Chicken sexing

- Chicken sexing is the process by which newborn chicks are determined to be male or female
- Doing this accurately is worth $billions to the poultry industry
- Novices can classify with 50% accuracy
- Experts can sex 1400 chicks/hour with 98% accuracy

- *But nobody knows how they do it*

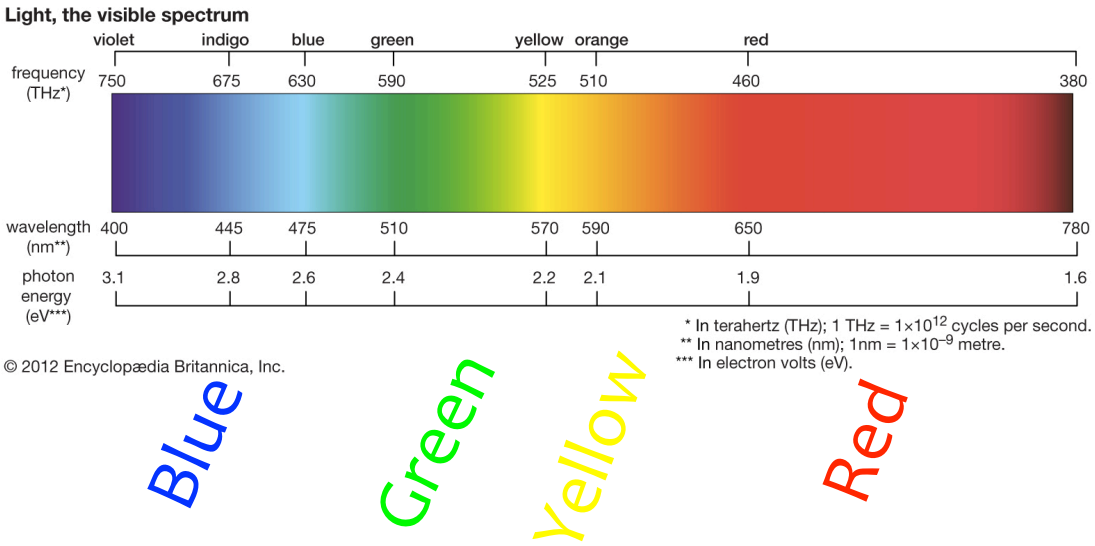
- The difference between novices and experts is perceptual feature learning

Subjectivity of features

Realists hold that features are given by the world

- e.g.: color as physical wavelength

Ultraviolet<-



->Infrared

Blue Green Yellow Red

But what are the bands?

There are no physical boundaries in the wavelength spectrum; the boundaries are mental

What are physical features?

- Locke thought there were primary qualities that were inherent in objects themselves, e.g. size, shape, location

  - while secondary qualities were mental apprehensions (e.g. color)

- … While modern physics has identified a variety of very non-intuitive properties as the only "truly" primitive ones

  - e.g. mass, charge, and spin

- So where does that leave ordinary perceptual features like size, color, and shape?

  - Answer: they are the result of complex perceptual inferences processes which can be influenced by categorization

What is a "feature?"

- The Ugly Duckling Theorem (again):

  - If "feature" just means "a way of dividing up objects" then the UD theorem means that all categories share the same number of features

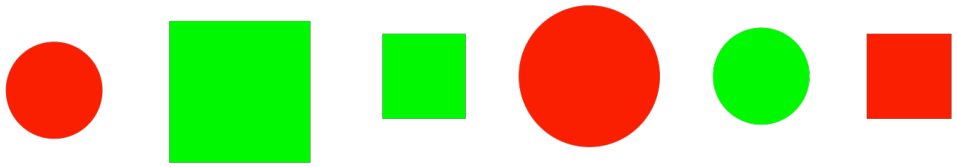
- The solution is that the system has certain properties it assumes as primitive features—other arbitrary divisions among objects are not features

- Perception provides the primitive features.

- ….but perception is influenced by how we categorize the world

The standard model

- Traditionally, experiments have treated the features as "given", and only the category as unknown

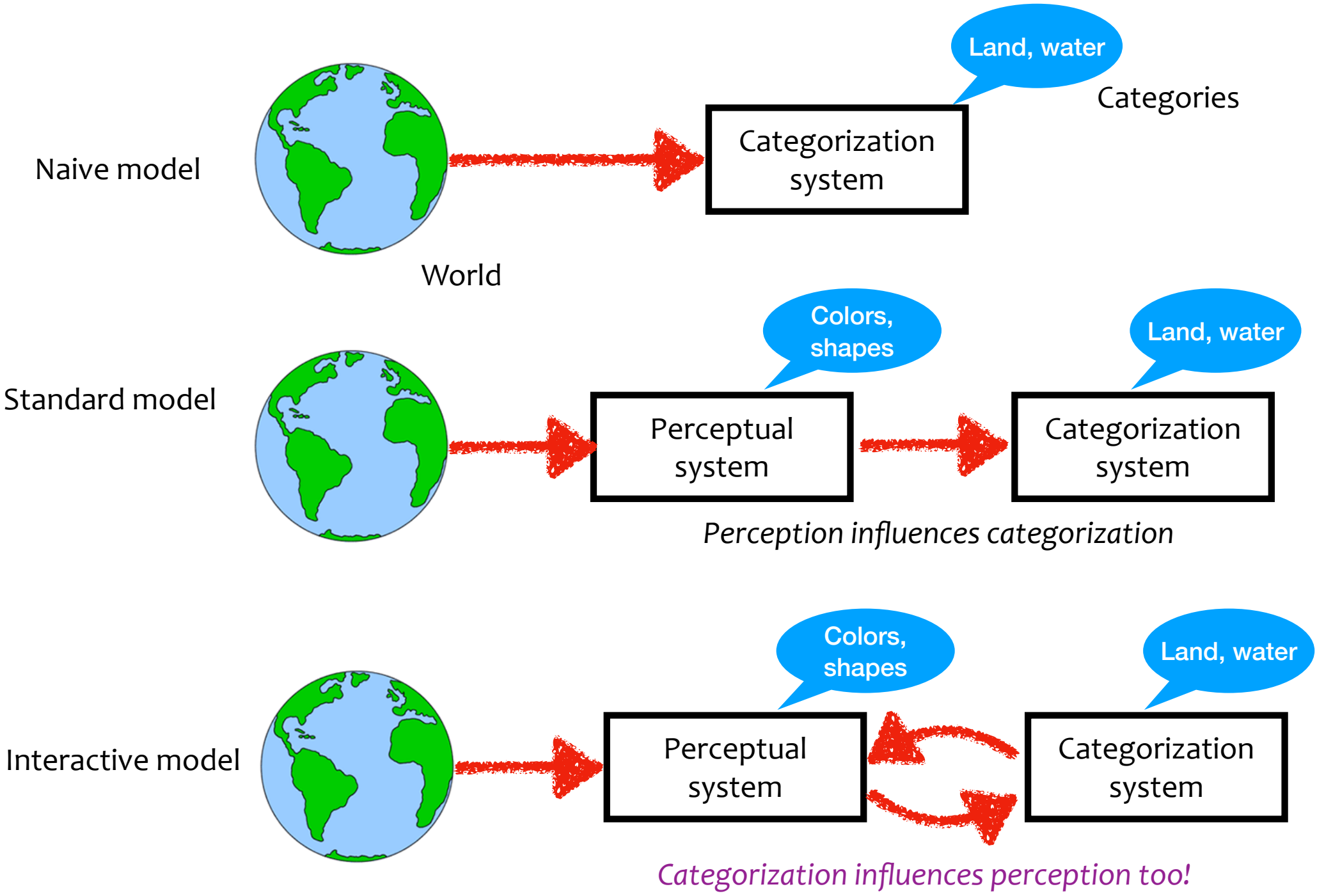


small ∧ green

conjunctive

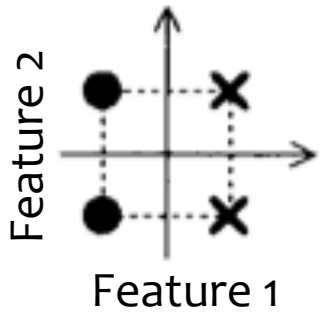
- But if perceptual features have to be inferred just like the categories, what's the difference?
- There is no clear answer to this, except to say that some perceptual feature set is given by evolution
- … but it can be modified by training

Three views of perception vs conception



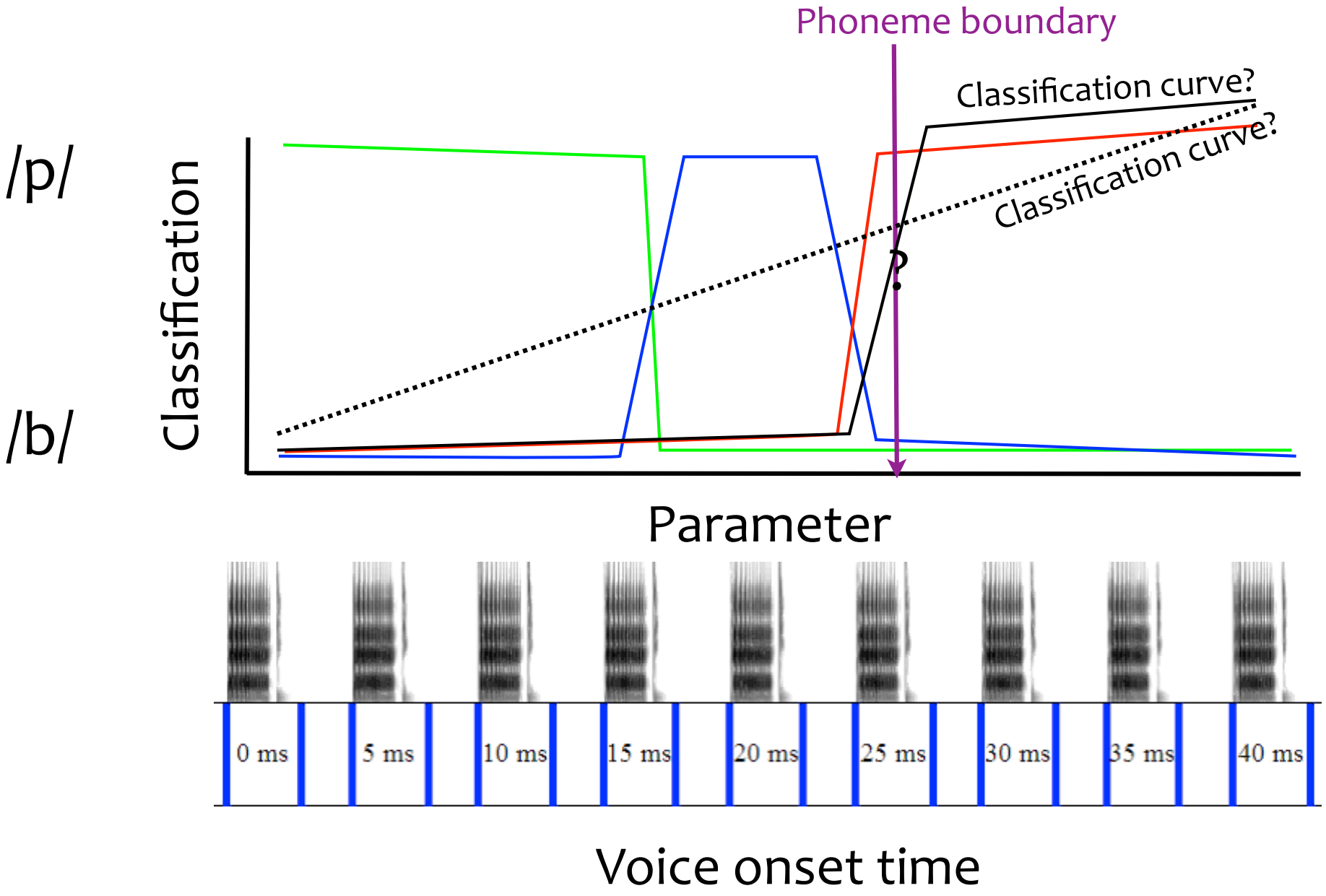
Attention weighting

- In some influential exemplar models, the perceptual feature space is assumed to expand or shrink in proportion to "attention" to particular perceptual dimensions.



Before learning

Categorical perception in speech perception

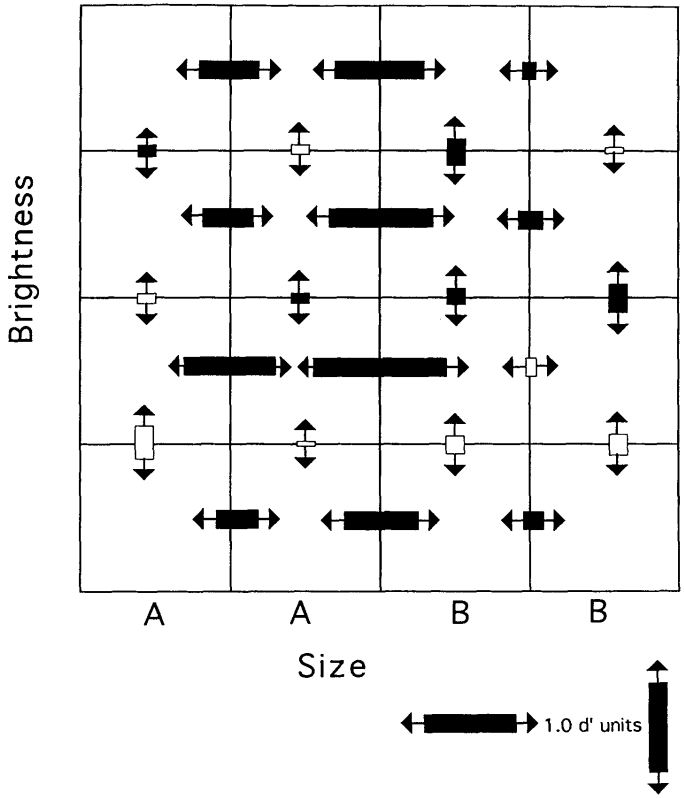


Categorical perception

- Categorical perception is the tendency to interpret perceptual features in a categorical manner
  - Objects within a category seem more perceptually similar
  - Objects in different categories seem more perceptually different
  - Perceptual discrimination near the boundary improves measurably
- Note that this cannot be explained by attention weighting!

Goldstone 1994

- Stimuli in a size-brightness feature space
- Subjects were trained on a size categorization task
- Before and after the category training, subjects were tested in basic perceptual discrimination along the size axis and the brightness axis



- Subjects' size discrimination improved more than brightness
- ->The experiment induced categorical perception of size