Vision, Lecture 2

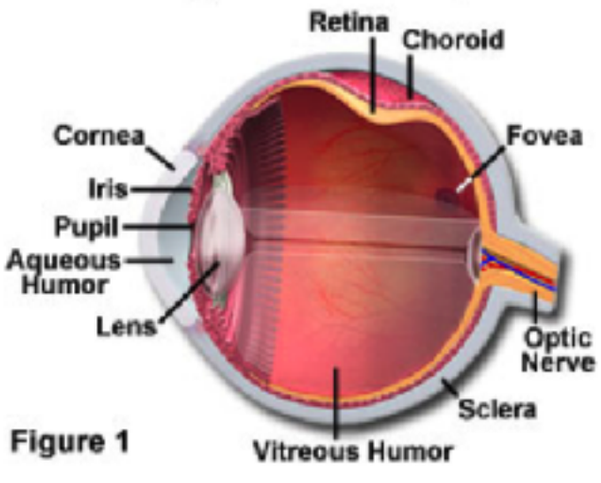
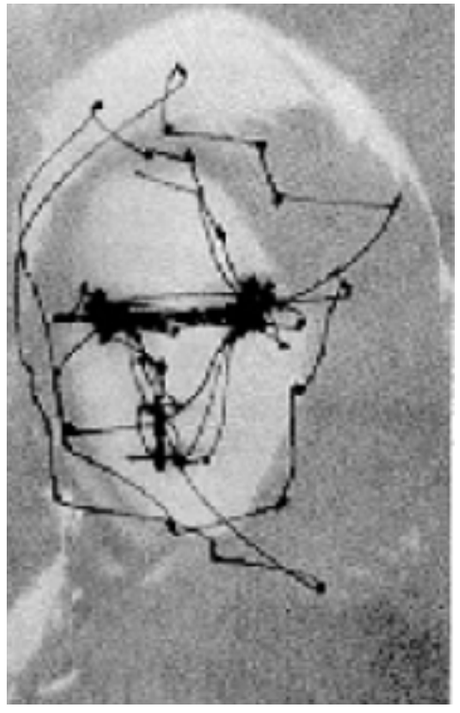


Figure 1



Vision and Attention

In the short video you are about to watch, you should pay attention to the location of the coin.

Attentional blindness: Bonneteau

Some of you will have noticed the pepper. Many people do not, however.

This is an example of *inattentional blindness*, and is the reason mobile phones are banned when driving...

Inattentional blindness occurs when we pay a lot of attention to one ongoing set of events, and thereby fail to notice other things that are going on.

It is not quite the same thing as change blindness, though they are similar.

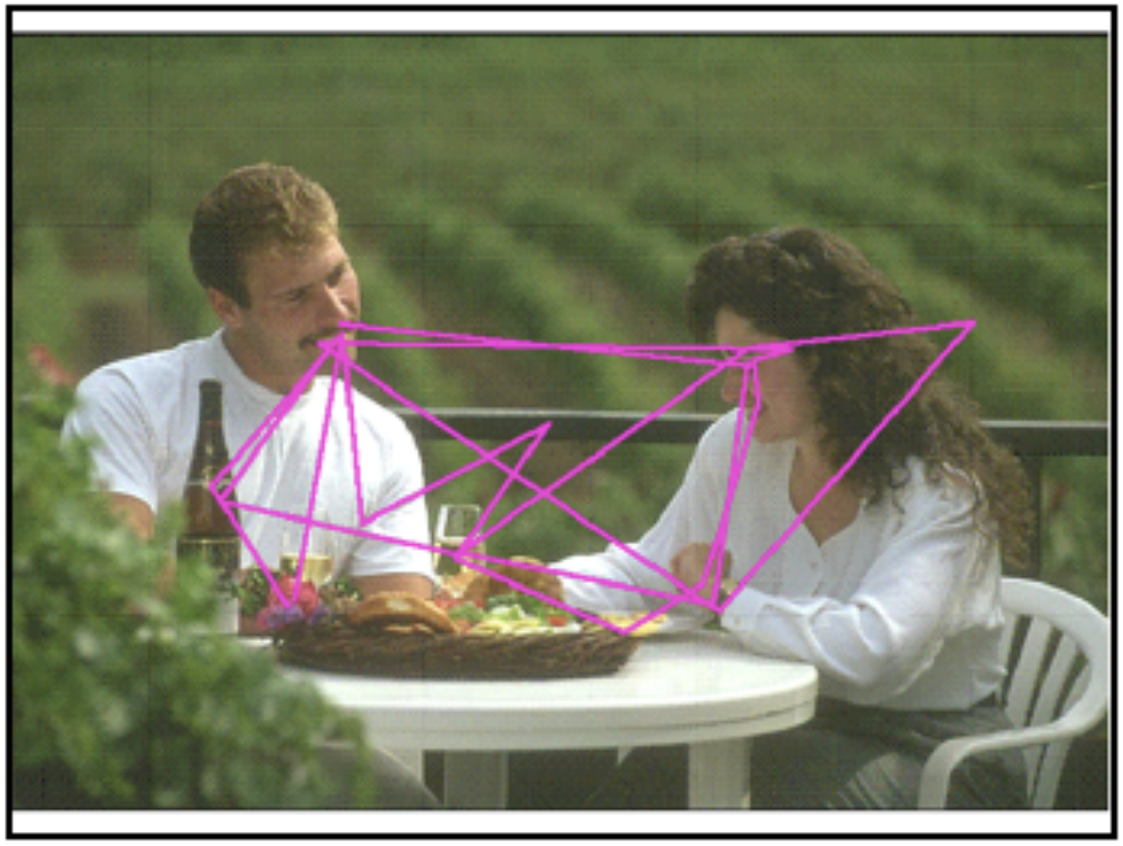
Change blindness

Under certain circumstances, very large changes can be made in a picture without observers noticing them. In these experiments, the changes are arranged to occur simultaneously with some kind of extraneous, brief disruption in visual continuity, such as the large retinal disturbance produced by an eye saccade, a shift of the picture, a brief flicker, a "mudsplash", an eye blink, or a film cut in a motion picture sequence.

This is change blindness.

Example videos at

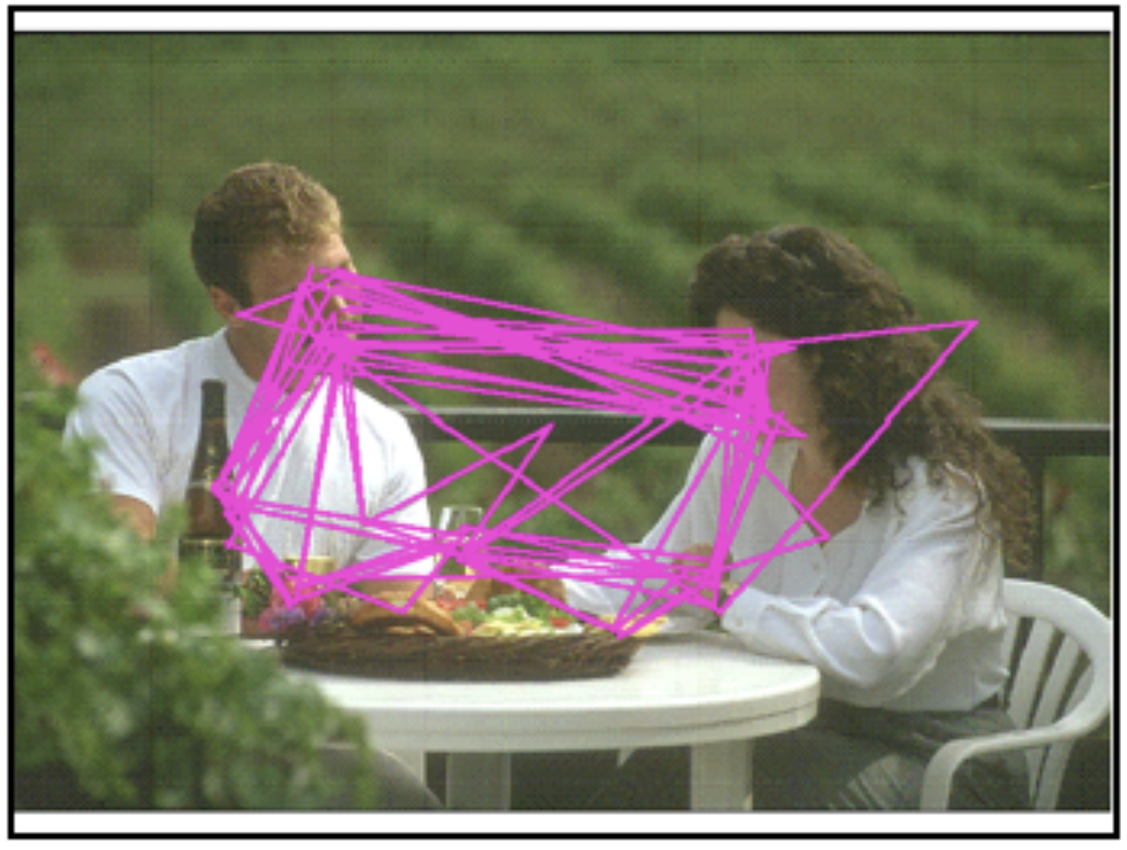
http://www.psych.ubc.ca/~rensink/flicker/download/



Change was timed to co-occur with a subject's blinks.

Here is his visual search pattern

Here is the next 10 seconds



"Change blindness doesn't show that we fail to experience the rich array of detail we seem to see. It shows something else: that our ability to sustain perceptual contact with the environment over time is not just a matter of there somehow being a picture of the scene in our brains; rather, it is a matter of access. And this, in turn, is a matter of skill."

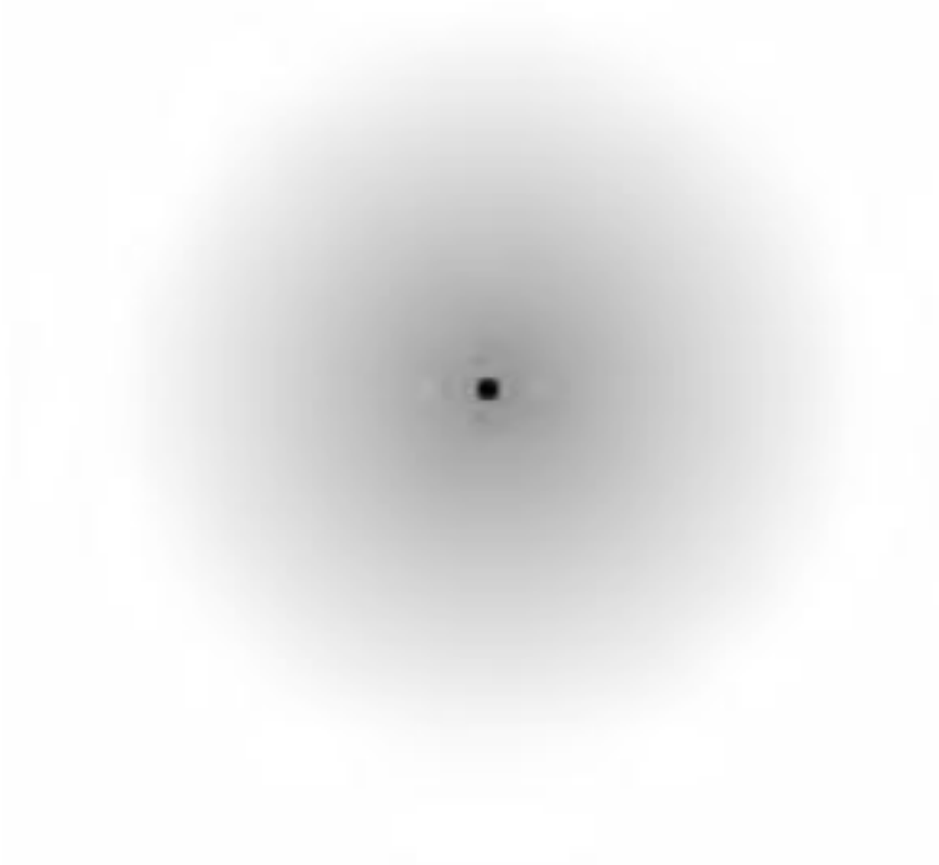
Alva Noe, Out of our heads, p. 141

Seeing is not a matter of image analysis by the brain. It is a matter of exploration and engagement with the world.

Change is necessary to perceive.
A stabilized image fades away.....

During normal vision, the eyes are in constant motion, and this motion causes continuous shifts of the retinal image with respect to the retina. To investigate the effects of such movement, a method called the 'stopped' or 'stabilized image' has been employed in a number of laboratories. This method allows the eye to move normally, but prevents the movements from producing corresponding shifts of the retinal image across the retina.[1] The basic finding is this: when the retinal image of an object is stabilized, the object rapidly fades out and disappears.

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



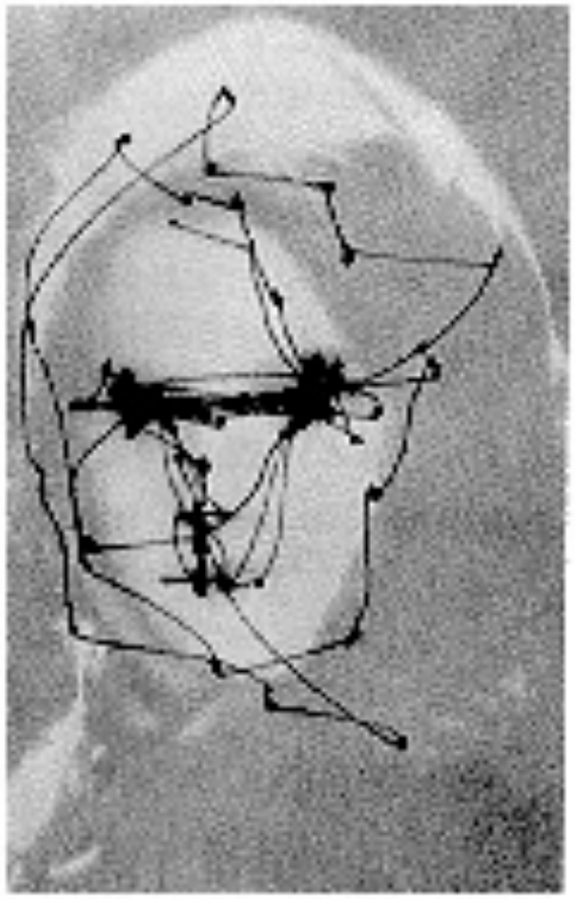
The Retina does not hold a static image:

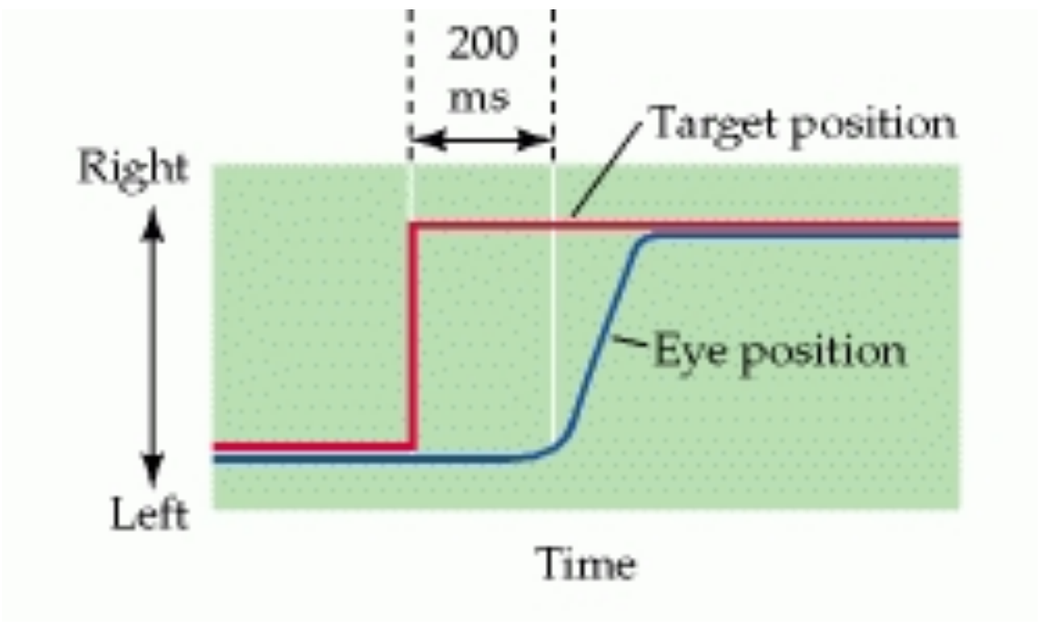
Eyes move constantly:

— saccades
— smooth pursuit movement
— vergence
— vestibulo-ocular movements
— tremor (80 Hz)

Another reason why the eye is quite unlike a camera!!!

Saccades: Rapid discontinuous jumps that change the point of fixation

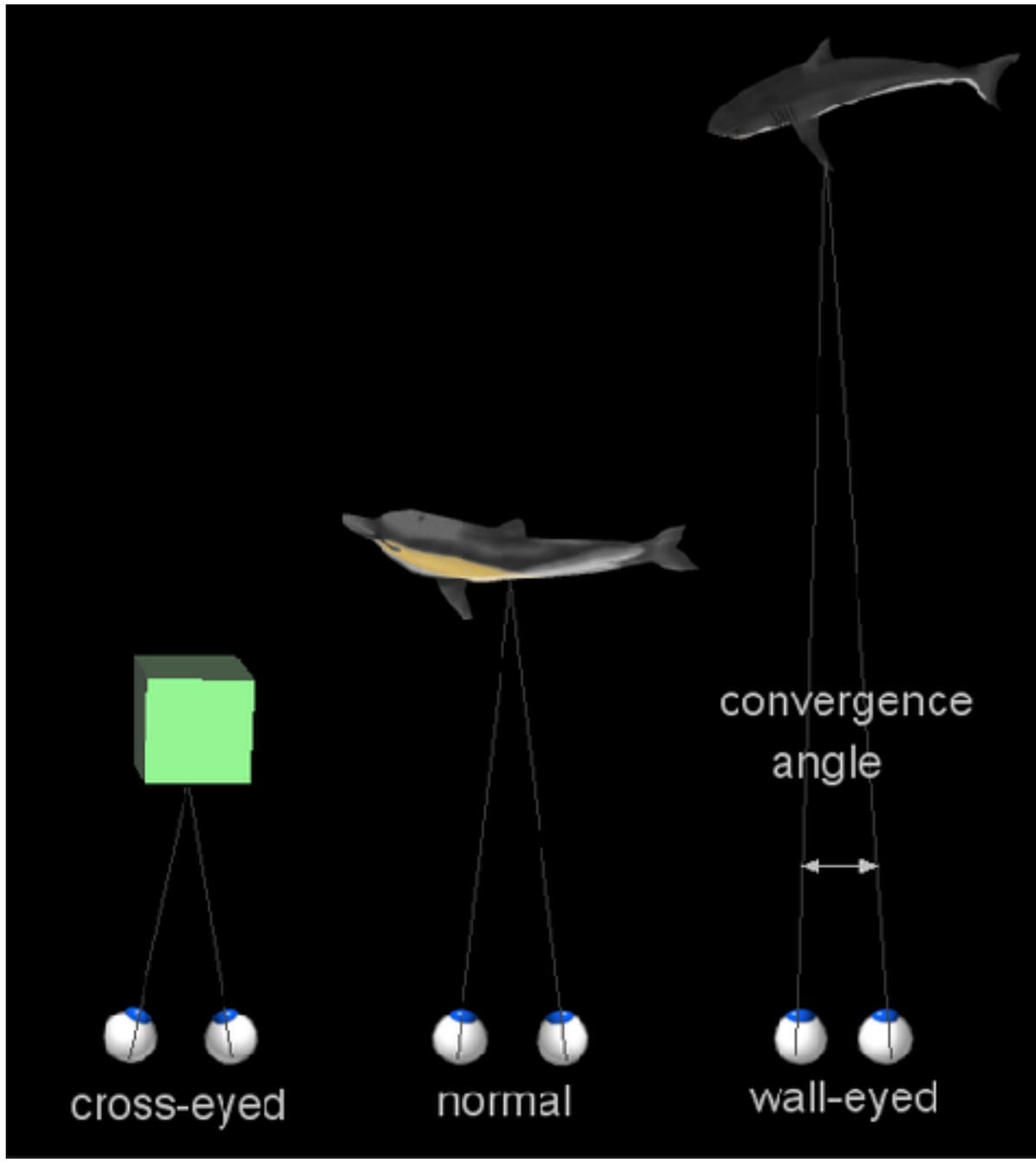




Vergence Movement

Aligns the fovea of each eye with targets at varying depths

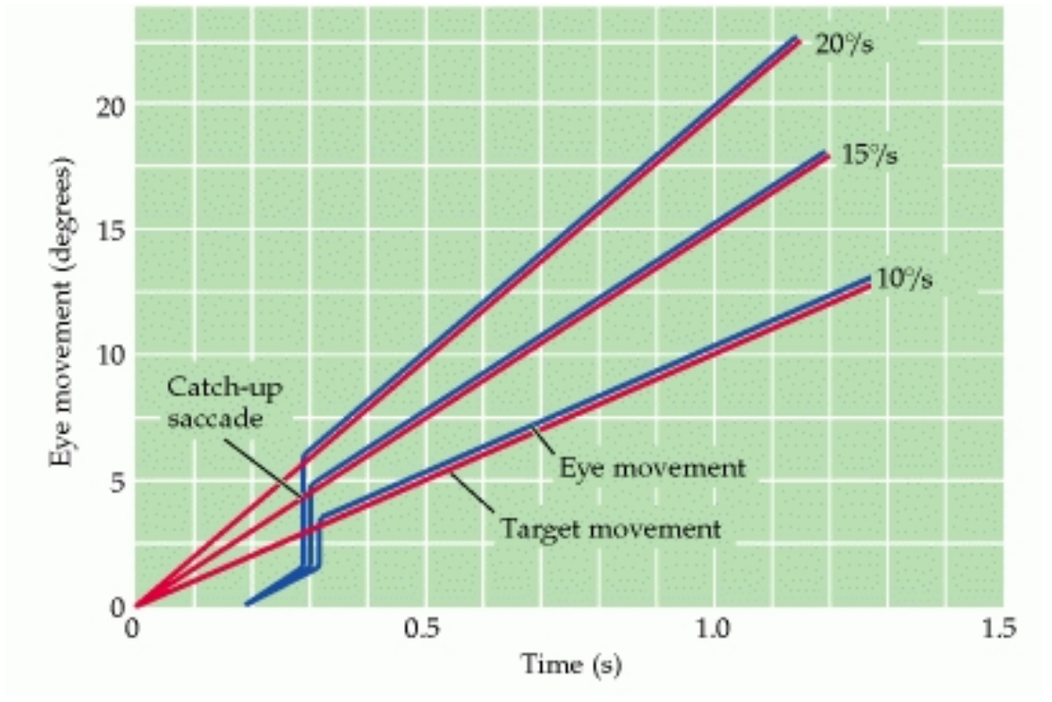
Unlike saccades and pursuit, the two eyes do not do the same thing here.



Smooth Pursuit Movement

Slow tracking movements that keep a moving target on the fovea.

Can't be done without a target (people produce a saccade instead)



Vestibulo Ocular Reflex

Keeps the eye on target when the head moves.

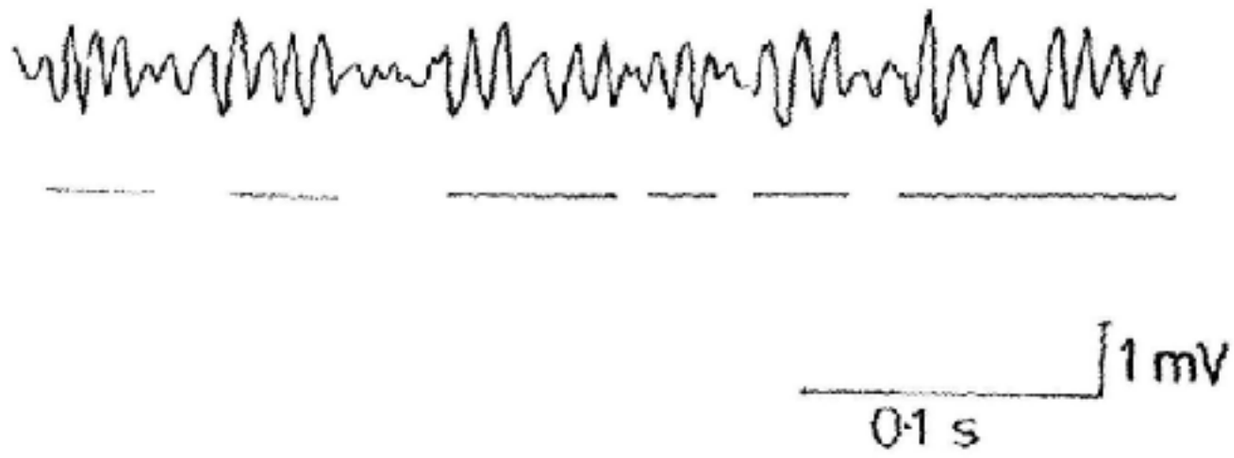
This is very like a steady cam.

Birds offload the vestibulo ocular reflex to the head and neck, which looks . . . interesting

Smooth pursuit movement and the VO reflex describe the *same* invariant relation between the seeing subject and the world. Food for thought. Are they two different mechanisms? Or one relation?

Tremor

High frequency (peak at 80 Hz), low amplitude physiological tremor



The eye is not a camera

The visual system (including the eye) is an active system

It constantly samples intentionally from its surroundings, seeking out information.

What is seen is a function, not only of the environment, but of the attention and requirements of the observer

The retinal image is not constant, and change is *required* for vision

There is no separation between the observer and the vision system. They are one!

'Rather than thinking of visual processing as separate from cognitive or motor processing, they are interlinked in terms of integral behaviours'

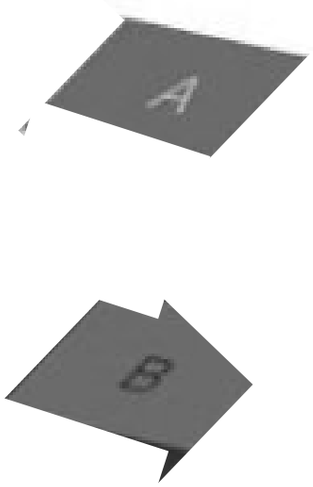
Ballard '91: Animate Vision

Fun with illusions

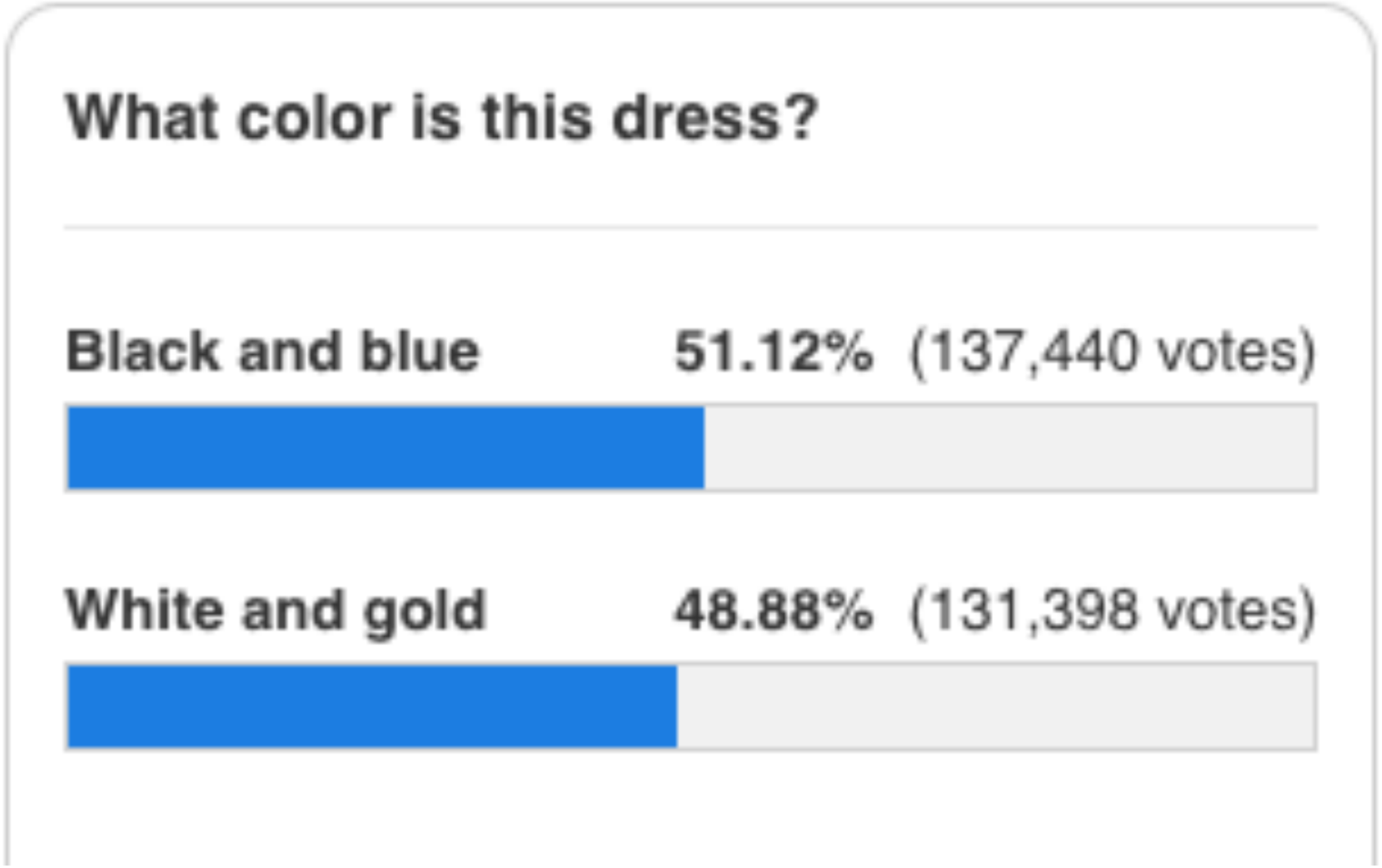
http://illusionoftheyear.com/

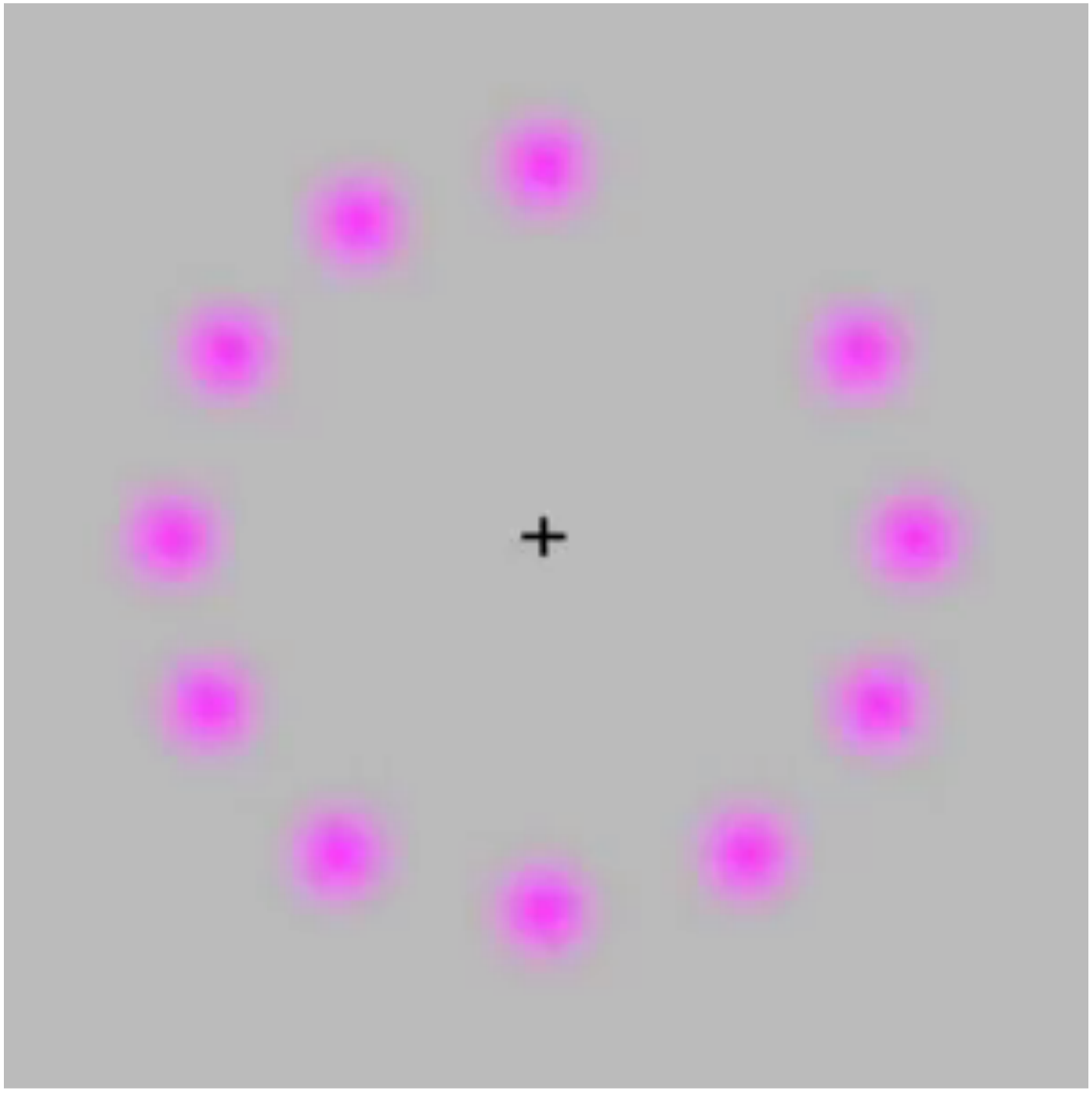
In each of the following, the visual system is being ‘tricked’ by the illusion’s designer. The role of the visual system is not to record, but to make sense of objects and events in the environment. Can you tell why it might be tricked in each case?

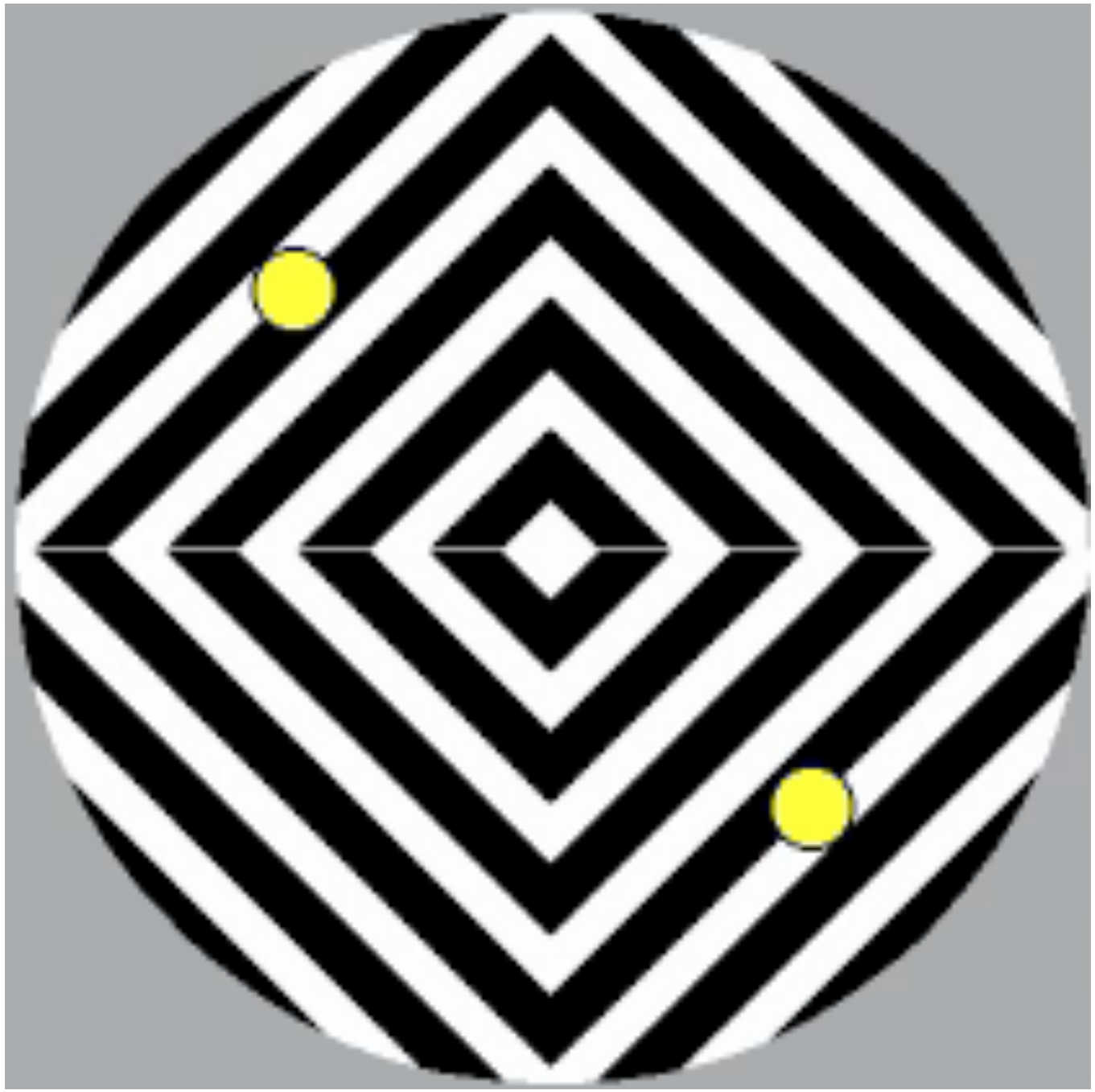
Take home message:
Vision is a form of sense-making, not the passive pick up of pre-existing information

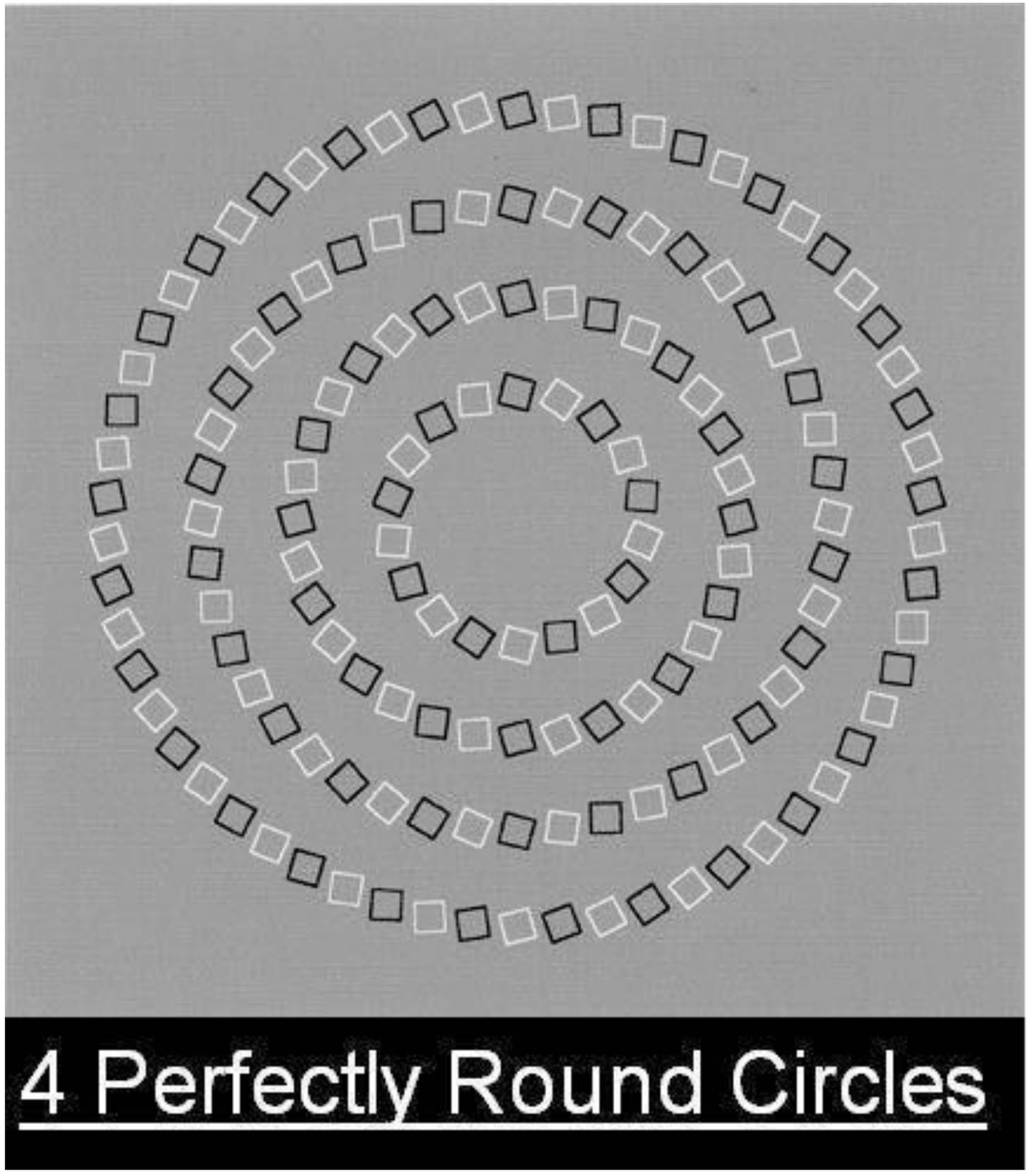

A
B

The dress that broke the internet in 2015

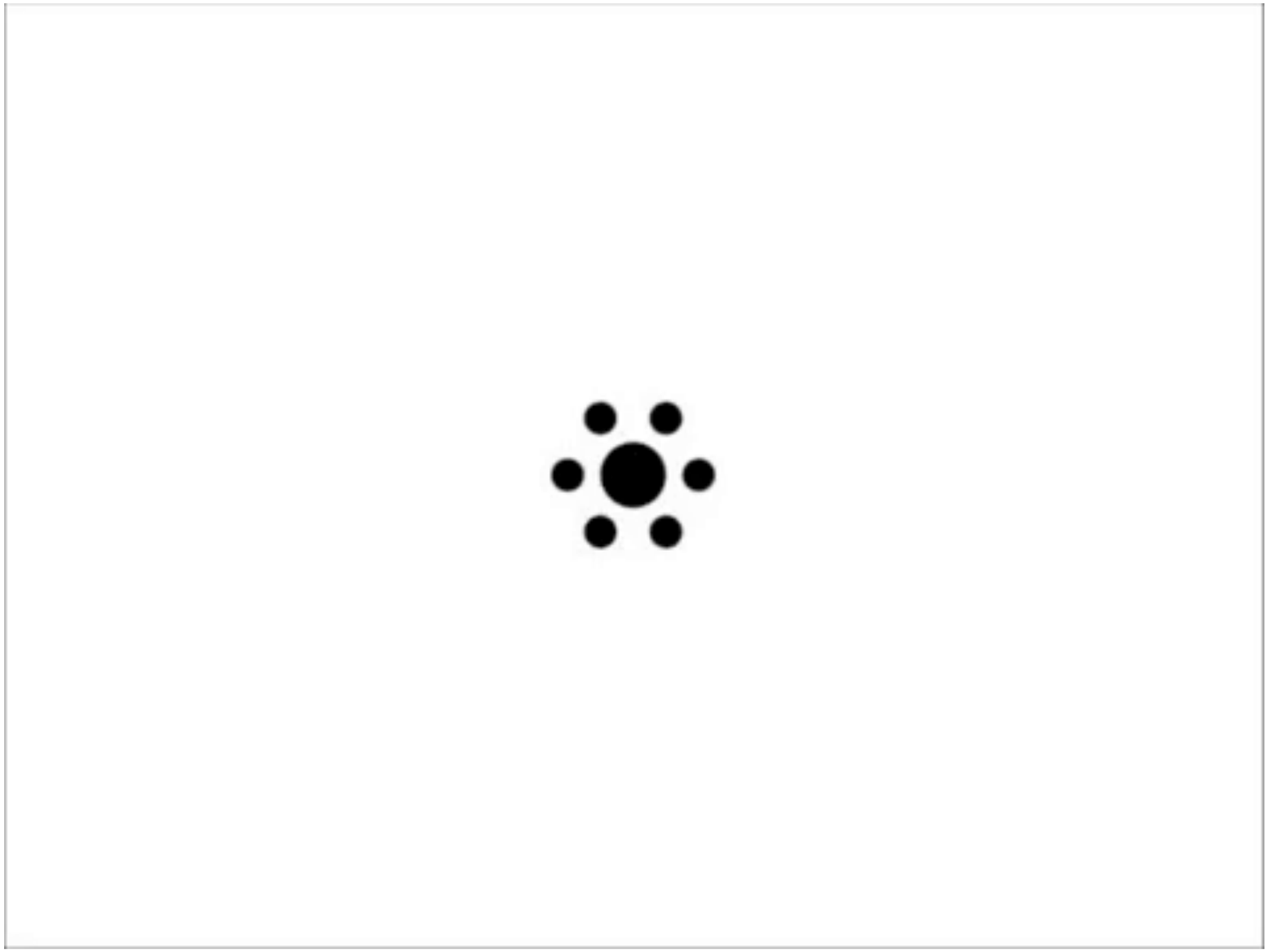

What color is this dress?
Black and blue 51.12% (137,440 votes)
White and gold 48.88% (131,398 votes)

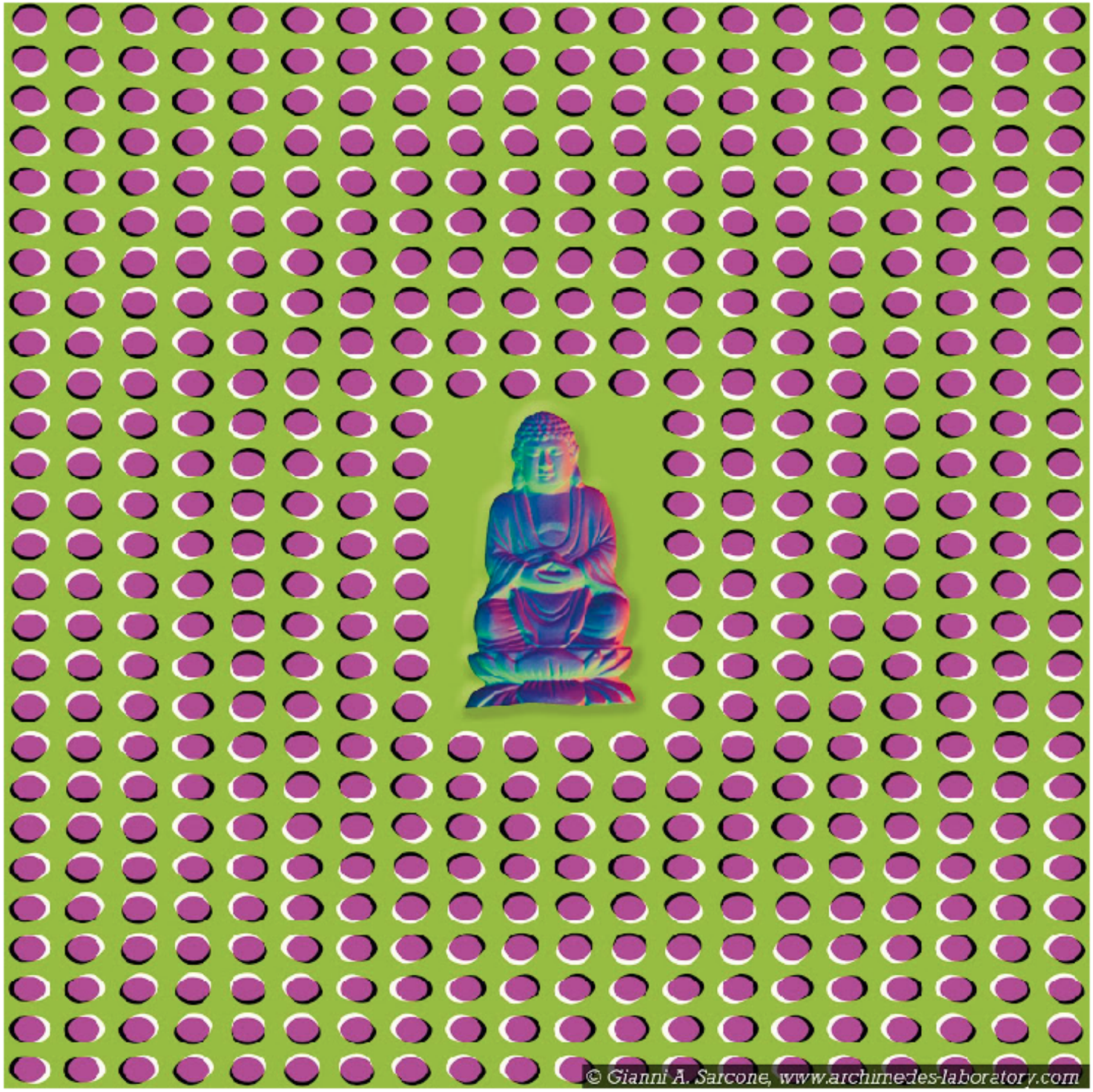





4 Perfectly Round Circles

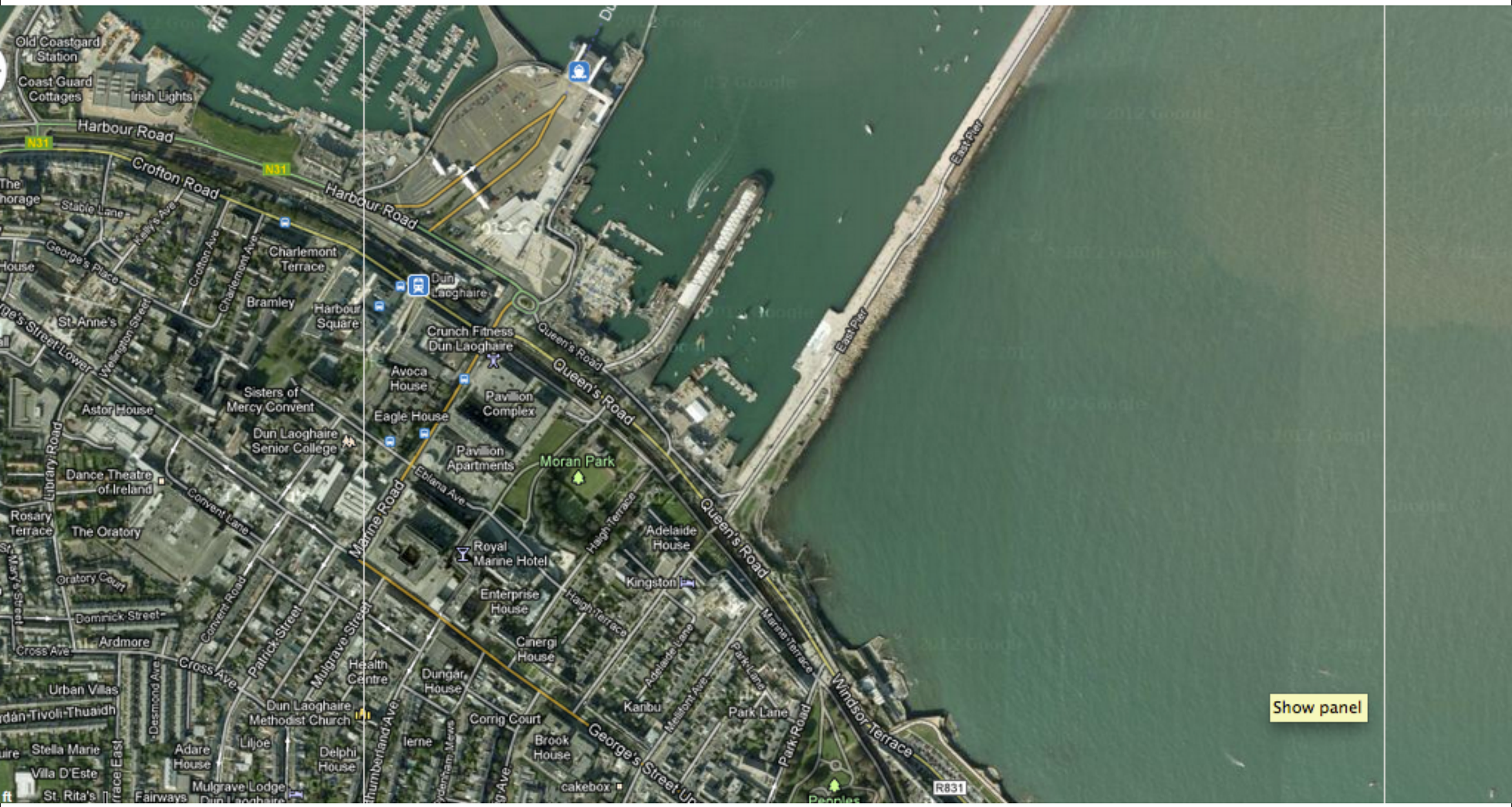
Dynamic Ebbinghaus Illusion




© Gianni A. Sarcone, www.archimedes-laboratory.com

UCD DUBLIN

NCAD-UCD 2013



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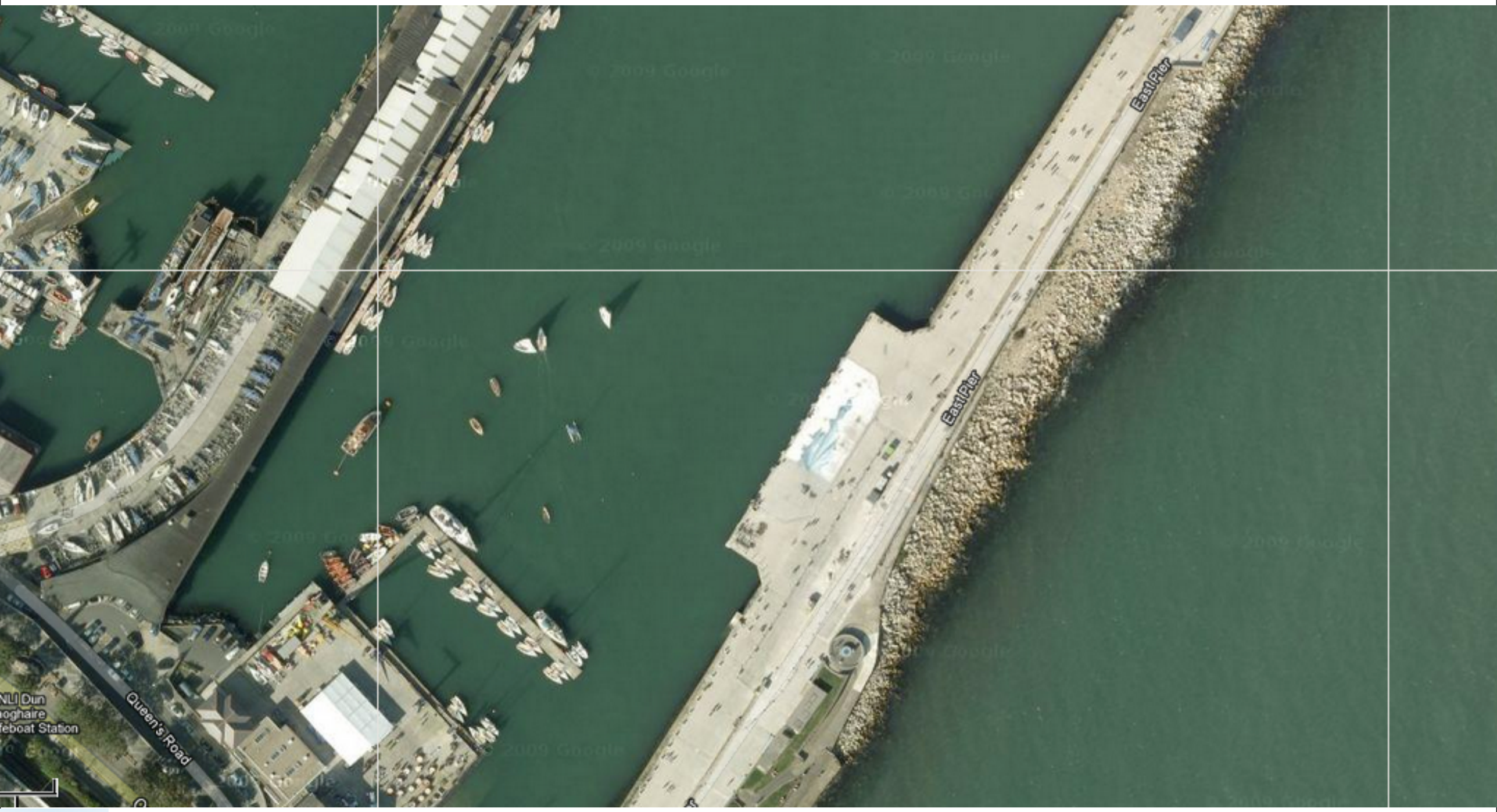

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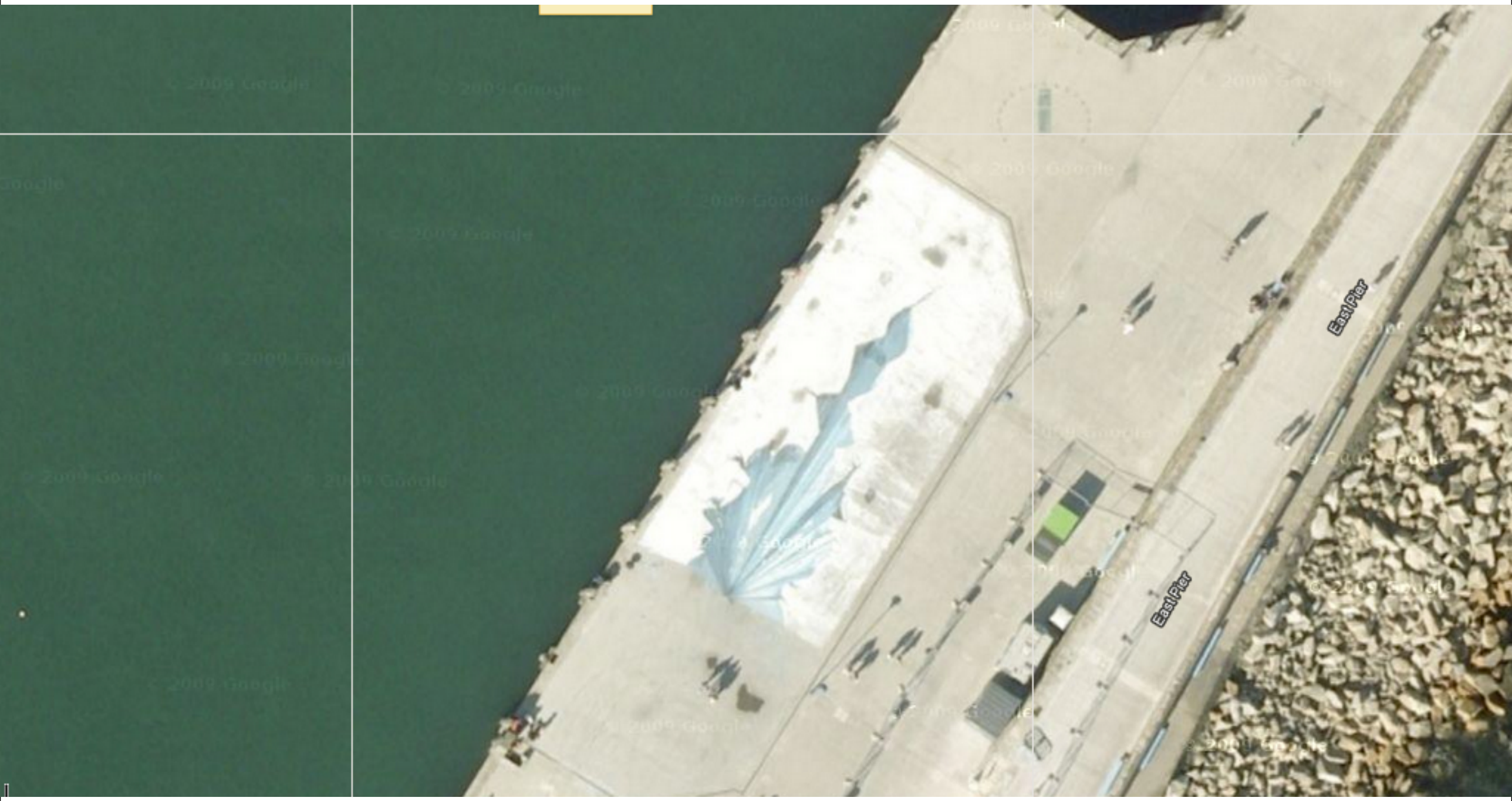


UCD DUBLIN

NCAD-UCD 2013

Edgar
Müller
2008

NCAD-UCD 2013

NCAD-UCD 2013

Felice Varini

Anamorphic Art

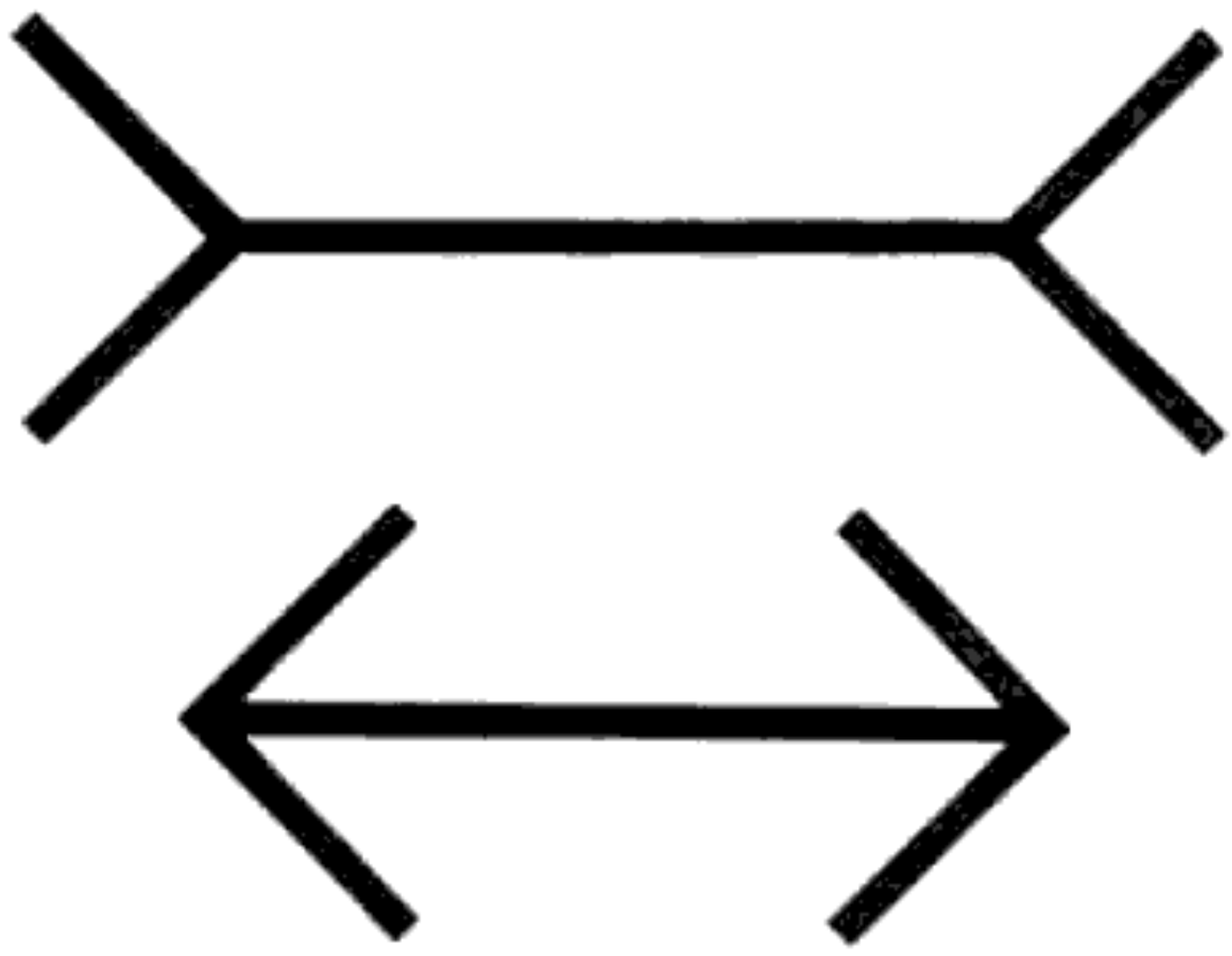
NCAD-UCD 2013

Notice how most optical illusions require you to keep your head still and stare from a single point in order to work.

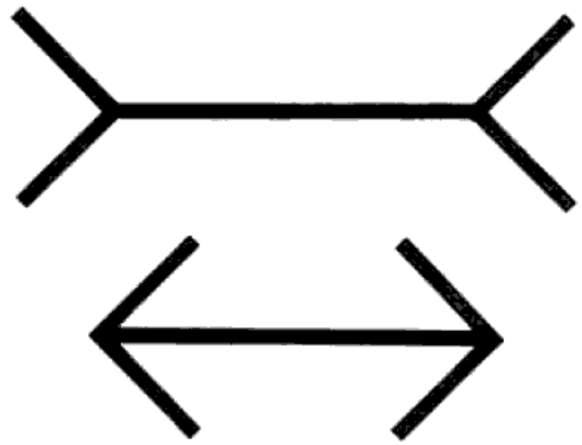
This is not your normal mode of vision.

If seeing is an activity, most optical illusions represent a pathological kind of inactivity.

Müller-Lyer Illusion



Müller-Lyer Illusion



There has been much discussion about whether this illusion arises from low-level properties of the visual system (physiology), or from experience with carpentered edges (culture).

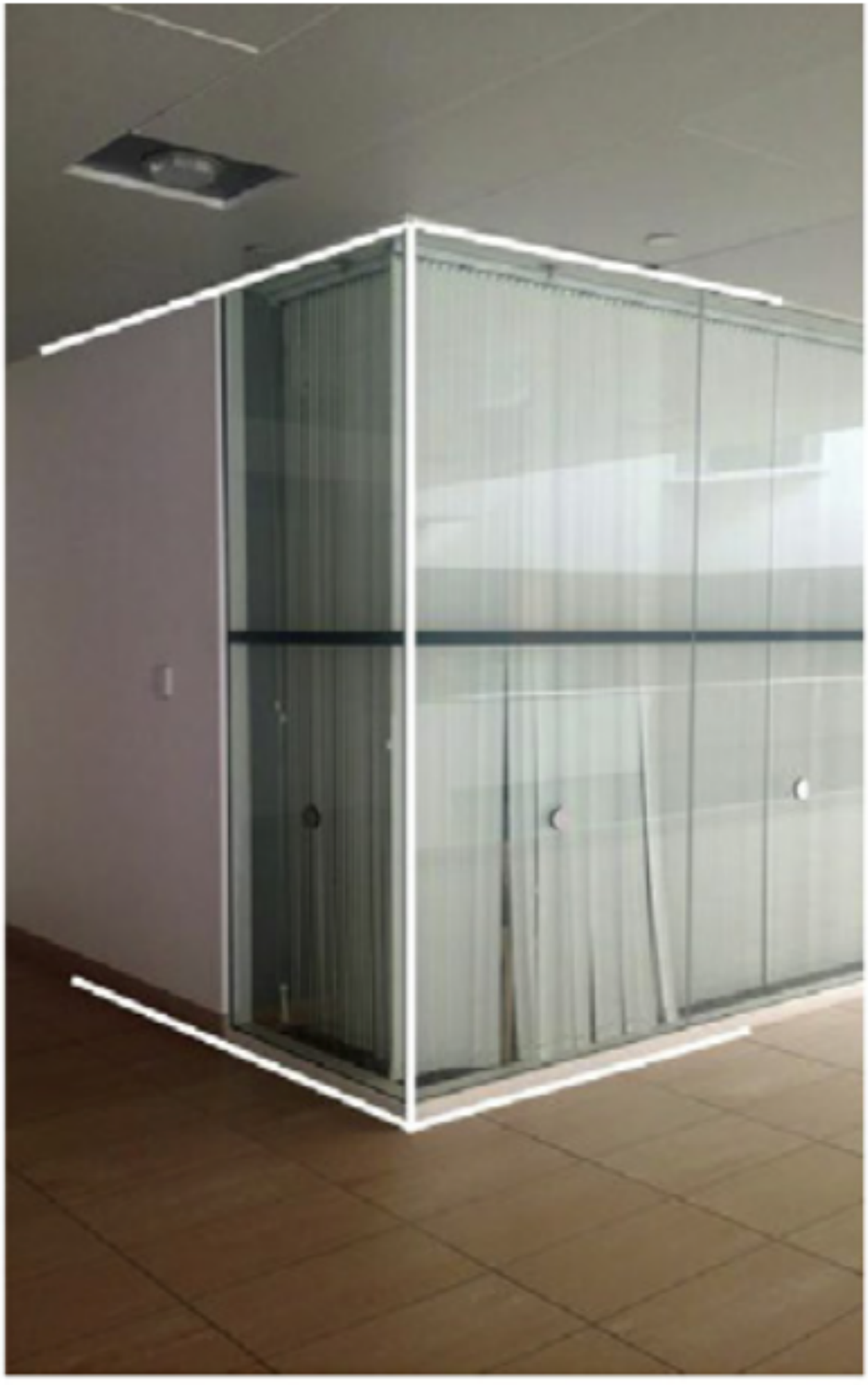


Table 1. Details for Samples

Group	Country/City	Sample Size
Ankole Adults/Kids	Uganda	131/93
Toro Adults/Kids	Uganda	49/37
Suku Adults/Kids	Congo Republic	40/21
Songe Adults/Kids	Congo Republic	45/44
Fang Adults/Kids	Gabon Republic	42/43
Bete Adults/Kids	Ivory Coast	38/37
Ijaw Adults/Kids	Nigeria	47/37
Zulu Adults/Kids	South Africa	21/14
San Adults	Kalahari Desert	36
S.A. European Adults	Johannesburg	36
S. A. Miners	South Africa	60
Senegal Adults/Kids	Senegal	74/51
Dahomey Kids	Guinea Coast	40
Hanunoo Adults/Kids	Philippines	37/12
Evanston Adults/Kids	U.S., Illinois	111/77
Bassari Adults/Kids	Eastern Senegal	50/50
Yuendumu	Central Australia	52

Not everybody reacts in the same way.

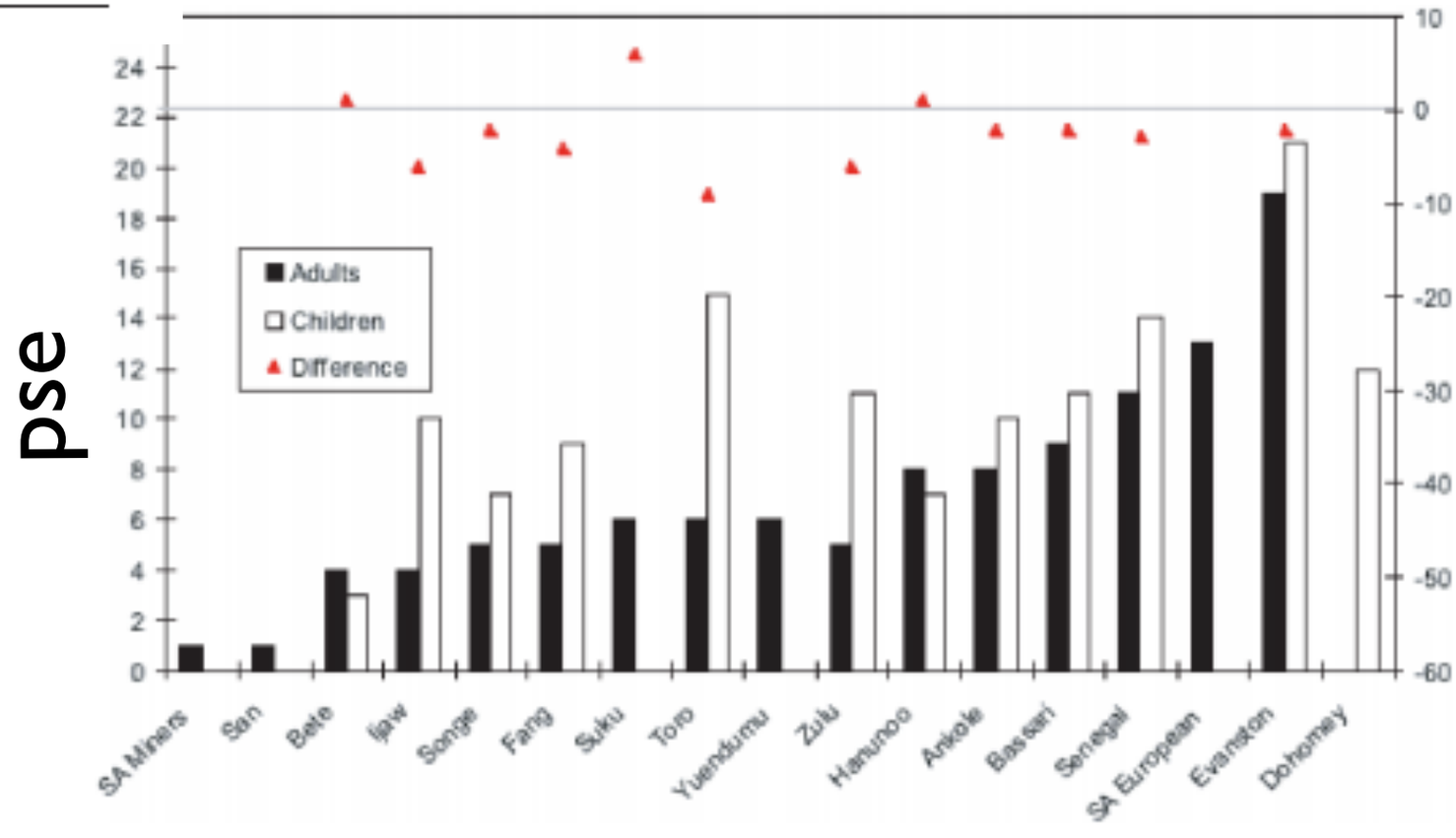
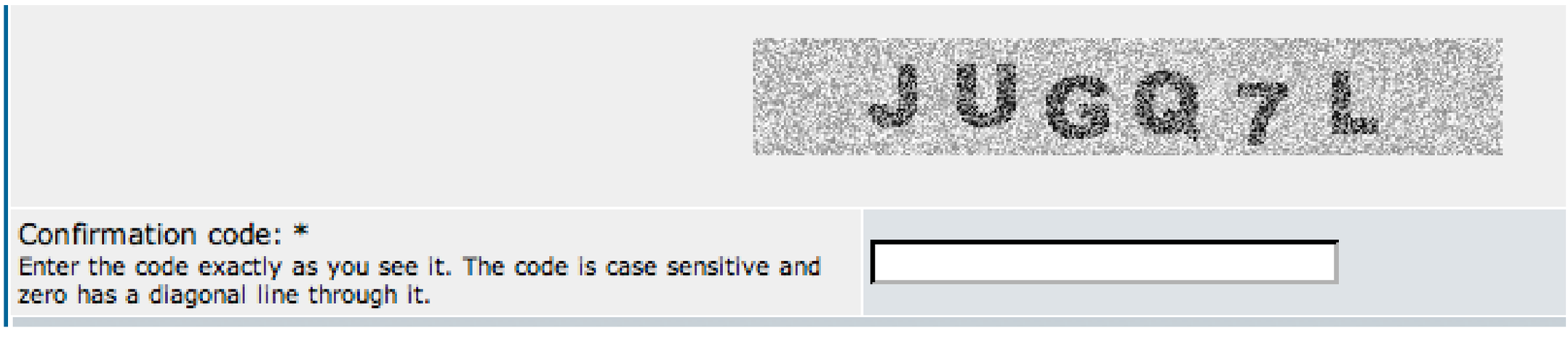
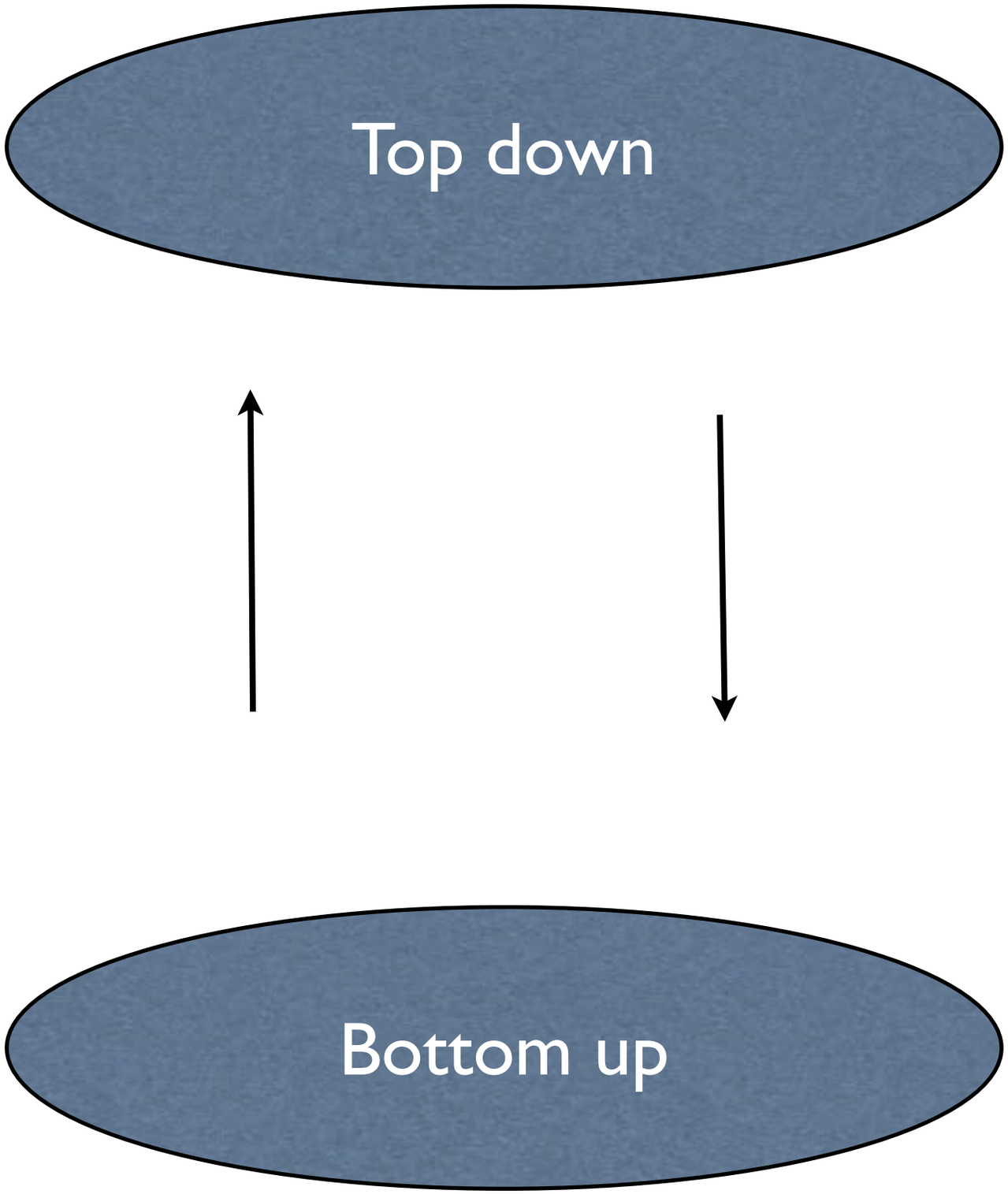


Figure 2 Müller-Lyer Results from Segall et al.'s (1966) cross-cultural project. PSE is the percentage that segment *a* must be longer than *b* before individuals perceive them as equal.

Computational approaches to vision



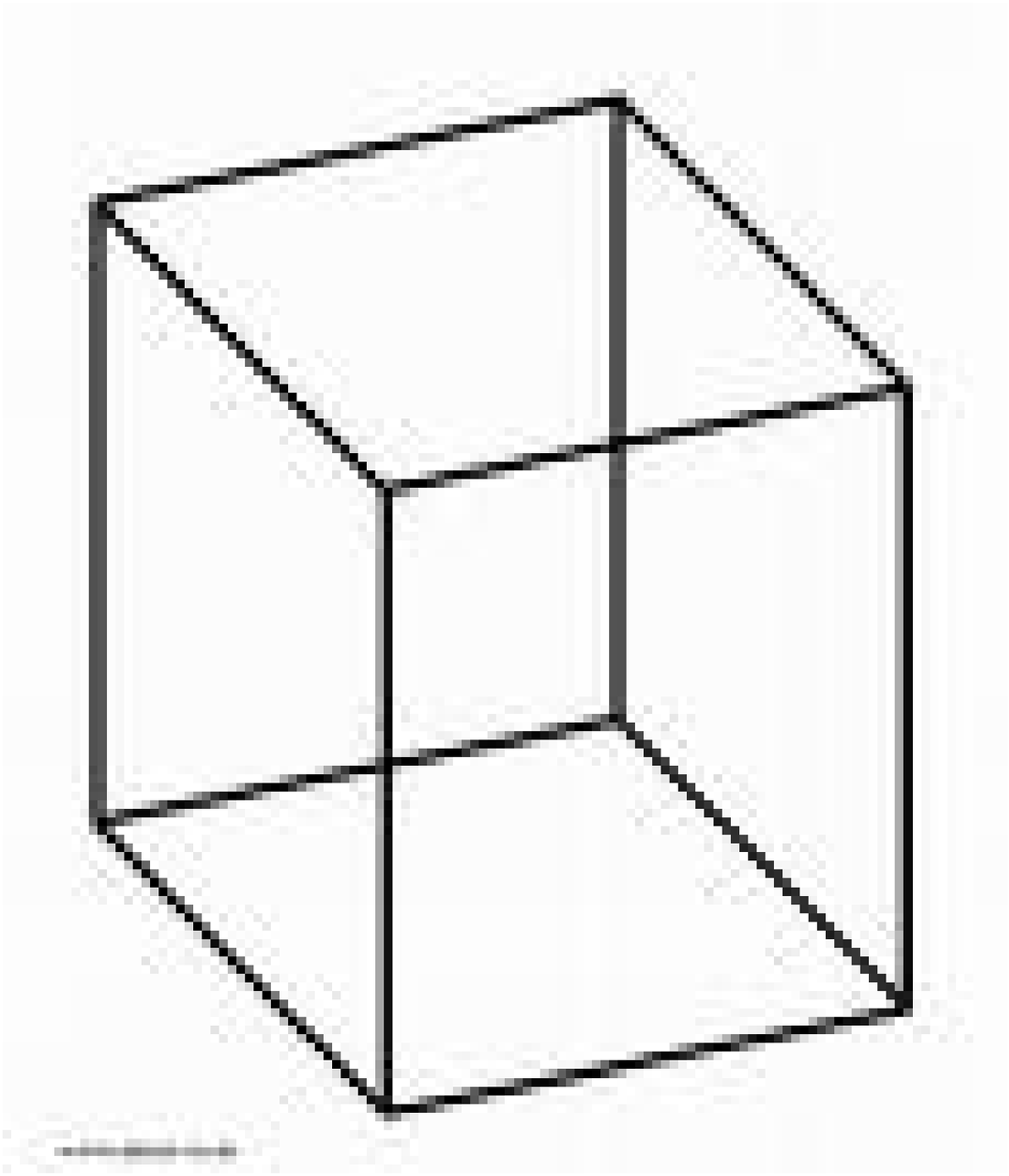
Some things we find very easy have proved remarkably hard to do with computers (and vice versa)



Expectations
Attention
World knowledge

Motion
Edges
Shape from shading

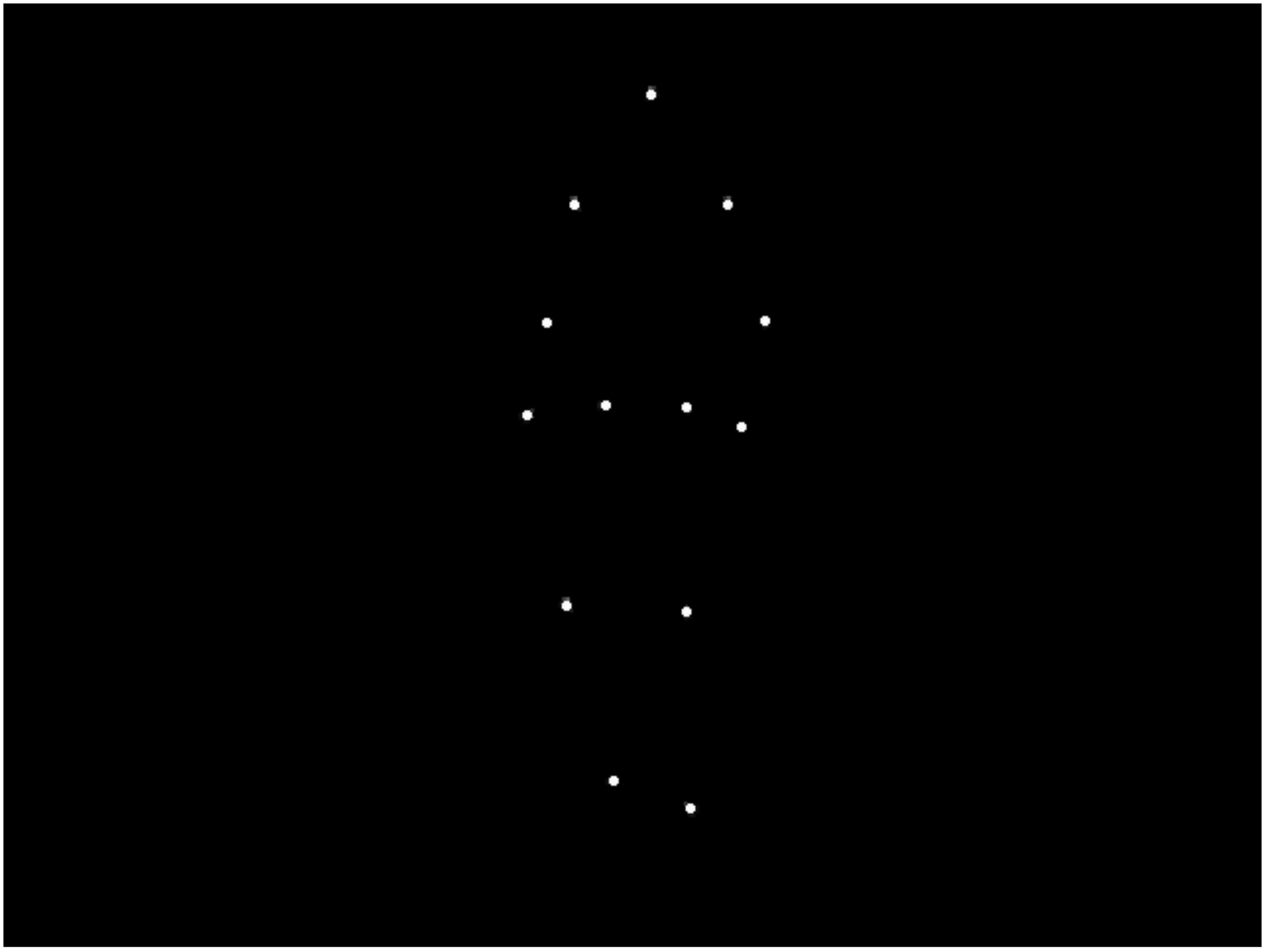
Perceptual Coherence



Bistable Perception:

The Neckar Cube

Rotating walker illusion (Stuart Jackson)



Take Home Messages

- Vision is *purposeful*
- The eye is *not* a camera
- Under "vision" we mean the system that both guides our movements and that helps us identify things (what vs where)
- The visual system evolved to deal with a world which is largely predictable (and so it can be fooled)