Components of Representational Systems

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Basic Characteristics of Meaning Representations

Verifiability

Unambiguous Representations

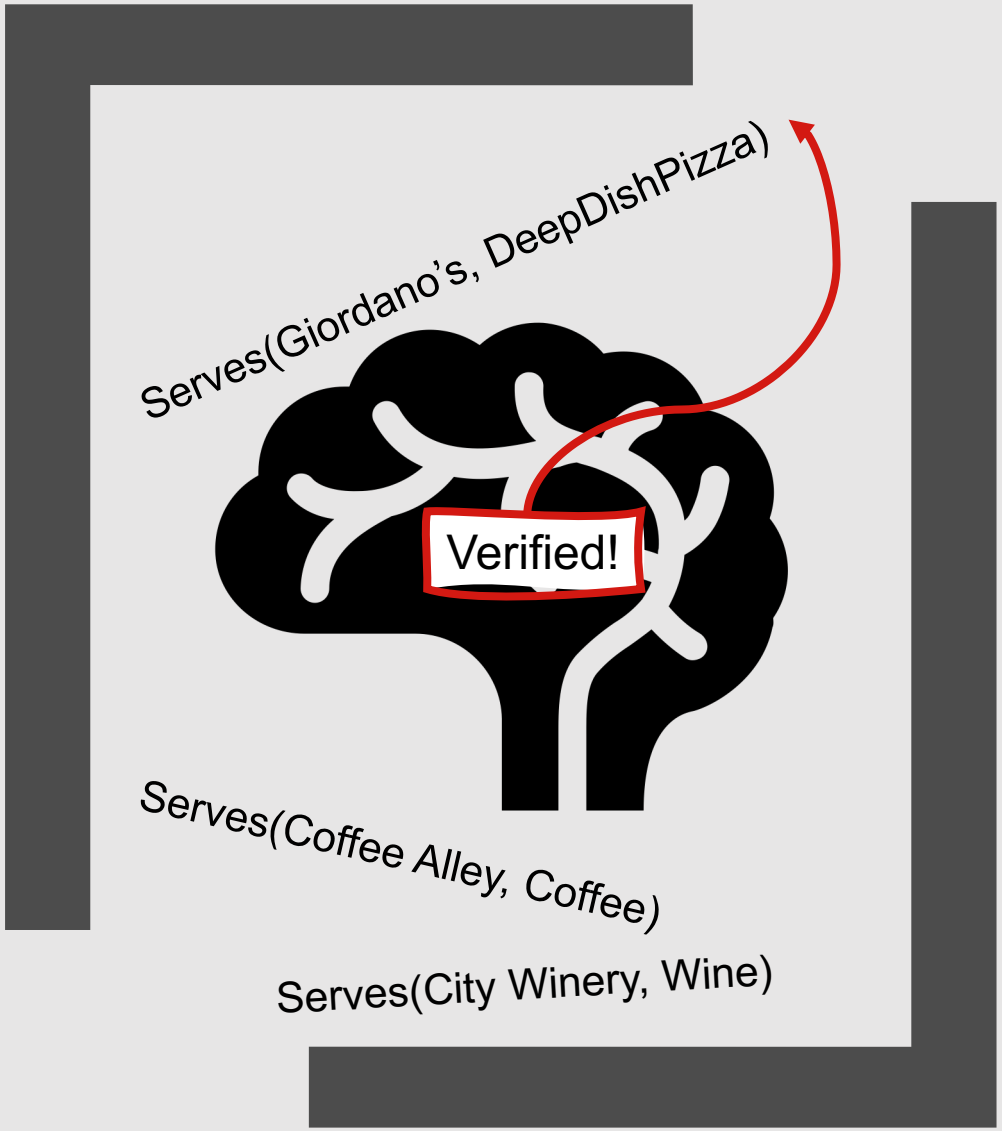
Canonical Form

Inference and Variables

Expressiveness

Verifiability

- Meaning representations determine the relationship between (a) **the meaning of a sentence** and (b) **the world as we know it**
- Computational systems can verify the truth of a meaning representation for a sentence by matching it with **knowledge base** representations
  - **Knowledge Base:** A source of information about the world

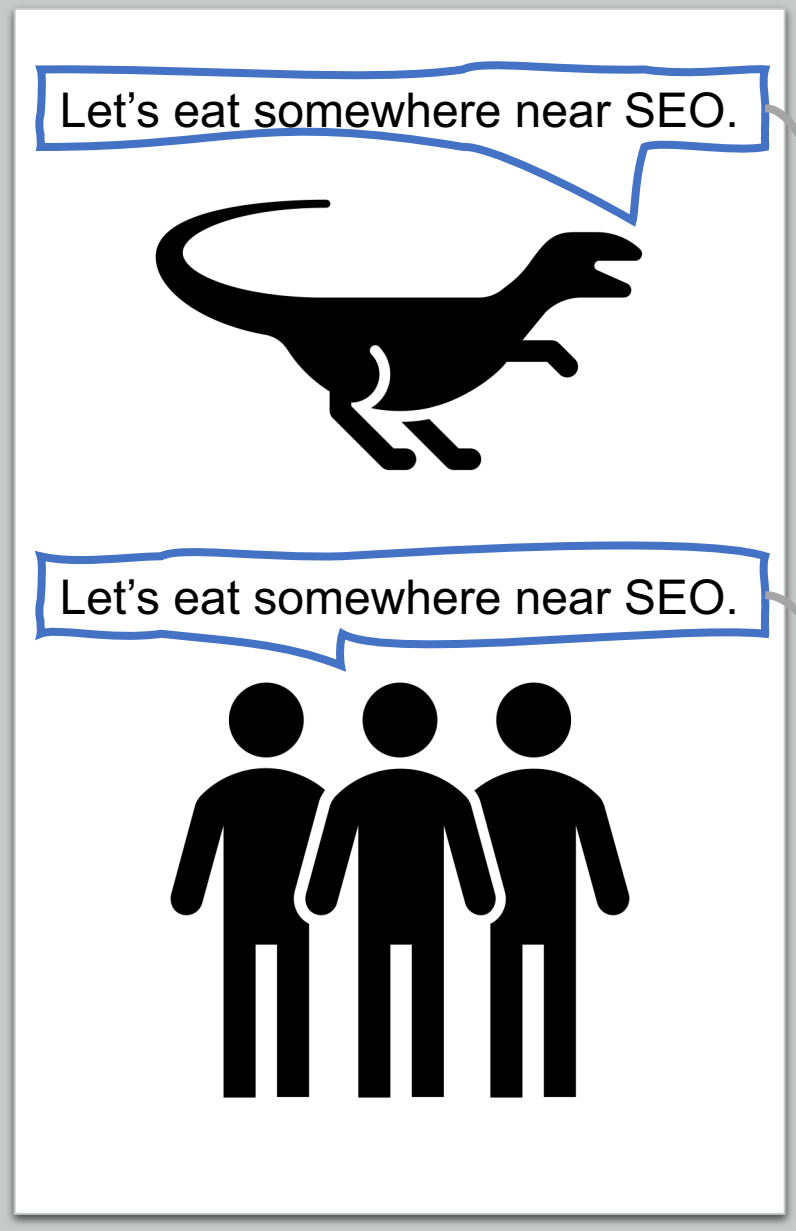


Verifiability

- Example proposition: **Giordano's serves deep dish pizza**.
- We can represent this as: **Serves(Giordano's, DeepDishPizza)**
- To verify the truth of this proposition, we would search a knowledge base containing facts about restaurants
- If we found a fact matching this, we have verified the proposition
- If not, we must assume that the fact is incorrect or, at best, our knowledge base is incomplete

Unambiguous Representations

- Ambiguity does not stop at syntax!
- Semantic ambiguities are everywhere:
  - Sarcasm
  - Idiom
  - Metaphor
  - Hyperbole
- Specifically, individual expressions can have different meaning representations depending upon the circumstances in which they occur



Unambiguous Representations

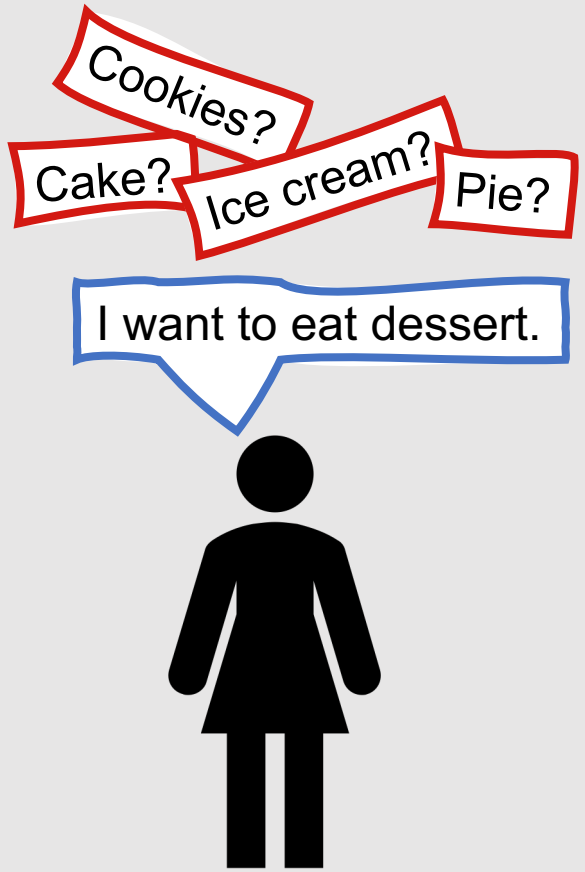
- We'll ignore ambiguities arising from figurative language in this course, and focus on the semantic ambiguities that can still arise from literal expressions
- To resolve semantic ambiguities, computational methods must be employed to select which from a set of possible interpretations is most correct, given the circumstances surrounding the linguistic input

Let's devour some building near SEO!

Let's eat at a restaurant near SEO!

Vagueness

- Closely related to ambiguity
- However, vagueness does not give rise to multiple representations
- In fact, it is advantageous for meaning representations to maintain a certain level of vagueness
  - Otherwise, you may be “overfitting” to your set of example sentences



Canonical Form

- Ambiguity means that a given sentence could be assigned multiple meaning representations
- However, **multiple sentences could also be assigned the same meaning representation**
  - Giordano's serves deep dish pizza.
  - They have deep dish pizza at Giordano's.
  - Deep dish pizza is served at Giordano's.
  - You can eat deep dish pizza at Giordano's.

Inference and Variables

- It’s impossible for a knowledge base to comprehensively cover all facts about the world, so computational systems also need to be able to draw commonsense inferences based on meaning representations
  - Will people who like deep dish pizza want to eat at Giordano’s?
    - We don’t have a fact explicitly specifying that they do, but we can infer that if they like deep dish pizza, they will probably like a restaurant that serves it

Inference

- **Inference:** A system's ability to draw valid conclusions based on the meaning representations of inputs and its store of background knowledge
- Systems must be able to draw conclusions about the truth of propositions that are not explicitly represented in the knowledge base but that are logically derivable from the propositions that are present

Variables

- Variables allow you to build propositions without requiring a specific instance of something
  - Serves(x, DeepDishPizza)
- These propositions can only be successfully matched by known instances from a knowledge base that would resolve in a truthful entire proposition
  - Serves(x, DeepDishPizza)
    - Serves(Giordano's, DeepDishPizza) 🙂
    - Serves(Coffee Alley, DeepDishPizza) 🤨

Expressiveness

- **Expressive power:** The breadth of ideas that can be represented in a language
- Meaning representations must be **expressive** enough to handle a wide range of subject matter