

Quando il cervello si confonde: il curioso caso delle illusioni ottiche



UNIVERSITÀ
DEGLI STUDI
FIRENZE

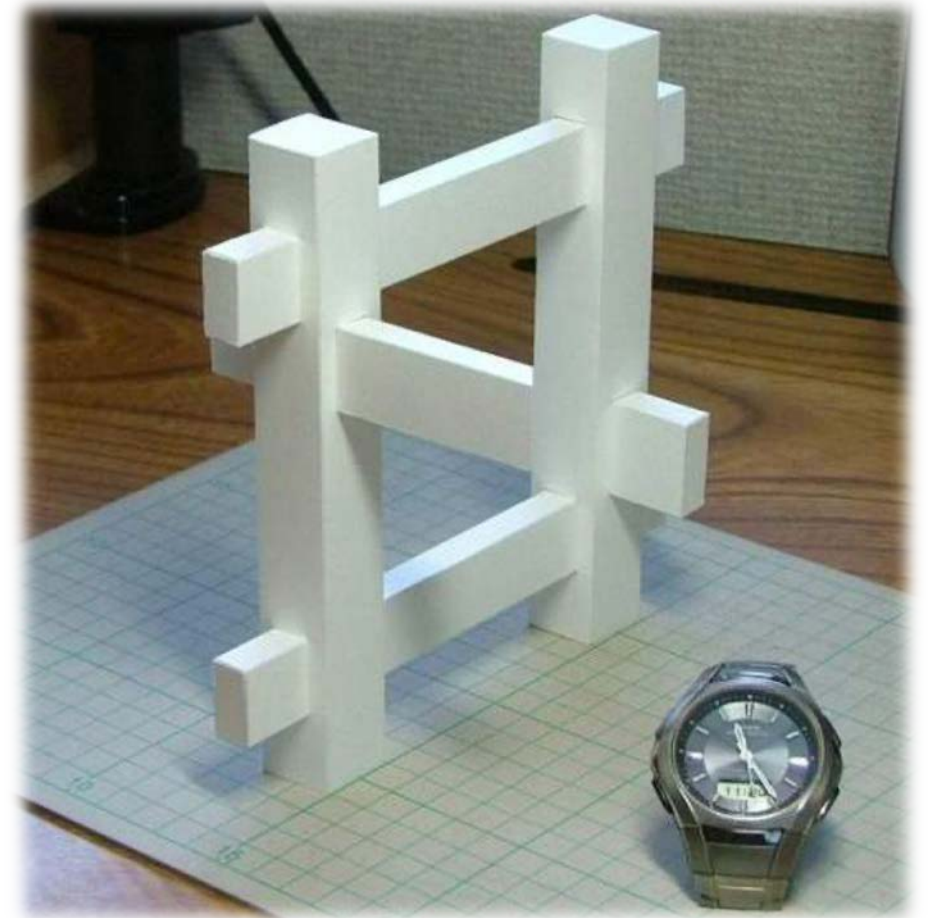
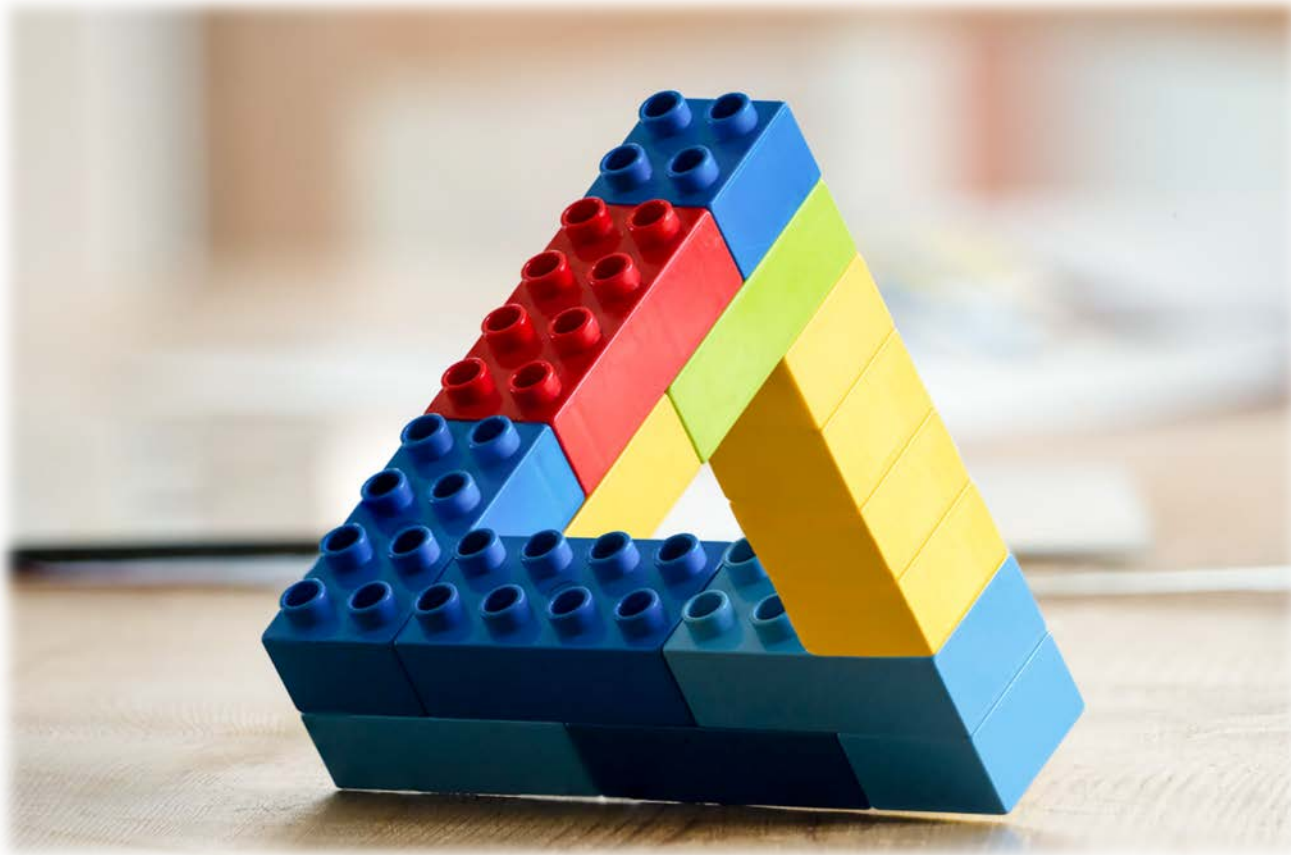
Speaker: Roberto Arrighi
Email: roberto.arrighi@unifi.it



European Research Council
Established by the European Commission

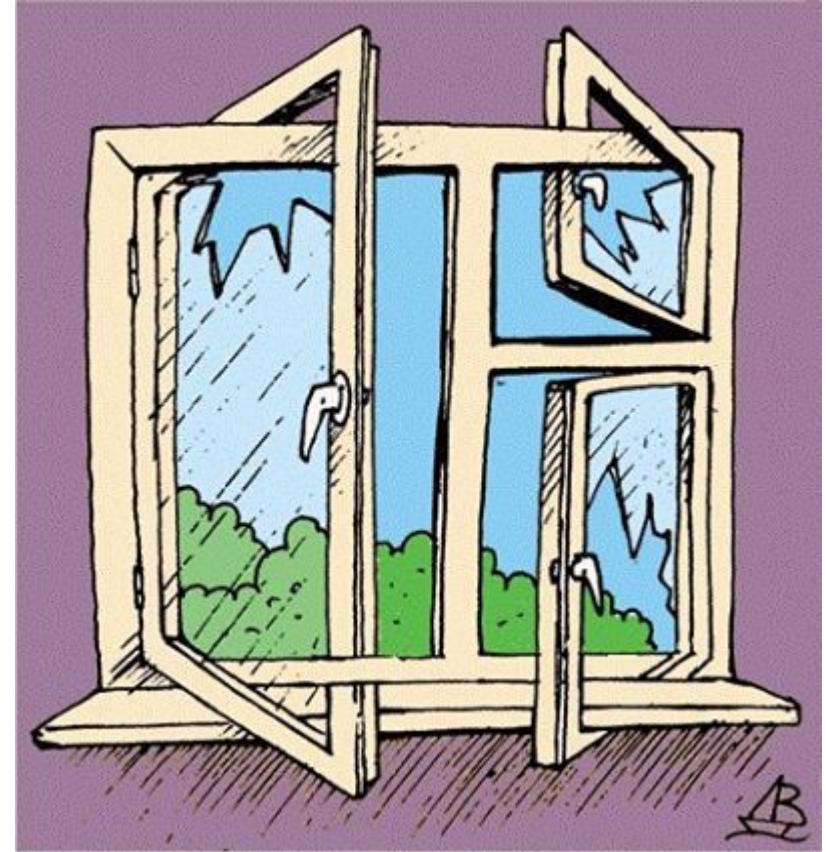
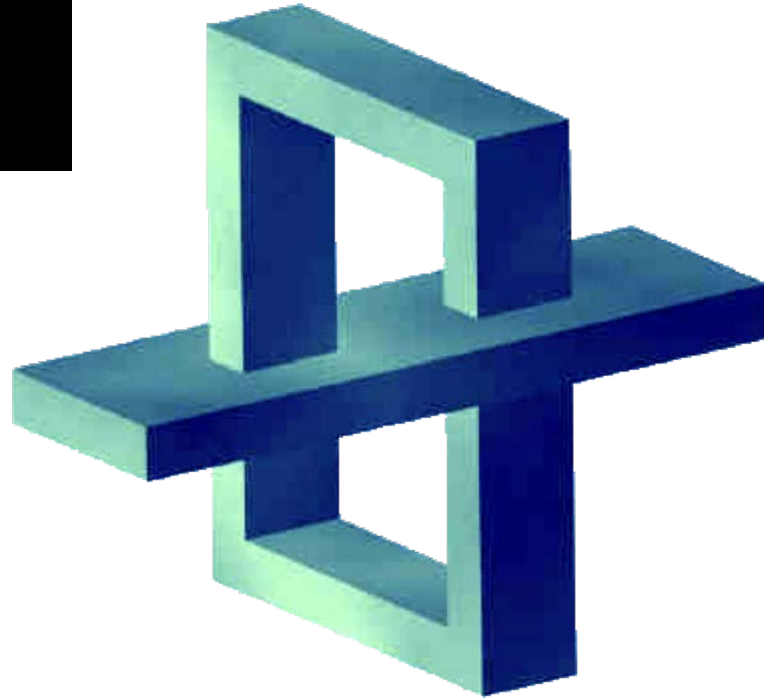
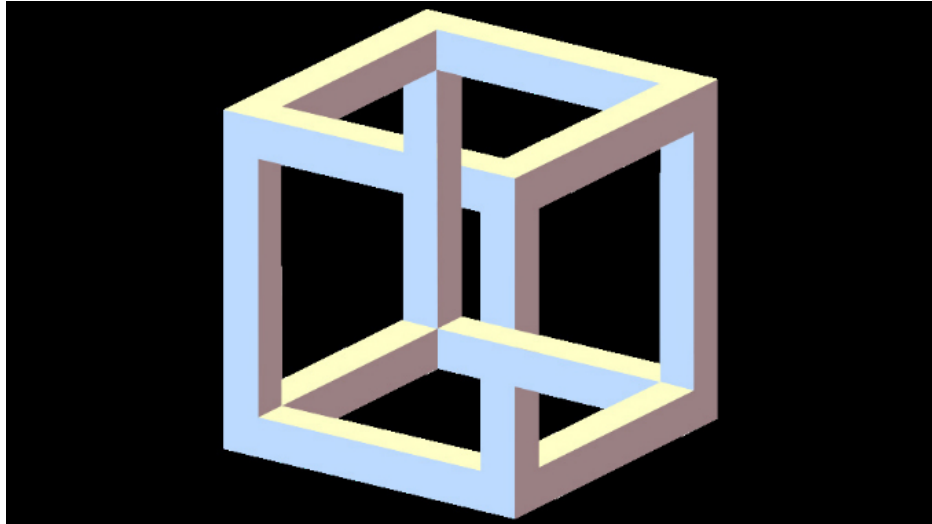
Perché parlare delle illusioni ottiche?

1) Le illusioni ci possono far vedere mondi ed oggetti impossibili!



Perché parlare delle illusioni ottiche?

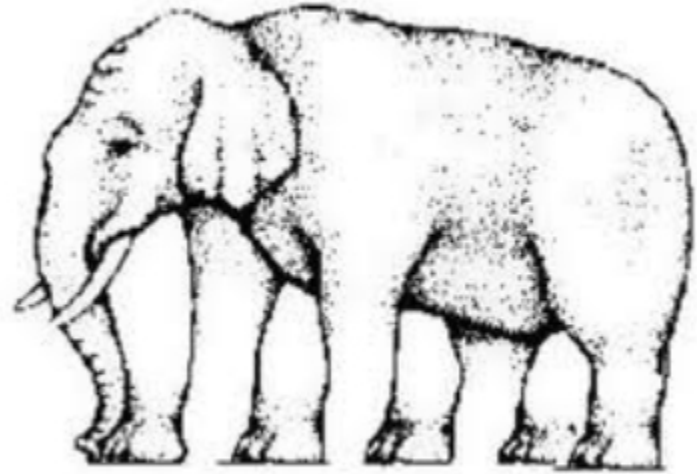
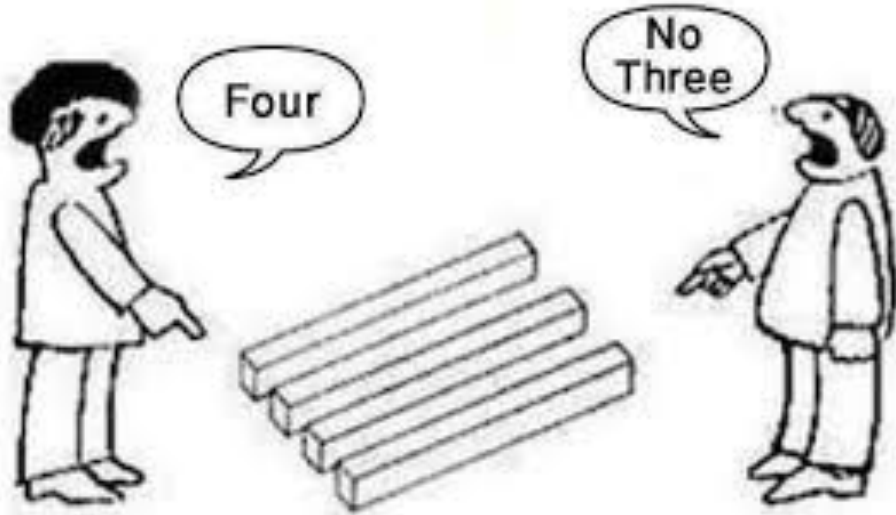
1) Le illusioni ci possono far vedere mondi ed oggetti impossibili!



Perché parlare delle illusioni ottiche?

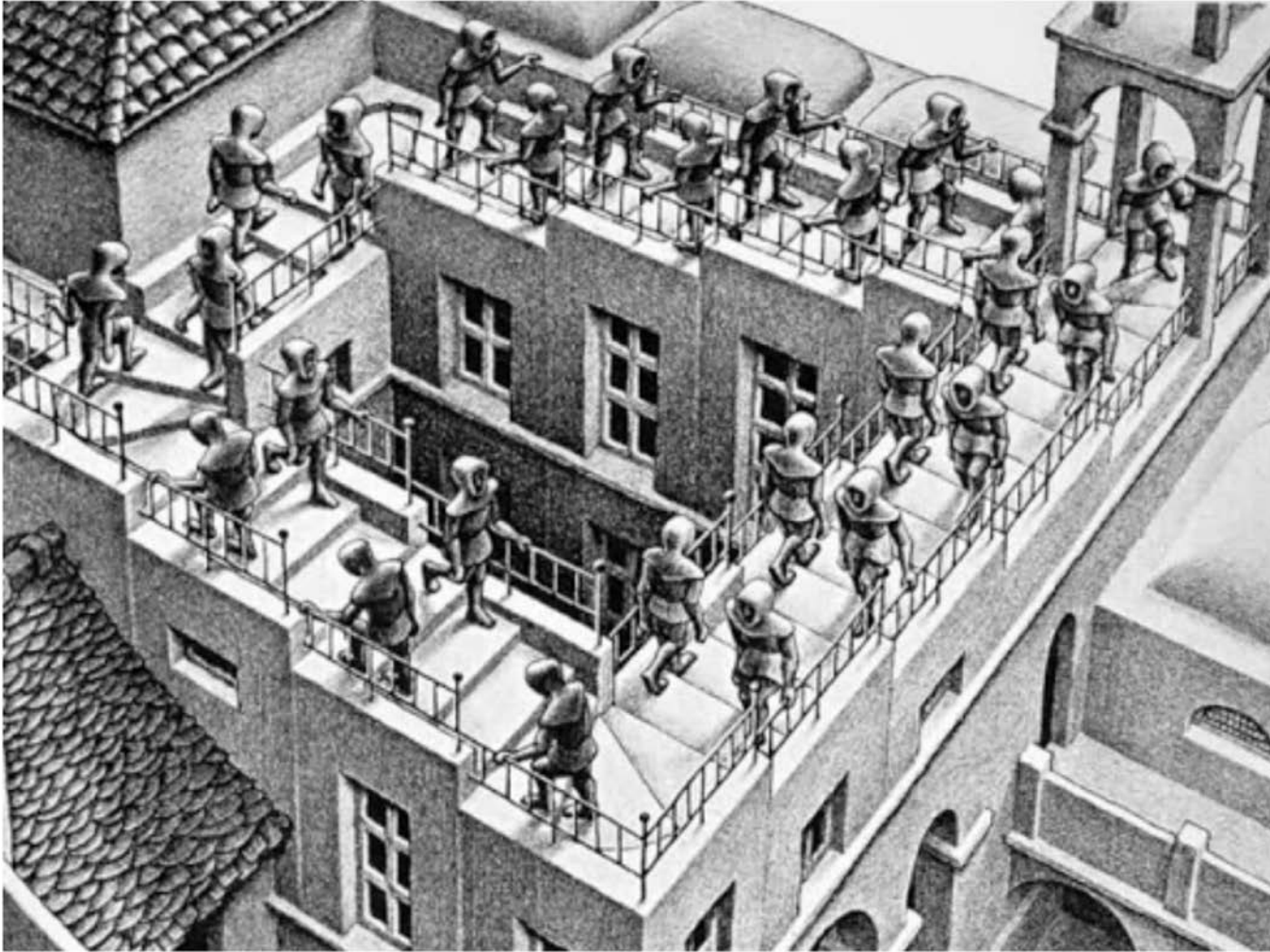
1) Le illusioni ci possono far vedere mondi ed oggetti impossibili!

It is really confusing!!!



Perché parlare delle illusioni ottiche?

1) Le illusioni ci possono far vedere mondi ed oggetti impossibili!



La magia delle illusioni ottiche di Escher

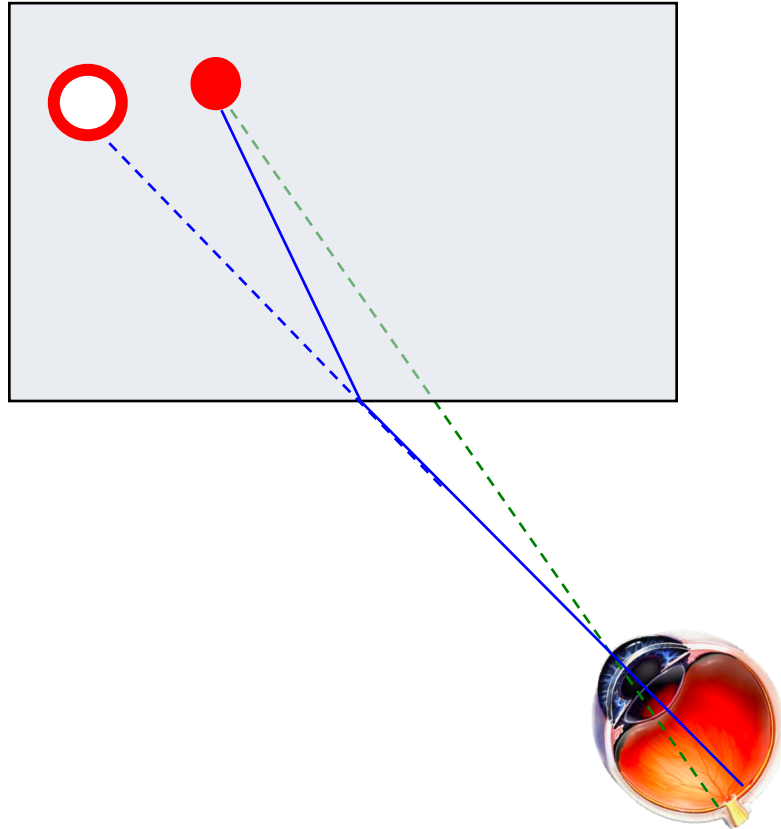


Perché parlare delle illusioni ottiche?

2) Possono aiutare a tenere svegli gli studenti a lezione!

Legge di Snell

$$\eta_1 \sin \theta_1 = \eta_2 \sin \theta_2$$

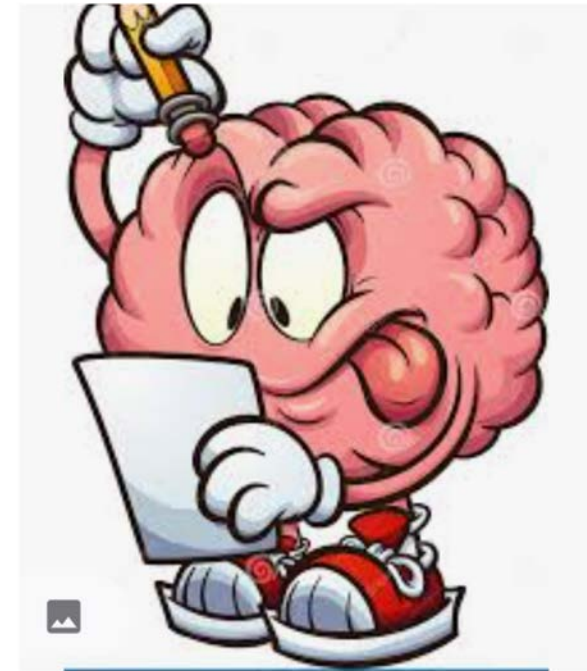


Perché parlare delle illusioni ottiche?

3) Ci possono insegnare cose molto importanti su come funziona il nostro cervello!

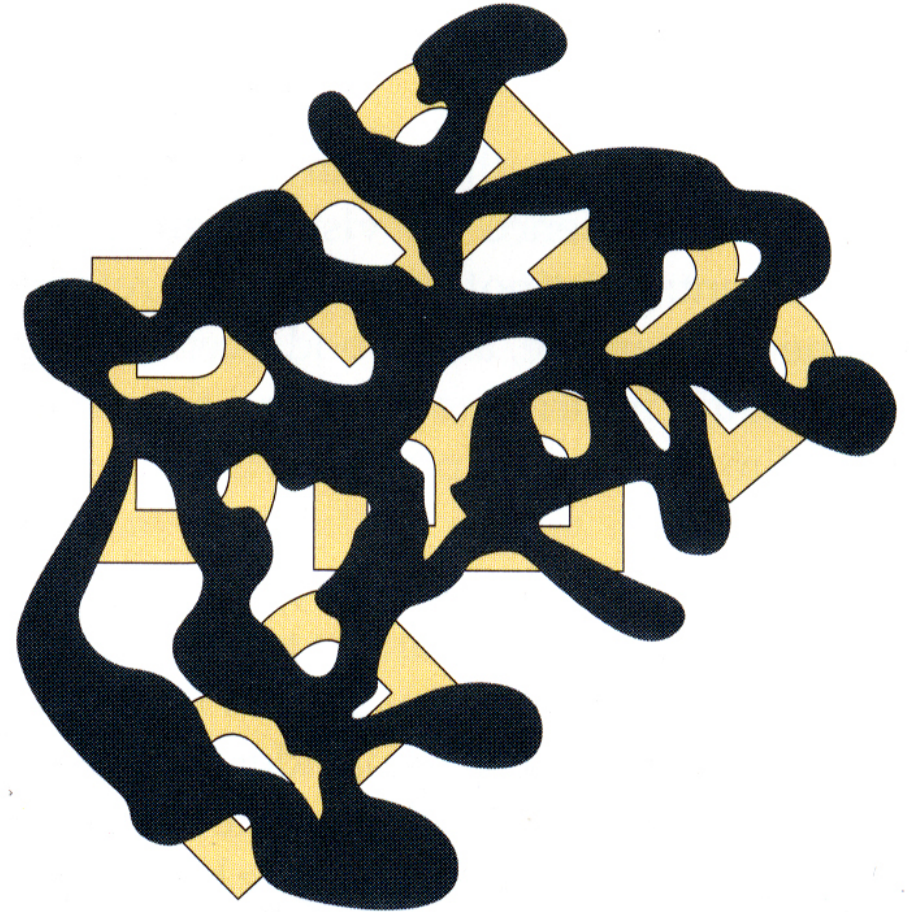
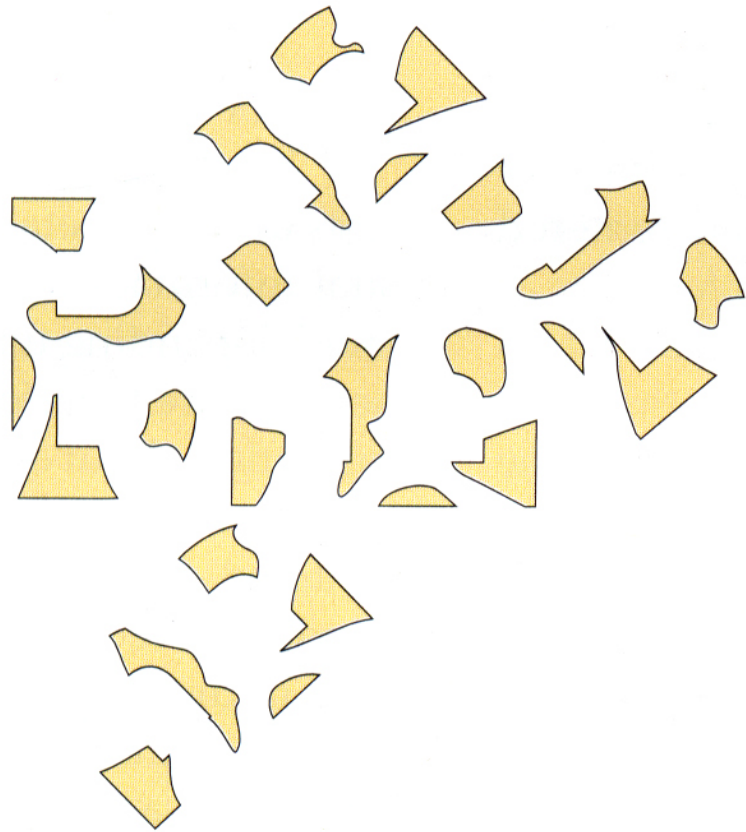


Vedere **NON** vuol dire che il cervello fa una fotografia di ciò che ci circonda



Vedere è l'azione tramite cui il cervello interpreta e dà significato a ciò che ci circonda

Vediamo anche grazie alla conoscenza di ciò che abbiamo visto in precedenza.



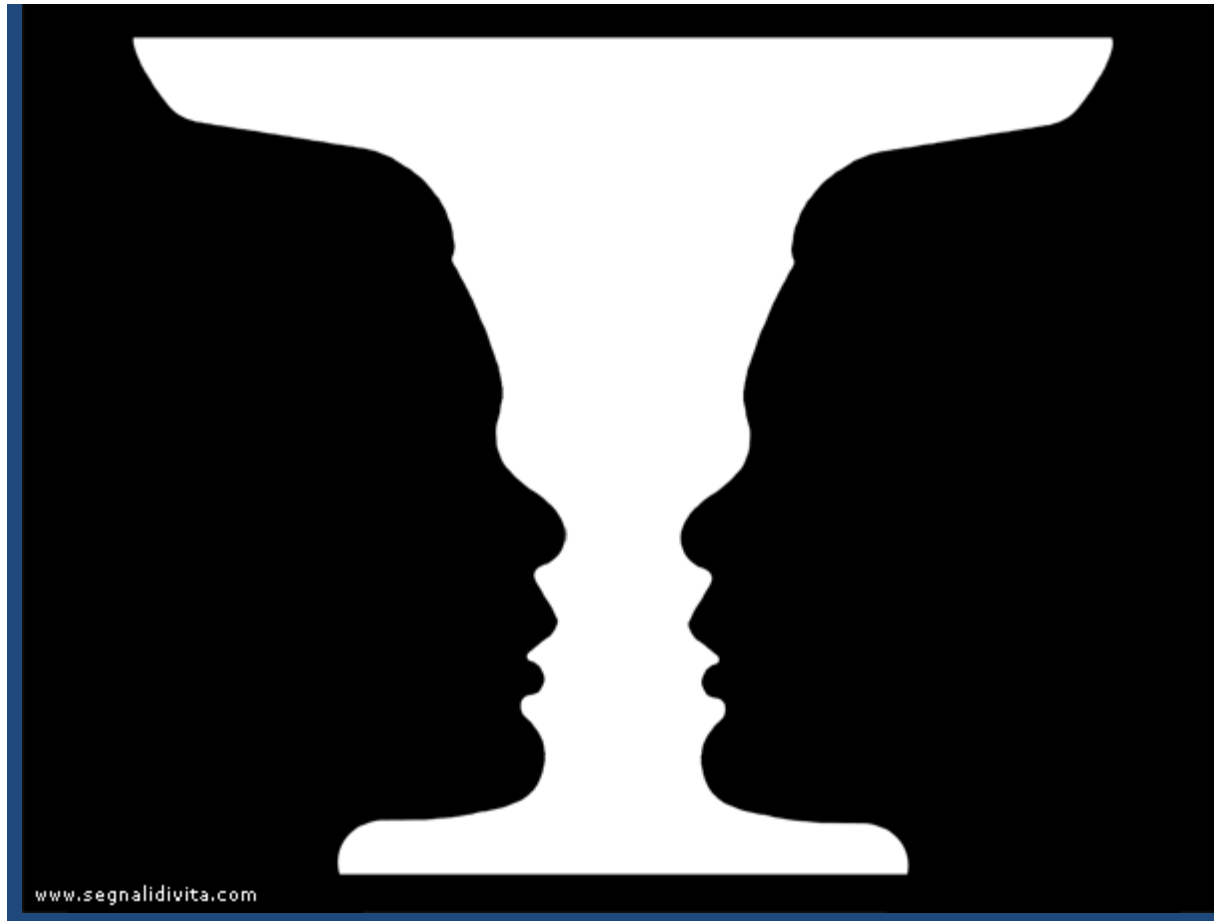
Perché parlare delle illusioni ottiche?

3) Ci possono insegnare cose molto importanti su come funziona il nostro cervello!



Perché parlare delle illusioni ottiche?

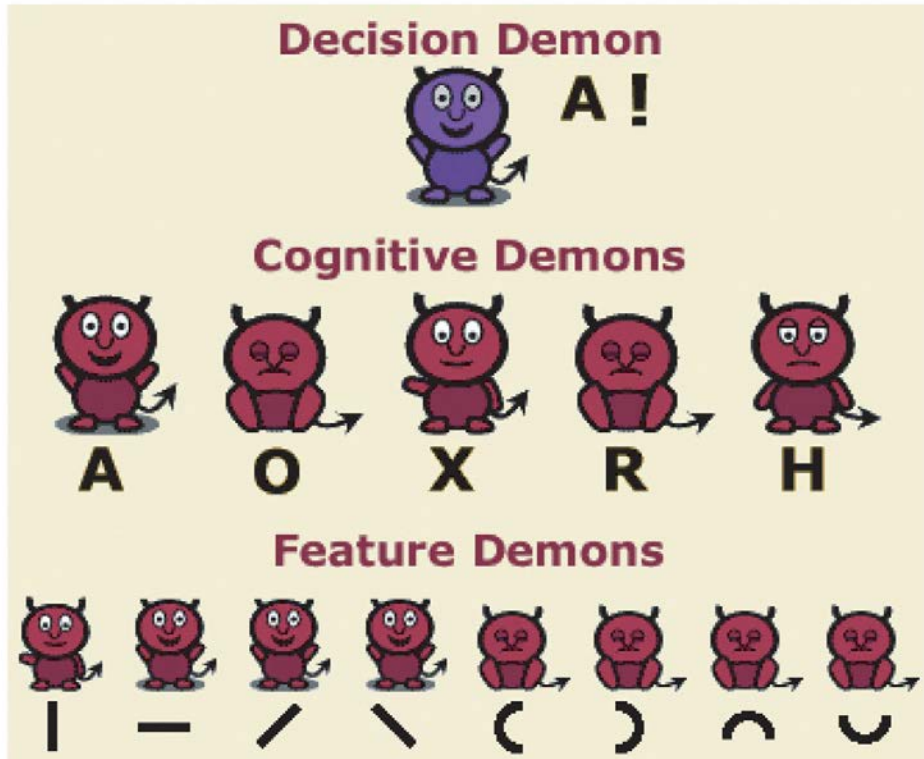
3) Ci possono insegnare cose molto importanti su come funziona il nostro cervello!



Vaso di Rubin

Perché parlare delle illusioni ottiche?

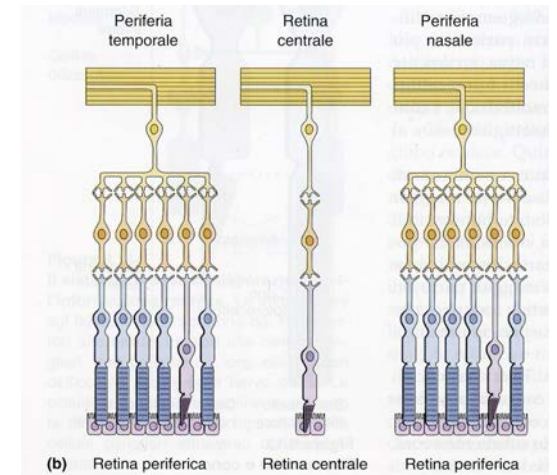
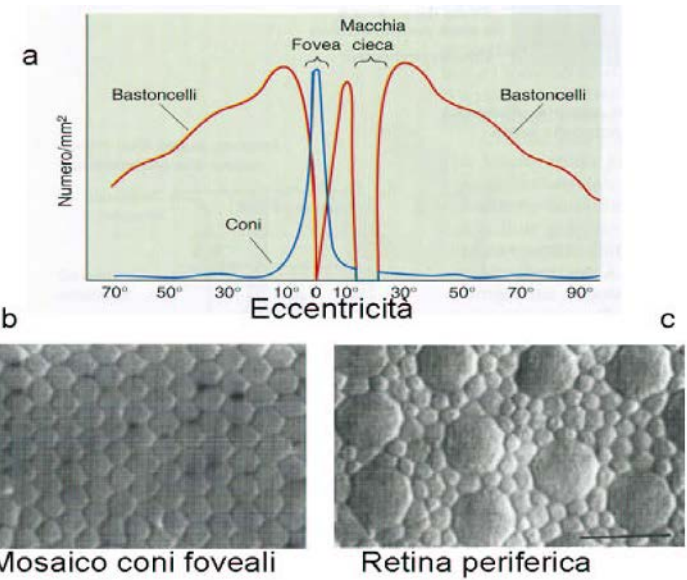
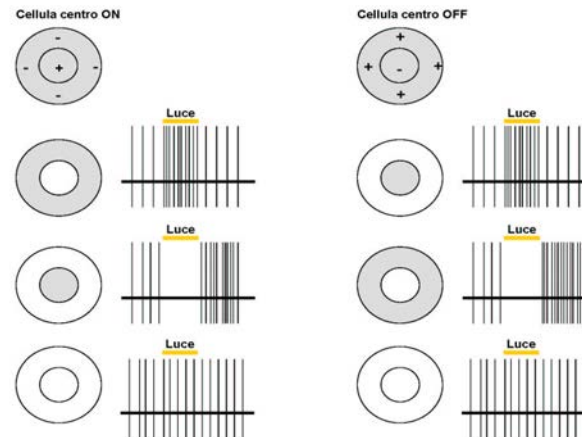
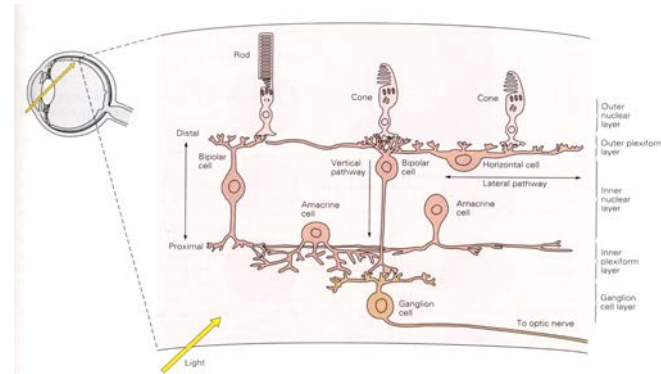
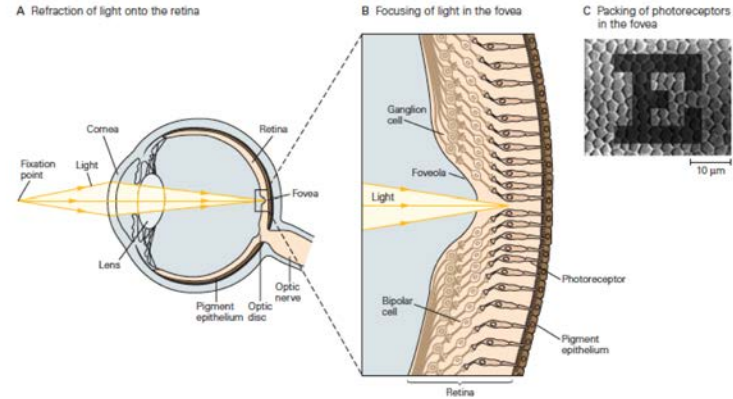
3) Ci possono insegnare cose molto importanti su come funziona il nostro cervello!



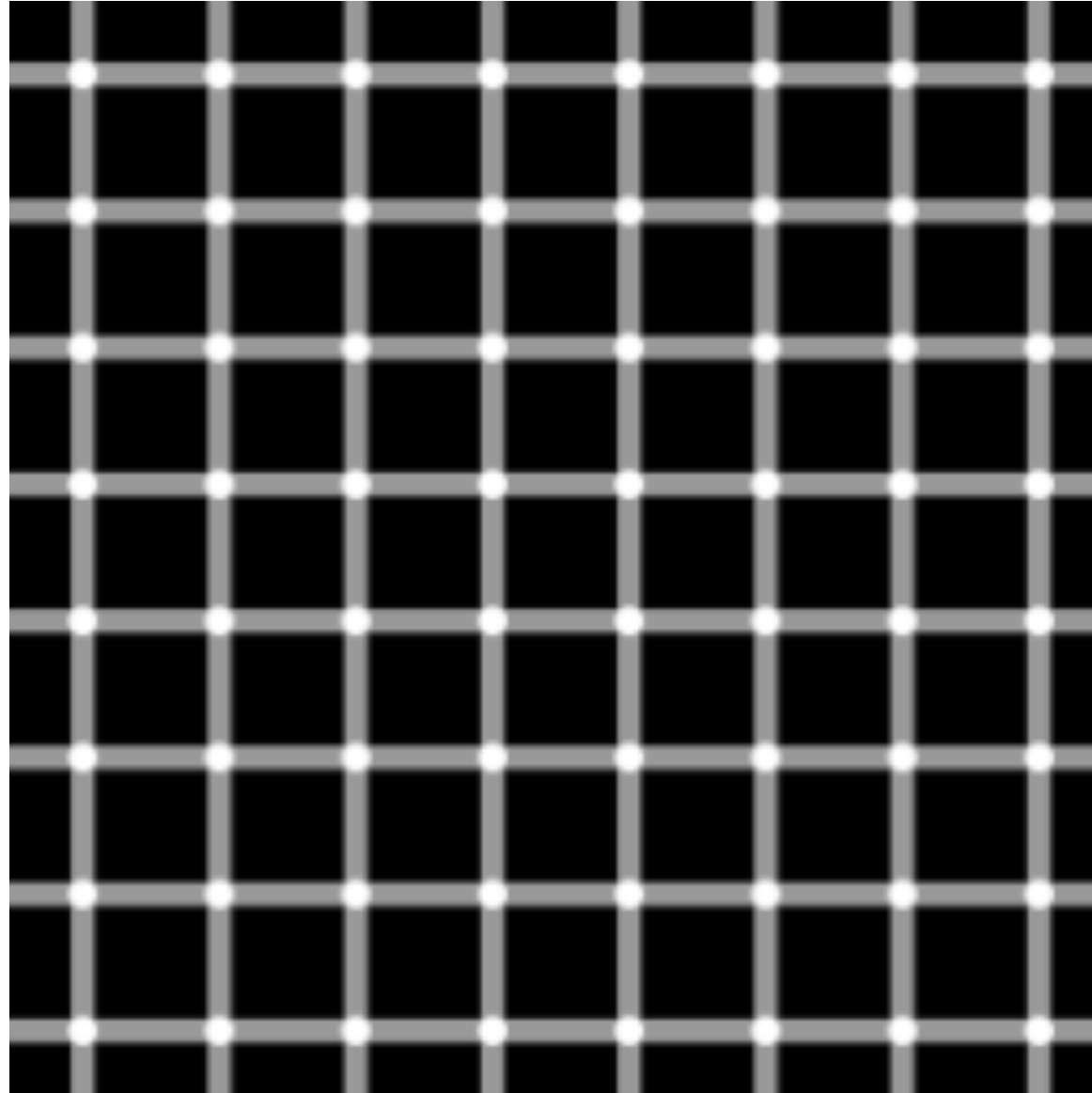
SENSATION AND PERCEPTION, Figure 4.14 © 2006 Sinauer Assoc



Noi vediamo ad «alta risoluzione» solo una piccola parte centrale di tutto il campo visivo. Questo principio passa sotto il nome di Tunnel Vision.

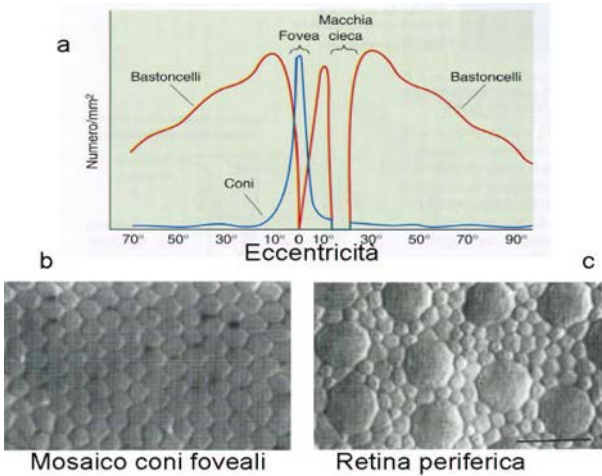


Noi vediamo ad «alta risoluzione» solo una piccola parte centrale di tutto il campo visivo. Questo principio passa sotto il nome di Tunnel Vision.

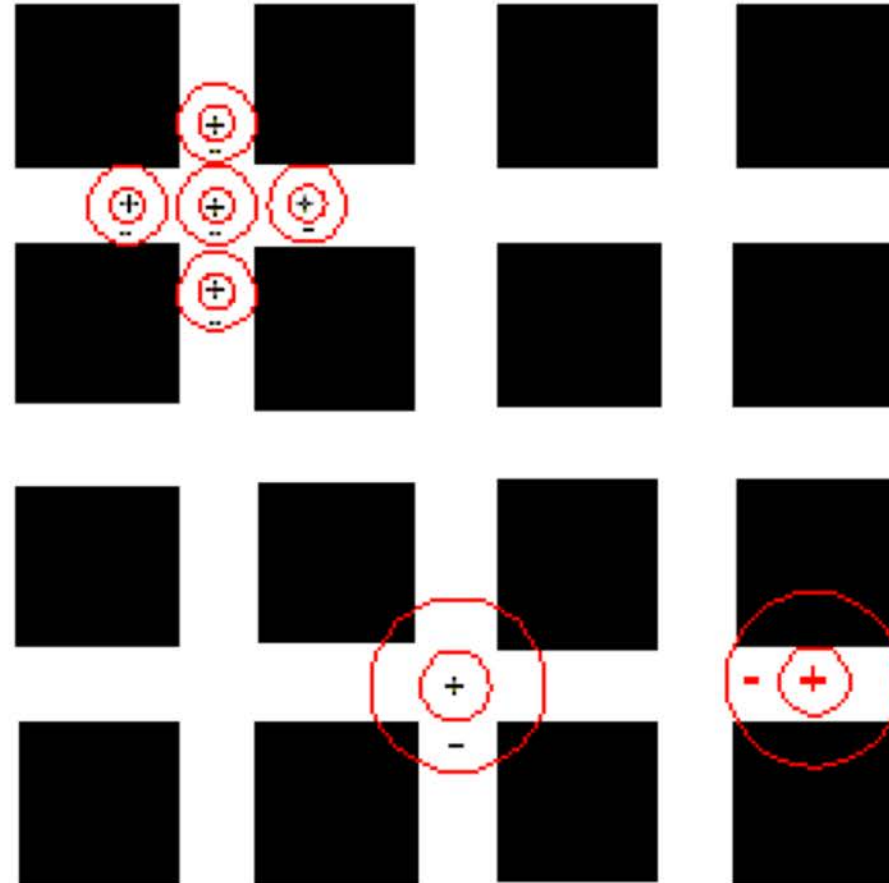


Hermann grid

Griglia di Hermann



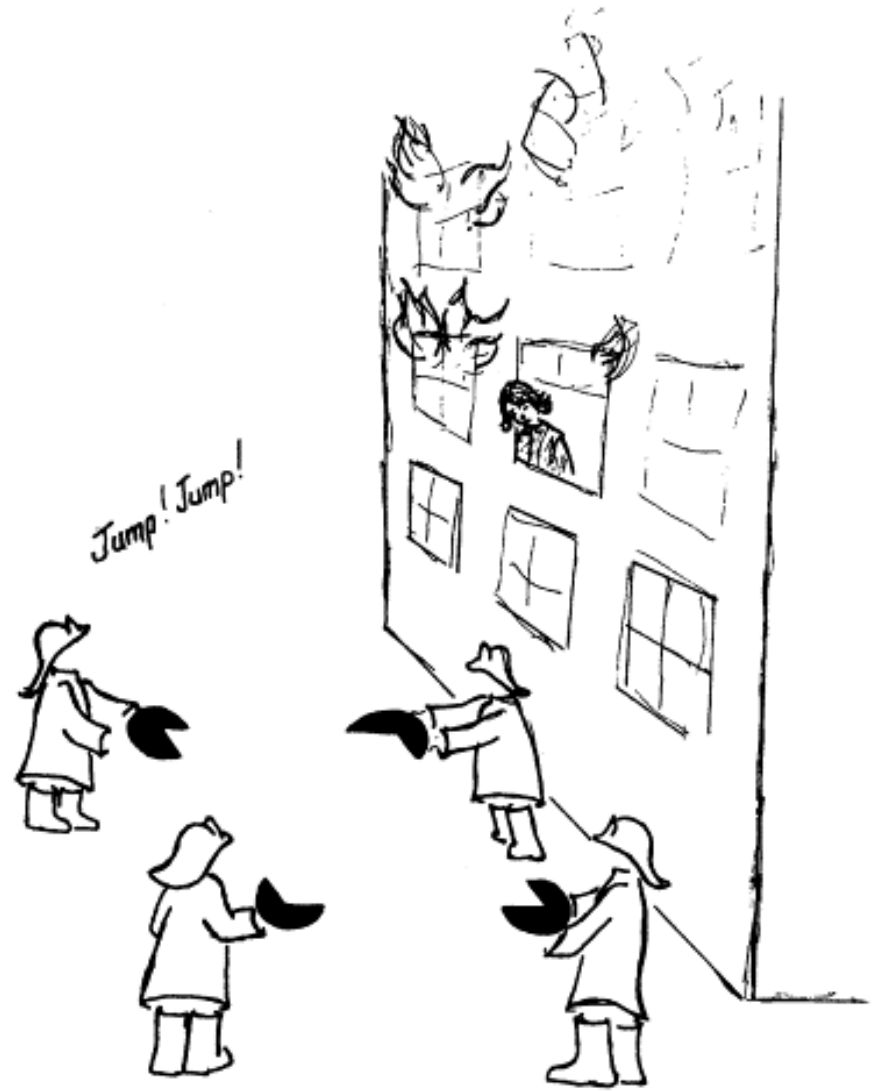
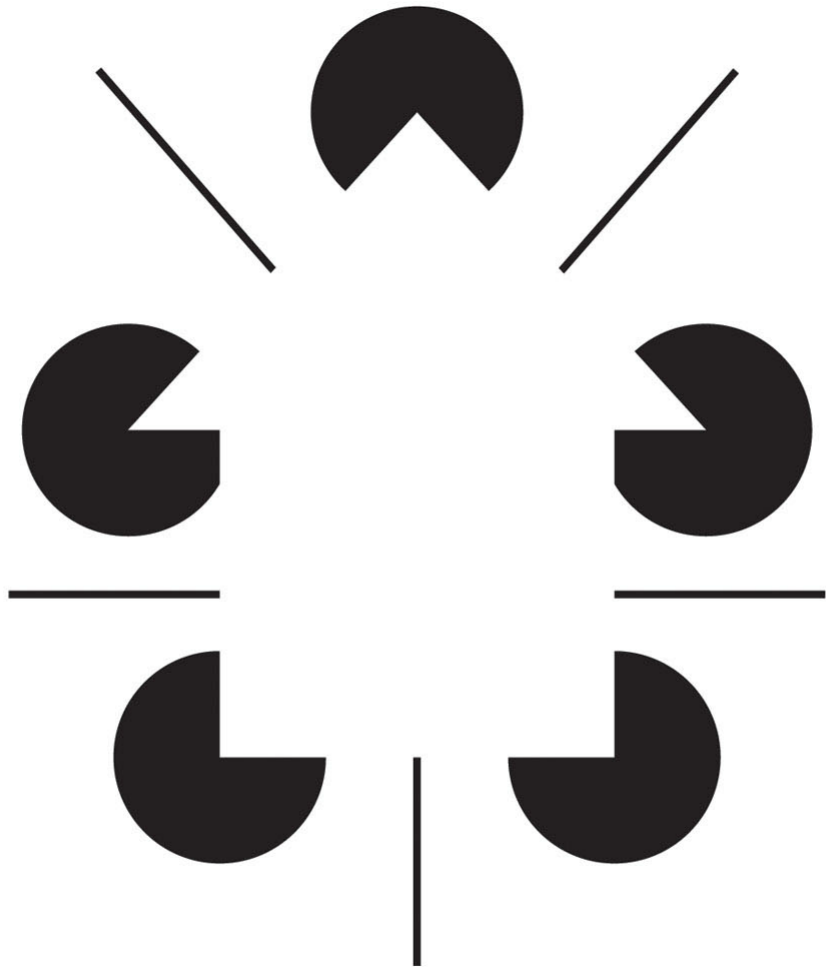
foveal
representation



extra-foveal
representation

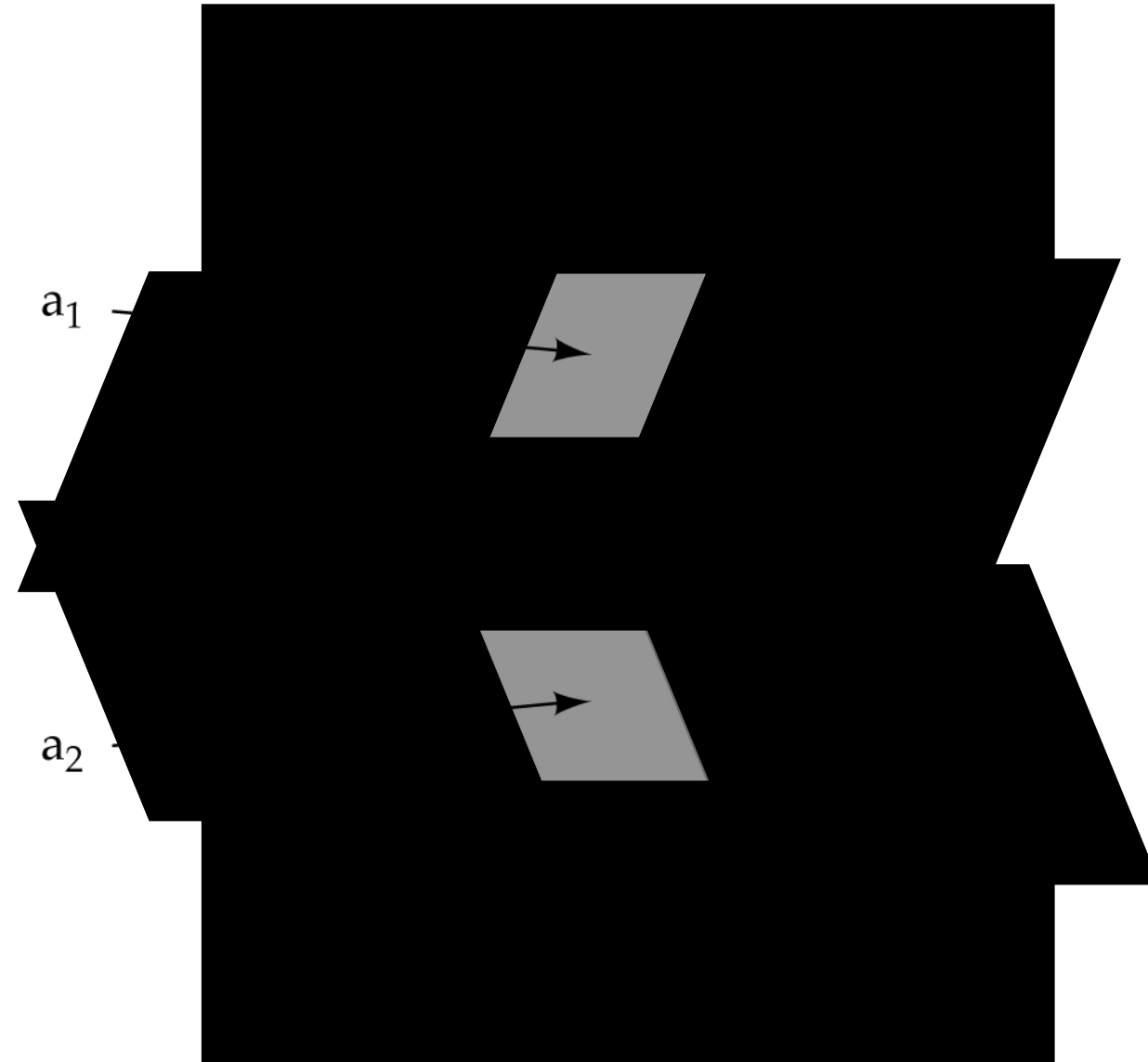


Distinguere gli oggetti fra loro e gli oggetti dallo sfondo...



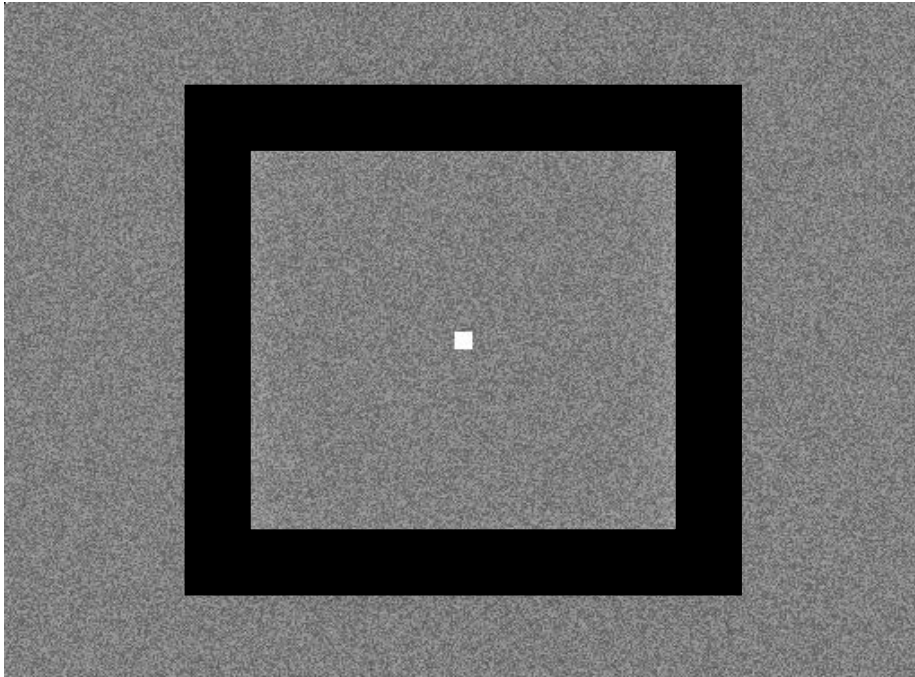
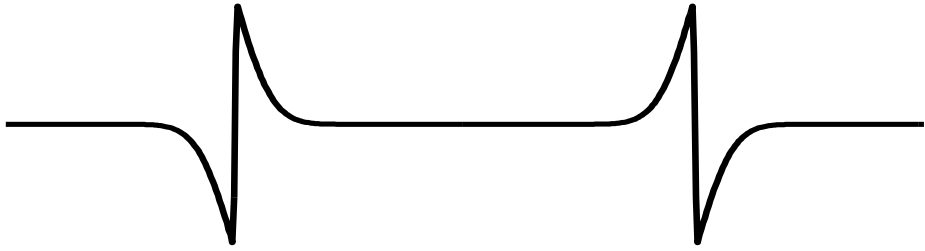
GESTALT FIREMEN PLAY A JOKE!

Quello che vediamo in un punto del campo visivo, dipende da come interpretiamo l'immagine nel suo complesso

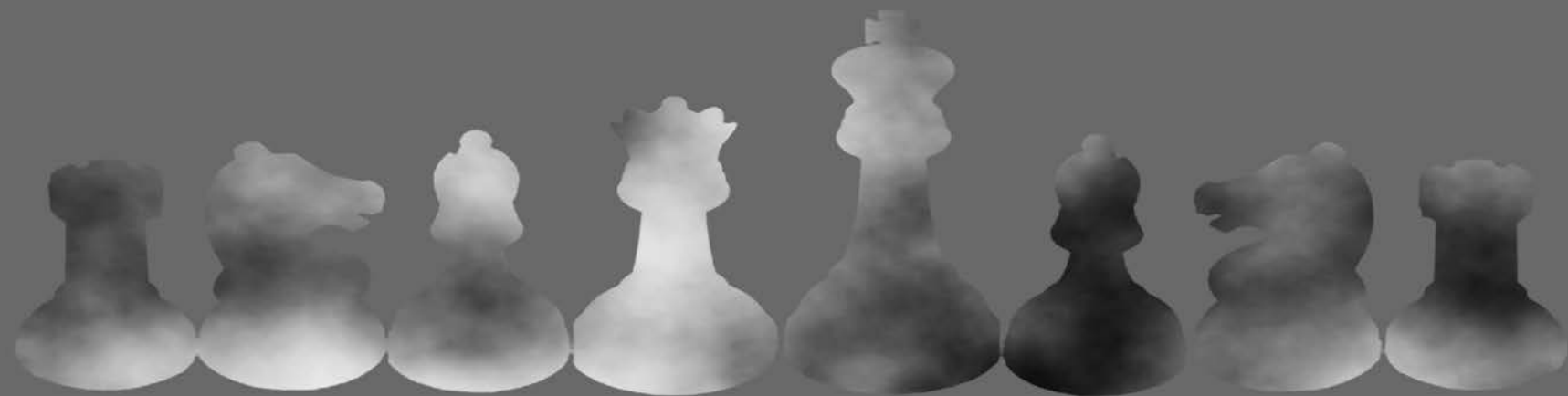
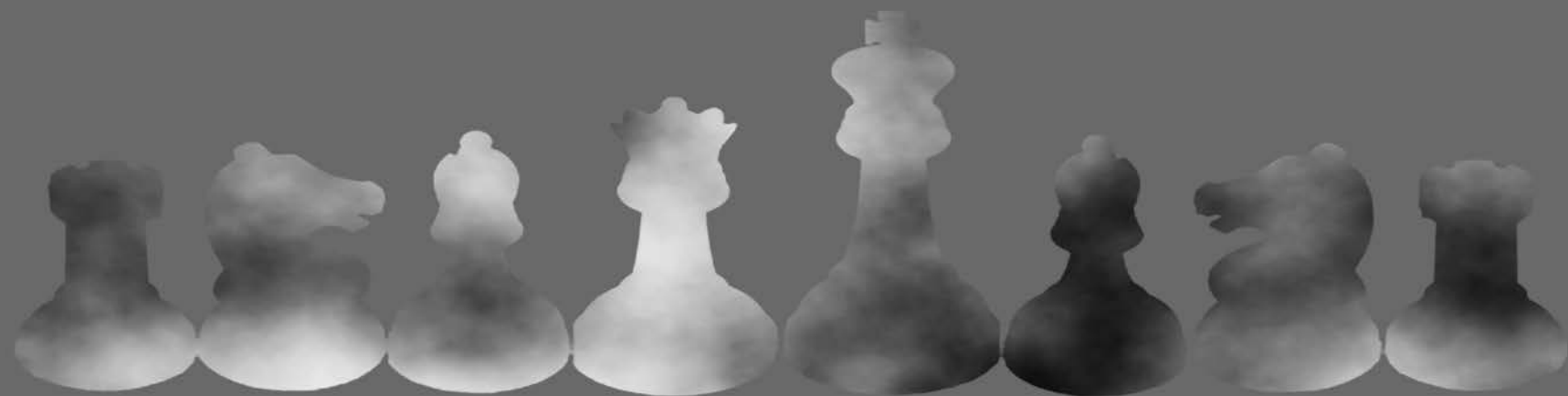


Quello che vediamo in un punto del campo visivo, dipende anche da quello che si trova altrove

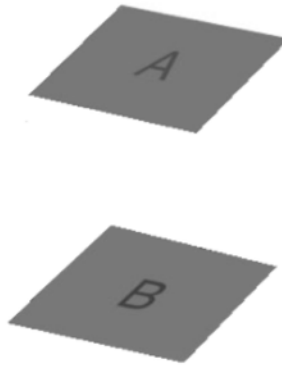
Cornsweet illusion







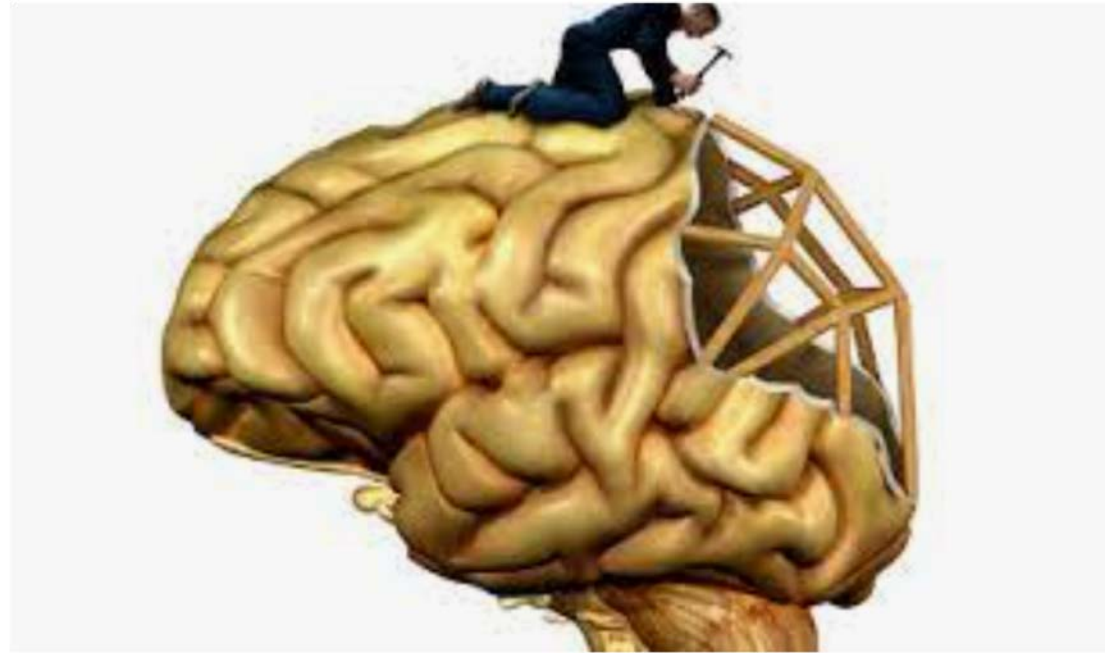
The Adelson's Checkershadow Illusion



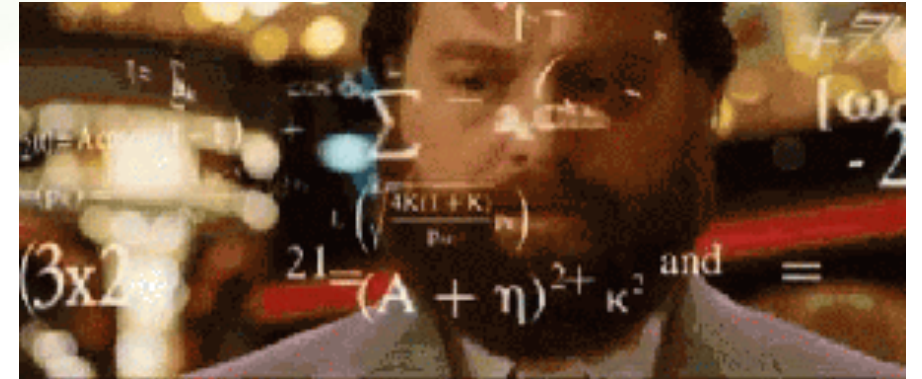
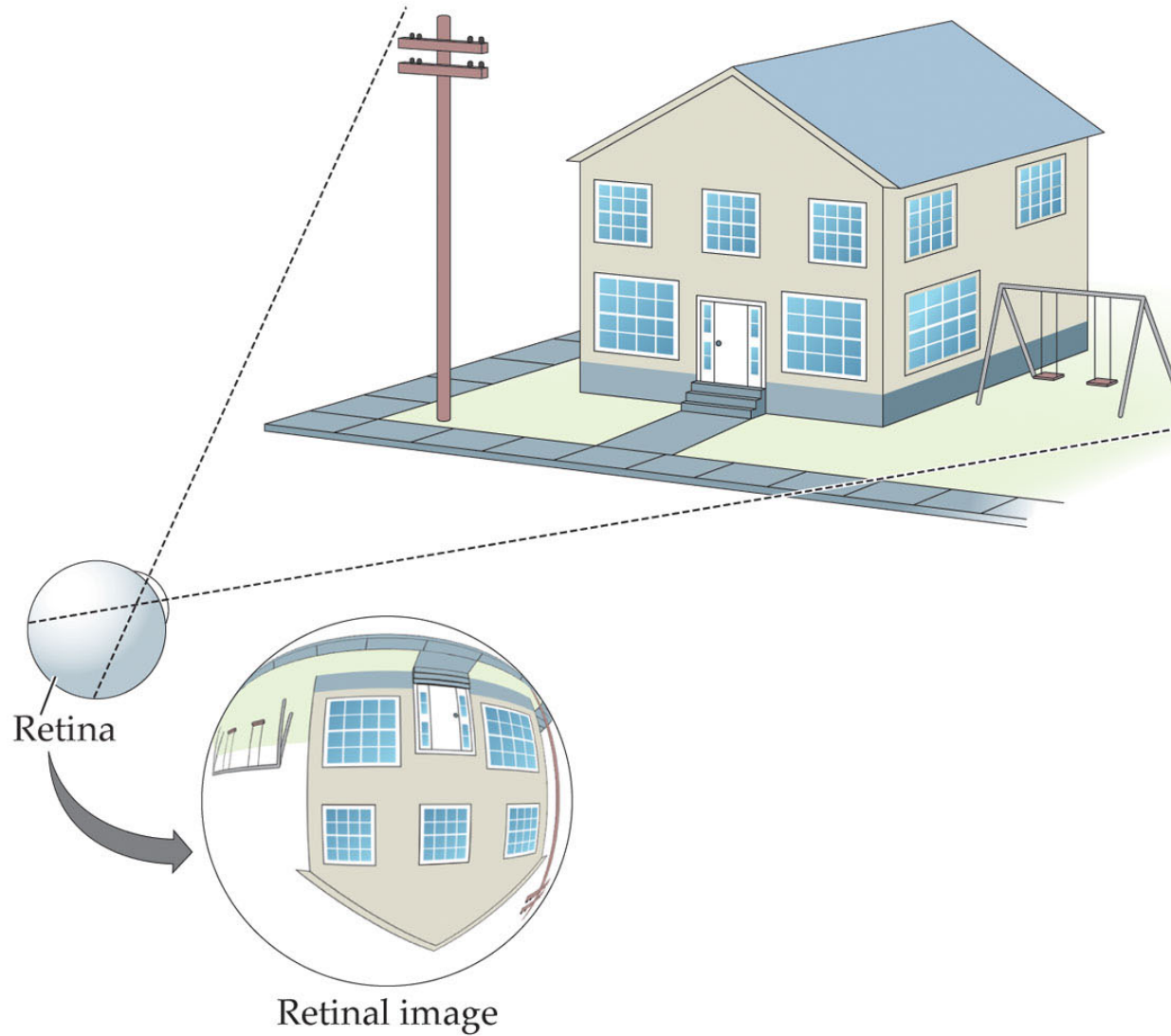
The Adelson's Checkershadow Illusion

youtube.com/brusspup

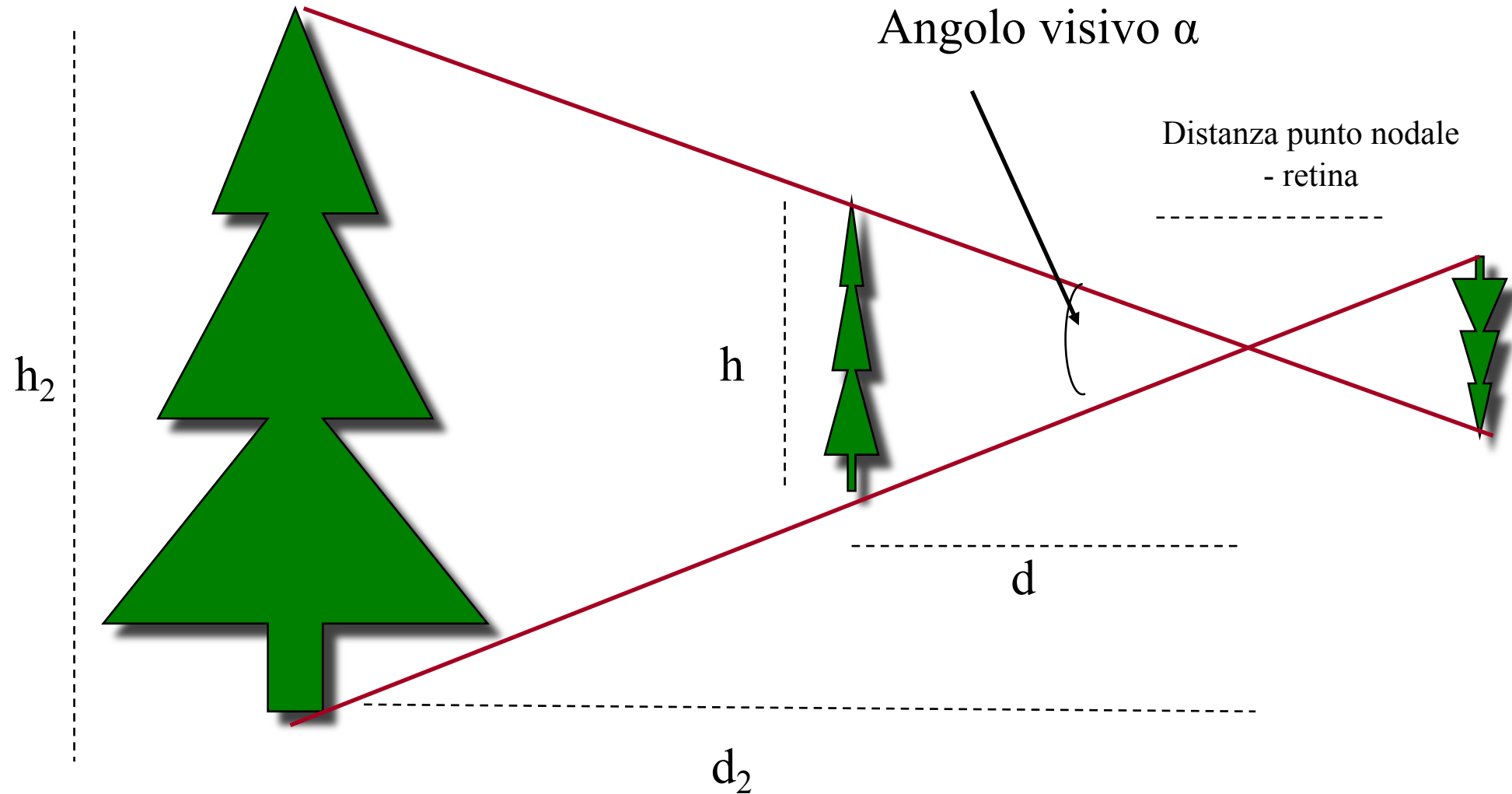
La visione e la dimensione perduta



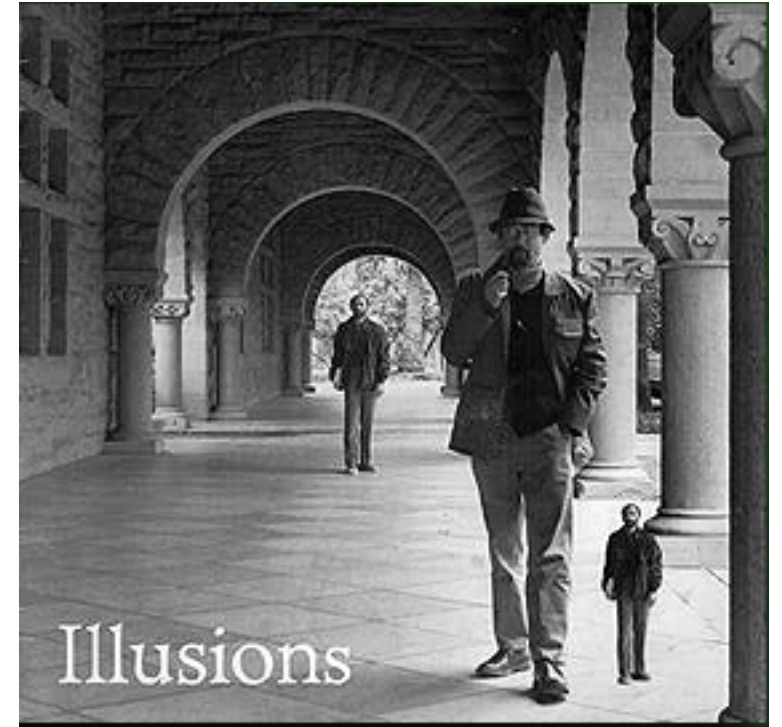
Da un mondo 3D a una immagine 2D

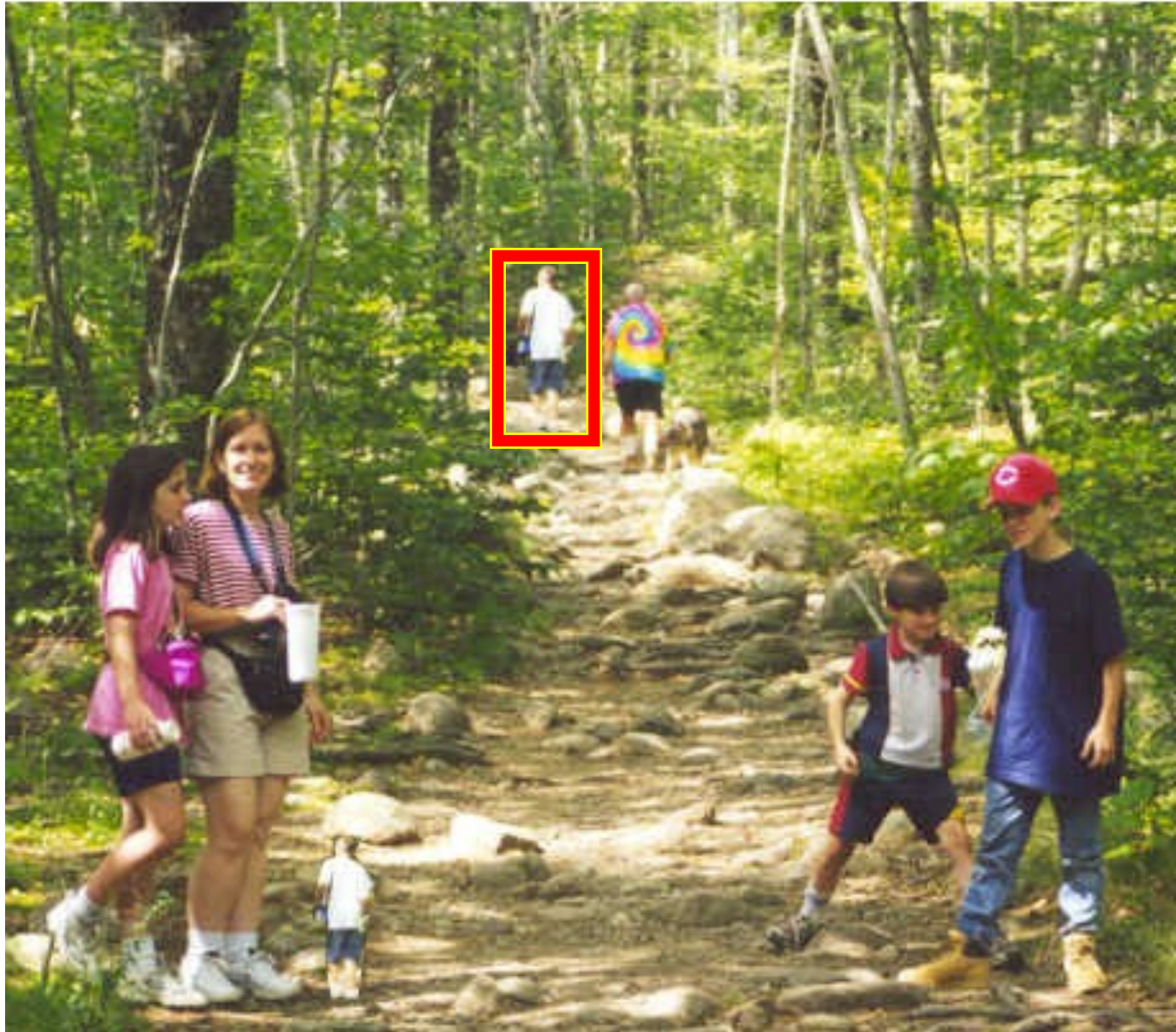


Come il cervello stima la grandezza degli oggetti



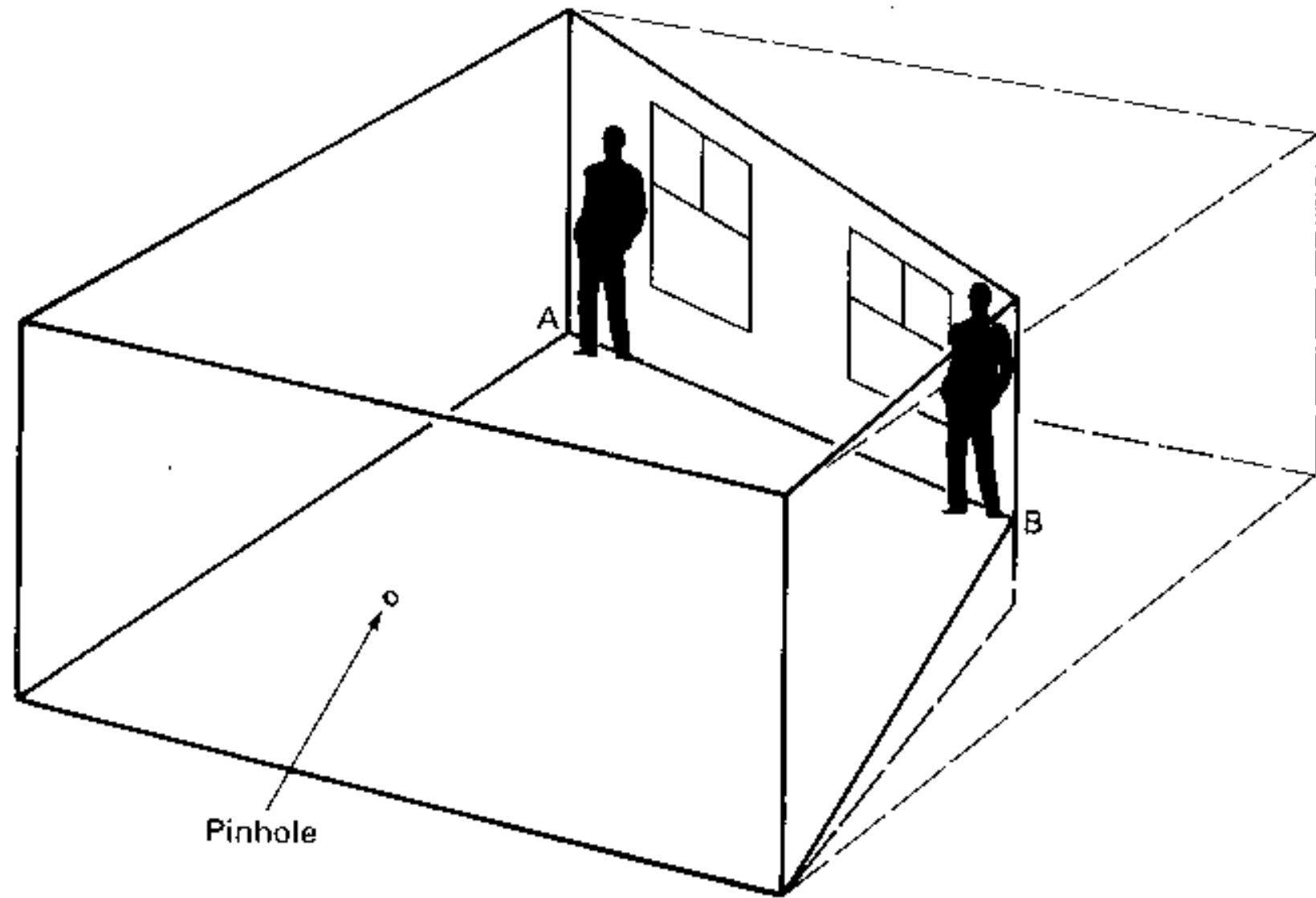
Se la stima della distanza è sbagliata....





La stanza di Ames



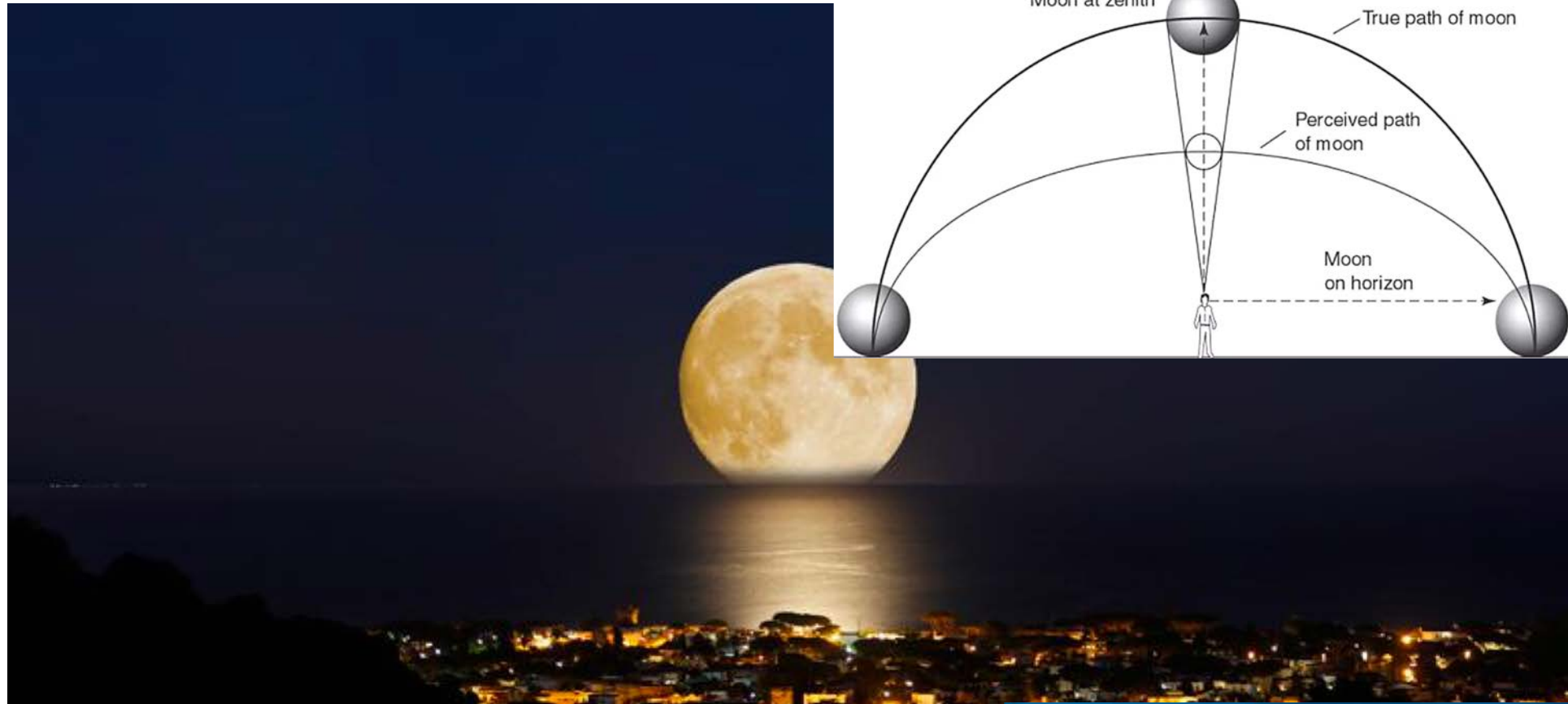




Quanto è grande la luna?



L'illusione della luna



🏠 > Current Issue > vol. 97 no. 1 > Lloyd Kaufman, 500–505, doi: 10.1073/pnas.97.1.500



Explaining the moon illusion

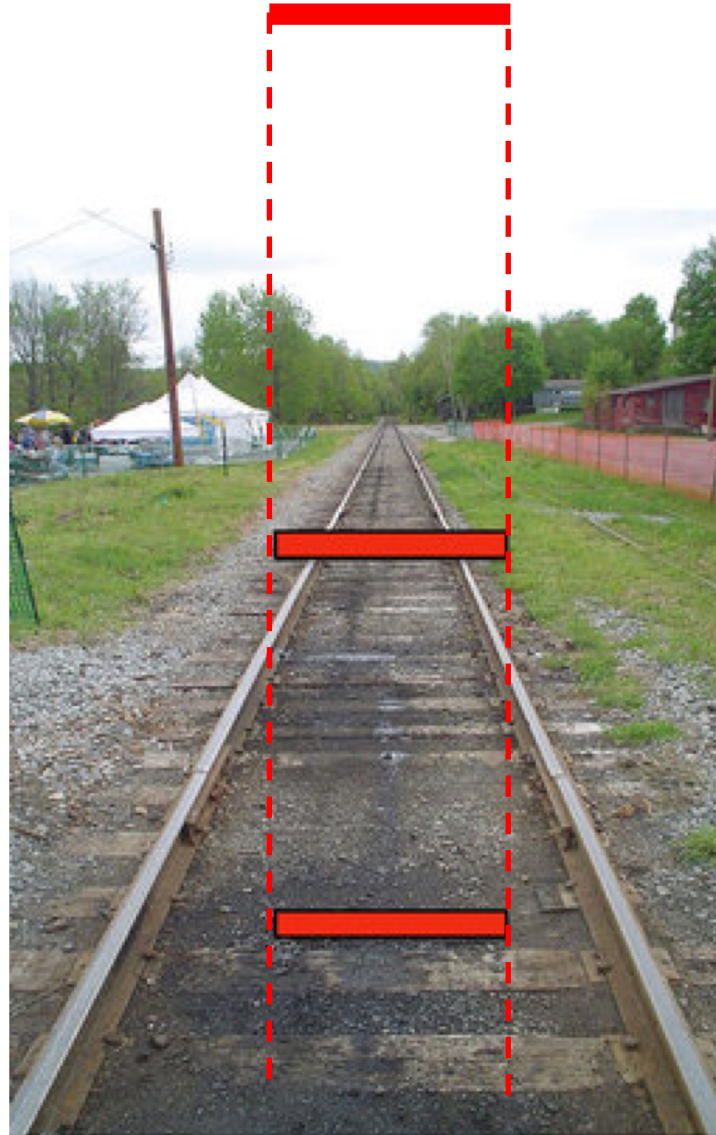
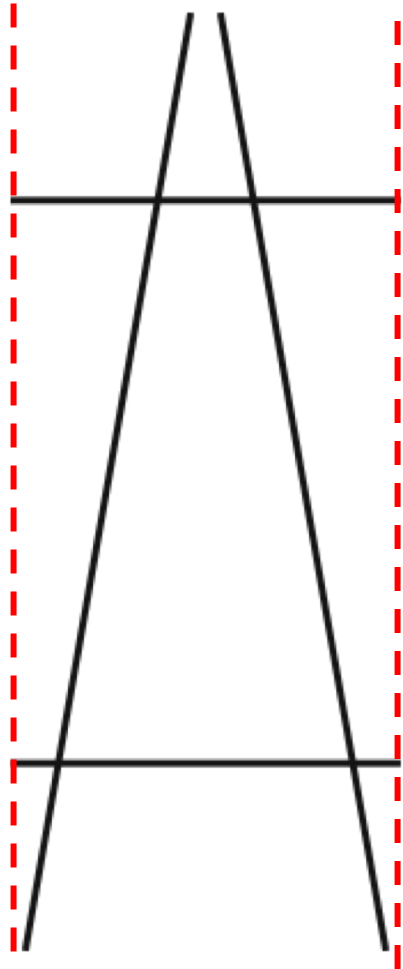
Lloyd Kaufman^{*†} and James H. Kaufman[‡]

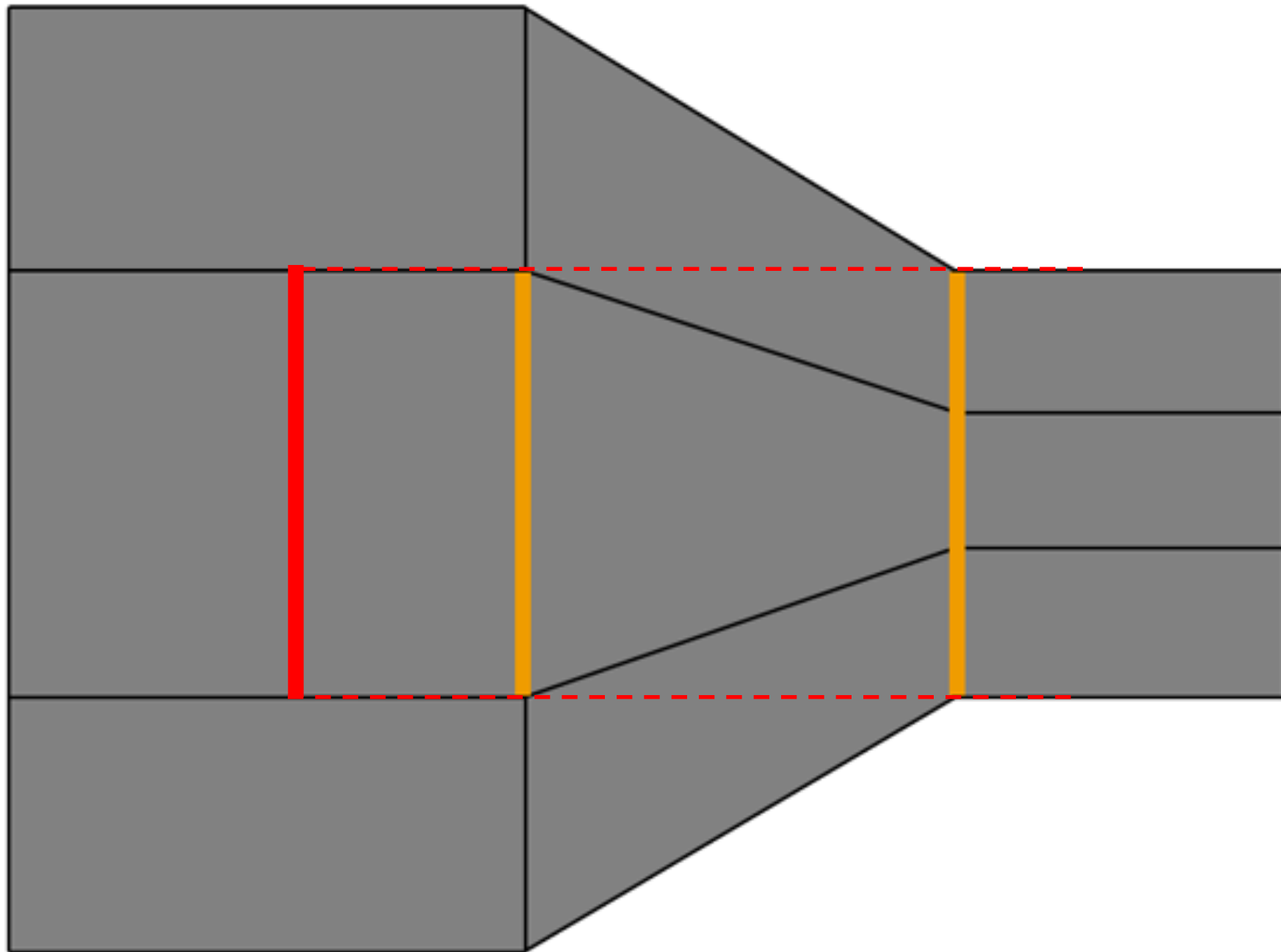
Quando si parla di profondità bisogna ovviamente anche tenere presente le regole prospettiche!

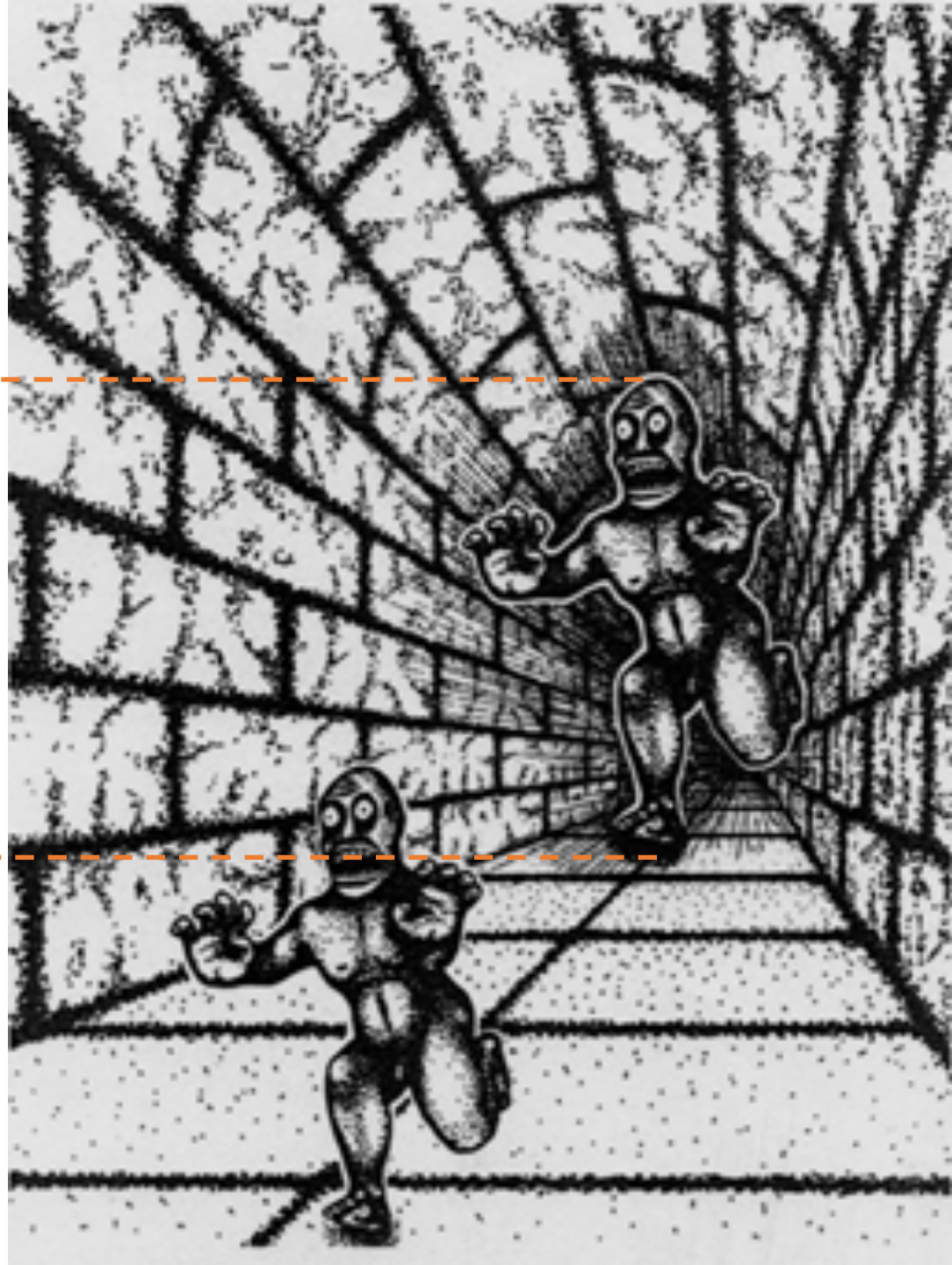
**Immagini parallele che non
siano disposte sul piano
ortogonale a quello di
osservazione condividono
lo stesso punto di fuga**



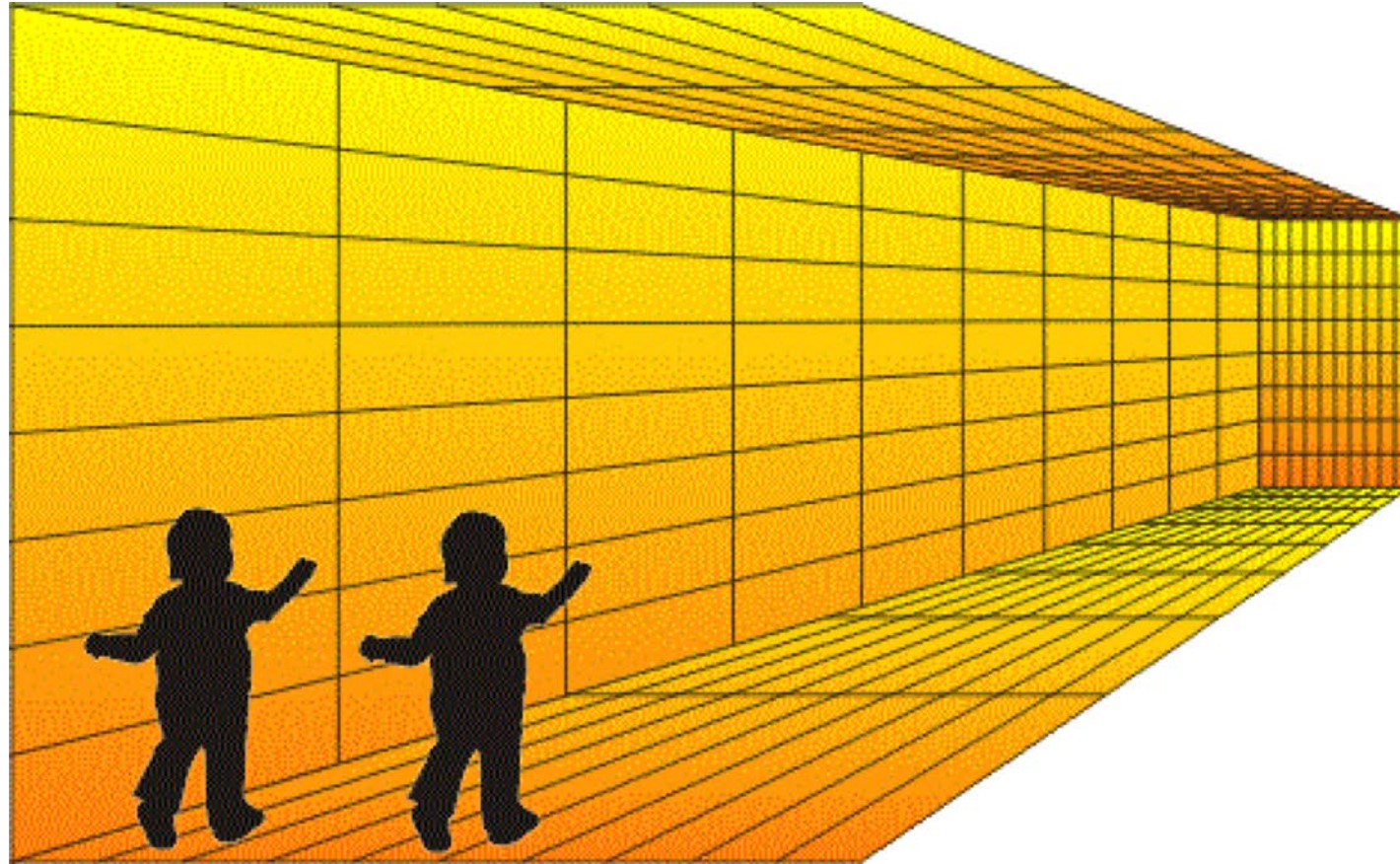
L'illusione di Ponzo







Il cervello ricalcola la grandezza percepita degli oggetti in riferimento alle informazioni prospettiche in modo rapidissimo!



Alcuni artisti usano le regole prospettiche per fare veri e propri capolavori!



Alcuni artisti usano le regole prospettiche per fare veri e propri capolavori!

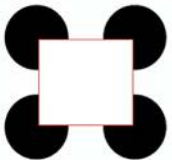



Superfici uguali? Usano
la stessa tovaglia?





Il caso del paziente MM


FORM

a Outlined form

 What is the outlined shape? MM = 100%;
 C = 100%, 100%, 100%;
 P = 1

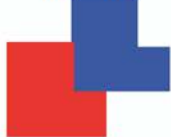
b Texture segmentation

 What orientation is the rectangle of different contrast?
 MM = 96%; C = 100%, 100%, 100%; P = 0

c Line contour integration

 Is there a pathway of lines within the random lines?
 MM = 80%; C = 100%, 90%, 95%; P = 0.02

d Glass pattern

 Is there a circular pattern within the random noise? MM = 73%; C = 80%, 85%, 100%; P = 0.06


e Illusory contours

 What is the 'hidden' shape outlined by the black apertures?
 MM = no response; C = t

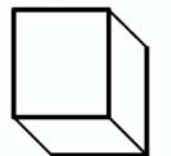
DEPTH

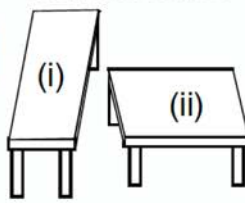
f Occlusion

 What is the color of the object in front?
 MM = 100% C = t

g Texture segmentation

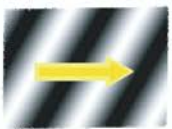
 Which sphere is bulges out?
 MM = 100% C = t


h Transparency

 How many objects are there, and which is in front?
 MM = 0% C = t


i Perspective

 What is the shape of the object?
 MM = no response
 C = t


j Shepard Tables

 Which tables match in shape / use the same table-cloth? width/height bias (100% veridical);
 MM = 100%; C = 63%, 63%, 47%; P = 0.009


MOTION

k Simple/complex/barber pole motion

 What direction is the pattern moving in?
 MM = 100% C = t

l Form from motion

 What is the orientation of the rectangle of different motion?
 MM = 100%; C = t

m Motion Glass patterns

 Is there a circular/swirling pattern within the random noise?
 MM = 90%; C = 95%, 80%, 85%; P = 0.74

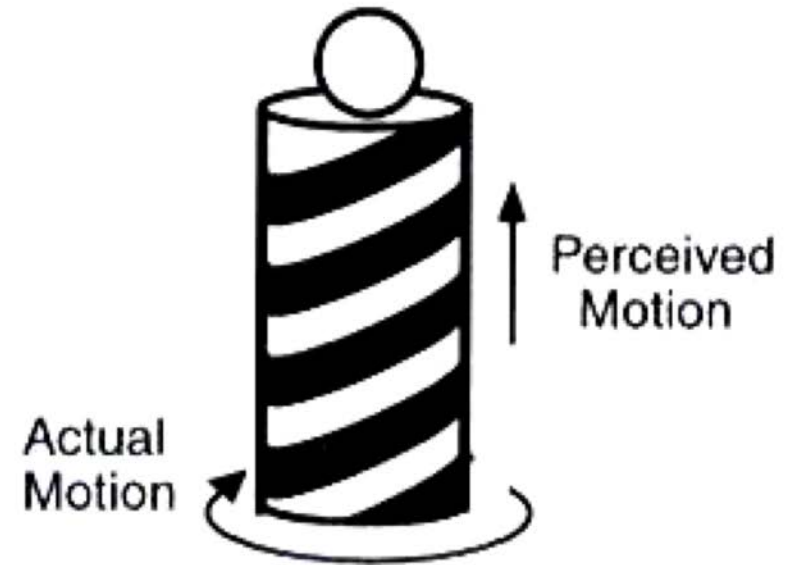
n Kinetic depth effect

 What is the shape of the object?
 MM = 100%; C = t

o Ecological motion

 What do the moving dots represent?
 MM correctly identified a moving walker.

L'importanza della percezione del movimento...



L'illusione dell'insegna dei barbieri

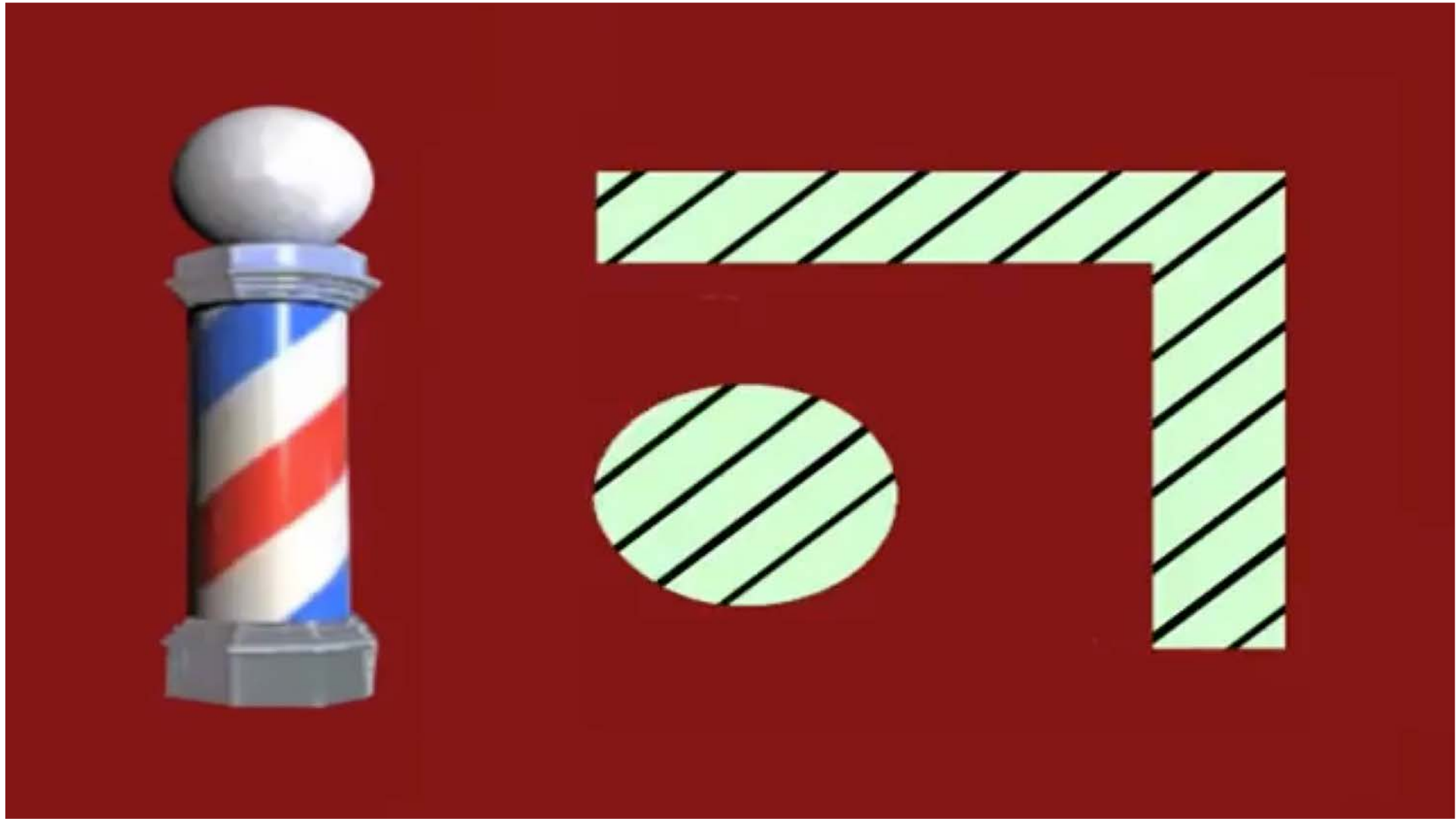


A. Barberpole Illusion

The barber pool illusion

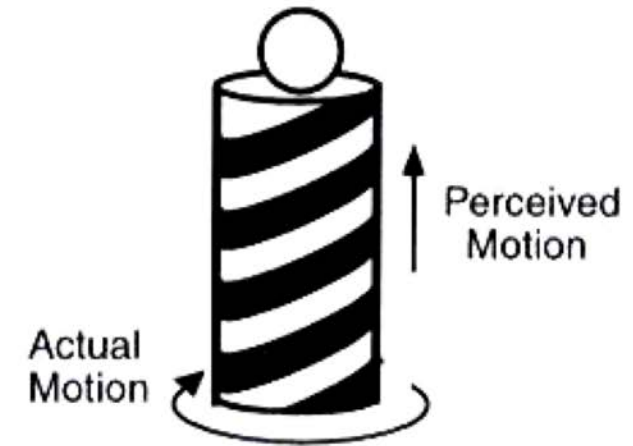


The barber pool illusion

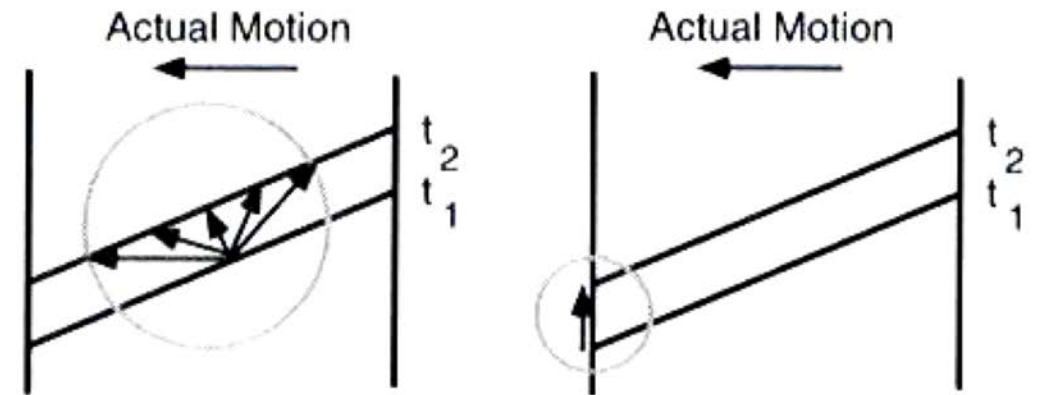


The barber pool illusion

L'illusione
dell'insegna
dei barbieri

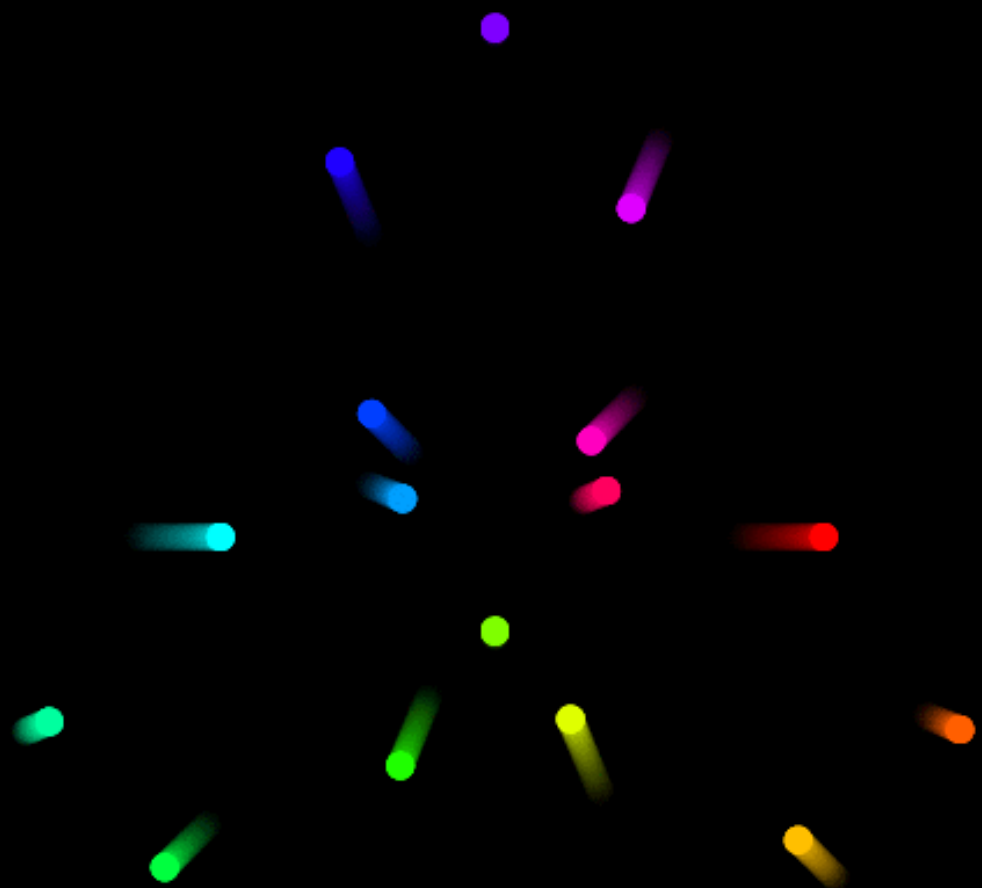


A. Barberpole Illusion

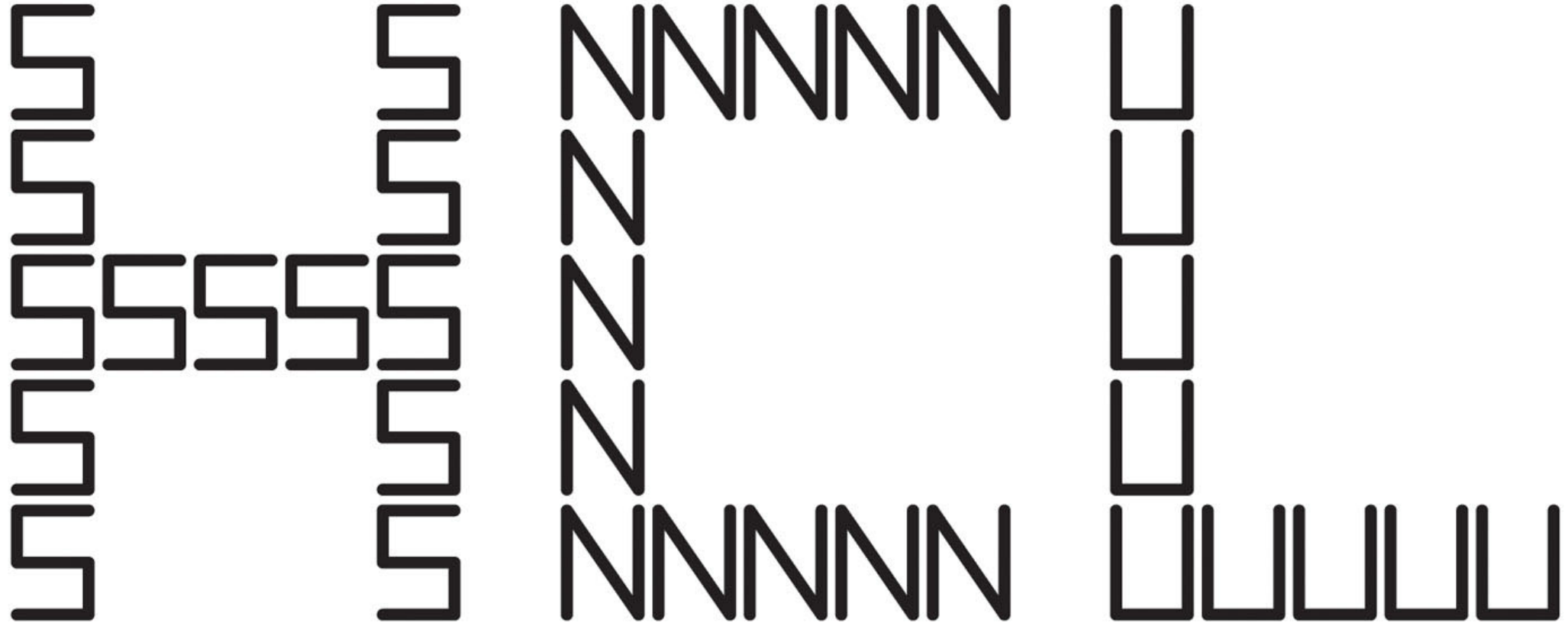


B. Possible Motions
in the Center

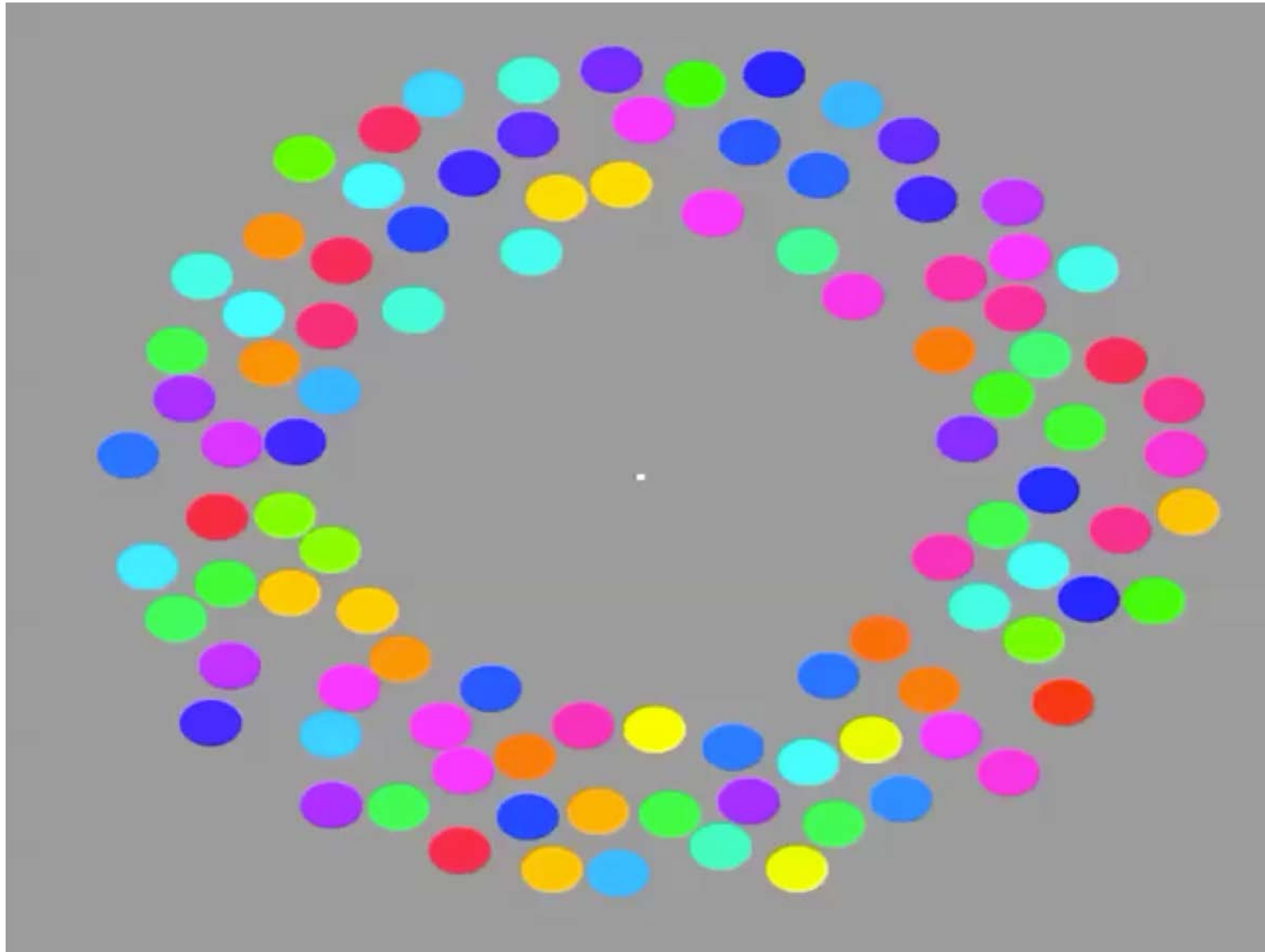
C. Possible Motion
at the Edge



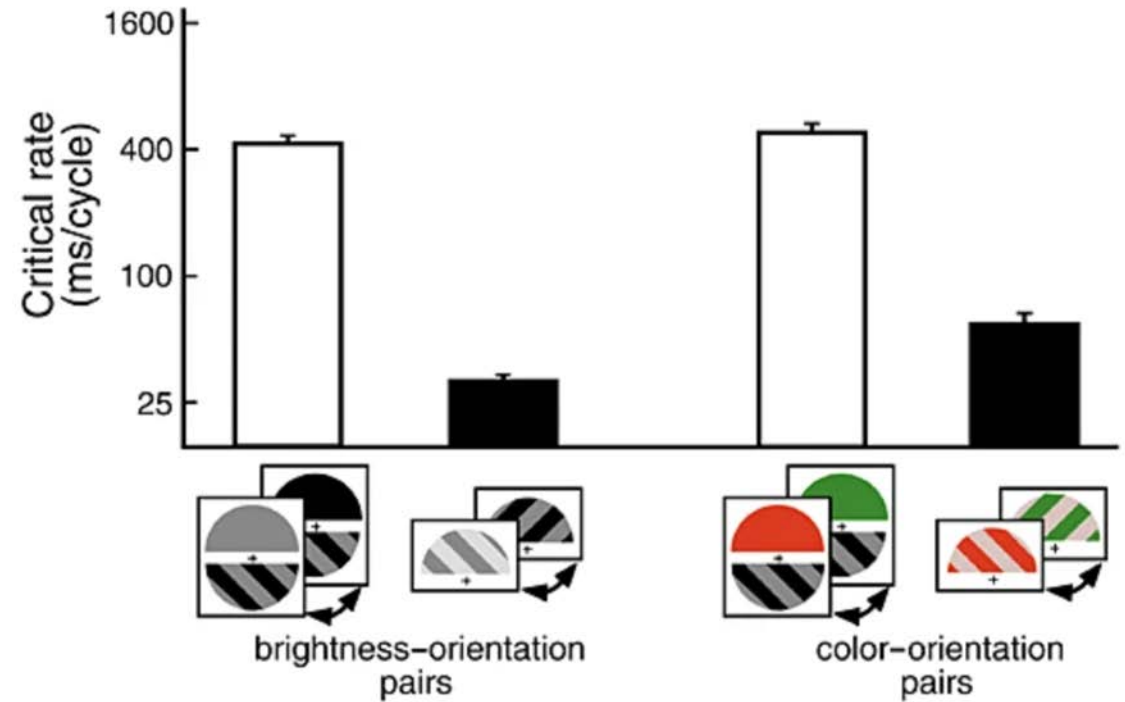
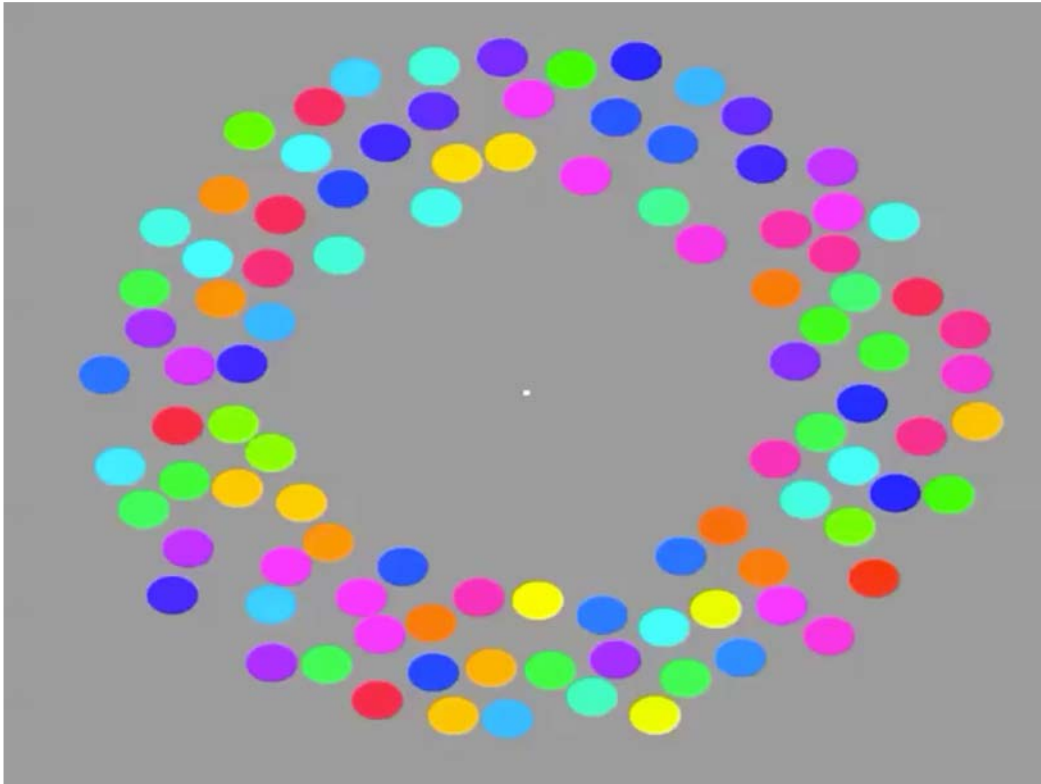
Percezione Locale e Globale

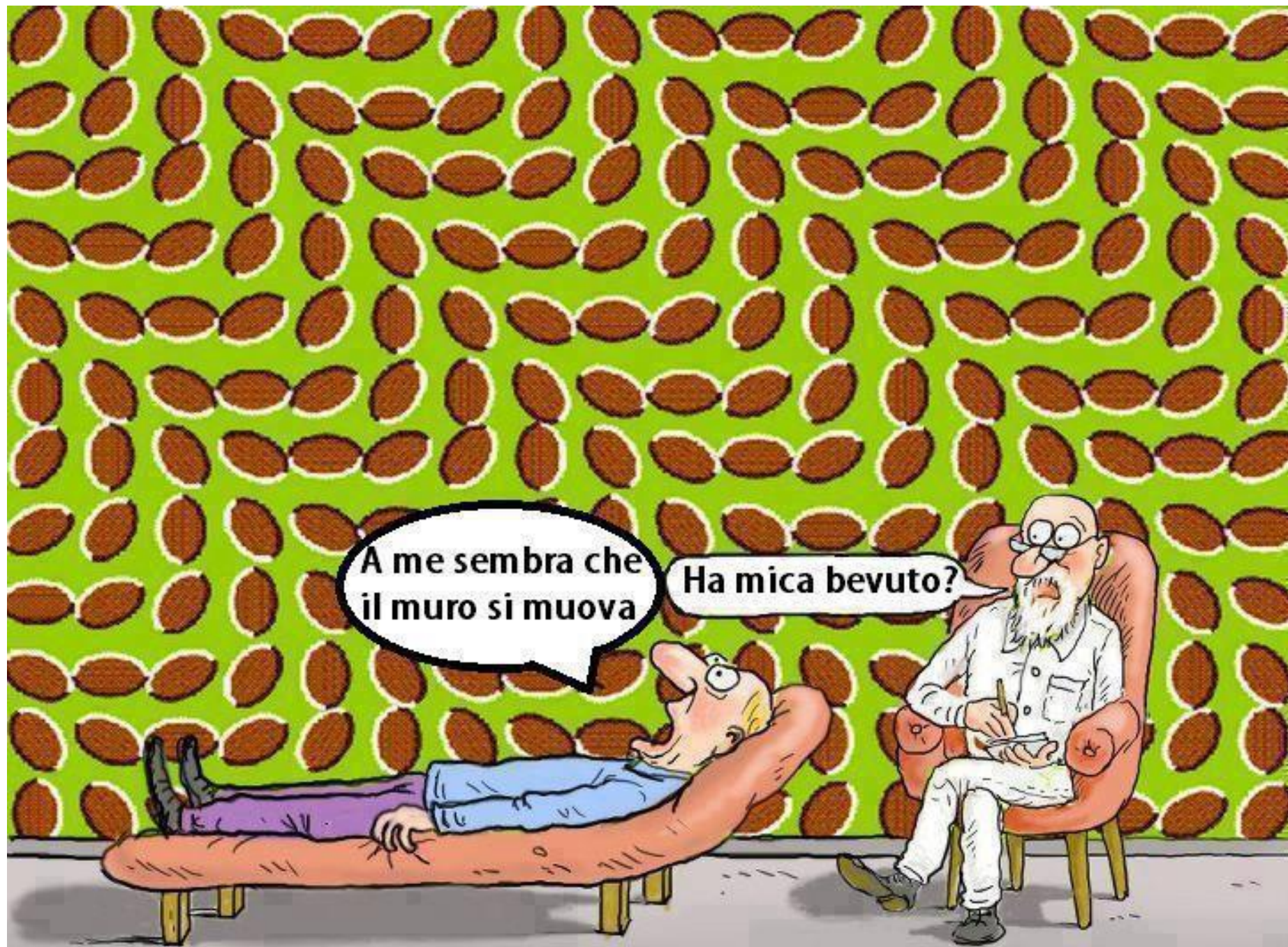


The motion silencing illusion



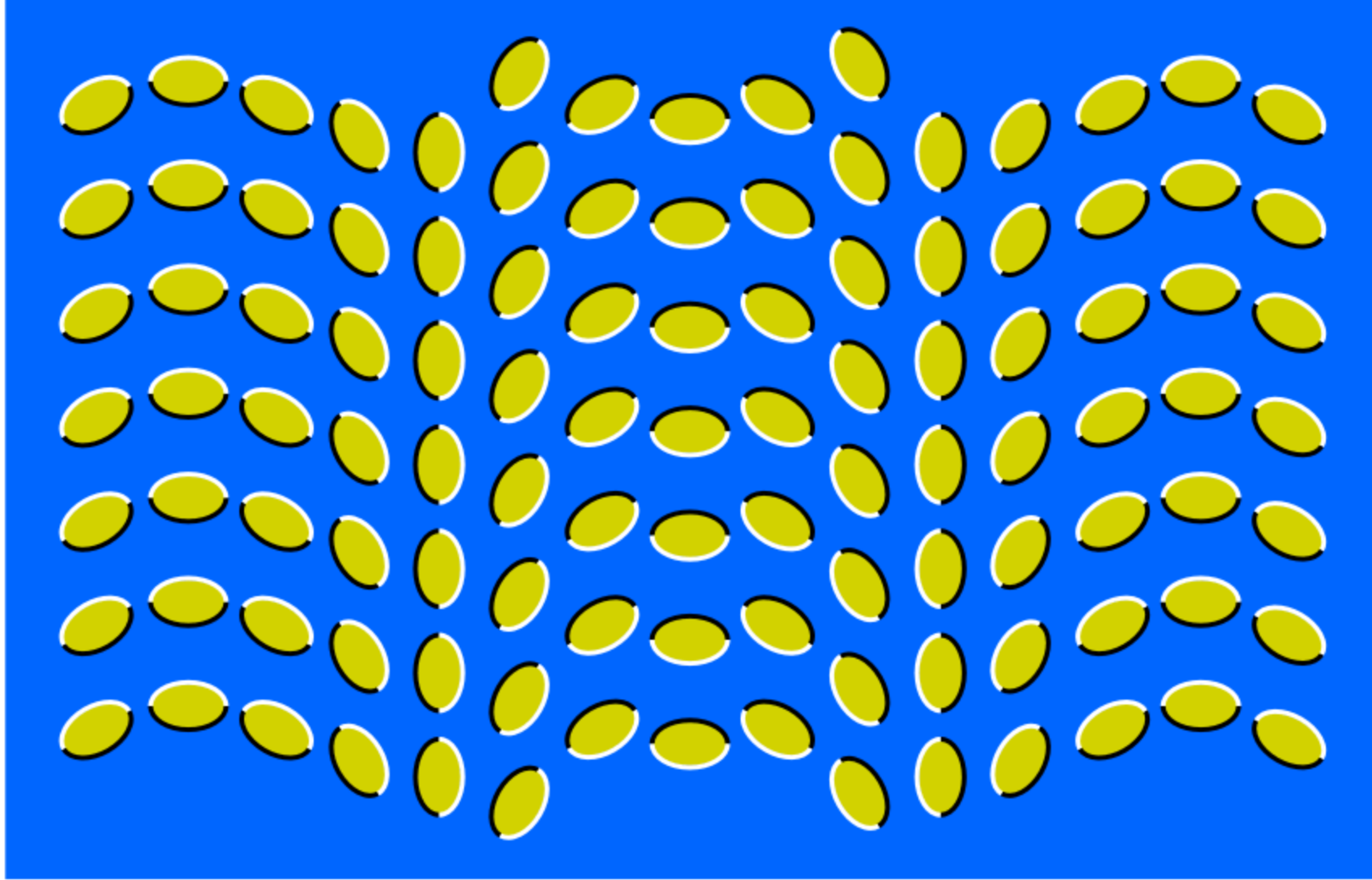
The motion silencing illusion

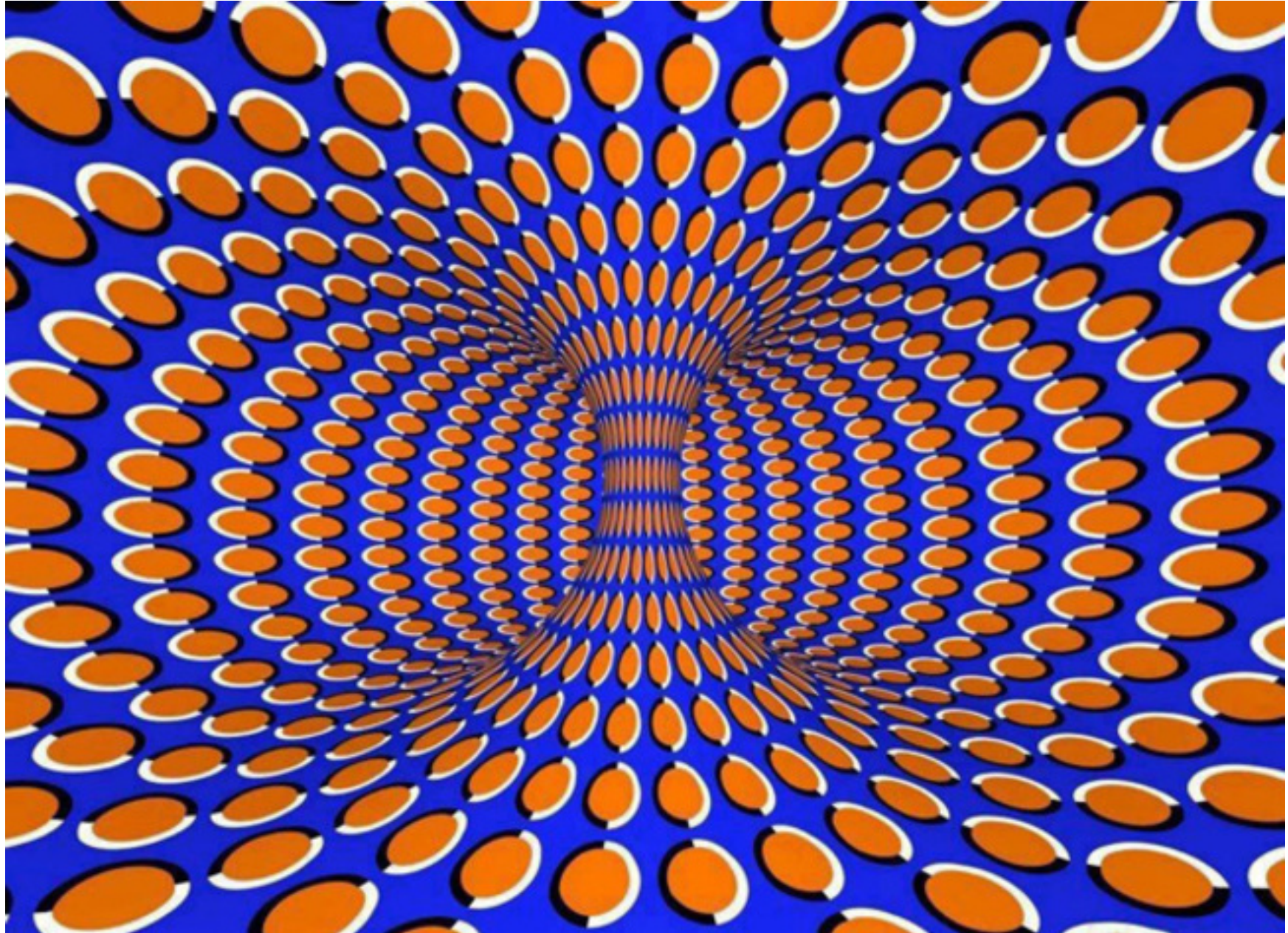


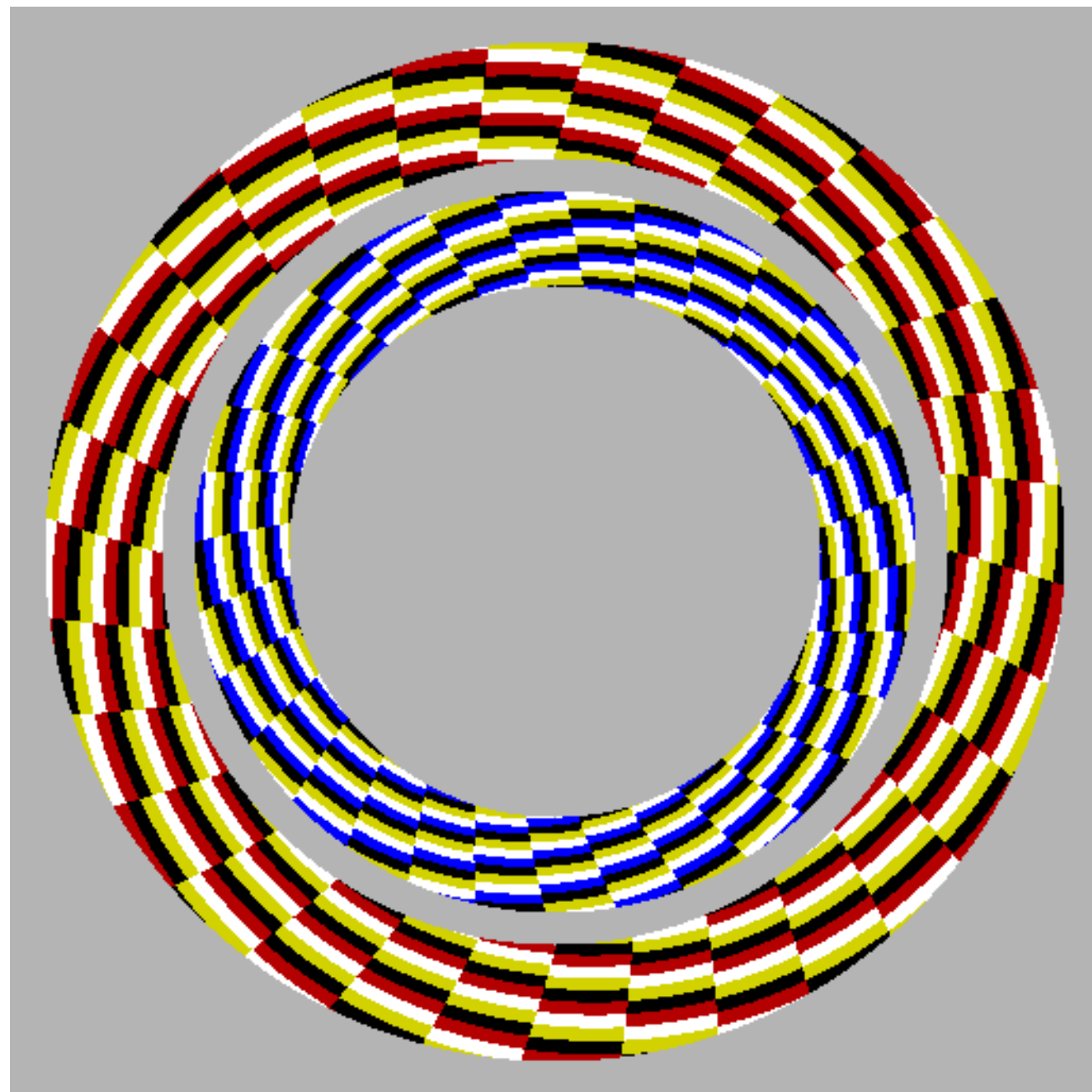


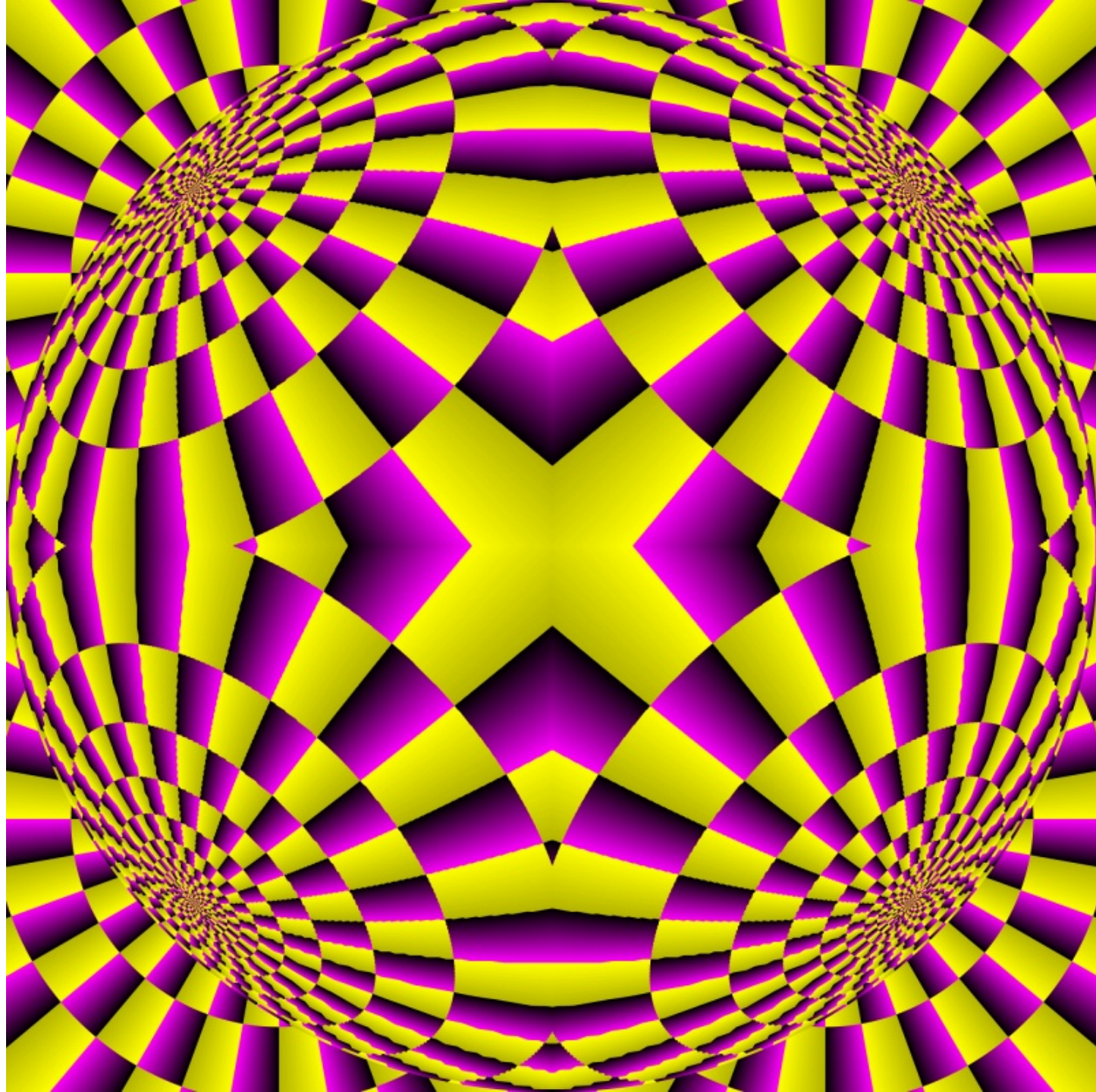
A me sembra che
il muro si muova

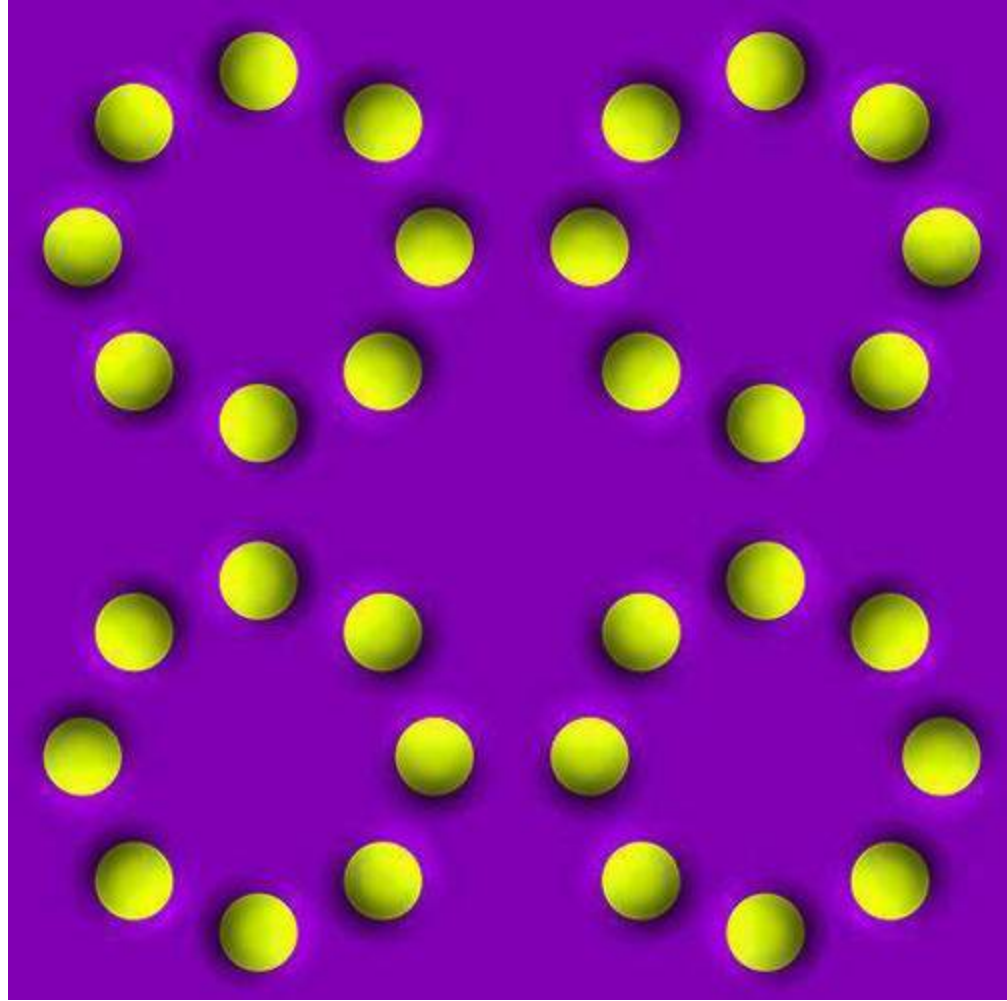
Ha mica bevuto?

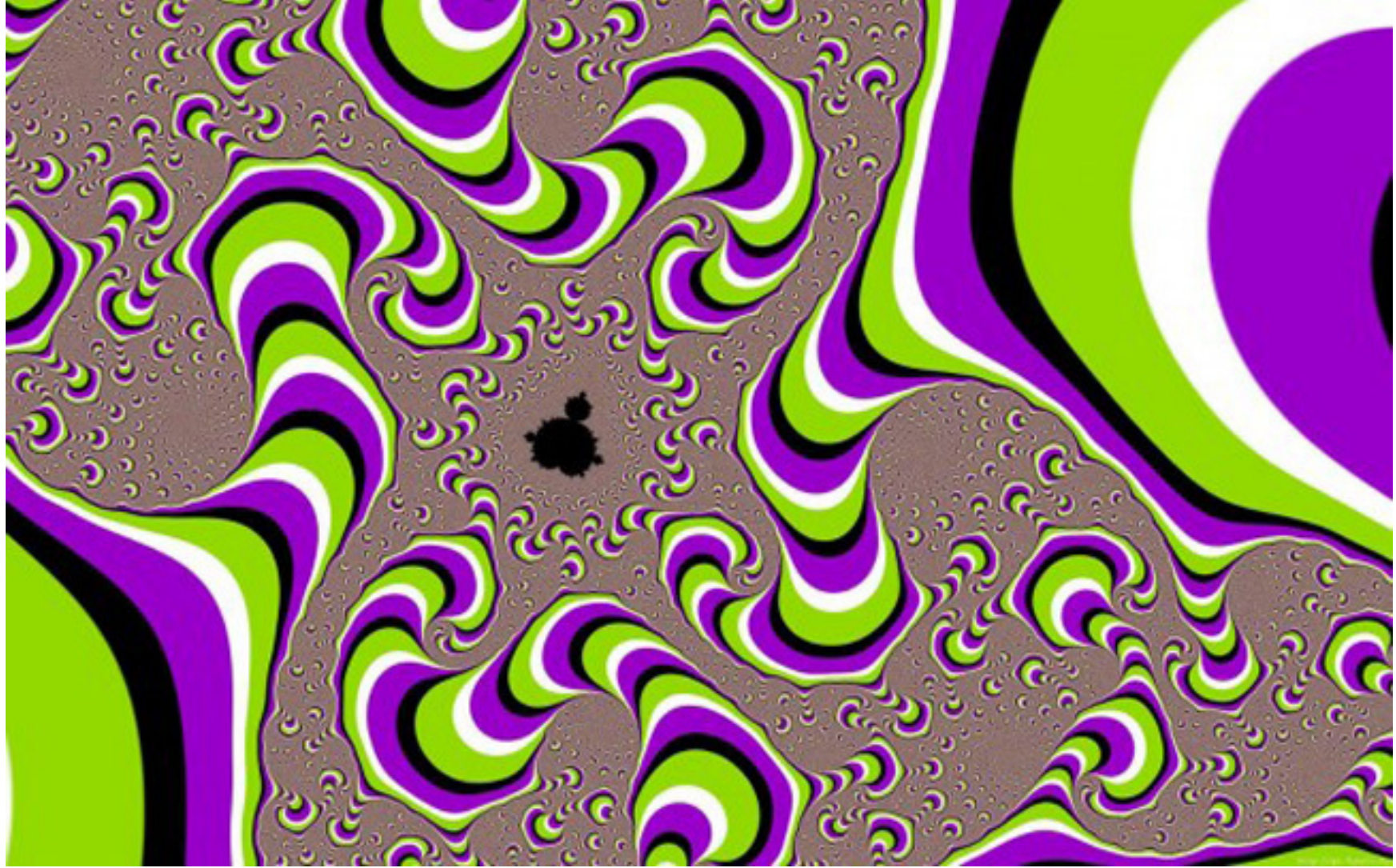


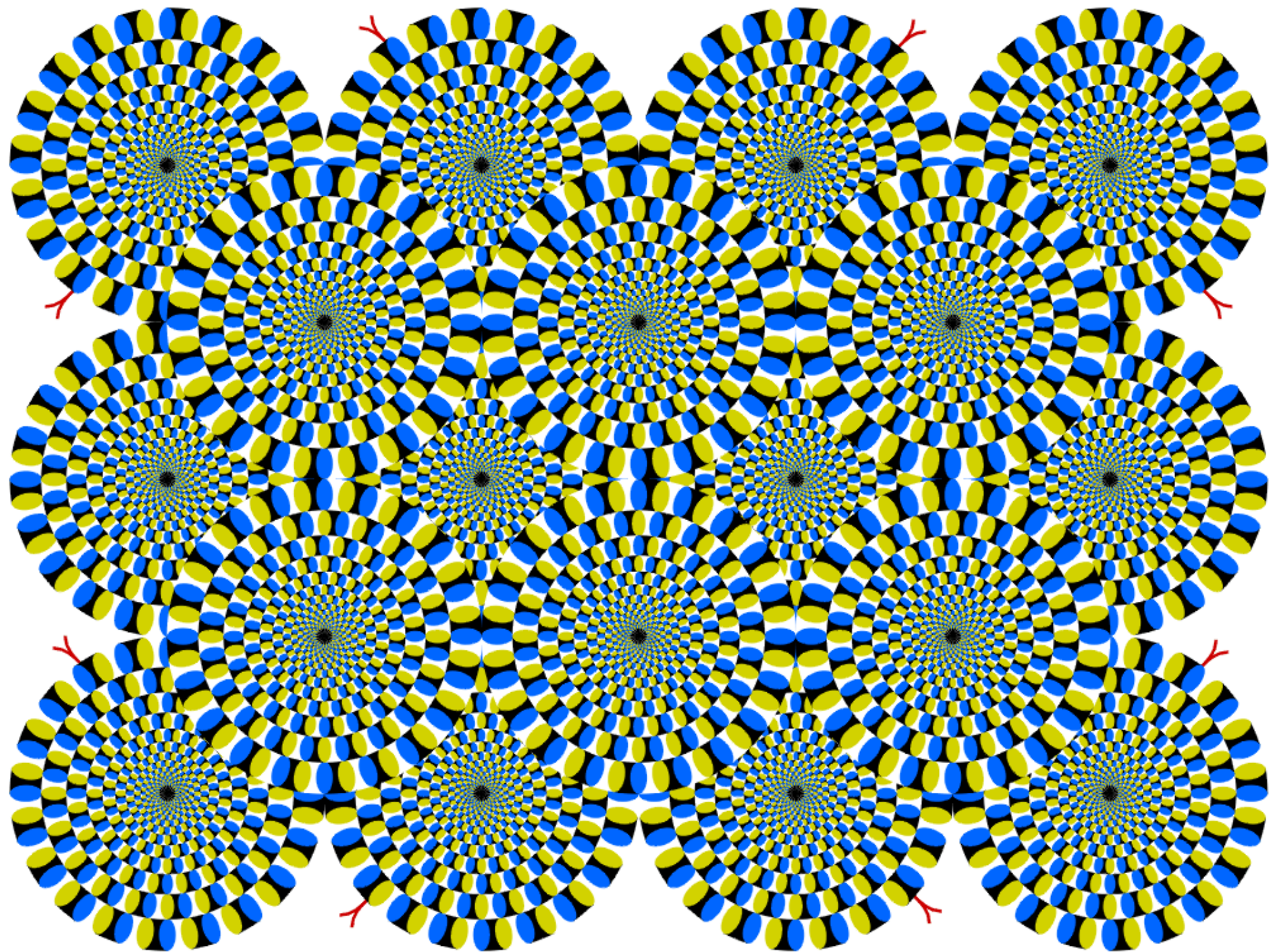




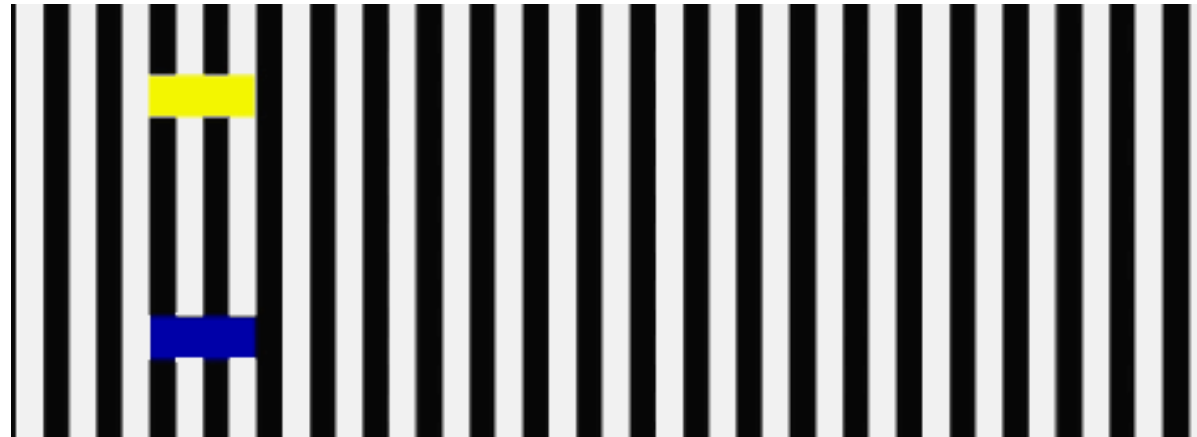








The stepping feet illusion

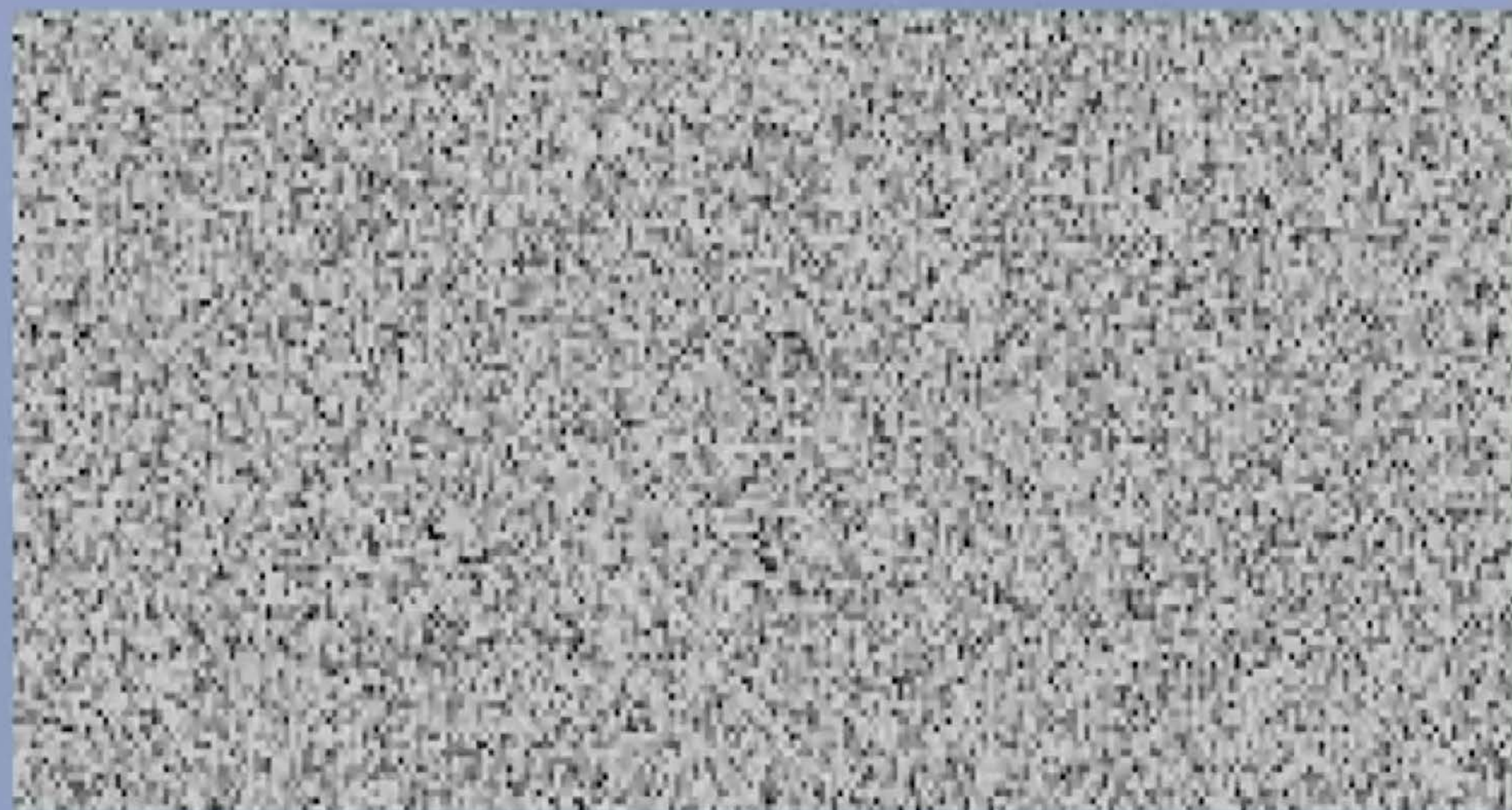


L'importanza del contrasto nell'integrazione temporale

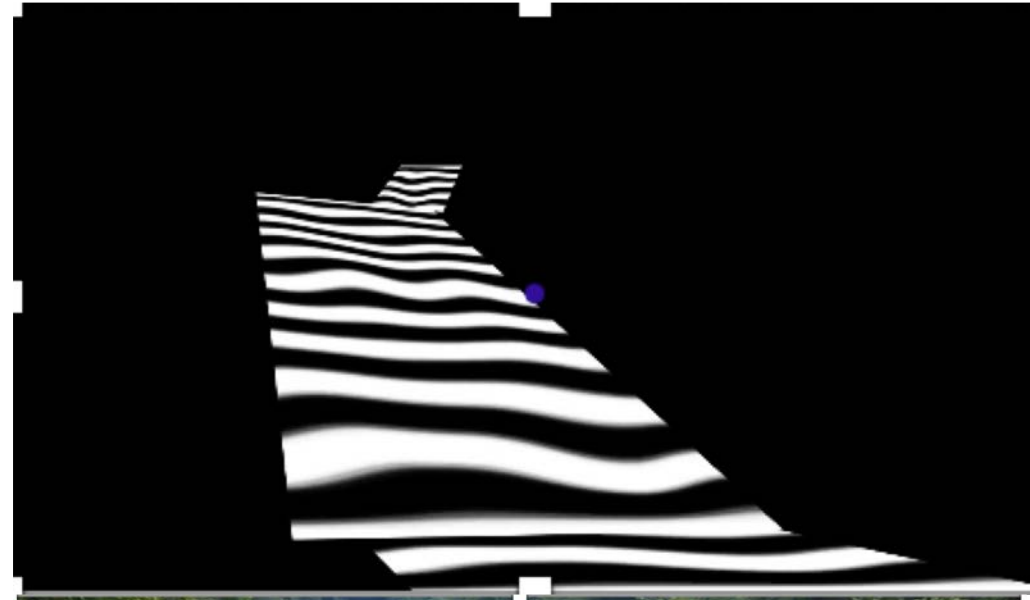


Esiste più di un meccanismo per la percezione del movimento...





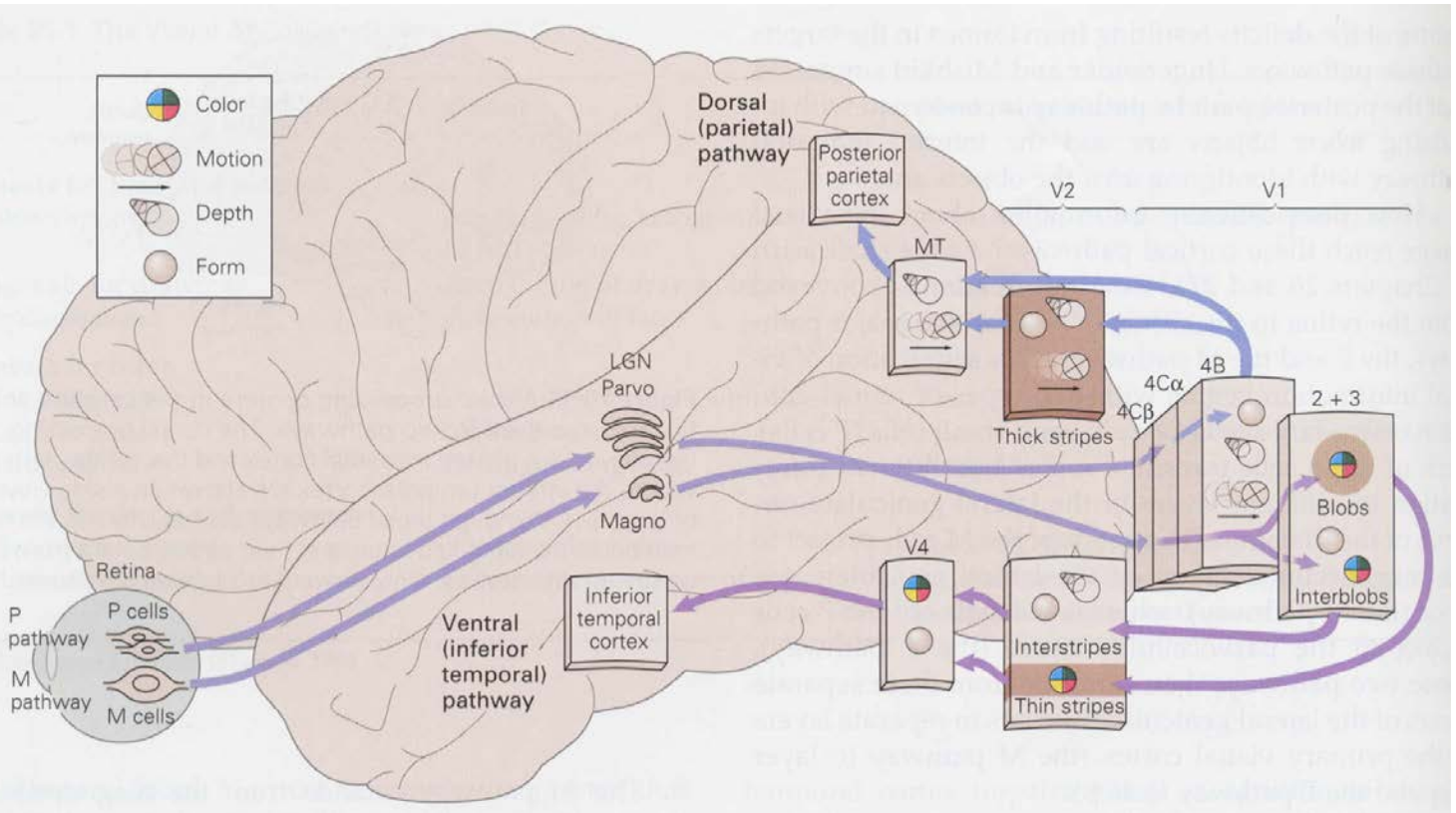
Waterfall illusion (Addams, 1834)







Motion aftereffect explained



MT Neurons with Similar Direction Preference Cluster into Directional Columns

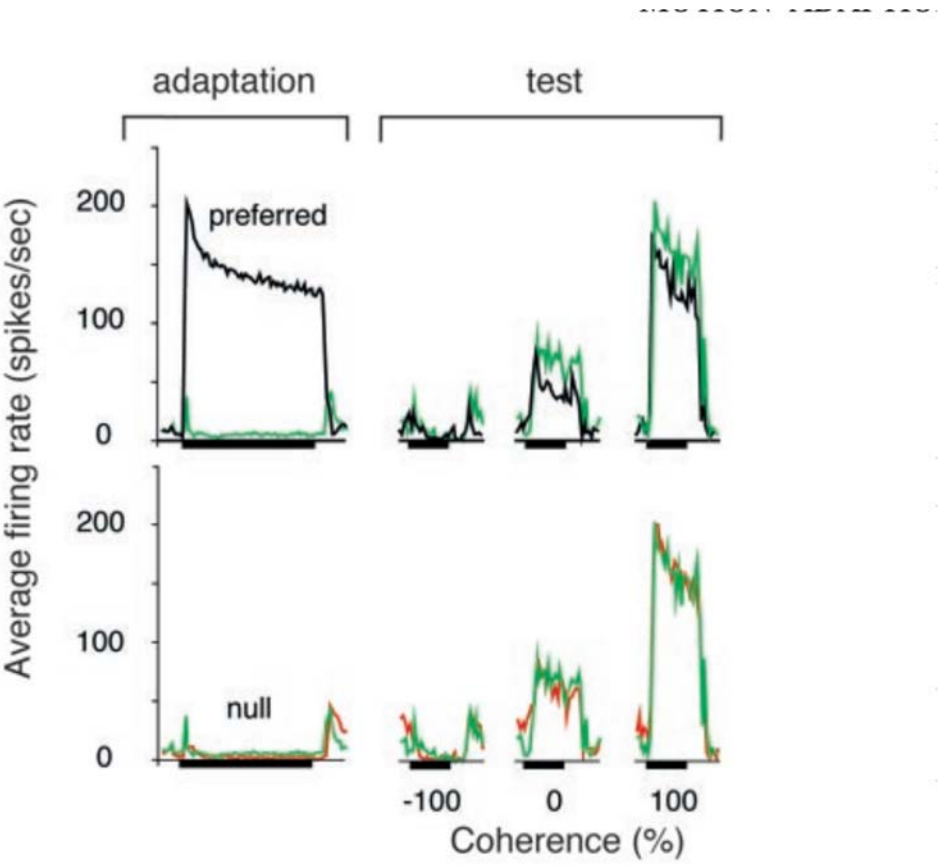
A region 0.5 mm x 0.5 mm contains columns tuned to directions covering 360°

Axis of motion column

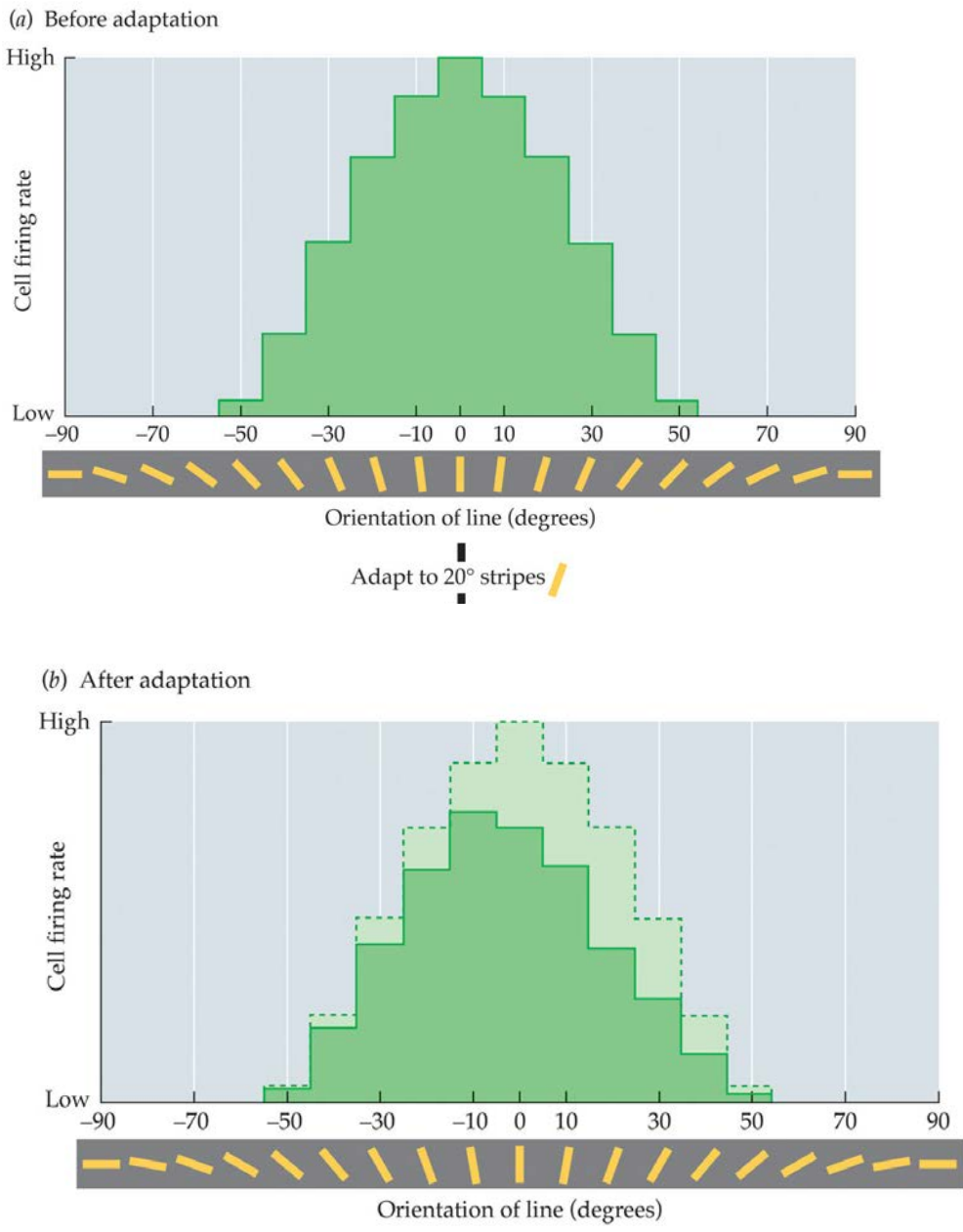
Direction column

from Albright et al 1984

Motion aftereffect explained

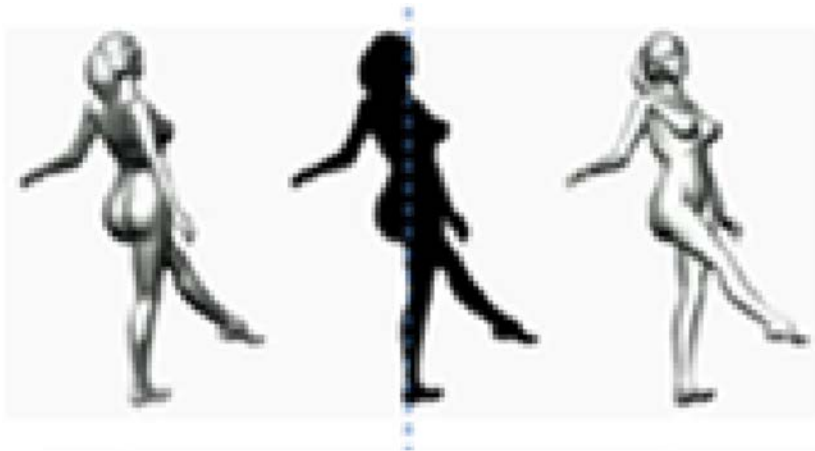


Van Wezel & Britten 2002



Secondo un sondaggio online condotto da CognitiveDaily nel 2008 su 1600 partecipanti, 2/3 percepiscono la rotazione come oraria.

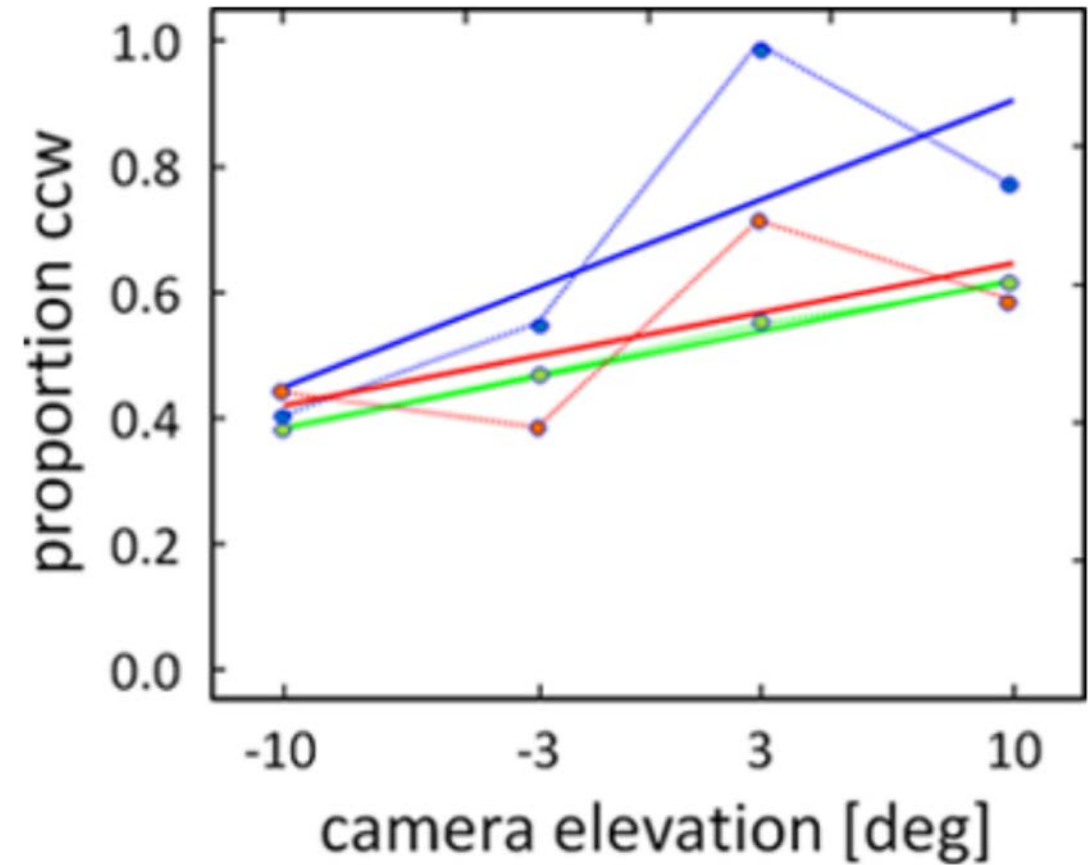
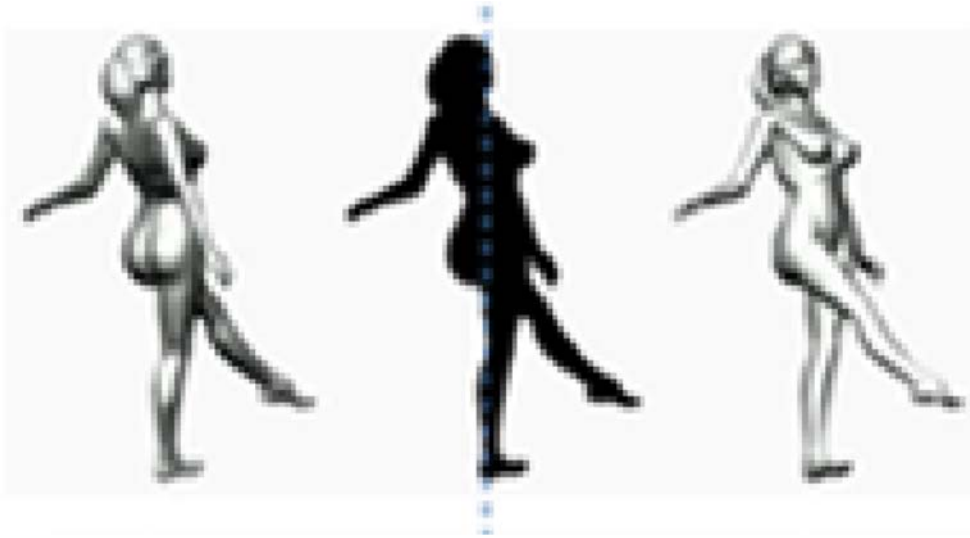




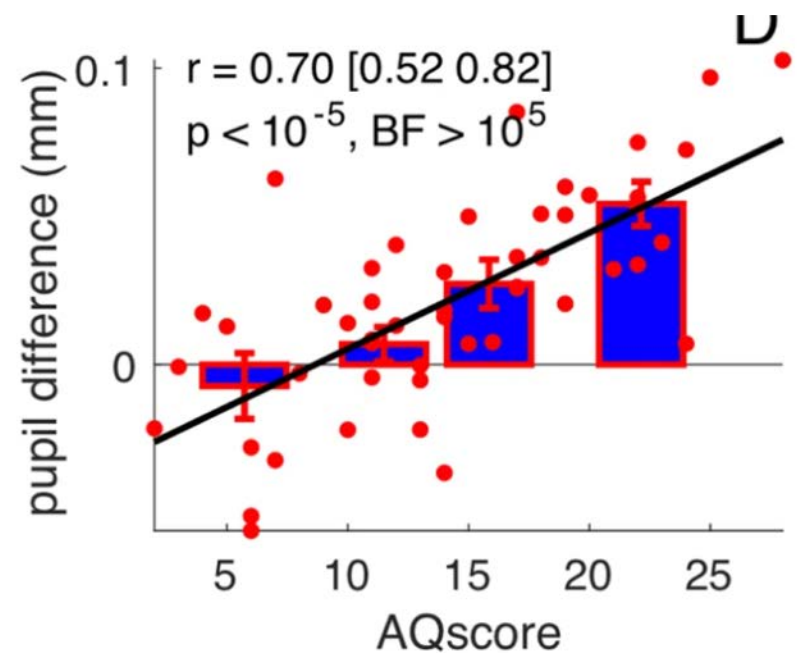
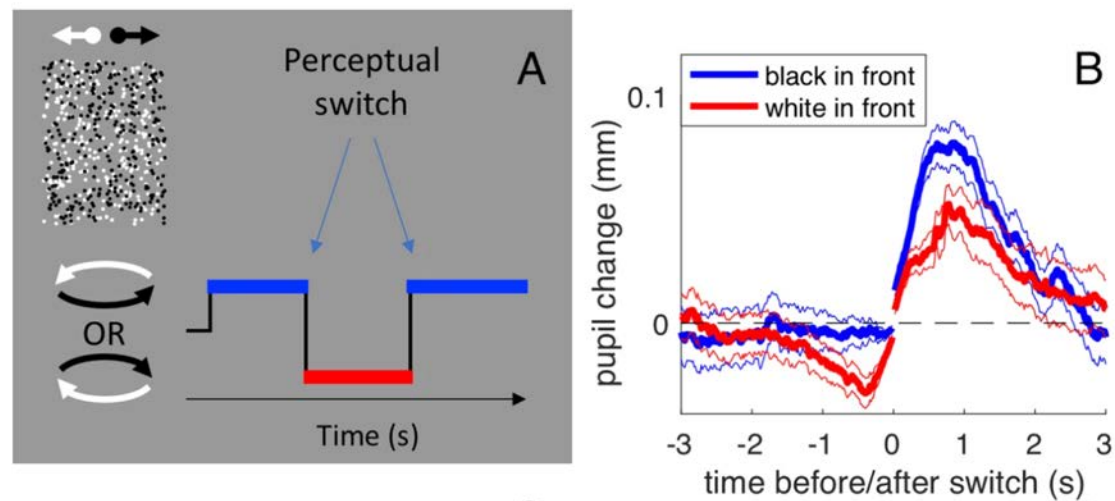
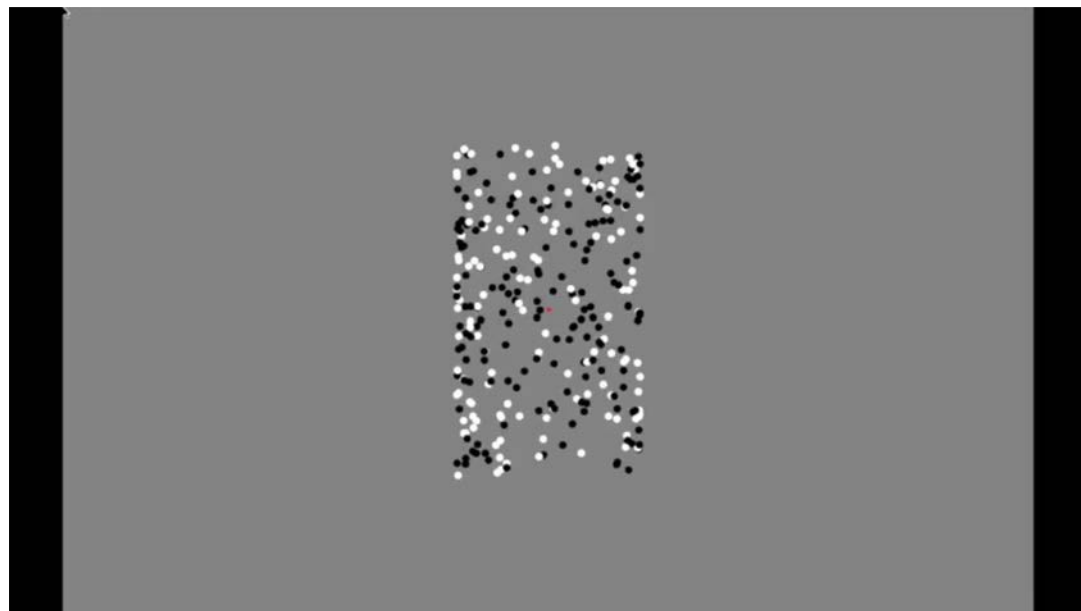
In the right column the figure rotates clockwise as we go through the sequence of frames (from top to bottom), and we look at it from a slightly elevated viewpoint (10 deg).

In the right column we illustrate the other interpretation. We look at the front of the figure in the first frame, the figure rotates counter-clockwise, and the viewpoint is 10 deg from below

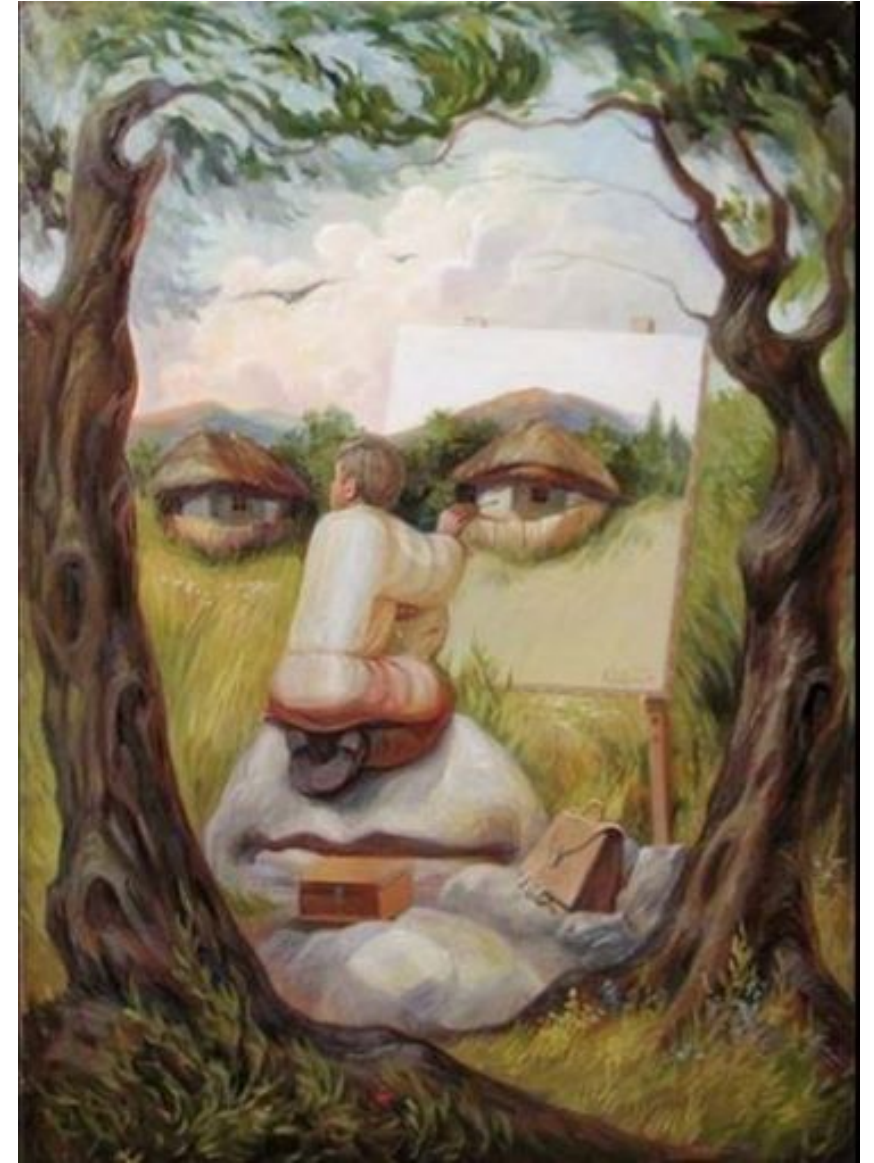
Effetti del cambiamento del punto di vista



Le illusioni possono essere usate per studiare gli “stili percettivi”

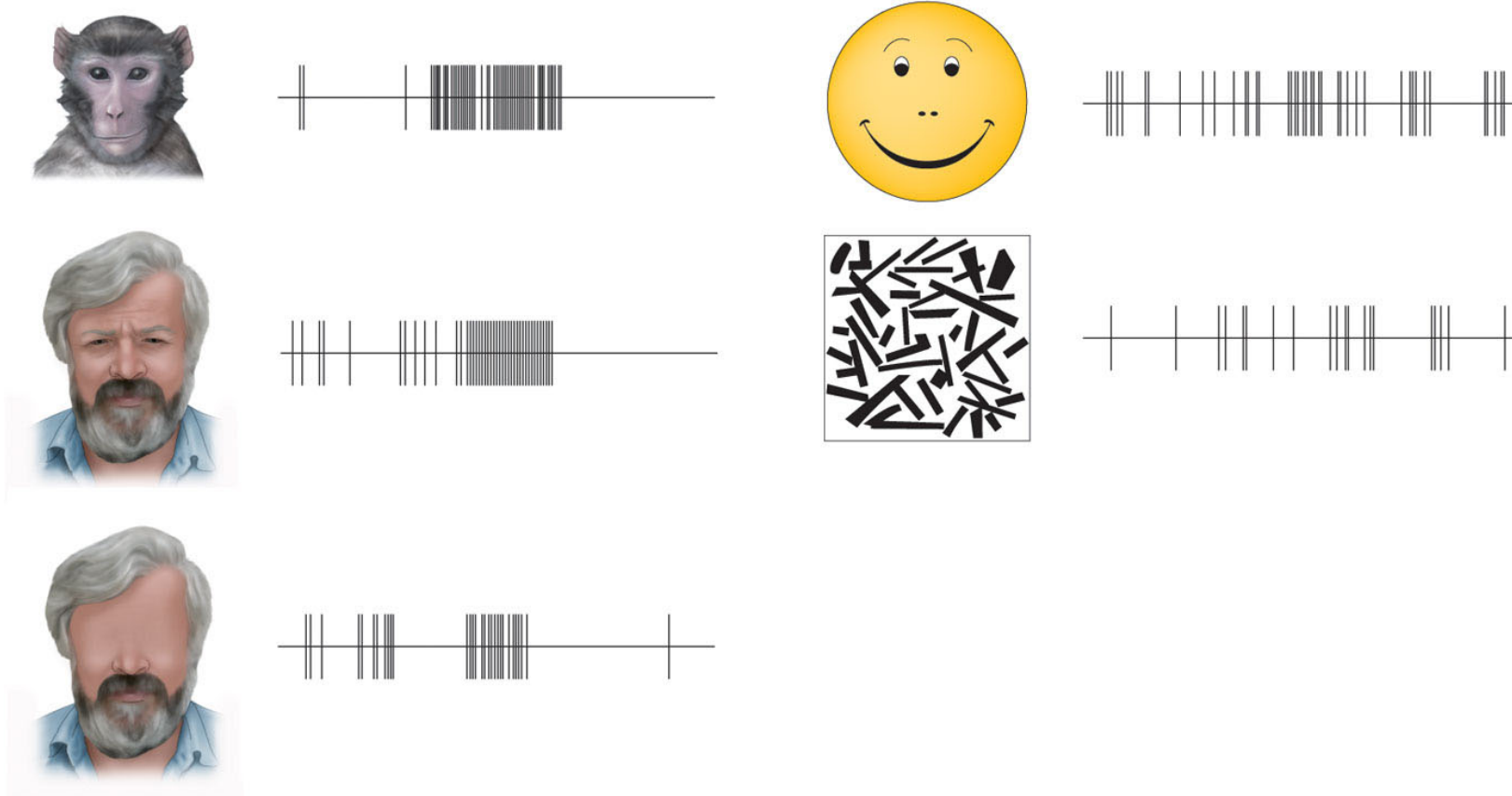


Vediamo anche grazie alla conoscenza di ciò che abbiamo visto in precedenza.

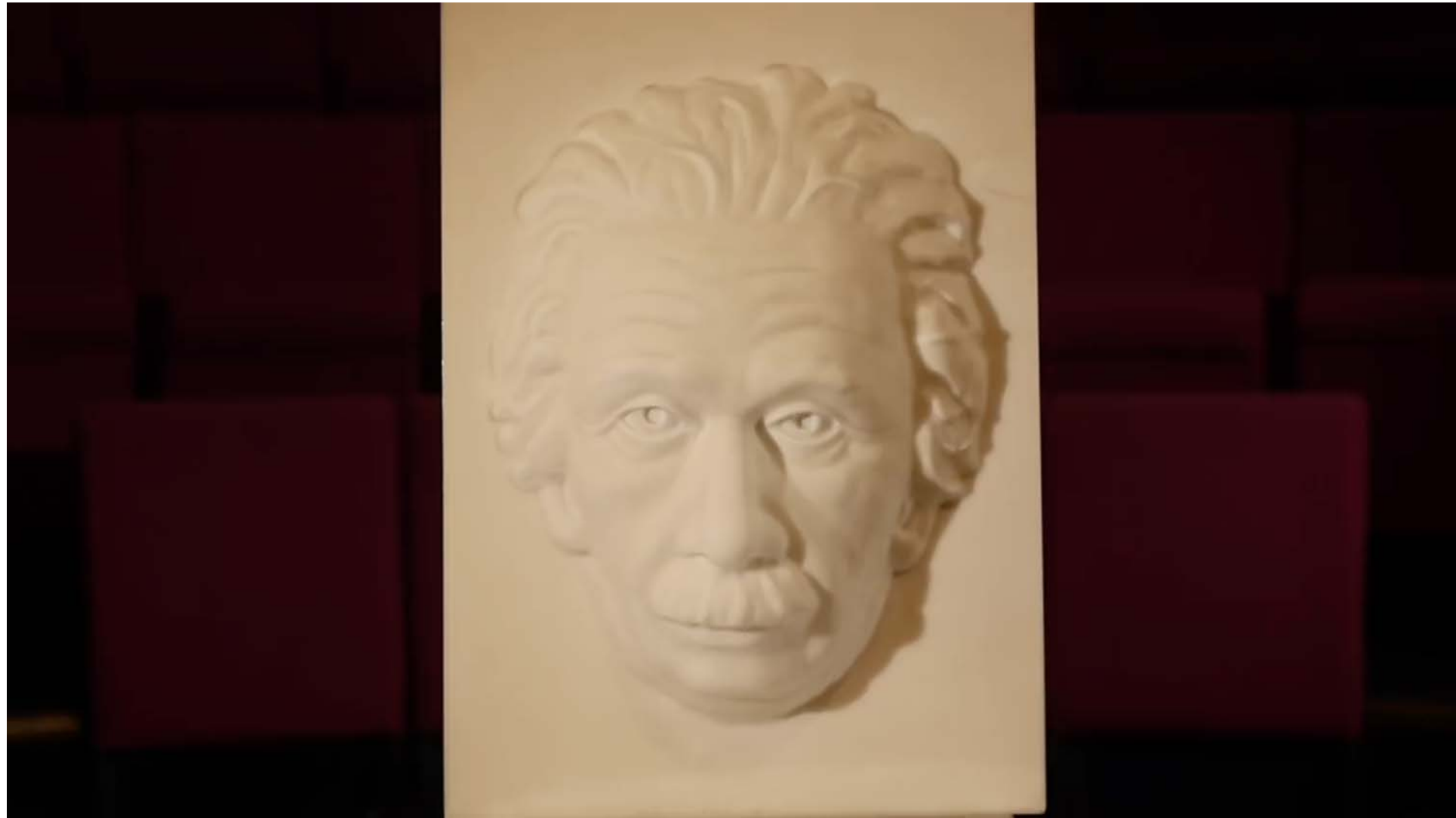


Face Cells

- Può un singolo neurone essere responsabile del riconoscimento di nostra nonna?



Strong perceptual prior for faces: hollow mask illusion



The Thatcher illusion

Peter Thompson, 1980



Analisi globale contro locale



Face Recognition

Perception. 2010;39(8):1125-41.

Does Thompson's Thatcher Effect reflect a face-specific mechanism?

Wong_YK¹, Twedt E, Sheinberg D, Gauthier J.

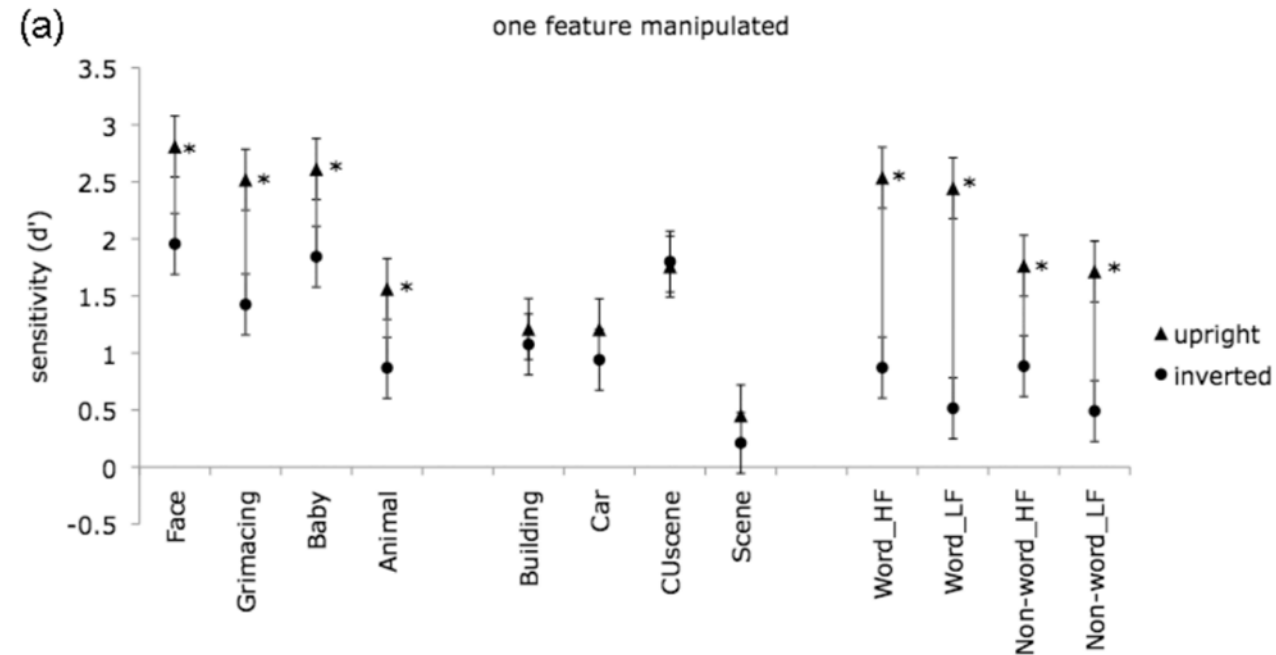
Author information

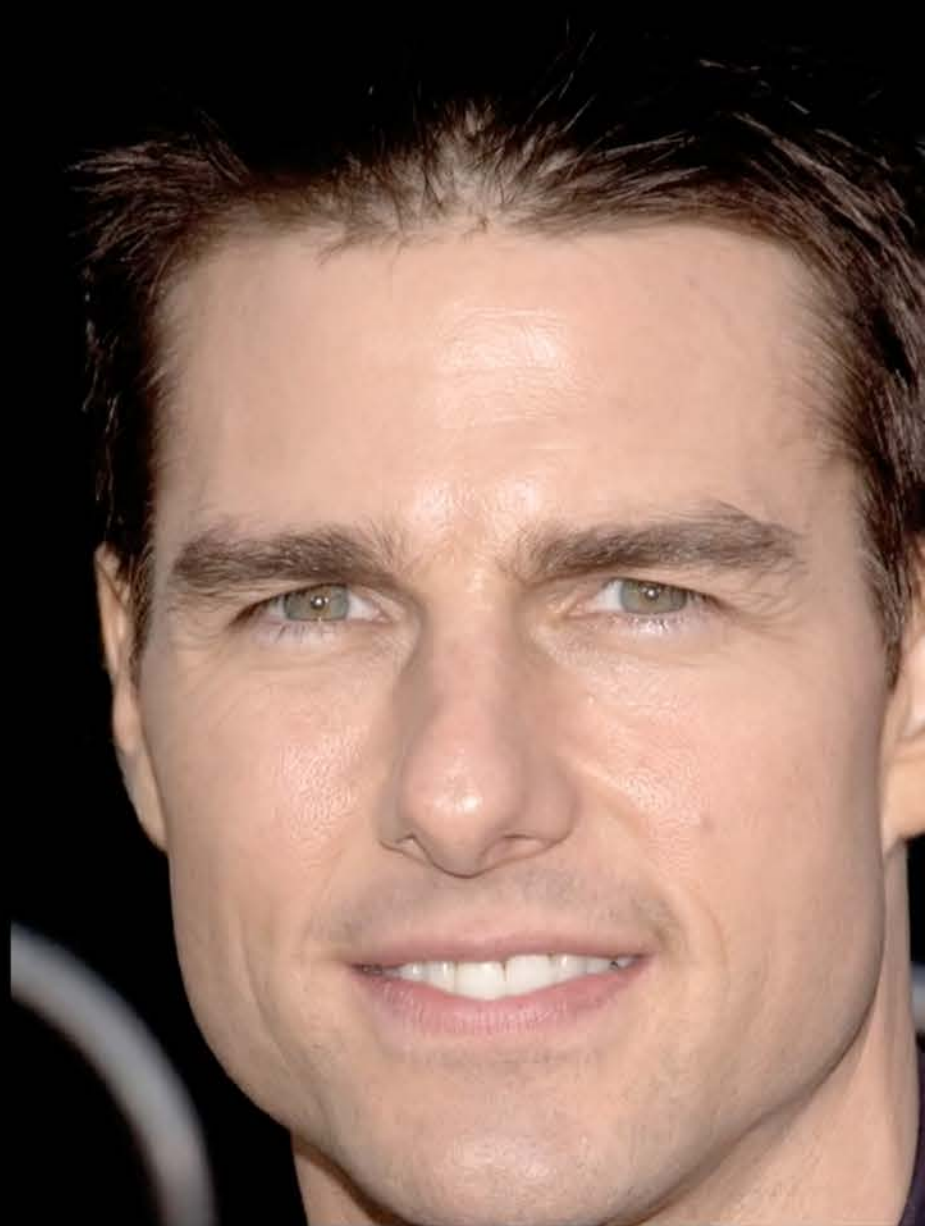
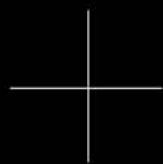
Abstract

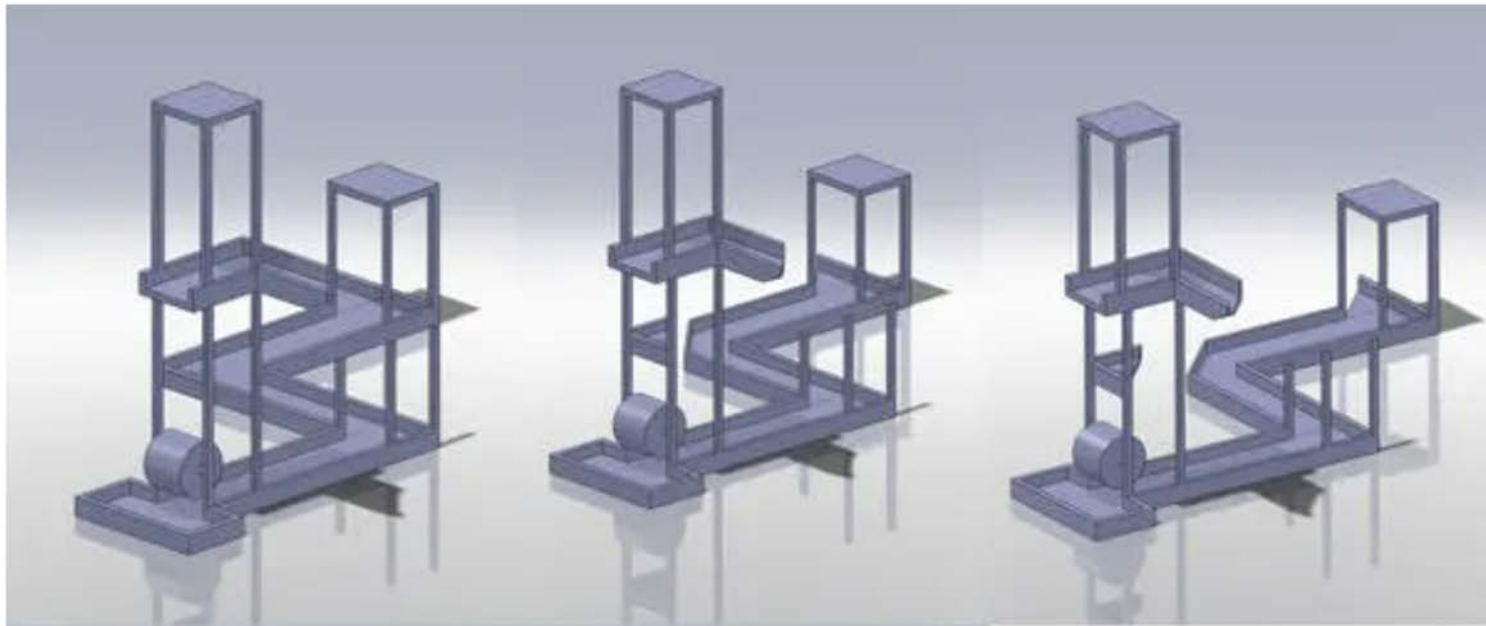
The Thatcher Illusion or Thatcher Effect (TE--Thompson 1980, *Perception* 9 483-484) reflects the difficulty in perceiving the local inversion of parts when the whole object, generally a face, is globally inverted. We tested the generality of the TE with a range of faces and nonface objects, and observed the TE with many non-face categories including cars, buildings, bikes, and letter strings. In terms of magnitude, the face TE is not exceptionally large compared to other object categories, and the magnitude of the TE can be predicted by performance on this task for upright stimuli, regardless of whether the object is a face or not. We did not observe evidence for a unique mechanism contributing to the TE for faces. We discuss factors that influence the magnitude of the TE, some common across domains and others more specific to a particular category.

PMID: 20942363 DOI: [10.1068/p6659](https://doi.org/10.1068/p6659)

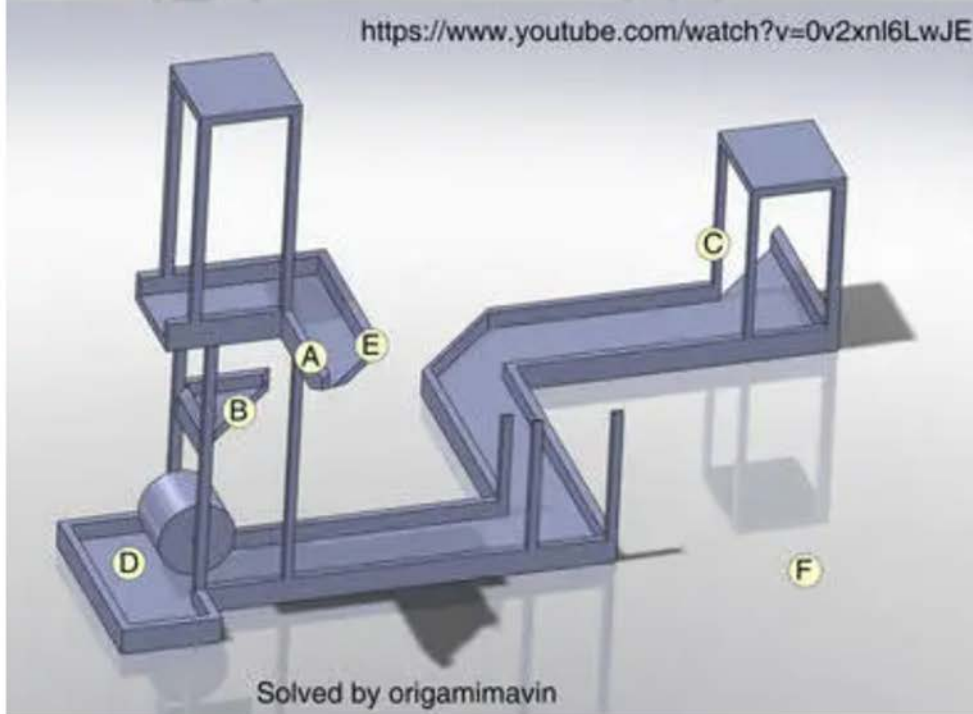
[Indexed for MEDLINE]







<https://www.youtube.com/watch?v=0v2xn16LwJE>



Solved by origamimavin

0:32-shadow touches A first
 0:42-liquid never touches B
 0:45-delay at C as it rounds the bend
 0:50-shadow on C but not A

The video was made in 2 cuts. The first is the water on the bottom platform, running from D flowing towards C. Another starts at E, falls down the waterfall, and continues again from D to C. There delay at 0:45 shows where the brake is.

F (in the video) also shows water marks in this shape from previous attempts, and there are 2 buckets of water for 2 places to pour.

oops...