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Interacting Minds Centre

# Knowledge

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# Preliminaries

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We're making some changes to help you 😊

Mikkel will take over the course starting Week 43

He will keep the syllabus so you don't have to adapt to new plans

Here is his contact information: [mikkel@cc.au.dk](mailto:mikkel@cc.au.dk)  
(also on the syllabus)



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# Knowledge

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# Building blocks of knowledge

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- › Concepts
- › Categories
- › Prototypes
- › Exemplars



# Concepts

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- › Semantic meaning of objects, events, and ideas
  - What is a cat? = What are the properties and behaviors of a cat?
- › Conceptual knowledge – allows us to recognize objects and make inferences about their properties



# Categories

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Sometimes called “ontological categories”

What is a cat? = What animals are included in the category “cats”?

- › Categorization – placing things into categories
- › Definitions don’t work well – describe a cat then look for exceptions.
- › Family resemblance – things in the same category may resemble each

# Prototypes

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Typical or “ideal” representations of a category  
What is your prototypical cat?



- › Typicality = Not all members of a category have equal status – faster recognition for prototypical features



# Exemplars

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Example from actual members

What is your exemplary cat?

Mine is brown with stripes.

Someone else might think of a lion.



# Basic Level Categories

**Global level  
furniture**

**Basic level  
table**

**Specific level  
kitchen table**





# Conceptual Knowledge

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## CATEGORIES

- Give us great economy in representation and communication
- Help us to predict
- Strongly influence the way experiences are encoded and remembered

## SOMETIMES NEGATIVE EFFECTS

- Categorization can lead to stereotyping (Dunning and Sherman, 1997).



# Propositional Representations

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## PROPOSITIONAL ANALYSIS

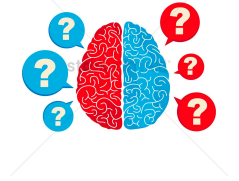
### RELATION

- › An element that organizes the arguments of a propositional representation (i.e., verbs, adjectives)

### ARGUMENT

- › An element of a propositional representation that corresponds to a time, place, person, or object

# Propositional representations



In an attempt to become more precise about what is meant by “meaning”, some have developed what is called a propositional representation.

- › How do you define a proposition?
- › A proposition is a sentence which affirms or denies a **predicate** of a **subject** with a **relation** between them, e.g.:
  - › Humans are mortal!
- › A proposition can be true or false, which is nice for philosophers and computers!
- › Kintsch (1974): Thought to be the smallest unit of knowledge that can stand as a separate assertion

# Propositional representation

- › is, according to Kintsch, representation of *meaning* as a set of propositions
- › The original stimulus might be a picture or a sentence, but the representation is abstracted away from the verbal or visual modality – (i.e. non-perceptual)
- › People tend to remember the propositions they encounter (the simple, abstract propositional units) but are insensitive to the actual

This has been an example of an amodal symbol system!



The hope is to model representation of meaning as a set of propositions!



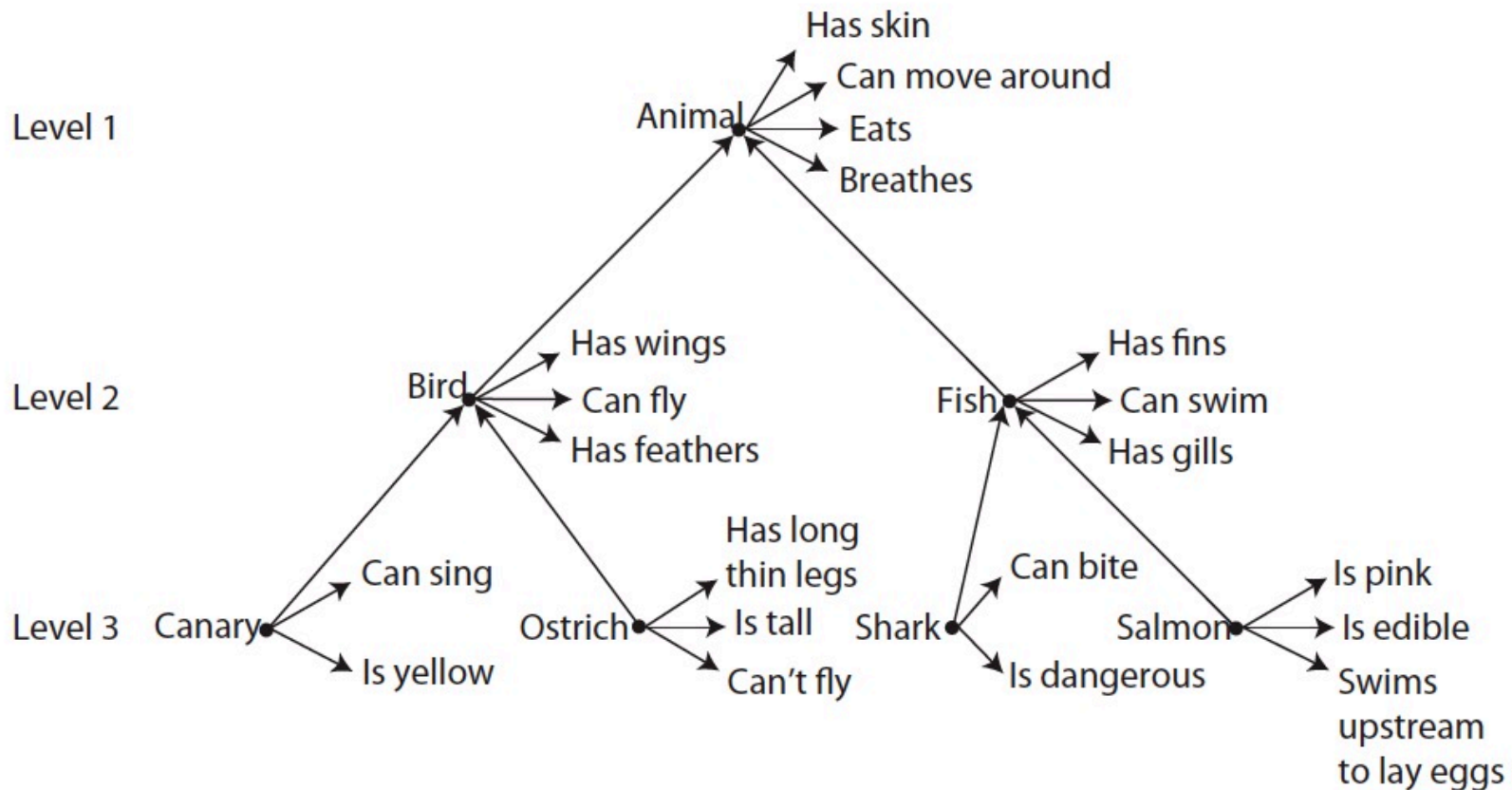
# Conceptual Knowledge: Semantic Networks

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## NETWORK REPRESENTATIONS

- Used to encode conceptual knowledge as well as propositional knowledge
- People store information about various categories in a network structure
  - › A particular link in a semantic network that indicates the superset of the category

## A Hypothetical Memory Structure Using the Example *Canary*







# Amodal vs. Perceptual Symbol Systems

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## AMODAL SYMBOL SYSTEM

- Elements within the system are inherently non-perceptual.

## PERCEPTUAL SYMBOL SYSTEM

- All information is represented in terms that are modality specific and basically perceptual.
  - › DUAL-CODE THEORY Information is represented in combined verbal and visual codes.

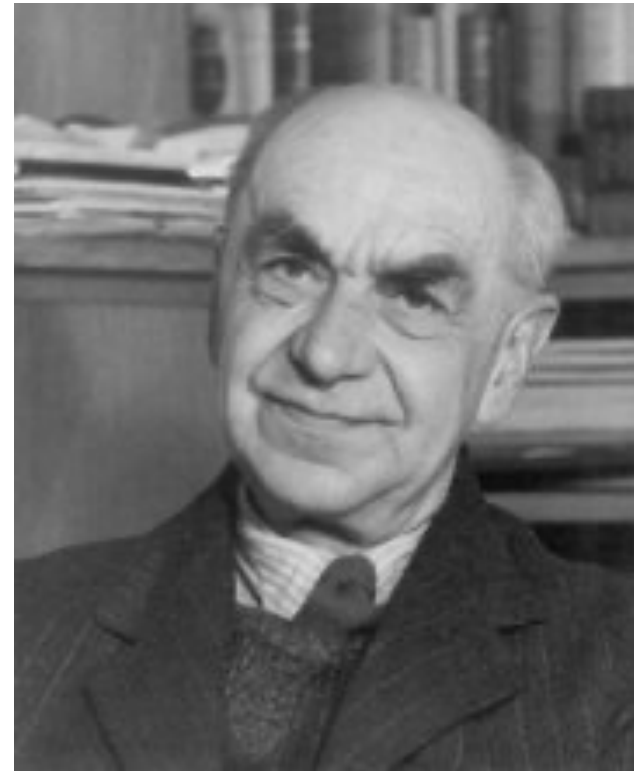
# Our Assumptions Fill Gaps in Our Understanding

**Bartlett**, culture and memory structures

## Method

- › Read a folk story from another culture
- › Report memory of story later

## RECAP



Bartlett, 1932



# Schank & Abelson (1977)

## Script theory

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All memory is episodic

Can have generalised episodic memories

- › Memory of a **type** of event
- › Memory of how that event **usually** goes
- › Called a **script**

Scripts function as schemata

- › Scripts organise new inputs
- › Scripts reconstruct memories

Scripts can be used to fill gaps in memory – these assumptions come from your cultural scripts, and are not universal!

FYI: Script theory is used in A.I.

A cognitive version of Bartlett's theory

# The restaurant script

## Scene 1: enter

- › Find a spot to sit

## Scene 2: order

- › Choose food
- › Signal to waiter
- › Etc

## Scene 3: eat

## Scene 4: leave

- › Pay bill



# Social learning or social transmission

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- › Broadly defined as “Learning that is influenced by observation of or interaction with another individual, or its products” (Heyes, 1994)
  - › Or “Learning that is **facilitated** by observation of or interaction with another individual (or its products)” (Hoppit & Laland, 2014)
- › Opposed to **asocial learning**; trial and error learning, statistical learning of the environment
- › Social learning is often referred to as ‘**Culture**’:
  - › Socially transmitted information → cultural transmission of information across generations

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- Cumulative culture:

- Process of information (knowledge, technology, etc) **accumulating over time**, building

On previous generations – and resulting in cultural traits which would be **impossible to obtain in an individual's own lifetime**

- Culture:

**Group-typical behavior patterns** shared by members of community that rely on socially learned and transmitted information

- Tradition:

Distinctive behavior pattern **shared** by two or more (in a unit),  
**persisting over time** and acquired through social learning

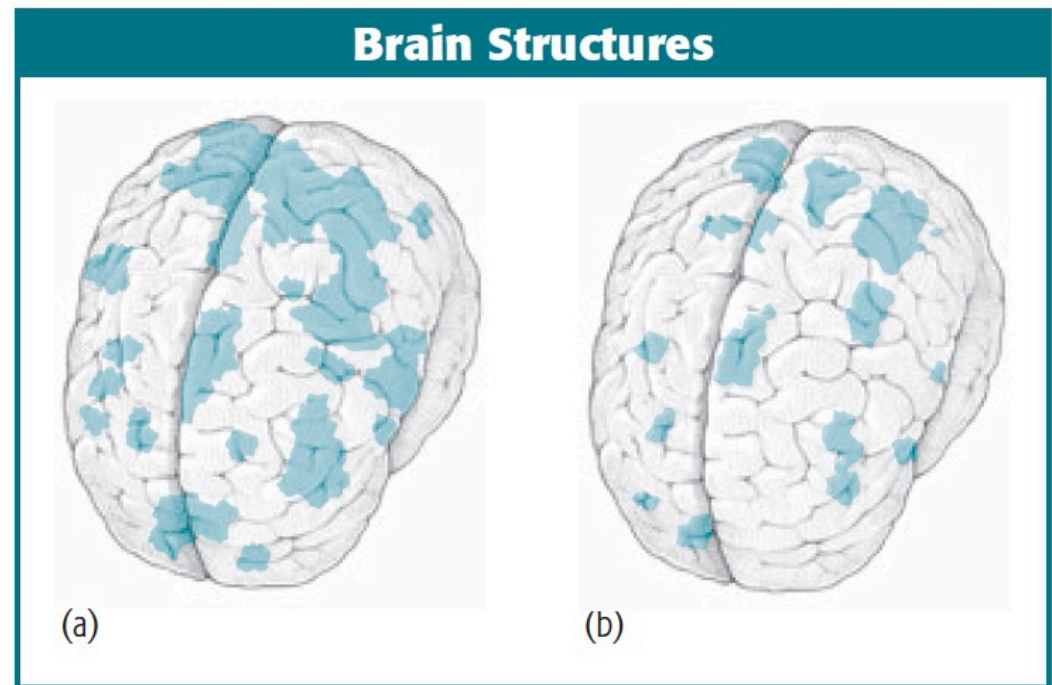
- Social transmission

when a trait T exerts a **lasting positive causal influence** on the  
rate of acquisition or performance of T in another individual

As people become more **proficient** at a task, they seem to use less of their brains to perform that task (**efficient**)

## Brain activation changes with skill acquisition

- Regions activated in the symbol-manipulation task of Qin et al. (2003)
- **Less is (sometimes) more:**  
The brain seems to have become more efficient
- Important to remember that bigger is not always better in brain-terms







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# Knowledge and the brain

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# Sensory-functional hypothesis

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- › Category-specific memory impairment = injury caused a loss to the ability to identify one type of object
  - › Couldn't identify living animals, but could identify artefacts
  - › Features (animals) vs. functions (artefacts)
- › Sensory-functional hypothesis = we use semantic memory to distinguish between features and functions

# Semantic category approach

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- › Semantic category approach = specific neural circuits are dedicated to specific categories
  - › Also called “domain-specific approach”
  - › E.g., FFA, PPA, EBA
- › Location of category processing region determines whether brain naturally associates it
  - › Is this a chicken and the egg problem?
  - › The brain things evolved this way because the associations were useful



# Multiple-factor approach

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- › Multiple-factor approach = many dimensions make up every object
  - › Our cognitive organization may reflect multiple dimensions of similarity
  - › Crowding = many objects share similar features (e.g., eyes, legs etc)

# Embodied approach

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- › Embodied approach = Knowledge of concepts is determined by our motor-sensory interactions with objects
  - › Regions of the brain related to perception activate for both the image of a hammer and the word hammer





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# Encultured contributions

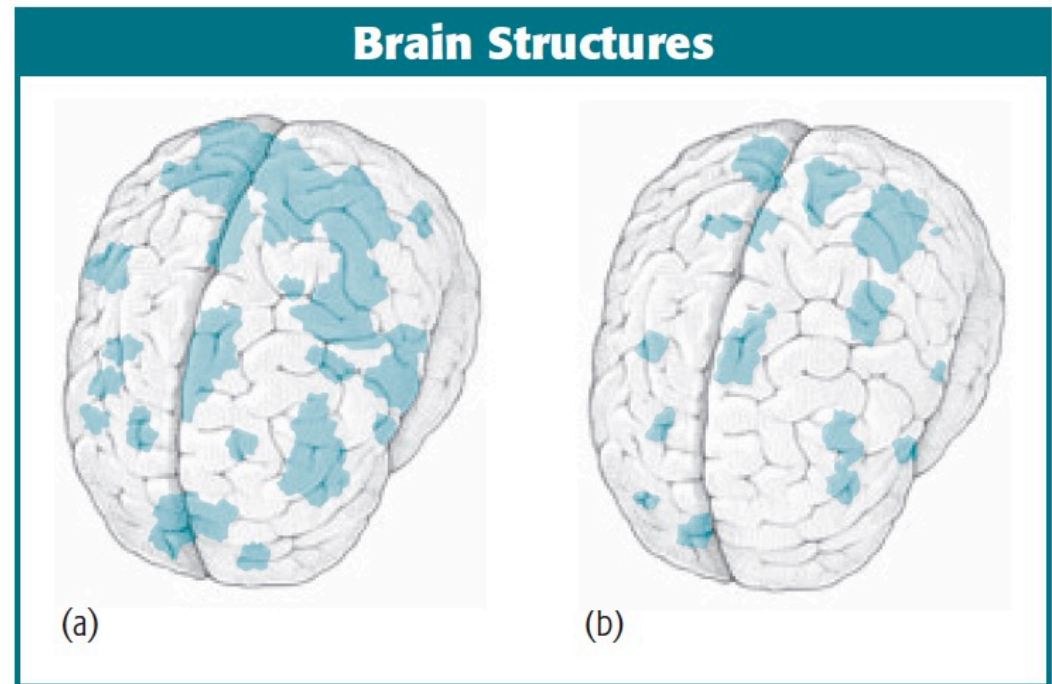
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As people become more **proficient** at a task, they seem to use less of their brains to perform that task (**efficient**)

## Brain activation changes with skill acquisition

RECAP

- Regions activated in the symbol-manipulation task of Qin et al. (2003)
- **Less is (sometimes) more:**  
The brain seems to have become more efficient
- Important to remember that bigger is not always better in brain-terms



(a) day 1 of practice; (b) day 5 of practice



# Our Assumptions Influence Our Memories

## Schema theory

- › Bartlett's subjects applied a British worldview
- › Inputs were organised according to existing frameworks/paradigms
- › The structures used to store and reconstruct memories are called *schema* – e.g, *cultural schema*







# Brains + Schema

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- › What you are exposed to is reinforced in the brain and influences functional organization of the brain as well as exemplars, prototypes, etc.



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# Why Trust the Subject?

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# Perception is flawed, Memory is Flawed, Knowledge is Contextual

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› Why is this a question for scientists?



# Modern research concerns

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- › Interviews reveal human variance
- › Academic frame is different from lay frame
  - › Do you understand what I mean? Do I understand what you mean?
- › Some patients have poor self-access
  - › Range of variance in 'healthy' population
- › Thoughts can be hard to access
  - › Fleeting, fragmented
- › People lie / embellish
  - › May be ashamed or want to hide true nature



# Trusting the subject

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- › Modern concerns are excellent
- › Good Methods can resolve these concerns



# Trusting the subject

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- › Double-meaning
  - › Believing participants
  - › Collecting reliable data
- › Both meanings are interrelated



# Trusting the Subject

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## 3 claims:

1. We definitely have self-access sometimes- we can feel it
2. Carefully-collected reports are known to be reliable
3. Psychology and cognitive science relies on subjective reports

## Scientists purport to be objective

- › Subjective reports are treated as competing with objective data
  - › False dichotomy
- › Advocated for a ‘triangulation’ of methods
  - › Introspection, behavioral, and physiological



# Methods for trusting the subject

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Good methods can resolve modern concerns

- › Approaches:
  - › Must be reliable
    - › Test-retest, inter-rater
  - › Must be consistent
    - › Changes can't be due to varied methodologies
  - › Must be valid (i.e., true)
    - › Data must reflect the participant, not the method





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