Semantic Memory

1

1

General Knowledge

- Structure of Semantic Memory
  - Background
  - Feature Comparison Model
  - Prototype Approach
  - Exemplar Approach
  - Network Models
- Schemas & Scripts
  - Background
  - Recall of Scripts
  - Schemas & Memory Selection
  - Schemas & Boundary Extension
  - Schemas & Memory Abstraction
  - Schemas & Memory Inferences
  - Schemas & Integration in Memory
  - Conclusions

2

2

Semantic Memory

- General Conceptual Knowledge
- Lexical Knowledge (e.g., "apple" and )
- Organized - (e.g., 'pencil' related to 'pen'; think of 'apple' ----> 'banana'
- Categories and Concepts

  Category - a class of objects that belong together (e.g., variety of objects: 'fruits' or 'apple')

  Concept - mental representation of a category

3

3

- Concepts allow us to make inferences when we encounter new instances (e.g. read 'chair)
- Natural concepts vs. Artifacts

↓	↓
apple	table
dog	pen
tree	chair

- Questions
  - Organization and Structure?
  - Storage?
  - Inferences?
  - Cognitive Economy?
  - Relatedness and Similarity?

4

4

The Sentence Verification Technique

For each of the items below, answer as *quickly as possible* either true or false.

1. A poodle is a dog.
2. A squirrel is an animal.
3. A flower is a rock.
4. A carrot is a vegetable.
5. A mango is a fruit.
6. A petunia is a tree.
7. A robin is a bird.
8. A rutabaga is a vegetable.

5

5

Classic Feature Comparison Models

- Concepts = list of features or attributes (e.g., Smith, Shoben, and Rips 1974)
- Classic Definition of Concepts
- Defining vs. Characteristic Features
- Decision Process - 2 Stages
  - Stage 1 = compare all features (global comparison)
  - Stage 2 = compare only the defining features
- Typicality Effects

6

6

The Sentence Verification Technique

How does the Feature Comparison Model account for differences in response times?

1. A poodle is a dog.
2. A squirrel is an animal.
3. A flower is a rock.
4. A carrot is a vegetable.
5. A mango is a fruit.
6. A petunia is a tree.
7. A robin is a bird.
8. A rutabaga is a vegetable.

7

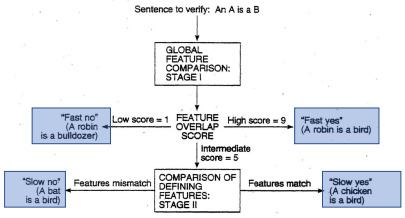
7

A robin is a bulldozer

A robin is a bird

A bat is a bird

A chicken is a bird



8

8

The Prototype Approach

9

9

Prototype Approach

- Classical View vs. Prototype
- Eleanor Rosch
- Category organized around a Prototype – An ideal member
- Membership established by comparing possible members to the prototype
- Graded membership – members vary in how representative of the category they are

10

10

What is a bachelor?

- According to the classic definition of conceptual representation of category membership:
  - bachelor = unmarried, male.
- But which of these individuals is really a bachelor?
  - My 6 month old son Tim
  - An elderly Catholic Priest
  - My 32-year old cousin, John, who works at a bank in Chicago

11

11

Characteristics of Prototypes

1. Prototypes are supplied as examples of a category.
2. Prototypes serve as reference points.
3. Prototypes are judged more quickly after priming.
4. Prototypes can substitute for a category name in a sentence.
5. Prototypes share common attributes in a family resemblance category.
   - No one attribute shared by all members
   - In / out phenomenon

12

12

Prototypes Supplied as Examples of a Category – (e.g. Mervis, Catlin, & Rosch (1976))

- Group 1: generated examples for 8 different categories
  - Birds? … robin, sparrow …
  - Fruits?
  - Sports?
  - Etc.
- Group 2: provided prototype ratings (low to high) for each example
  e.g., sparrow 7 - high
  penguin 2 - low
- Strong correlation between frequency and rating
- Typicality Effect

13

13

Prototypes serve as Reference Points

PROTOTYPES AS REFERENCE POINTS

Pairs of items are listed below, together with a sentence containing two blanks. Choose one item to fill the first blank, and place the other item in the second blank. Take your time, try the items both ways, and choose the way in which the "sentence" seems to make the most sense.

1. (10, 11) _____ is essentially _____.
2. (103, 100) _____ is sort of _____.
3. (48, 50) _____ is roughly _____.
4. (1000, 1004) _____ is basically _____.

14

14

Prototypes Judged More Quickly than Nonprototypes, After Semantic Priming

15

15

For the following items: Decide whether each item is a word ('yes') or not a word ('no'). Respond by pressing the 'yes' button or the 'no' button:

apple

table

tadjld

mountain

pudor

16

16

Lexical Decision Task

You must decide whether each item is a word ('yes') or not a word ('no'). The DV is the response time & the IV is the type of stimulus (e.g. word vs. nonword)

apple

table

tadjld

mountain

pudor

17

17

What Is a Priming Effect?

Lexical Decision Task

doctor	hospital	automobile
↓	↓	↓
Y/N	doctor	doctor
↓	↓	↓
450 ms	Y/N	Y/N
	↓	↓
	400 ms	450 ms

18

18

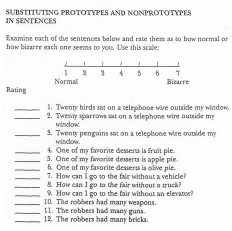
Category Priming Effect

	Robin	Penguin
	550 ms.	670 ms.
Prime:	Bird	Bird
	Robin	Penguin
	? ms.	? ms.
RTs?:	480 ms.	660 ms.

19

19

Prototypes can substitute for a Category Name



SUBSTITUTING PROTOTYPES AND NONPROTOTYPES IN SENTENCES

Examine each of the sentences below and rate them as to how normal or how bizarre each one seems to you. Use this scale:

1 2 3 4 5 6 7
Normal Bizarre

Rating

_____ 1. Twenty birds sat on a telephone wire outside my window.
_____ 2. Twenty sparrows sat on a telephone wire outside my window.
_____ 3. Twenty penguins sat on a telephone wire outside my window.
_____ 4. One of my favorite desserts is fruit pie.
_____ 5. One of my favorite desserts is apple pie.
_____ 6. One of my favorite desserts is olive pie.
_____ 7. How can I go to the fair without a vehicle?
_____ 8. How can I go to the fair without a truck?
_____ 9. How can I go to the fair without an elevator?
_____ 10. The robbers had many weapons.
_____ 11. The robbers had many guns.
_____ 12. The robbers had many bricks.

20

20

Prototypes Share Attributes in a Family Resemblance Category

21

21

PROTOTYPE RATINGS FOR WORDS IN THREE CATEGORIES. ROSCH AND MERVIS (1975).

	Category		
Item	*Vehicle*	*Vegetable*	*Clothing*
1	Car	Peas	Pants
2	Truck	Carrots	Shirt
3	Bus	String beans	Dress
4	Motorcycle	Spinach	Skirt
5	Train	Broccoli	Jacket
6	Trolley car	Asparagus	Coat
7	Bicycle	Corn	Sweater
8	Airplane	Cauliflower	Underwear
9	Boat	Brussels sprouts	Socks
10	Tractor	Lettuce	Pajamas
11	Cart	Beets	Bathing suit
12	Wheelchair	Tomato	Shoes
13	Tank	Lima beans	Vest
14	Raft	Eggplant	Tie
15	Sled	Onion	Mittens

22

22

Group 1: Prototype Ratings

e.g., vehicles: car, truck, tractor, sled
vegetable: carrots, beets, eggplant
clothing: shirt, sweater, vest

Group 2: List attributes possessed by each item:

e.g., car: wheels, steering wheel, doors, etc.

Score: What proportion of an item's attributes were shared by other category member's

Strong correlation between score and prototype rating.

23

23

Levels of Categorization

24

24

What are these objects?






25

25

Levels of Categorization 1

- Superordinate Level
  - furniture, animal, tool
- Basic Level
  - chair, dog, screwdriver
- Subordinate Level
  - desk chair, German Shepherd, flathead screwdriver

26

26

Characteristics of the Basic Level

1. Basic-level names are used to identify objects
2. Members of basic-level categories have more attributes in common
3. Experts use subordinate categories differently

27

27

Experts vs. Novices

	Expert	Novice
Superordinate	_____	_____
Basic	10 +	11 +
Subordinate	10 +	6 +

28

28

Conclusions about Prototype Approach

- Prototype approach accounts for our ability to form concepts about groups or categories that are loosely structured
- Prototypes are *idealizations* or *abstractions* from many examples of a category
- What constitutes a prototype for a given category can shift over time (e.g. a prototypical piece of clothing)
- What about specific information about a particular member? Need another mechanism perhaps.

29

29

Exemplar Approach

30

30

Exemplar Approach

- First learn information about specific examples of a category.
- Each example stored in memory is called an ***exemplar***
- The ***conceptual representation*** of a category ***is*** simply the collection of stored exemplars for that category
- Decision Process = Potential 'new' member compared to the collection of exemplars.
- We classify new stimulus by deciding how closely it resembles *all* of the stored examples of a category.

31

31

Conclusions about the Exemplar Approach

- Exemplar approach emphasizes there is no need for abstraction.
- Abstraction (or forming a prototype) requires throwing away specific information about individual cases
- Problem with the exemplar approach: Semantic memory storage requirements may be enormous
- May be more suitable for smaller categories

32

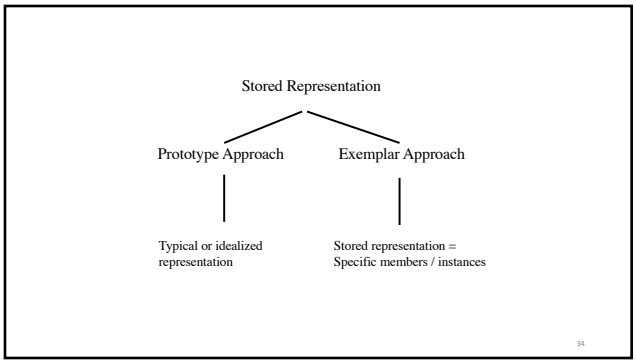
32

Comparing Prototype & Exemplar Approaches

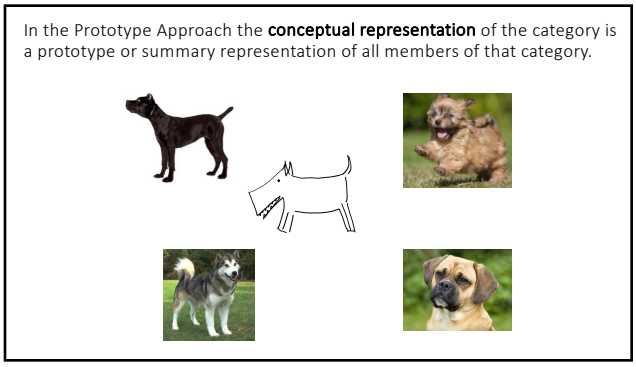
- Both approaches suggest category membership is determined by comparing a new item against a ***stored representation*** of the category.
- If the ***similarity*** of new item is strong enough, you conclude the item belongs in the category.
- **Prototype approach** – Stored representation is a summary (or abstraction), an idealized, best member
- **Exemplar approach** – Stored representation is the collection of stored exemplars (or examples) of the category.

33

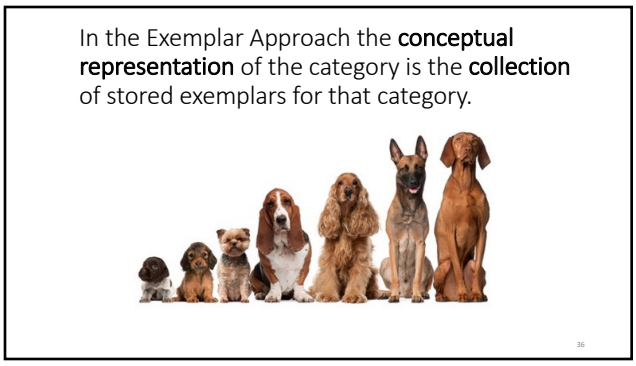
33


Stored Representation
Prototype Approach
Exemplar Approach
Typical or idealized representation
Stored representation = Specific members / instances
34

34


In the Prototype Approach the conceptual representation of the category is a prototype or summary representation of all members of that category.

35


In the Exemplar Approach the conceptual representation of the category is the collection of stored exemplars for that category.
36

36

Combining Both Approaches

- Exemplar approach may be most relevant when a category is small.
- Prototypes may be more relevant as category size increases
- Individual differences (e.g. as a function of expertise)
- Possible co-existence of prototypes and exemplars
- Strategic differences
- Importance of category learning

37

37

Network Models

38

38

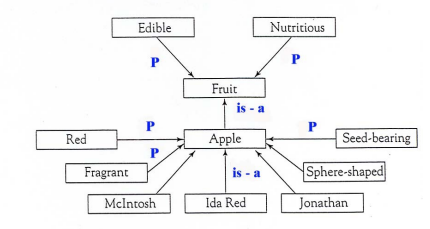
Network Models

- Semantic networks
  - (concepts and connections ----> nodes and links)
- Collins & Loftus
  - Node = concept
    Link = relation or connection
  - Spreading activation
- Sentence verification ----> intersections
- Explaining 'Typicality Effect'

39

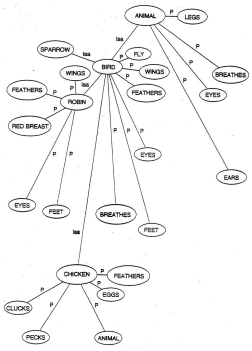
39

AN EXAMPLE OF A NETWORK STRUCTURE FOR THE CONCEPT *APPLE*, AS IN THE COLLINS AND LOFTUS NETWORK MODEL.



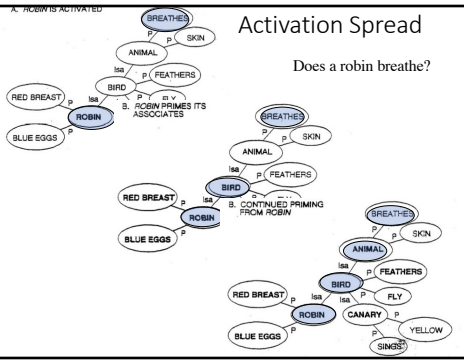
40

40



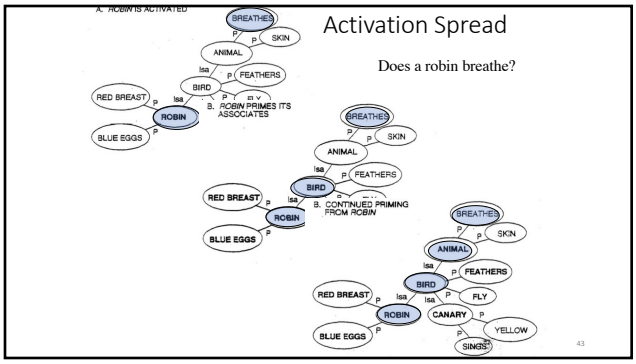
41

41

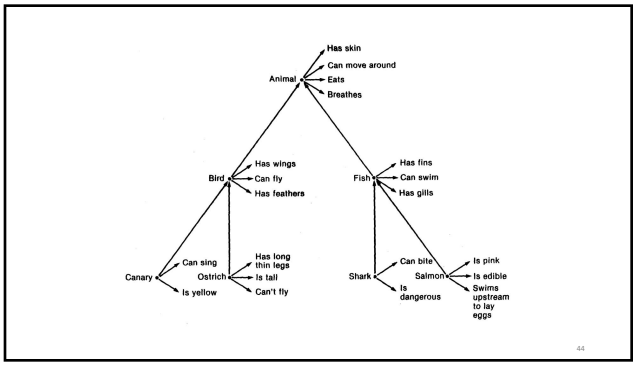


42

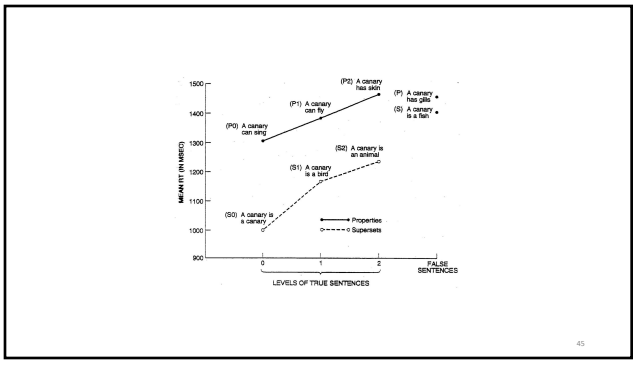
42


Activation Spread
Does a robin breathe?
A. ROBIN IS ACTIVATED
B. ROBIN PRIMES ITS ASSOCIATES
B. CONTINUED PRIMING FROM ROBIN
BREATHES
SKIN
ANIMAL
FEATHERS
BIRD
FLY
CANARY
YELLOW
SINGS
RED BREAST
ROBIN
BLUE EGGS
isa
P
43

43


Has skin
Can move around
Eats
Breathes
Animal
Has wings
Can fly
Has feathers
Bird
Has fins
Can swim
Has gills
Fish
Can sing
Ostrich
Is yellow
Canary
Has long thin legs
Is tall
Can't fly
Can bite
Salmon
Is dangerous
Shark
Is pink
Is edible
Swims upstream to lay eggs
44

44


(P2) A canary has skin
(P1) A canary can fly
(P0) A canary can sing
(P) A canary has gills
(S) A canary is a fish
(S2) A canary is an animal
(S1) A canary is a bird
(S0) A canary is a canary
Properties
Supersets
MEAN RT (IN MSEC)
1500
1400
1300
1200
1100
1000
900
0
1
2
FALSE SENTENCES
LEVELS OF TRUE SENTENCES
45

45

Summary of Network Models

Unlike the other theories, Network Models capture relationships between concepts

Network Models capture the *hierarchical* nature of Categorical Knowledge.

Network Models can easily explain typicality effects

46

46

Schemas & Scripts

47

47

Schemas

1. Larger cognitive units
2. Packages of interrelated units
3. Used to interpret, encode, understand, and remember new instances
4. Provide expectations about what should occur (top - down)
5. Default values / parts - filled in when schema activated
6. Sometimes - errors

48

48

Scripts

- Simple, well- structured sequence of events associated with a highly familiar activity
- Schema vs. script
- Recall of scripts
  - Different from conceptual categories (Barsalow & Sewell, 1985)
  - Script Identification - early vs. late (Trafimow and Wyer, 1993)

49

49

Trafimow & Wyer (1993)

- 4 different scripts
  - Photocopying a piece of paper
  - Cashing a check
  - Making tea
  - Taking the subway
- Irrelevant details added (e.g., taking candy out of pocket)
- Script - identification information presented first or last
- Filler
- Recall: of script - related events

23% vs. 10%
(script identified first) (script identified last)

50

50

THE NATURE OF SCRIPTS

Read the following paragraph, which is based on a paragraph from Trafimow and Wyer (1993, p. 368):

After doing this, he found the article. He then walked through the doorway and took a piece of candy out of his pocket. Next, he got some change and saw a person he knew. Subsequently, Joe found a machine. He realized he had developed a slight headache. After he aligned the original, Joe put in the coin and pushed the button. Thus, Joe had copied the piece of paper.

Now, turn to the list of new terms for Chapter 7, on page 267. Look at the first two columns of terms and write out the definition for as many of these terms as you know, taking about 5 minutes on the task. Then look at the additional instructions for the present demonstration, which appear at the bottom of Demonstration 7.6, on page 247.

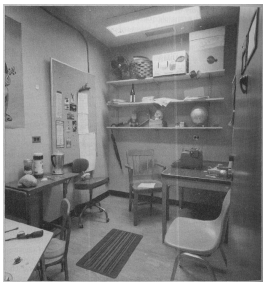
51

51

Demonstration

52

52



53

53

Okay…

Write down everything that you can remember seeing in the room.

I'll give you 1 minute

Starting now.

… 10

… 20

… 30

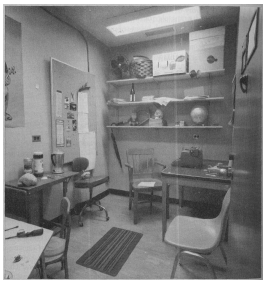
… 40

… 50

… 60

54

54



55

55

Schemas and Memory Selection

- Remember best info consistent with schema or inconsistent
- Brewer & Treyons (1981)
- Rojahn & Pettigrew (1992)
- Incidental vs. Intentional learning

56

56

Schemas and Memory Abstraction

- Abstraction Process
- Verbatim vs. Gist

57

57

CONSTRUCTIVE MEMORY. BASED ON JENKINS (1974).

Part 1

Read each sentence, count to five, answer the question, and go on to the next sentence.

SENTENCE	QUESTION
The girl broke the window on the porch.	Broke what?
The tree in the front yard shaded the man who was smoking his pipe.	Where?
The cat, running from the barking dog, jumped on the table.	From what?
The tree was tall.	Was what?
The cat running from the dog jumped on the table.	Where?
The girl who lives next door broke the window on the porch.	Lives where?
The scared cat was running from the barking dog.	What was?
The girl lives next door.	Who does?
The tree shaded the man who was smoking his pipe.	What did?
The scared cat jumped on the table.	What did?
The girl who lives next door broke the large window.	Broke what?
The man was smoking his pipe.	Who was?
The large window was on the porch.	Where?
The tall tree was in the front yard.	What was?
The cat jumped on the table.	Where?
The tall tree in the front yard shaded the man.	Did what?
The dog was barking.	Was what?
The window was large.	What was?

58

58

Cover the preceding sentences. Now read each of the following sentences and decide whether it is a sentence from the list in Part 1.

1. The girl who lives next door broke the window. (old _____, new _____)
2. The tree was in the front yard. (old _____, new _____)
3. The scared cat, running from the barking dog, jumped on the table. (old _____, new _____)
4. The window was on the porch. (old _____, new _____)
5. The tree in the front yard shaded the man. (old _____, new _____)
6. The cat was running from the dog. (old _____, new _____)
7. The tall tree shaded the man who was smoking his pipe. (old _____, new _____)
8. The scared cat was running from the dog. (old _____, new _____)
9. The girl who lives next door broke the large window on the porch. (old _____, new _____)
10. The tall tree shaded the girl who broke the window. (old _____, new _____)
11. The cat was running from the barking dog. (old _____, new _____)
12. The girl broke the large window. (old _____, new _____)
13. The scared cat ran from the barking dog that jumped on the table. (old _____, new _____)
14. The girl broke the large window on the porch. (old _____, new _____)
15. The scared cat which broke the window on the porch climbed the tree. (old _____, new _____)
16. The tall tree in the front yard shaded the man who was smoking his pipe. (old _____, new _____)

59

59

Results?

How many of the sentences did you recognize as 'old' sentences?

Most participants recognize half or more of the sentences as old.

In fact, *none* of the sentences were from the original list (old). They were all *new* sentences

Why do these *new* sentences *feel* old? We've formed a general representation of the scene…the beginnings of a schema.

60

60

Schemas and Inferences in Memory

- Bartlett (1932)
- Ebbinghaus vs. Bartlett
- Interaction of prior knowledge and experience and formation of new memories
- "War of the Ghosts" story
- Initial vs. Delayed Recall

61

61