

Perception

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Perceiving the World

Sensation: Stimulus input
activates sensory receptors

Perception: Interpretation
of sensory input in the brain

Bottom-up processing: sensory information from receptors
about the object & context

Top-down processing: input from knowledge & expectations

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Bottom-Up Processing

Neural coding of sensory input

Detection of features

Lines

Edges & Contours

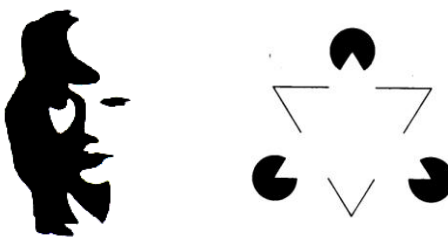
Color

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Detection of Edges and Contours

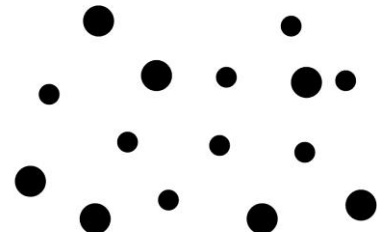
Figure-Ground Resolution



Detection of Edges and Contours

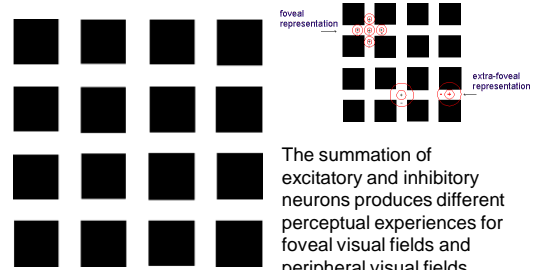
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Stimuli that demonstrate effects of neural mechanisms of perception



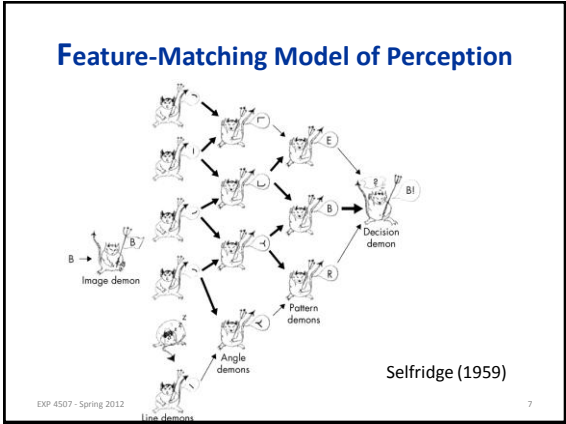
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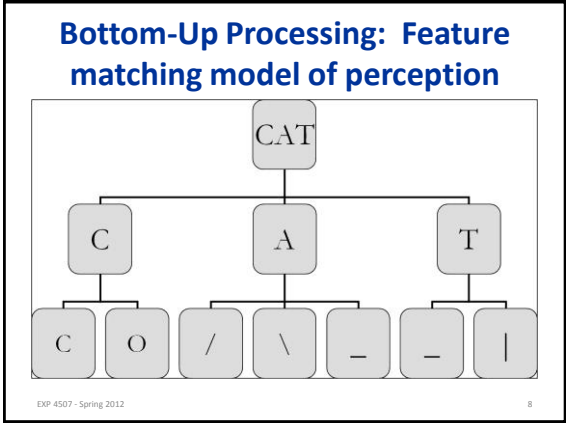
Why do we see spots that don't exist? (Hermann Grid)

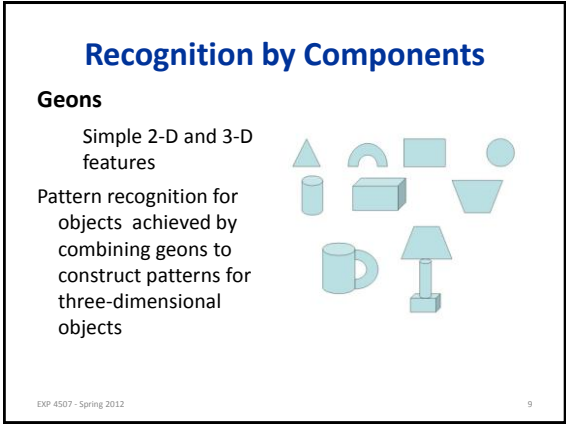


The summation of excitatory and inhibitory neurons produces different perceptual experiences for foveal visual fields and peripheral visual fields

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Shortfalls of Pure Bottom-Up Processing

Feature combination models have difficulties with frequent stimuli that we routinely recognize correctly:

Ambiguous stimuli

Stimuli that should be identified and perceived as the same pattern but vary in appearance

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Ambiguous Stimuli

Spring 2010

JDM - Course Overview

Variations in Stimuli



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Speech Perception: Speech Signal is Complex & Ambiguous

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Perception of Speech

Demonstration of Diana Deutsch's speech perception stimuli

http://philomel.com/phantom_words/example_phantom_words.php

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Unconscious Inference (Helmholtz)

Precursor to the concept of top-down processing

Prior knowledge and assumptions about the environment create biases to perceive the world in specific ways

Likelihood principle: we tend to interpret perceptions in terms of the *most likely* causes for these perceptions

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Gestalt Principles

Law of Pragnanz

We perceive the world in the way that most simply organizes the parts of the visual array.

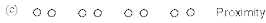
Systematic and simple ways in which arrays can be organized:

- Good continuation, Smoothness**
- Similarity, Proximity, Closure, Symmetry**
- Law of familiarity (prior experience)**
- Common fate**

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Examples of Gestalt Principles



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Good Figure / Simplicity (Pragnanz)

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Good Figure / Simplicity (Pragnanz)



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Organizing Principles: Physical Regularities

Oblique effect
Environment is dominated by
horizontal and vertical lines
We perceive these more
readily/accurately than
other orientations

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Light from above heuristic

Images from Goldstein text

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Common Fate

Organizing Principles: Semantic Regularities

Scene perception
Speed of perception of expected and non-expected objects in a scene

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Effects of Experience

Perceptual learning
Plasticity of sensory encoding areas based on early experiences

- Blakemore & Cooper (1970) – modified organization of visual cortex in kittens
- Gauthier et al. (1999) – fMRI studies of activation in fusiform face area (FFA) before and after training in recognition of Greebles

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Effects of Experience

Perceptual learning

Tuning speech perception to accented speech
Development of expertise in perception and categorization of fingerprints

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Perception and Action

Movements and goal-directed actions can enhance perception of stimuli relevant to these actions

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