

# Categorizing: Delineating the Phenomena



## Clicker Question

What factors influence what you see in this picture?



- A. How your visual system works
- B. What you expect to see
- C. What features you attend to
- D. All of the above

## Review



- Perception is not transparent—we don't just see what is out there. What we see is influenced by
  - The way the visual system is constructed
  - The effects of attention
  - What we have previously learned
  - What we expect to see
- How can we evaluate whether we are right about what we claim to see?
  - Corroboration by *independent* observers/evidence
  - Assess plausibility

## Clicker Question

What is wrong in the following case: You read in a newspaper about a yellow dragon that is terrorizing Pt. Loma. You go back to the shelf and buy another copy of the same newspaper to double check the story

- A. You know yellow dragons avoid Pt. Loma
- B. Newspapers often get the story wrong
- C. Nothing is wrong
- D. Buying a second copy of a newspaper does not provide independent confirmation

## Clicker Question

What else is wrong with the report of a yellow dragon terrorizing Pt. Loma?

- A. Nothing
- B. We have good reason to doubt the existence of dragons
- C. We weren't there so we didn't get a chance to look for ourselves
- D. Everyone knows there are too many bars on Pt. Loma

## Jennifer Thompson and Ron Cotton



The man on the left, **Ron Cotton**, who spent 11 years in prison for the rape of Jennifer Thompson. The man on the right is the rapist **Bobby Poole**

## Clicker Question

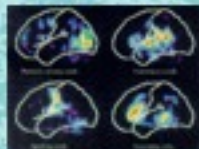
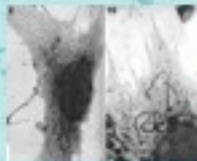
If you are a juror in a criminal trial that relies on eye-witness testimony, will you

- A. Discount all eye-witness testimony
- B. Trust only those eye-witnesses that seem honest
- C. Trust eye witnesses as the most reliable sources

## Evaluating observation

- If perceiving depends so much on us
  - and we can be so unreliable
- How can we determine what is really out there?
- No absolute guarantees! Even perception is fallible!
- Importance of independent observers
- Importance of plausibility assessments

## Extending observation with instruments



## Instruments and Artifacts

- The use of instruments to make observations raises just as many problems (or more) than the use of our senses
- Is the product of the instrument *merely* an artifact?
  - Something made up by the instrument and not reflective of the world *out there*
- How to tell?
  - As with basic perception, we must rely on
    - Multiple independent sources agreeing
    - The plausibility of what we claim to observe

## Individuals and categories

- The entities we encounter in the world are individuals —a particular dog, a particular flower, etc.



- But without classifying things into categories, we don't see *anything*.



## Putting things into categories

- Even when confronted with abstract pictures, we try to identify *what* we are seeing



## Why categorize?

- Knowing the category something belongs to gives us information
  - Knowing that something is water tells us what?
  - Knowing that something is an airplane tells us what?
- Even when something isn't true of all members of a category, we still make inferences
  - What are some things we infer from knowing that something is a bird?
  - What are some things we infer from knowing that someone is a convicted felon?

## Multiple category schemes

- But there is not a right way to categorize the things we can see
- Different category schemes result in different knowledge claims
- Scientific progress often occurs as a result of re-categorizing something
  - The sun and moon were once considered planets
    - What happened when we changed the category?
  - Humans were not always grouped with primates
    - What changed when such a grouping was made?



## Delineating the phenomenon

- The way in which we categorize phenomena provides our cognitive handle on it
  - The way we think about it
  - The questions we ask about it
  - The investigations we conduct
  - The way we use it



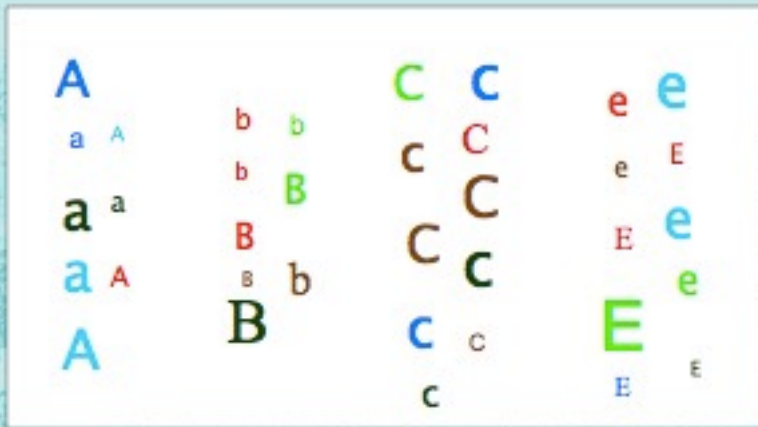
# Clicker Question

How many ways can you categorize these items

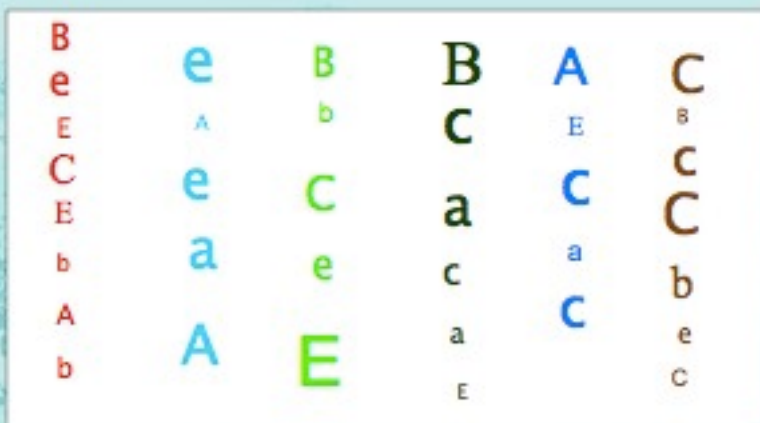
- A. 1
- B. 2
- C. 3
- D. 4
- E. 5+



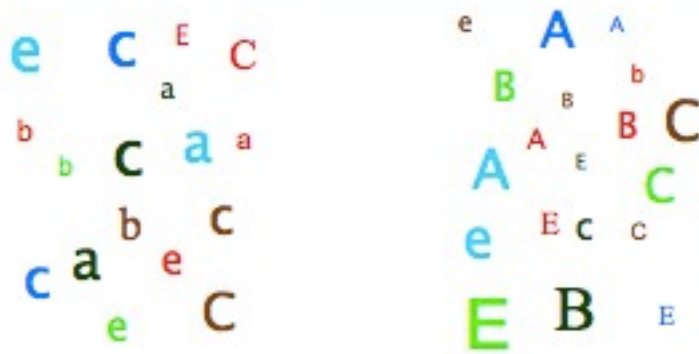
## Categorizing by letter



## Categorizing by Color



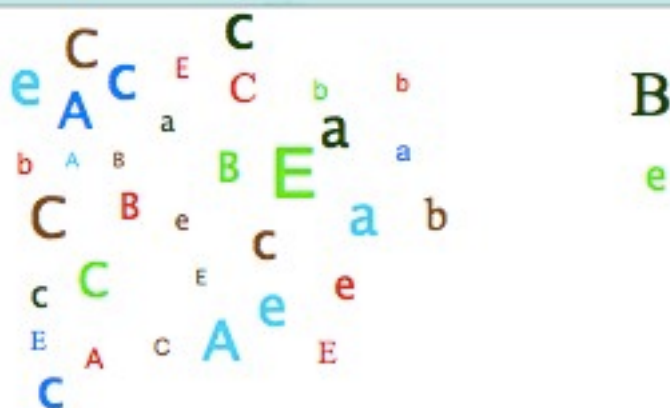
## Capitals vs lowercase



## Categories and names

- We tend to put things into categories for which we have names
  - But categories do not have to be nameable
- Rather, languages name those categories which are important to its speakers
  - About which they want or need to say something
- The categories available to us in our language, though, constrain what we can say
  - And what we can make generalizations about

## Perfectly good categories— but no names







## Categorized by mode of language training



Lana



Panzee

Sherman



Kanzi



Matata

Panbanisha



## Discovering new categories

- A frequent first step in developing scientific inquiry is to delineate a particular set of phenomena to study
- Consider vitamins
  - Today they seem like a very natural category
    - Although many people have no clue what they do
  - We buy them and take them (when we remember)



## Delineating Vitamins

- In the 19<sup>th</sup> century no one knew about vitamins
- Linking disease to germs was itself a radical (and very controversial) idea
  - Semmelweis lost his job for recommending that doctors wash their hands between performing autopsies and assisting in child birth
  - Now people put up statues in his honor
- After the discovery of germs (bacteria) researchers began to treat all diseases were treated as due to germs
  - But we still have to remind people about them!



## Clicker Question

Given the success of the germ theory, what would lead someone to think a newly identified disease was *not* due to a germ?

- A. Desire to come up with a new idea
- B. Observation that something other than germs caused the disease
- C. Inability to find evidence for a germ that caused the disease

## Delineating Vitamins 2

- For some diseases, no germs (bacteria) could be found



Scurvy



Beriberi



Rickets

- Eventually it was recognized that each of these diseases could be prevented by adding very small quantities of substances such as ascorbic acid to the diet

## Delineating Vitamins

- These diseases were still mysterious
  - Foods were assumed to either be incorporated into the tissue of the organism or to be burned for energy
  - The amount of vitamins required made these functions improbable
- But at this stage the category had been established
  - Vitamins were viewed as substances that are required in minute quantities in the diet and which are not burned or used to build tissue
    - Scientists could now inquire into what role they did play

# Data from observations

- Although predictions against which hypotheses are tested involve individual entities or events, it is the entities or events as categorized that serve as evidence in science
- It is critical to develop appropriate categories to use in reporting evidence and formulating hypotheses
- Frequent issue--whether
  - to split: record each different model of car
  - to lump: count each different model of car as a car



# Exclusive and exhaustive categories

Establish categories so that each item fits into a category—**exhaustive**

Establish categories so no items fits into two categories—**exclusive**

## Clicker Question

Applied to living organisms, the categories *plant*, *fish*, *insect*, *mammal*, *bird*, are

- A. Exclusive but not exhaustive
- B. Exhaustive but not exclusive
- C. Both exclusive and exhaustive
- D. Neither exclusive not exhaustive

## Clicker Question

Applied to baseball players, the categories *bats left handed* and *bats right handed* are:

- A. Exclusive but not exhaustive
- B. Exhaustive but not exclusive
- C. Both exclusive and exhaustive
- D. Neither exclusive not exhaustive

How do marmots spend their days?



## How do animals spend their days?

Develop a coding system for animal behavior—an ethogram):

- f = head down foraging
- r = rearing up on two legs while foraging
- l = standing quadrupedally and looking
- c = standing quadrupedally and looking while chewing
- u = standing bipedally and looking while chewing
- w = walking or other locomotion
- x = other behavior
- o = out of sight

## Different Organisms, Different Categories



33

## How do UCSD undergraduates spend their days?

- What would be the useful categories to develop a profile of how students spend their time?
- On the job (work for pay)
- In transit \*
- Get exercise \*
- In class
- Off-line study/class assignments
- On-line study/class assignments
- On-line (personal)
- Tasks of daily living \*
- Eat
- On the telephone/cellphone
- Relax/socialize \*
- Sleep Start \_\_\_\_\_ Finish \_\_\_\_\_
- Other \* (optional to specify)

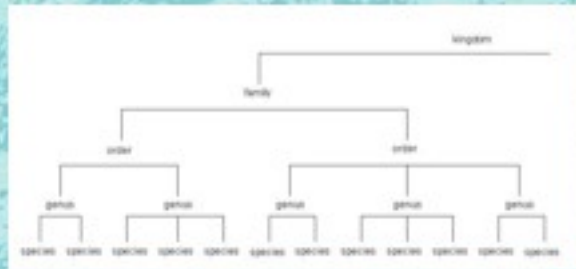


## High-level category



## Representing taxonomy in trees

Higher-level categories typically represented above the more specific categories, with lines representing relationships



## Why Worry About Hierarchies of Categories?

- Some features are common to members of multiple categories
  - We can infer the same things about all members of the hierarchy
- Other features differ in systematic ways between subcategories of a higher-level category
  - It is useful to determine the manner in which these features differ

