Changing patterns

The art and science of subtle persuasion

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Seeing is believing!

Life begins

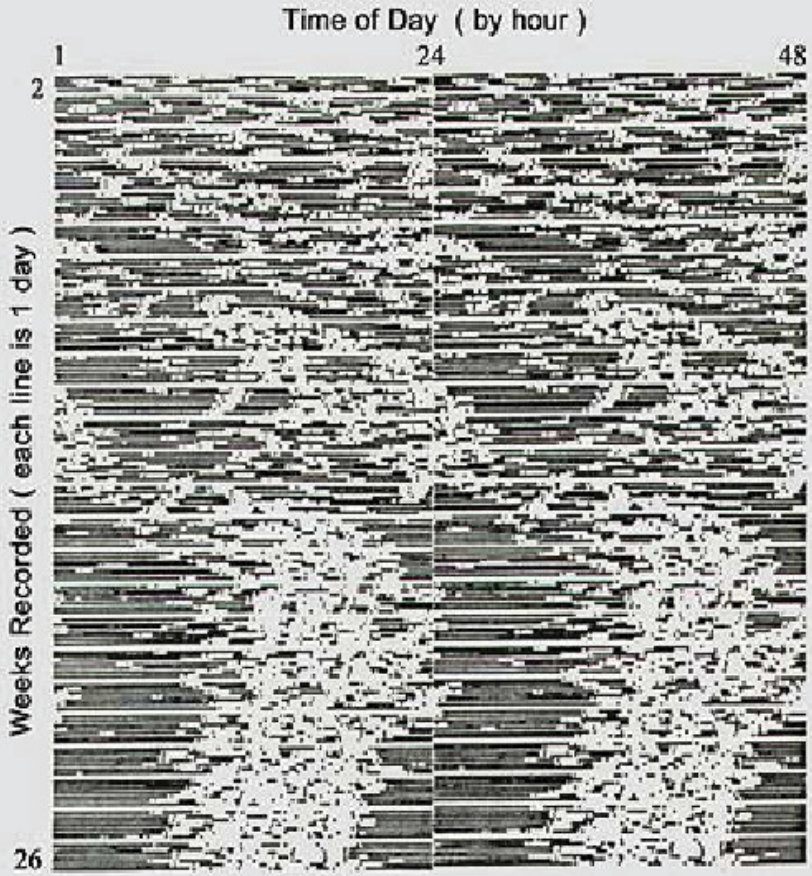
Our eyes

Optical illusions: simple apparatus, complex results!
Now you see it, now you don't -

Perspectives in light and sound

Light and dark, feedback loops, brain and body

Baby sleep pattern



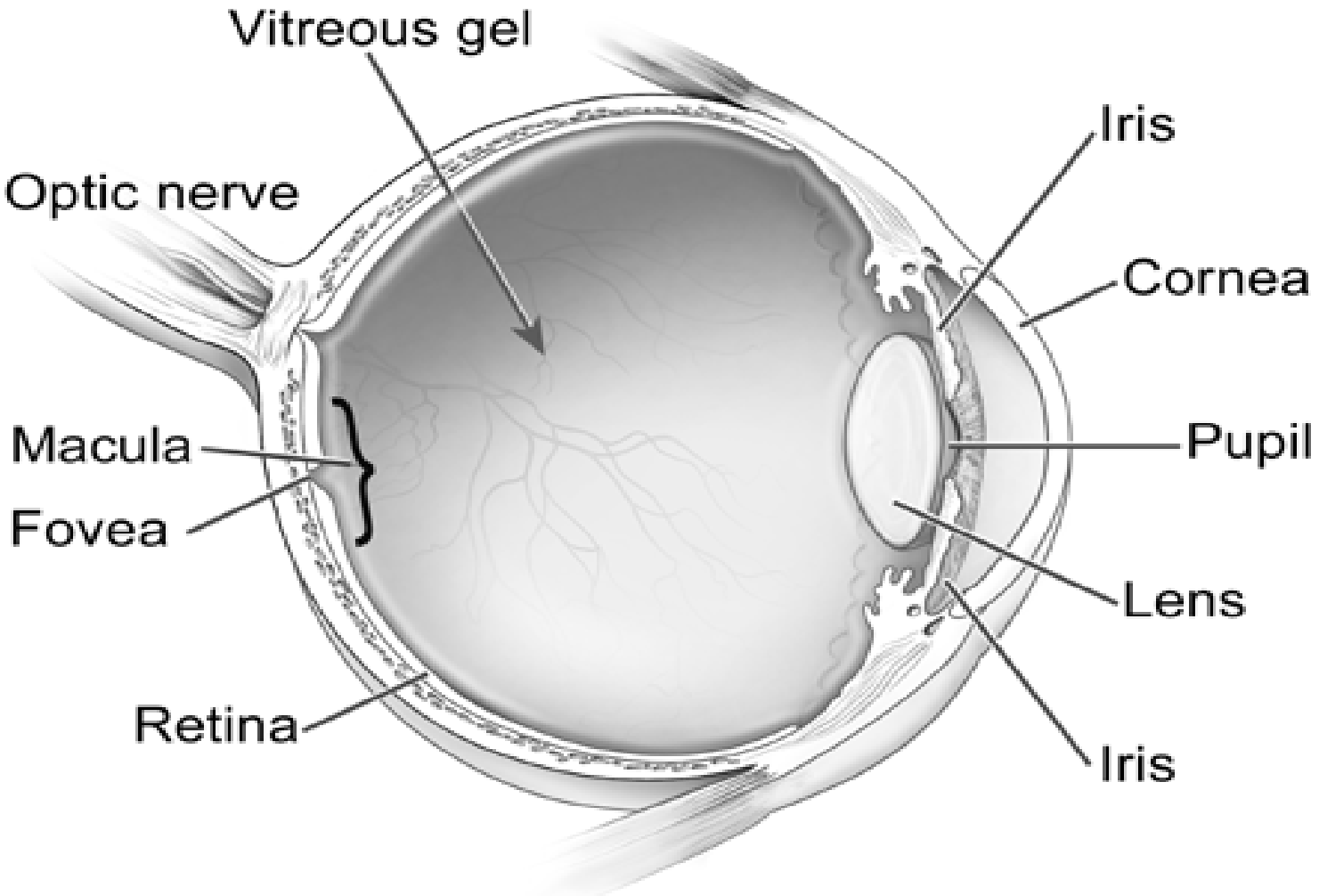
The sleep-wake record of a human baby. The record is double plotted so that the horizontal axis is 48th; the record extends from the second to the 26th week after birth.

Adapted from Nathaniel Kleitman and T. Englemann "Sleep Characteristics of Infants," Journal of Applied Physiology, Vol.7, 1953,
as reprinted in Sue Binkley, The Clockwork Sparrow: Time, Clocks, and Calendars in Biological Organisms,
Englewood Cliffs, NJ, Prentice-Hall, Inc., 1990

Wake up, look and listen!

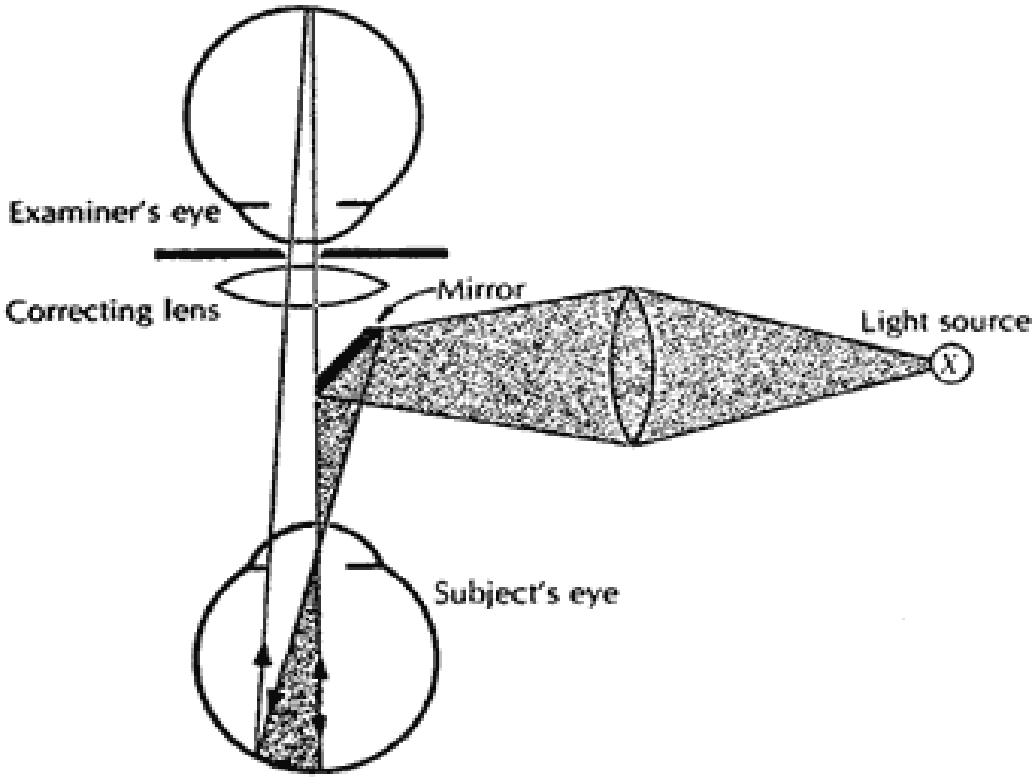
Hermann von Helmholtz
(1821 –1894)
Foundations of
vision and hearing

EYE

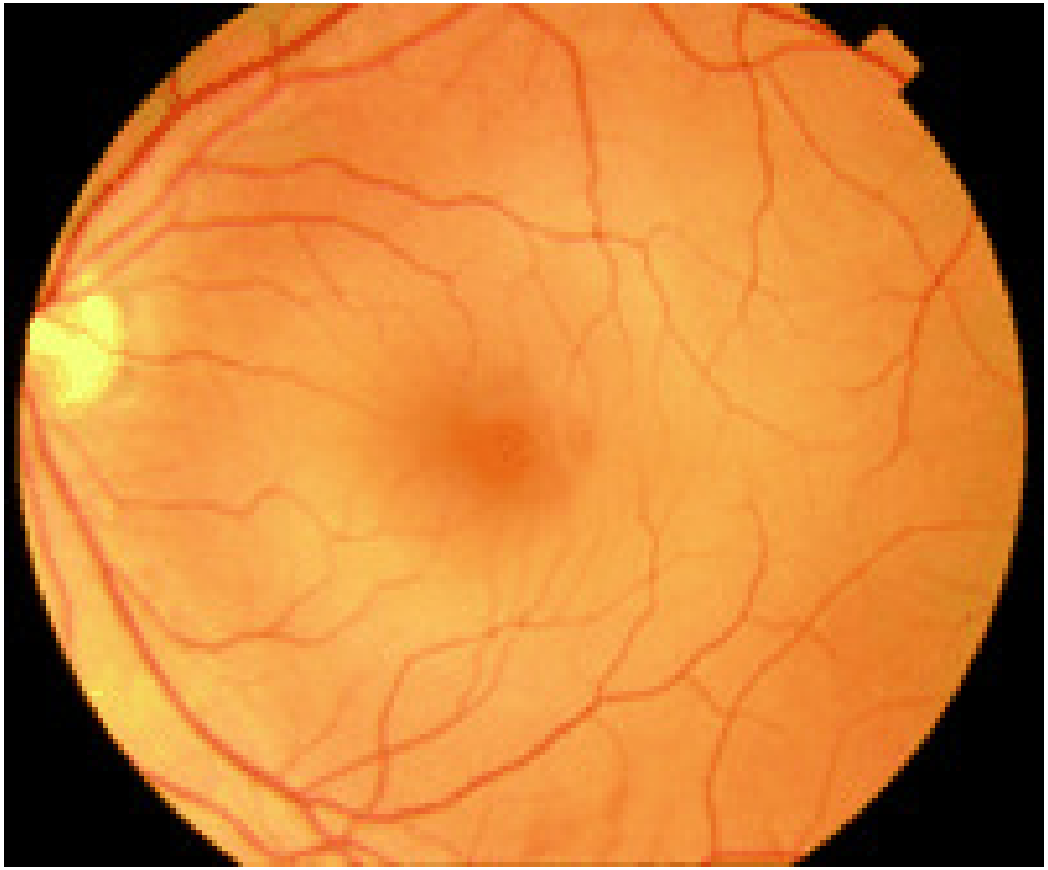

Vitreous gel
Optic nerve
Iris
Cornea
Macula
Fovea
Pupil
Lens
Retina
Iris

Opthalmoscope

Fig. 3.23 **Diagram of an opthalmoscope. The source of light is imaged in the subject's pupil, and a large area on the back of the eye is illuminated. Some of the light that is reflected from the retina emerges from the pupil, and half of that light gets past the mirror and into the examiner's eye. The correcting lens matches the optics of the subject's and the examiner's eyes. For example, if both the subject and the examiner are focused for infinity, light emerging from the subject's pupil will be collimated, and an image of the subject's retina will be formed on the examiner's retina if the power of the correcting lens is zero. If the subject is nearsighted (so that he cannot focus as far as infinity), and the examiner still focuses at infinity, then the correcting lens must have nonzero power.**



Normal Retina



Eye Accommodation

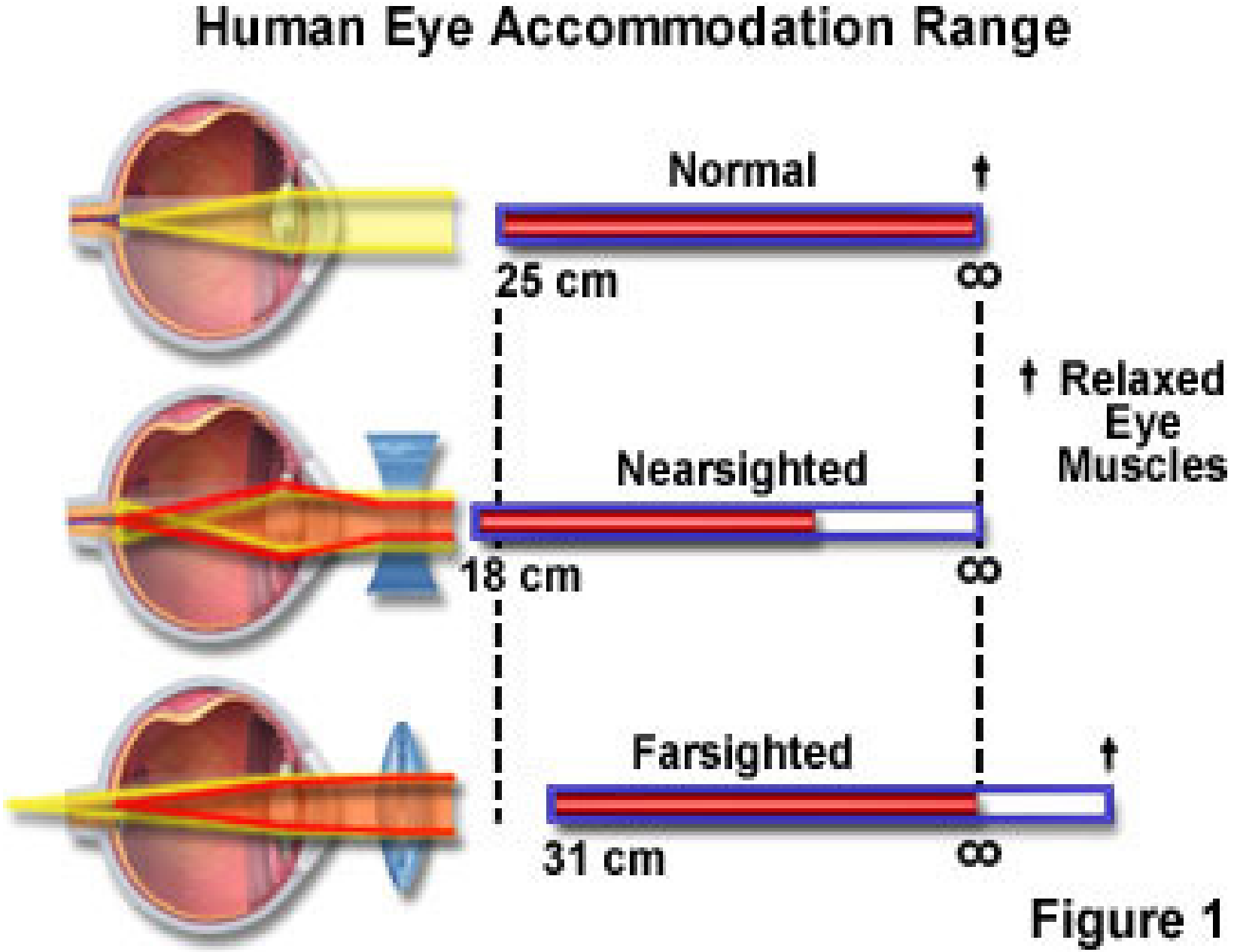
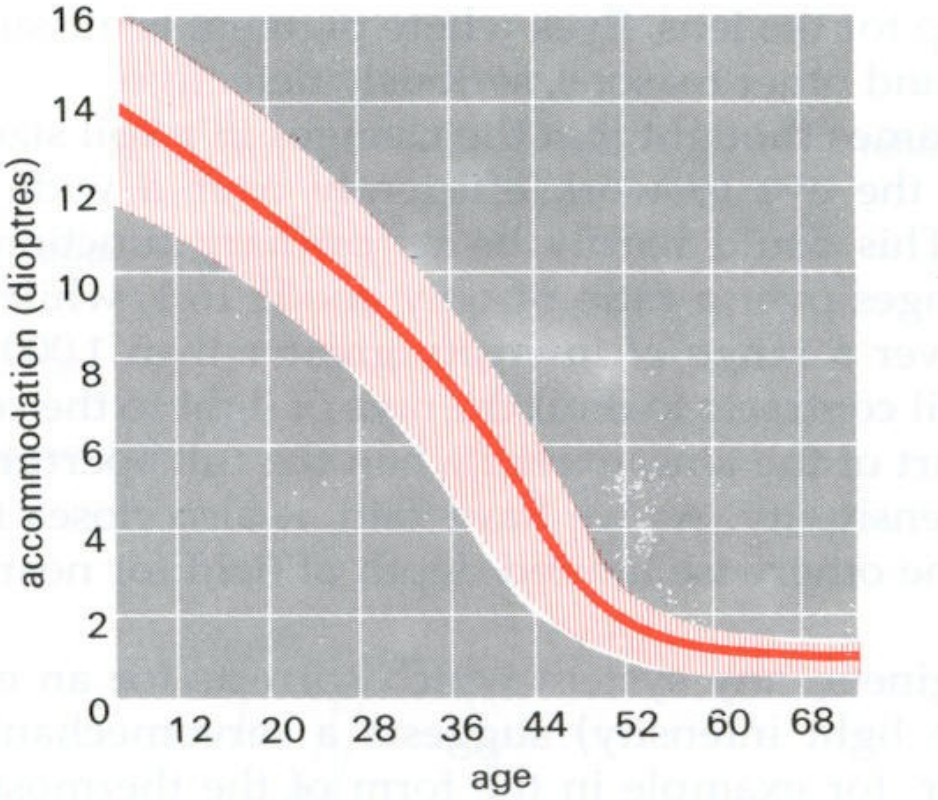


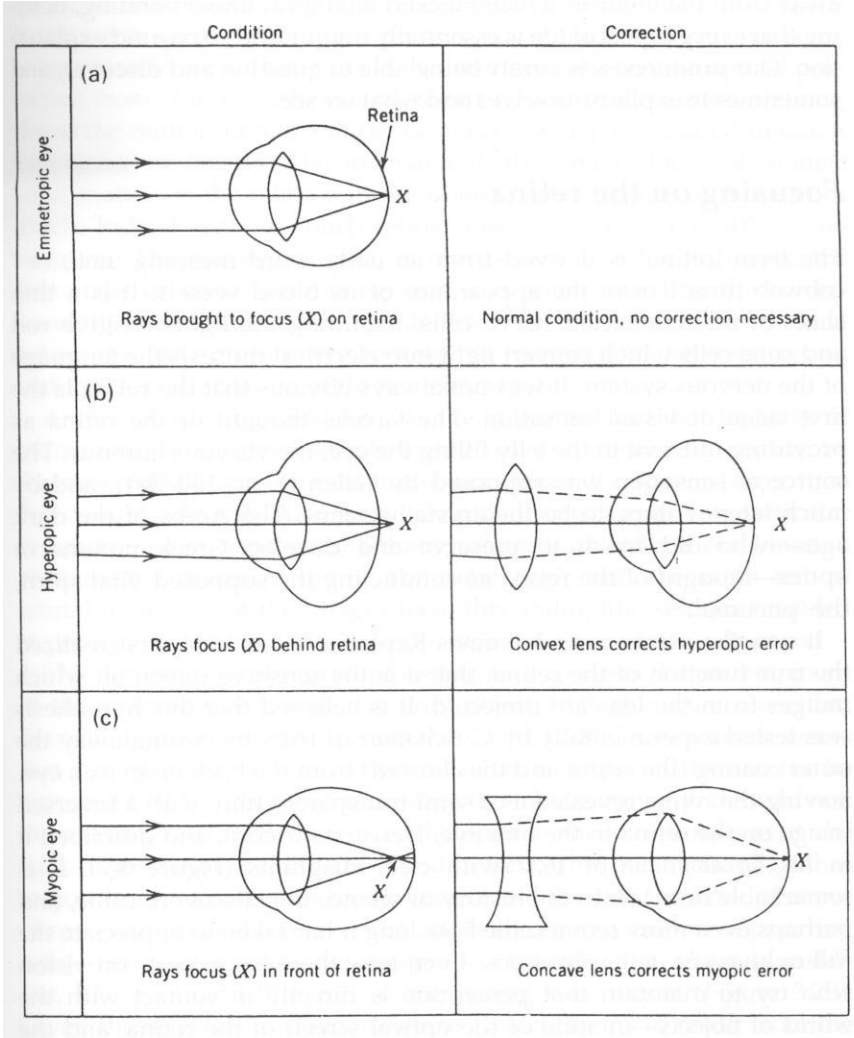
Figure 1

Accommodation change with age

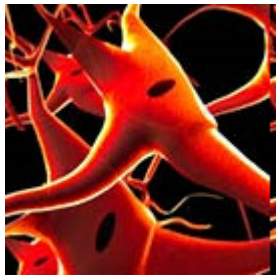
(from R. Gregory, *Eye and Brain*)

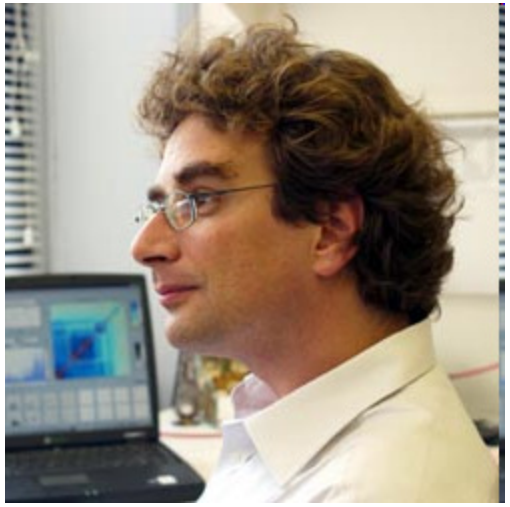


Eye problems
First eyeglasses – Venice 1286?



- **DIETMAR PLENZ**
- Dietmar Plenz
- Der Rhythmus der Gedanken - 08.01.2007
- ...neben der hochauflösenden Messtechnik auch mathematische Verfahren, um die Datenflut zu analysieren. Damit hat sich Dietmar Plenz beschäftigt, der am National Institut of Mental Health in Bethesda bei Washington arbeitet. Er hat die spontanen elektrischen...



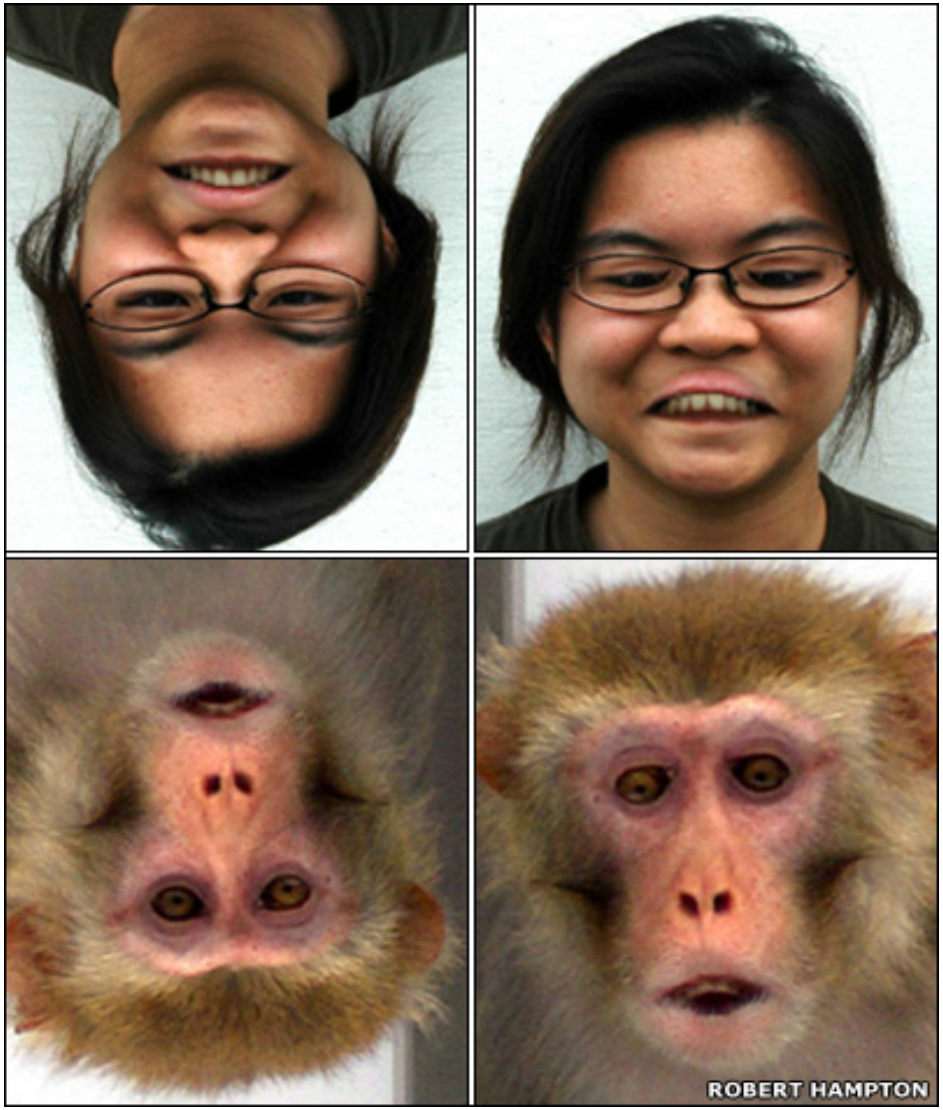


Thompson effect - 1

Thompson effect - 2

Thompson, P. (1980)
Margaret Thatcher:
a new illusion. Perception 9:483–484

Monkeys fall for visual illusion (Victoria Gill, Science reporter, BBC News, July 2009)



http://news.bbc.co.uk/2/hi/science/nature/8119028.stm

- The study, in the journal Current Biology, is the first to show this effect in non-human animals.
- The authors say this suggests that the ability to identify a familiar face may have evolved in an ancestor common to humans and rhesus monkeys.
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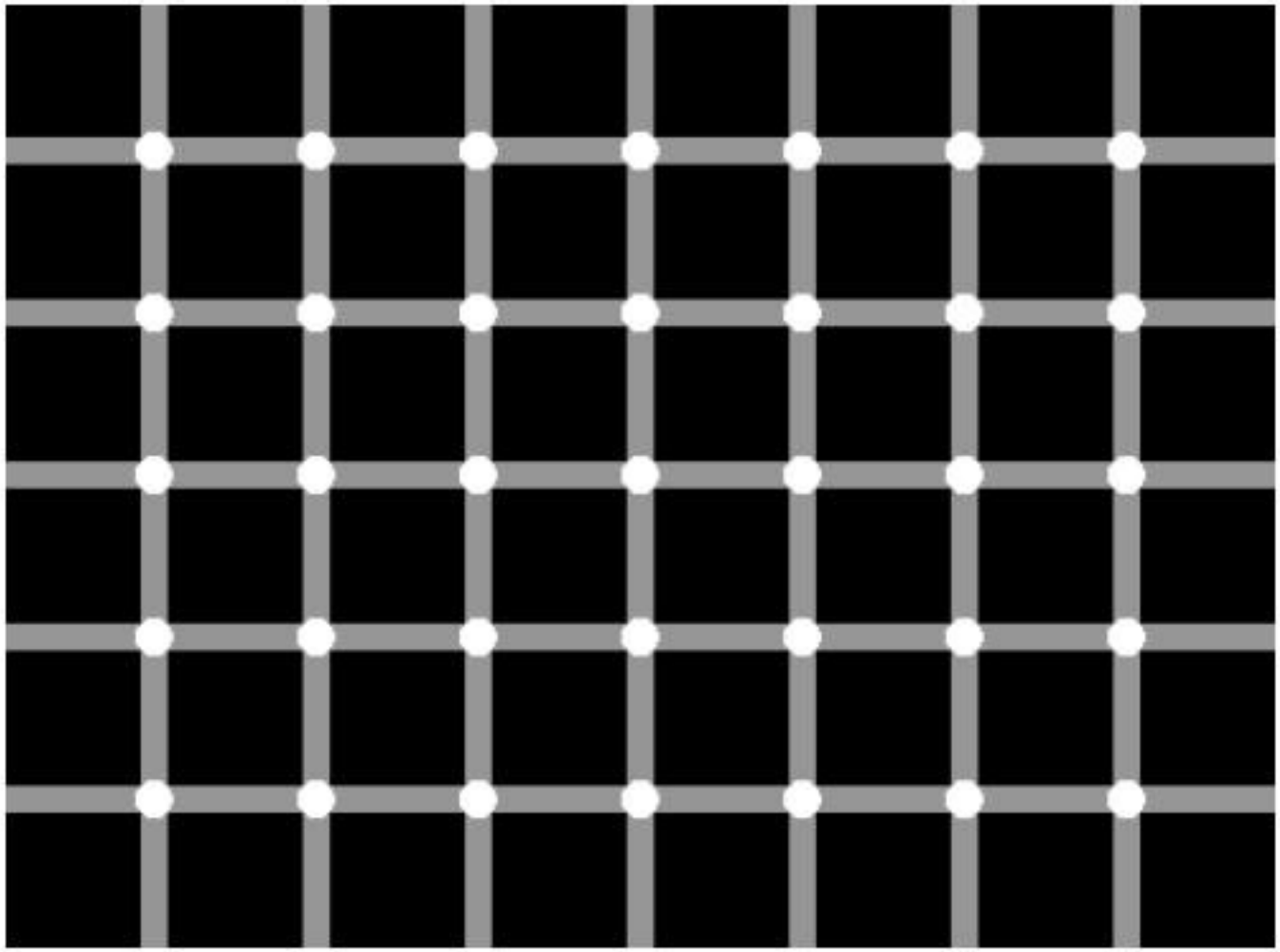
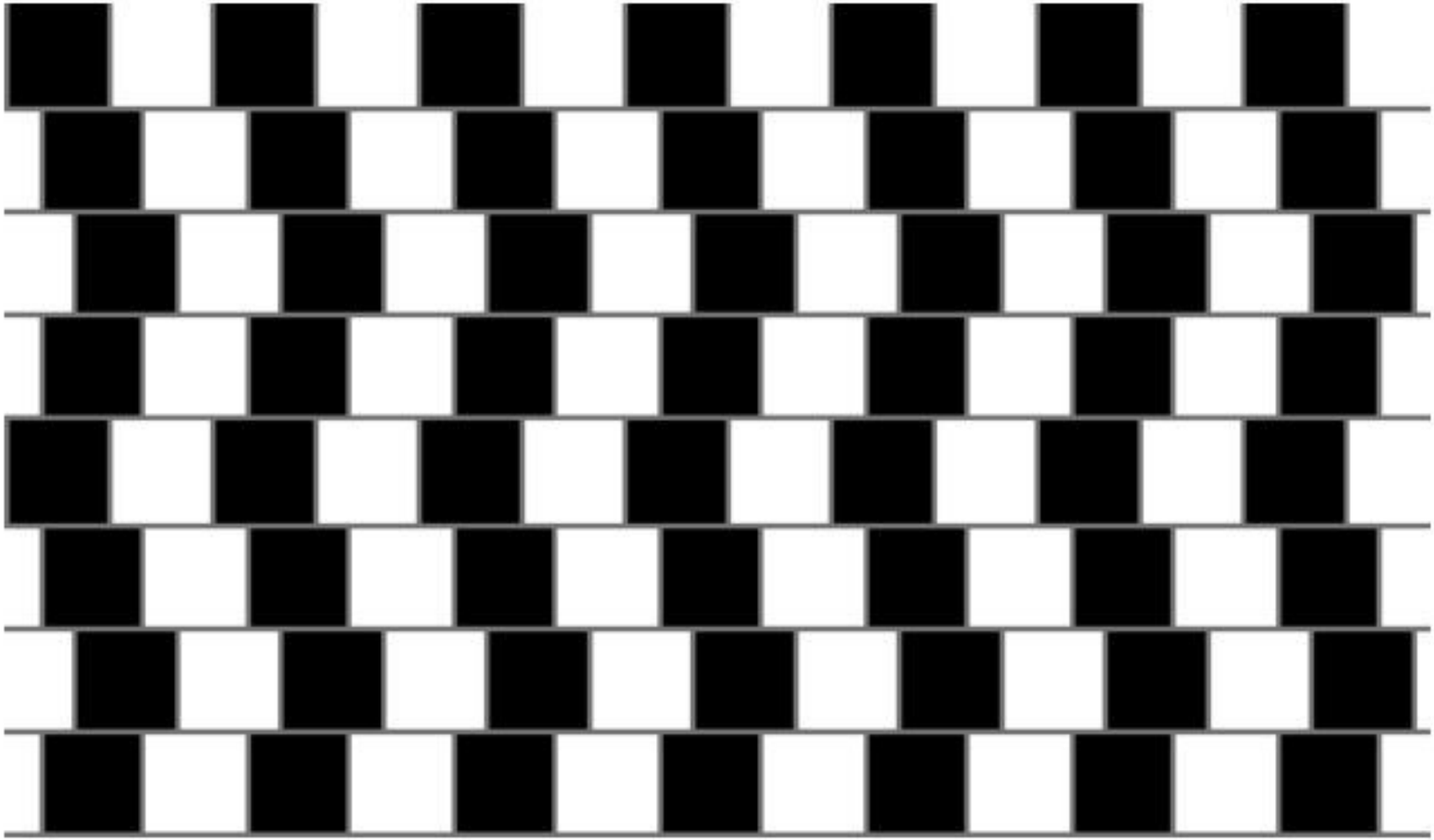
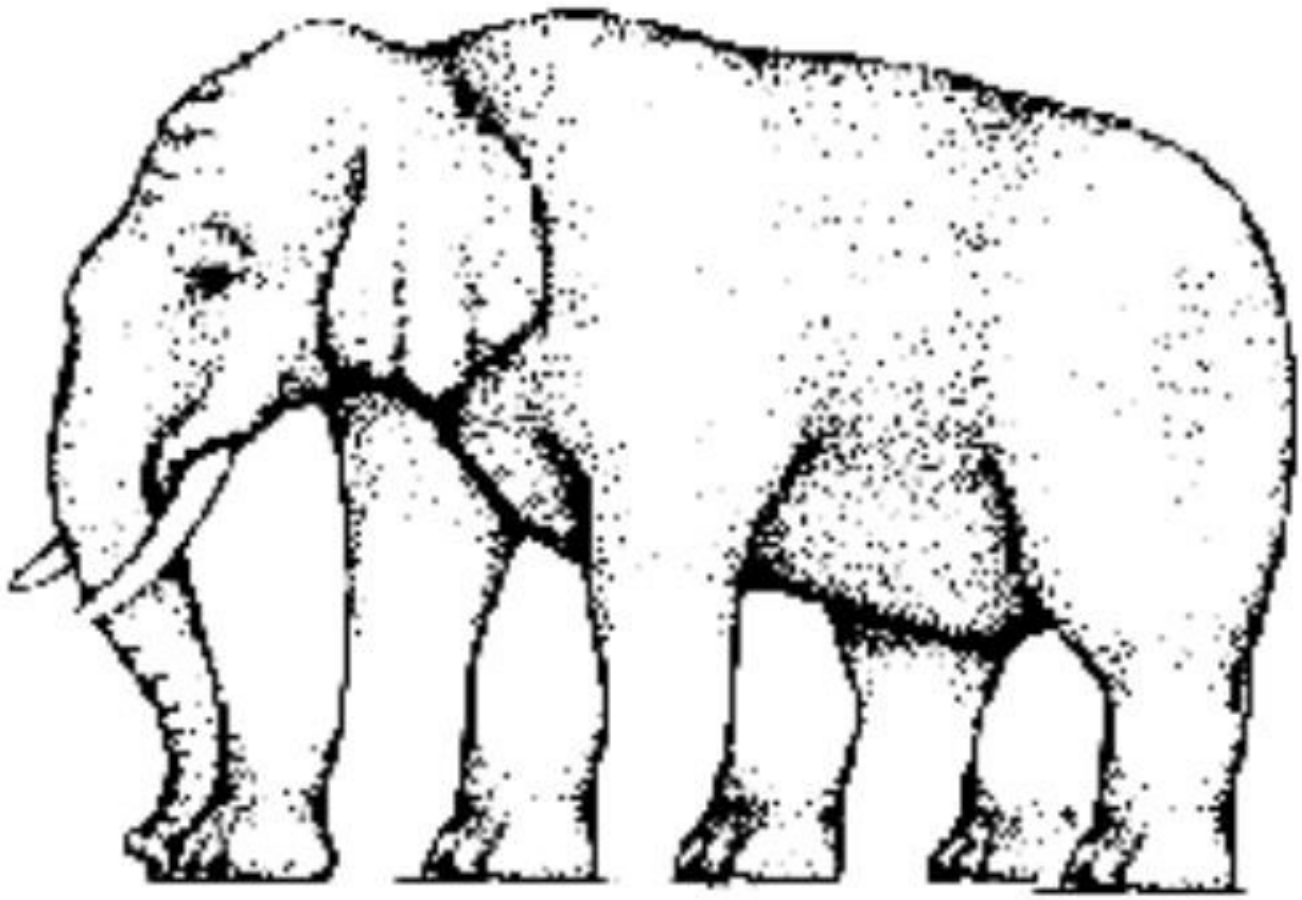
- http://www.wjh.harvard.edu/~lombrozo/home/illusions/thatcher.html



Count the black dots! :o)

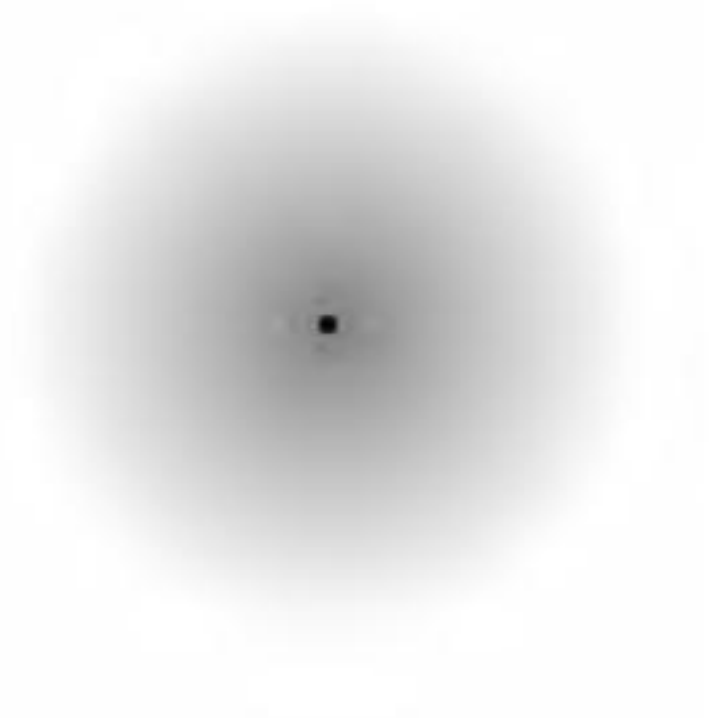


Are the horizontal lines parallel or do they slope?

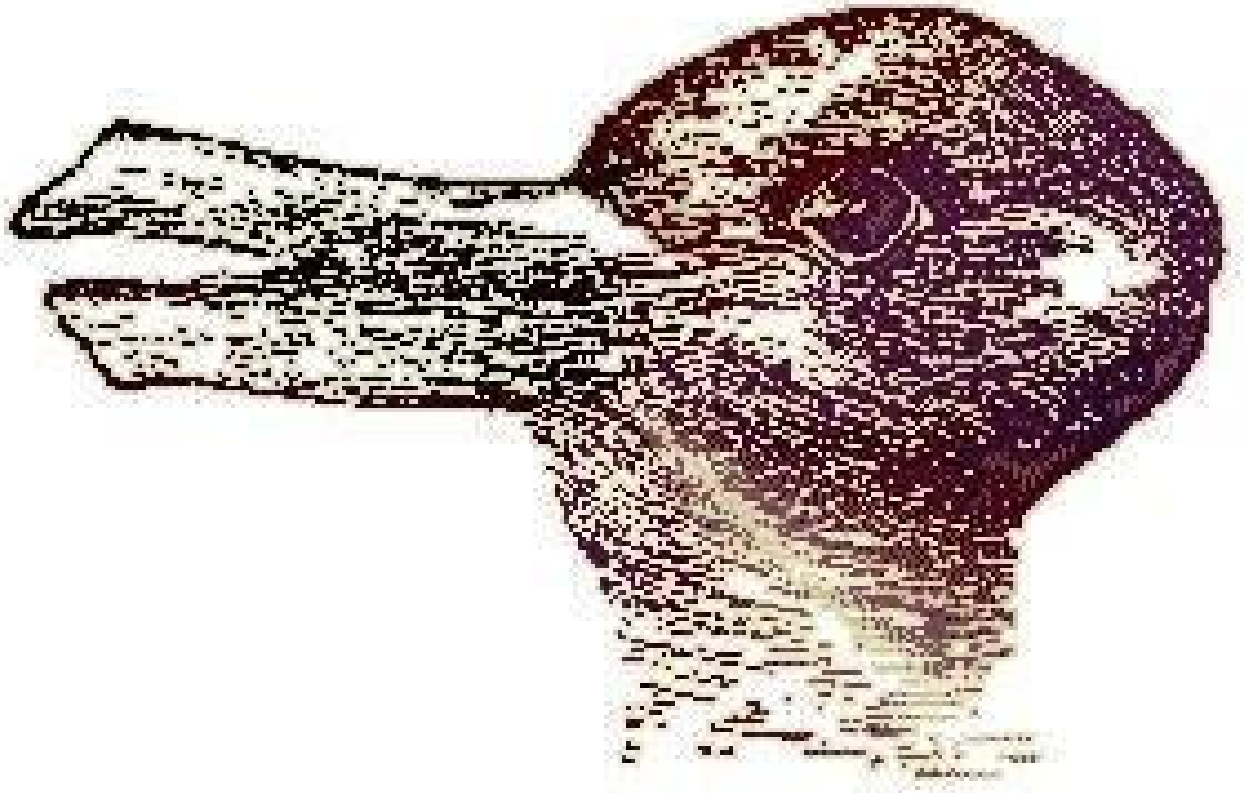


How many legs does this elephant have?

Keep staring at the black dot. After a while the gray haze around it will appear to shrink.



Man Playing Horn... Or Woman Silhouette?
(hint: woman’s right eye is the black speck in front of horn handle)



A Rabbit.... Or A Duck?

hint: the duck is looking left, the rabbit is looking right

Look at the chart and say the COLOUR not the word

YELLOW BLUE ORANGE
BLACK RED GREEN
PURPLE YELLOW RED
ORANGE GREEN BLACK
BLUE RED PURPLE
GREEN BLUE ORANGE

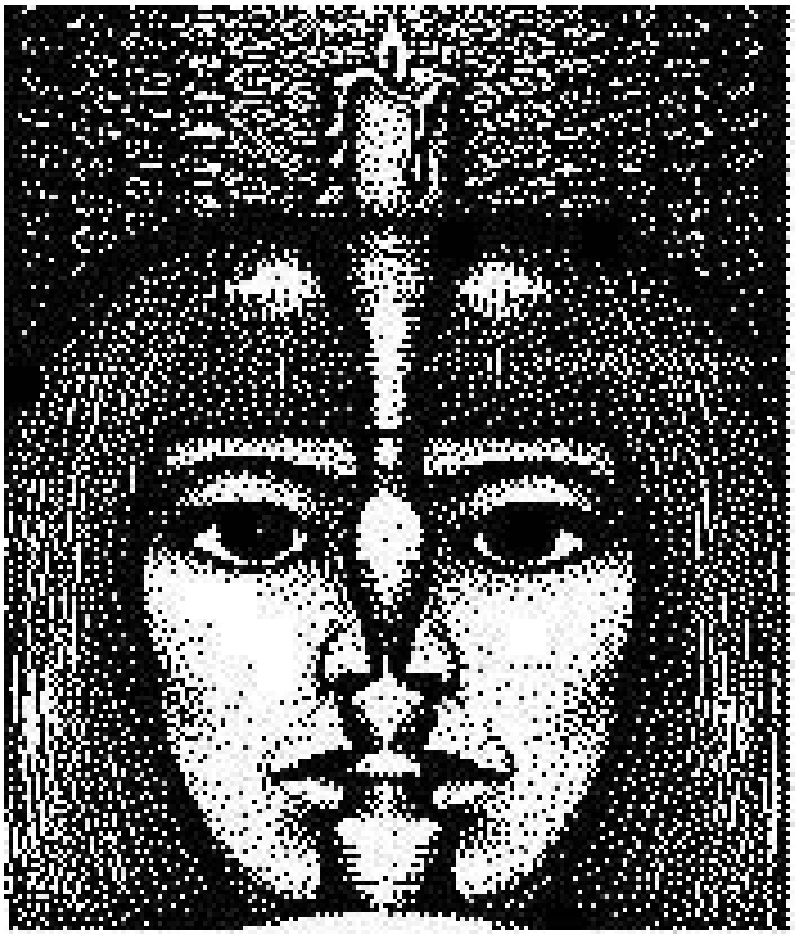
Left – Right Conflict

Your right brain tries to say the colour but your left brain insists on reading the word.

Woman In Vanity... Or Skull?
hint: move farther a bit from the screen and blink to see the skull or the woman (looking at the mirror)

A Face Of A Native American... Or An Eskimo?

Old Woman...Or Young Girl?
hint:The old woman's nose is the young girls chin.



Two Faces... Or One?

(hint: two faces side profile…or one face front view)

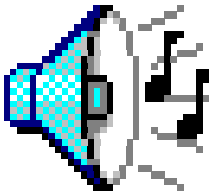
Great website for illusions

- http://www.michaelbach.de/index.html

Jean-Claude Risset

Computer Suite from *Little Boy* (1968)

"Fall"



Sound – Shepard's Tones

1964: Psychologist Roger N. Shepard published a paper entitled *Circularity in Judgements of Relative Pitch* (J. Acoust. Soc. Am)

These tones were designed to eliminate all relative pitch discrimination information. As a result, when played in sequence, each tone sounds higher than all tones preceding it and lower than all tones following it.

'Art and science are distinct in terms of their goals, tempo and criteria. But my scientific and artistic activities nourish each other. The driving force behind science, as well as creativity, is a kind of emotion and desire.'

Jean-Claude Risset was awarded the CNRS gold medal in 1999 for his work as a theoretical physicist. As a composer, he has received many awards, most notably the Prix Ars Electronica (1987) and the Grand Prix National de la Musique (1990). To succeed in these two equally difficult worlds, considerable tenacity, a twofold talent, and a little luck are required.

Can the eye see a single photon?

ENERGY, QUANTA, AND VISION

SELIG HECHT, SIMON SHLAER, AND MAURICE HENRI PIRENNE

(From the Laboratory of Biophysics, Columbia University, New York)

(Received for publication, March 30, 1942)

The Journal of General Physiology

"the range of 54 to 148 quanta at the cornea becomes as an upper limit 5 to 14 quanta actually absorbed by the retinal rods. This small number of quanta, in comparison with the large number of rods (500) involved, precludes any significant two quantum absorptions per rod, and means that in order to produce a visual effect, *one quantum must be absorbed by each of 5 to 14 rods in the retina*."

“The case of the wandering light”

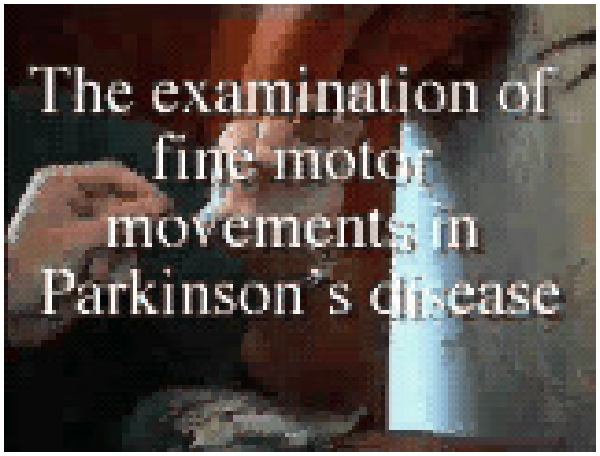
The **Autokinetic Illusion** gives you the impression that a stationary object is moving in front of the airplane's path; it is caused by staring at a fixed single point of light (ground light or a star) in a totally dark and featureless background. This illusion can cause a misperception that such a light is on a collision course with your aircraft

FAA, Office of Aerospace Medicine (OAM)
Washington, D.C

Parkinson’s disease

- Parkinson's is caused by a shortage of a chemical messenger, dopamine, in the brain. Dopamine is a key neurotransmitter involved in motor control.
- Scientists suspect that PD is caused by a complex interaction between genes and the environment. Environmental toxins play a role in triggering the disease, although no one knows which toxins, or why they trigger the disease in some people and not others.

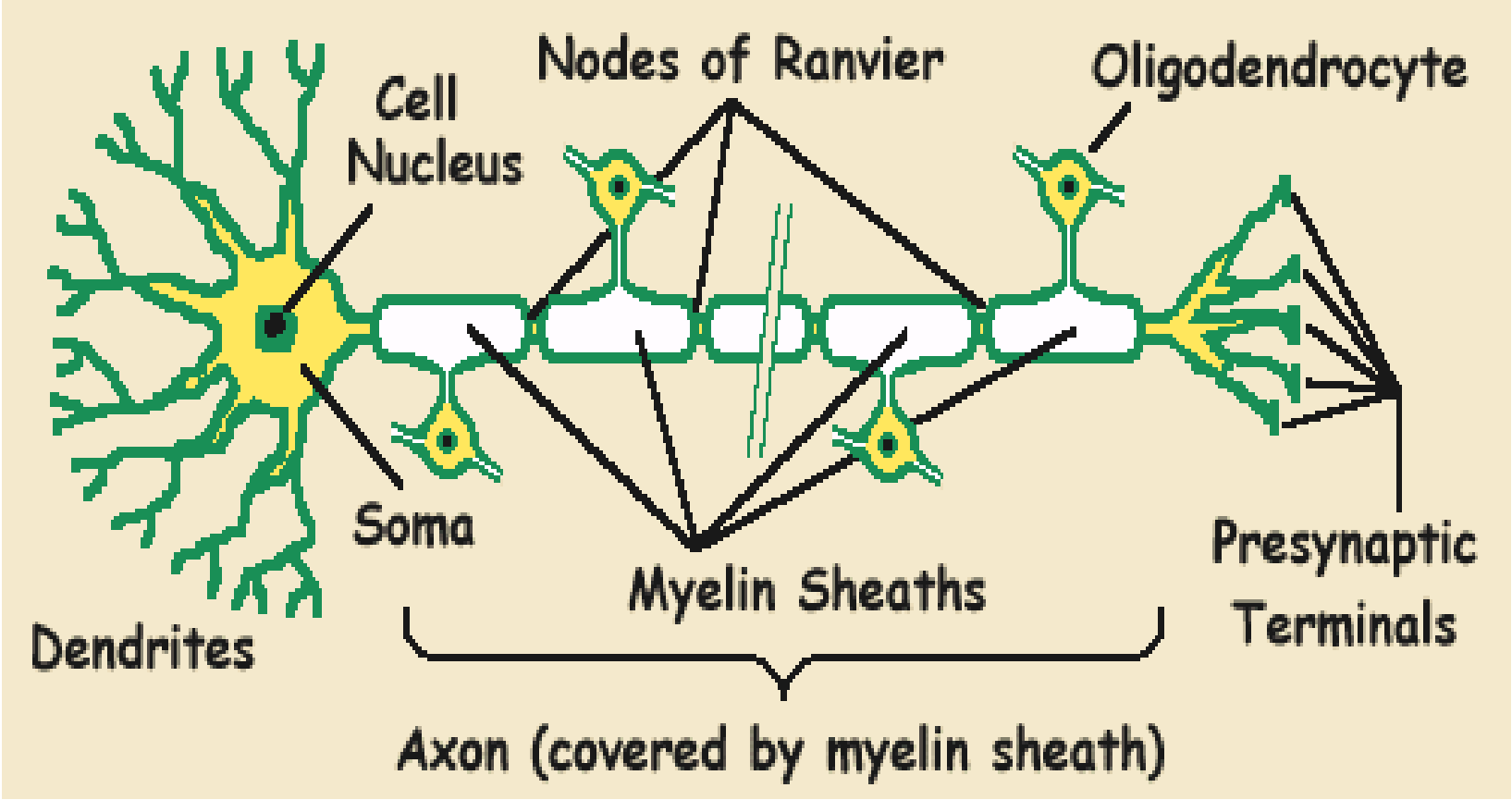
Feedback control of movements



Postural

Instability

Multiple Sclerosis (MS)



What happens in MS

- During periods of multiple sclerosis activity, white blood cells (leukocytes) initiate and take part in what is known as the inflammatory response. During the inflammation, the myelin gets stripped from the axons in a process known as demylination.

- The effect of this has many parallels to the rubber insulation on wire perishing - some or all of the electricity in the wire could short out and the efficient conductivity of the wire could be reduced. When the myelin sheath is damaged, the transmission of nerve impulses is slowed, stopped or can jump across into other demyelinated axons.

(NIH description)

Optical illusions – what are they good for?

A vision problem is the first symptom of Multiple Sclerosis (MS) for many people. The sudden onset of double vision, poor contrast, eye pain, or heavy blurring is frankly terrifying—and the knowledge that vision may be compromised makes people with MS anxious about the future.

Fortunately, the prognosis for recovery from many vision problems associated with MS is good.

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Visual latency

- Bio-feedback loop
- Measure latency time with a meter stick!

  SQRT(2D/g)

  (g ~ 10 m/s/s)

Pulfrich Pendulum

Application - for detecting abnormal delay in the visual pathway in multiple sclerosis.
D. Rushton
Brain. 1975 Jun;98(2):283-96.

Pulfrich's pendulum has been developed as a method for detecting abnormal delay in the visual pathway of patients with suspected multiple sclerosis.

Something less serious – 3D glasses

http://www.3dglassesonline.com/pulfrich.html

Astronomer Carl Pulfrich, the namesake for the optical illusion created by 3-D glasses featuring a dark lens and a clear lens, was blind in one eye and never got to see the effect named after him. However, he knew the illusion would exist under the right circumstances.

Thanks to Clay Daetwyler and Richard Berg

Talk dedicated to the memory of Dan Margulies

of

The University of Maryland Lecture-Demo Program

http://www.physics.umd.edu/lecdem/

Father William

- “You are old, Father William,” the young man said,
  “And your hair has become very white;
  And yet you incessantly stand on your head –
  Do you think, at your age, it is right?”

  “In my youth,” Father William replied to his son,
  “I feared it might injure the brain;
  But, now that I'm perfectly sure I have none,
  Why, I do it again and again.”

  “You are old,” said the youth, “as I mentioned before,
  And have grown most uncommonly fat;
  Yet you turned a back-somersault in at the door –
  Pray, what is the reason of that?”

  “In my youth,” said the sage, as he shook his grey locks,
  “I kept all my limbs very supple
  By the use of this ointment – one shilling the box –
  Allow me to sell you a couple?”

Father William

“You are old,” said the youth, “and your jaws are too weak
For anything tougher than suet;
Yet you finished the goose, with the bones and the beak –
Pray how did you manage to do it?”

“In my youth,” said his father, “I took to the law,
And argued each case with my wife;
And the muscular strength, which it gave to my jaw,
Has lasted the rest of my life.”

“You are old,” said the youth, “one would hardly suppose
That your eye was as steady as ever;
Yet you balanced an eel on the end of your nose –
What made you so awfully clever?”

“I have answered three questions, and that is enough,”
Said his father; “don't give yourself airs!
Do you think I can listen all day to such stuff?
Be off, or I'll kick you down stairs!”