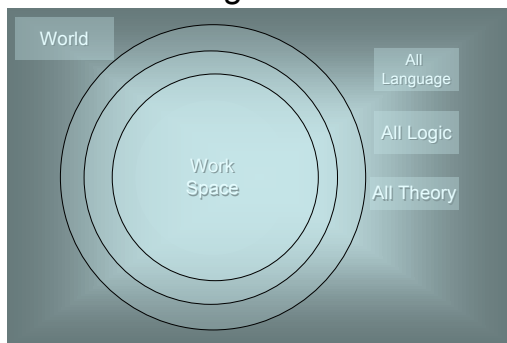


Logic, the world and theory

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Big Picture



Expressiveness

- The world is all that exists, even the unexpressed.
- The sum of all languages and language forms is all that can be expressed.
- The representation of things that are true or false or true and not-true is all that logic can represent.
- The consistent fusion of language and logic produces all theory.
- The work space for any problem is constrained by all.

Control

- The world cannot be controlled.
- All languages taken together are controlled by the speakers and their history.
- All logics are controlled by consistency.
- All theories are controlled by the world, logic and language.
- The work space is controlled by all.

Initial Assumptions

- Logic considers only two values; true and false.
- Only declarative and “literal” sentences of language can be either true or false.
- The internal representations in a sentence may or may not be important and in either case only the truth value is important.

Expanding Logic

- Propositional logic: the internal structure of the proposition is ignored and only propositional connectives are relevant.
- First order logic: adding to propositional logic objects, predicates and quantifiers over objects. (Higher orders are possible.)
- Modal logic: at least collections of propositions in which propositional logic holds and accessibility relations between the collections

Computers transform data

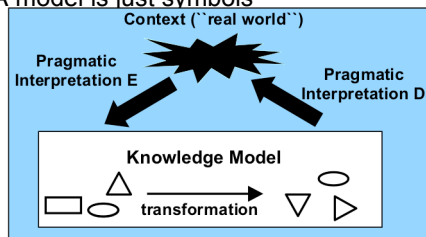
- Logic Models



- Well-defined transformation rules preserve and/or derive symbols and relations in the model

Interpreting a model

- A model is just symbols



Examples of interpretations

- Suppose we are presented with a simple model containing the following two relations:
parent(Edward, George)
parent(George, Edward)
- Many conclusions are possible
 - E.g., language and culture of the example are English.
- The parent relation denotes the relationship between a human parent and their child.
- Edward and George are English human names, representing actual humans.
 - If we know British history, these are important historical figures; namely, British monarchs.

More interpretations

`parent(Edward, George)`

`parent(George, Edward)`

- 2 possible interpretations
 - the first symbol represents the parent of the second, or
 - the second symbol represents the parent of the first.
- Assume order is consistent between the two.

More interpretations

`parent(Edward, George)`

`parent(George, Edward)`

- Assume that both of the relations given are true; i.e., hold at the same time.
 - An apparent inconsistency
 - A person Edward who is the parent of a person George cannot simultaneously have that same person George as its parent
 - Violates what we know about the parent relationship between humans.
 - We therefore would assume that the knowledge model includes at least three distinct persons, with two of them named Edward, or two of them named George.

Still more interpretations!

- Names not chosen at random
 - Chosen to exploit our knowledge in clarifying the example
 - Note that for those unfamiliar with British monarchs, this social/cultural cue does not occur.
- Using previous two assumptions, we infer that arguments are parent then child, since for British monarchs, only George V had someone named Edward as both his parent or child.
- Infer that the individuals denoted are as follows:
`parent(Edward-VII-British-monarch, George-V-British-monarch)`
`parent(George-V-British-monarch, Edward-VIII-British-monarch)`
- We could also conclude an additional relationship:
`grandparent(Edward-VII-British-monarch, Edward-VIII-British-monarch)`
