Perceiving the World

The **Paradox** of Perception

Quirkology Channel

THE COLOUR CHANGING CARD TRICK

www.RichardWiseman.com

Which way was the train moving?

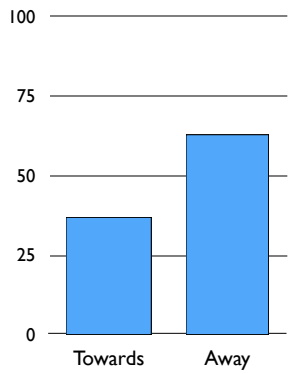
A. Towards us

B. Away from us

Which way was the train moving?

A. Towards us

B. Away from us



Another **Paradox**

Not enough information to specify what is out there

Too much information for our puny brains to process

Quirkology Channel

THE COLOUR CHANGING CARD TRICK

www.RichardWiseman.com

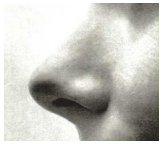
A **Paradox**

Not enough information to specify what is out there

Too much information for our puny brains to process

vision
(sight)

audition
(hearing)



olfaction
(smell)

gustation
(taste)

somatosensation
(touch)

+ proprioception
'internally' sensing your own body

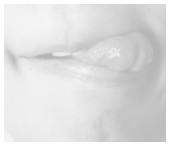
+ thermosensation
feeling temperature

nociception
feeling pain

vision
(sight)

audition
(hearing)

olfaction
(smell)



gustation
(taste)

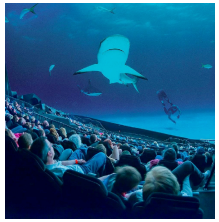
somatosensation
(touch)

+ proprioception
'internally' sensing your own body

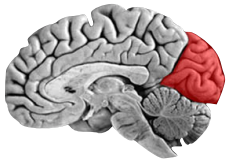
+ thermosensation
feeling temperature

nociception
feeling pain

Vision "Dominates"



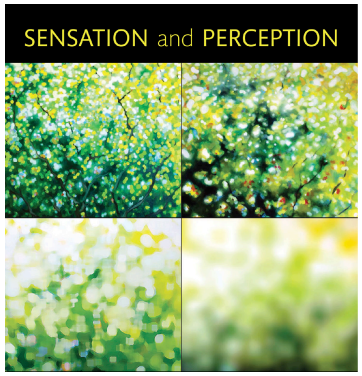
…in the brain too



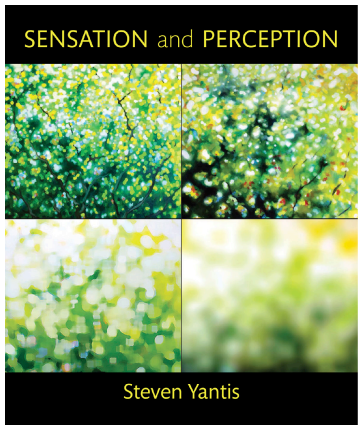
…and we understand it best

Scientific publications on "gustation":
17,000

Scientific publications on "visual perception":
1.25 million


SENSATION and PERCEPTION

Like
Neuroscience
Psychophysics
Cognition
The Vision Sciences Group
Meet the team at jhu.vg
Action
Computation
Development
Johns Hopkins University
Inspiring Innovation And Discovery - Creating The Future Of Vision Science


SENSATION and PERCEPTION
Steven Yantis

Sensation

stimulation of our sense organs by the world

"a small white sphere with an orange pattern on its surface"

Perception

organizing sensory stimulation into a coherent picture of the world

1960s

spend the summer linking a camera to a computer and getting the computer to describe what it saw

Today

CVF THE COMPUTER VISION FOUNDATION
A NON-PROFIT ORGANIZATION THAT FOSTERS AND SUPPORTS RESEARCH IN ALL ASPECTS OF COMPUTER VISION

Show, Attend and Tell: Neural Image Caption Generation with Visual Attention

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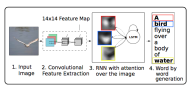
* Université de Montréal, † University of Toronto, + CIFAR

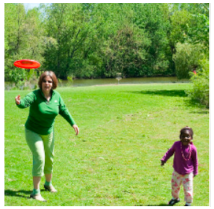
Abstract

Inspired by recent work in machine translation and object detection, we introduce an attention based model that automatically learns to describe the content of images. We describe how we can train this model in a deterministic manner using standard backpropagation techniques and stochastically by maximizing a variational lower bound. We also show through visualization how the model is able to automatically learn to fix its gaze on salient objects while generating the corresponding words in the output sequence. We validate the use of attention with state-of-the-art performance on three benchmark datasets: Flickr8k, Flickr30k and MS COCO.

Figure 1. Our model learns a words/image alignment. The visualized attentional maps (3) are explained in Sections 3.1 & 5.4



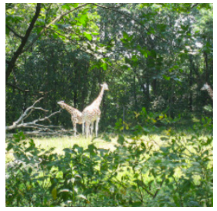
Yet despite the difficult nature of this task, there has been a recent surge of research interest in attacking the image



"a woman is throwing a frisbee in the park"

"a stop sign is on a road with
a mountain in the background"

"a little girl sitting on a bed with a teddy bear"



"a large white bird standing in a forest"

"an airplane is parked on
the tarmac at an airport"

"a man wearing a hat on a skateboard"

Perception is **Hard**

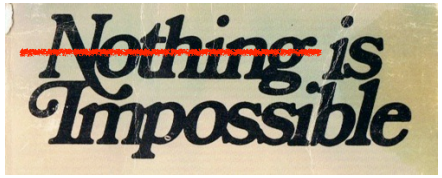
why did we think it would be easy?

Instinct Blindness

John Tooby
Leda Cosmides

"The phenomenal experience of an activity as 'easy' or 'natural' often leads scientists to assume that the processes that give rise to it are simple. **Seeing seems simple** … precisely because there is a vast array of complex, dedicated computational machinery that makes this possible."

Perception

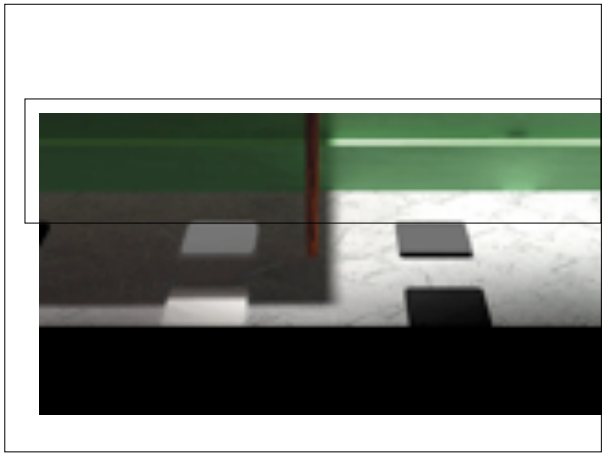


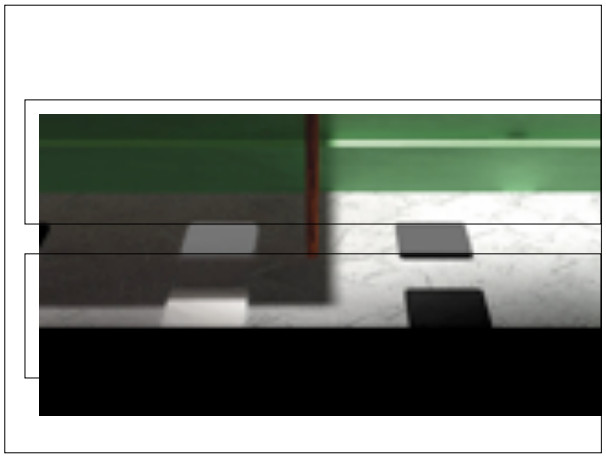
X = ?

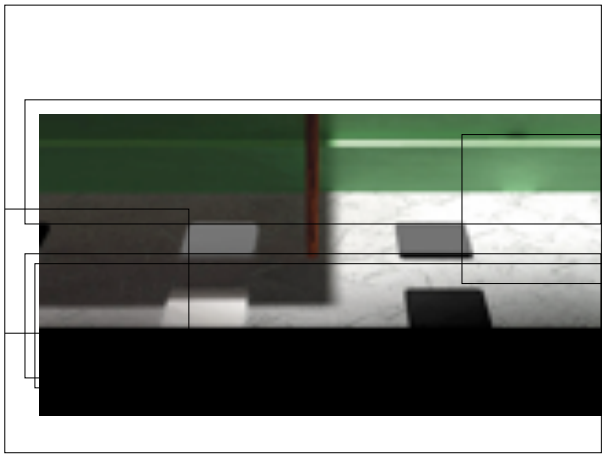
X * Y = 8

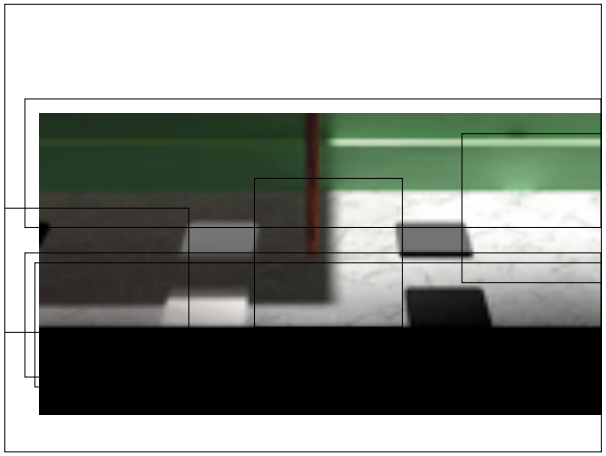
You can't!

Color &
Lightness









$X = ?$

$X * Y =$

"true" color	*lighting conditions*	*light hitting eye*

"Unconscious Inferences"

$X = ?$

$X * Y =$

"true" color	*lighting conditions*	*light hitting eye*

"Unconscious Inferences"

white → X

dark shadow → Y

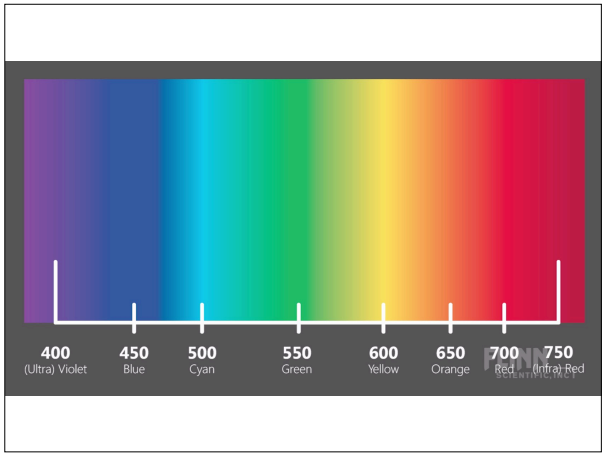
$X * Y =$

"true" color	*lighting conditions*	*light hitting eye*

black ↓ *bright light* ↓

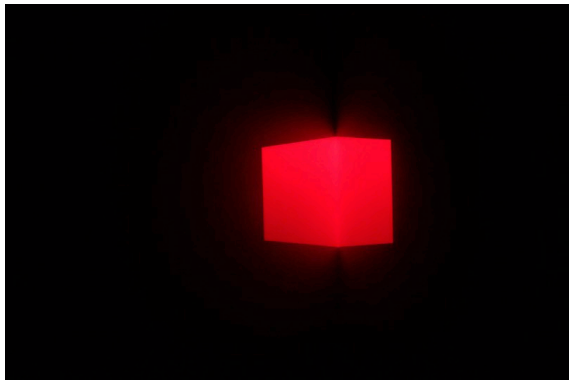
X * Y =

"true" color *lighting conditions* *light hitting eye*

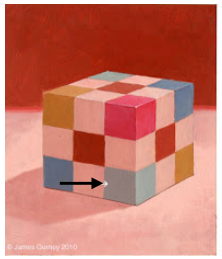


$$X * Y = 700nm$$

"true" color | *lighting conditions* | *light hitting eye*



© James Gurney 2010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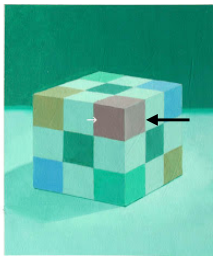
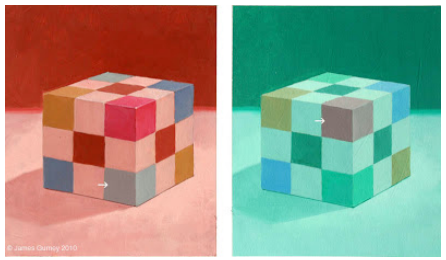
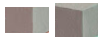
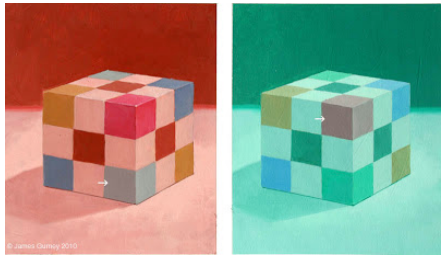


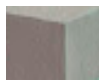

© James Gurney 2010



Light alone
is meaningless!



"Discounting the Illuminant"

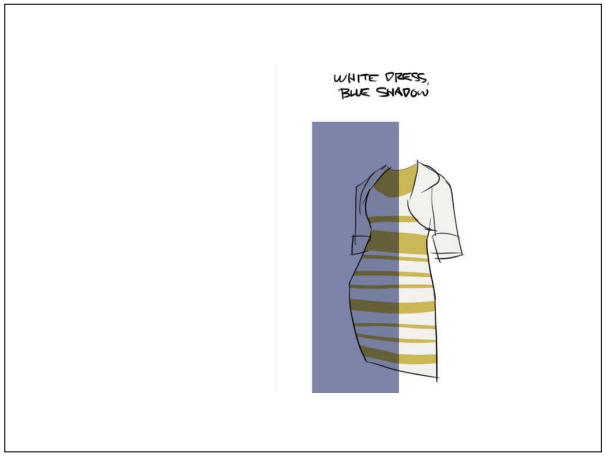
X * Y = 

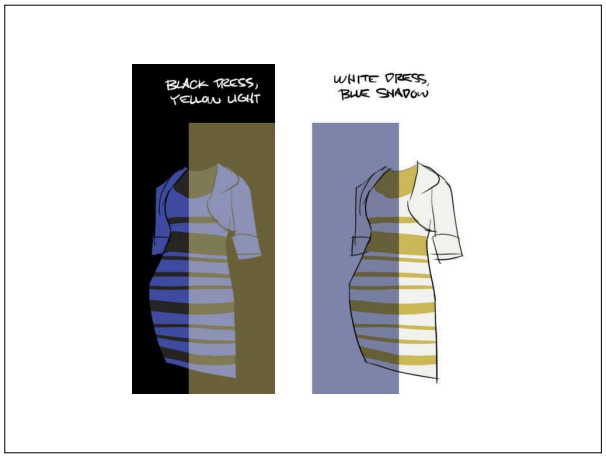
"true" color *lighting conditions* *light hitting eye*

SQUAWK BOX
#THEDRESS BREAKS INTERNET
CNBC

BLACK DRESS,
YELLOW LIGHT

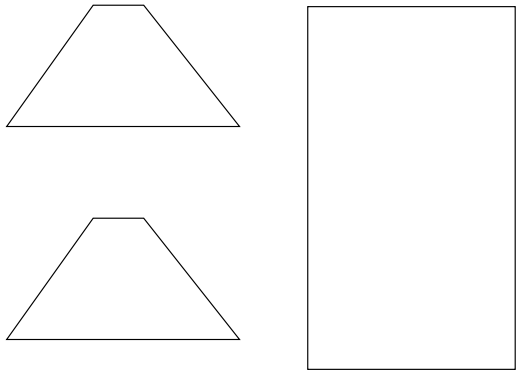
SQUAWK BOX
#THEDRESS BREAKS INTERNET
CNBC

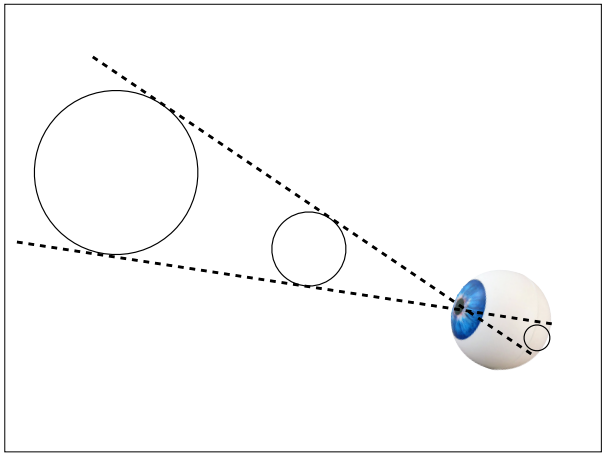

WHITE DRESS,
BLUE SHADOW


BLACK DRESS,
YELLOW LIGHT
WHITE DRESS,
BLUE SHADOW

3D Space

The world is **3D**,
but your retina is **2D**!





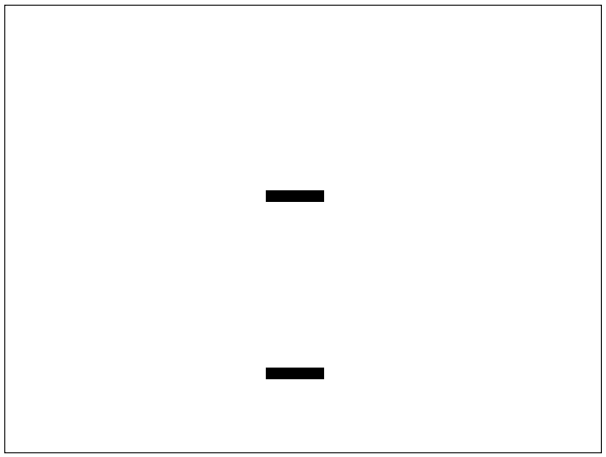
"Cues" to Size & Depth

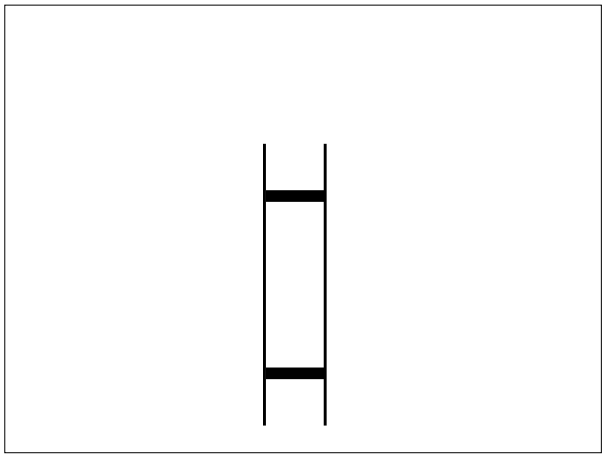
X / Y = ◯

true size / *distance* = *size of retinal image*

Linear Perspective

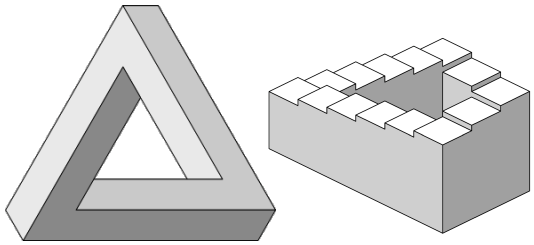
Ponzo Illusion





Motion

Occlusion

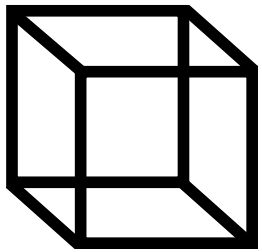


Perspective

Motion

Occlusion

…



Roll over image to zoom in

BSG HandCraft

Wire Hoods. Bag of 50

13 customer reviews

Price: $7.49 ($0.15 / Wire Hood) + $5.04 shipping

Note: Not eligible for Amazon Prime. Available with free Prime shipping from other sellers on Amazon.

In Stock.

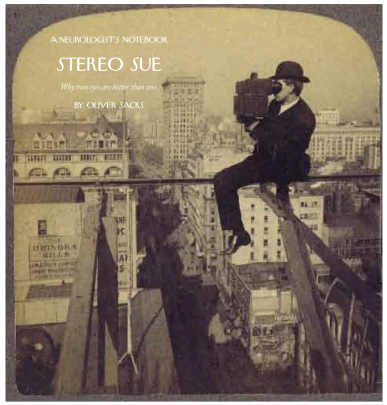
Want it Monday, Sept. 18? Order within **11 hrs 36 mins** and choose **Two-Day Shipping** at checkout. Details

Ships from and sold by Home Brew Ohio.

New (5) from $8.95 & FREE shipping.

Specifications for this item

Part Number	2535
Number of Items	50
Measurement System	US
UPC	696737260864
Brand Name	BSG HandCraft



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Magnification

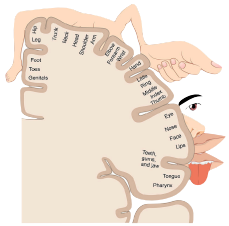
Attention

Magnification

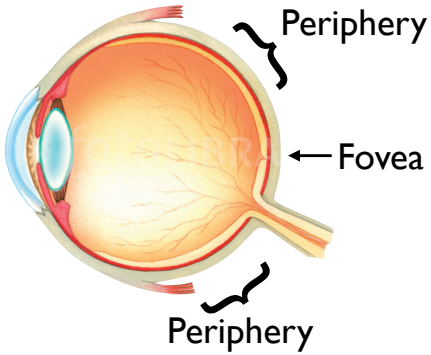
Attention

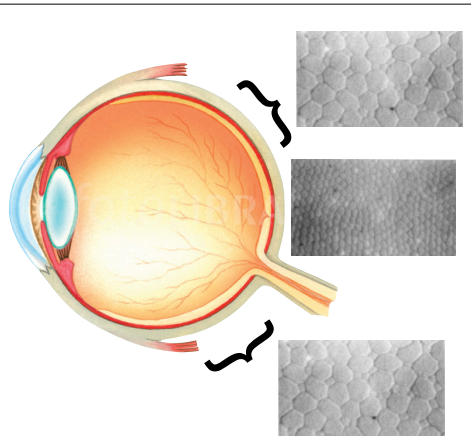
Cortical Magnification

increased sensitivity



"Map" of body on the brain





Refrigerator Light Illusion

whenever I check, it's on!

Refrigerator Light Illusion

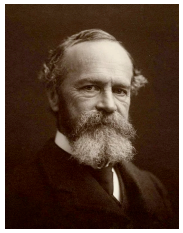
wherever I look, it's clear and in focus

Magnification

Attention

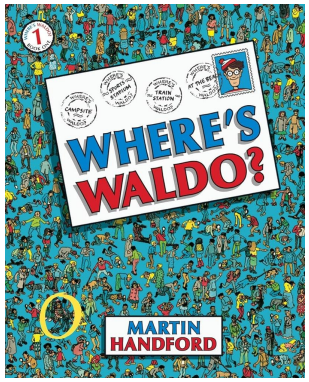
Magnification

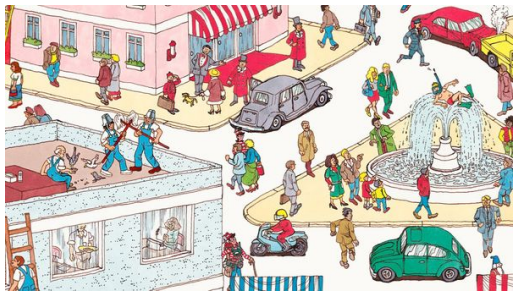
Attention



William James
(1842-1910)

Attention … is the taking possession by the mind, in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought


WHERE'S
WALDO?
MARTIN
HANDFORD



Attention

↕

Awareness

"Change Blindness"