Usability Engineering

Session 2

Agenda

- Session 2 Topics
- Questions from Session 1?
- Objectives of Session 1
  - Introduction of basic concepts:
    - History of Cognitive Psychology
    - Research Methods use in Cognitive Psychology
    - Visual Perception
  - Review of Remote-control Photos
    - Next steps

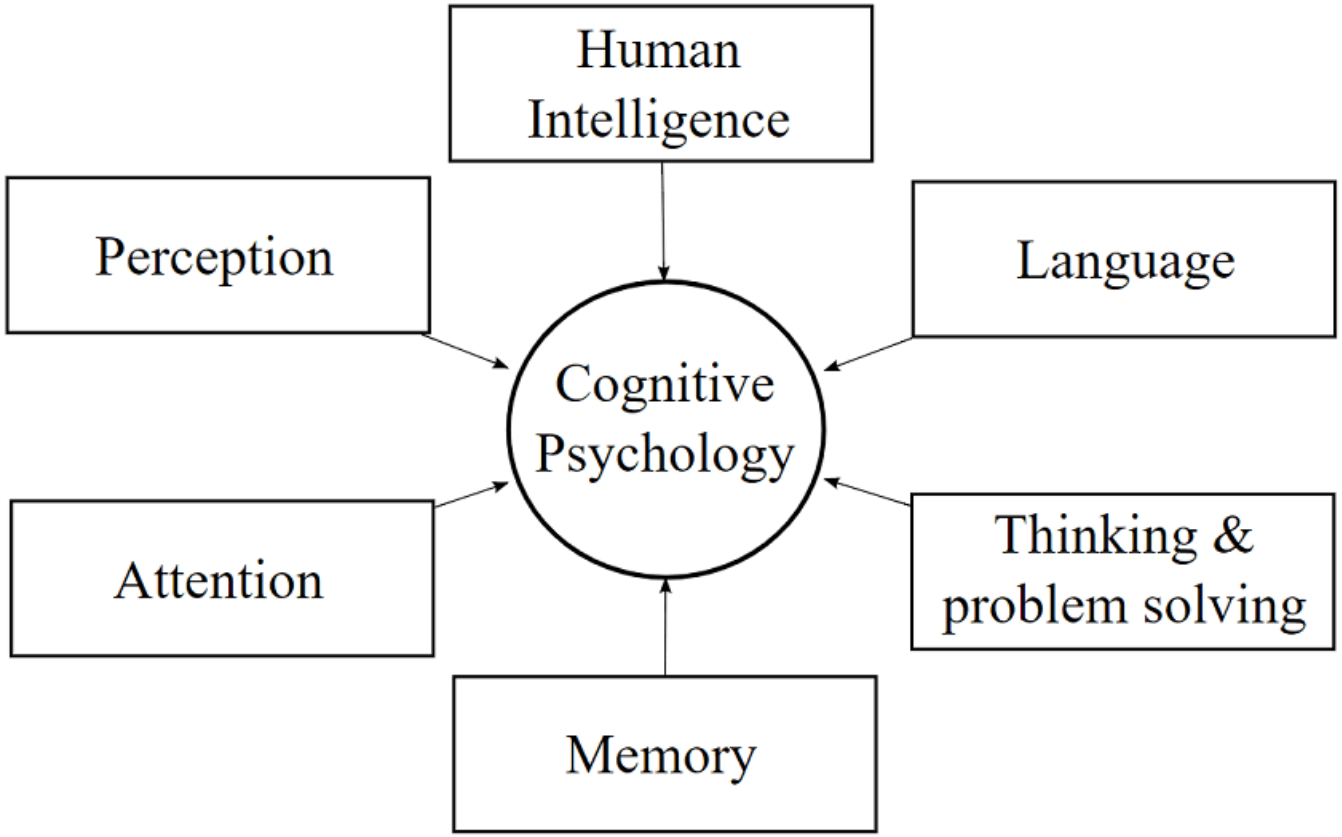
History of Cognitive Psychology

History of Cognitive Psychology

- Definition of Psychology
  - The scientific study of human behavior
    - Pavlov, Skinner, etc.
    - Behavioral Psychology: reinforcement
  - The scientific study of human behavior and mental processes
    - William James, George Miller, Ulric Neisser, etc.
    - Cognitive psychology: thinking and memory

Conclusion: Cognitive Psychology is the scientific study of mental processes.

Cognitive Psychology



Human Intelligence

- Human Intelligence is the mental quality that consists of:
  - the abilities to learn from experience,
  - adapt to new situations,
  - understand and handle abstract concepts,
  - and use knowledge to manipulate one's environment.

Language

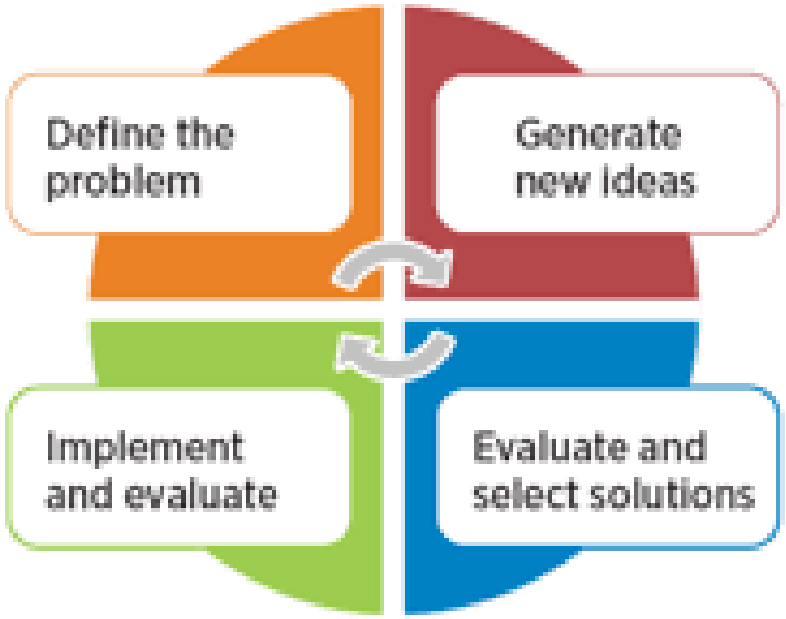
- Noam Chomsky: says the
  - Language is the inherent capability of native speakers to understand and form grammatical sentences.
  - A language is a set of (finite or infinite) sentences, each finite length constructed out of a limited set of elements. This definition of language considers sentences as the basis of a language.

*Note: Chomsky is considered a linguist. His area of research comprised the analysis of language and the structure of language.

Thinking

- Thinking is a mental process in which ideas, images, mental representations and other such hypothetical elements of thought are experienced or manipulated.
  - There are three main types of thinking:
    - Convergent thinking (using logic). This type of thinking is also called critical, vertical, analytical, or linear thinking
    - Divergent thinking (using imagination)
    - Lateral thinking (using both logic and imagination)

Problem Solving



Relationship Between Thinking and Problem Solving

- **Problem Solving** is the result of **critical thinking**. It involves discovering and analyzing the problem **with the** goal **of** finding the best possible solution.

Memory

Memory is defined in psychology as **the faculty of encoding, storing, and retrieving information**.

Attention

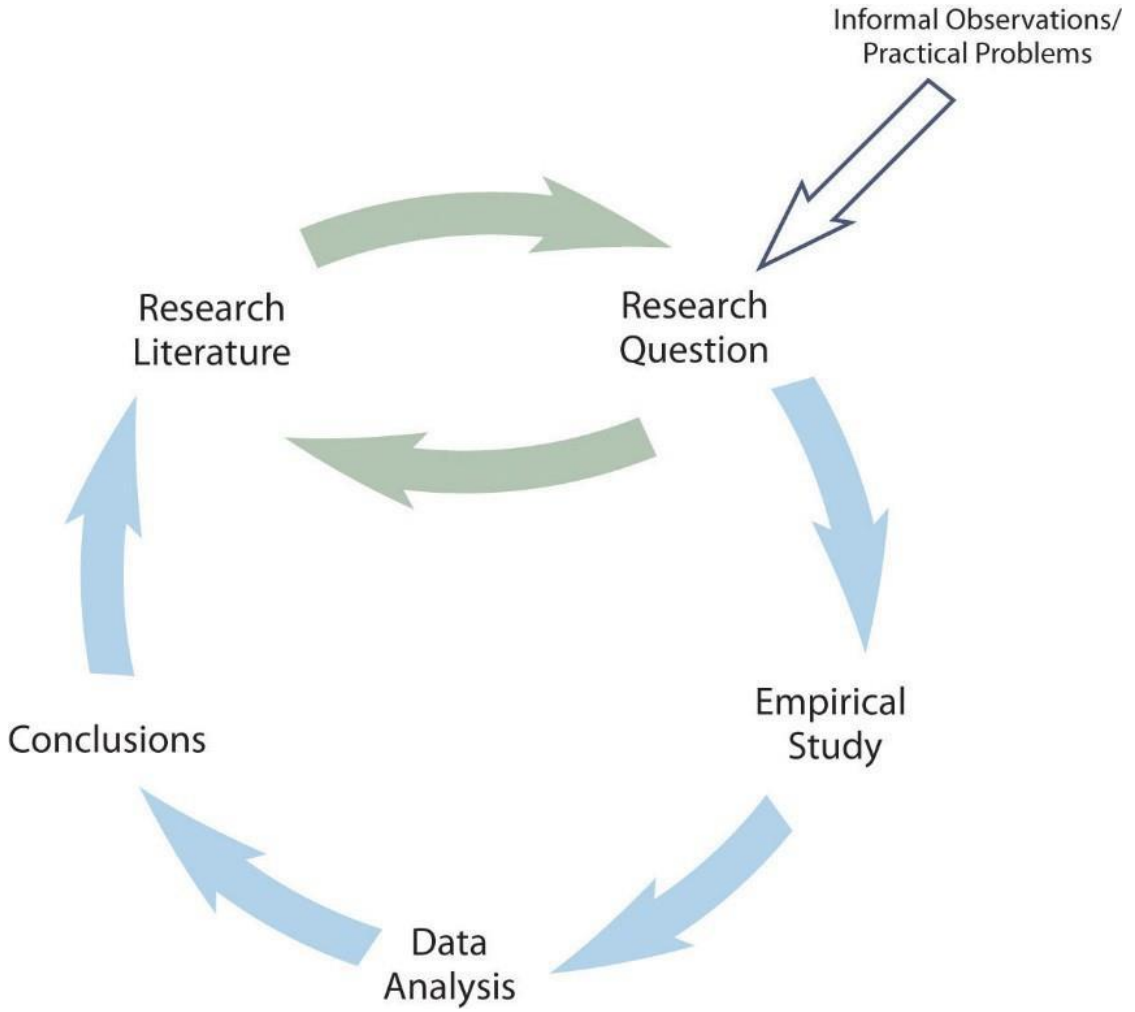
- Attention is **the ability to actively process specific information in the environment while tuning out other details**.
- Attention is limited in terms of both **capacity** and **duration**,
- **Three types of Attention:**
  - **Selective Attention**: The ability to attend to a specific stimulus or activity in the presence of other distracting stimuli.
  - **Alternating Attention**: The ability to change focus attention between two or more stimuli.
  - **Divided Attention:** The ability to attend different stimuli or attention at the same time.

Perception

- Sensation **sensory receptors detect sensory stimuli.**
  - General sensations which include **touch, pain, temperature, proprioception (kinesthesia/movement), and pressure**.
  - Special Senses: Vision, hearing, taste, and smell which convey sensations to the brain through cranial nerves.
- Perception is **the sensory experience of the world**.
  - Perception involves the organization, interpretation, and conscious experience of those sensations.
  - Through the perceptual process, we gain information about the properties and elements of the environment that are critical to our survival.

Research Methods for Cognitive Psychology

Research Process



Research Question

- The origin of research questions
  - Previous research
  - Event occurrence
  - Curiosity
- How to frame a Research Question
  - Hypotheses: Greater than or Less than

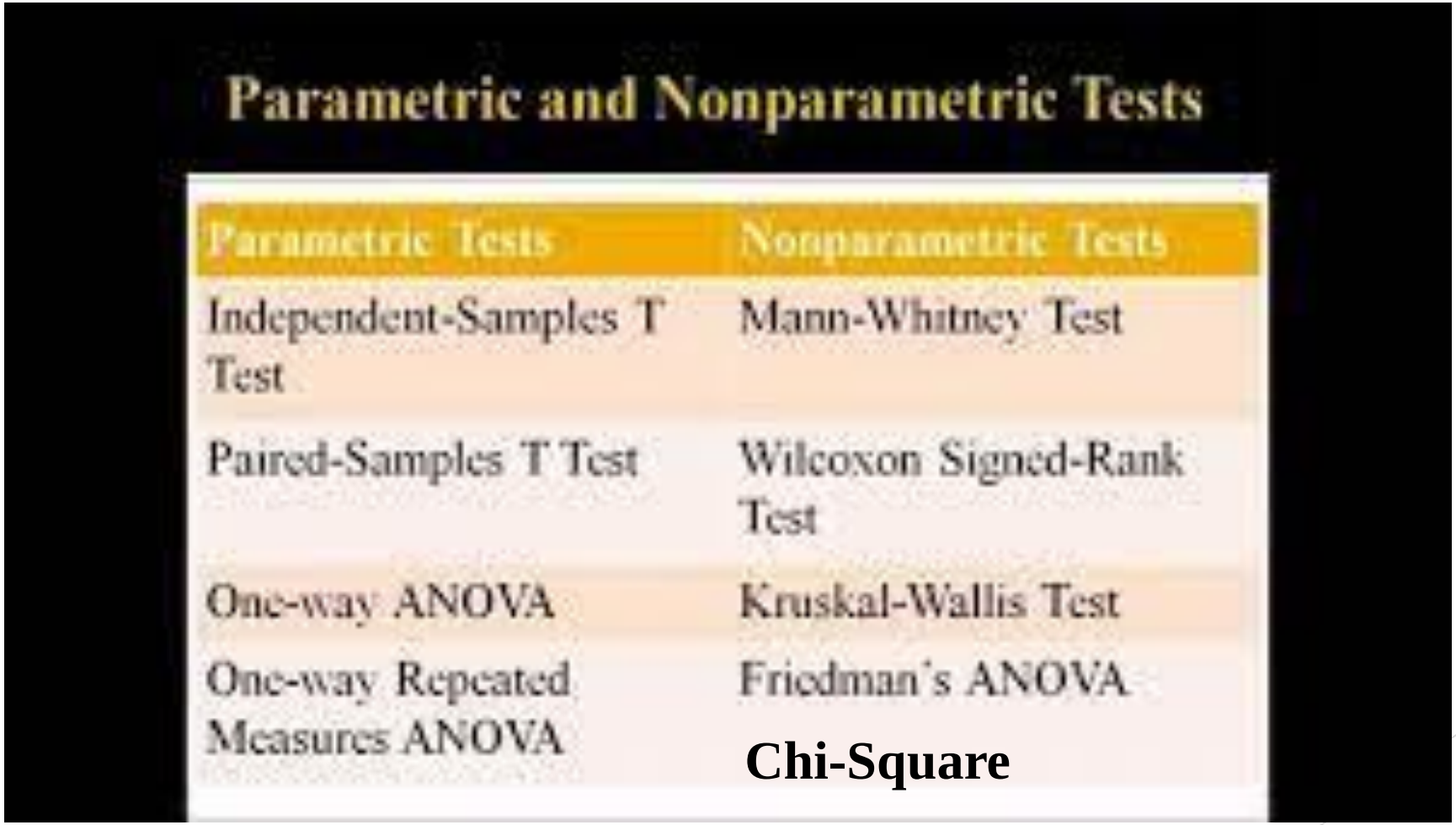
Research Literature Review

- Review of past research in refereed journals
  - What is a refereed journal?
  - Some examples in Cognitive Psychology:
    - Cognitive Psychology, Cognition, Applied Cognitive Psychology, Memory and Cognition, The Journal of Psychology, Journal of Experimental Psychology, Journal of Applied Research in Memory and Cognition, Cognitive Science, Journal of Cognitive Neuroscience, Journal of Experimental Psychology: Human Perception and Performance.
- How much past Literature do you review?

Empirical Studies

- Definition
  - Empirical research is based on observed and measured phenomena and derives knowledge from actual experience rather than from theory or belief.
- Types
  - Experimental Research
    - Hypothesis Testing
      - Significant difference
      - Correlational
      - Observational

Data Analysis



Conclusions

- Research Conclusions
  - Statistical Results
  - Hypothesis Support/Non-Support
  - Implications on past research findings
  - Implications on present and future research findings
  - Applications??

Visual Perception

Sensation and Perception

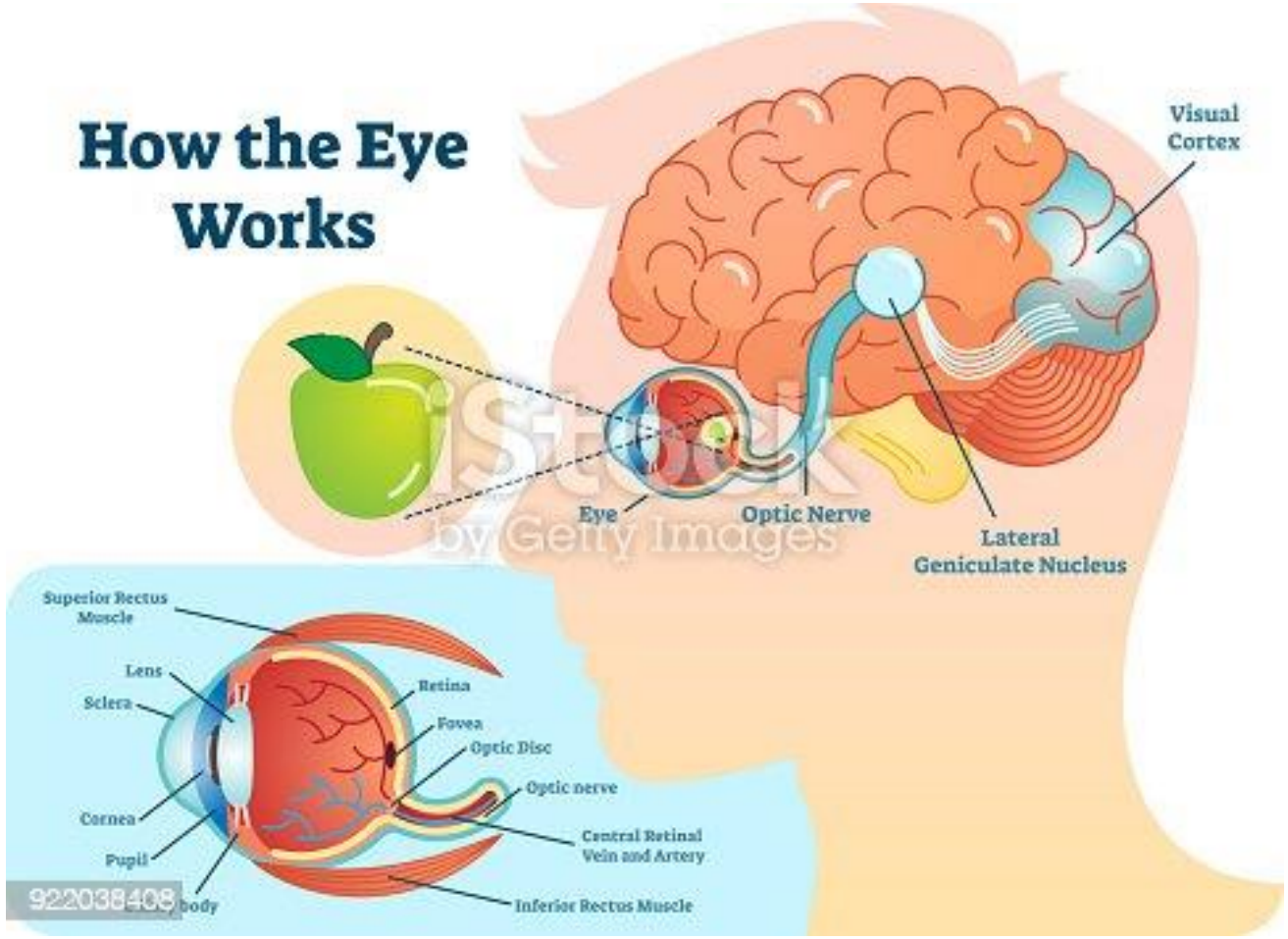
Sensation and perception are two separate processes that are very closely related.

- **Sensation** is input about the physical world obtained by our sensory receptors, and
- **Perception** is the process by which the brain selects, organizes, and interprets these sensations. In other words, senses are the physiological basis of perception.
  - Perception of the same senses may vary from one person to another because each person's brain interprets stimuli differently based on that individual's learning, memory, emotions, and expectations.

Visual Perception And Visual Sensation

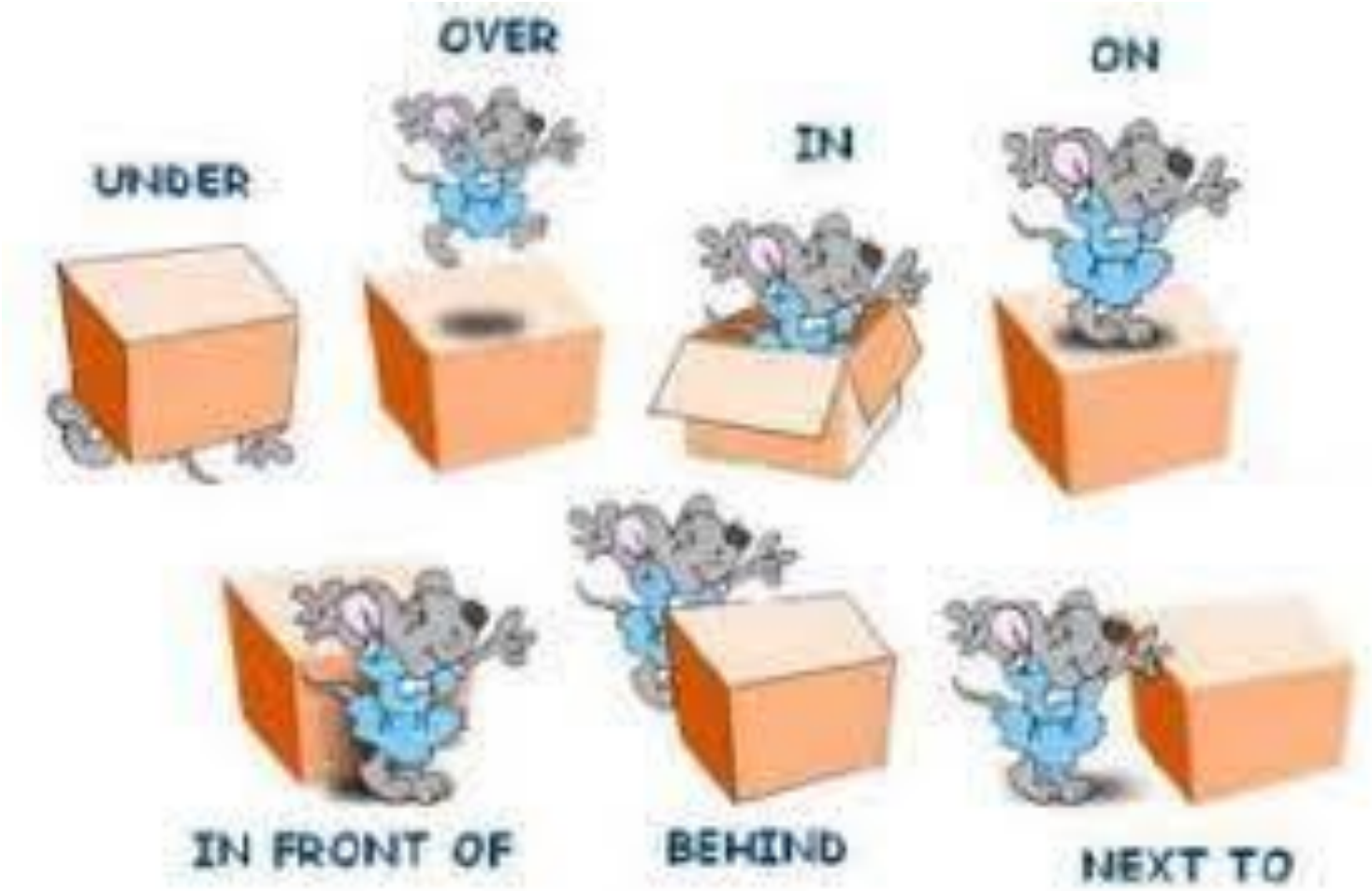
- Visual sensation is the physiological process of when the eye focuses light on the *retina*.
  - Within the retina, there is a layer of photoreceptor (light-receiving) cells which are designed to change light into a series of *electrochemical signals* to be transmitted to the brain.
- Visual perception occurs in the brain's *cerebral cortex*; the electrochemical signals get there by traveling through the optic nerve and the thalamus. The process can take a mere 13 milliseconds.
  - Visual perception is the ability to perceive our surroundings through the light that enters our eyes.
  - The visual perception of colors, patterns, and structures has been of particular interest in relation to graphical user interfaces (GUIs) because these are perceived *exclusively* through vision.

From Sensation to Perception



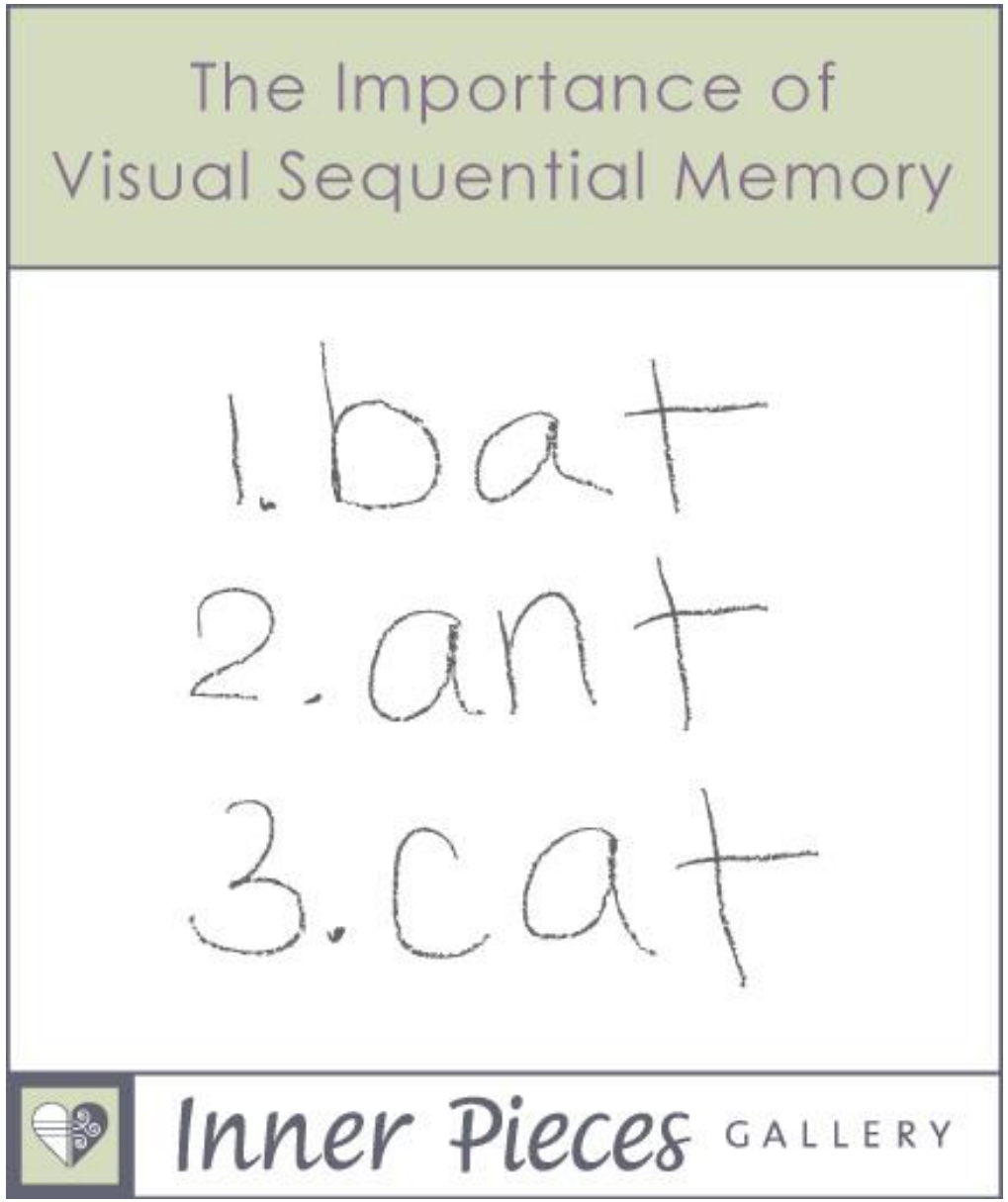
Visual Spatial relations

- Visual spatial relations is the ability to determine one form or part of a form that is turned in a different direction than the others.
- This is why children (and adults) have such a hard time recognizing b and d or p and q. They don't understand that just because it's rotated, it's a different letter.
- They also have difficulty differentiating between in and out, over and under, and left and right, because those are a spatial skills concepts.


UNDER
OVER
IN
ON
IN FRONT OF
BEHIND
NEXT TO

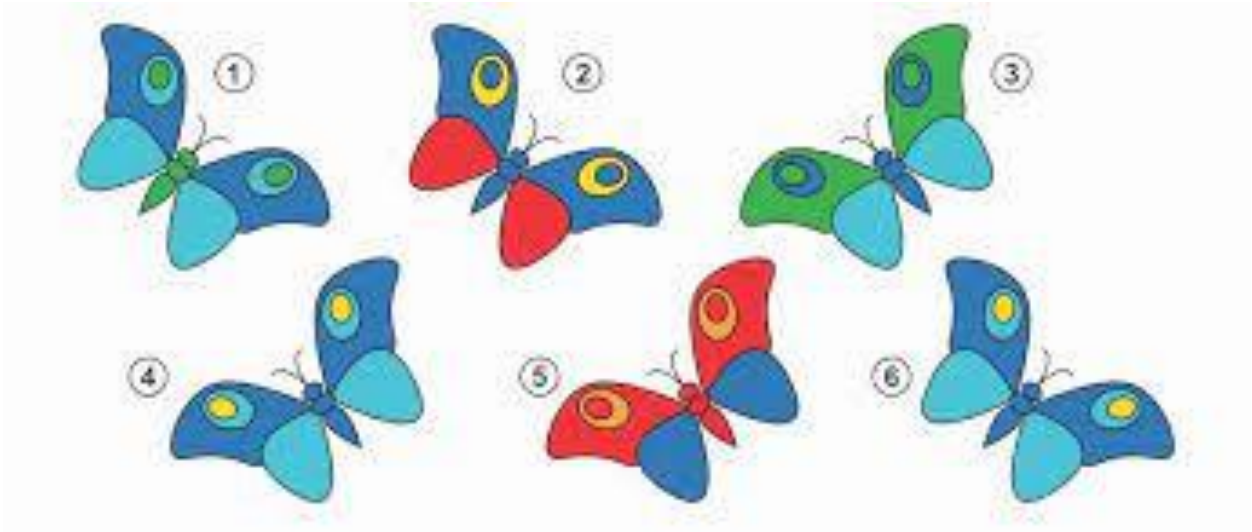
Sequential Memory

- Sequential memory is the ability to remember a series of forms and find it among other forms.
- If you are having a hard time sequencing the alphabet, or copying from one place to another, this may be a problem with sequential memory.


The Importance of
Visual Sequential Memory
1. bat
2. ant
3. cat
Inner Pieces GALLERY

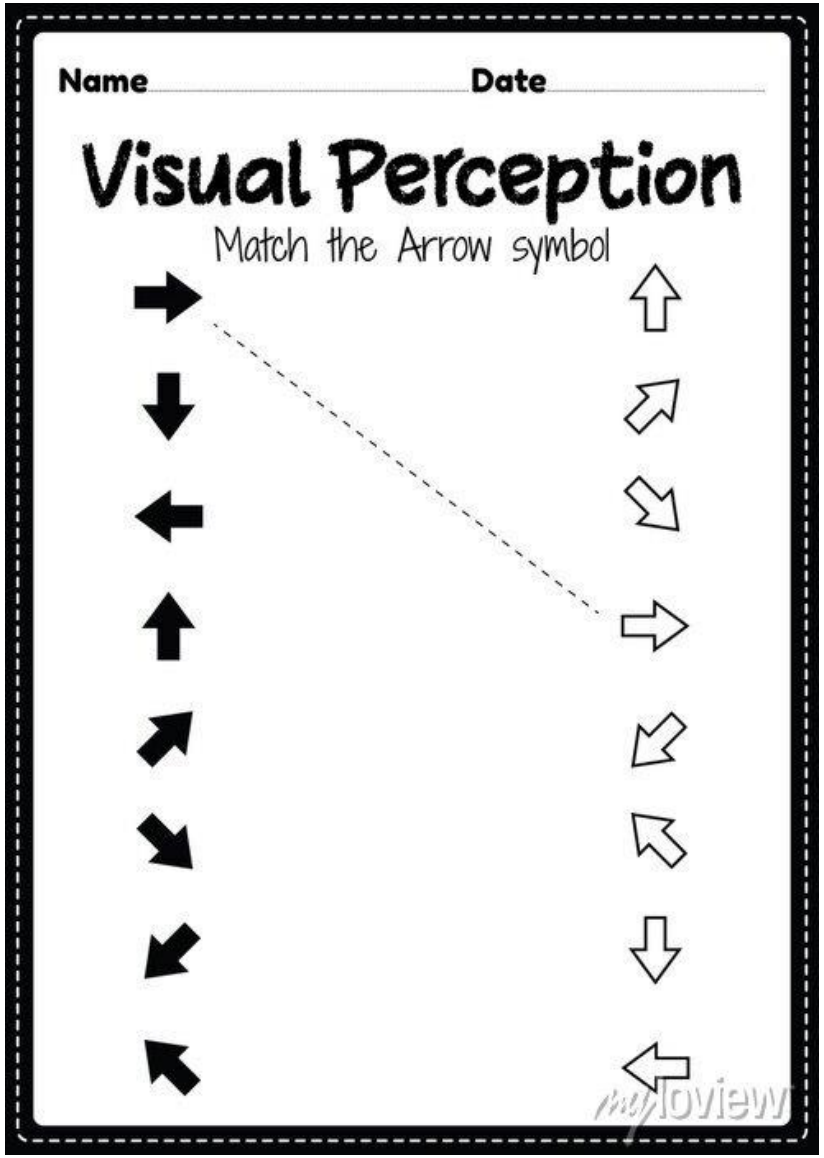
Visual Discrimination

- Visual discrimination is the ability to differentiate between objects and forms.
- For example, like being able to identify money and sort coins or other objects.


1
2
3
4
5
6

Form Constancy

- Form constancy is the ability to see a form and find it among other forms, although it is sized differently or rotated.
- Children can have trouble recognizing letters and numbers (e.g., recognizing that 6 and 9 are two different numbers).


Name
Date
Visual Perception
Match the Arrow symbol

Visual Memory

- Visual memory is the ability to store visual details in short-term memory, such as recalling a phone number.
- Reading comprehension is going to be affected when visual memory is deficient.
- Think about showing a photograph to someone, and then taking it away and asking them questions about it.


MEMORY TEST
5

Visual Closure

- Visual closure is the ability to fill in the missing details into an incomplete shape.
- Visual closure requires abstract problem solving.
  - A good example of this is working on puzzles; being able to put a picture together in your mind and to piece it together correctly.
- Tproblems with visual closure can cause a problem with writing and spelling.

Visual figure ground

- This is the ability to perceive a form and find it hidden in a conglomerated ground of matter.
- For example, asking a child to find the blue crayon in their pencil box.
  - Visual figure ground is being able to filter out all the other crayons to look for that blue crayon.
- The adult equivalent of using visual figure ground skills would be when we are rummaging through our junk drawer to find something we need.


ICONEO

Review of Remote-control Photos

Next Steps

Next Steps

- Create Basic Tasks , e.g., on/off; channel selection; volume control; change input, etc.
  - Have at least 5 tasks
  - Create the optimal Task Steps and Sequence to complete the tasks
- User Input:
  - Ask Users to “perform” the tasks
- Record the sequence of the steps users did to perform the task
- Evaluate user inputs against the optimal steps and sequence