What is a shoe?

Concepts
- What is the information in Long Term Memory?
  - May be several different types
- We have knowledge about the world
  - Due to personal experience
  - Or due to language
- Such information must be in some kind of format, which we call concepts
- But what are the concepts?
  - what is the concept of "dog," "walking," or "free-market capitalism"?

Concepts
- We will look at three topics in concepts
  - Definitions (don’t really work)
  - Prototypes (closer to how humans think)
  - Exemplars (more likely than prototypes)
- And then combinations of concepts
  - propositions

Definitions
- Plato (and Socrates) spent a lot of effort trying to define terms like virtue and knowledge
  - they were largely unsuccessful
- the 20th century philosopher Wittgenstein wondered if definitions of even simple concepts were possible

Definitions
- Consider the concept shoe, you might define it as Webster’s Dictionary does
  - A covering for the human foot, usually made of leather, having a thick and somewhat stiff sole and a lighter top.
  - Anything resembling a shoe in form, position, or use.
  - Lots of shoes fit this definition

Definitions
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  - But now consider some situations and decide if they are really shoes
  - A shoe that is intended for display only
Definitions

Consider the concept shoe, you might define it as Webster’s Dictionary does:

- A covering for the human foot, usually made of leather, having a thick and somewhat stiff sole and a lighter top.
- Anything resembling a shoe in form, position, or use.

But now consider some situations and decide if they are really shoes:

- a shoe filled with cement, which cannot be worn
- a covering worn on the hands of a person without legs who walks on his hands
- And this?

The difficulty is the same one that Plato and Socrates had trying to define virtue:

- for any definition you come up with, I can find examples that do not seem to fit the definition
- But we all know what a shoe is
- so our knowledge of this concept must not be based on some precise definition
- Note, scientists can (sometimes) create precise definitions (e.g., a dog is defined by a DNA pattern or by mating abilities)
- but the definition is somewhat arbitrary

Prototypes

Perhaps what defines a concept is similarity among its members:

- there may be no absolutely necessary characteristics
- there may be no absolutely sufficient characteristics

Prototype theory supposes that similarity is judged relative to a prototype example of the concept:

- e.g., an ideal, average, or most frequent version of the concept

In prototype theory it is possible for an object to be “more” or “less” a certain concept:

Consider the concept “coffee cup” and variations (some are “cup-ier” than others)
In prototype theory it is possible for an object to be "more" or "less" a certain concept. Consider the concept "coffee cup" and variations (some are "cup-ier" than others).

Lots of experiments suggest the role of prototypes. Posner & Keele (1968): learning category names for random dot patterns. Discriminate two sets of random dot patterns. Each pattern is a variation of one of two prototype patterns.

Variations are made by moving some of the dots. Subjects learn to classify many different variants — they never see the prototypes themselves. The key test is done after subjects learn to classify the variants — reaction time for judgment is recorded for stimuli they have never seen before — new variants, the prototypes. Reaction time is faster for the prototypes. Which suggests that the mental representation of the categories (concepts) are built to favor the prototype of the category.

Look at CogLab data.
Prototypes

- Results are based on data from 156 participants.
- Pattern type: Reaction time (ms)
- Prototypes: 645
- Variants: 690
- Unanswered by this (and many other) experiments is what a prototype is:
  - a “thing” that resides in memory and contains information about the category features?
  - the result of processing information?
- A bit of thought suggests it is the result of processing information

Prototypes

- Consider the types of concepts you can have and how specific they can be
  - things: bird, dog, chair, shoe,...
  - actions: walking, running, sleeping,...
  - goal-derived: “things to eat on a diet”, “things to carry out of a house in case of a fire”;
  - ad hoc: “things that could fall on your head”, “things you might see while in Paris”, “gifts to give one’s former high school friend who has just had her second baby”;
  - When studied, these concepts all seem to have prototype characteristics

Prototypes

- We can generate new concepts from old concepts
  - it’s inconceivable that every possible prototype exists ready to be used
  - some must just be built as they are needed
  - perhaps even the prototypes for simple concepts like “bird” or “shoe” are also just built when they are needed
- A theory that can account for this processing approach is exemplar theory

Exemplars

- A concept consists of lots of examples of the concept
  - e.g., a “coffee cup” concept might contain lots of examples of coffee cups

Exemplars

- Comparing an object to see if it is a coffee cup involves comparing it to each example in memory and seeing if it matches anything well enough

Exemplars

- Even if it is a new object, it may match several exemplars well enough to generate an overall response to indicate it is a coffee cup
Exemplars

- Some coffee cups seem prototypical because they match lots of exemplars
  - that’s what defines a prototype

Exemplars

- Unlike prototype theory, exemplar theory also contains information about the variability of examples within a concept
- Thus, we know that pizzas have an average size of 16 inches but can come in lots of different sizes
- And we know that foot-long rulers have an average size of 12 inches, but essentially no variability in size

Complex associations

- How do we represent a concept that involves combinations of concepts?
  - e.g., “Dogs chase cats.”
  - e.g., “Last Spring, Jacob fed the pigeons in Trafalgar Square.”
- Need to identify the role of each concept

Propositions

- Higher order ideas
  - things doing something
- Statement that is either true or false
  - things cannot be judged true or false
  - e.g., Book, Albert, Threw, Professor, Test, Gave
  - consists of an ordered list of concepts
    - e.g., (relation:X, Agent:Y, Object:Z)
      - (relation:Throw, Agent:Albert, Object:Book)
      - (Throw, Albert, Book)

Proposition

- Network Representation
  - The proposition connects the appropriate concept nodes

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Proposition

- In the test phase, a word is given and the subject responds as quickly as possible

- The expectation is that activation will flow through the entire proposition that includes this word

- So, if the next word is part of the same proposition, a subject will respond even faster

- If words are from different propositions, no priming

Proposition

- In the test phase, a word is given and the subject responds as quickly as possible

- Activation will flow through the entire proposition that includes this word
Proposition

- When the next word is shown, its node has not been primed, so it responds more slowly

Test Phase: Priming Task

- compare RTs for second in a pair of words
- within a common proposition (bandit – passport)
- between propositions (passport – signature)
- not related in sentence (horizon – signature)
- interested in RT to second word in each pair

Ratcliff & McKoon (1978)

- results
  - within same proposition words: 561 msec
  - between proposition words: 581 msec
  - unrelated: 671

- evidence of priming by propositional activation

- We think in propositions!

Conclusions

- Concepts
  - definitions
  - prototypes
  - exemplars

- Propositions
  - Evidence we think in terms of propositions

Next time

- Other types of knowledge
- Mental images
  - mental rotation
  - mental scaling
  - limitations of

- CogLab on Mental rotation due?
- Is a picture in your head like a picture in the world?