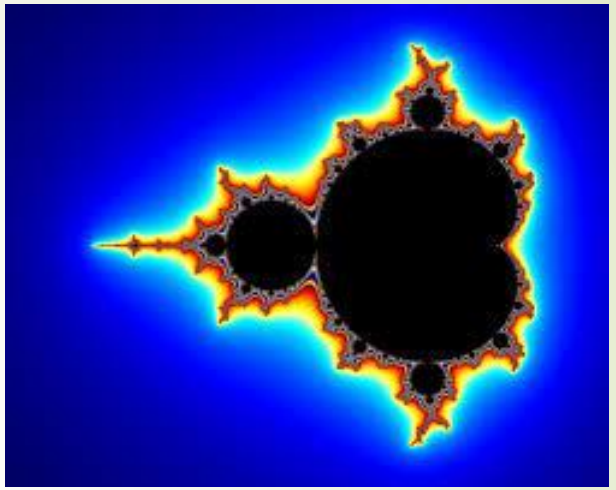
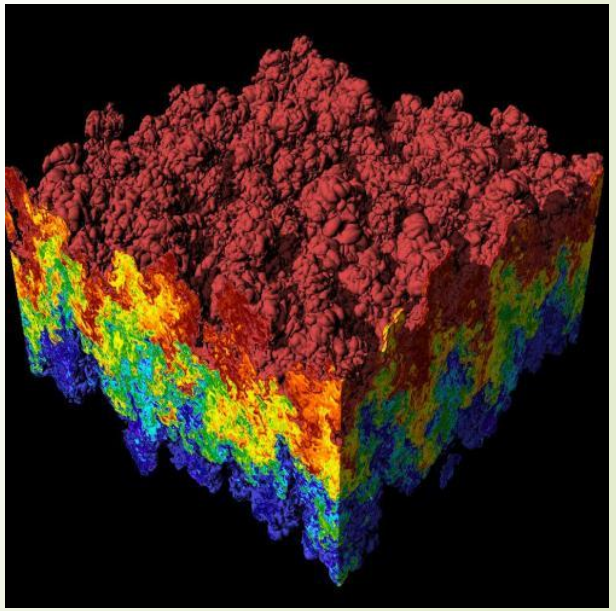
Data Visualization

Brait Õispuu

Types of Visualization

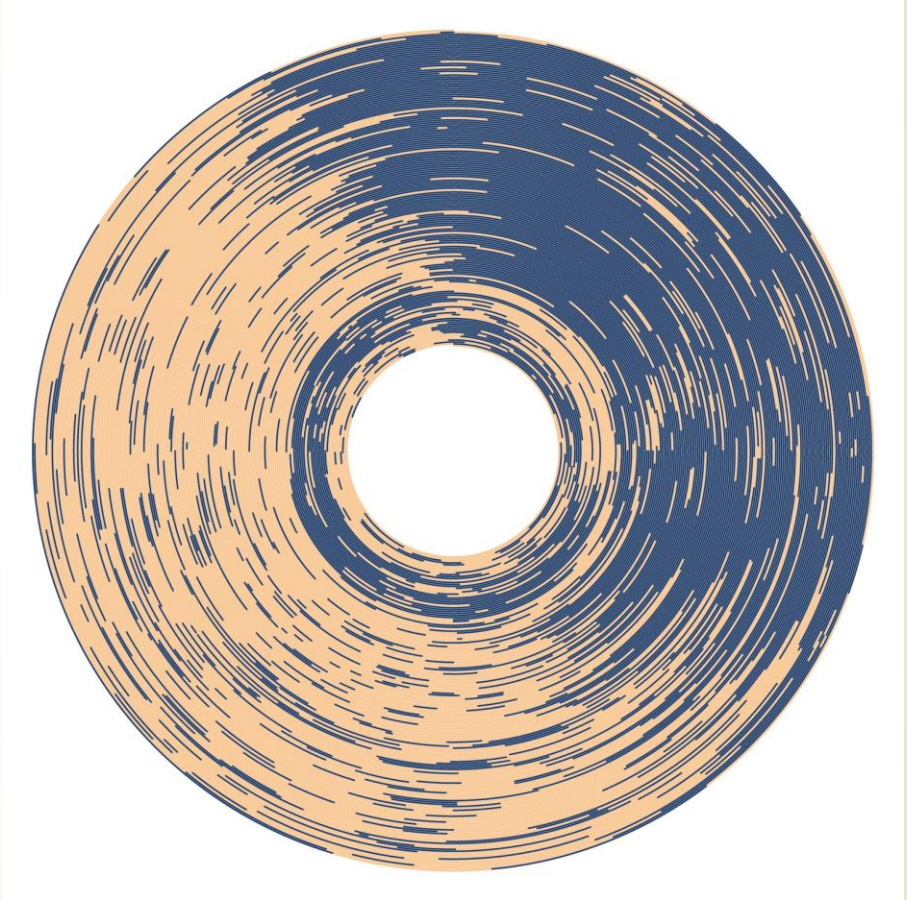
- Mathematical Visualization
  - y = x+1
  - Mandelbrot
- Scientific Visualization
  - Data acquired via lengthy simulations
  - Missing data must be handled





Types of Visualization (2)

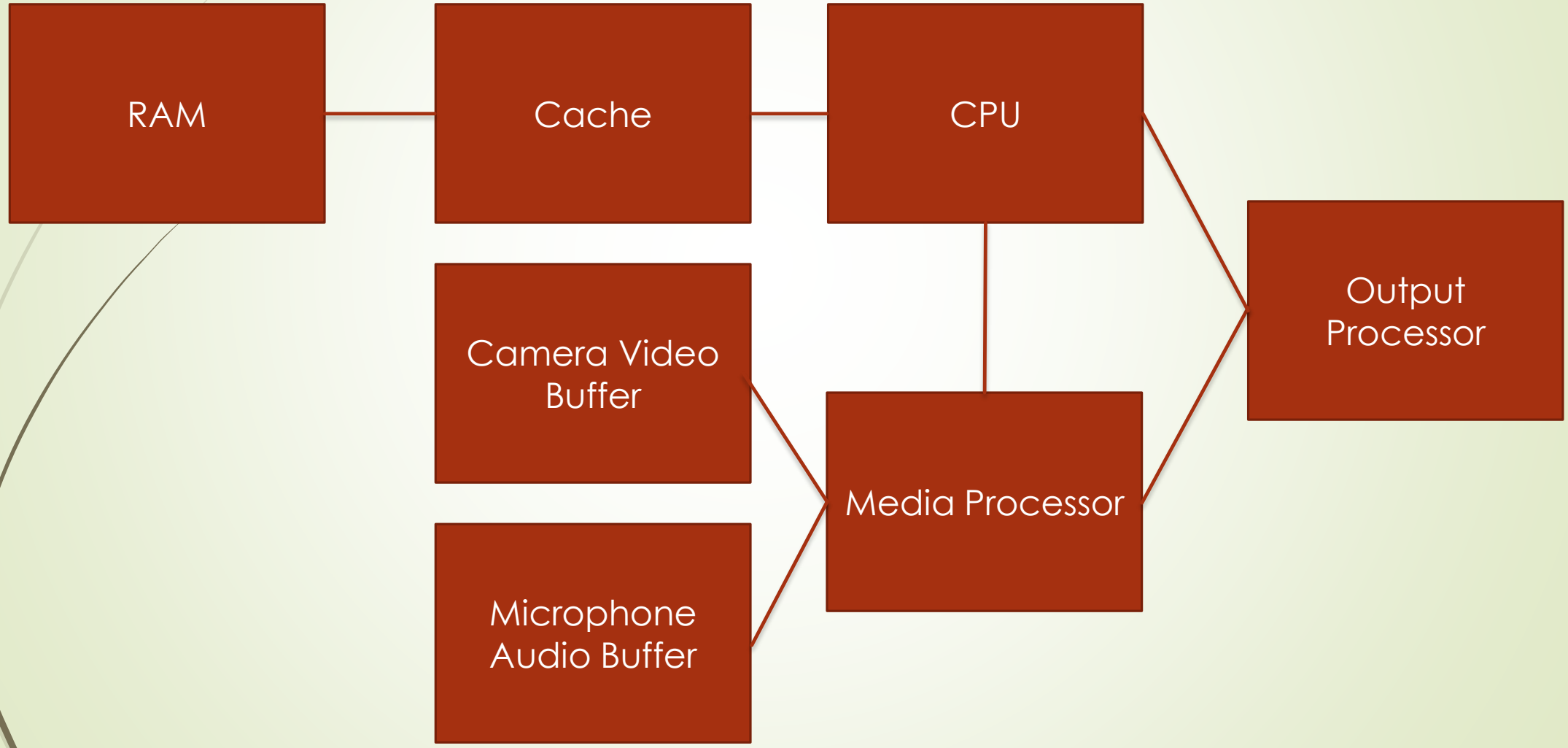
- Information Visualization
  - Abstract, non-coordinate data
  - Trying to provide a concrete form
  - andrew_elliot – 4 months of sleep
- Domain Specific Visualization
  - Medical Scans
  - Business Intelligence



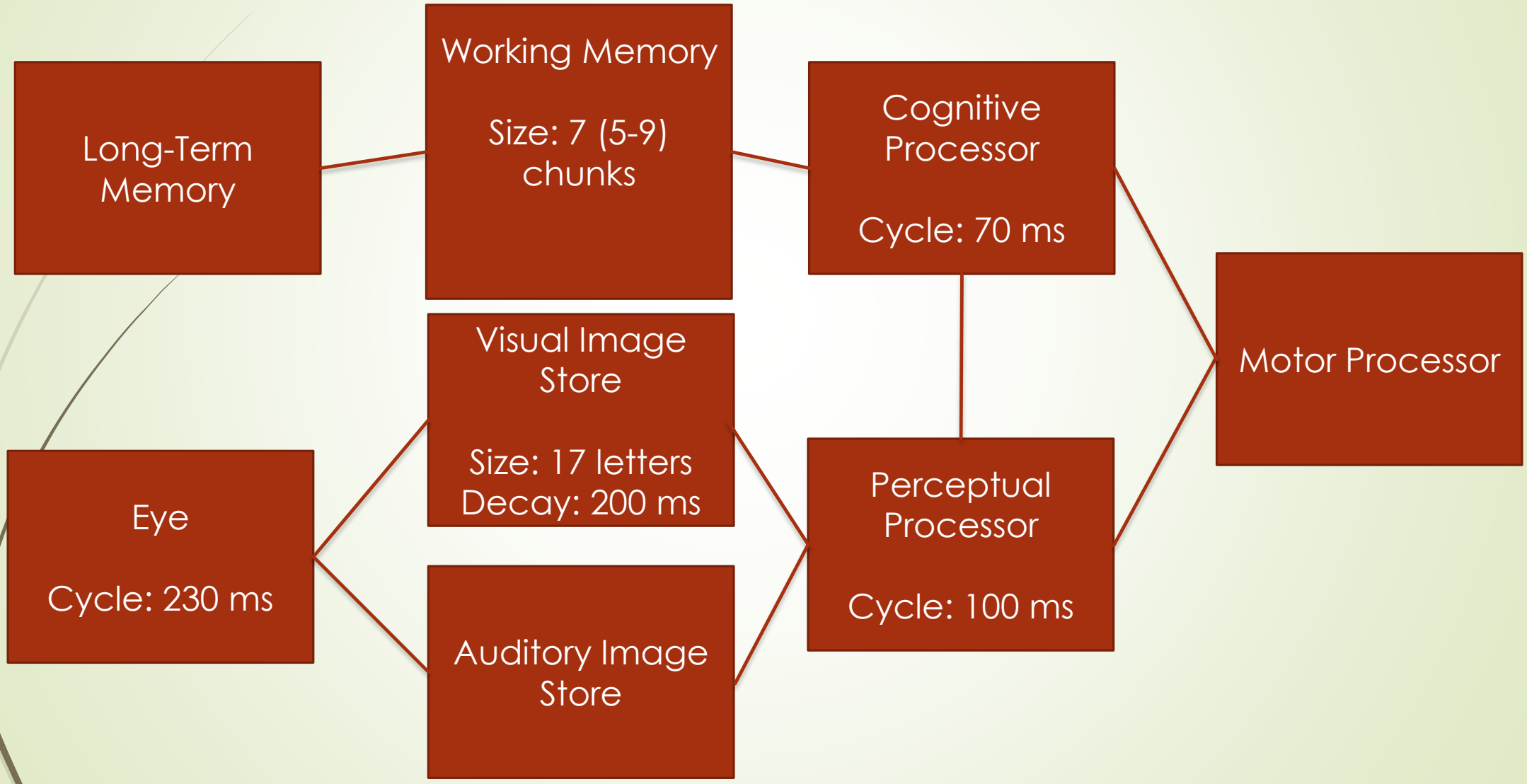
Modes of Visualization

- Interactive Visualization
  - Discovery
  - Single investigator or small groups
- Presentation Visualization
  - Communication
  - Large groups, mass audiences
  - No user input
- Interactive Storytelling
  - Presentations via interactive webpages

The Computer



The Human

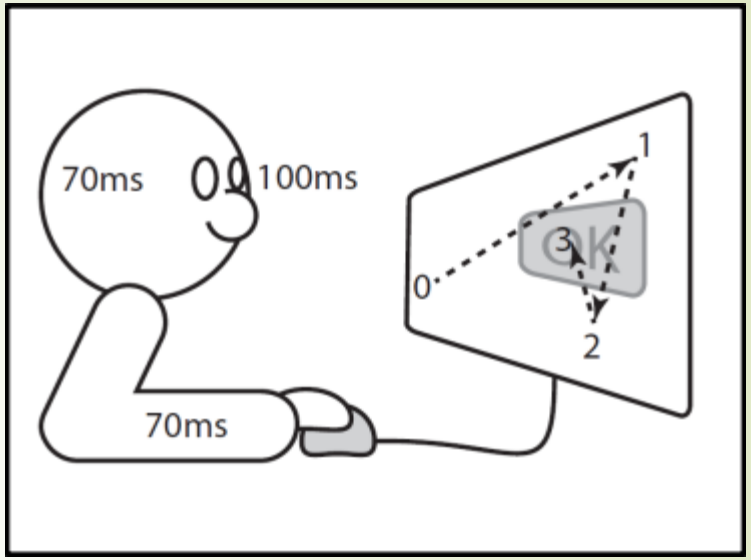

Long-Term Memory
Working Memory
Size: 7 (5-9) chunks
Cognitive Processor
Cycle: 70 ms
Motor Processor
Visual Image Store
Size: 17 letters
Decay: 200 ms
Eye
Cycle: 230 ms
Auditory Image Store
Perceptual Processor
Cycle: 100 ms

Reading

- We read in chunks
- We don't percieve it

- Aoccdrnig to rscheearch at Cmabrigde Uinervtisy, it deosn't mttaer in waht oredr the ltteers in a wrod are, the olny iprmoetnt tihng is taht the frist and lsat ltteer be at the rghit pclae. The rset can be a toatl mses and you can sitll raed it wouthit a porbelm. Tihs is bcuseae the huamn mnid deos not raed ervey lteter by istlef, but the wrod as a wlohe.

Hand-Eye Coordination



- The brain knows where the limbs are
- Fitt's Law
  - Larger movements are faster but less accurate than smaller ones
- It does not really matter whether you have large or small selectables.
  - 70 ms to move your hand
  - 100 ms to see the result
  - 70 ms to decide how to correct it

Memory

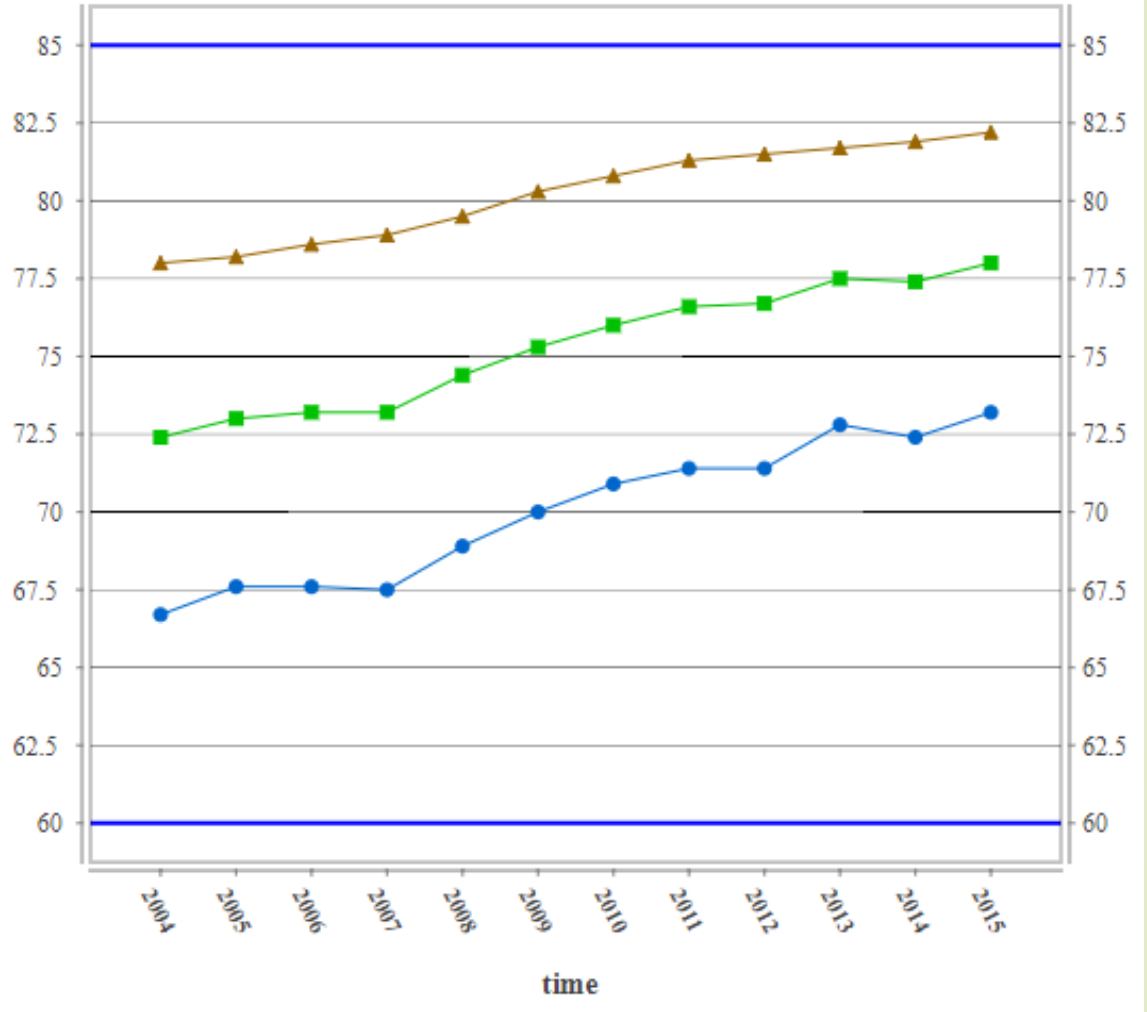
- Human DRAM
  - 70 ms access time
  - Holds about 7 things
  - Recency effect
  - Chunks and logical units

Forgetting

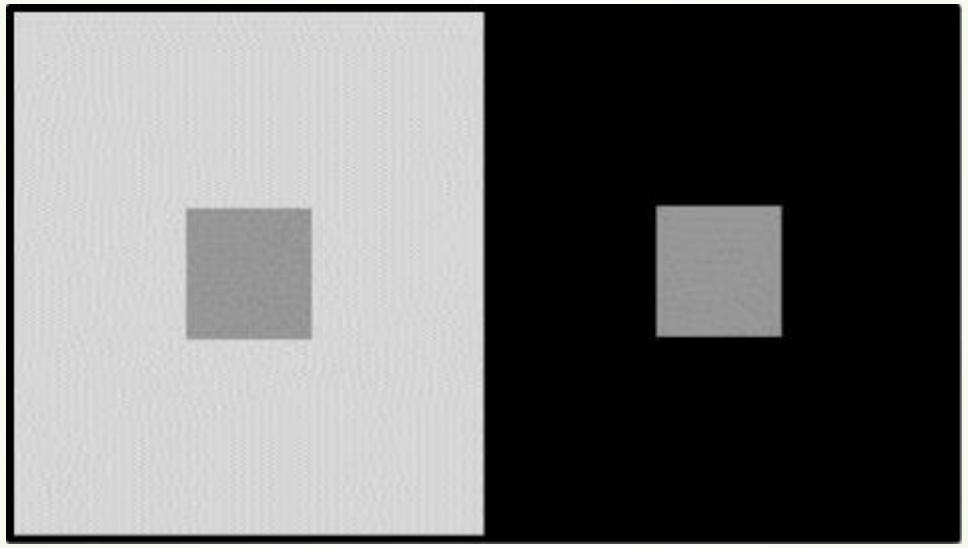
- Decay
  - Logarithmical – we forget most of the things early-on
  - Jost's Law – if two equally strong memories at a given time, then the older is more durable
- Interference
  - proactive inhibition – can't teach an old dog new tricks
  - retroactive interference – mind blown
  - emotion - good old days, forget the mundane

Reasoning

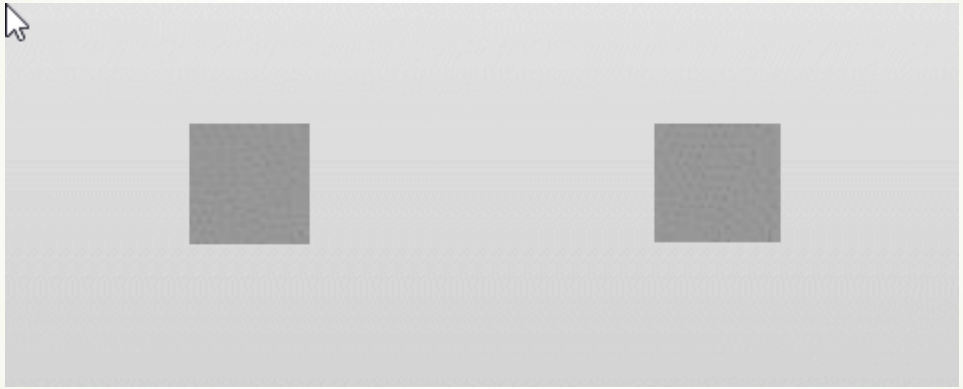
- Deductive Reasoning
  - Drawing a conclusion based on data
- Inductive Reasoning
  - Generalizing
- Abductive Reasoning
  - Modeling
  - Asking why?
- All of the above can be applied correctly and incorrectly



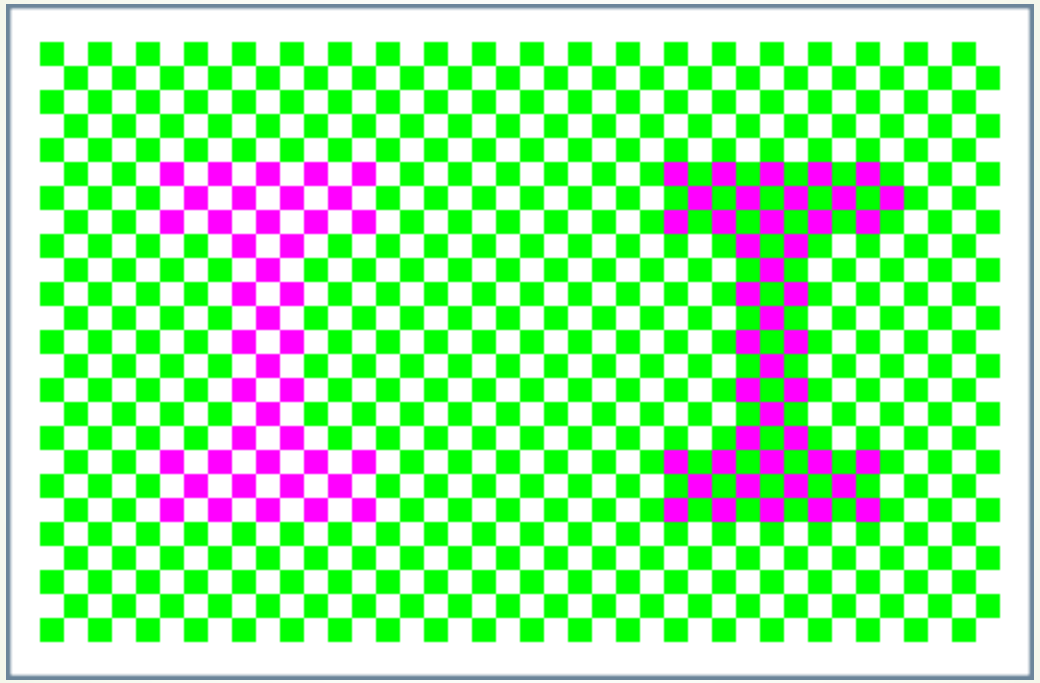
Perception



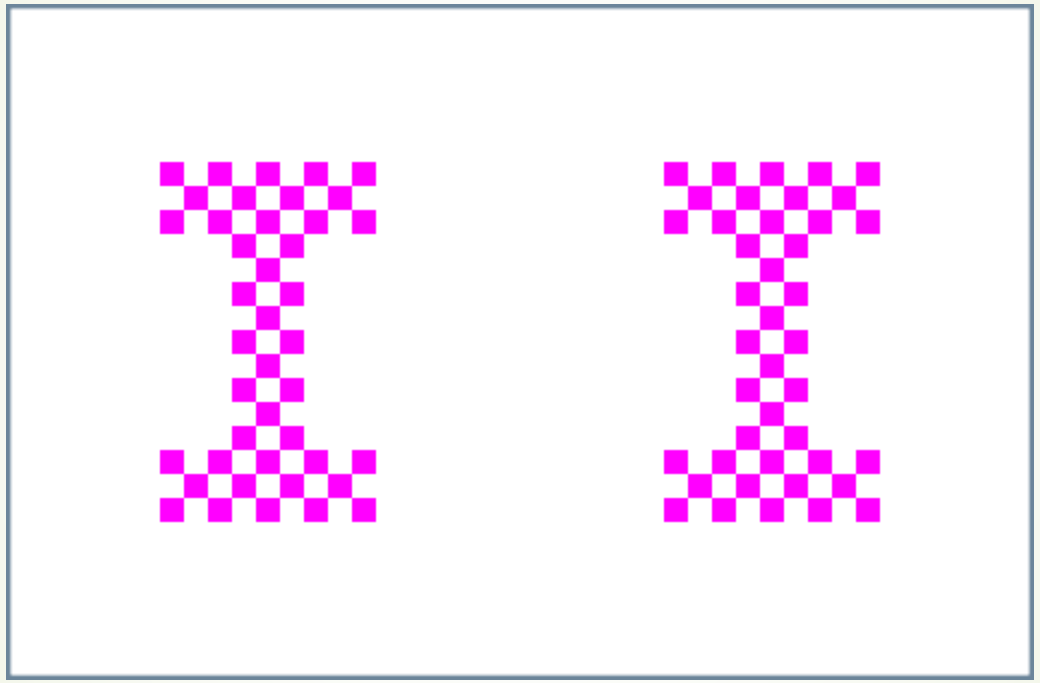
Perception



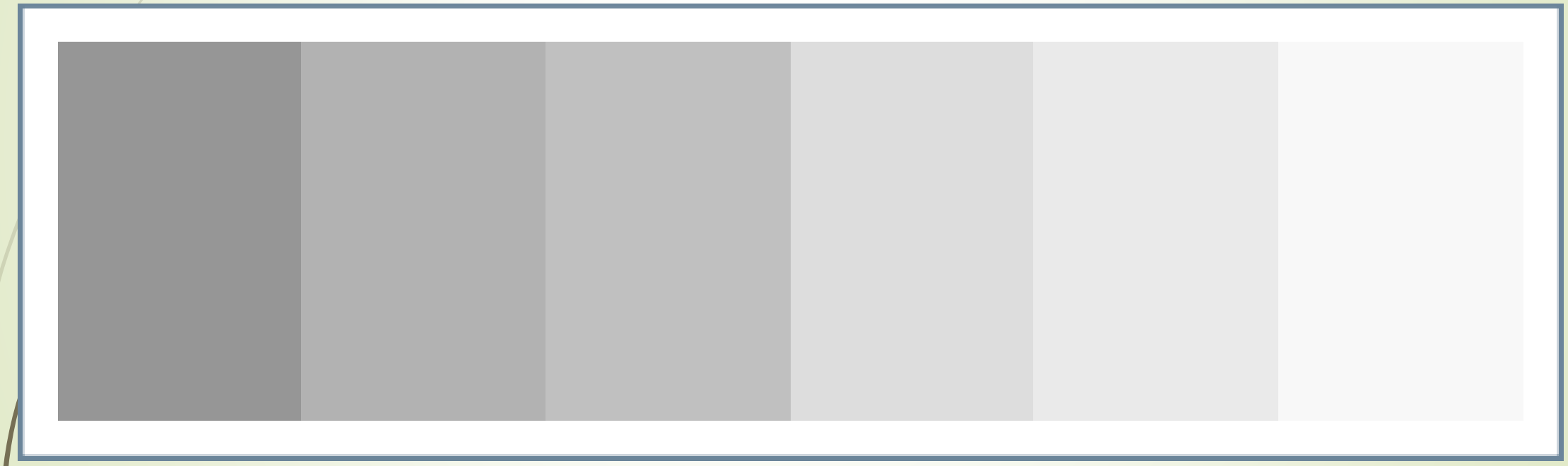
Color context



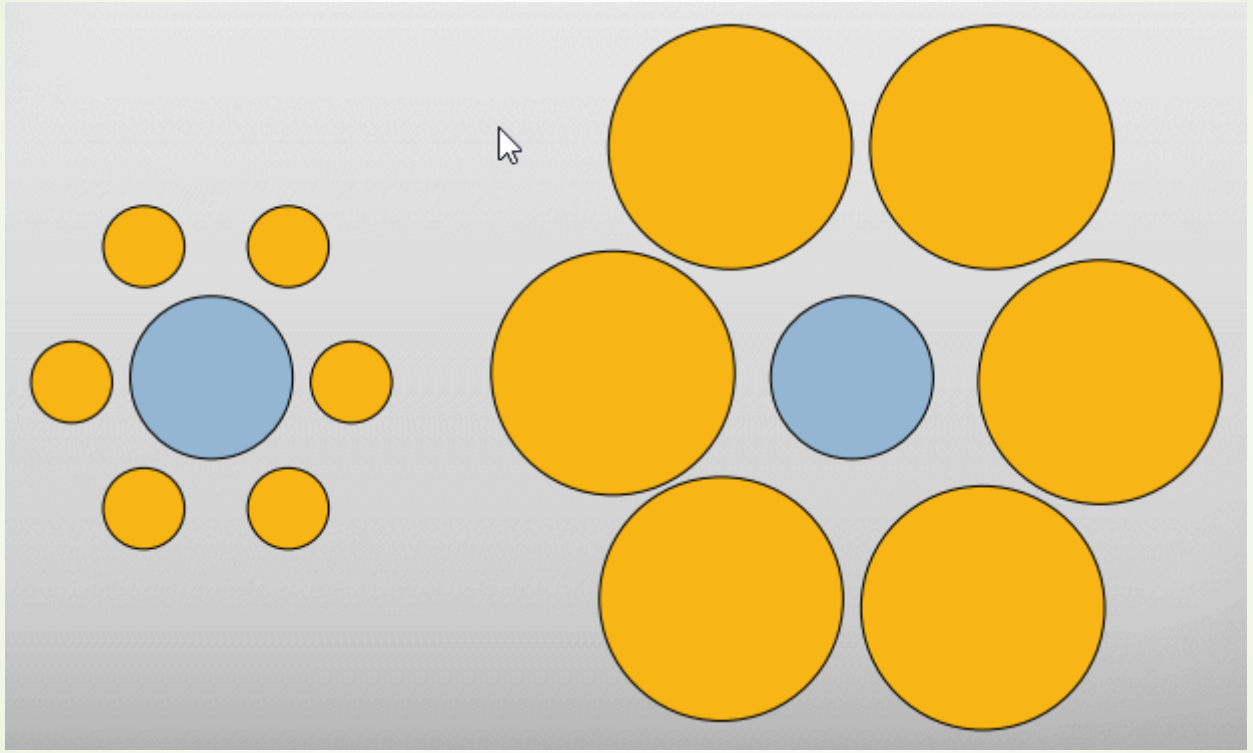
Color context



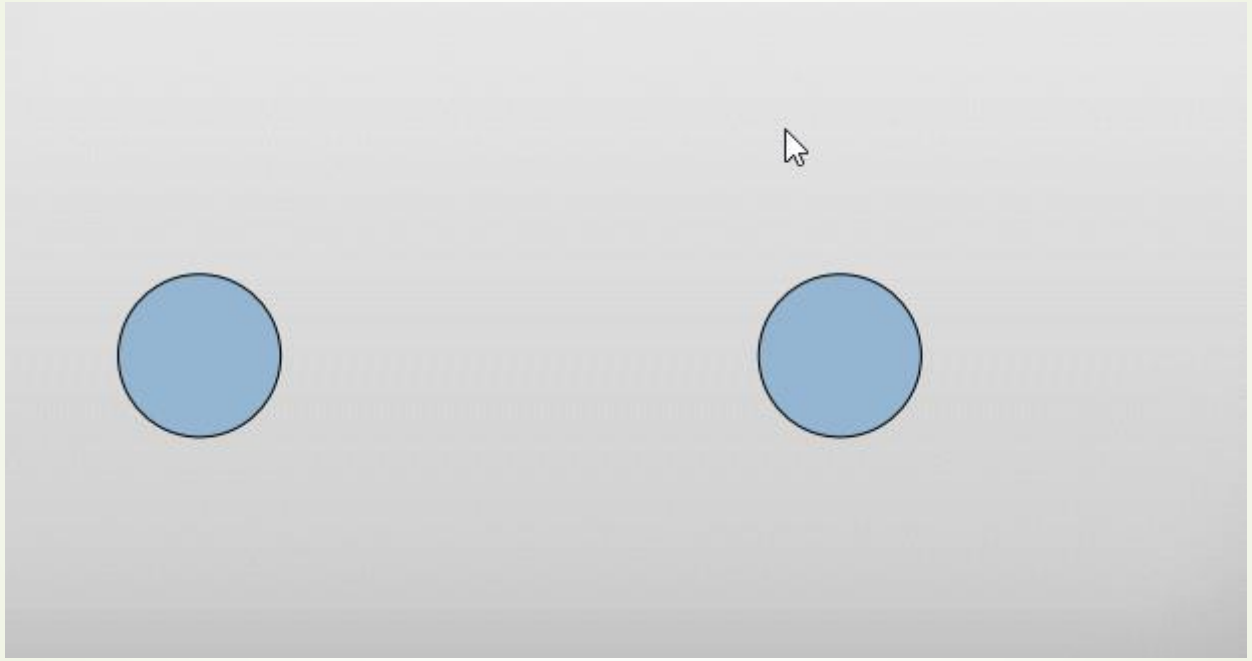
Mach Bands



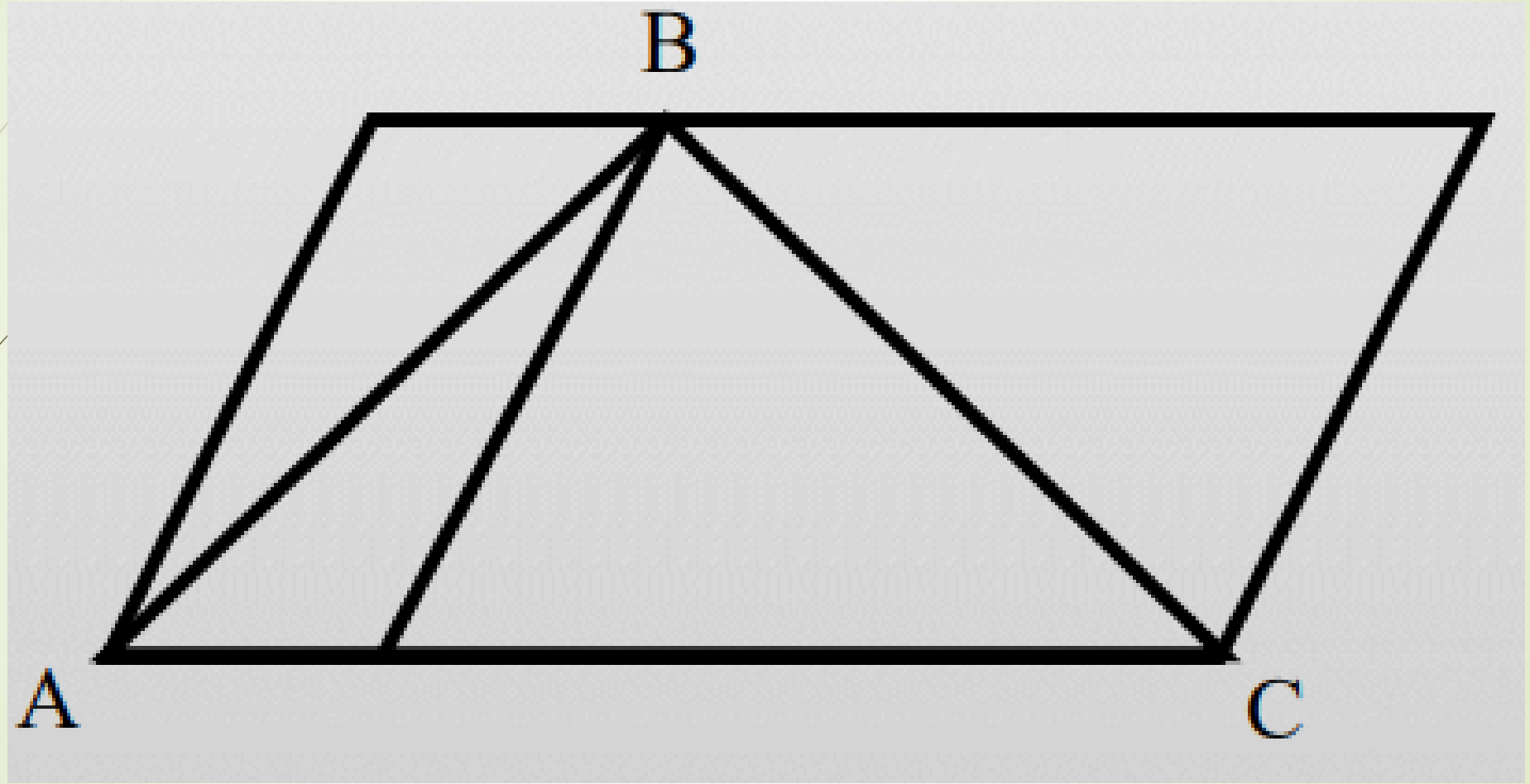
Size Context



Size Context



Which is Longer, AB or BC?



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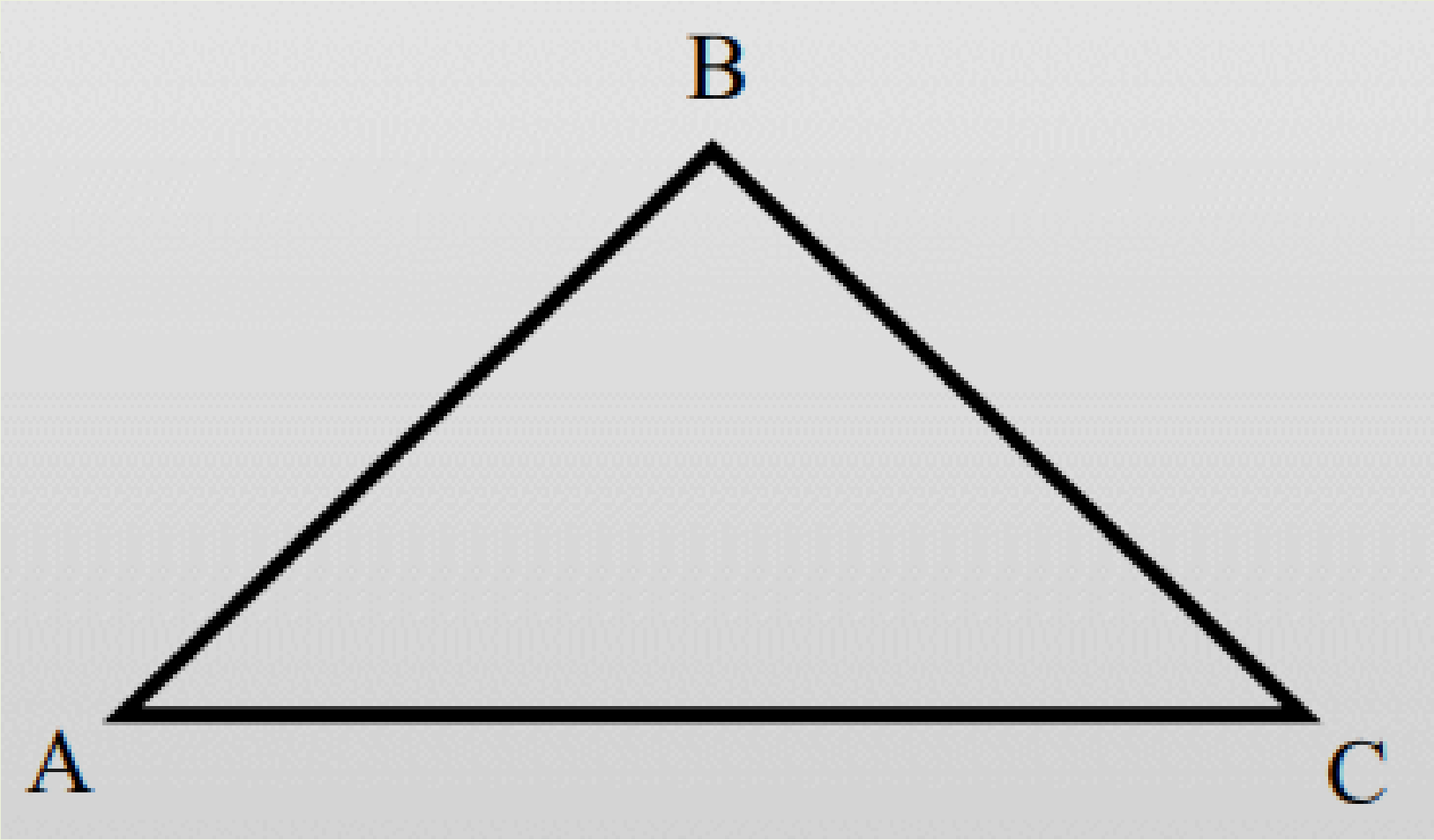

Data Types

	Discrete (no between values)	**Continuous** (values between)
Ordered (values are comparable)	**Ordinal,** e.g. size: S,M,L,XL,… **Quantitative,** e.g. counts: 1,2,3,…	**Fields,** e.g. altitude, temperature
Unordered (values not comparable)	**Nominal,** e.g. shape: ☐○△ **Categories,** e.g. nationality	**Cyclic values,** e.g. directions, hues

Data as Variables

Science	Databases	Data Warehouses
Independent Variable	Key	Dimension
Dependent Variable	Value	Measure

Mapping Quantitative Values

- Position
- Length
- Angle/Scope
- Area
- Volume
- Color/Density

Mapping Ordinal Values

- Position
- Density
- Saturation
- Hue
- Texture
- Connection
- Containment
- Length
- Angle
- Slope
- Area
- Volume

Mapping Nominal Values

- Position
- Hue
- Texture
- Connection
- Containment
- Density
- Saturation
- Shape
- Length
- Angle
- Slope
- Area
- Volume

Using Different Charts

Dep.	Quantitative Continuous	Bar	Line
	Quantitative Discrete	Bar	Bar
Ind.	Quantitative Continuous	Gantt	Scatter
	Nominal or Q. Discrete	Table	Gantt
		Nominal or Q. Discrete	Quantitative Continuous
		Independent	

Parallel Coordinates