Attention Perception and Performance

Introduction to the Human Sciences
Lecture 3
09 April 2019

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Today's Topic

Introduction

How we do study mental processes

Perception

Personality and Social Psychology

2

Case Study – Facilitated Communication

EXTRAORDINARY CLAIM
Is the evidence as strong as the claim?

REPLICABILITY
Can the results be duplicated in other studies?

RIVARLY HYPOTHESIS
Have important alternative explanations for the findings been excluded ?

CORRELATION VS. CAUSATION
Can we be sure that "A" causes "B" ?

FALSIFIABILITY
Can the claim be refuted?

AIM

Everyday Thinking –
- Inaccurate observations – lacks validity and reliability
- Overgeneralization
- Selective observation

Scientific Thinking
- Reduce uncertainty and randomness
- Reduce Error
- Improve Predictability
- Causality and Probability

Why is this so challenging?

- Complex System – 86 billion neurons and how it leads to thinking, emotion, action …. We still do not know
- Variability – So much variability that we differ in terms of finger prints; culture , knowledge, age, experience etc influences and shapes us who we are … and similarly our thoughts, emotion and actions
- Reactivity – if one knows them being observed, they behave differently than them without knowledge … so, your response changes for same condition when you are observed vs. when you do not …

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What are the Essential Ingredients? – Systematic and Controlled Approach

- Systematic and objective observation
  - Hypothesis testing (Falsification of hypothesis)
  - Reducing subjectivity
  - Generalization validity
  - Ensuring Validity at every stage – from construct to conclusion
- Control – ruling out the various possible explanation for better predictability and causal probability
- Ruling out the metaphysical explanations
  - *People are poor and starving because God wills it …*

(Howard lee , 2007 from Essentials of Behavioral Research)

Demand Characteristics

Observers Demand

SINGLE VS. DOUBLE BLIND

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Activity 1

- Can we perceive invisible stimuli?
  Subliminal Processing
- Can we "read" someone else's thoughts?
  Extra-Sensory Perception
- Can certain blind people still "see" some of their surroundings?
  Partial *vs.* Complete Visual Impairment
- Do some people "taste" shapes or "hear" colours?
  Synaesthesia

Reality

Virtual Reality

Experience through our senses !
How this conscious experience is different?

Things that we do not / can't sense are not real?
eg. visual impairment, Agnosia

Things that we do sense in absence of real stimulus, is reality?
Like hallucination?

Is its umwelt ?

What is PERCEPTION ?

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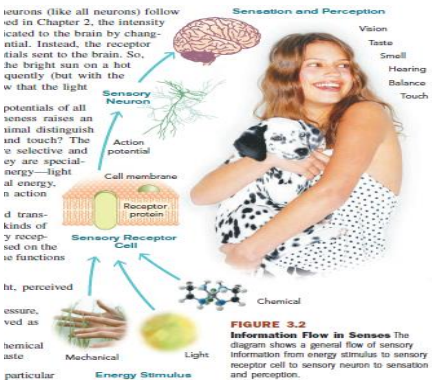
Perception is **organization, identification, and interpretation** of a sensation/ raw stimulus in order to **form a mental representations**



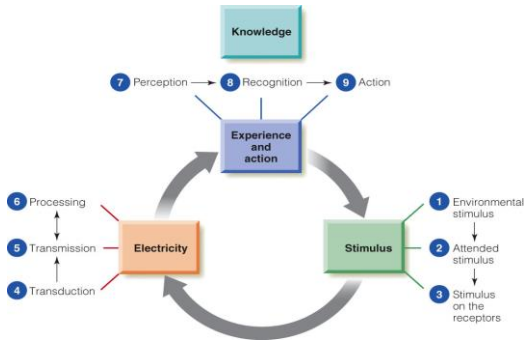
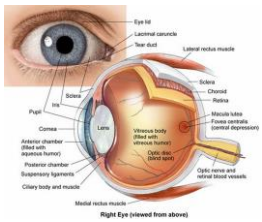
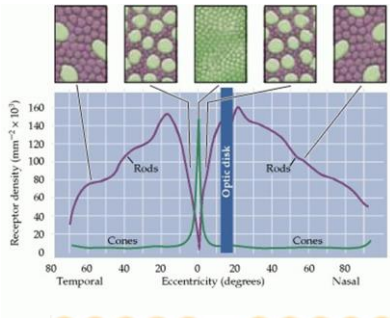


Figure 1.1 The perceptual process. The steps in this process are arranged in a circle to emphasize that the process is dynamic and continually changing.

Transduction & Transmission

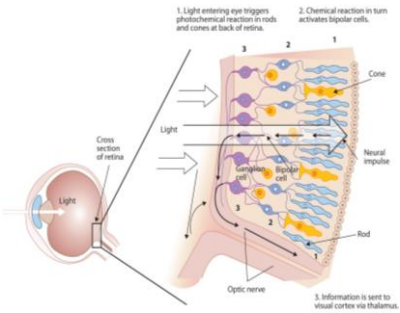


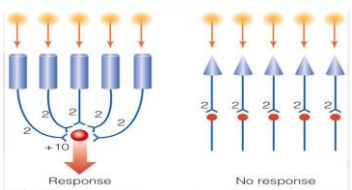


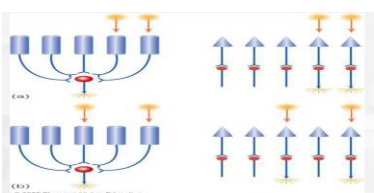
126 million rods and cones converge to 1 million ganglion cells
Higher convergence of rods than cones
- Average of 120 rods to one ganglion cell
- Average of 6 cones to one ganglion cell
- Cones in fovea have 1 to 1 relation to ganglion cells

What's happening here?
Dos this making us to perceive reality?

Rods – limited in localization
Cones – needs more light







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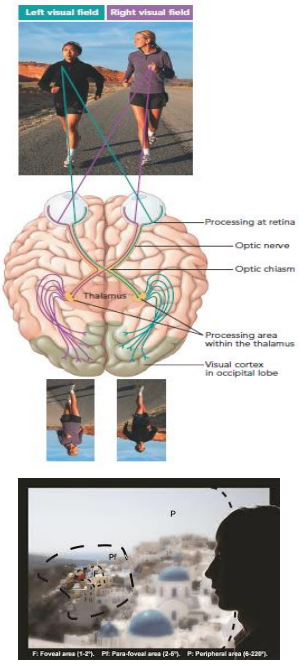

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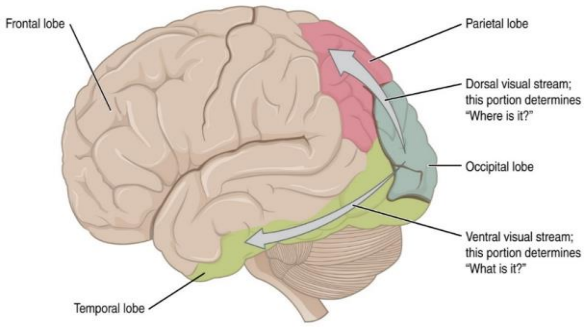

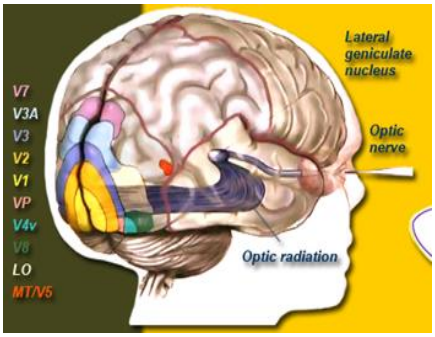

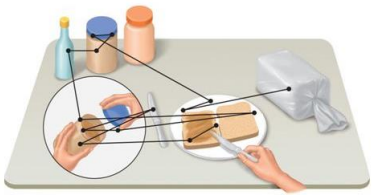

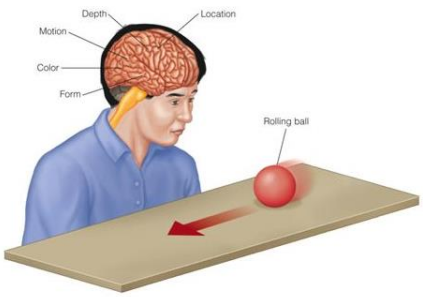


The Binding Problem

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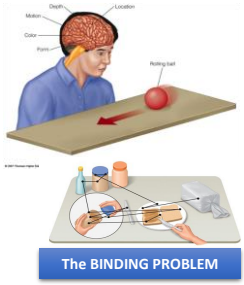
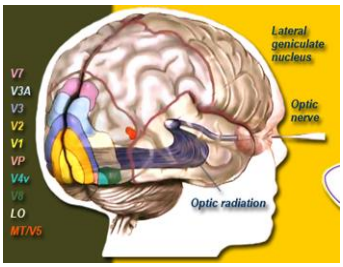
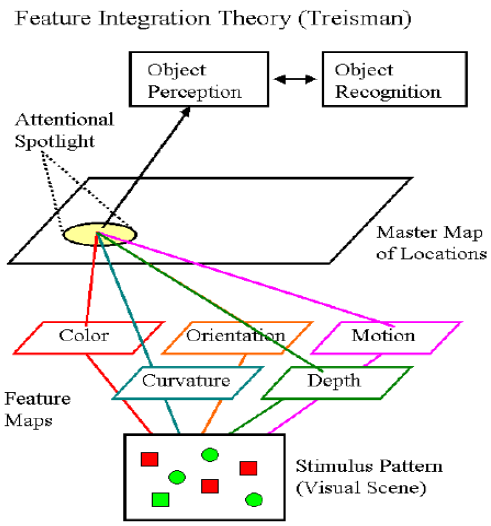
Attention and Perception

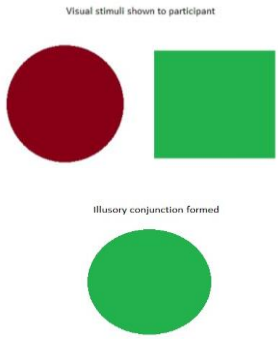


The BINDING PROBLEM





Attention work as a GLUE



Illusory Conjunction

Do we always need Attention?

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- **Inattention Blindness – Failure to perceive the object that are not the focus of attention**

- **Change Blindness – failure to detect changes to the visual details of a scene**

- **Subliminal Perception – Thought or behaviour that is influenced by a stimuli that a person cannot consciously report perceiving**

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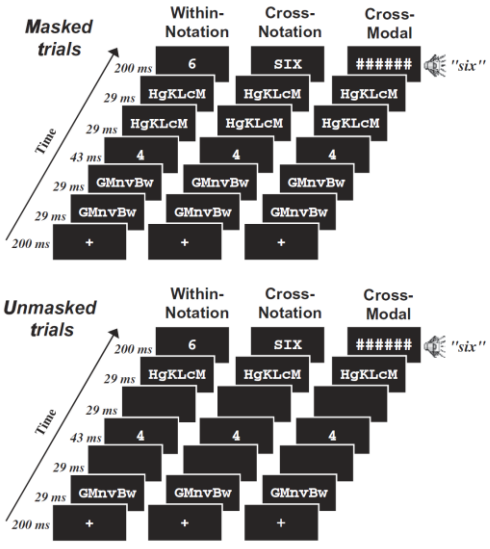
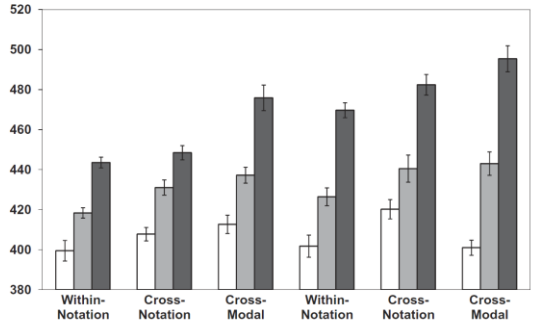
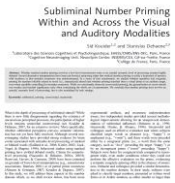
Subliminal Processing





	Masked presentation			Unmasked presentation		
	Within-Notation	Cross-Notation	Cross-Modal	Within-Notation	Cross-Notation	Cross-Modal
Repetition	400	408	413	402	420	401
Congruent	418	431	437	426	441	443
Incongruent	444	448	476	470	482	495


Mechanisms of subliminal response priming


Subliminal Number Priming Within and Across the Visual and Auditory Modalities

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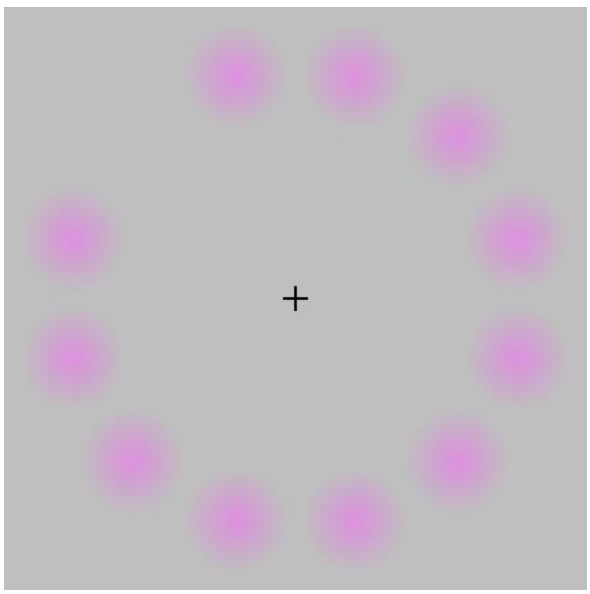

Lilac Chaser Illusion – Phi phenomenon

- **Apparent motion –** perception of motion as a result of alternating signals appearing in rapid succession in different locations – visual sensory memory
- **Colorafter/ afterimage effect –** caused by sensory adaptation of a given cones and can be explained by colour opponent system
- **Troxler's fading –** rigid fixation on some element in the visual field can cause surrounding stationary images to seem to slowly disappear or fade

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Multitasking – Attention and Perception – car following paradigm

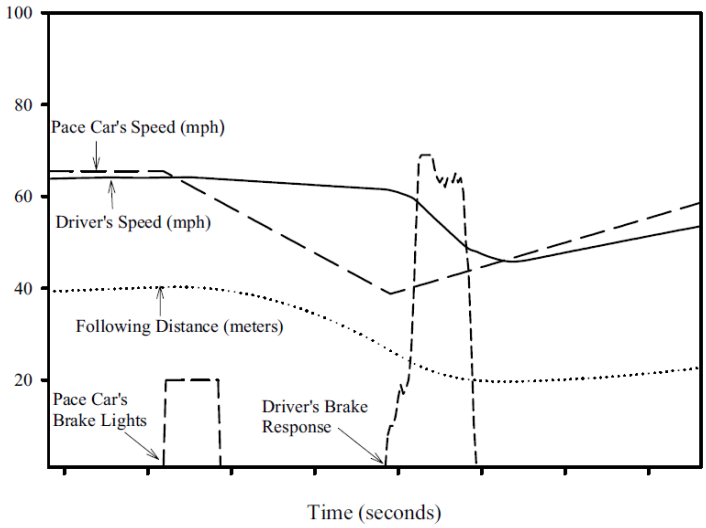

Table 1 Frequency Totals for the 2 (Cell Phone in Use Vs. Cell Phone Not in Use) × 2 (Stopping Violation Vs. No Violation) Observational Study of Four-Way Stop Sign Compliance.

	Stopping violation	No violation	
On cell	82	28	110
Not on cell	352	1286	1638
	434	1314	1748

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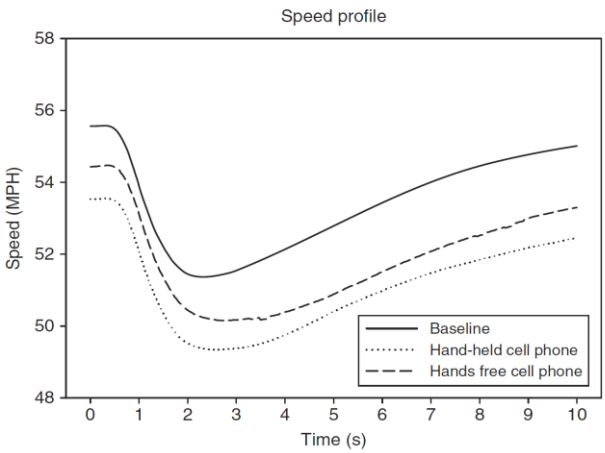
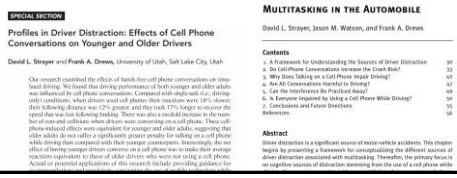


Figure 5 The driving speed profile plotted as a function of time. The single-task baseline condition is presented with the hand-held and hands-free dual-task cell-phone conditions.

Table 2 Driving Performance Measures Obtained in the Alcohol, Baseline, and Cell-Phone Driving Conditions.

	Alcohol	Baseline	Cell phone
Total accidents	0	0	3
Brake reaction time (ms)	779 (33)	777 (33)	849 (36)
Speed (MPH)	52.8 (2.0)	55.5 (0.7)	53.8 (1.3)
Following distance (m)	26.0 (1.7)	27.4 (1.3)	28.4 (1.7)
Maximum braking force percentage of max	69.8 (3.7)	56.7 (2.6)	55.5 (3.0)
SD following distance (m)	10.3 (0.6)	9.5 (0.5)	11.8 (0.8)
Time to collision (s)	8.0 (0.4)	8.5 (0.3)	8.1 (0.4)
Time to collision <4 s	3.0 (0.7)	1.5 (0.3)	1.9 (0.5)
Half-recovery time (s)	5.4 (0.3)	5.3 (0.3)	6.3 (0.4)

MANOVAs indicated that both cell phone and alcohol conditions differed significantly from single-task baseline ($F(8,32) = 6.26$, $p < 0.01$ and $F(8,32) = 2.73$, $p < 0.05$, respectively). When drivers were conversing on a cell phone, they were involved in more rear-end collisions, their initial reaction to vehicles braking in front of them was slowed, and the variability in following distance increased. In addition, compared to the single-task baseline, it took participants who were talking on a cell phone longer to recover the speed that was lost during braking.


SPECIAL SECTION

Profiles in Driver Distraction: Effects of Cell Phone Conversations on Younger and Older Drivers

David L. Strayer and Frank A. Drews, University of Utah, Salt Lake City, Utah

Our research examined the effects of hands-free cell phone conversations on simulated driving. We found that driving performance of both younger and older adults was influenced by cell phone conversations. Compared with single-task (i.e., driving-only) conditions, when drivers used cell phones their reactions were 18% slower, their following distance was 12% greater, and they took 17% longer to recover the speed that was lost following braking. There was also a twofold increase in the number of rear-end collisions when drivers were conversing on a cell phone. These cell-phone-induced effects were equivalent for younger and older adults, suggesting that older adults do not suffer a significantly greater penalty for talking on a cell phone while driving than compared with their younger counterparts. Interestingly, the net effect of having younger drivers converse on a cell phone was to make their average reactions equivalent to those of older drivers who were not using a cell phone. Actual or potential applications of this research include providing guidance for

COGNITIVE DISTRACTION WHILE MULTITASKING IN THE AUTOMOBILE

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2. Do Cell-Phone Conversations Increase the Crash Risk? 33
3. Why Does Talking on a Cell Phone Impair Driving? 47
4. Are All Conversations Harmful to Driving? 67
5. Can the Interference Be Practiced Away? 69
6. Is Everyone Impaired by Using a Cell Phone While Driving? 59
7. Conclusions and Future Directions 55
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Abstract

Driver distraction is a significant source of motor-vehicle accidents. This chapter begins by presenting a framework for conceptualizing the different sources of driver distraction associated with multitasking. Thereafter, the primary focus is on cognitive sources of distraction stemming from the use of a cell phone while

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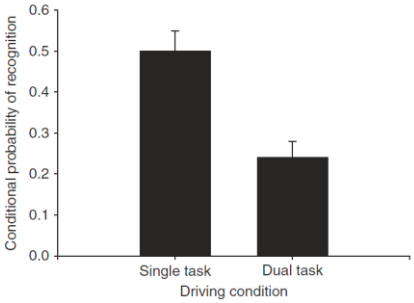
Figure 10 An illustration of how visual scanning is disrupted when drivers are talking on a hands-free cell phone. The left panel represents the scanning pattern of an undistracted driver and the right panel represents the scanning pattern when the driver is talking on a hands-free cell phone.



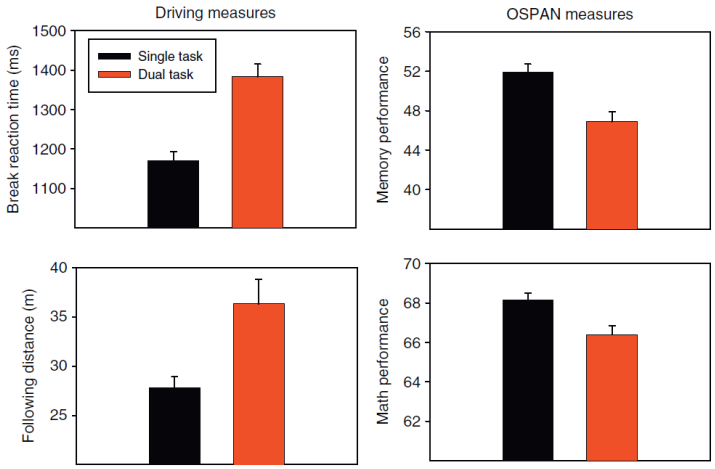
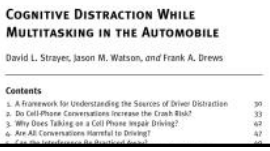


Figure 11 The group-level data for single-task and dual-task conditions.



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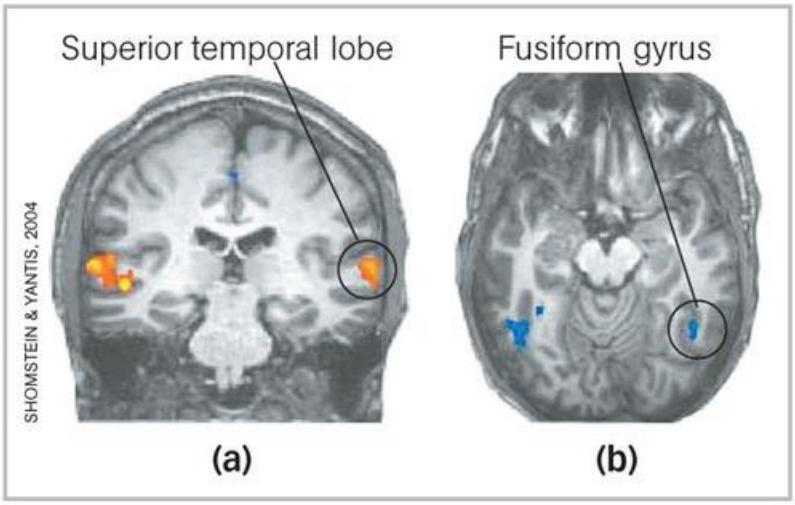

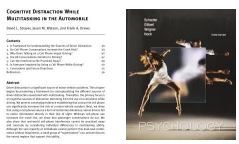

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Auditory and visual stimulus – dual task

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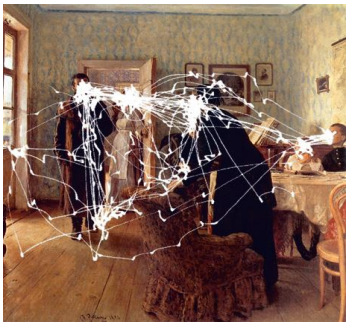
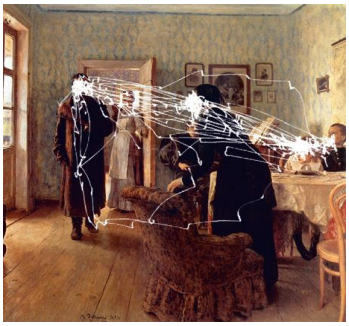
Ilya Repin, *An Unexpected Visitor*, (1884)

Yarbus, 1967



Free Examination



Ages of the People

Clothes they are wearing

Activity prior to the visitor

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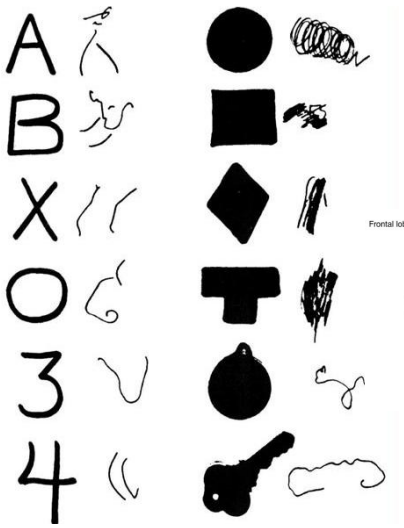
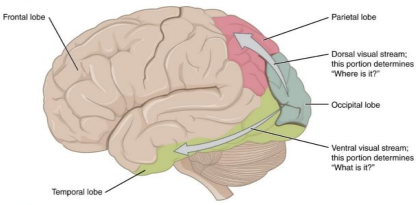
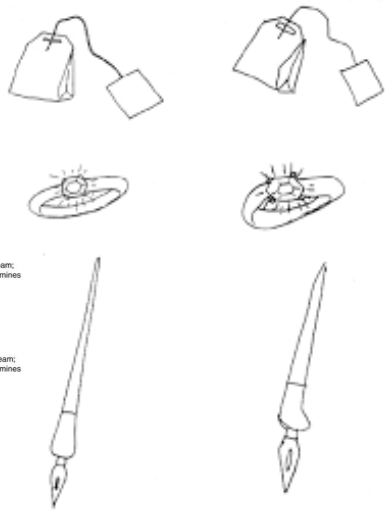
Visual Agnosia



Apperceptive

(Benson & Greenberg, 1969)





Associative

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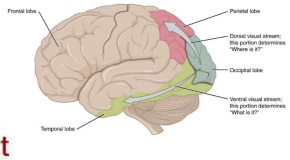
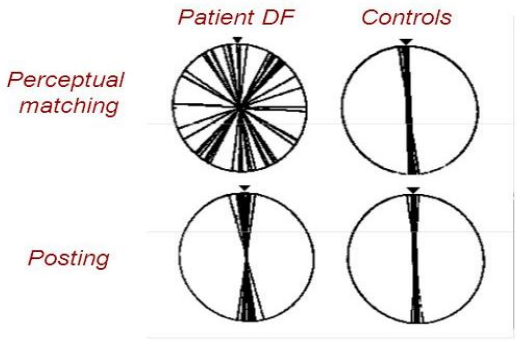
Visual Agnosia – large occipital cortex and a region in ventral stream



- DF has ventral damage
  - Profound agnosia :: can not even tell orientation of object
  - Motor control accurate :: motor system functions accurately.



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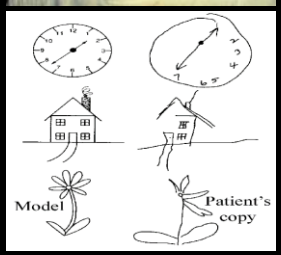
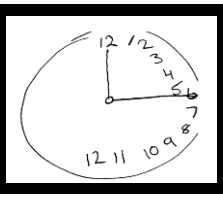
Visual Neglect





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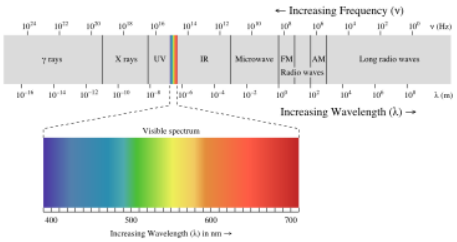
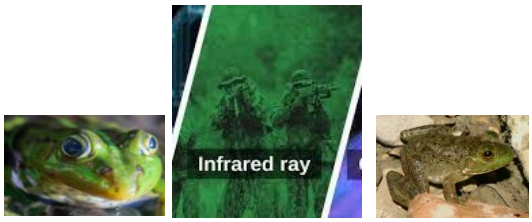
What about Colours?

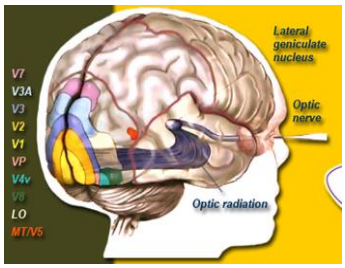
human vision (R+G+B), UV vision (bright = UV), tetrachromatcic: UV+R+G+B



Where the Sense of COLOR comes from?



https://www.youtube.com/watch?v=9CpEV9_JOv8



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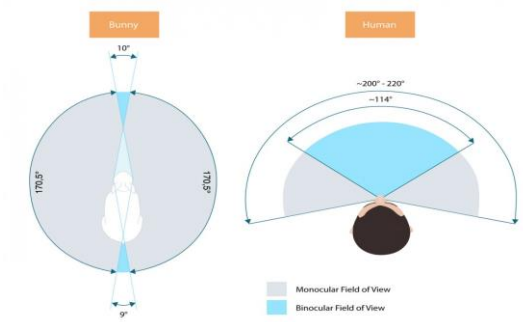

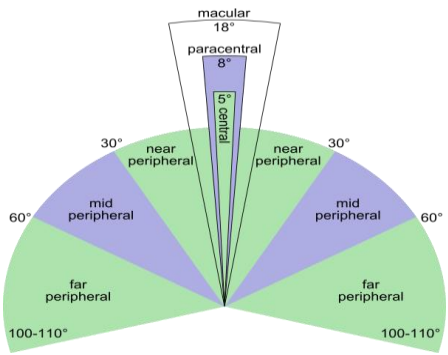

Upright to Upside down Reality !

24

How **Reality differs in absence / regain of modality ? – Mike May Story**

Mary's room Problem

Sensory Branding

1946-1966 1966-1996 1996-2008 2008-now

28

29

30

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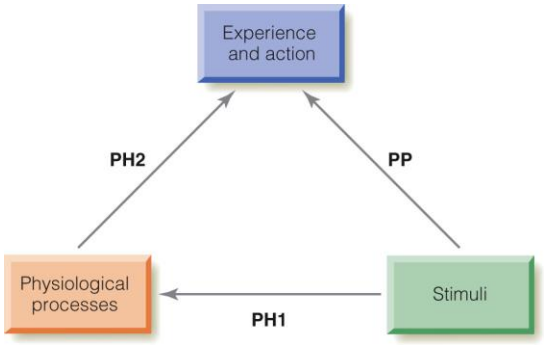
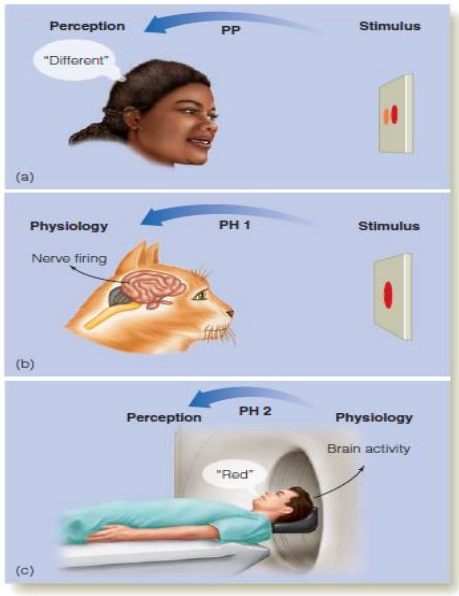
How do we study Perceptual Processes?

•**Self report**, looking at introspection method (Wilhelm Wundt and Edward Titchener) but then it is not reliable

• **Objective-subjective measure** of observers' sensitivity to a given stimulus with respect to its varying strength – Psychophysics (Gustav Fechner , mid 1800)





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Measuring Perception

- **Recognition** – categorizing, naming
- **Detection** - methods of limits / adjustment etc.
- **Perceiving Magnitude** – awareness of size/ intensity
- **Searching** - looking for target amidst other irrelevant stimuli

Difference threshold: the smallest difference between two stimuli that can be detected half the time, a/k **just noticeable difference – Weber's Law**

- The stronger the initial stimulus is , the larger the difference is required to be noticed

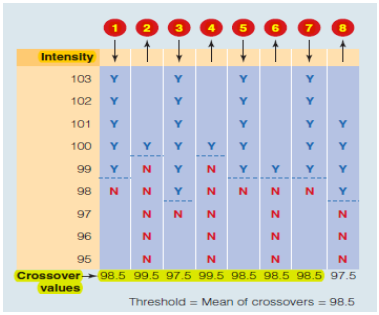
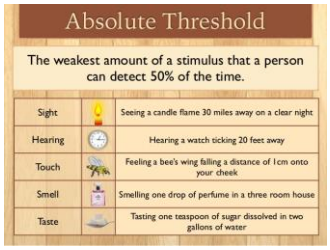
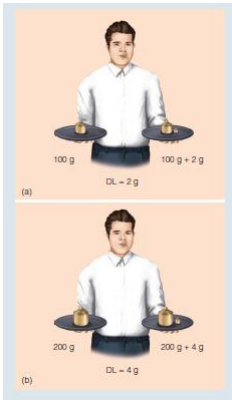


Figure 1.12 The results of an experiment to determine the threshold using the method of limits. The dashed lines indicate the crossover point for each sequence of stimuli. The threshold—the average of the crossover values—is 98.5 in this experiment.



Methods of Limits (Absolute threshold)



Difference Threshold

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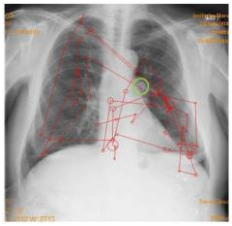
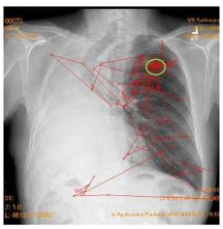
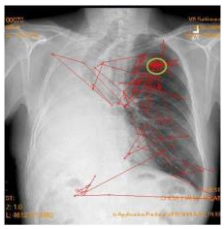
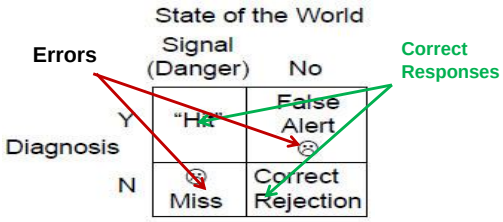
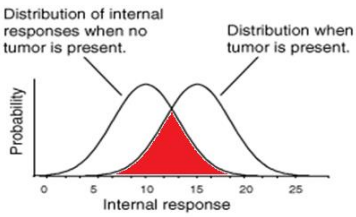
Signal Detection Theory – Perceptual Sensitivity

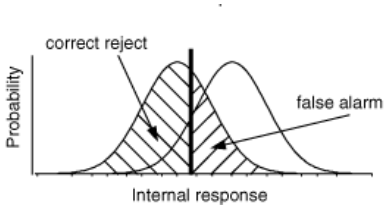


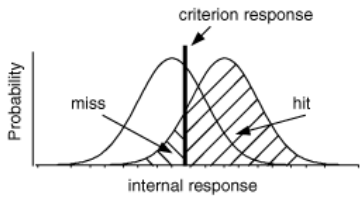












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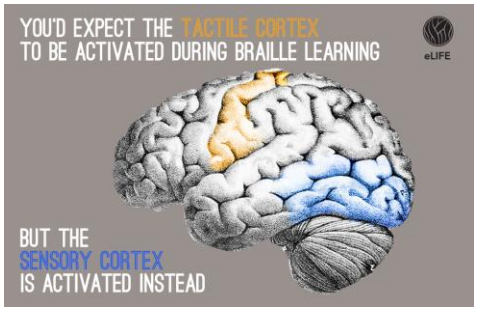
Sensory Cross Talk: Sensory system stick to one sense – or Do they?



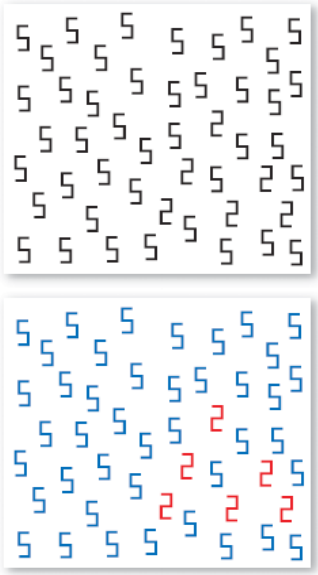
Visually impaired visual cortex

https://www.youtube.com/watch?v=G-IN8vWm3m0

McGurk Effect

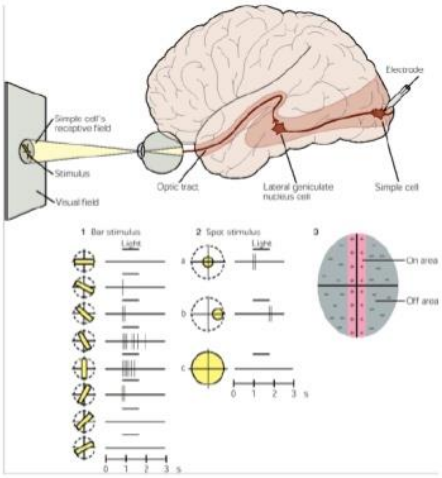
https://www.youtube.com/watch?v=sxwn1w7MJvk

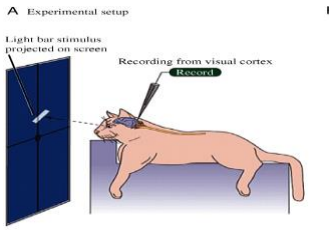
Rubber hand Illusion



Synaesthesia: grapheme-color syn.

Simple Cells

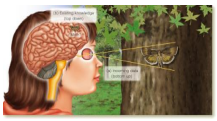




Hubel & Wiesel, 1959, 1962, 1965,1968

https://www.youtube.com/watch?v=4nwpU7GFYe8

Top-down and bottom-up processing



What's in this picture?

What am I seeing?

Bottom-up processing: taking sensory information and then assembling and integrating it

Top-down processing: using models, ideas, and expectations to interpret sensory information

Is that something I've seen before?

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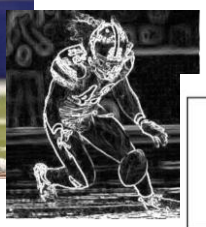
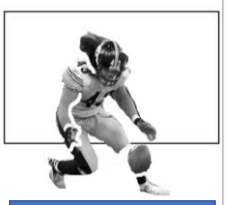
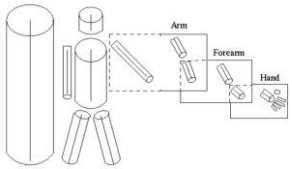
Three levels of description *(David Marr, 1982)*



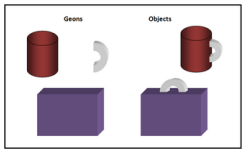
Stage 1- Primal Sketch



Stage 2 and 3- complete primal sketch + 2 ½ D sketch



Stage 4 – view independent sketch



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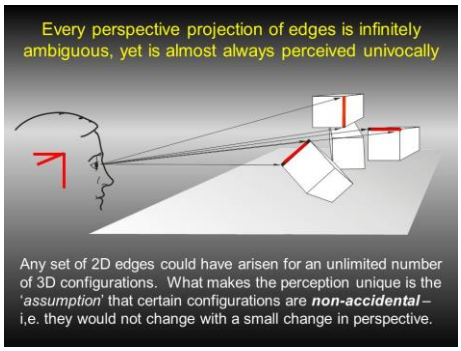
Modular *vs.* Distributed views of perception



Perceptual Constancy

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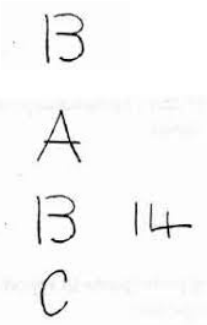
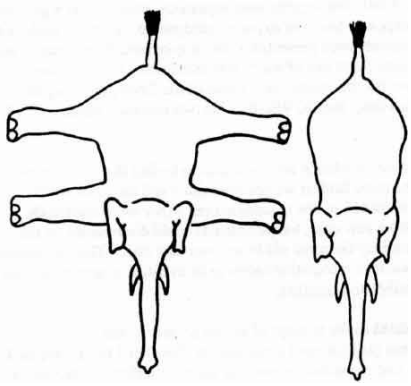
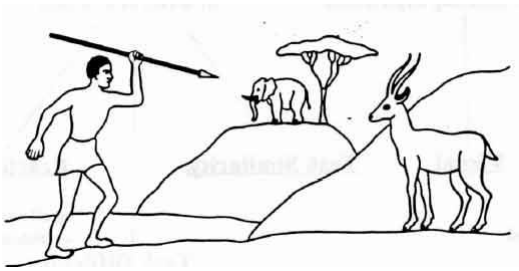
Perceptual Set







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A Sunday Afternoon on the Island of La Grande Jatte, George Seurat a French Impressionist

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Closure

https://www.youtube.com/watch?v=ummScwWcroI – Figure Ground Segregation

https://www.youtube.com/watch?v=Up5Fm4xLr8M – Common Fate

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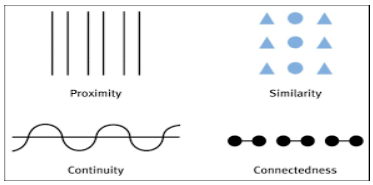
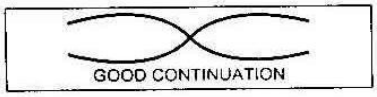
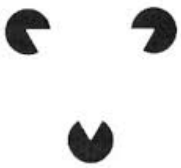
Gestalt Psychology – "Pregnanz" – simple , totality, whole percept

Principles and Segregation







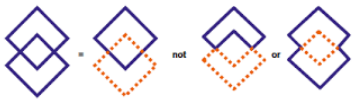


FIGURE 2.13
Symmetry: The human visual system tries to resolve complex scenes into combinations of simple, symmetrical shapes.

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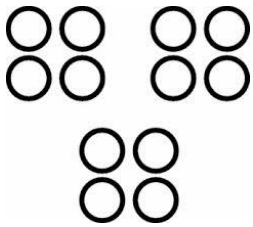
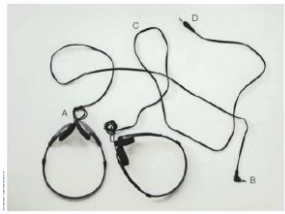
Gestalt Principles

Proximity



Continuation



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closure

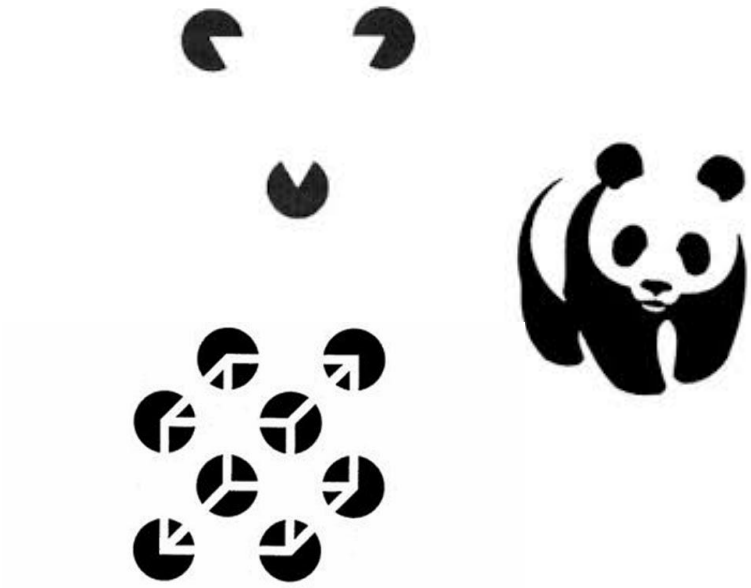

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Figure Ground Segregation

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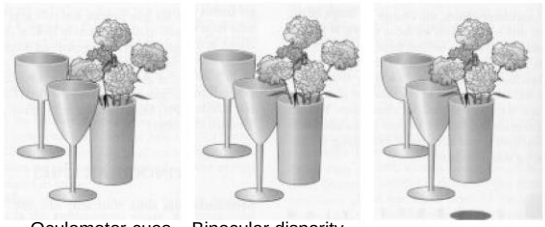


Oculomotor cues – Binocular disparity

Texture Gradient- Monocular

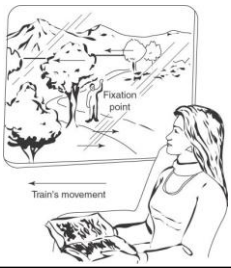
Occlusion

Atmospheric

Linear Perspective

Monocular – Relative cues

Motion Parallax



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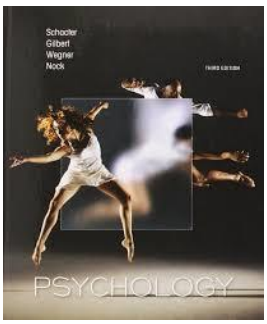

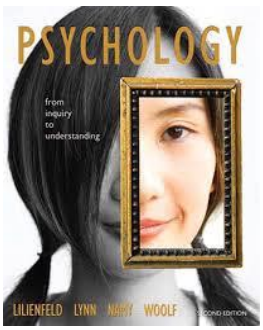

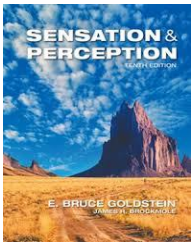

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