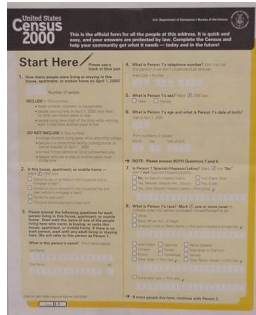


Categorizing: Delineating the Phenomena



Clicker Question

What factors influence what you see in this picture?



- How your visual system works
- What you expect to see
- What features you attend to
- 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
 - Assessment of 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

You know yellow dragons avoid Pt. Loma

Newspapers often get the story wrong

Nothing is wrong

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?

Nothing

We have good reason to doubt the existence of dragons

We weren't there so we didn't get a chance to look for ourselves

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

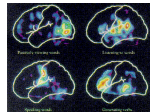
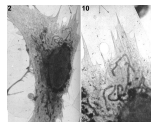
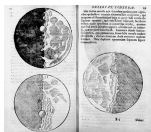
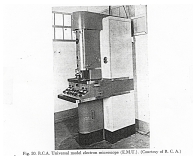
If you are a juror in a criminal trial that relies on eye-witness testimony, will you

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

Evaluating observation

- If perceiving depends so much on us
 - and we can be so unreliableHow can we determine what is really out there? There are heuristics we can employ to reduce the chance of error
 - Consult independent observers
 - Make plausibility assessments
- No absolute guarantees! Perception will always be fallible!

Extending observation with instruments



Instruments and Artifacts

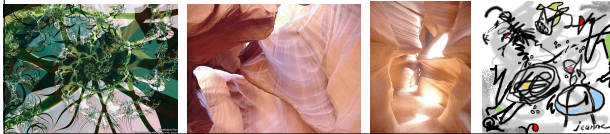
- The use of instruments to make observations raises just as many problems (or more) than the use of our senses
- Is the product of the instrument *merely* an artifact?
 - Something made up by the instrument and not reflective of the world *out there*
- How to tell?
 - As with basic perception, we must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

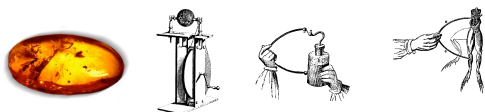
Multiple category schemes

- 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

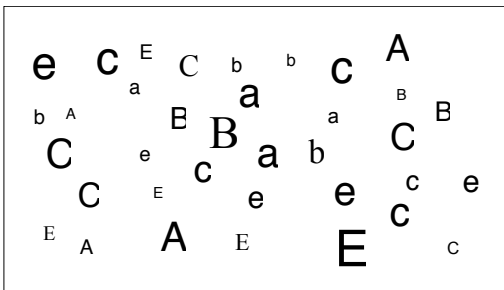
- The way in which we categorize phenomena provides our cognitive handle on it
 - The way we think about it
 - The questions we ask about it
 - The investigations we conduct
 - The way we use it



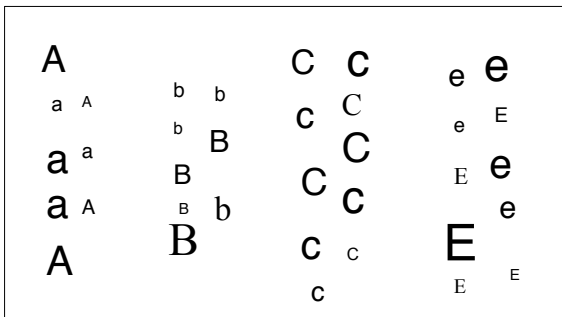
Clicker Question

How many ways can *you* categorize these items

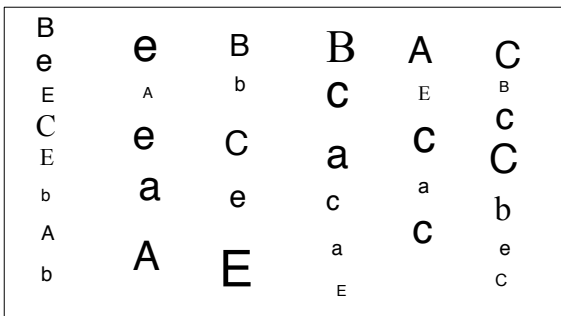
- 1
- 2
- 3
- 4
- 5+



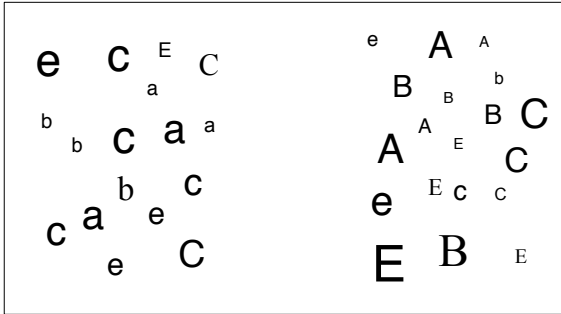
Categorizing by letter



Categorizing by Color



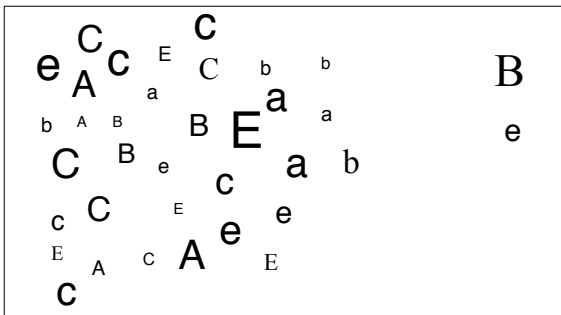
Capitals vs lowercase



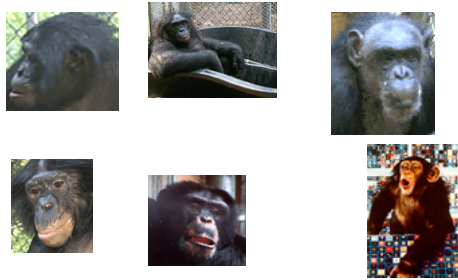
Categories and names

- 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



Categorize these Great Apes



Categorized by species

Species differences not always obvious. *Pan troglodytes* and *Pan paniscus* were only differentiated in the 1930s.



Categorized by mode of language training



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 19th 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 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?

- Desire to come up with a new idea
- Observation that something other than germs caused the disease
- 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

Clicker Question

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

- Exclusive but not exhaustive
- Exhaustive but not exclusive
- Both exclusive and exhaustive
- Neither exclusive not exhaustive

How do marmots spend their days?



35

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

Hierarchical organization

In political contexts, *hierarchy* refers to power relations

In taxonomy, it simply refers to the inclusion of more specific categories into more general ones

- What is true of the more general categories is true of each of the sub-categories within it
- Provides a powerful way of organizing and keeping track of information

Categorizing by letter (again)

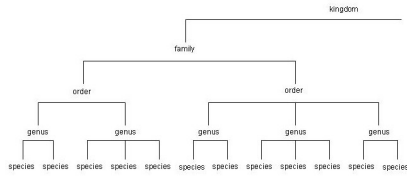
A		C	C	e	e
a A	b b	c C		e E	
a a	B	C C		E e	
a A	B b	C C		E e	
A	B	c c		E E	
		c		E	E

High-level category

A	e e	C C	b b
a A	e E	c C	b B
a a	E e	C C	B B
a A	e	C C	B b
A	E E	c c	B
	E	c	

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

