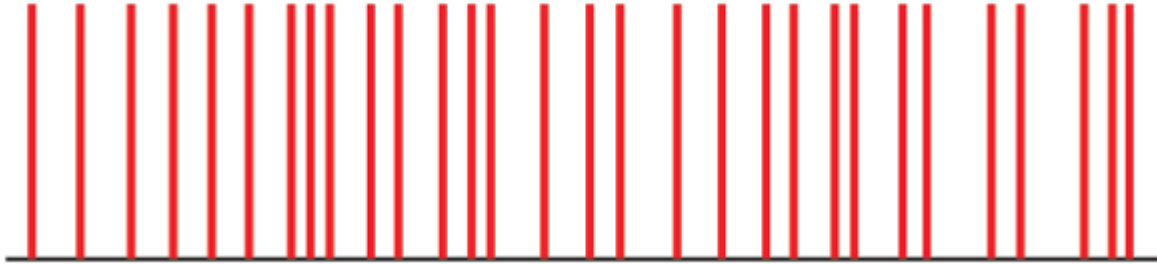




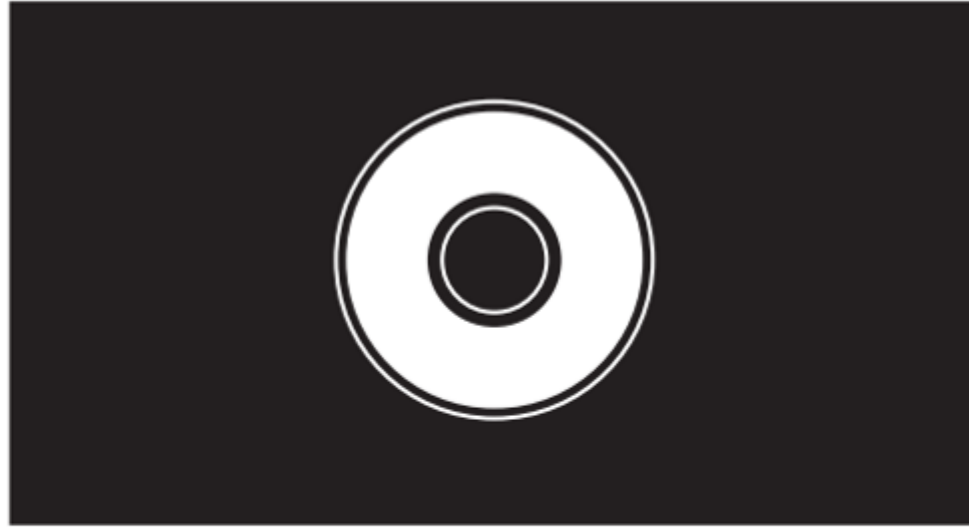
DARK



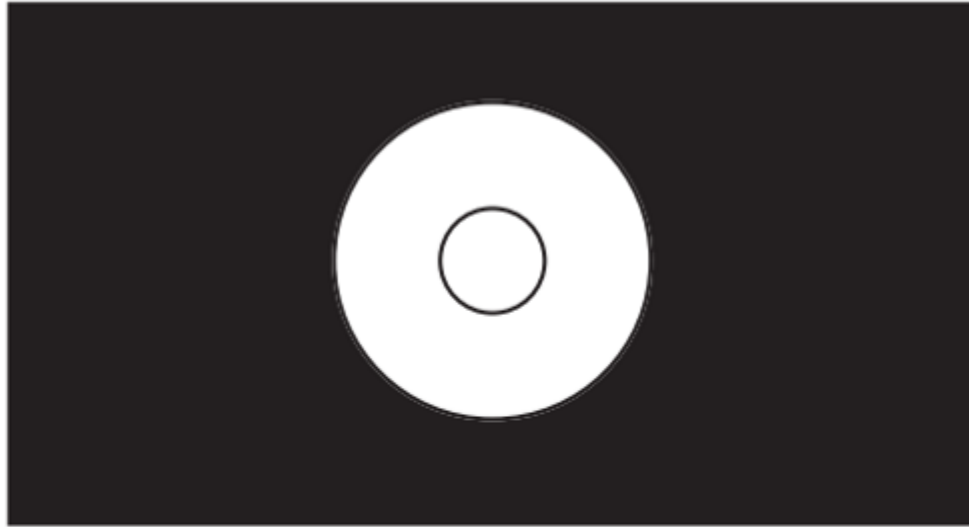
baseline rate



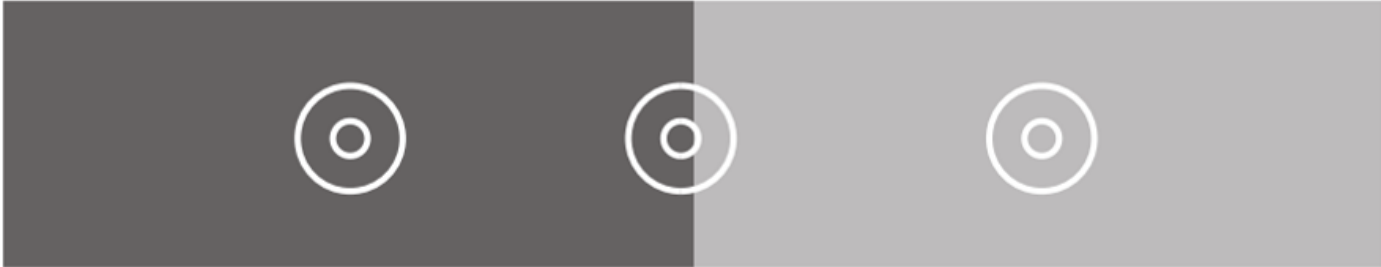
above baseline rate

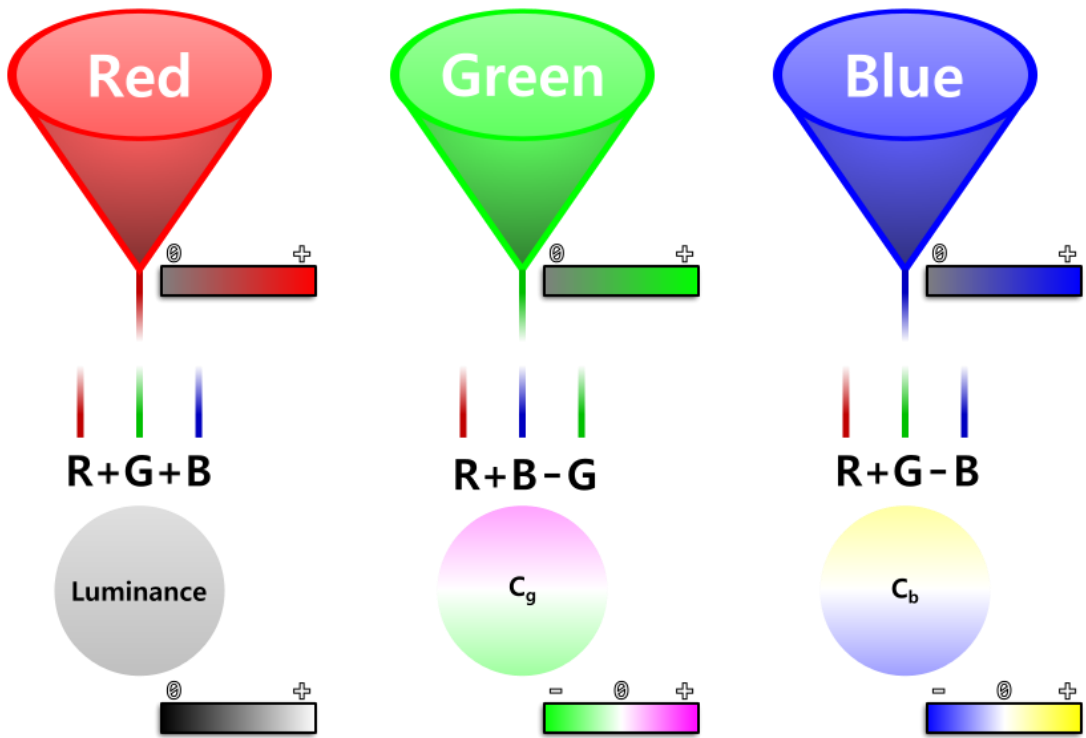


below baseline rate



baseline rate





1. Trichromatic Stage

Trichromatic cone cells respond positively to one of three frequencies exhibited by photons arriving on their surface.

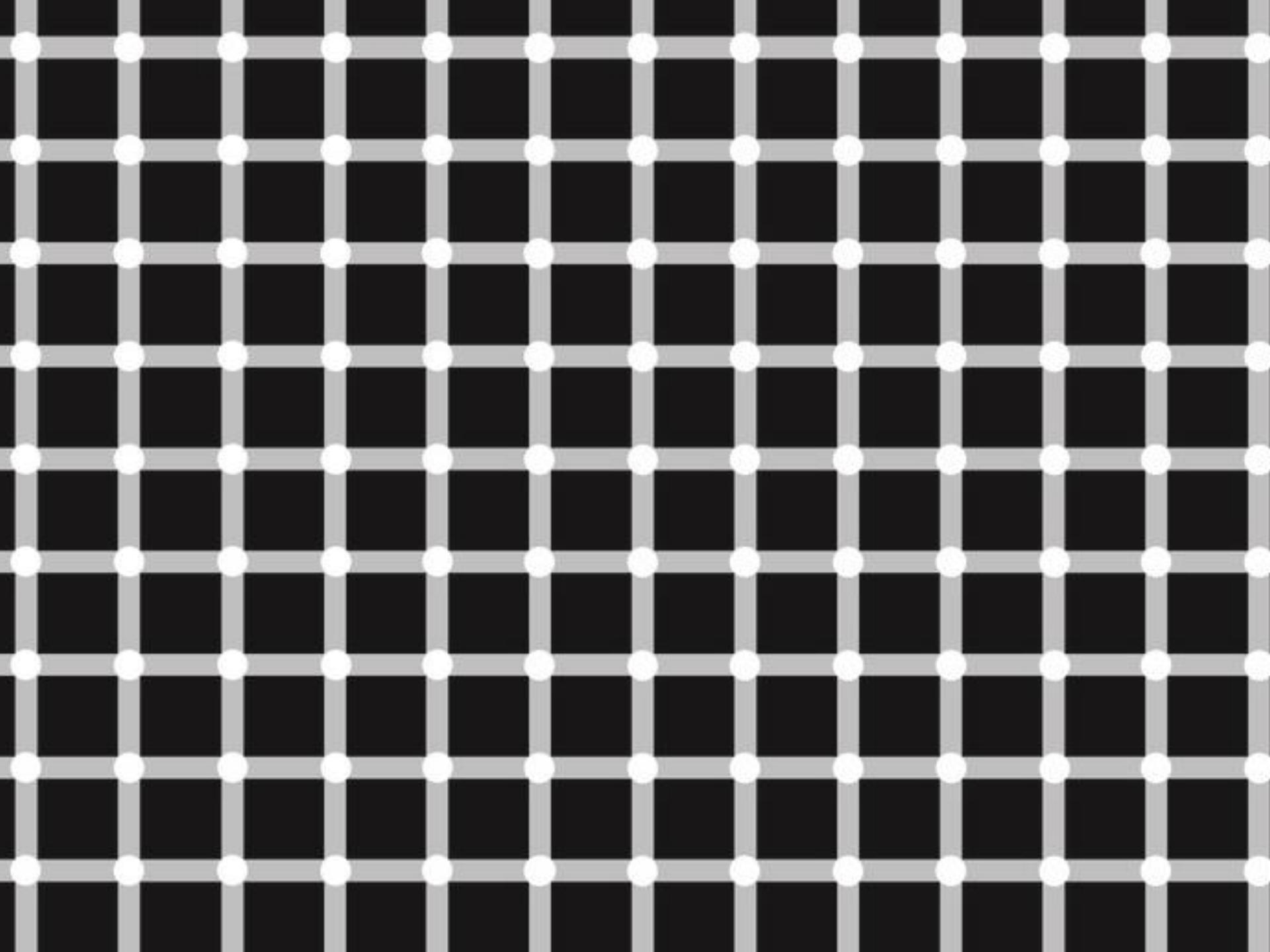
2. Opponent Process Stage

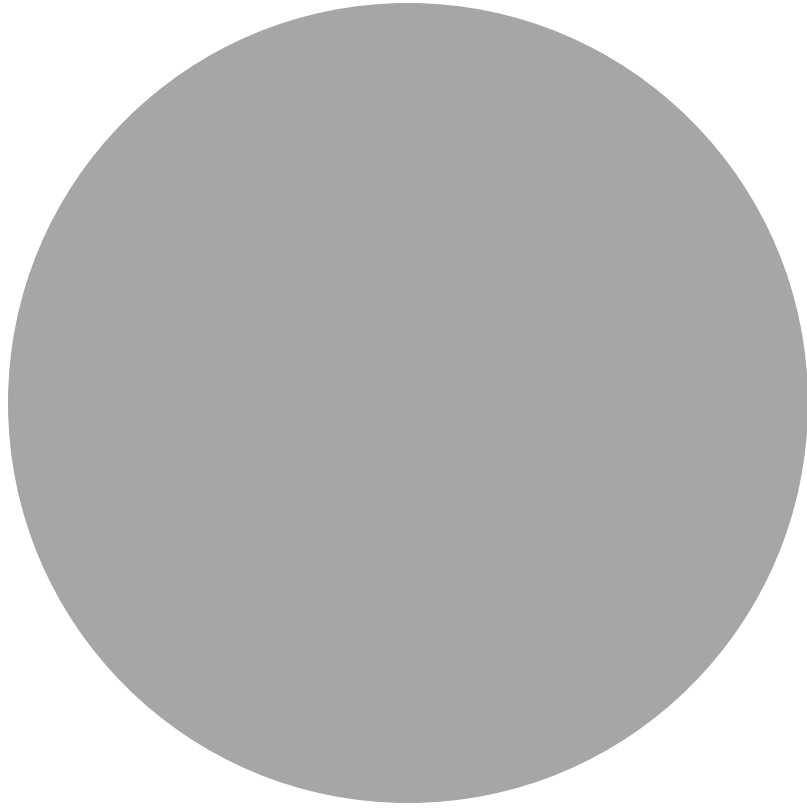
The three color channels are discovered by nearby opponent cells.

Opponent cells tuned to luminosity are excited by the red, green, and blue color signals.

C_g cells are excited by red and blue and inhibited by green. C_b cells are excited by red and green and inhibited by blue.

**EYES RESPOND TO
DIFFERENCES IN INTENSITY**







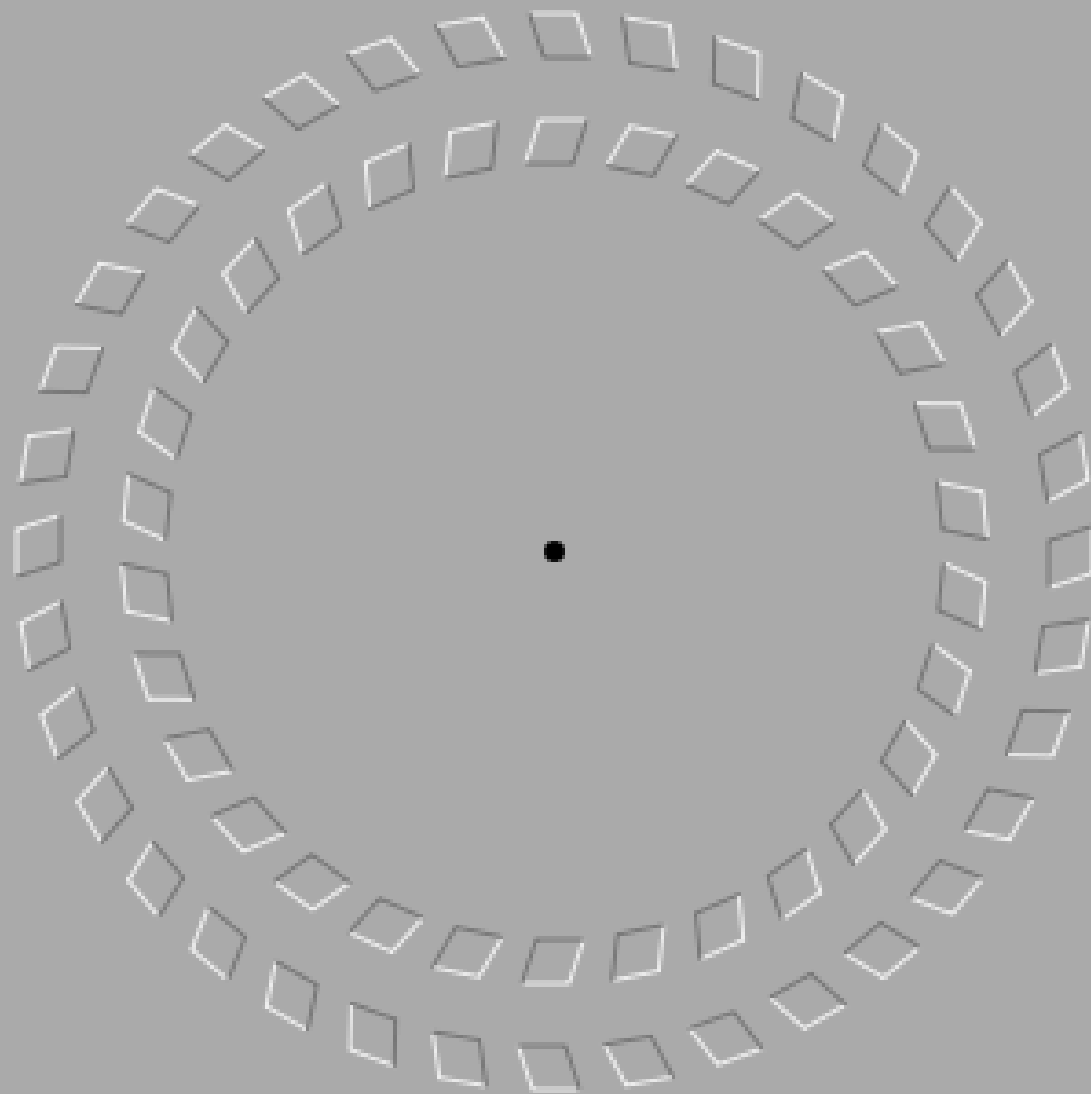
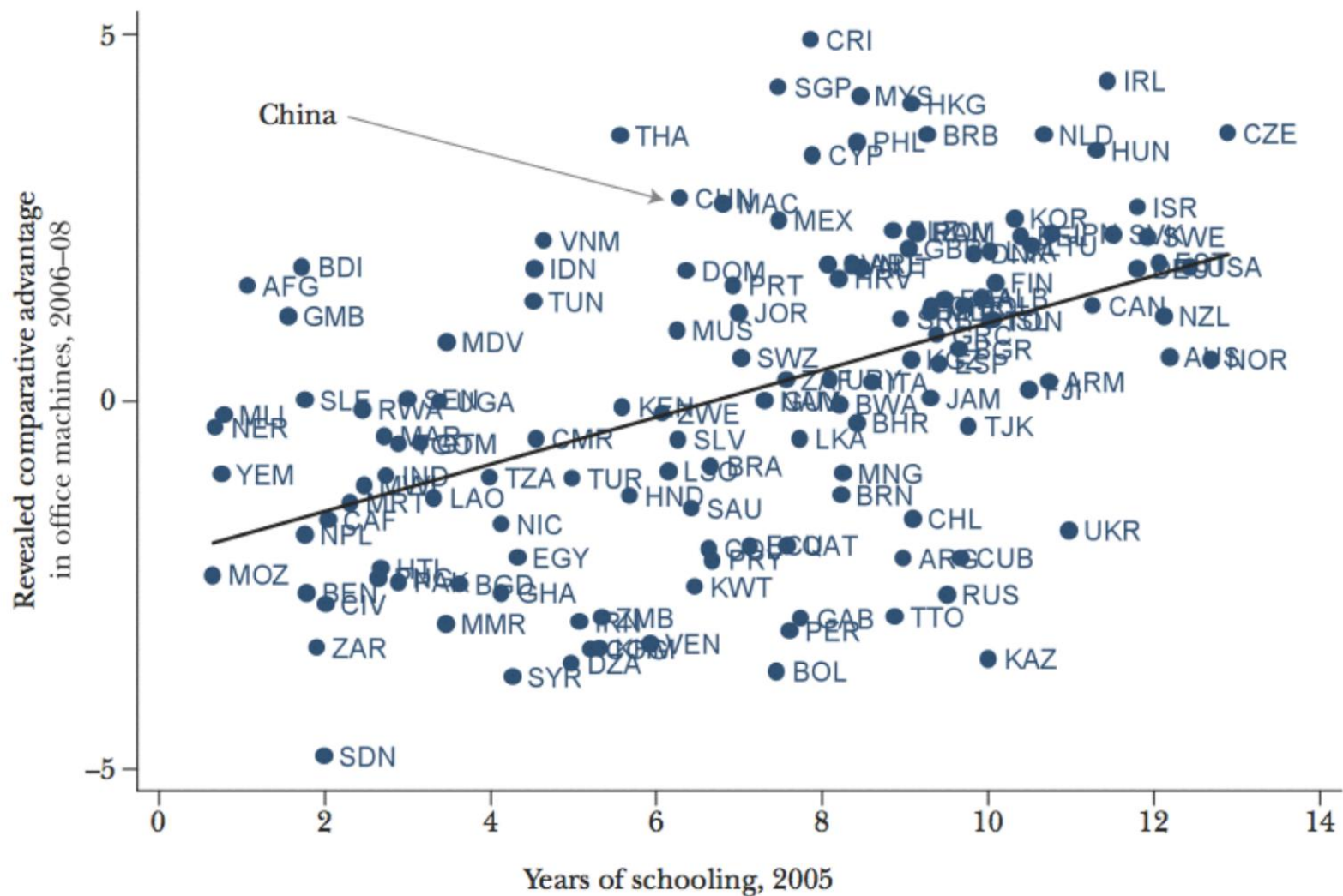


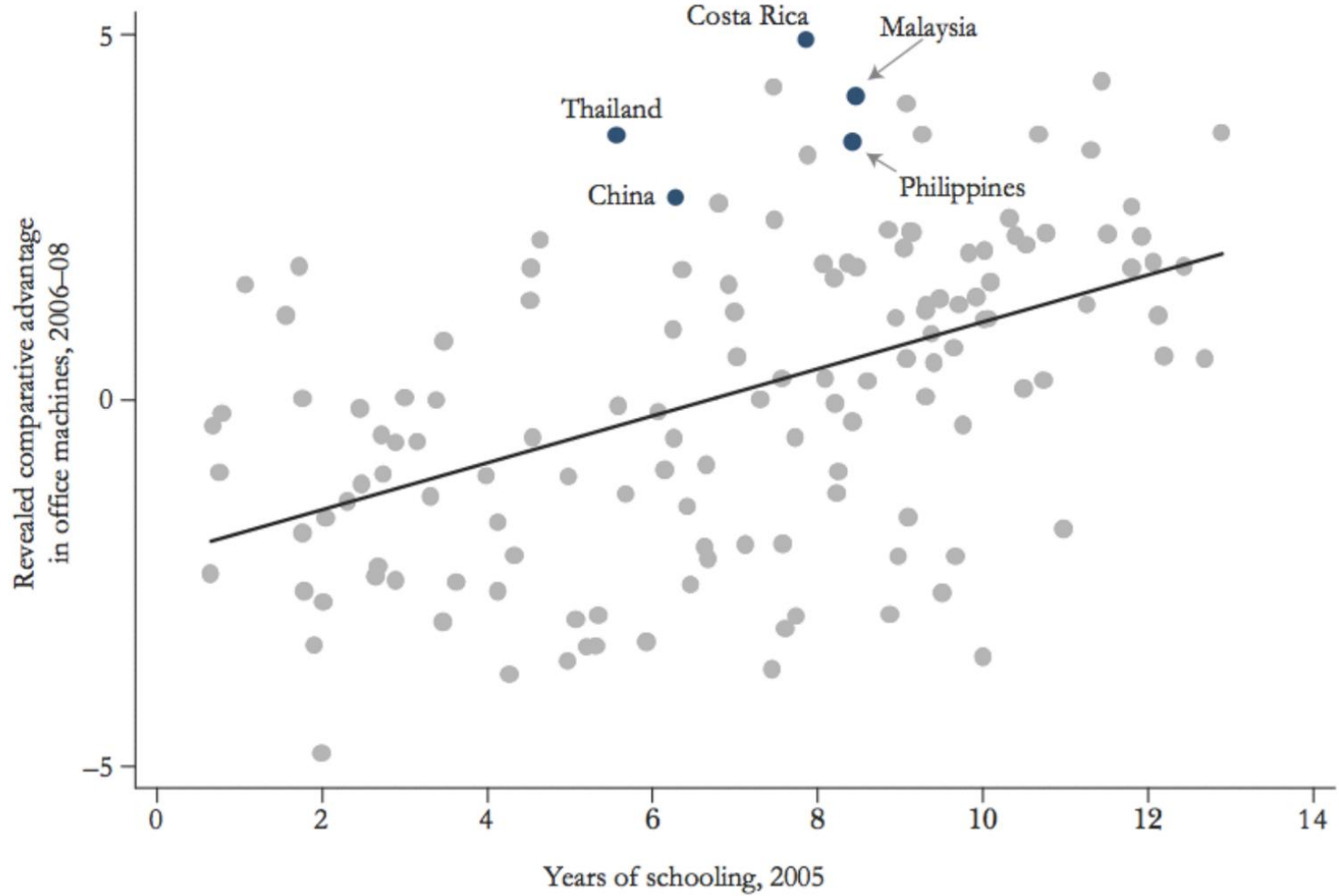
Image from Baingio Pinna, Gavin J. Brelstaff

**USE VISUAL PRINCIPLES TO CREATE A
HIERARCHY OF IMPORTANCE**

Education and Exports of Office Machines

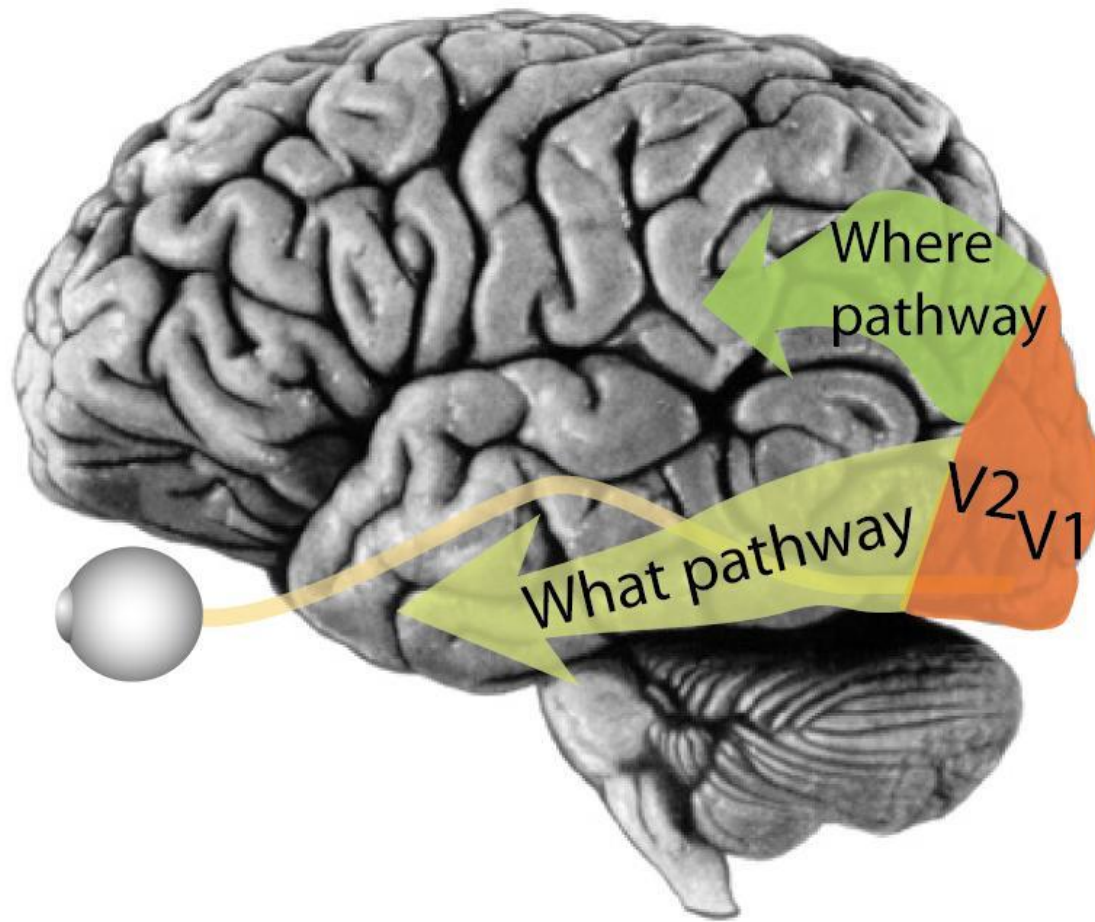


Education and Exports of Office Machines



2 | PSYCHOLOGY

VISUAL PROCESSING



WHERE PATHWAY

COLOR BLIND

FAST

LOW ACUITY

HIGH CONTRAST SENSITIVITY

MOTION PERCEPTION

DEPTH PERCEPTION

SPATIAL ORGANIZATION

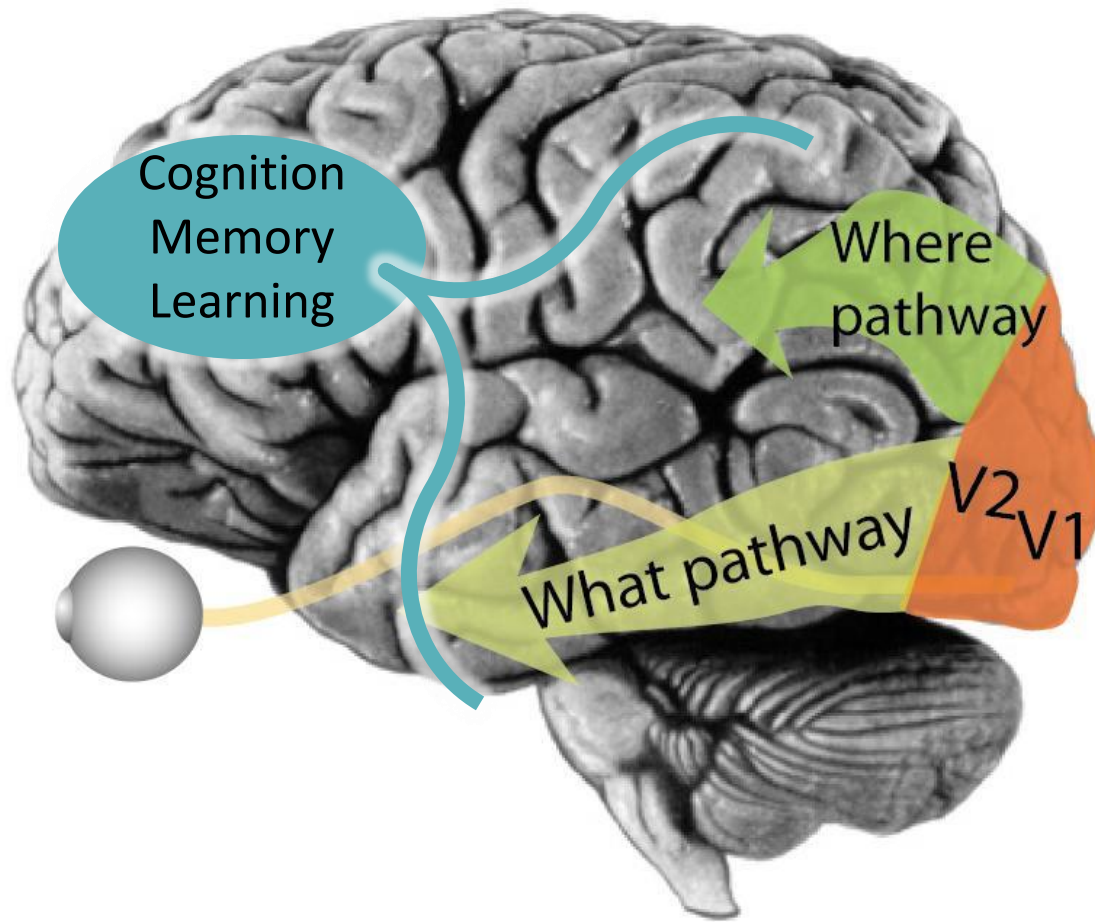
FIGURE/GROUND SEPARATION

WHAT PATHWAY

COLOR SELECTIVE
SLOW
HIGH ACUITY
LOW CONTRAST SENSITIVITY

OBJECT RECOGNITION
FACE RECOGNITION
COLOR PERCEPTION

**OBJECTS ARE PROCESSED DIFFERENTLY
THAN LOW LEVEL FEATURES**



MENTAL MODELS

**PEOPLE DON'T REMEMBER
FACTS — THEY REMEMBER
MENTAL MODELS**

**YOUR MENTAL MODEL MAY
BE DIFFERENT THAN MINE**

MUCK WITH MODELS

YOU WILL SEE AN OLD HAG

YOU WILL SEE A YOUNG LADY



**MENTAL MODELS HELP US PROCESS QUICKLY
BUT CAN BE DIFFICULT TO RECOGNIZE AND CHANGE**

**SOME TIPS AND TRICKS ARE COVERED BY
PREATTENTIVE PROCESSING AND GESTALT THEOREMS**

ENTER STEVEN!!

3 | PERCEPTION

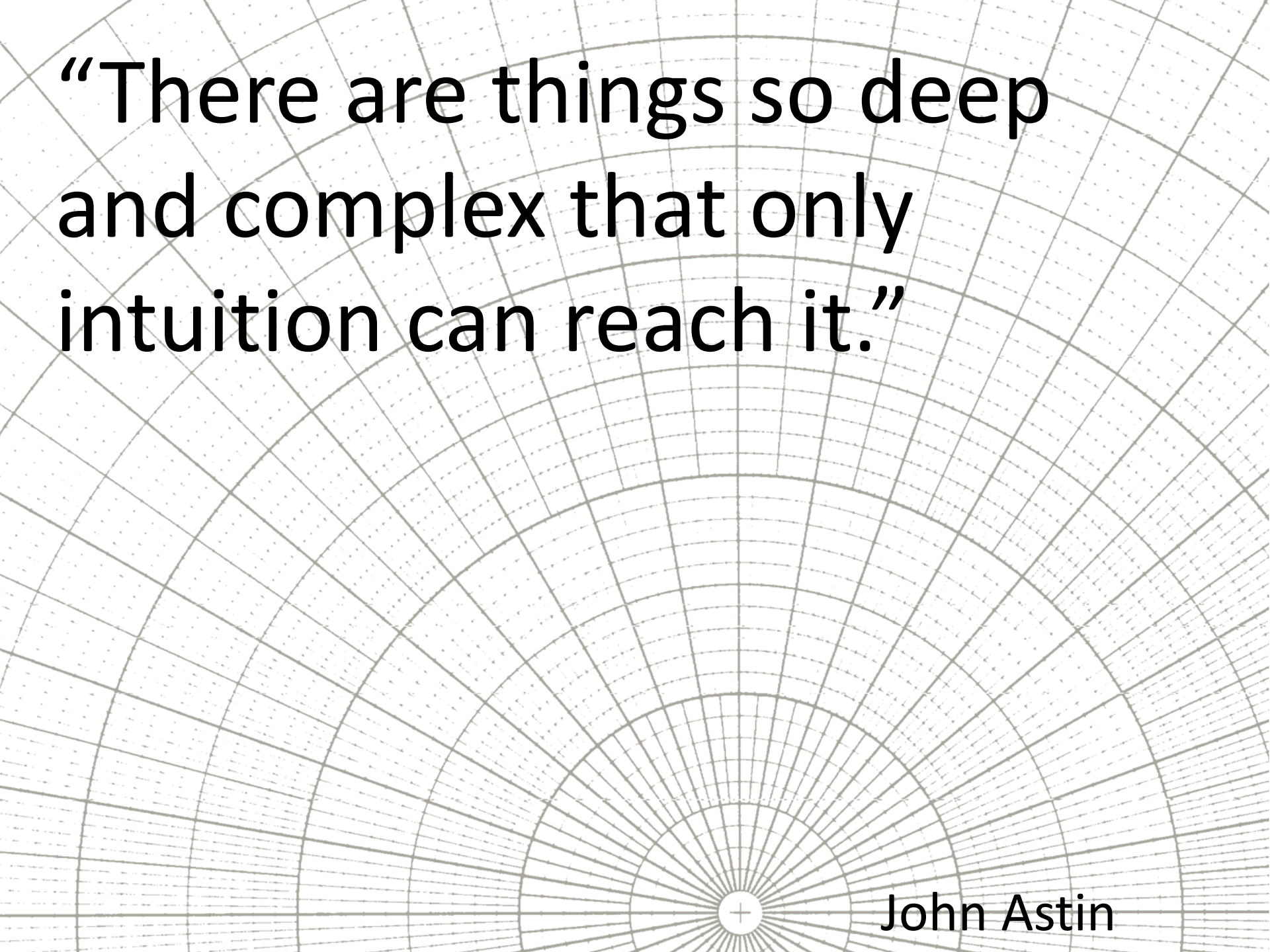
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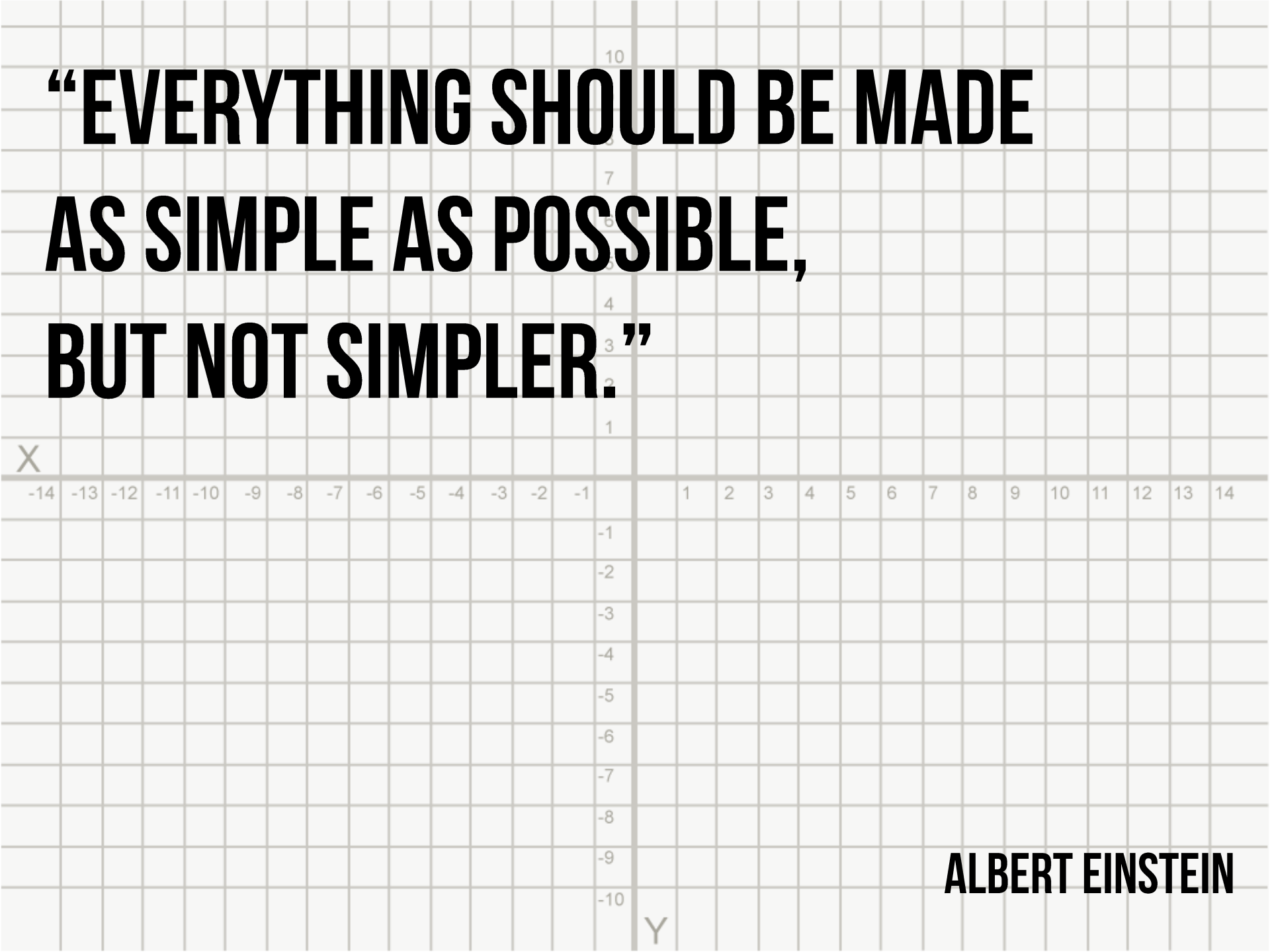
IF SEEING IS BELIEVING...

HOW DO I SEE?



“There are things so deep
and complex that only
intuition can reach it.”

John Astin



**“EVERYTHING SHOULD BE MADE
AS SIMPLE AS POSSIBLE,
BUT NOT SIMPLER.”**

ALBERT EINSTEIN

