Chapter 9
Concepts and Generic Knowledge

Definitions and Concepts
• Definition
  – includes superordinate category
  – Properties of the defined object that distinguish it from other members of the category
  – E.g. a triangle is a polygon (a closed, straight-sided figure) with three sides & three angles
• Concepts – often difficult to define; e.g. game, virtue
  – Always exceptions to definition
• People comfortable using concepts even if they can’t define them

Family Resemblance
• Defining features essential for category membership
• Characteristic features characterize most members of the category
• Definition of concept includes properties likely to characterize instances
  – E.g. dogs have 4 legs, fur, a tail and they bark
• Wittgenstein: Family resemblance
  – Members of a family share traits, but not all family members have the same set of traits
  – E.g. Dad & one kid have blond hair, blue eyes; Mom and 2nd kid have brown hair and eyes. Daughter has grandfather’s nose; son has grandmother’s personality etc.
Family Resemblance - 2

- Family Resemblance
  - No defining features (features shared by all family members)
  - Matter of degree, not all-or-none
  - No necessary or sufficient properties
    - E.g. Triangle must have three sides which form a closed figure. Note: this is a definition.
    - Properties are both necessary & sufficient.

Prototypes & Fuzzy Boundaries

- Specify “most typical” or most “average” example, e.g. robin is typical bird
  - Prototype
- Some birds are obviously birds; some birds are harder to classify, e.g. penguins swim & waddle but don’t fly. Emus are large & don’t fly.
- Different people may have different prototypes (typical bird in Nfld. vs typical bird in Brazilian jungle)
- Prototypes = benchmarks or anchors
- Usually think about prototype

Prototypes & Fuzzy Boundaries - 2

- Categorization involves comparison between prototype and exemplar
- Some categories have fuzzy boundaries (e.g. celebrity)
  - Not clear who is and who is not a celebrity
- Fuzzy boundaries → graded membership
- Graded membership: some members are more typical members of category
  - Items more similar to prototype = more typical members
Testing the Prototype Notion

• Sentence verification Task: A robin is a bird.
• Latency (response time) depends on Semantic Distance (number of connections to be traveled)
• Responses faster for true than false sentences (More connections to search for false sentences.)

Testing the Prototype Notion - 2

• Typicality effects: “A robin is a bird” is faster than “A penguin is a bird”
• Explanation: distance from prototype
  – Faster response when more features in common with prototype
• Circular argument. Need different measures of “typicality”.
• If we can measure “typicality” in a variety of tasks and get similar effects ➔ don’t have problem with circular argument.

Testing the Prototype Notion - 3

• Variety of tasks converge
• “Typical” category members
  – give fastest RTs in sentence verification
  – are produced first in production task
  – are given highest typicality ratings
  – are best recalled in memory task,
  – are rated as the most attractive etc.
• Eliminates problem of circular argument
Converging Evidence for Prototypes

- **Sentence Verification**: faster responses for “typical” exemplars → more similar to prototype
- **Picture Identification**: Is next picture a dog? Get faster responses for “typical” exemplars of category
- **Production Task**: Ask Ss to produce exemplars from a particular category. Most “typical” exemplars are produced first.
- **Judgements of Category Membership**: Items given higher ratings (more similar) are those that give fast responses in SV & PI tasks

Converging Evidence for Prototypes - 2

- **Three-step task**: ask people to make up sentences about categories. (E.g. Businessmen wear suits.)
  - Es substituted either typical (prototype) or atypical category member,
- Ss rate new sentences on plausibility or silliness.
- Ratings reflected typicality of substituted words
  - “Executives…” more acceptable than “Escort service owners…”

Basic Level Categories

- “Natural” level of categorization → Basic level
  - Not too general & not too specific
- Answer question, “What is that?”
- Basic level categories – named by single words; e.g. What kind of pet do you have? What furniture do you have in your apartment?
- Basic level categories used most often, learned first.
- Memory errors: recall basic-level word rather than more specific word which was presented & vice versa
Analogies from Remembered Exemplars

- Prototype theory: always use the same prototype for comparison
- Categorization may depend on specific exemplars rather than prototype
  → Exemplar-based reasoning
  - Use of prototype or exemplar may depend on similarity of test item to exemplar, retrievability (frequency, recency etc.) of exemplar
  - E.g., doctor diagnosing might think of recent similar case

Typicality Effects and Exemplars

- Exemplar theory: may use different exemplars depending on context & retrieval cues present
- If item is similar to typical exemplars, many items retrieved quickly → rapid decision in sentence verification or classification task
- E.g., show robin-like (or starling-like) creature and ask if it is a bird. S recalls robin or sparrow or other typical bird & decides ‘yes’.  
  - For penguin, emu, or ostrich, similar exemplar harder to retrieve.
  - Fewer similar exemplars retrieved than if test exemplar is ‘typical’.

Typicality Effects and Exemplars - 2

- Get faster response times for typical exemplars
- Less typical exemplars more difficult to retrieve in production task
  – Not primed, less interconnected
- Exemplar-based reasoning consistent with observed typicality effects
- Both exemplar theory & prototype theory can explain typicality effects
Typicality Effects and Exemplars - 3

- Prototypes do not preserve information about variability of category exemplars, but people do take variability into account.
- Exemplar-based reasoning can account for variability.
  - Retrieval of several exemplars, exemplar similar to test item.

Analogy from Remembered Exemplars: Demo

- MAUGH
- LOUGH
- BEDICE
- SONE
- BOUR
- ROUCH

Analogy from Remembered Exemplars: Demo - 2

- MAUGH: LAUGH vs. DAUGHTER
- LOUGH: TOUGH vs. COUGH vs. DOUGH vs. BOUGH vs. THROUGH etc.
- BEDICE: POLICE vs. DEVICE vs ALICE
- SONE: DONE vs. GONE vs. TONE
- BOUR: HOUR vs. FOUR
- ROUCH: TOUCH vs. COUCH vs. POUCH COVE
Exemplars & Variability

- Retrieving a number of category exemplars → info about variability of category members
  - Info about variability → category boundaries
  - Anthropologist finds skeleton that is somewhat similar to known dinosaurs, but has some differences.
- Prototype does not give information about variability

Pliability of Mental Categories

- Mental categories not fixed like subject categories in MUN library catalogue.
- People can change perspective
  - Rate typicality of tropical birds, Chinese birds etc. Will get different typicality ratings than without special instructions.
- Goal-derived categories (categories established to meet specific criteria)
  - Things to take on a moose-hunting trip
- Ad Hoc categories (categories created in response to specific question)
  - Tourist attractions in Paris

Pliability of Mental Categories - 2

- Humans are very flexible &
- Use knowledge about both prototypes & exemplars
Odd & Even Numbers

• Situation in which typicality and category membership ratings not correlated
• Categories "Odd Numbers" & "Even numbers" are well defined.
• Have Ss rate typicality of odd & even numbers
• Get consistent ratings with different numbers in each category rated differently
  – Higher numbers rated ‘less typical’ in each category than lower numbers
  – See Table page 289 of text
• Presence of clear category boundaries does not rule out use of other information in category membership judgements.

Lemons & Counterfeit Money

• Situations in which typicality judgements do not correlate with category membership judgements
  – Whales more typical fish than sea lampreys, but whales are not fish & sea lampreys are.
• Category membership not necessarily judged by typicality.
• Take lemon, remove resemblance to lemons. (eg. Paint it, spray perfume on it, add sugar & flavouring, flatten it. Etc. Lemon no longer looks, smells or tastes like a lemon.)
Lemons & Counterfeit Money - 2

- Counterfeit money or well made plastic lemon – looks like real thing, but isn’t.
  - People understand difference between real think & realistic imitation
- Perceptual similarity is not defining characteristic of many concepts.
- Can have category membership without similarity (abused lemon) & recognition of nonmembership in spite of similarity (counterfeit money)
- Keil: asked children what makes something a coffee pot or a raccoon, could a toaster be turned into a coffee pot?

Lemons & Counterfeit Money - 3

- Children understood that with certain modifications a toaster could be changed into a coffee pot, but a skunk could not be changed into a raccoon.
- We reason differently about living things & manufactured objects
- “Deep” features:
  - Counterfeit money not made by the mint.
  - Lemons grow on trees, are used to season food etc.
  - Raccoons are living things, don’t have skunk parents.
    - Adults would understand about skunks & raccoons having different genes

Lemons & Counterfeit Money - 4

- Essential properties: depend on a network of other beliefs about how things come to be (animals are born or hatched from eggs; real money produced by government)
- Concepts are part of a network of information about how objects in world relate to one another
  - Concepts about money depend on knowledge of government, banking, currency etc.
- Typicality not necessary nor sufficient for category membership.
Complexity of Similarity

• Resemblance – depends on context.
  – Identical twins: “not alike at all” (Speaker focuses on differences.)
  – Any two unrelated human beings are highly similar.
• Which features are important to consider depend on background knowledge & on category & situation.
  – Colour relevant to determining if fruit is lime or lemon, if blueberries are ready to pick or not.

Complexity of Similarity - 2

• Background knowledge & situation - cont’d.
  – Weight important for checked baggage, if one is traveling by air, but size important for carry-on bags or for travel by car or bus.
  – Appearance important in detecting counterfeit money, but newly designed bills or coins, which look different from the old money, are readily accepted.
• In order to use category knowledge, must know essential or “deep” properties of category
• Human thinking highly flexible and adaptable

Complexity of Similarity - 3

• When comparing objects, which features to compare depends on beliefs about concepts in question.
  – Importance of attribute depends on concept
    • Origin important for money, living things but not for manufactured items.
    • Exact colour relevant for artists paints or for decor, but not for buying radios or books
Concepts as Theories about the World

• Concepts = theories about objects
  – Include exemplars, prototypes, beliefs & expectations
• To classify a new object...
  – Attend to features on basis of knowledge & beliefs
    • Encounter wild animal
    • See interesting plant
    • Meet new person
  – Responses based on how we categorize object or person or situation.

Concepts as Theories about the World - 2

• Responses to new person, situation or object based on prior experience, knowledge & beliefs about similar people, objects, situations.
• Concept = interconnected network of knowledge & beliefs about the world. Knowledge of any concept (emus, prototypes) involves knowledge about related concepts (penguins, robins & eagles or exemplars, similarity etc)
  – Concept = ‘theory’ about objects

Category Coherence

• Properties of objects in a category linked in ‘meaningful’ manner
  – Birds fly, build nests in trees, lay eggs, migrate south in winter
• Easier to learn concepts if features are coherent
• ADD & ADHD – defined by group of symptoms
  – Hyperactivity, inability to pay attention (to schoolwork), distractability (in school), impulsiveness, difficulty planning ahead & organizing oneself, etc.
    • no theoretical mechanism ⇒ diagnosis is hit-or-miss
    • Features are not coherent ⇒ controversy over diagnosis
Category Coherence - 2

- Dyslexia – usually defined in terms of discrepancy between IQ & reading achievement.
  - Difficulty learning to read and spell in presence of normal IQ
  - There are dyslexic kids with high IQ and with low IQ
  - There are children with low IQ who learn to read
  - Children with Autism Spectrum Disorder often good spellers & decoders but don’t understand what they read

Concepts as Theories of the World

- Determine how easily we learn new concepts (hammer example in text)
- Influence category judgements
  - E.g. diagnosis of dyslexia and ADHD
- Shape reasoning about a concept.
  - School policies regarding special needs, importance of diagnosis
  - Assumption that children with dyslexia or ADHD need special teaching methods or behaviour management

Categorization and Reasoning

- Categorization → generalization
- Generalize from the category to specific exemplars, & vice versa
  - Unfamiliar bird → assume it flies, builds nests in trees, lays eggs, has feathers rather than fur, etc.
  - Unfamiliar animal, resembles cat → infer it is predator, has claws & teeth, can climb trees, gives birth to live young