

CS4826 - HCI

Week 2

Evolving notion of Interaction

- Technology is rapidly changing, and so is how people can use it
- It is about what it can do. But also about what people WANT to do with it (see. Web 2.0 and social networking)
- Are the users also changing??? Questioning the notion of “user”

Evolving notion of Interaction

- Interaction is a complex phenomenon, and needs a multi-disciplinary approach
- Apply insights from other fields to relevant problems
- Learn how to study interaction

Conceptual Background to HCI

Cognitive Psychology: **to understand the psychological processes involved in the acquisition and use of knowledge by people.**
Perception, attention, memory, learning, thinking, and the importance of social and environmental influences on those domains.

How do humans create mental plans and “translate them into action?

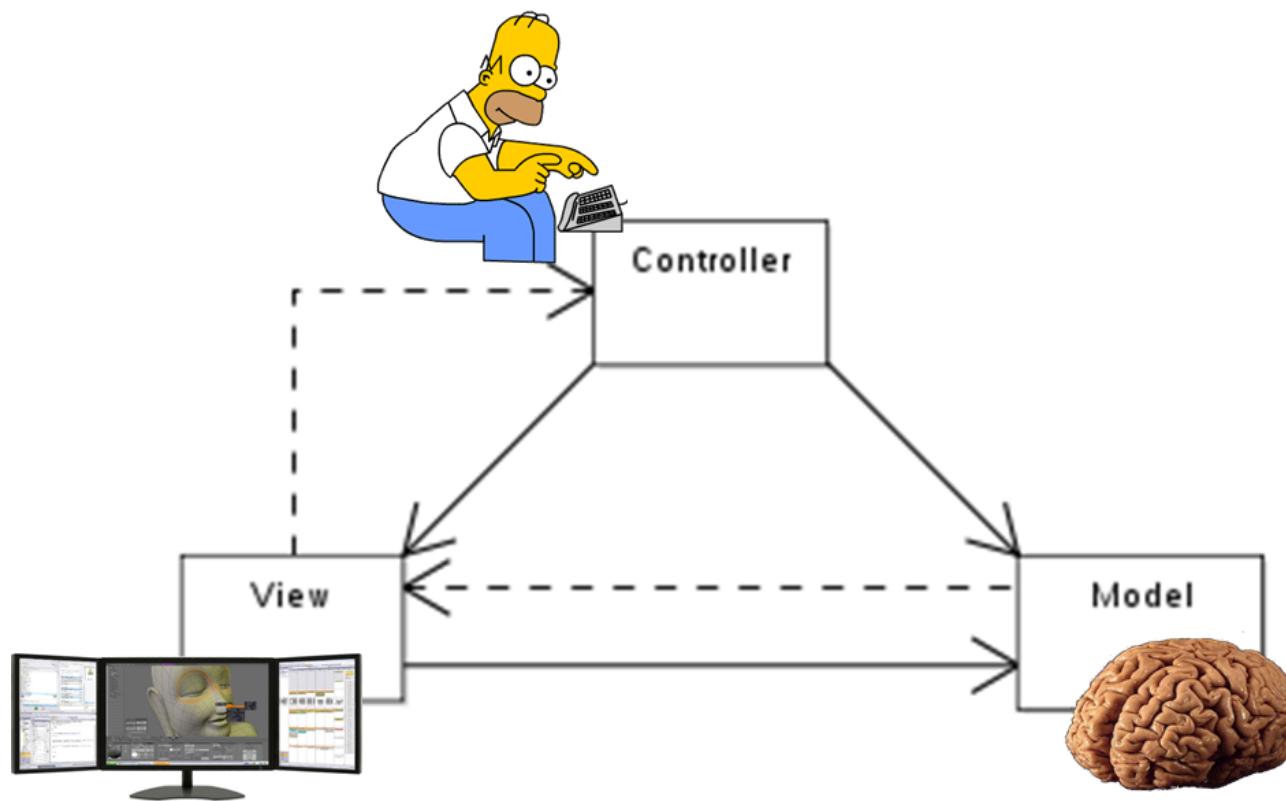
Conceptual Background to HCI

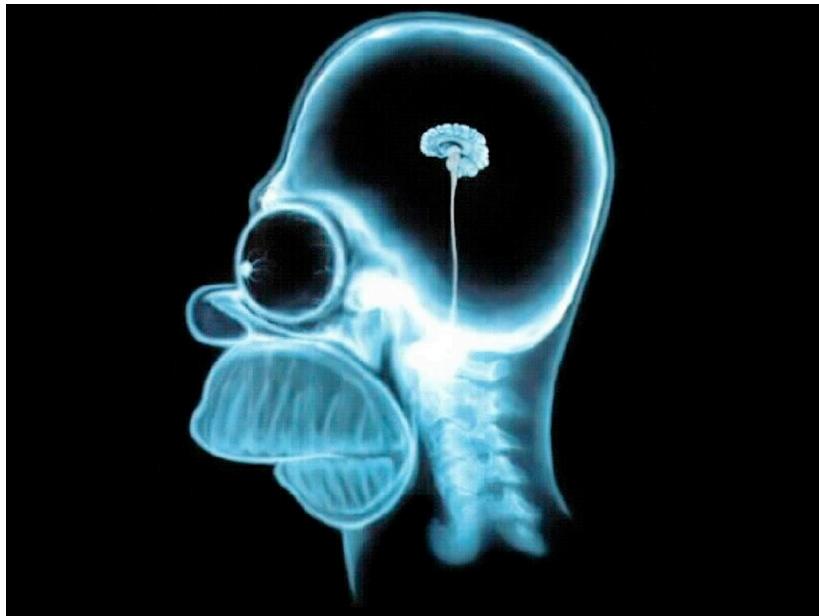
How do users react to the machine's response?

How do users represent ("imagine") the computer's abilities to interact?

The computer is not a human...but still a partner in interaction. How do we relate to it?

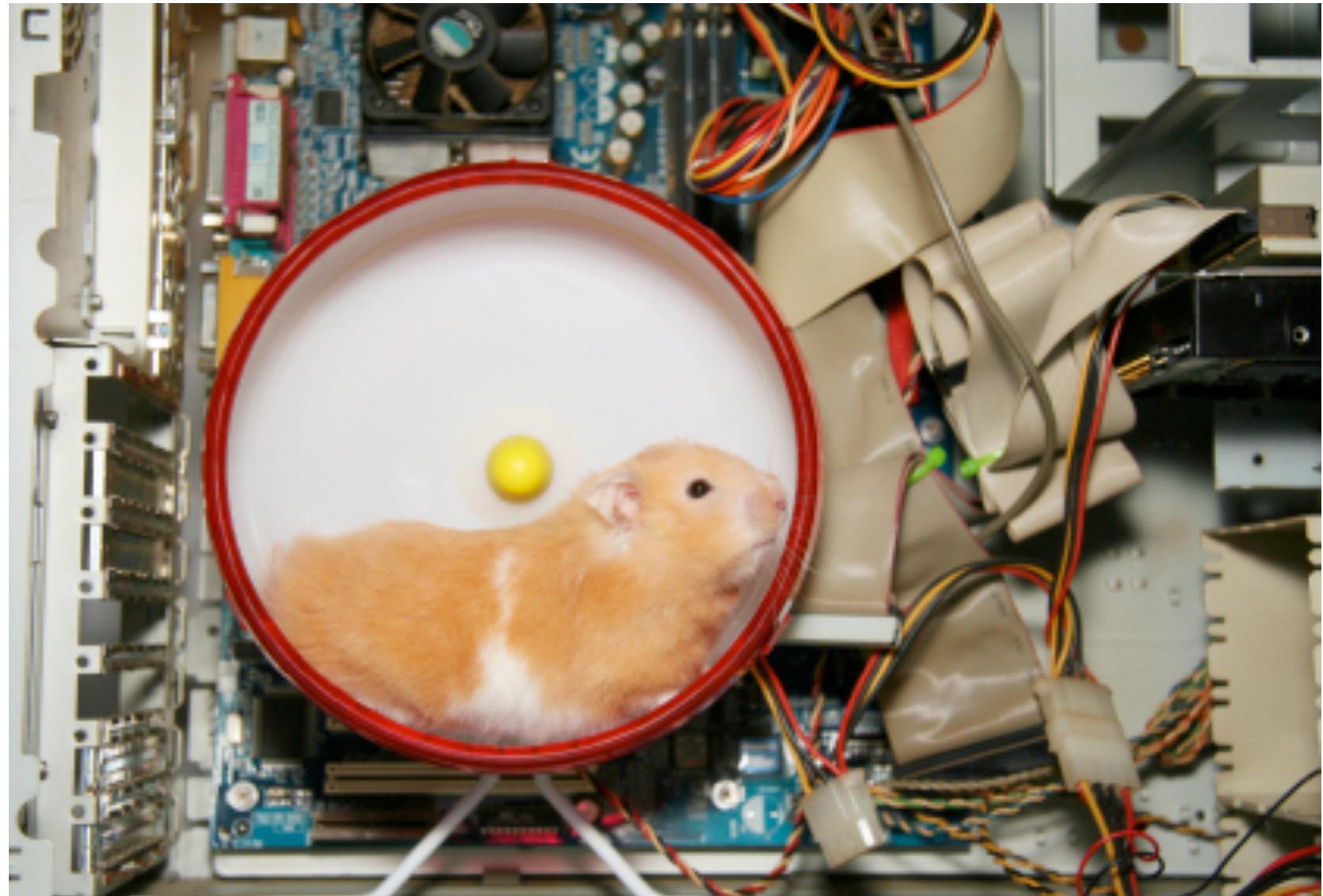
Conceptual Background to HCI: Cognition





...not the same as....





Conceptual Background to HCI: Cognition

What is important for HCI is how the User conceptualizes interaction:

- Activity and Task performance
- Memory
- Attention
- Perception (graphical interfaces)
- Goal definition...

Conceptual Background to HCI: Ergonomics

Ergonomics: studying how humans physically interact with physical devices.

Is the study of designing objects to be better adapted to the shape of the human body.

The study of workplace equipment design or how to arrange and design devices, machines, or workspace so that people and things interact safely and most efficiently. Also called human factors analysis or human factors engineering.

How do we physically interact with an interface?

How to make things visible

How to fit the interface on the user?

Anthropometrics

Health & safety

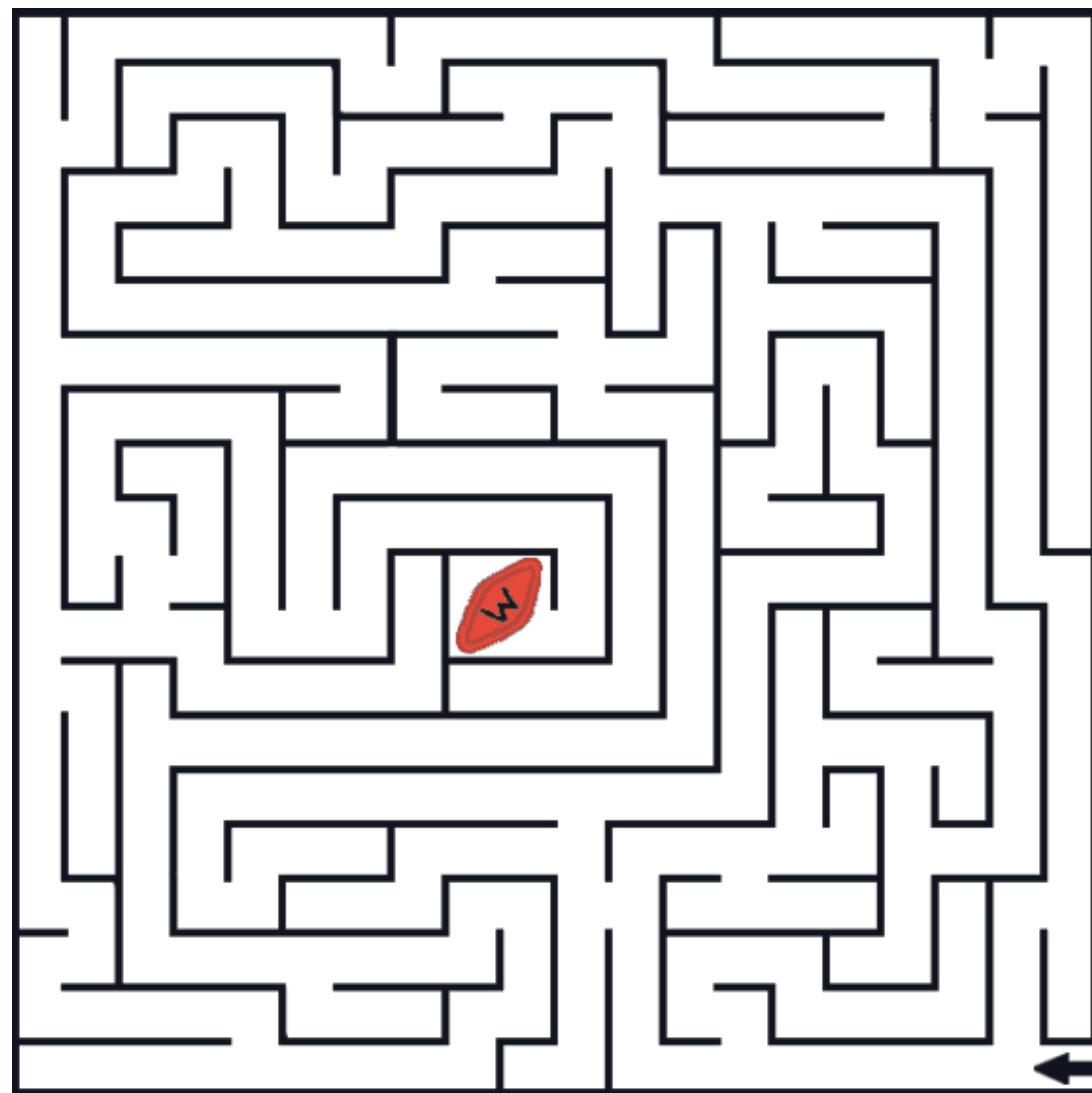
Conceptual Background to HCI: Ergonomics

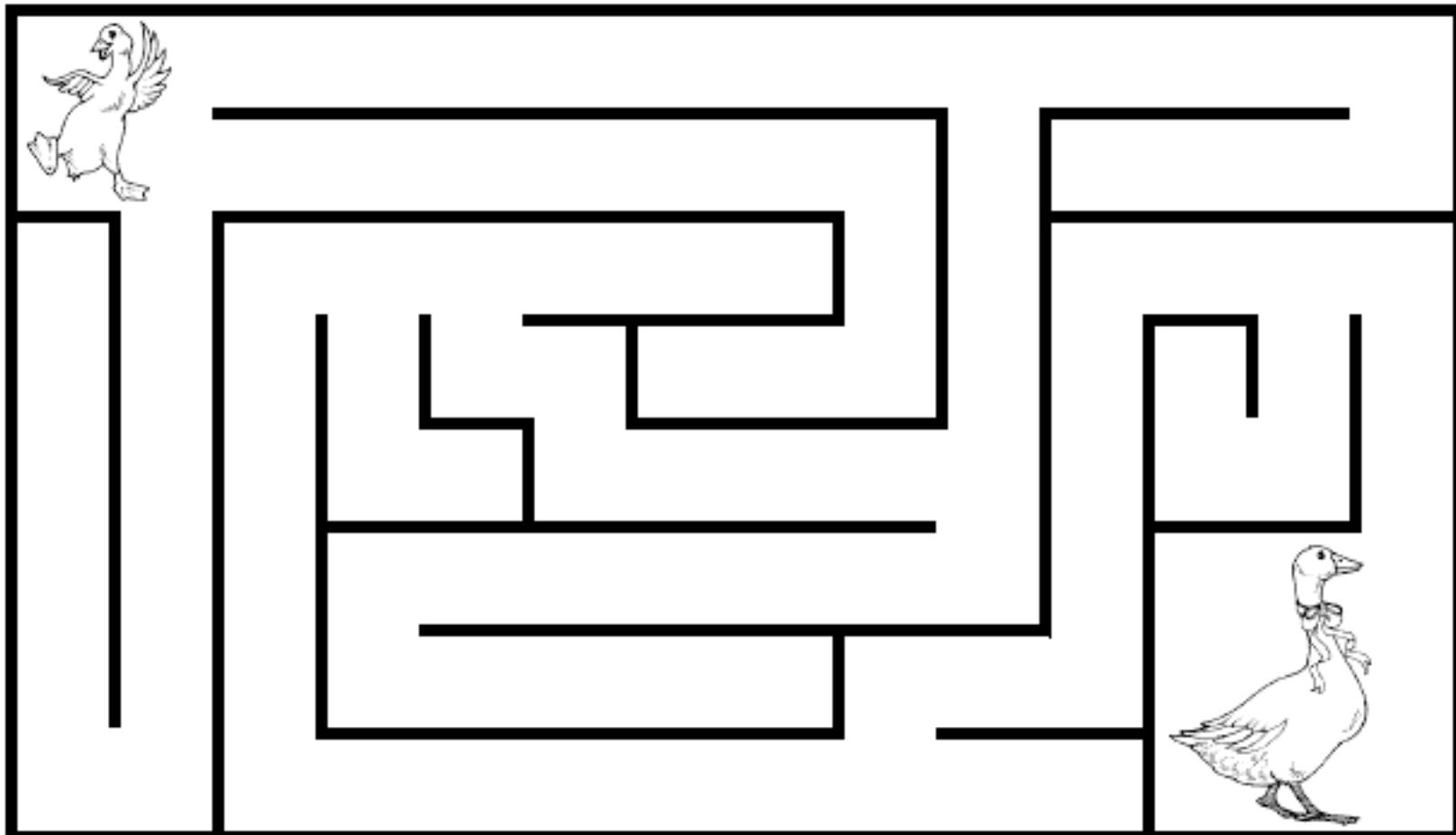
Also cognitively...**Cognitive Ergonomics**

How to make our thinking and planning processes more “comfortable”?

The same goal can be achieved by different sets of tasks. Different sets of tasks can present more or less cognitive load for the user

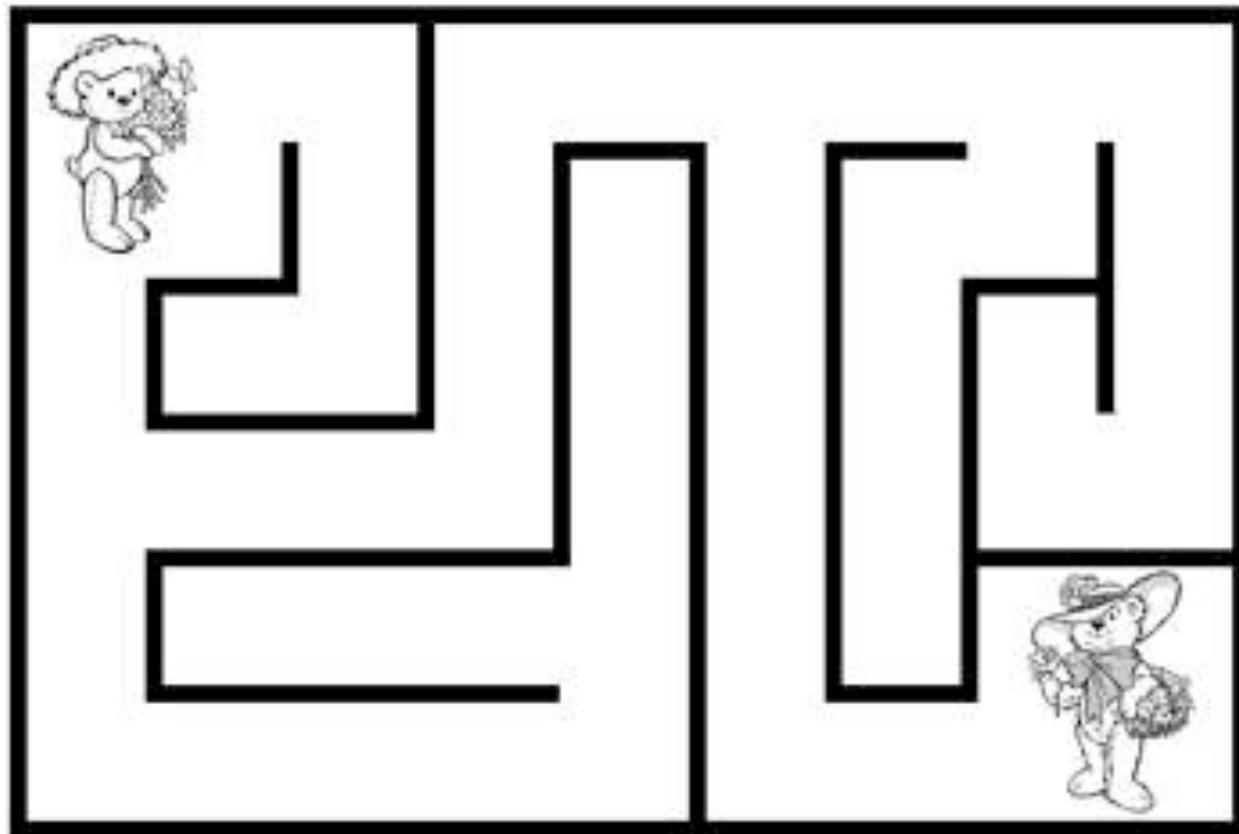
How to make things more comfortable?





Help the gosling find his Mom

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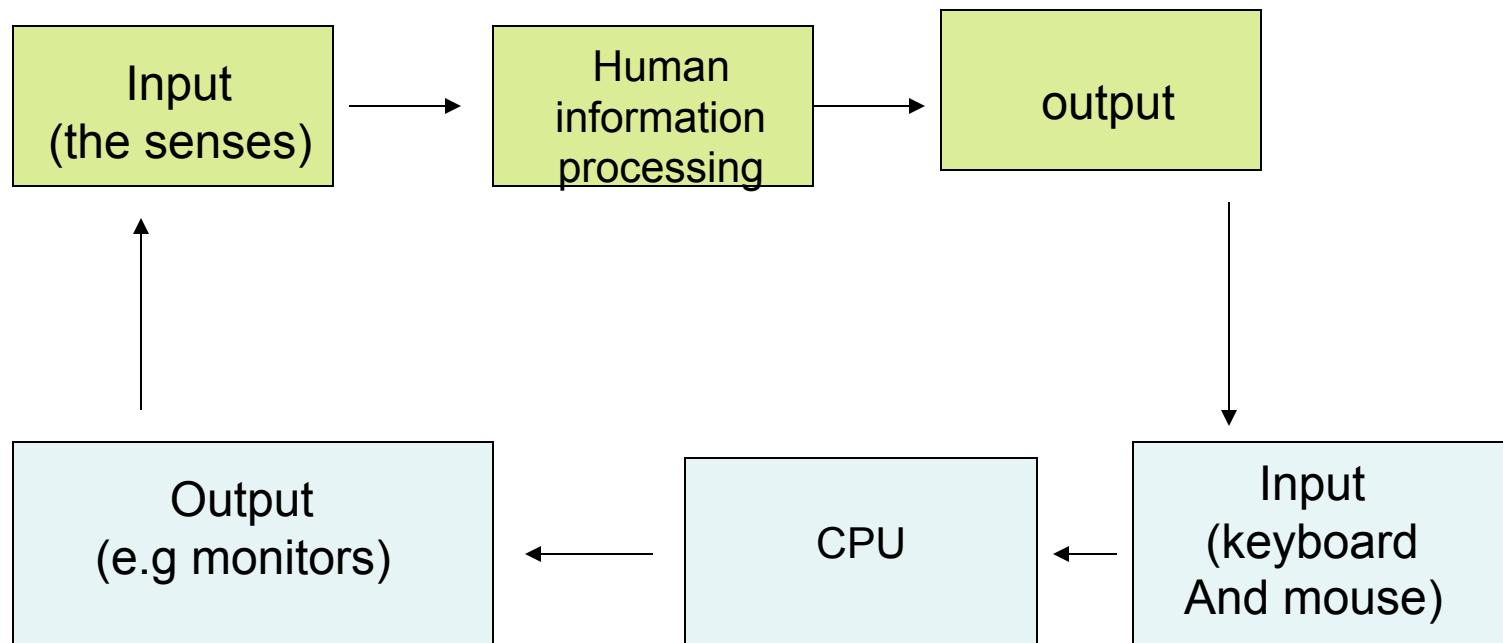
Help lil bear bring flowers to his Mom

Core issues from Psychology

- Perception
- Cognitive Load
- Attention
- Memory
- Decision Making

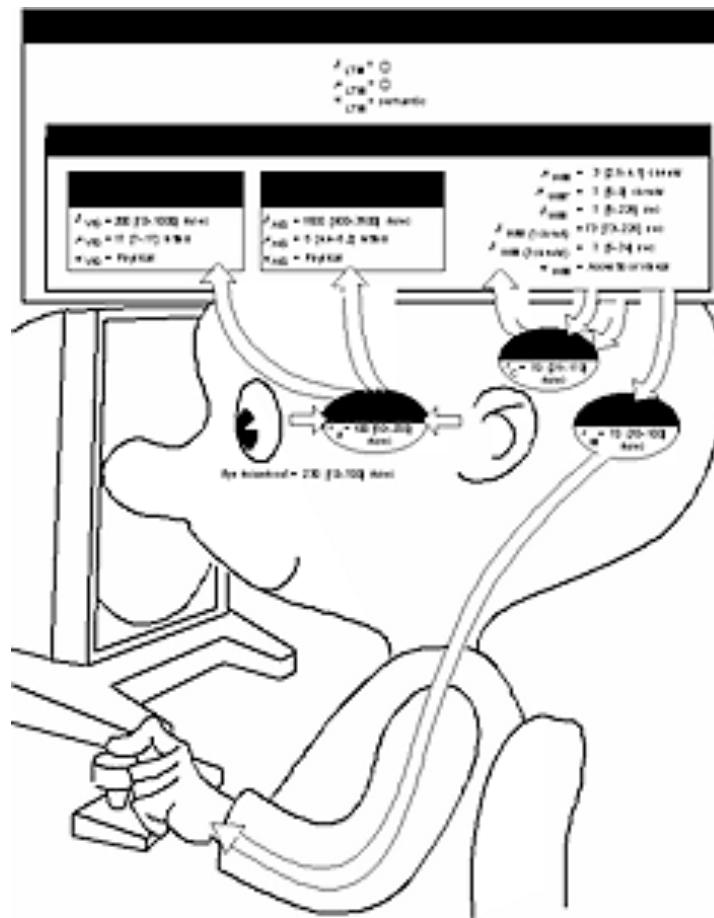
The information Processing Model

human

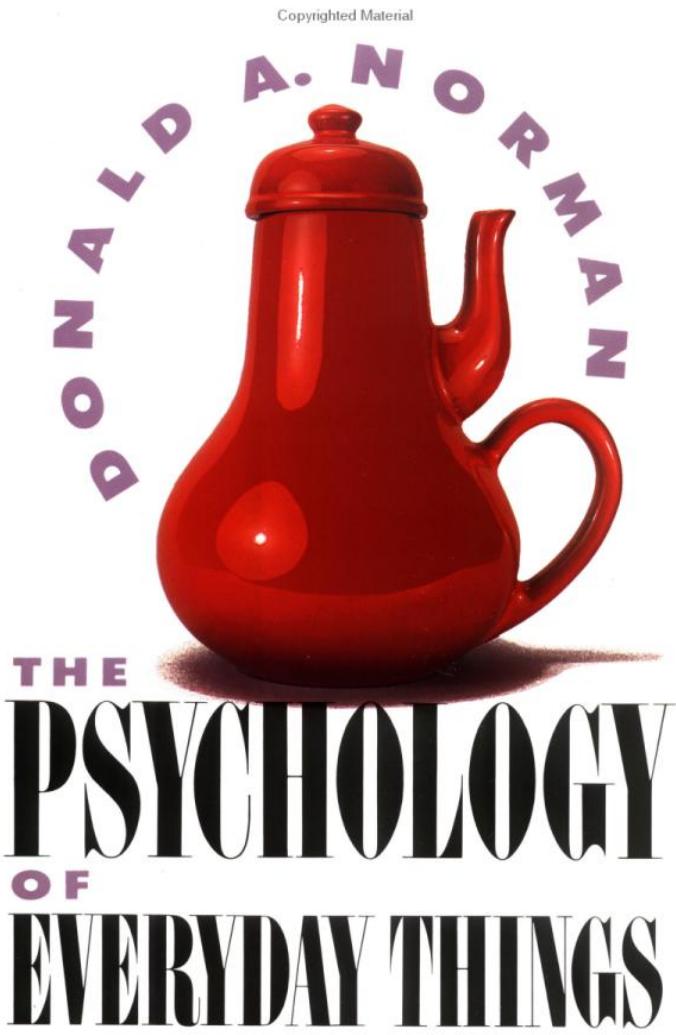


computer

The information Processing Model



Don Norman: The Psychology of Everyday Things, 1988

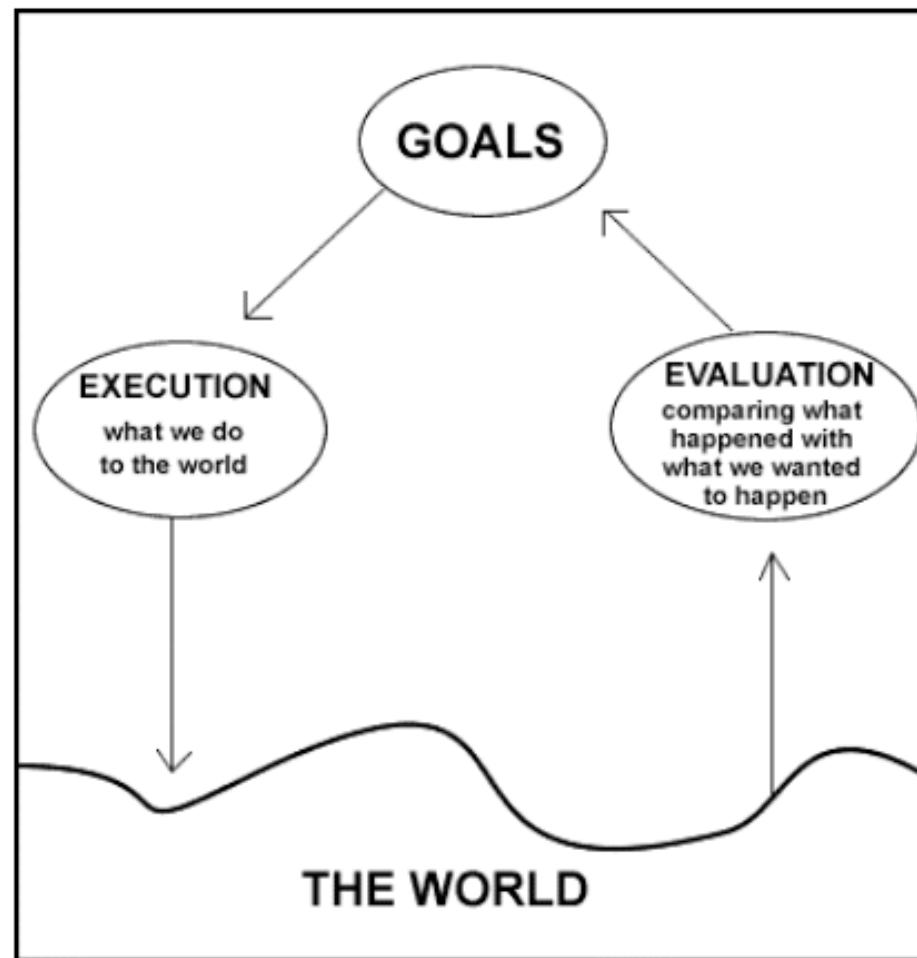


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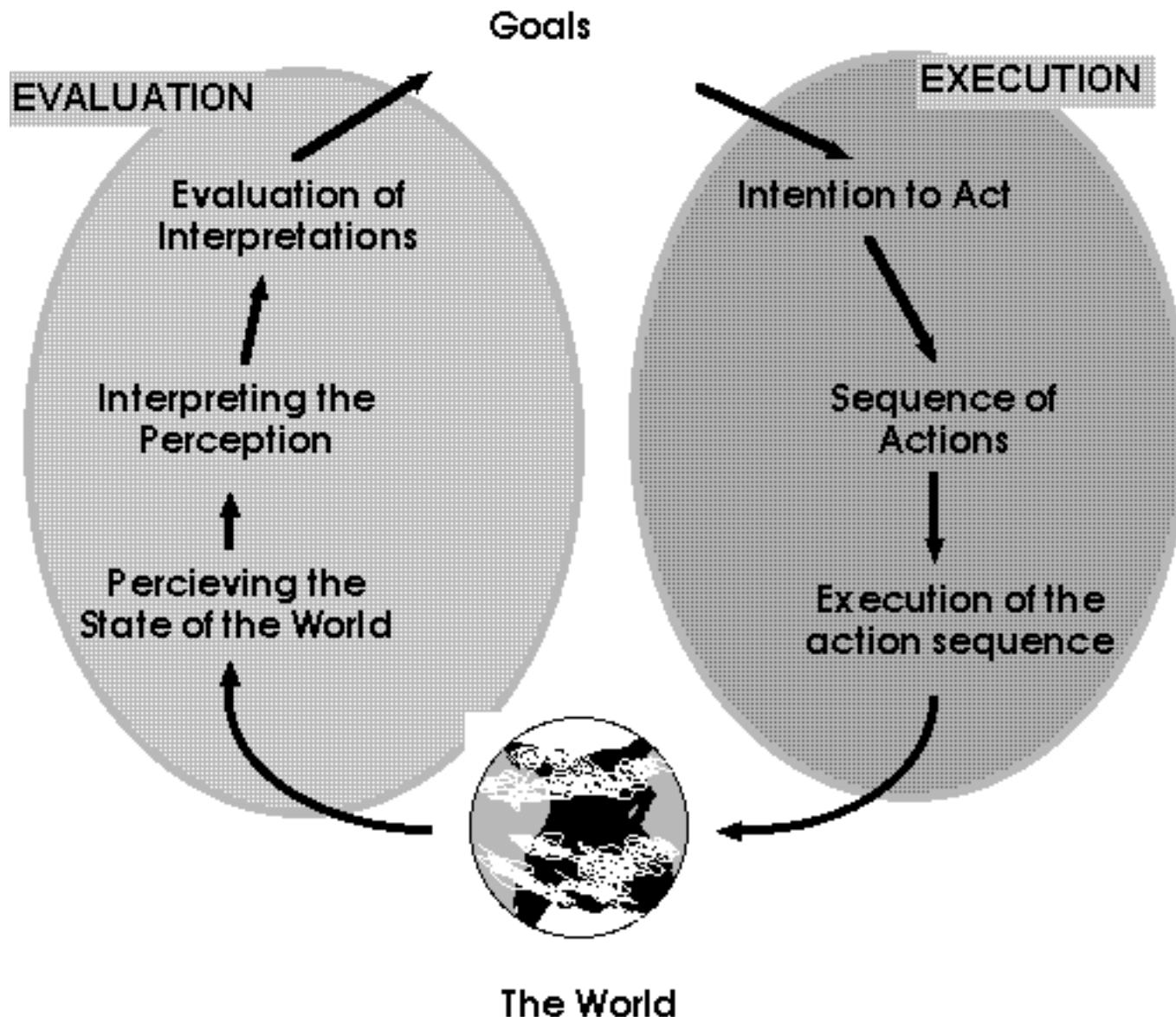
Norman's Theory of Action

- Cognition happens in relation to the world around us
- “distributed” cognition
- We need to understand cognitive phenomena as they happen in the world

Norman's model of Action



The 7-stages model



Attention

A general term referring to the selective aspects of perception so that at any instant an organism focuses on certain features of the environment to the relative exclusion of other features.

E.g., Cherry (1953). "The cocktail party phenomenon".

Attention

Allowing us to “focus” on certain things.

Evolutionary advantages.

Attention is linked to goals. We attend to things that are important to us.

It is selective but sometimes our attention is “caught”.

Attention is very often divided.

Physical and semantic differences between messages or images important.

Memory

- Different memory systems
- Working memory vs long-term memory

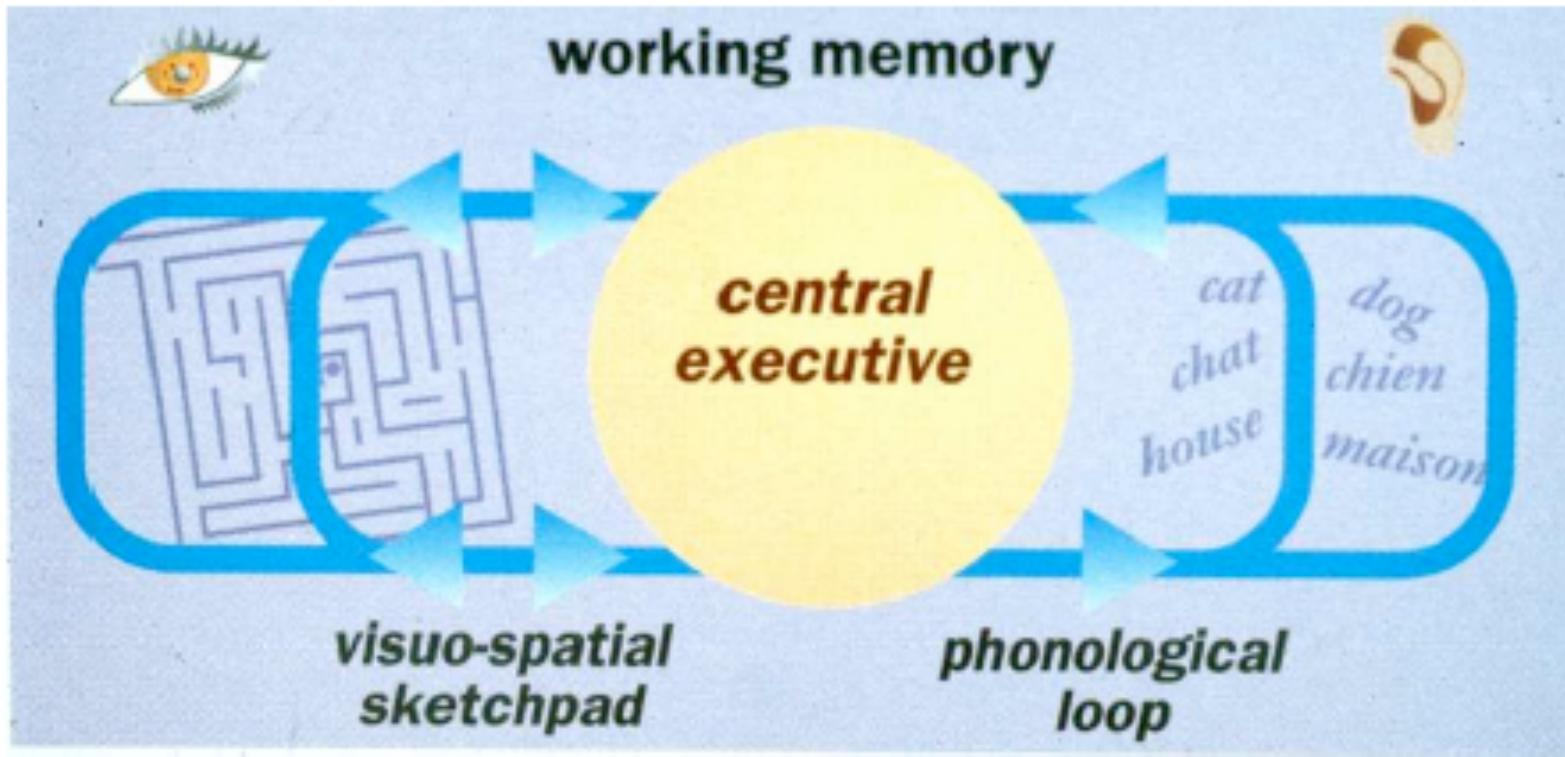
Working memory

Working memory is an inclusive term for a number of short-term memory systems that enable individuals to hold on to recently acquired information for between 30 secs to about 4 mins. Among these memory systems are the **phonological loop** and the **visuospatial sketchpad**.

The **phonological loop** can briefly hold information about language or language-like sounds. Rehearsal can maintain items in the phonological loop.

The **visuospatial sketchpad** briefly holds visual information about spatial relationships. This includes **eidetic images** which are accurate mental images of objects not currently present. Sometimes referred to as **photographic memory**.

Rehearsal is a process whereby information can be held in short-term memory for relatively long periods of time. Repeating the item over and over can lead to long-term memory storage.



Baddeley & Hitch's model of working memory

Working memory

Displacement is what happens when you try to overload any of your STMs. Say if you are trying to place 20 items in there you are likely to remember a few of the first, a few of the last but hardly any of the middle items.

The **serial position effect** is a phenomenon in verbal learning. Items at the beginning or at the end of a long series are more easily remembered and items in the middle are the hardest to recall.

Sometimes referred to as the **recency-primacy** effect.

The capacity of STM can be increased using certain techniques such as **chunking**. This concept come from George Miller who also gave us the **magic No 7**.

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Miller's Magic No. 7

Miller argued that the capacity of STM was limited to $7 + - 2$ items of meaningless information such as nonsense syllables or numbers and has become a popular guiding principle amongst HCI designers (e.g., designing menu options limited to 7 choices). However, the relevance of this finding is questionable these days.

Reasons:

Visual menus don't have to be limited to 7 choices because the options usually don't need to be remembered, just read from the list.

Given that very successful websites such as Amazon and Ebay present the user with many more choices than allowed by the limits of STM, it is clear that in real contexts of use this law does not apply with the presentation of visual options

The concept implies that there is no relationship between the items to be remembered. This is rarely the case in real life. We find it easier to remember items of information that relate to each other. Even in computer menus the options are grouped logically.

Cowan (2002) tested Miller's finding and suggest that in reality STM capacity may be as low as $4 + - 1$ items.

Miller's Magic No. 7

One area where this idea may still be relevant though is in relation to auditory menus where the options are listed verbally and the user has to remember what each one is.

For example, when calling customer support you may be greeting with something like this:

- To access your account information press 1
- To hear your balance press 2
- To pay your bill press 3
- To report a fault press 4
- To enquire about our other services press 5
- To cancel your account press 6
- To speak to a customer service agent press 7.
- To listen to these options again press 8

At this point you've probably forgotten which number you should press if you want to report a fault or pay your bill.

Long-term memories

Declarative Memory is required to recall factual information.

The ability to recognise a face or a piece of sensory information is dependent on declarative memory

Episodic memory is related to events

Semantic memory is the memory for meanings

Storage and Retrieval

Rehearsing: usually used for items that have no semantic connections with each other. It involves a lot of mental effort and attention

Constructive remembering: using the semantic connections help recreate the meaning (e.g. a joke)

Implicit Memory

Implicit memories include perceptual and motor skills.
Unconscious expression of skills and habits.

Sometimes called “skill memory” or “procedural memory”

Implicit memories are acquired over long periods of time but they hard to forget (e.g. riding a bike!)

These procedures are usually fairly automatic and don’t require much conscious thought. Actually, not thinking about it might help executing that skill

Encoding effects

Locus-dependent memory is a memory that has been associated with a particular location so that it is easier to recall when in that location.

State-dependent learning refers to the phenomenon where memories are recalled with greater ease when you are in the same or similar mood or physical state as when you first acquired the memory.

The **spacing** effect refers to the fact that repeated items are learned better and are more easily recalled the greater amount of time between the first and the second exposure to the items.

Massed practice is a study method that does not create a spacing effect and is therefore not likely to lead to long-term retention.
Cramming.

Encoding variability is where the same information is acquired in different moods, states or circumstances.

Perception

What is perception?

Sensation - occurs when information contacts sensory receptors; eyes, ears, tongue, nostril & skin. Sensation is about **detecting** various forms of energy present in the environment.

Perception is concerned the **interpretation** and meaning of what is sensed.

The difference between **sensation** and **perception** - for example, it is the difference between detecting acoustic energy and hearing music or the physical energy transmitted to and detected by the retina may be interpreted as a colour, shape or pattern.

Sensation and perception are no longer considered distinct from each other. **Sensation** has come to be considered as the **earlier stage** of perceptual processing. **Perception** is usually used to connote the **later stages** in which the results of earlier processing are brought together to form more complexly processed experiences. "Pure" (un-interpreted) sensations do not exist in our experience of the world.

Perception is an **active** process. It exists neither in the head, sense organs or the environment alone but in the **interaction** between these elements.

Why study perception?

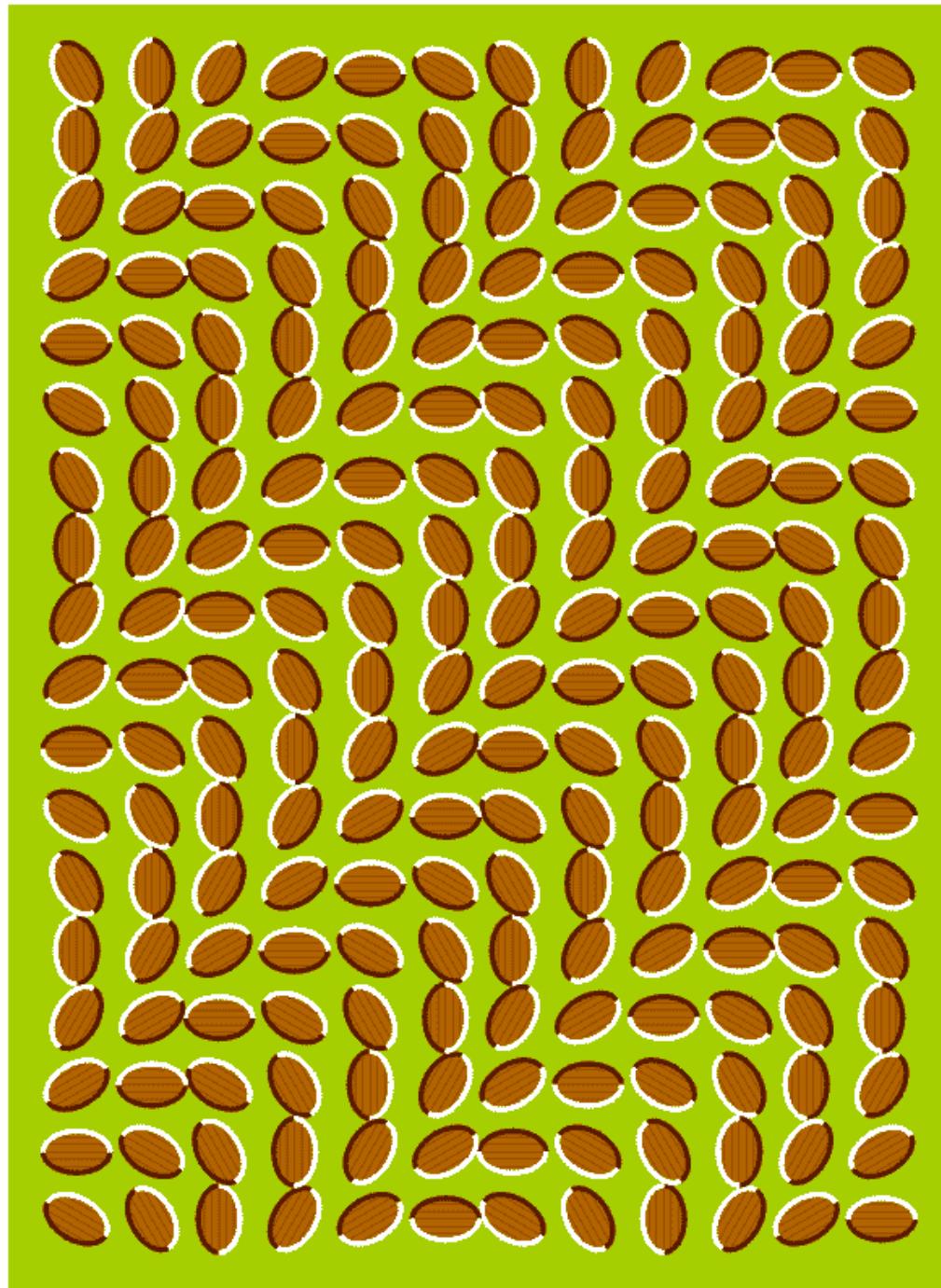
The process of perceiving is not simply a case of just looking through our eyes at what is "out there" and "seeing" the world for what it is.

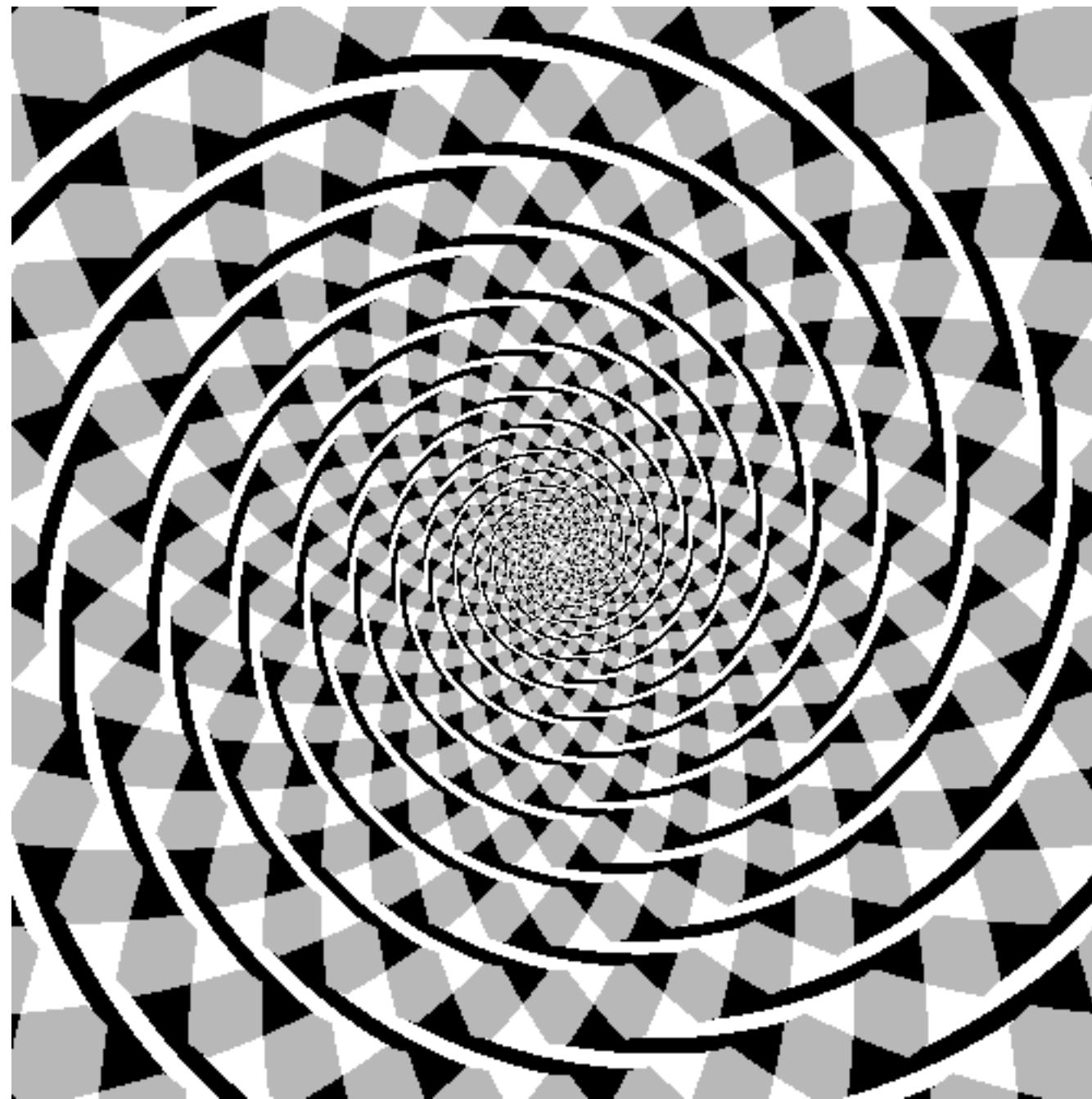
We take sensory information and use it like building materials for constructing understandings of the world.

This involves a very complex set of processes that includes anatomy & physiology, learning and experience, evolution, context and expectations. Perception is quite a significant achievement.

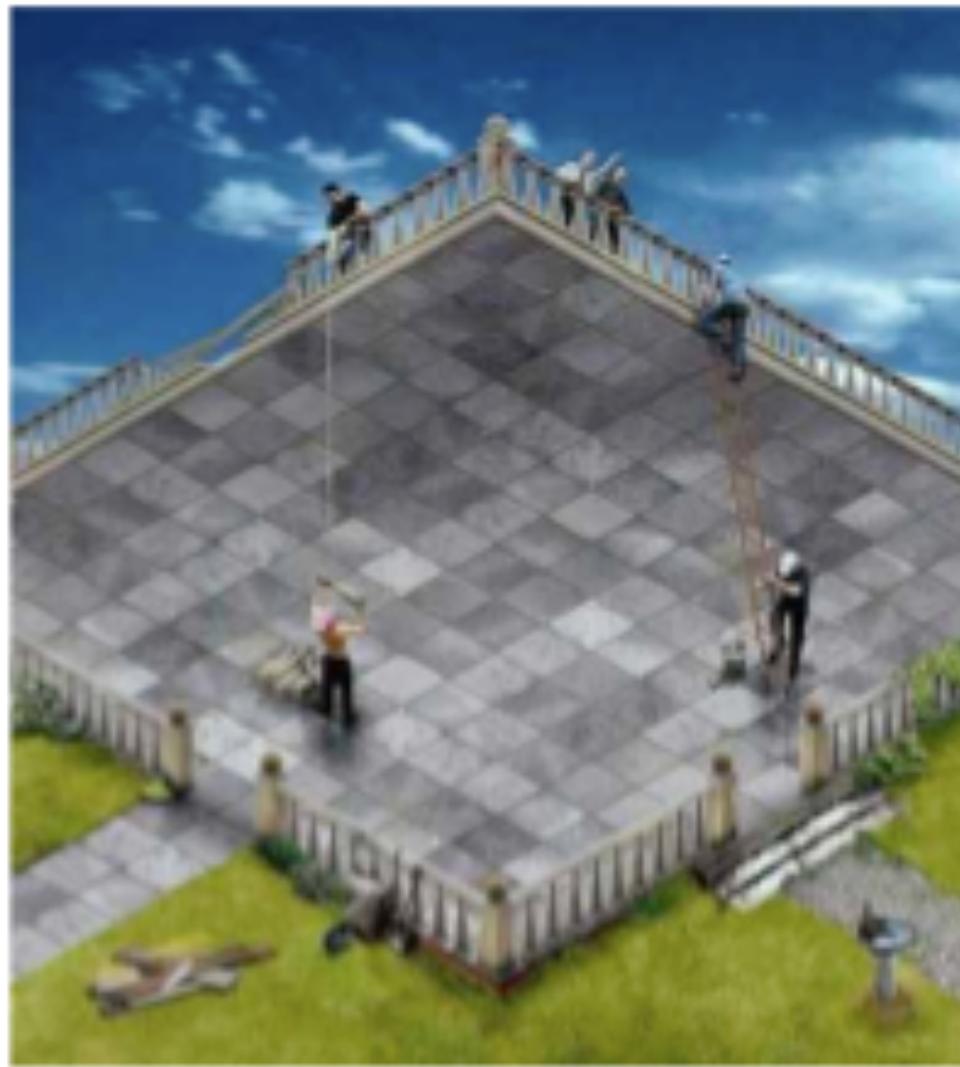
We seem pre-disposed to perceive patterns in the world which illustrates our tendency to constantly and intuitively make sense out of which is essentially chaotic. How do we achieve this?

Sometimes we just can't help making perceptual mistakes. Such as that which happens when we are presented with illusions.

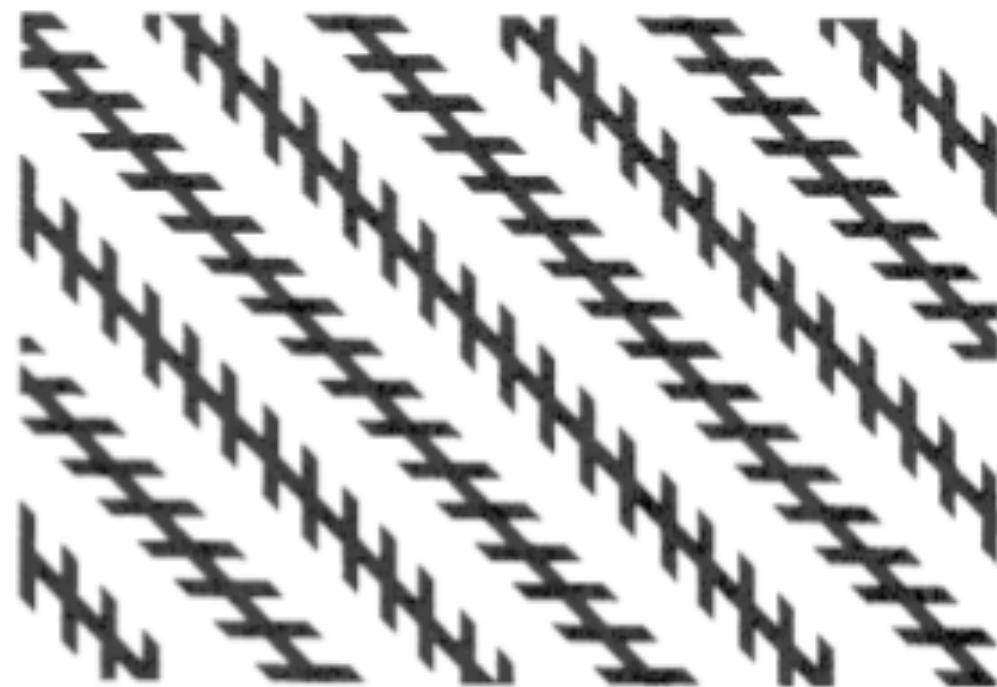




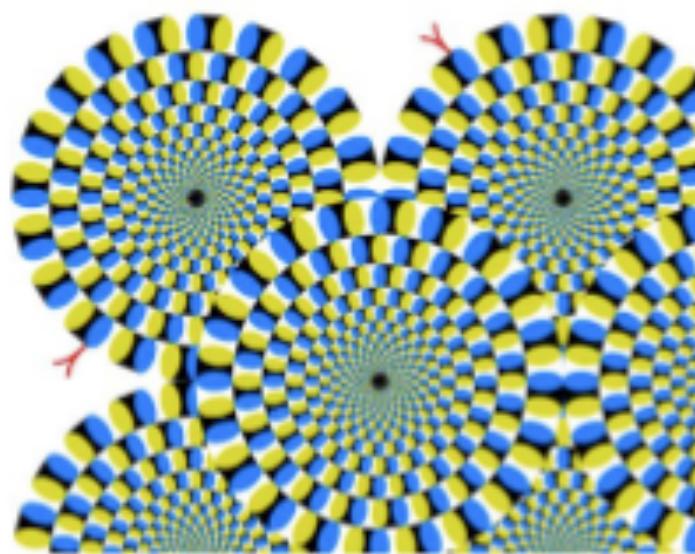
Illusions



Illusions



Illusions



Form and shape perception

Figure & Ground separation - deciding what parts of an image are to be considered background and what to be considered the object of focus.

Figure: in perception, a perceptual experience that is characterised by contour, coherence, structure, and solidity. It is typically experienced against a **ground**.

Ground: in perception, all that is perceived to be background.

Reversible figures are any class of figures that suddenly appear to change perspective or figure-ground relationship when looked at carefully and steadily.

They are used to demonstrate the fact that **figure & ground separation** is not to do with something inherent in the stimulus because the same reversible figure may give rise to **different perceptual organisations** depending how you look at it.



Top-down & Bottom-up processing



The Gestalt Approach

Early 20th Century group of Psychologists

They believed that the whole experience of perception is greater than the sum of its parts. The German word “Gestalt” means “wholeness”

We take partial information from the environment and fill in the gaps to make meaning (perception is constructive too!)

Gestalt Laws of Perception



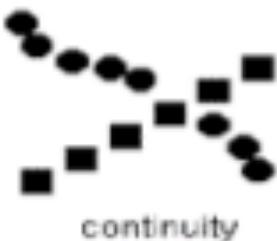
proximity



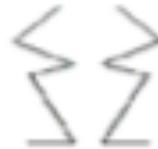
similarity



closure



continuity



symmetry

The importance of context

THE CHT

The role of language & labels

red green blue green red yellow blue
yellow red blue yellow green red blue
blue yellow yellow blue red blue yellow
red green green red green green green
green blue blue yellow yellow yellow
yellow red green yellow blue green red
blue green red red green red green blue
red yellow yellow red blue yellow blue
yellow blue red blue green green yellow
green red yellow blue yellow blue red
blue red blue green red yellow blue
green green red yellow blue yellow blue

The Stroop Effect

Other senses

Psychologists and people in general tend to be **ocularcentric**. We tend to focus on the visual sense and take the others for granted.

Other perceptual modalities include:

Auditory

Haptic or tactile

Olfactory or smell

Taste.

Multi-modality and cross-modality