Categorizing: Delineating the Phenomena

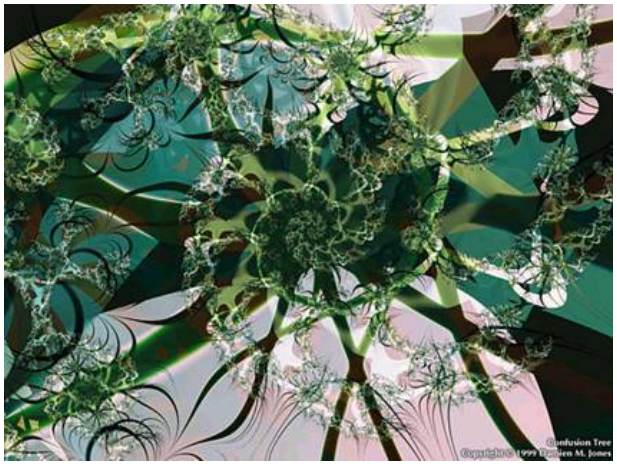
http://philosophy.ucsd.edu/faculty/wuthrich/

12 Scientific Reasoning

Acknowledgements: Bill Bechtel

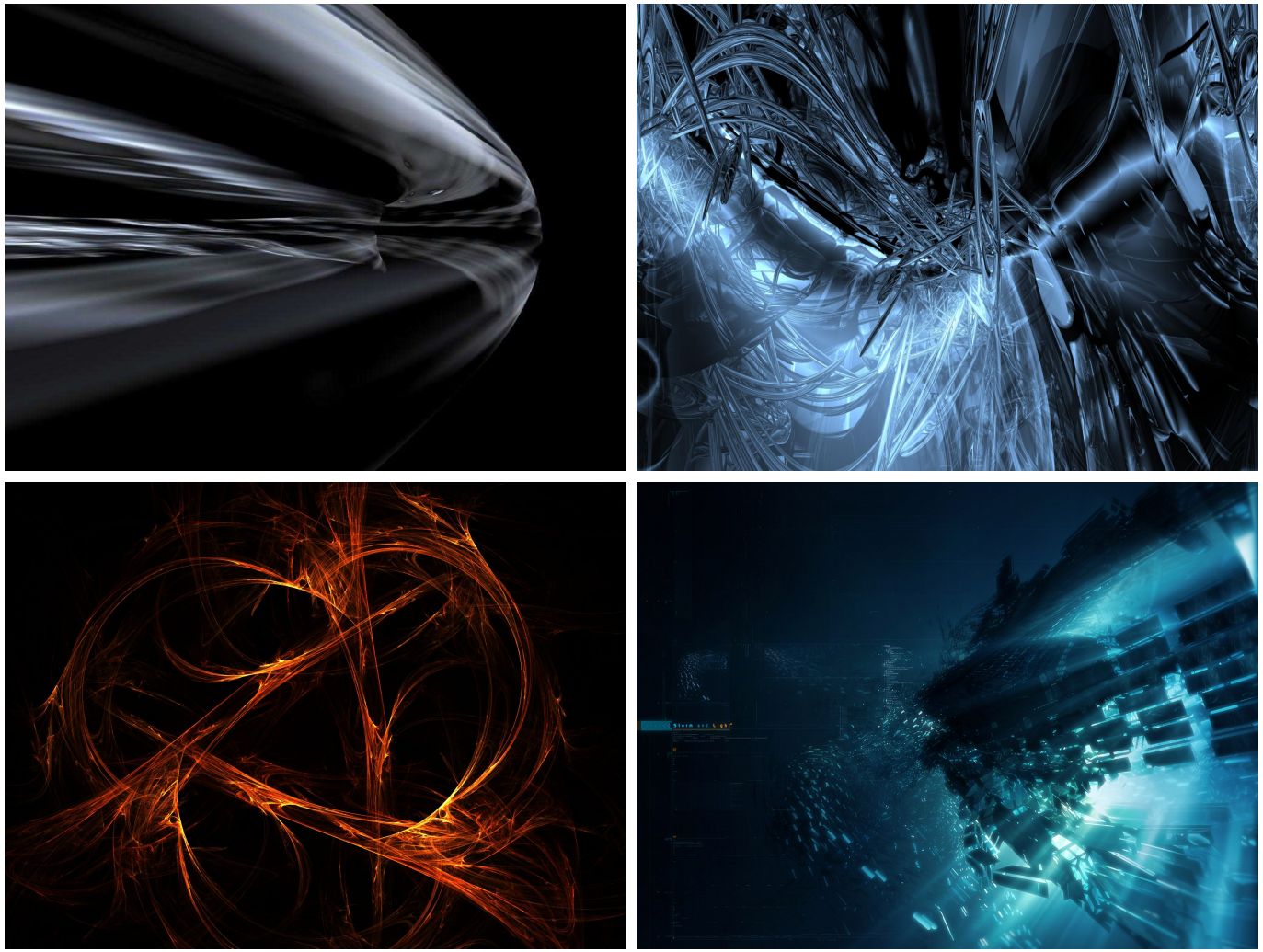
Individuals and categories

- The entities we encounter in the world are individuals—a particular dog, a particular flower, a particular bacterium, 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 identity 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?

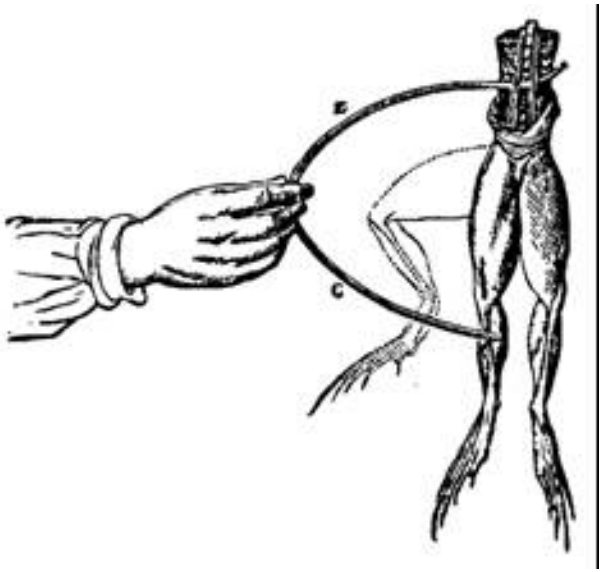
Multiple category schemes

- 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?

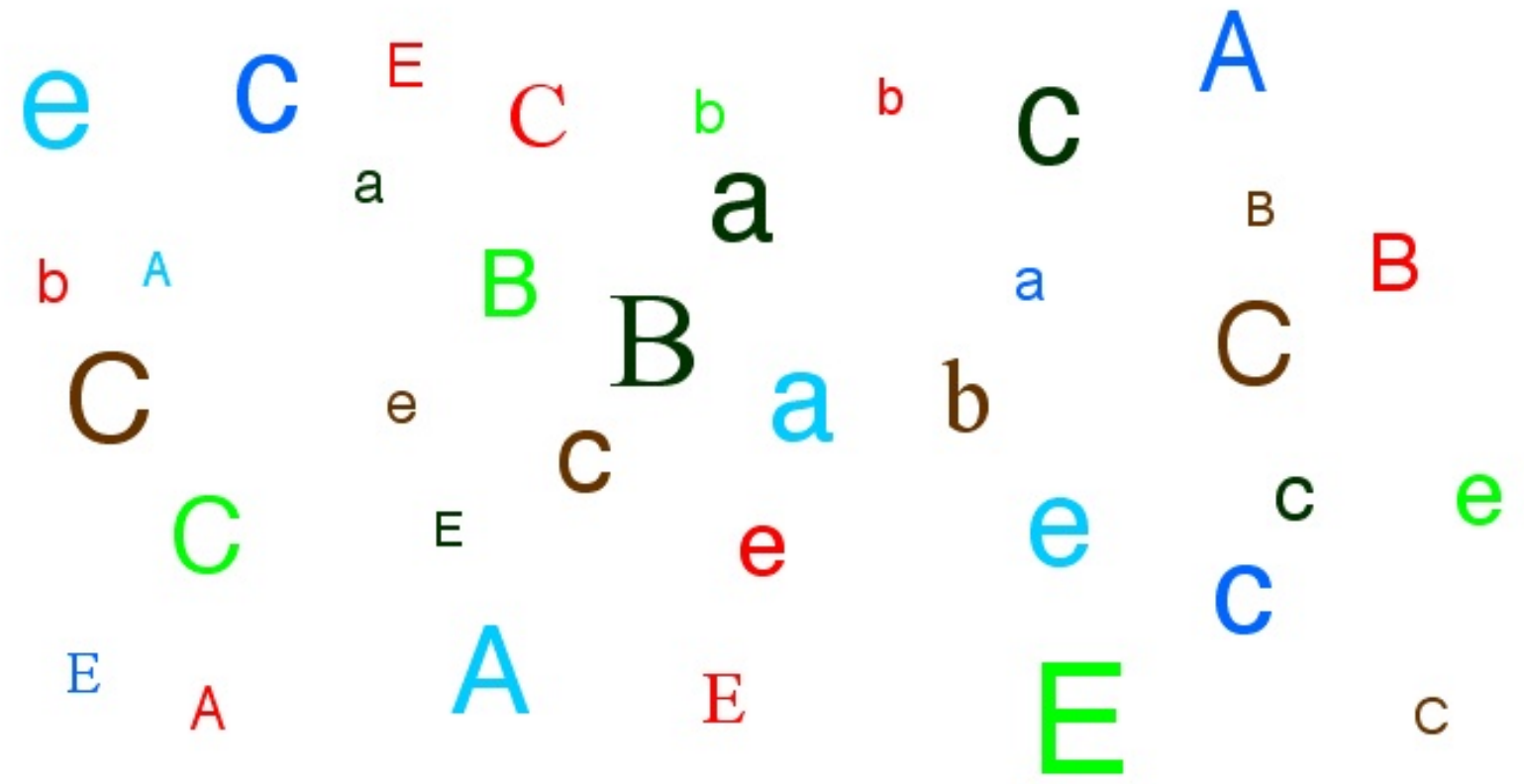
Delineating the phenomenon

The way in which we categorize phenomena provides our cognitive handle on it,

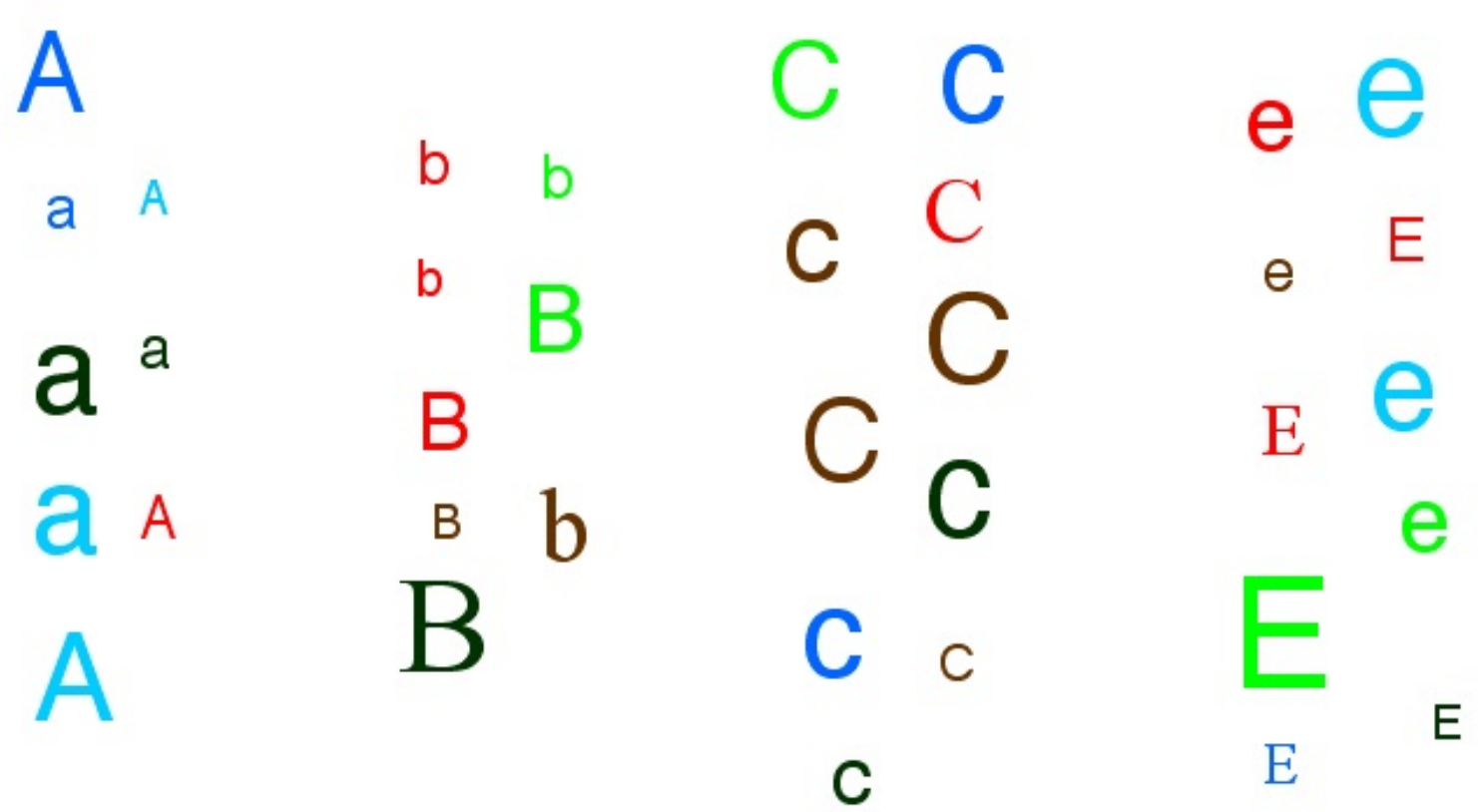
- the way we think about it,
- the question we ask about it,
- the investigations we conduct,
- the way we use it.



Categorize these: how many ways can you do it?

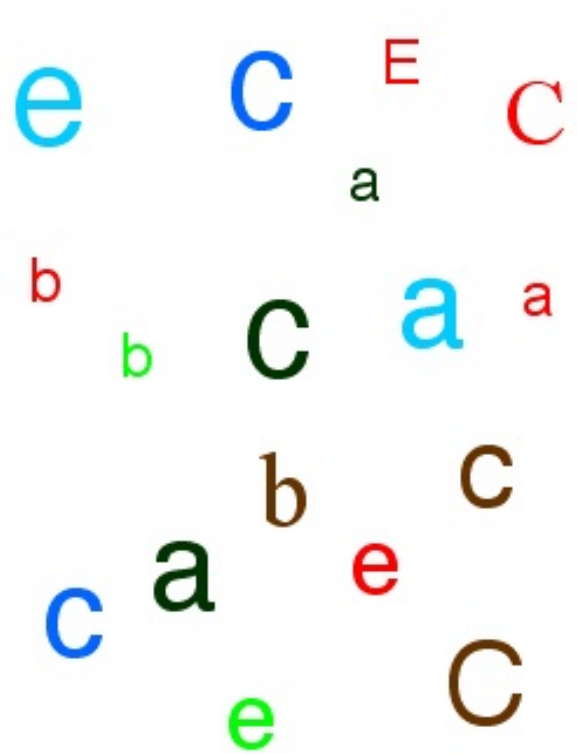


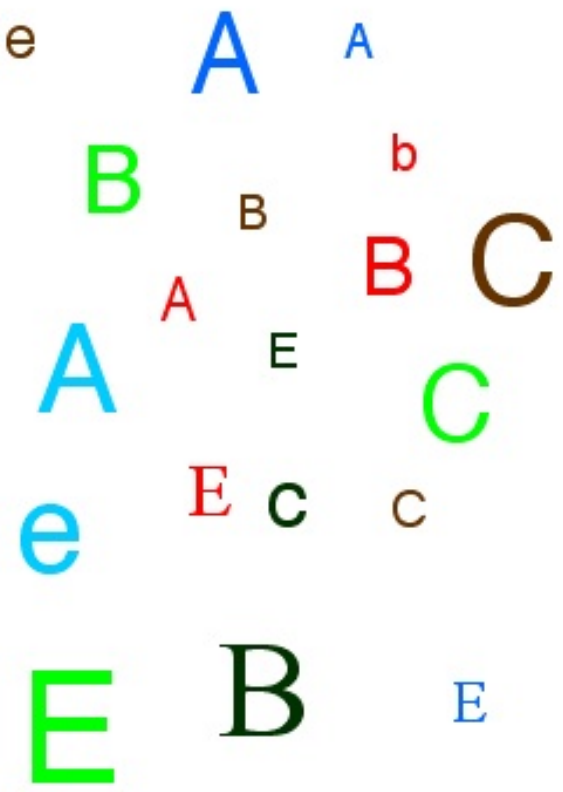
Categorizing by letter



Categorizing by colour

Capitals vs. lowercase

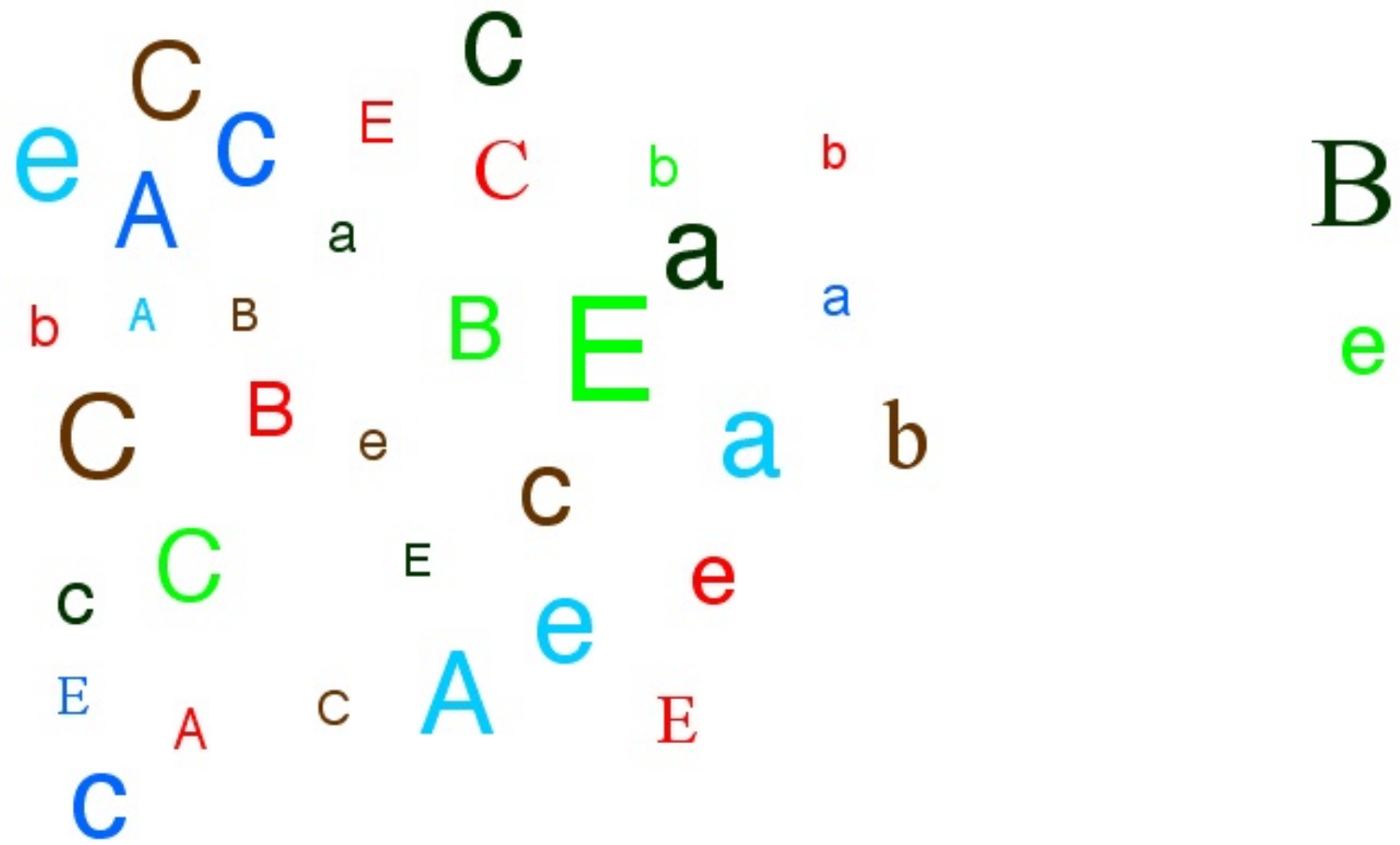




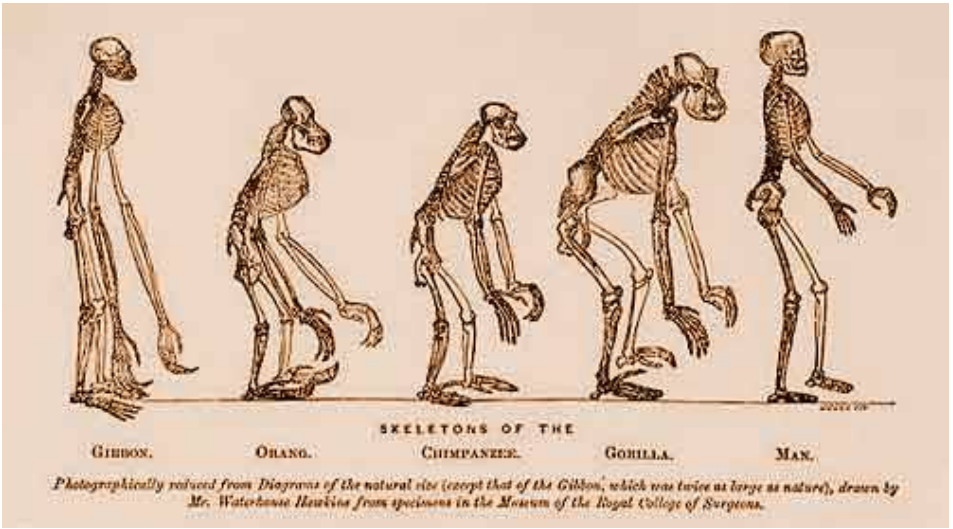
Categories and names

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

Perfectly good categories—but no names



Forming categories



Categorize these apes

Categorized by species

Species differences are not always obvious. *Pan troglodytes* (Chimpanzee, top) and *Pan paniscus* (Bonobo, bottom) 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).

Delineating vitamins

- In the C19 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 and print stamps in his honour.
  - Afterwards all diseases were treated as due to germs—but we still have to remind people about them!

- But 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.
- These diseases were still a mystery.
  - 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 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:
  - to split: record each different model of car
  - to lump: count each different model of car as a car

United States
Census
2010
2010 Census
This is the official form for all the people at
It is quick and easy, and your answers are
Use a blue or black pen.
Start here
The Census must count every
April 1, 2010.
Before you answer Question 1, coun
this house, apartment, or mobile home
people, including babies, who live
products counts in institutions

Exclusive and exhaustive categories

- establish categories so that each item first into a category—exhaustive
- establish categories so no item fits into two categories—exclusive

How do animals spend their days?

Develop a coding system for animal behaviour (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

How do UCSD undergraduates spend their days?

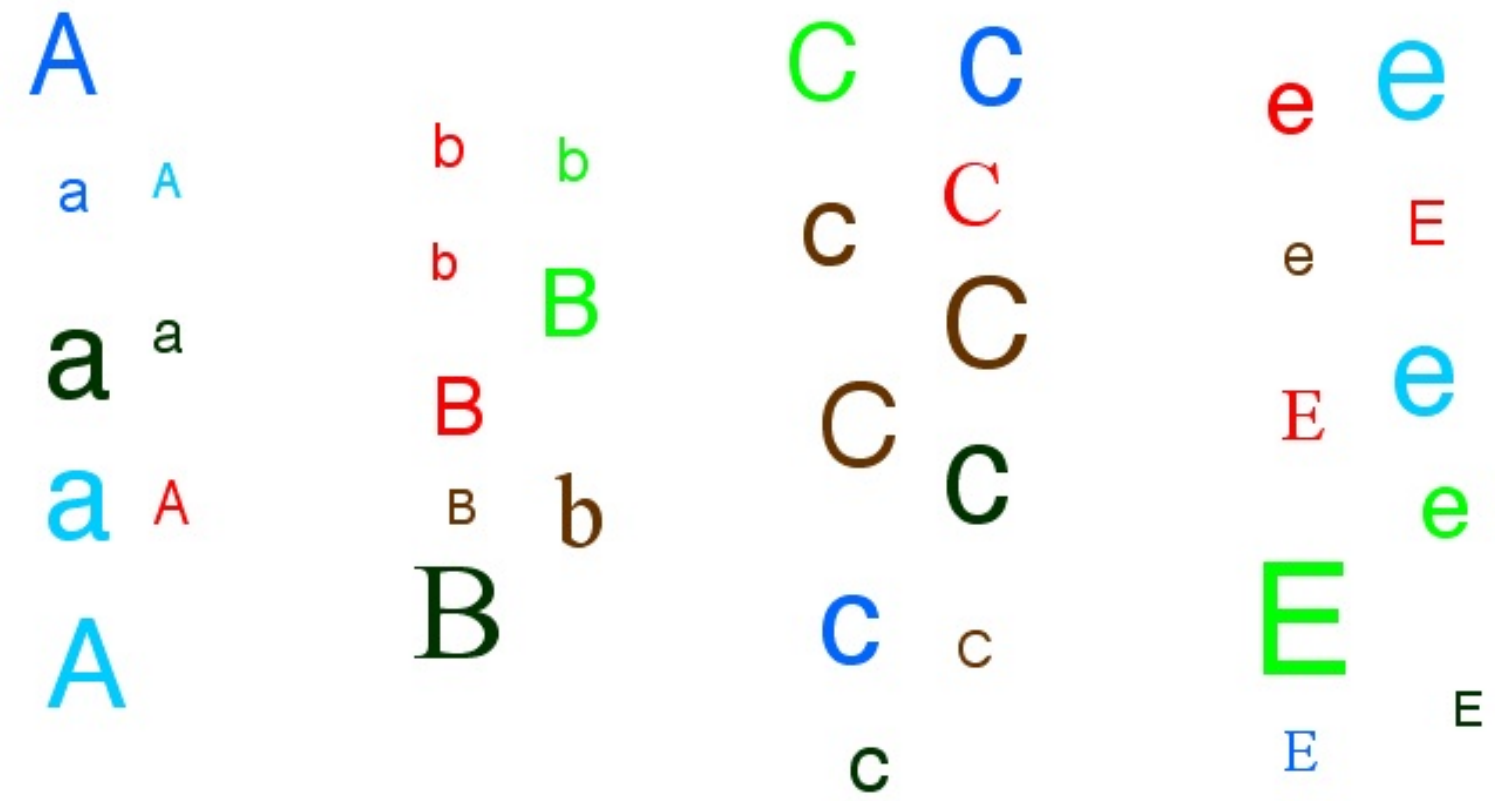
What would be the useful categories to develop a profile of how students spend their time?

- 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/Facebook*
- Sleep Start... Finish...
- Other* (optional to specify)

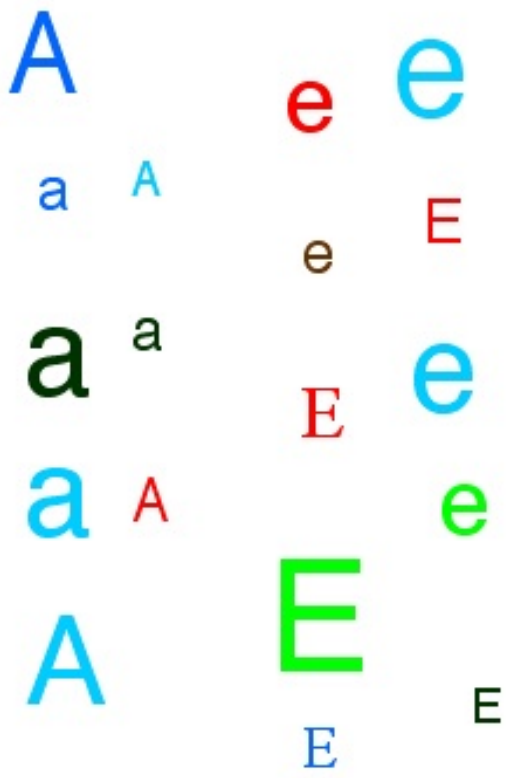
Hierarchical organization

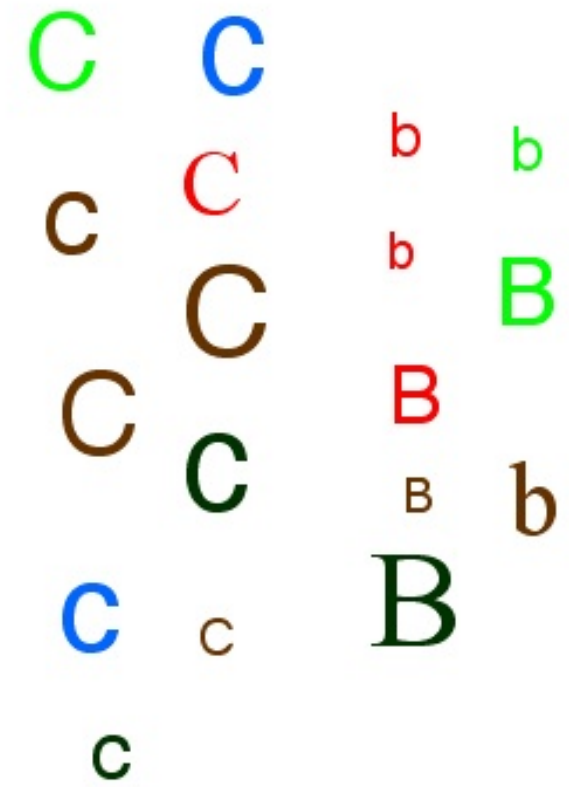
- In political contexts, hierarchy refers to power relations.
- In taxonomy, it simply refers to the inclusion of more specific categories into more general ones:
  - What is true of the more general categories is true of each of the sub-categories within it.
  - Provides a powerful way of organizing and keeping track of information.

Categorizing by letter (again)



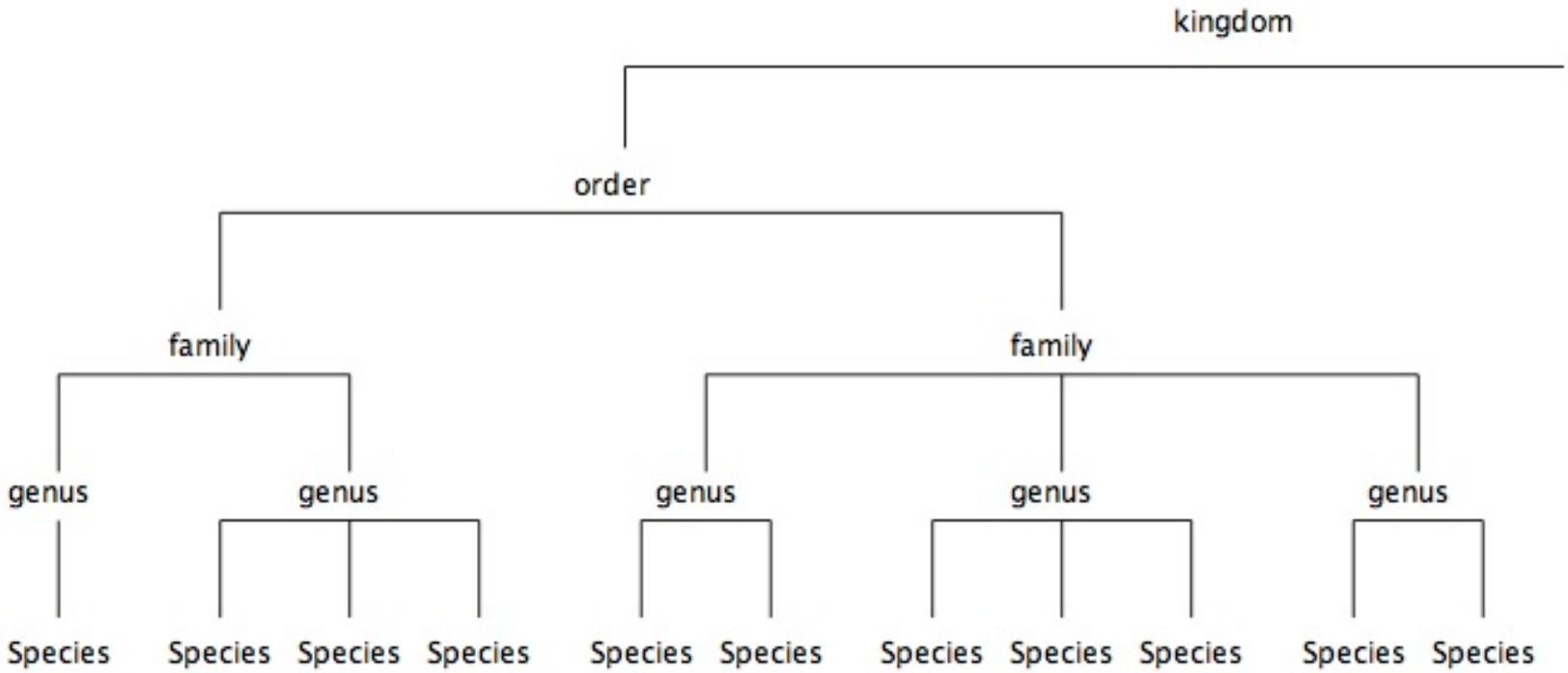
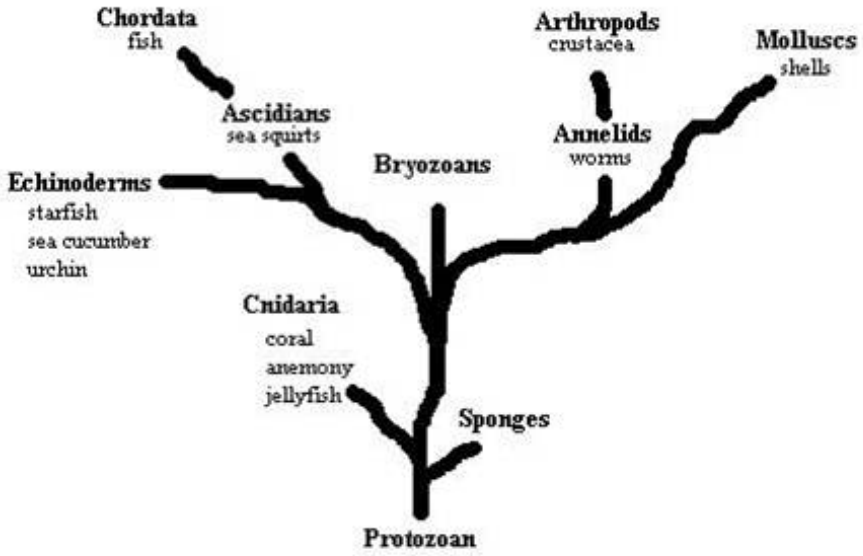
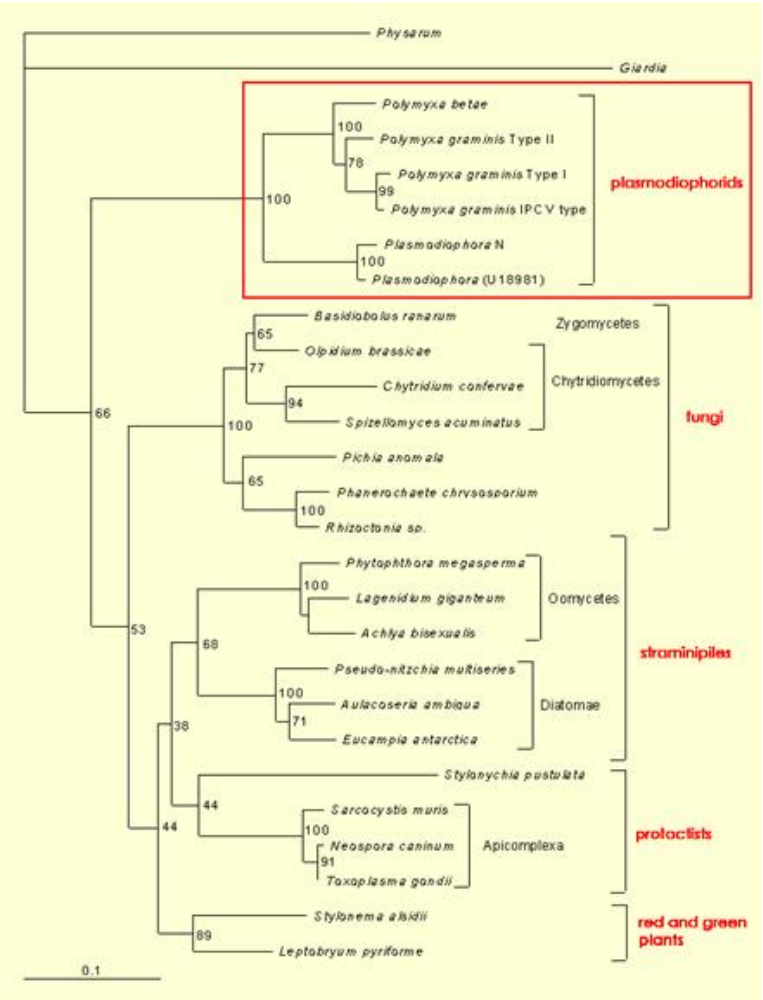
High-level category





Representing taxonomy in trees

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



Other orientations of trees