Classical View: Extensional Definition of Categories

The **Extension** of a Category is an *exhaustive enumeration* of its members.

An **Extension** is a *set-theoretic* perspective on category structure that allows for useful set-theoretic operations to create *new complex categories*.

**E.g.,**

\[
\text{DOG} = \{ \text{Fido, Fred, Sam, Jupiter, Apollo, Spot, Rover, Lassie, Rintintín, …} \}
\]

\[
\text{FEMALE} = \{ \text{Eve, Mary, Helen, Hera, Boudicea, Theresa, Lassie, …} \}
\]

\[
\text{BLACK} = \{ \text{Fido, Jupiter, Apollo, Rover, Onyx, Tar, Soot, DarthVader, …} \}
\]

“female dog” = FEMALE \(\cap\) DOG = \{ Lassie, …\}

“black dog” = BLACK \(\cap\) DOG = \{ Fido, Jupiter, Apollo, …\}
## Classical Definitions: Necessary and Sufficient Conditions

A **Necessary** condition is one that *must be obeyed* to be a member of a category.

E.g., *edible, organic, tree-borne, internal-seeds*, etc. are necessary for an **Apple**

*two-wheeled, mobile, rigid, manual*, etc. are necessary for a **Bicycle**

*warm-blood, live-birth, suckles-young*, etc. are necessary for a **Mammal**

A **Sufficient** condition is one that *in itself is enough* to be a member of a category.

E.g., *having-womb* is sufficient for membership in the category **Female**

A **Set of Conditions is Sufficient** if possessing them all *guarantees* membership.

E.g., *warm-blood and suckles-young* are together sufficient to be a **Mammal**
Nonetheless, Not all Category Members are Equal

“Knowledge is knowing that a tomato is a fruit”

BUT

“Wisdom is knowing not to put it in a fruit salad”

In Classical Logical terms, all members are equal: each conforms to the necessary and sufficient conditions for membership. All are equally valid.

In Cognitive psychology terms, this is clearly not so: some members of a category are more typical/representative than others, and members are linked not by shared necessary features, but by a network of family resemblances.
The Non-Classical, Cognitive Perspective

Radial Category

Categories are radially structured about highly central and evocative prototypes

Cognitive Psychology suggests that category membership is not a black-and-white affair, based on Boolean membership criteria
Radial Category Organization:
Some frames are more representative of a parent class than others

Bird

Degree of membership determined by typicality / similarity to prototypical members.
Radial Category Organization:

The Central Member is the Prototype, against which Typicality is Measured

Fish

- Anchovy
- Tuna
- Angel
- Haddock
- Mackerel
- Mullet
- Eel
- Blowfish
- Salmon
- Trout
- Monk
- Pike
- Cod
- Plaice

Other:
- Clam
- Whale
- Shark
- Pirarha
- Shrimp
- Dolphin

Most categories have a shady area of almost or ‘strictly speaking’ members