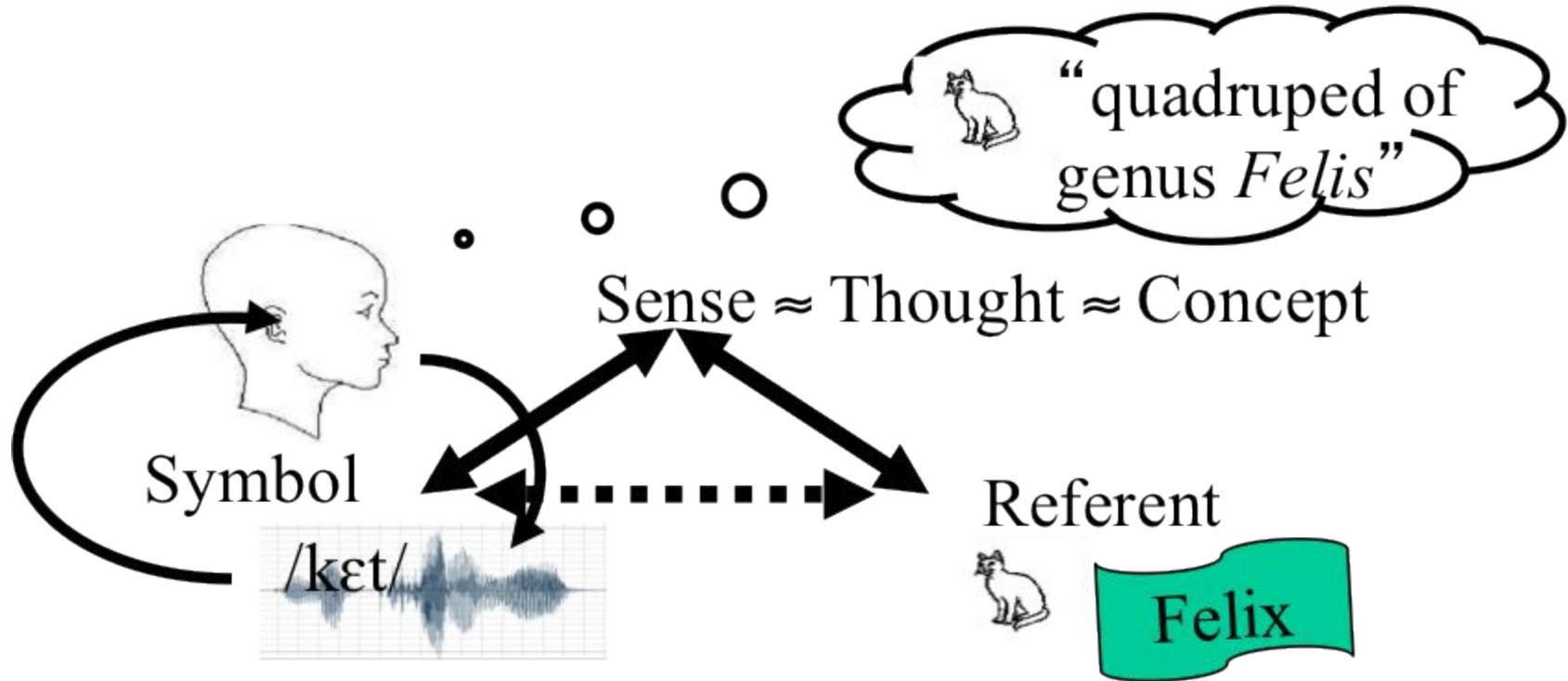# Semantics

Semiotics

Linguistics

4 Meanings of *mean*

1. Representations - Ψ conveys info about φ
2. Translations - potato == tŭdòu
3. Paraphrases - different symbols same info
4. Intentions - Ψ means φ if Ψ is a person and φ is something Ψ intends to do

The Semiotic Triangle

Intension vs. Extension

Intension - the meaning of the word that is not grounded in the real world.

  E.g. talking about Japan right now

Extension - the physical referents in world that the word can be mapped to.

Composition (Frege)

The meaning of sentences is built incrementally by combining the meanings of their constituents.

First Order Logic

Terms

Terms are unique entities.

They are represented by lowercase letters.

Terms

Mary hugs **John**: hug(mary, john).

Predicates == Sets

Predicates are either properties (i.e., require one term) or relationships (i.e., require more than one term).

Predicate

Mary **hugs** John: hug(mary, john).

Conjunction and Disjunction

Conjunction: ∧ (, in PROLOG)

Disjunction : ∨ (; in PROLOG)

Merida ate liver and onions:

eat(merida, liver) ∧ eat(merida, onions).

Elinor or Fergus drank the wine:

drank(elinor, wine) ∨ drank(fergus, wine).

Implication and Biconditional

→ : Implication (reverse direction in PROLOG)

↔ : Biconditonal

If Mary is asleep, she is at home.

sleep(mary) → locatedAt(mary, home)

A polygon is a triangle iff it only has three sides.

triangle(polygon) ↔ 3sides(polygon)

∃*x* : Existential Quantifier

There exists an *x* such that ….

The bald, king of France …

∃ x kingOf(x, france) ∧ bald(x)

∀*x* : Universal Quantifier

For all *x*, … (e.g., Ducks quack.)

Compare:

$$\forall x \; duck(x) \land quack(x)$$

And

$$\forall x \; duck(x) \to quack(x)$$

∀*x* : Universal Quantifier

For all *x*, … (e.g., Ducks quack.)

Compare:

$$\forall x \; duck(x) \land quack(x)$$

And

$$\forall x \; duck(x) \rightarrow quack(x)$$

Scope

Every girl has kissed a boy.

Compare:

$\exists x [\forall y [girl(y) \rightarrow boy(x) \wedge kissed(y,x)]]$

And

$\forall y [girl(y) \rightarrow \exists x [boy(x) \wedge kissed(y,x)]]$

Model Theoretic Semantics

Models

A model is a representation of a situation or context. A model contains:

Domain -- the set of entities in the context

Interpretation Function -- a set of ordered pairs

Assignment Function (g)

Can we assign values to variables that satisfy the constraints in both the model and the query?

For example,

Model: Query:

Another example,

Model: Query: