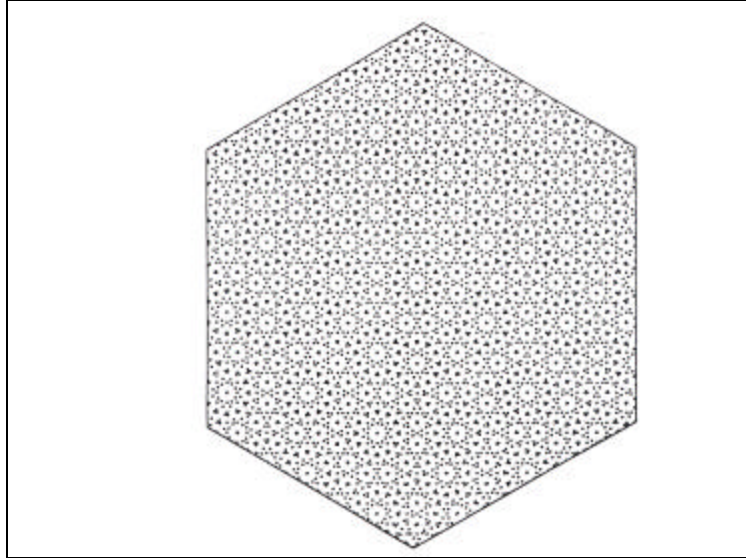


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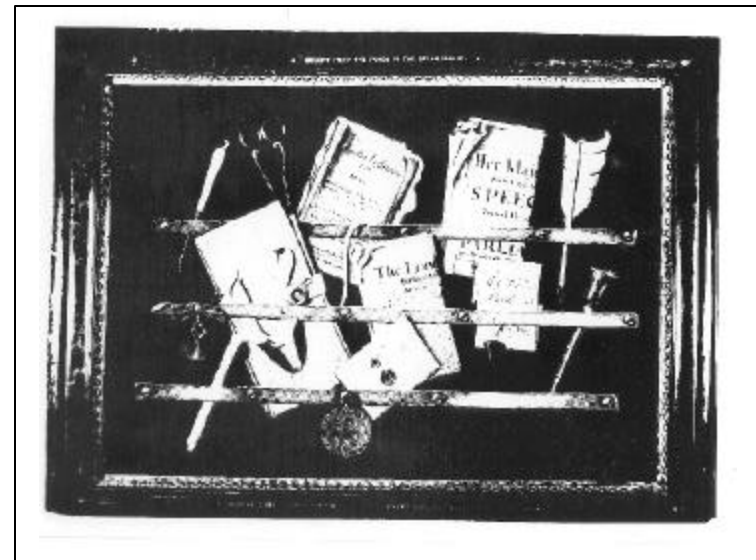
Week 5, Lecture 2: Visual and Auditory Scene Analysis



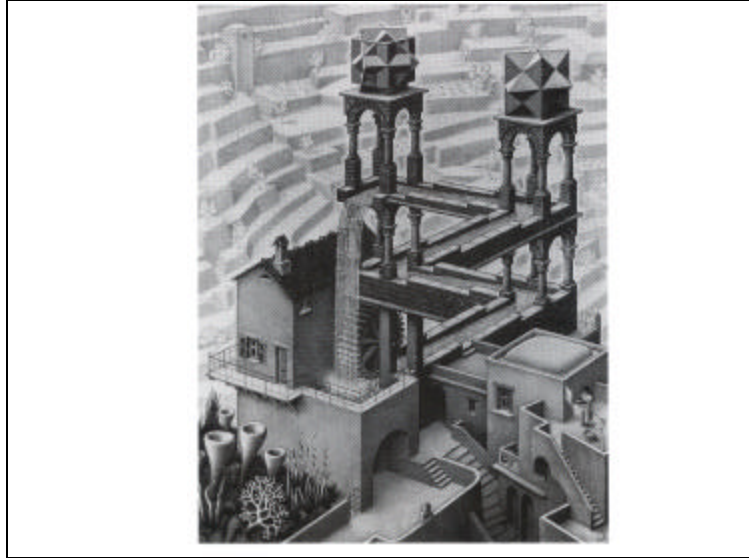
Perception II: Scene Analysis

Scene Analysis

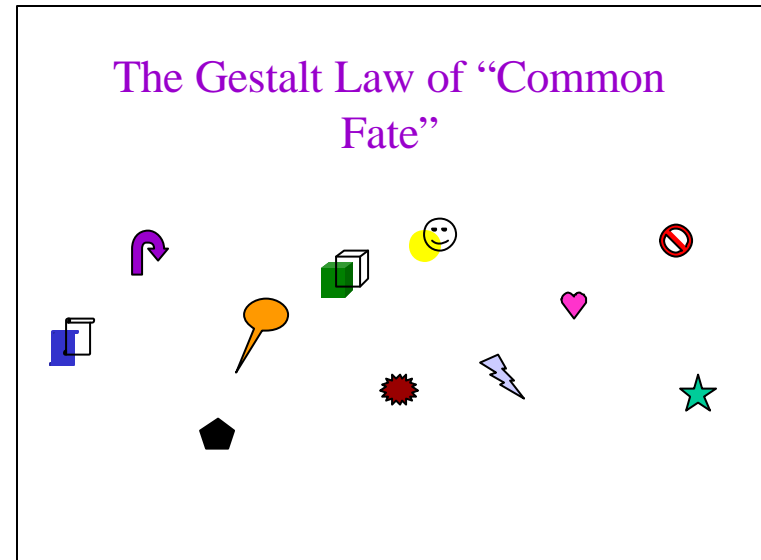
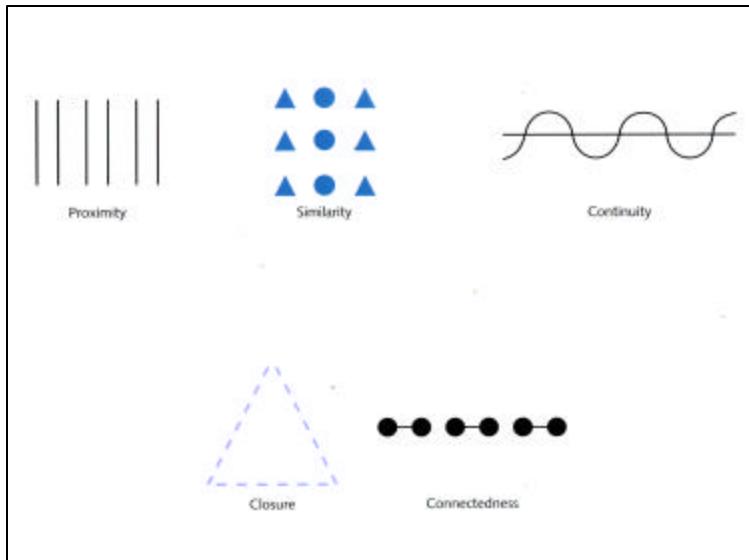
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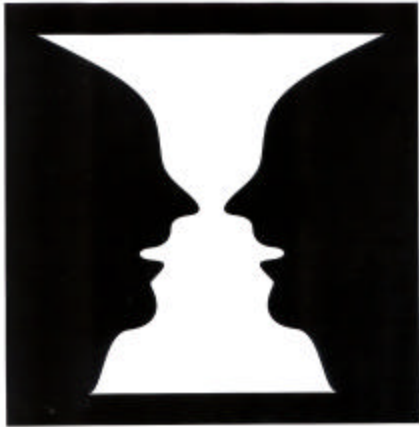


The Gestalt Laws of Grouping

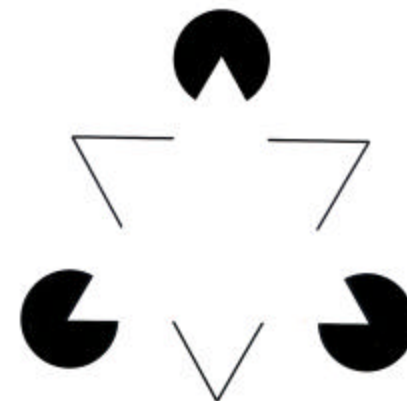


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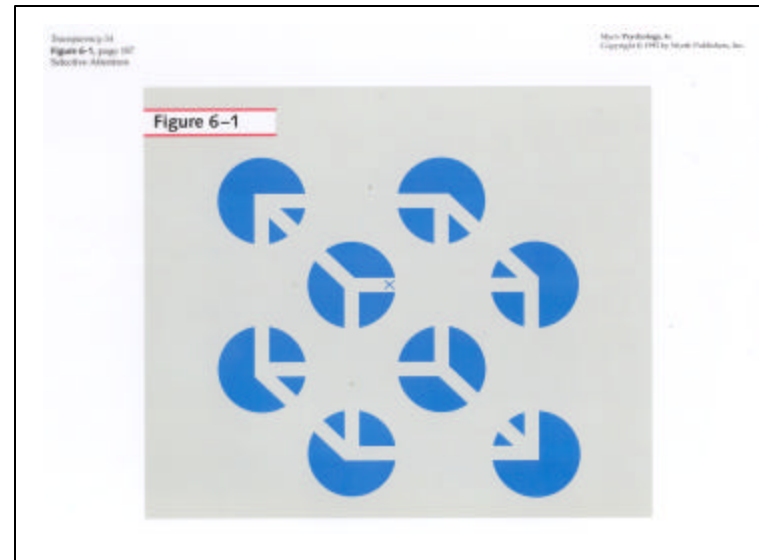
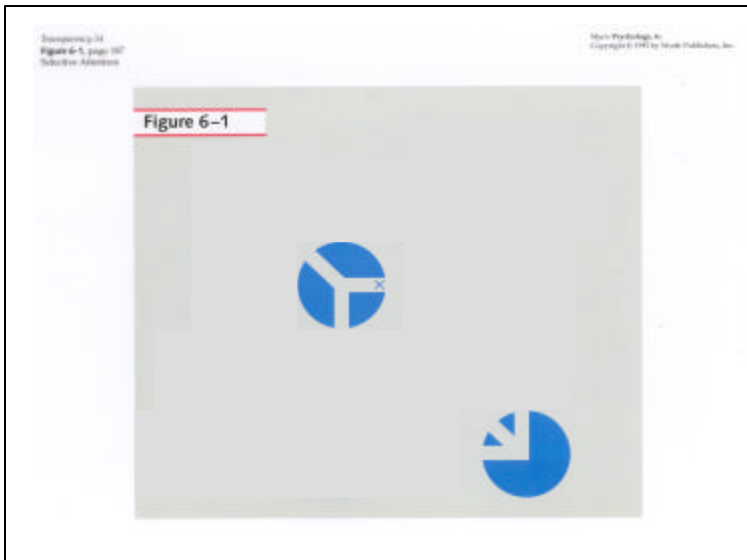
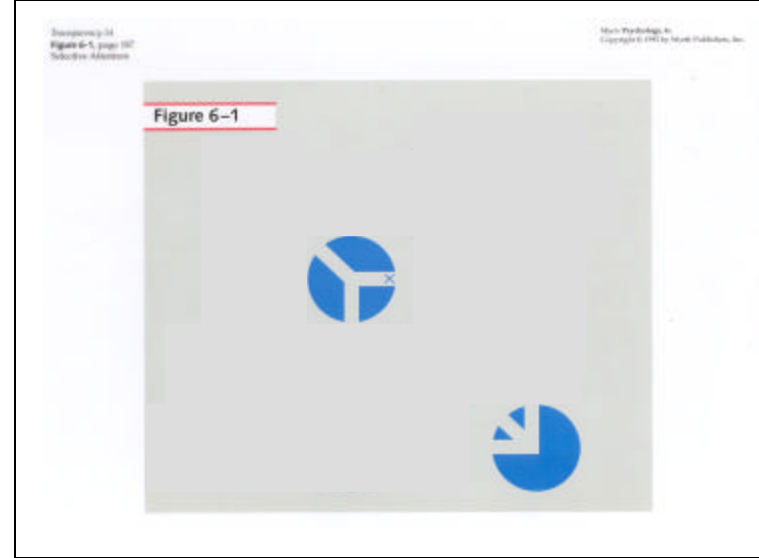
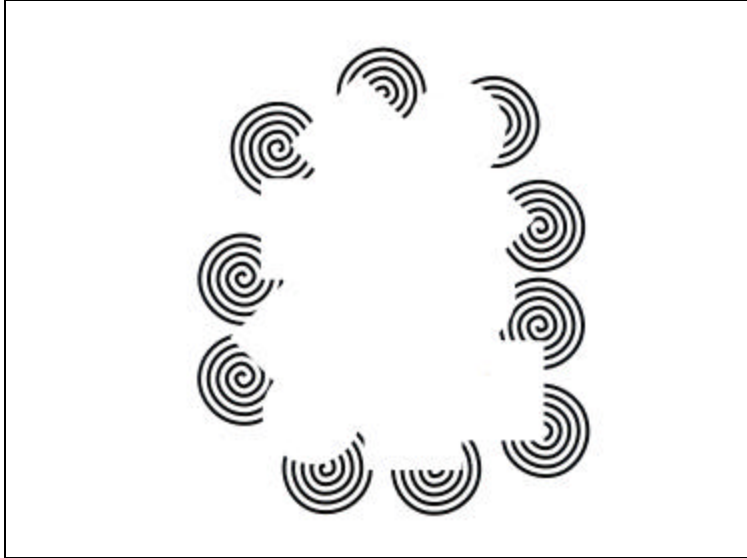
Figure-Ground Segregation



Illusory Contours

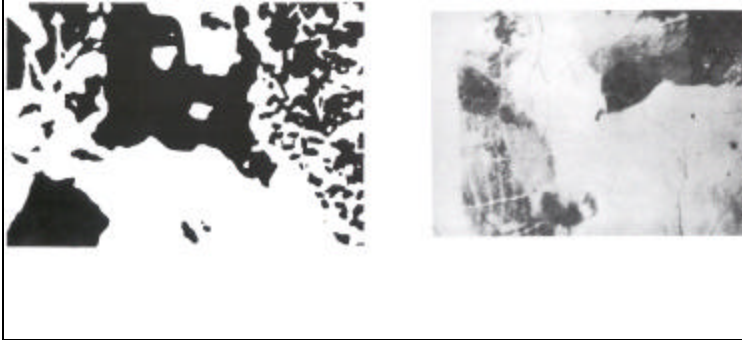


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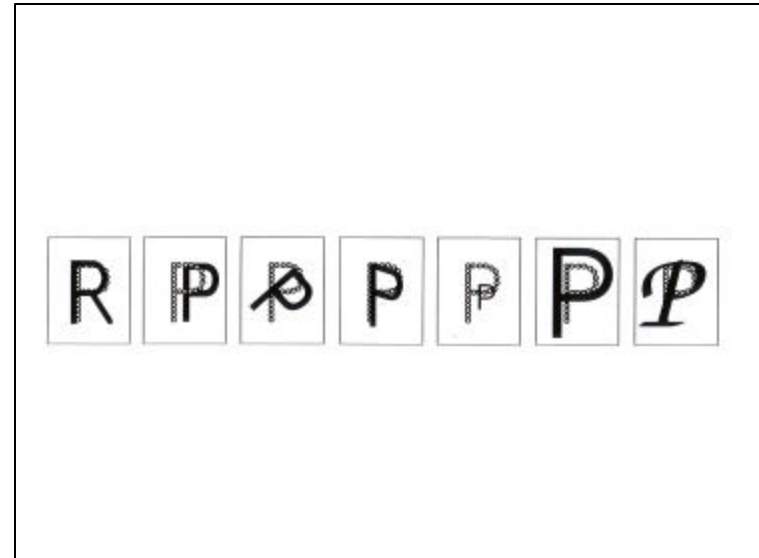
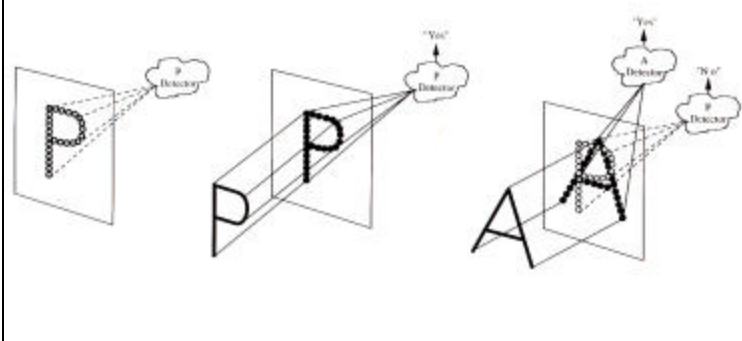


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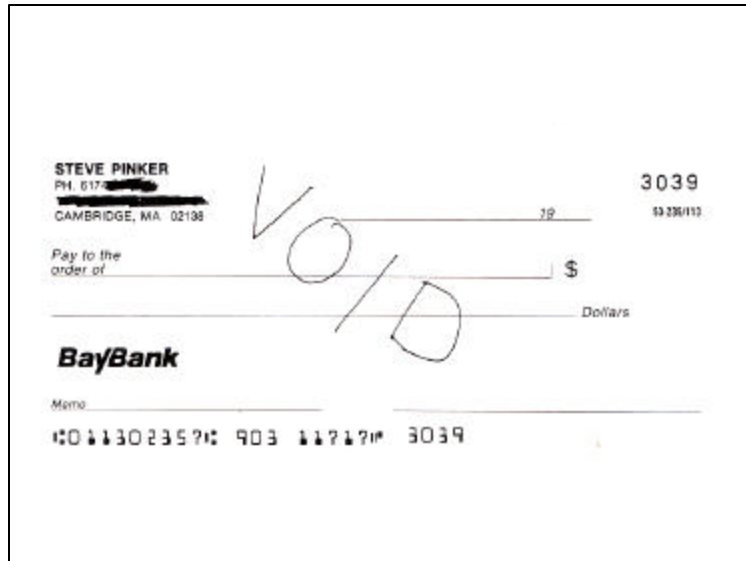
Top-Down Influences on Scene Analysis



The Problem of Shape Recognition

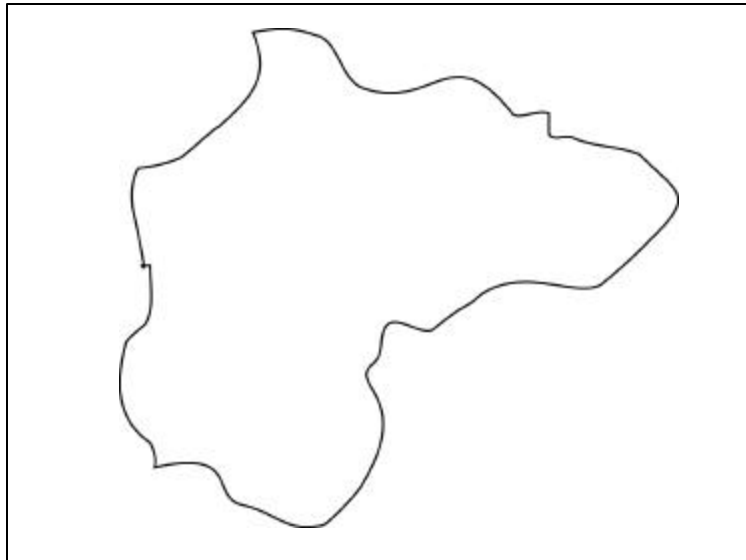


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Three Better Theories of Shape Recognition

1. Multiple templates
2. Mental transformations (imagery)
3. Object-centered reference frames (geons)



Visual Frames of Reference (Coordinate Systems)

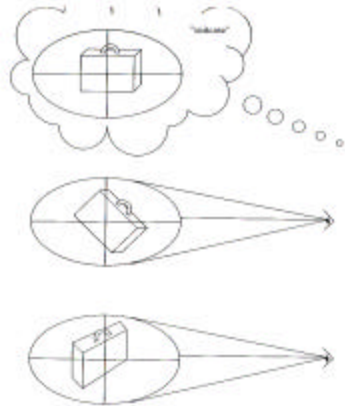
- Viewer-centered frame: X aligned with retinal left-right axis; Y aligned with retinal up-down axis; Z aligned with line of sight
- Object-centered frame: X aligned with an axis of the *object*: elongation, symmetry, intrinsic front-back. Other axes at right angles to x.

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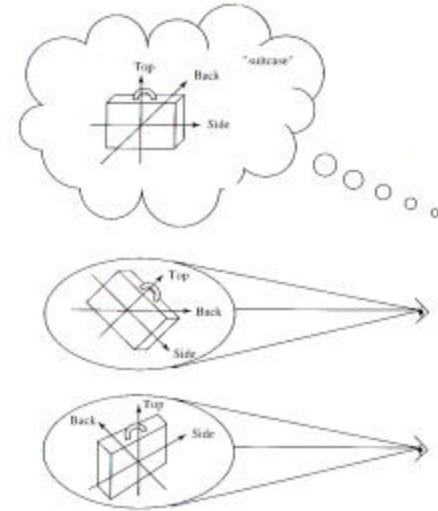
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The problem with using a viewer-centered reference frame:

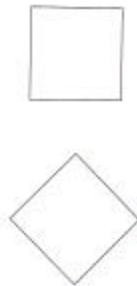


The advantage of using an object-centered reference frame:

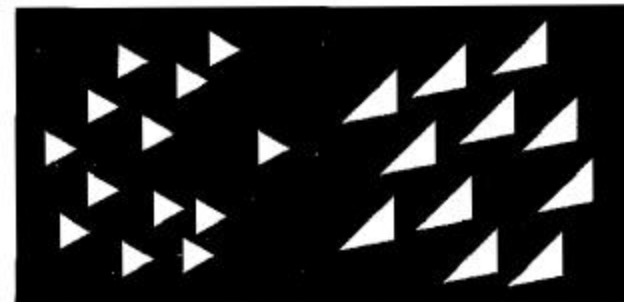


The Effects of Reference Frames on Shape Perception:

Effects of the Up-Down Axis:



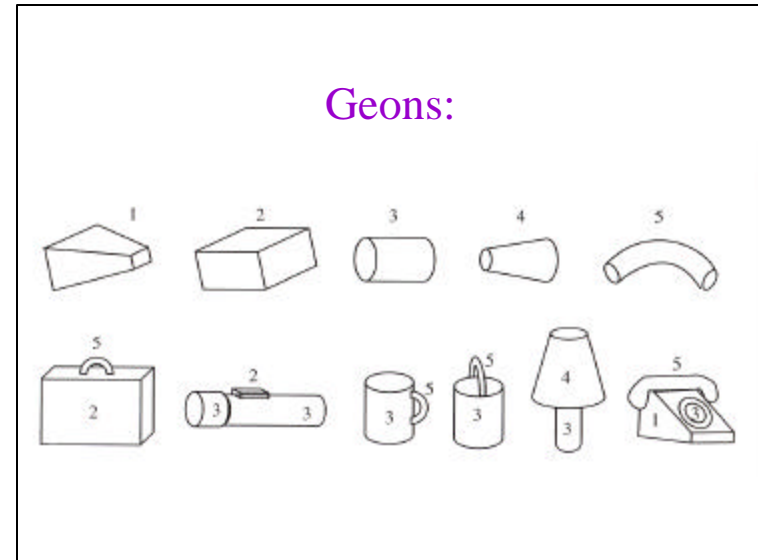
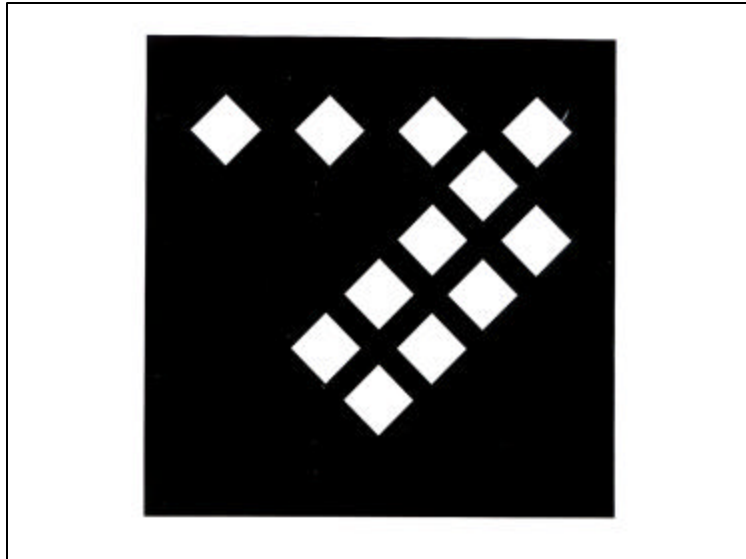
Sometimes the Brain aligns Reference Frames with Objects, not just the vertical axis:



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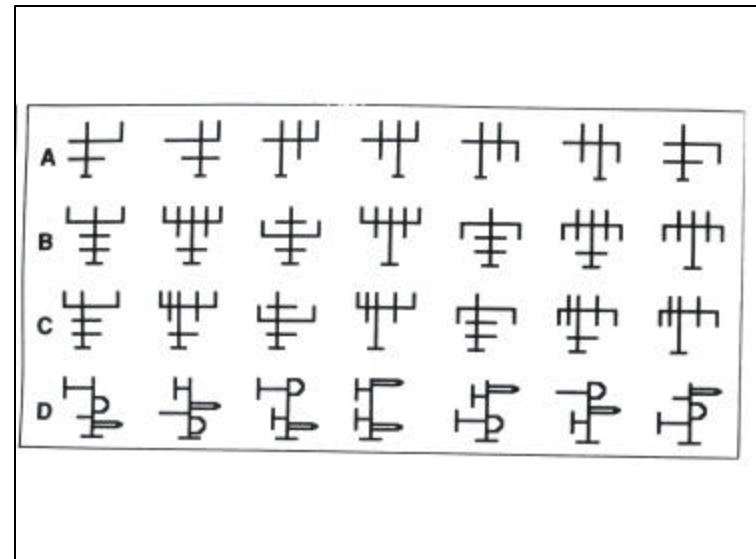
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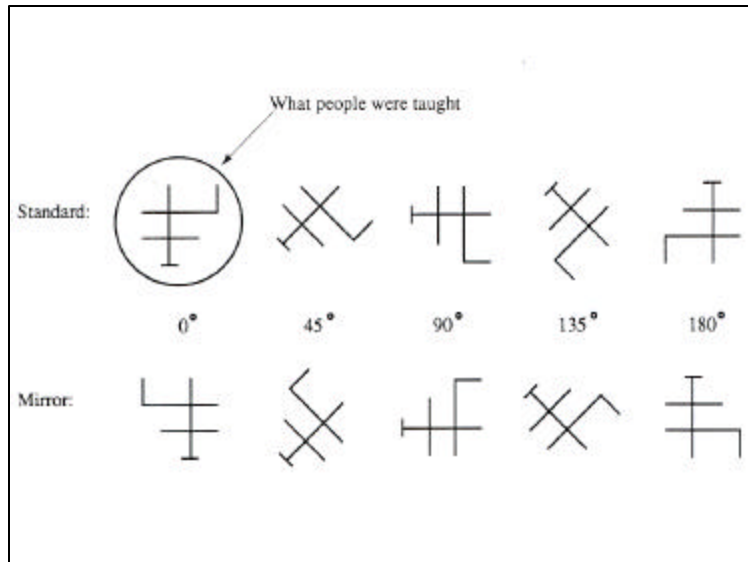


Testing the Three Theories (Tarr & Pinker, 1989, 1990)

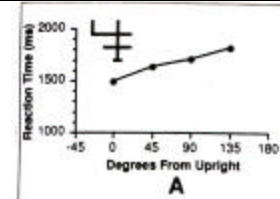
- If people use object-centered representations, they should recognize an object equally well at all orientations
- If people use mental rotation, they should take longer for objects that are more tilted
- If people use multiple templates, they should take longer for orientations they haven't seen before



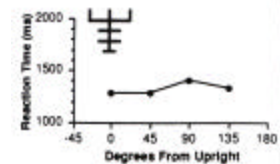
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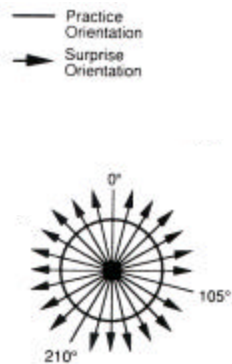
Asymmetrical objects are mentally rotated:



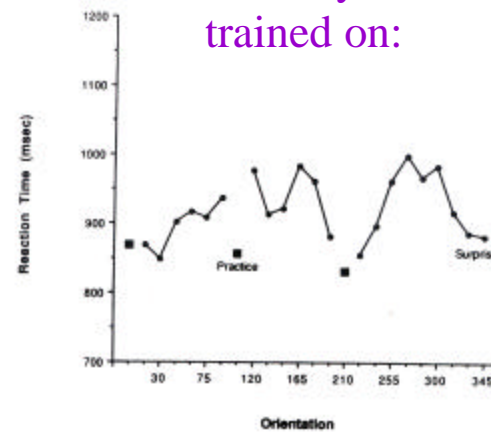
Symmetrical objects are matched in an object-centered reference frame:



Train at some orientations, test at others:



People are faster with orientations they have been trained on:



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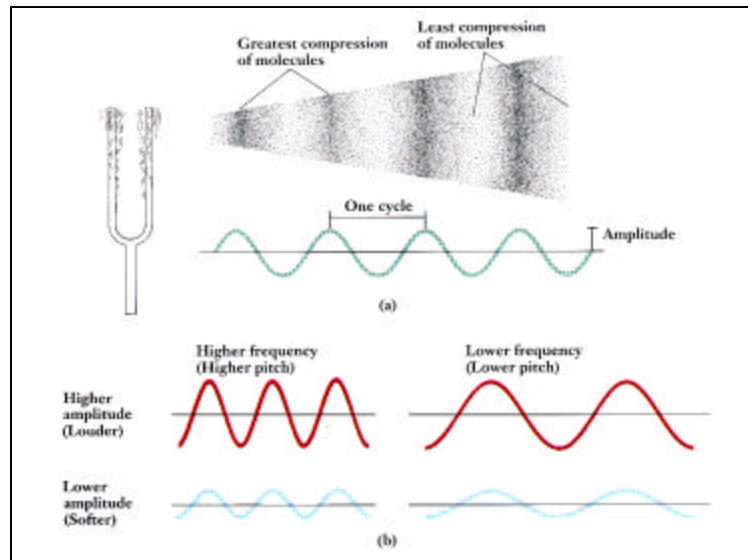
Week 5, Lecture 2: Visual and Auditory Scene Analysis

Visual and Auditory Scene Analysis

- **Visual scene analysis:**
 - World: 3-D Objects arranged in 3-D space
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Auditory Scene Analysis

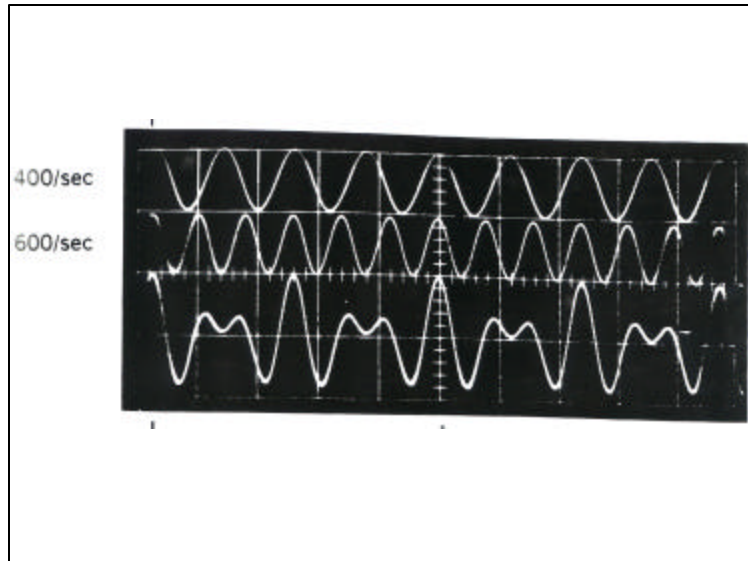
- World: Things making noise (sound sources) -- each produces a set of frequencies.



Auditory Scene Analysis

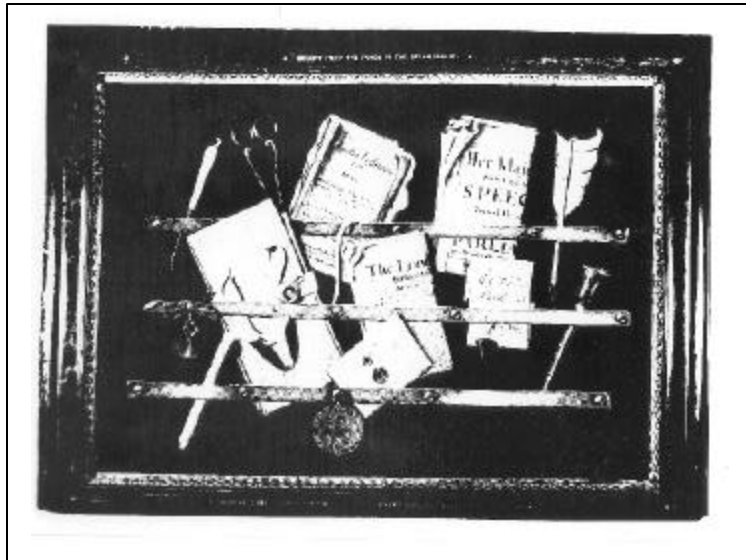
- World: Things making noise (sound sources) -- each produces a set of frequencies.
- **Wave superposition:** all frequencies shmooshed together in complex waveform.

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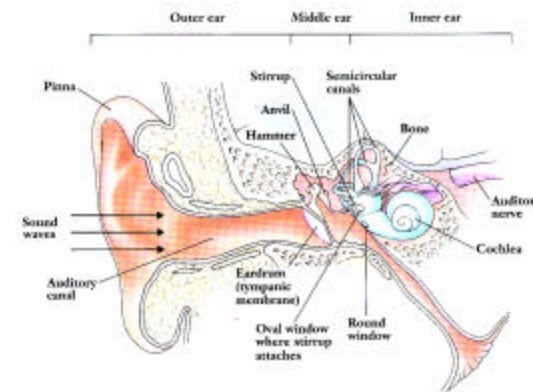
Auditory Scene Analysis:

- World: Things making noise (sound sources) -- each produces a set of frequencies.
- Wave superposition: all frequencies shmooshed together in complex waveform.
- Auditory perception: Recover the soundmakers (which frequencies belong together), arrangement.



Scene Analysis, continued

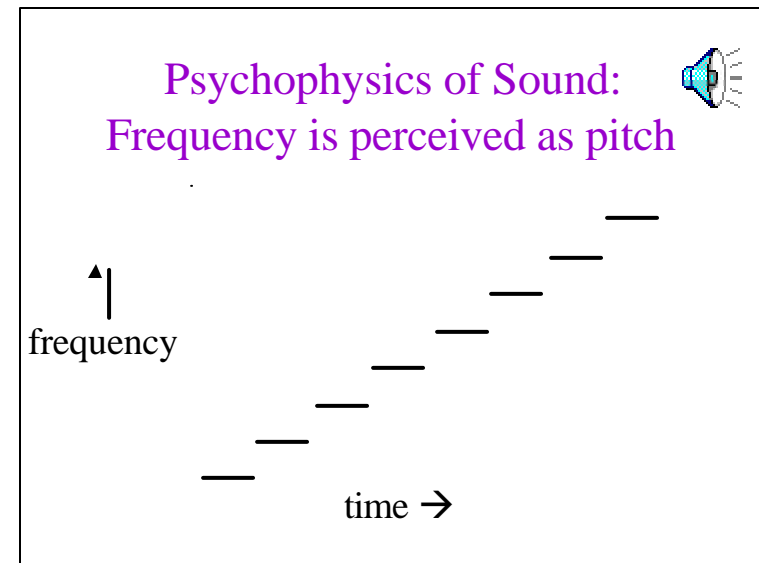
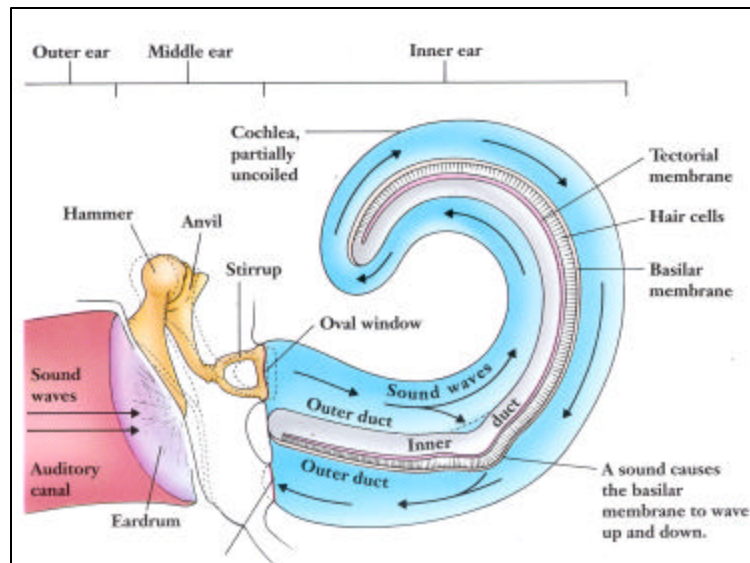
- Frequency analysis by the ear and brain.



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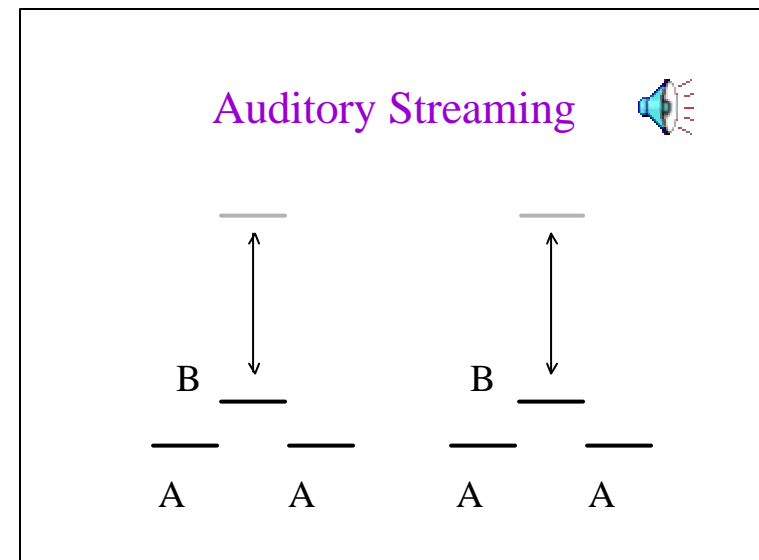
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How Auditory Scene analysis is similar to Visual Scene Analysis:

- Space in vision = frequency X time in audition.
- Object in vision = sound source (noisemaker) in audition.
- Gestalt laws of auditory organization: proximity, continuation, common fate (motion).



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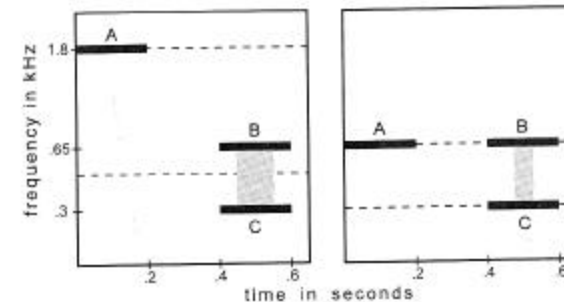
Week 5, Lecture 2: Visual and Auditory Scene Analysis

Gestalt laws reflect physical constraints:

- In vision, matter is cohesive and bounded: parts of an object stick and move together
- In audition, soundmakers have resonances and nonzero mass: they can't change pitch instantaneously

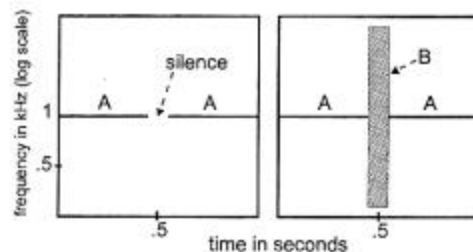
Simultaneous & Sequential Grouping

25 Capturing a tonal component out of a mixture: Part 1.



Gestalt Continuity in Audition

28 Apparent continuity.



Auditory Scene Analysis & Music

6 Segregation of high notes from low ones in a sonata by Telemann.



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7 Streaming in African xylophone music.

The diagram illustrates the concept of streaming in African xylophone music. It features two circular patterns of notes, labeled A and B, arranged in a circular sequence. Pattern A consists of the following sequence of notes: 1, 4, 5, 2, 3, 1, 4, 4, 1, 2, 2, 5, 2, 1, 2, 4, 4, 2, 3, 1. Pattern B consists of the following sequence of notes: 3, 4, 1, 1, 4, 4, 4, 2, 3, 1, 2, 3, 2, 2, 5, 4, 3, 2, 2, 3. Arrows indicate the direction of streaming for each pattern: a curved arrow above A points left, and a curved arrow above B points right. A straight arrow points from the center of A to the top note (4), and a straight arrow points from the center of B to the bottom note (5). Two speaker icons are positioned to the right of the patterns, one above the other.