

Chapter 7

Knowing
Semantic Long Term Memory

557

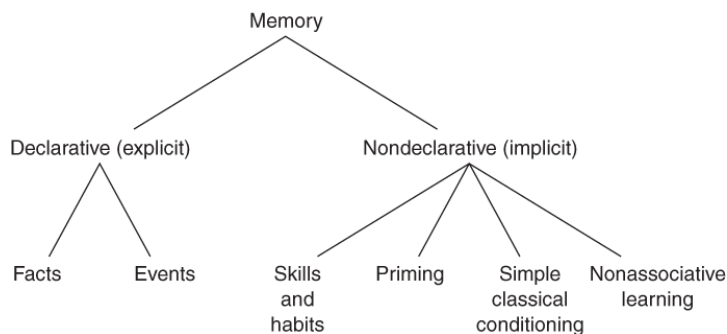
Review / Background

- LTM Taxonomy / Episodic LTM
- Learning (Storing information in LTM)
 - rehearsal, depth, generation & enactment, organization, imagery, context
- Remembering (Retrieving information from LTM)
 - availability vs. accessibility
- Clinical Evidence
 - Amnesia and Implicit Memory

558

Psyc 362 - Spring 2016

Squire (1993) Taxonomy of Long Term Memory



559

Psyc 362 - Spring 2016

Chapter Outline

- Semantic Memory
 - Network Model, Feature Comparison Model, Revised Network Model
- Connectionism
- Semantic Priming
- Schemata & Scripts
- Concepts & Categorization

560

Psyc 362 - Spring 2016

Semantic Memory

561

Psyc 362 - Spring 2016

Terminology

- Semantic Long Term Memory
- aka
 - Factual memory
 - “generic” memory
 - conceptual knowledge
 - memory for “meaning”

562

Psyc 362 - Spring 2016

Models of Semantic Memory

- Semantic Network Model...
- Feature Comparison Model...
- Revised Network Model...

563

Psyc 362 - Spring 2016

Semantic Network Model

- Collins & Quillian model (1969)
- **Network**
 - interrelated set of concepts
- **Nodes**
 - part of the network representing one concept
- **Pathways**
 - labeled directional pathway associating two concepts
- **Propositions**
 - Represents a relationship between concepts
- **Function**
 - Spreading Activation

564

Psyc 362 - Spring 2016

Propositions

- Express a relationship between concepts
- Examples
 - A robin has wings
 - An apple is a fruit

565

Psyc 362 - Spring 2016

Pathways and Propositions

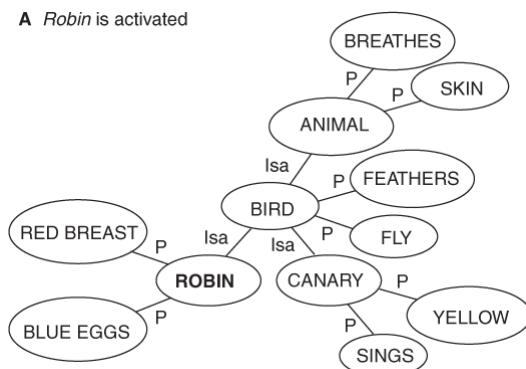
- Pathways connect two nodes together to form propositions.
- **ISA** pathways express category membership (e.g., A robin is a bird).
- **Property (P)** pathways express properties that concepts possess (e.g., x has the property of y-- a robin has the property of wings).

566

Psyc 362 - Spring 2016

Semantic Network Example

A Robin is activated



567

Psyc 362 - Spring 2016

Spreading Activation

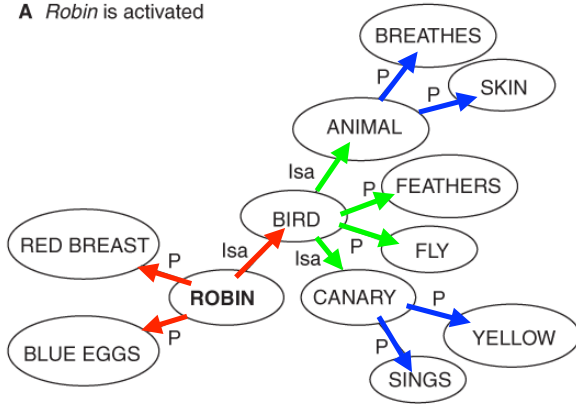
- The mental activity of accessing and retrieving information from the network.
- Takes passive concepts (those not currently in working memory) and activates them (puts them in working memory).
- Activation then spreads to related nodes (e.g., activation to the **doctor** node would also spread to the **nurse** node).
- This is one explanation for **Semantic Priming**

571

Psyc 362 - Spring 2016

Spreading Activation

A Robin is activated



572

Pyrc 362 - Spring 2016

Intersection Search

- True or False:
 - A robin is a bird?
- Activation lights the robin node, and then spreads to its neighbors.
- Activation also lights the bird node, and then spreads to its neighbors.
- The two spreads of activation eventually collide-- an intersection-- which lets you answer "True, a robin is a bird."

573

Pyrc 362 - Spring 2016

Semantic Relatedness

- The **distance** between two nodes in a network is determined by semantic relatedness.
- Concepts close in meaning / highly related (e.g., doctor, nurse) are stored close together in memory (few steps)
- Unrelated concepts (doctor, truck) are further away (more steps through more nodes)

574

Pyrc 362 - Spring 2016

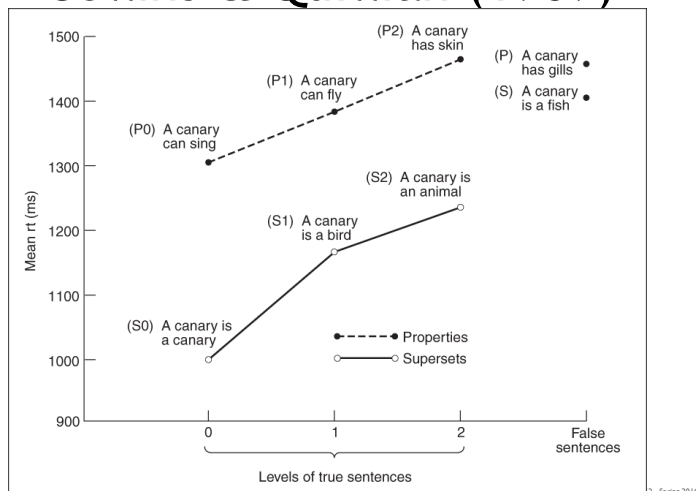
Support for the model

- Stimuli
 - semantic statements
 - "A canary is an animal"
- Methods
 - recognition task
 - simple yes/no answer
- DV
 - Reaction Time
- IV
 - level of semantic relatedness (level 0, 1, 2)

575

Pyrc 362 - Spring 2016

Collins & Quillian (1969)



576

Pyrc 362 - Spring 2016

Problems with the model: Typicality Effect

- Typicality effect
- RT Prediction?
 - "A pig is a mammal" vs
 - "A pig is an animal"
- CQ's model prediction is opposite of observed data

577

Pyrc 362 - Spring 2016

Problems with Semantic Network Model

- **Cognitive Economy**
 - assumes information only appears once in the model
 - logical, but unrealistic
- **Developmental Issues**
 - **Dolphin is a Fish?**
No
Dolphin is a Mammal
 - Would require big reorganization

578

Pyrc 362 - Spring 2016

Feature Comparison Model

- Smith et al. (1974)
- Attempted to fix some of the problems with Collins & Quillian model
- Semantic Memory is List-based
 - **Feature List...**
 - **Defining Feature**
 - **Characteristic Feature**

579

Pyrc 362 - Spring 2016

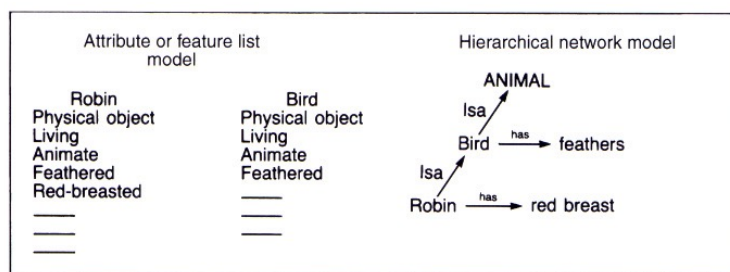
Feature Lists

- **Defining Features** at top of list
 - essential features
 - e.g. Robin is a...
Physical Object
Living
- **Characteristic Features**
 - common features that are not essential
 - e.g. Robin
sits in a tree
is pretty...

580

Pyrc 362 - Spring 2016

Feature List vs. Network Model



581

Pyrc 362 - Spring 2016

Feature Lists: Robin vs Bird

<u>Robin</u>	<u>Bird</u>
Physical Object	Physical Object
Living	Living
Animate	Animate
Feathers	Feathers
Flies	Flies
Red-breasted	

582

Pyrc 362 - Spring 2016

Feature Lists: Telephone vs Bird

<u>Telephone</u>	<u>Bird</u>
Physical Object	Physical Object
Not Living	Living
Inanimate	Animate
Plastic	Feathers

583

Pyrc 362 - Spring 2016

Feature Comparison

- T/F: A Robin is a Bird?
- Access both Feature Lists
- Compare lists (feature overlap)
- Stage 1 (Fast)
 - if overlap score is very high (or very low) give a quick Y/N answer
- Stage 2 (Slow)
 - if overlap score is indeterminate,
 - compare **Defining Features**

584

Pyrc 362 - Spring 2016

Fast Yes: Robin vs Bird

Robin
Physical Object
Living
Animate
Feathers
Flies
Red-breasted

Bird
Physical Object
Living
Animate
Feathers
Flies

585

Pyrc 362 - Spring 2016

Fast No: Telephone vs Bird

Telephone
Physical Object
Not Living
Inanimate
Plastic

Bird
Physical Object
Living
Animate
Feathers

586

Pyrc 362 - Spring 2016

Slow No: Bat is a Bird?

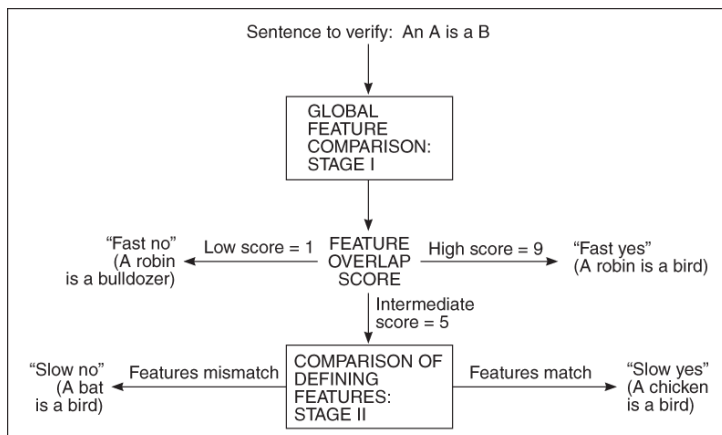
Bat
Physical Object
Living
Animate
No Feathers
Flies
Live Births

Bird
Physical Object
Living
Animate
Feathers
Flies
Lays Eggs

587

Pyrc 362 - Spring 2016

Feature Comparison



588

Pyrc 362 - Spring 2016

Problems with Feature Models

- **Property Statements**
 - A Frog is **Green**
 - A Whale is **Large**
- Does your brain really have a list of “things which are **large**?”

589

Pyrc 362 - Spring 2016

Problems with Feature Models

- **Lack of Hierarchy**
 - Arnold Schwarzenegger has Feet?
- Does your brain really store this fact for each person you know?
- Unlikely - probably the brain does use hierarchy.
- (Arnold is a man, men are people, people are humans, humans have feet)

590

Psyc 362 - Spring 2016

Improving the models

- Network Model (Collins & Quillian)
 - Couldn't handle Typicality Effect
- Feature Comparison (Smith)
 - was created to handle Typicality Effect
- Semantic Relatedness (Collins & Loftus, 1975)
 - an improved network model that can explain the Typicality Effect

591

Psyc 362 - Spring 2016

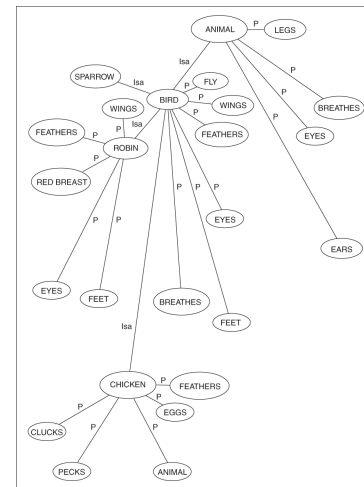
Revised Network Model

- Collins & Loftus (1975)
- Similar to Network Model
- Adds **Semantic Relatedness**
 - links are different **strengths** (drawn as different **lengths**)
- Does not require pure hierarchy (Cognitive Economy): Redundant info can be stored

592

Psyc 362 - Spring 2016

Revised Network Model



593

Psyc 362 - Spring 2016

Semantic Relatedness Effect

- Concepts that are more highly interrelated are retrieved faster
- Revised Network Model:
 - Typical members are stored closer to category
- Robin->Bird
 - vs
 - Chicken----->Bird

594

Psyc 362 - Spring 2016

Connectionism and Semantic Memory

598

Psyc 362 - Spring 2016

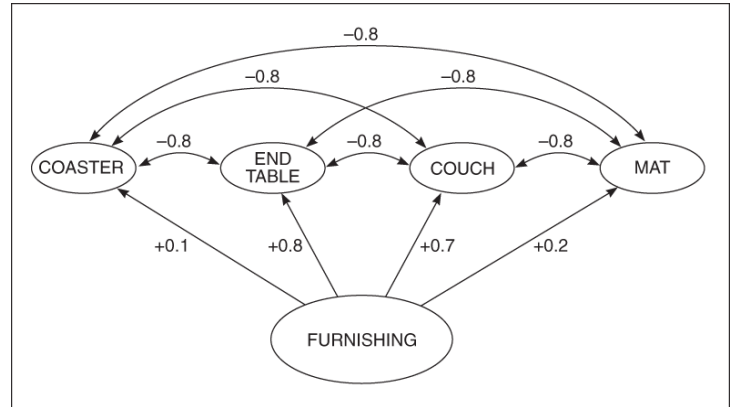
Terminology

- Connectionism
- PDP (parallel distributed processing)
- neural network
- Similar to Revised Network Model
- Differences:
 - paths (connections) are weighted
 - paths may be inhibitory (negative weights)
 - a “concept” is a pattern of activation across the network

599

Pyrc 362 - Spring 2016

Semantic Net Model



600

Pyrc 362 - Spring 2016

Connectionist Models

- Biological realism
 - nodes are like neurons, pathways like axons & dendrites
 - weights are like neurotransmitters (excitatory, inhibitory)

601

Pyrc 362 - Spring 2016

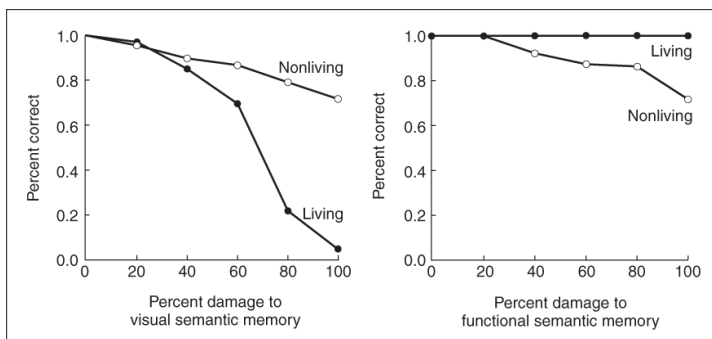
Connectionist Models of Semantic Memory Impairment

- Patient JBR - tested on naming objects
 - living things: 6%
 - inanimate objects: 90%
- How could this be?
- Theory:
 - living things classified by visual features
 - non-living things classified by function
- Model:
 - built a PDP model and then “lesion” it

602

Pyrc 362 - Spring 2016

Connectionist Models of Semantic Memory Impairment



603

Pyrc 362 - Spring 2016

Semantic Priming

610

Pyrc 362 - Spring 2016

Terminology: Priming

- Prime: the initial stimuli (believed to have an effect on the target)
- Target: later stimuli to be processed
- Priming
 - Facilitation - prime helps target processing
 - Inhibition - prime hurts target processing
- DV:
 - RT or accuracy
- IV:
 - kinds of relationship between Prime and Target

611

Psyc 362 - Spring 2016

Lexical Decision Task

- Meyer and Schvaneveldt (1971).
- **Task:** Judge whether a string of letters is a word
- **Measures:** Reaction time
- **Manipulations:** Subjects were shown two words at once (related or unrelated)
TRUCK PAPER (Unrelated YES)
CHAIR ZOOPLE (NO)
FIST HAND (Related YES)
- **Results:** Related words strongly primed each other, suggests looking up words meanings happens automatically when we look up its lexical information

613

Psyc 362 - Spring 2016

Lexical Decision Task: Results

Stimuli Pair	Y/N	Sample	RT	Accuracy
Word-Related Word	Y	Nurse-Doctor	855	6%
Word-Unrelated Word	Y	Bread-Doctor	940	9%
Word-Nonword	N	Book-Marb	1087	28%
Nonword-Word	N	Valt-Butter	904	8%
Nonword-Nonword	N	Cabe-Manty	884	3%

614

Psyc 362 - Spring 2016

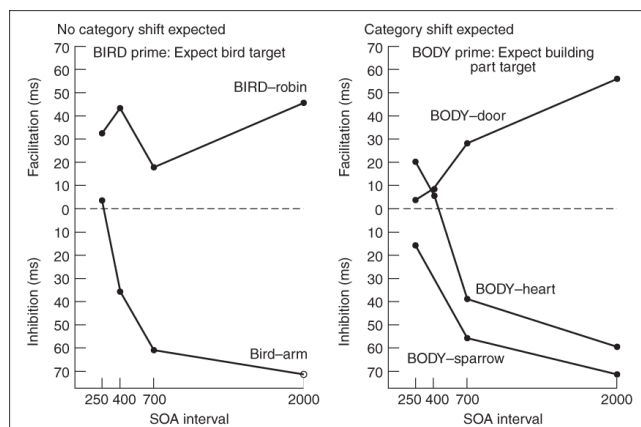
Automatic vs. Conscious Priming

- Neely (1977)
- Tested explicit vs. implicit priming
- Method:
 - S's told to expect category switch e.g. building → body
 - tricked subjects (by not switching category)
 - varied the timing
- Results - evidence for
 - Automatic priming (at short delays)
 - Conscious priming (at longer delays)

615

Psyc 362 - Spring 2016

Neely (1977)



616

Psyc 362 - Spring 2016

Priming is Implicit

- Marcel (1980)
- Lexical decision task. Prime word was followed by mask, then by target word.
- Subjects were also tested on recognition for prime word.
- In spite of no conscious recollection for prime word, the target word was primed

617

Psyc 362 - Spring 2016

Schemata and Scripts

618

Psyc 362 - Spring 2016

Bartlett's (1932) "War of the Ghosts"

- Ebbinghaus: nonsense syllables
- Bartlett: meaningful information
- Methods:
 - S's read a folk tale
 - re-told the story
- Measures:
 - progressive changes in what subjects remember

619

Psyc 362 - Spring 2016

One night two young men from Egulac went down to the river to hunt seals and while they were there it became foggy and calm. Then they heard war-cries, and they thought: "Maybe this is a war-party". They escaped to the shore, and hid behind a log. Now canoes came up, and they heard the noise of paddles, and saw one canoe coming up to them. There were five men in the canoe, and they said: "What do you think? We wish to take you along. We are going up the river to make war on the people." One of the young men said, "I have no arrows." "Arrows are in the canoe," they said. "I will not go along. I might be killed. My relatives do not know where I have gone. But you," he said, turning to the other, "may go with them." So one of the young men went, but the other returned home.

And the warriors went on up the river to a town on the other side of Kalama. The people came down to the water and they began to fight, and many were killed. But presently the young man heard one of the warriors say, "Quick, let us go home: that Indian has been hit." Now he thought: "Oh, they are ghosts." He did not feel sick, but they said he had been shot. So the canoes went back to Egulac and the young man went ashore to his house and made a fire. And he told everybody and said: "Behold I accompanied the ghosts, and we went to fight. Many of our fellows were killed, and many of those who attacked us were killed. They said I was hit, and I did not feel sick." He told it all, and then he became quiet. When the sun rose he fell down. Something black came out of his mouth. His face became contorted. The people jumped up and cried. He was dead.

620

Psyc 362 - Spring 2016

Bartlett's (1932) "War of the Ghosts"

- **Omissions:**
 - Poor recall for many of the details (specific names, or events)
 - Minor events were omitted (but recall for plot and sequence of events was good)
 - Shorter than the original
- **Normalizations:**
 - Tendency to add and alter the stories to make them more conventional or reasonable (top-down processing)

621

Psyc 362 - Spring 2016

Schemata

- Schema (plural: schemata)
 - Stored framework or body of knowledge about some topic.
- Bartlett used this concept to explain subject alterations when re-telling the War of the Ghosts story.
- When we encounter new material, we try to relate it into existing schemas (sometimes even altering the material to make it fit).

622

Psyc 362 - Spring 2016

Reproductive vs Reconstructive Memory

- Reproductive memory:
 - A highly accurate, verbatim recording of an event.
- Reconstructive Memory:
 - Remembering by combining elements of experience with existing knowledge.
- Is all memory reconstructive?

623

Psyc 362 - Spring 2016

Reconstructive Effects

- Sulin and Dooling (1974).
- Subjects read identical stories about either: Gerald Martin or Adolf Hitler. Carol Harris or Helen Keller.
- The Hitler and Keller groups' "memory" of these stories was influenced by their previous knowledge of Hitler or Keller.

624

Psyc 362 - Spring 2016

Reconstructive Effects Take Time

- Immediate recall - memory is reproductive
- Delayed recall (1 week) - memory is reconstructive

625

Psyc 362 - Spring 2016

Scripts

- Scripts is a subtype of Schemas
- General knowledge structures about ordinary events and situations that guide our interpretation and behavior
- Mental representation of what is supposed to happen in a particular situation in which order
- Examples: Birthday, restaurant, airport...
- Similar because of shared cultural knowledge

626

Psyc 362 - Spring 2016

Script Example

- John was feeling very hungry as he entered the restaurant. He settled himself at a table and noticed that the waiter was nearby. Suddenly, however, he realized that he'd forgotten his reading glasses.
- What is John's problem?

627

Psyc 362 - Spring 2016

Scripts and Memory

- Greaser 1981
- S's given stories to remember including typical vs. atypical events
- Memory for typical events: poor
- Memory for atypical events: good
- "Jack led the dog into the waiting room. While waiting for the vet, Jack dropped his car keys."

628

Psyc 362 - Spring 2016

Review

- Semantic Priming
 - Automatic at short intervals
 - Explicit (under conscious control) at longer intervals
- Schemata
 - Reproductive vs. Reconstructive Memory
 - War of the Ghosts
 - Omissions
 - Normalizations
- Scripts
 - memory for typical vs. atypical events

632

Psyc 362 - Spring 2016

Concepts & Categorization

- Major Theories
 - Classic
 - Probabilistic
 - Explanation-based

633

Psyc 362 - Spring 2016

Classic View of Categorization

- Categories are based on system of rules
- Necessary and Sufficient features
- Scientific Taxonomy

- Logical, but probably not psychologically realistic

634

Psyc 362 - Spring 2016

Natural Categorization

- What do categories look like when studying real people?

- Loose / Fuzzy
- Graded Membership

- Examples:
 - bat is not a bird, but loosely speaking it is
 - tomato is technically a fruit, but considered a vegetable
 - 4 is a better example of an even number than 28 (Armstrong et al 1983)

635

Psyc 362 - Spring 2016

Natural Categorization

- Central Tendency
 - “average” or best examples
- Typicality
 - how close something is to Center
- Category Norms
 - robin is a better bird than chicken
- Family Resemblance
 - not all features are required, but many are
- Correlated Attributes
 - e.g. things with Wings have Beaks

636

Psyc 362 - Spring 2016

Probabilistic Categorization

- Probability - statistical likelihood
- Prototype theory
 - a single example
 - typical or stereotypical example
 - the “core” or “central” example
 - does not include variation
- Exemplar Theory
 - we store examples of what we have seen
 - do not store a prototype

637

Psyc 362 - Spring 2016

Probabilistic Categorization

- Prototype Theory vs Exemplar Theory:
 - Which is true?
- Difficult to test - both make very similar predictions.
- Both theories do a good job of explaining human categorization
- But can't explain:
 - ad-hoc categories (new categories created on the fly)
 - circularity? How to form a category without already knowing the category?

638

Psyc 362 - Spring 2016

Explanation-Based Categorization

- Semantic Categories are theories of how the world works
- Things to keep your feet safe:
 - Shoe & Sock? Yes
 - Brick? No
- Things to pound a nail:
 - Shoe & Brick? Yes
 - Sock: No

639

Psyc 362 - Spring 2016

Embodied Categorization

- Categories relate to how our bodies & minds function the world
- Borghi et al. (2004)
- You are driving a car (inside)
vs.
You are washing a car (outside)
- RT to objects faster when consistent with location

640

Psyc 362 - Spring 2016

Psychological Essences

- Members of category all have same “essence” (invisible but important “ness”)
- Examples:
 - Does painting stripes on a Horse make it a Zebra?
 - Does painting numbers on a Plate make it into a Clock?

641

Psyc 362 - Spring 2016

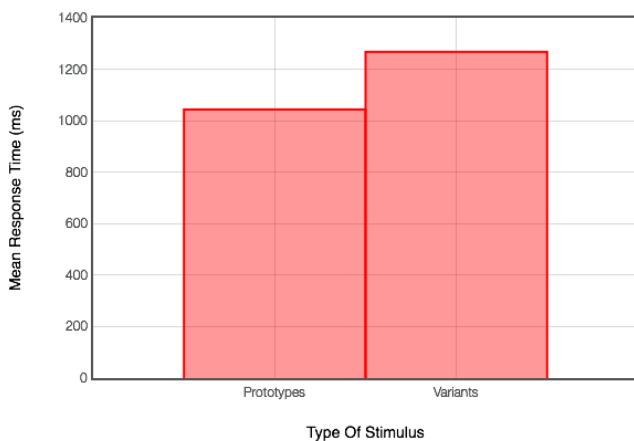
CogLab 7: Prototypes

- Methods:
 - Phase 1: learn to classify two dot patterns (A and B) with feedback
 - Phase 2: classify new set
- Independent Variable
 - Prototypes vs. New Patterns
- Theory
 - can we learn an abstract category based on examples?
 - will RT to the Prototype be faster than to new variations?

649

Psyc 362 - Spring 2016

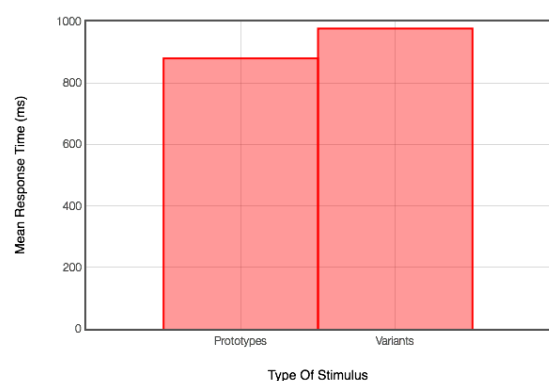
CogLab 7: My Data



651

Psyc 362 - Spring 2016

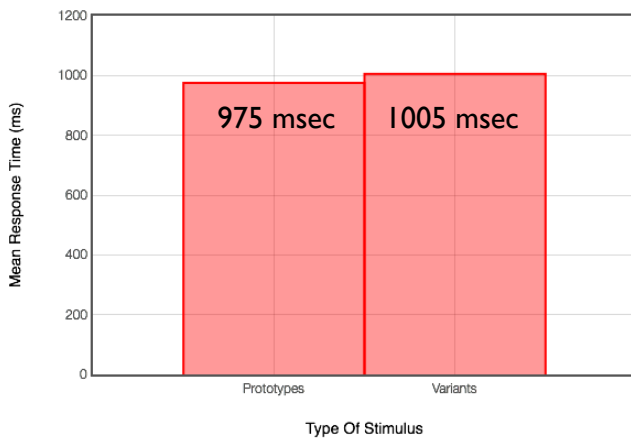
CogLab 7: Group Data



652

Psyc 362 - Spring 2016

CogLab 7: Global Data



Psyc 362 - Spring 2016

653

Posner (1968)

- Experiment #3
- Phase 1
 - S's learn pattern A and B
- Phase 2
 - S's tested on variations
- Results
 - RT to prototypes (schema) better than to new variations (2.3s) and closer RT to prior patterns (2.0s) than new variations (2.9)

Psyc 362 - Spring 2016

654

Posner (1968)

- “The first and second experiments allow the authors to reject the idea that only the abstracted prototype is stored. Clearly the information about the individual patterns must also be present in order for a loose concept (high variability) to give better transfer than a tight concept (low variability).”

Psyc 362 - Spring 2016

655

CogLab 7: Prototypes

- Debriefing
- Methods
 - differences?
- Predictions
 - TBD
- Robust? Limitations?

Psyc 362 - Spring 2016

657

Clinical Evidence

Category-Specific Semantic Impairment

- Warrington & Shallice (1984)
- Four patients with post-herpes simplex encephalitis
- Task: Identify concrete visual objects
 - inanimate objects: yes
 - living things & food: no
- Patients also had severe global amnesia
- Klüver-Bucy syndrome also seen
 - which includes hyperphagia and pica

Psyc 362 - Spring 2016

658

Psyc 362 - Spring 2016

659

Clinical cases

- Agnosia - inability to know what an object is
- Anomia - inability to name objects (but do know what it is)
- Aphasia - inability to speak
 - Receptive aphasia (Wernicke's)
 - Expressive aphasia (Broca's)
- All represent different forms of Semantic Network Disruption