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

Discussion 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
- Other (be prepared to say)

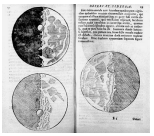
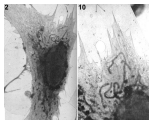
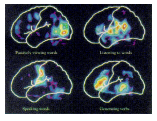
Evaluating observation

- If perceiving depends so much on us
  - and we can be so unreliable

  How 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



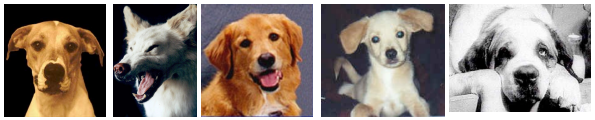





Instruments and Artifacts

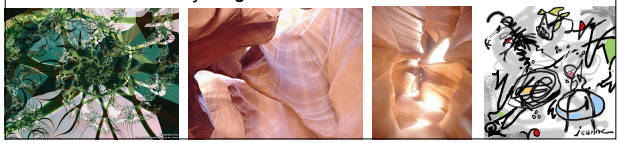
- The use of instruments to make observations raises just as many (or more) problems than the use of our senses
- Is the product of the instrument *merely* an artifact?
  - Something made up by the instrument and not reflective of the world *out there*
- How to tell?
  - As with basic perception, we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



Putting things into categories

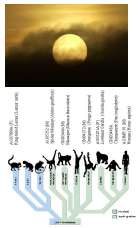
- Even when confronted with abstract pictures, we try to identify *what* we are seeing

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 just *one* 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?



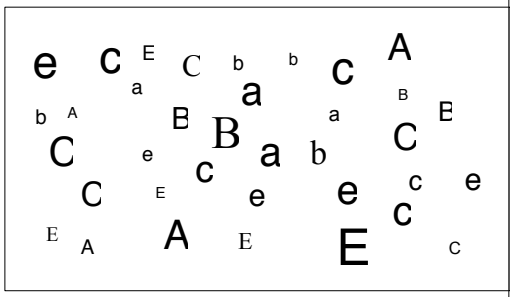
Delineating the phenomenon

- 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

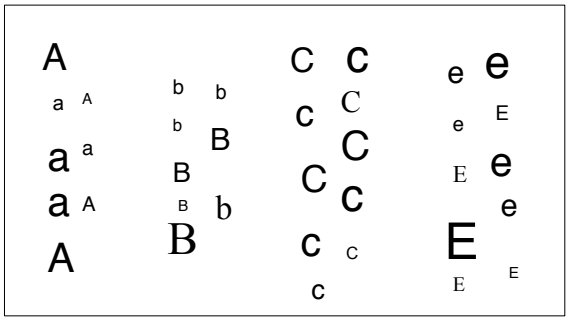
Discussion Question

How many ways can ***you*** come up with to categorize these items

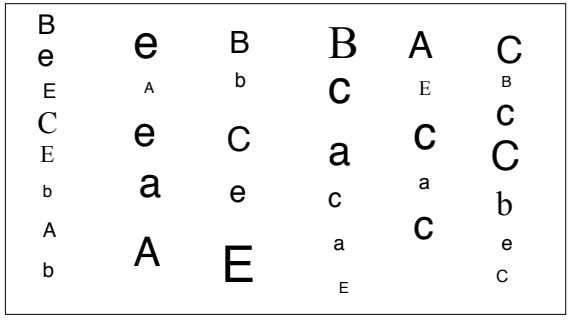
1
2
3
4
5+



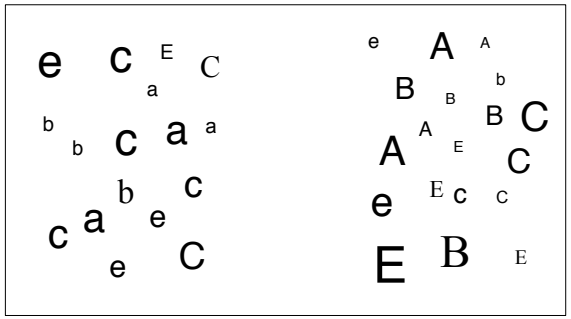
Categorizing by letter



Categorizing by Color



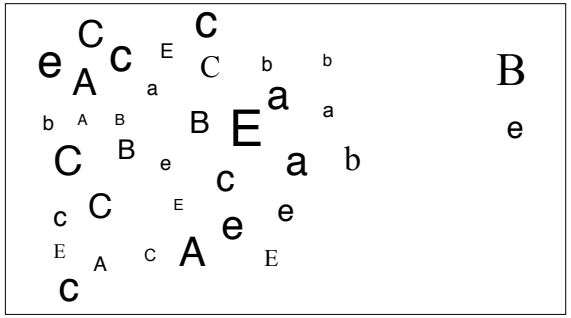
Capitals vs lowercase



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 category—but no names



Categorize these Great Apes



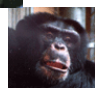



Categorized by species

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


Lana


Matata

Sherman



Kanzi


Panzee

Panbanisha


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 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

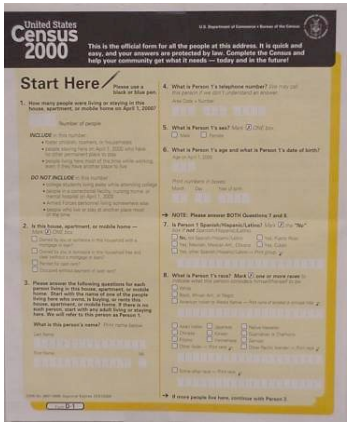
- Eventually it was recognized that each of these diseases could be prevented by adding very small quantities of substances such as ascorbic acid to the diet

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



United States Census 2000

This is the official form for all the people at this address. It is quick and easy, and your answers are protected by law. Complete the Census and help your community get what it needs — today and in the future!

Start Here

Exclusive and exhaustive categories

- Given the analysis one might want to do with the categorized items, it is sometimes important to design categories that are exhaustive and exclusive
  - Exhaustive categories: each item fits into a category
    - Important so as to insure that each individual gets counted (otherwise percentages are meaningless)
  - Exclusive categories: no items fits into two categories
    - Important so that no one gets counted twice

Clicker Question

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

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

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?

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

[redacted]

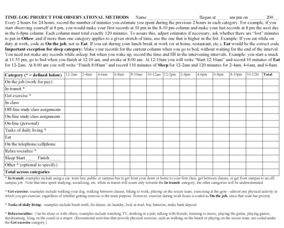
How do UCSD undergraduates spend their days?

- **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)**

Time-Log Project

- Code sheet available on course website
- Complete by Sunday night
- Record every 2 hours for 24 hours
- Enter times into Inquiry module [Observational Research on Daily Life activity under Observational Research]
  - **in minutes, not hours**



TIME-LOG PROJECT FOR OBSERVATIONAL METHODS. Name ____________________ Began at _____ am pm on _______ 200__.
Every 2 hours for 24 hours, record the number of minutes you estimate you spent during the previous 2 hours in each category. For example, if you start observing yourself at 8 pm, you would make your first records at 10 pm in the 8-10 pm column and make your last records at 8 pm the next day in the 6-8pm column. Each column must total exactly 120 minutes. To assure this, adjust estimates if necessary, ask whether there are "lost" minutes to put in **Other**, and if more than one category applies to a given stretch of time, use the one that is higher in the list. Example: If you eat while on duty at work, code as **On the job**, not as **Eat**. If you eat during your lunch break at work (or at home, restaurant, etc.), **Eat** would be the correct code. **Important exception for sleep category:** Make your records for the current column when you go to bed, without waiting for the end of the interval. You need not make any records while asleep, but when you wake up, record the time and fill in the intervening intervals. Example: you start a snack at 11:55 pm, go to bed when you finish at 12:10 am, and awake at 8:00 am. At 12:10am you will write "Start 12:10am" and record 10 minutes of **Eat** for 12-2am. At 8:00 am you will write "Finish 8:00am" and record 110 minutes of **Sleep** for 12-2am and 120 minutes for 2-4am, 4-6am, and 6-8am.

Category (* = defined below)	12-2am	2-4am	4-6am	6-8am	8-10am	10-12am	12-2pm	2-4pm	4-6pm	6-8pm	8-10pm	10-12M	**Total**
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)													
Total across categories													

* **In transit:** examples include using a car, train line, public or campus bus to get from your dorm or home to your first class, get between classes, or get from campus to an off-campus job. Note that time spent studying, socializing, etc. while in transit will count only towards the **In transit** category; the other categories will be underestimated.

* **Get exercise:** examples include walking your dog, walking between classes, biking to work, playing on the soccer team, exercising at the gym—almost any physical activity in which you get exercise, regardless of whether getting exercise is the main purpose. However, exercise during work hours is coded as **On the job**, since that code has priority.

* **Tasks of daily living:** examples include brush teeth, fix dinner, do laundry, look at mail, buy batteries, make bank deposit.

* **Relax/socialize:** Can be alone or with others; examples include watching TV, drinking at a pub, talking with friends, listening to music, playing the guitar, playing games, daydreaming, lying on the couch in a stupor. (Recreational activities that provide physical exercise, such as walking on the beach or playing on the soccer team, are coded under the **Get exercise** category.)

* **Other:** anything that does not seem to fit in one of the preceding categories., e.g., biology research project for independent study credit, psychology practicum, philosophy club meeting, volunteer work at a food pantry, shopping for clothes, getting a new audio system hooked up. Miscellaneous and "lost" minutes also go here.

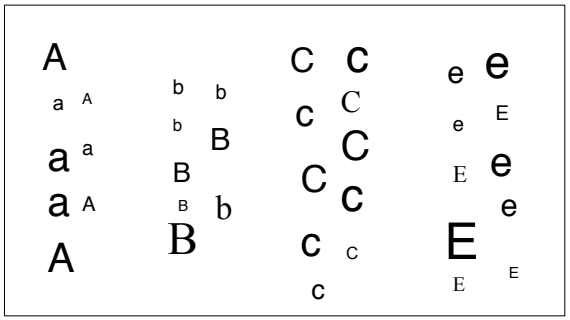
Hierarchical organization

In political contexts, *hierarchy* refers to power relations

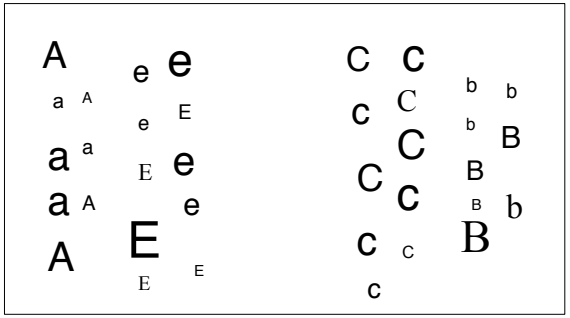
In taxonomy, it simply refers to the inclusion of more specific categories into more general ones

- 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)

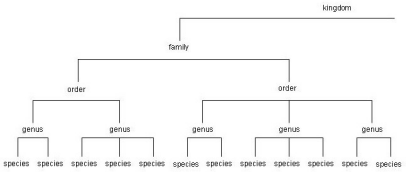


High-level category



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