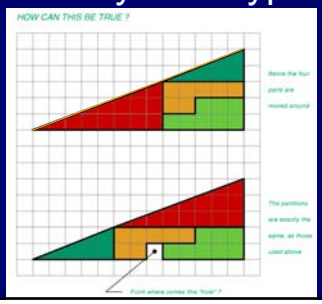
Our Strange Mental World
Identity and Typicality



Long History of Discovering What is Normatively Correct

- In the 17th century, Italian gamblers bet on the total number of "spots" rolled with three dice.
  - What are the chances of rolling a total of 9 spots?
  - What are the chances of rolling a total of 10 spots?
- Italian gamblers reasoned that there are 6 combinations that produce a 9:

1 2 6	1 3 5	1 4 4
2 3 4	2 2 5	3 3 3

- Likewise, they reasoned that there are 6 combinations that produce a 10:

1 4 5	1 3 6	2 2 6
2 3 5	2 4 4	3 3 4

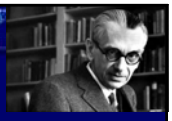
Figuring out What is Normative

- However, experience showed that gamblers were more likely to win if they bet on 10 than 9
- But, they couldn't figure out why.
- So, they asked Galileo for help. His strategy:
  - Color the dice: one white, one grey, one black.
  - 6 ways for white to fall
  - 6 ways for grey to fall
  - 6 ways for black to fall
  - So 6 x 6 x 6 = 216 combinations
  - Galileo wrote down all possibilities and counted them

New Normative Discovery

Outcome = 9	Possible Die Configurations
1 2 6	6
1 3 5	6
1 4 4	3
2 3 4	6
2 2 5	3
3 3 3	1
Total	**25 out of 216 or .116**

Outcome = 10	Possible Die Configurations
1 4 5	6
1 3 6	6
2 2 6	3
2 3 5	6
2 4 4	3
3 3 4	3
Total	**27 out of 216 or .125**

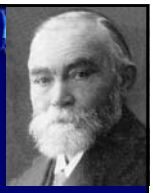
Attempts to Secure Certainty

- 19th Century Strategy: Secure the certainty of arithmetic by deriving it from logic via set theory
- Russell and the discovery of paradoxes
  - Liar Paradox: *This sentence is false*
  - The set consisting of items which are not a member of the set
  - Still aspired to the reduction of arithmetic to logic
- Gödel and incompleteness
  - Given any consistent set of axioms, there will be a true statement of arithmetic that is not derivable from those axioms
- Objective limitations to our quest for certainty

Cognitive Limitations

- The limitations established by Russell and Gödel are objective limitations
  - They apply to the formal systems themselves, not to our cognition
- Piattelli-Palmarini focuses instead on limitations due to our cognitive system
  - We operate in ways that differ from the norms set in our formal systems
  - Our concepts do not operate like sets
  - May not respect the principle of identity

Concepts and Sets



- Gottlob Frege:
  - Intension determines extension
  - Meaning determines reference
- Classical theory: categories and concepts defined by conditions for category membership
- A bachelor is, by definition, an unmarried male human being

Who is a bachelor?

- Alfred is an unmarried adult male. He has been living with his girlfriend for the past 23 years. Is Alfred a bachelor?
- Bernard is an unmarried adult male and does not have a partner. Bernard is a monk living in a monastery. Is Bernard a bachelor?
- Charles is a married adult male, but he has not seen his wife for many years. Charles is earnestly dating, hoping to find a new partner. Is he a bachelor?
- Donald is a married adult male, but he lives in a culture that encourages males to take two wives. Donald is earnestly dating, hoping to find a new partner. Is he a bachelor?

Typicality Judgments

- People happily judge typicality of members of categories
  - How typical a bird is chicken?
  - How typical a bird is blue jay
  - How typical a bird is a cocker spaniel?
  - How typical a bird is a Space Shuttle?

Problem with classical view

- Typicality effects
- Typicality Demo
  - will see **X --- Y**.
  - need to judge if X is a member of Y.
    - *finger --- body part*
    - *pansy --- animal*
  - If YES, clap your hands as FAST as you can!

turtle – precious stone
pants – furniture
robin – bird
dog – mammal
turquoise --- precious stone
ostrich -- bird
poem – reading materials
rose – mammal
whale – mammal
diamond – precious stone
book – reading material
opal – precious stone

Typicality Effects

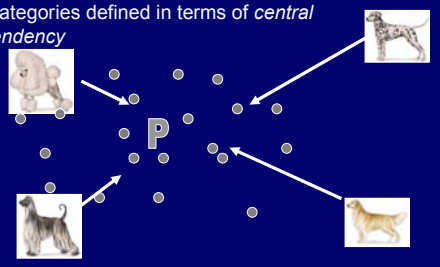
- typical
  - robin-bird, dog-mammal, book-reading, diamond-precious stone
- atypical
  - ostrich-bird, whale-mammal, poem-reading, turquoise-precious stone
- Faster, more accurate with more typical members of a category

Typicality

- Rankings of fruits in terms of typicality on a 1 to 7, with 7 as highest typicality:
  - Apple 6.25
  - Peach 5.81
  - Strawberry 5.00
  - Watermelon 4.06
  - Fig 3.38
  - Olive 2.25

Prototype Theories

- Categories defined in terms of *central tendency*



Learning involves abstracting a prototype from actual instances

Prototype Theories

- Prototype identifies a (usual non-real) entity that serves as the reference point for the category
- Seems to make the category representation an instance of the category

Exemplar Theories

- Exemplar = a specific remembered instance
- Your representation of "dog" consists of all the examples of dogs that you have encountered
- Typical items are encountered more frequently, so you will have many stored representations of them
- Exemplar theories can explain typicality effects
- Recognition task: typical items are more quickly recognized because memory search for a matching exemplar will be fast
- Production task: when asked to list items in a given category, typical items are more frequently represented in memory

Ad hoc categories

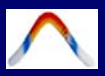
- It is easy to rate typicality for newly made up categories
  - Things to take with you when your house is on fire
  - Things to take on vacation
  - Things to see in Paris
- These are not likely to exist pre-structured in your mind
- Maybe all categories are constructed *on the fly* from more basic representations--Barsalou

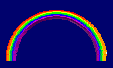
Beyond Mere Similarity

- Similarity (or resemblance) is crucial to both prototype and exemplar theories of categorization
- Categorization by similarity is a useful *heuristic*
- However, we rely on more than similarity when judging category membership
  - A painted, flattened lemon is still a lemon
  - A well-done counterfeit bill is not a $20 bill
  - A racoon with a strip painted on it is still a racoon, not a skunk
- We seem to invoke ***theoretical*** knowledge: "genetics" determines animal categories

Categories in Other Cultures




BAYI: men, kangaroos, possums, bats, most snakes, most fish, some birds, most insects, the moon, storms, rainbows, boomerangs, some spears, etc.

Categories in Other Cultures









BALAN: women, dogs, platypus, echidna, some snakes, some fish, fireflies, scorpions, crickets, the hair mary grub, anything connected with water or fire, sun and stars, shields, some spears, some trees, etc.

Categories in Other Cultures





BALAM: all edible fruit and the plants that bear them, tubers, ferns, honey, cigarettes, wine, cake

Categories in Other Cultures



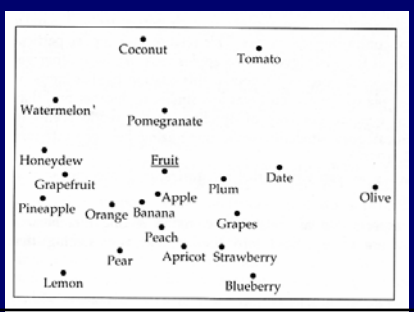



BALA: parts of the body, meat, bees, wind, yamsticks, some spears, most trees, grass, mud, stones, noises and language, etc.

Problems with Similarity Judgments

- Context Effects:
  - On a 5 point scale, how similar are Italy and Switzerland?
  - Comparing Italy, Switzerland, and Brazil
    - How similar are Italy and Switzerland?
- In this context, people's similarity rating for Italy and Switzerland goes up

Similarity and Multi-dimensional spaces



MDS for various birds and animals

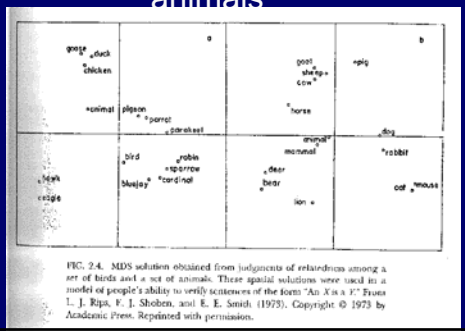


FIG. 2.4. MDS solution obtained from judgments of relatedness among a set of birds and a set of animals. These spatial solutions were used in a model of people's ability to verify sentences of the form "An X is a Y." From L. J. Rips, E. J. Shoben, and E. E. Smith (1973). Copyright © 1973 by Academic Press. Reprinted with permission.

Failure of Symmetry

- Symmetry Principle: d(x,y) = d(y,x).
- If symmetry held:
  - d(Cuba, China) = d(China, Cuba)
  - d(butcher, surgeon) = d(surgeon, butcher)
  - d(FDR, W) = d(W,FDR)
  - d(pomegranate, apple) = d(apple, pomegranate
- But people judge
  - Cuba is more like China than China is like Cuba
  - A butcher is more like a surgeon than a surgeon is like a butcher
  - W is more like FDR than FDR is like W
  - A pomegranate is more like an apple than an apple is like a pomegranate

Failure of Triangle Inequality

- Spatial representations predict that if A and B are similar, and B and C are similar, then A and C have to be somewhat similar as well (triangle inequality)

$$d(a,b)+d(b,c)\geq d(a,c)$$

- However, you can find examples where A is similar to B, B is similar to C, but A is *not at all similar* to C
  - Violation of the triangle inequality
- Example:
  - *Watch* is similar to *bracelet*
  - *Watch* is similar to *clock*
  - *Bracelet* is ***not*** similar to *clock*

Failure of Identity

- Markman and Gentner—cross-mapping analogy
  - Man from food bank gives food to woman
  - Same woman gives food to squirrel
  - Woman in first picture maps to (more similar to) squirrel than herself