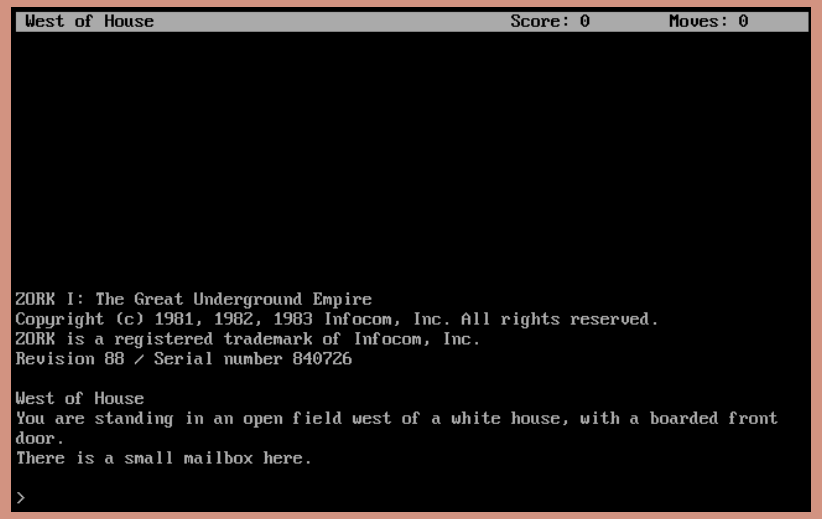
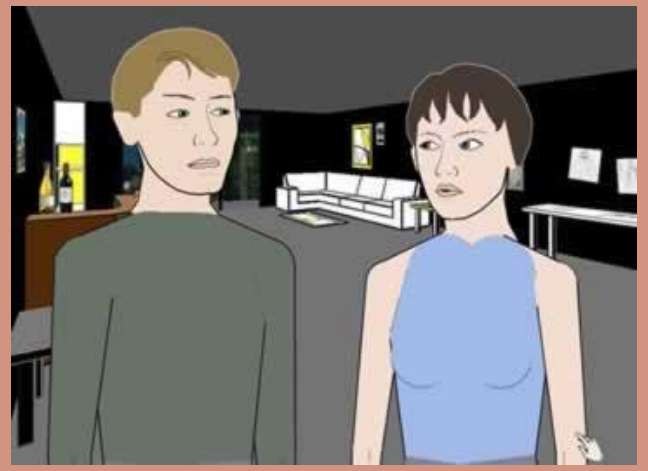
The Story So Far... (Recap)

CIS-700 Interactive Fiction and Text Generation
Module 4 - 3/15/2022
Dr. Lara J. Martin

Interactive Fiction & Storytelling



Zork I



Façade, https://www.playablstudios.com/facade
https://cdn.download-free-games.com/cf/images/nfe/screens/facade_2_m.jpg

Sentient Beings
https://grizel.itch.io/sentient-beings

What makes a good story?

What makes a story "good"?

Coherent

- coherence
- clear logic
- coherent plot lines
- consistency/continuity
- Fun (diverse) but logical.

Interesting

- surprises
- interesting, have a surprising ending
- compelling conflict
- engaging narrative
- convoluted
- coherent, has an element of surprise, complex characters, beautiful worldbuilding

Relatable Characters

- Compelling/relatable characters
- character growth
- Relatability
- Compelling plot, interesting and relatable characters, humor, unexpected but properly explained plot points
- compelling action and characters
- decent storyline, compelling characters and good writing

Something innate in us?

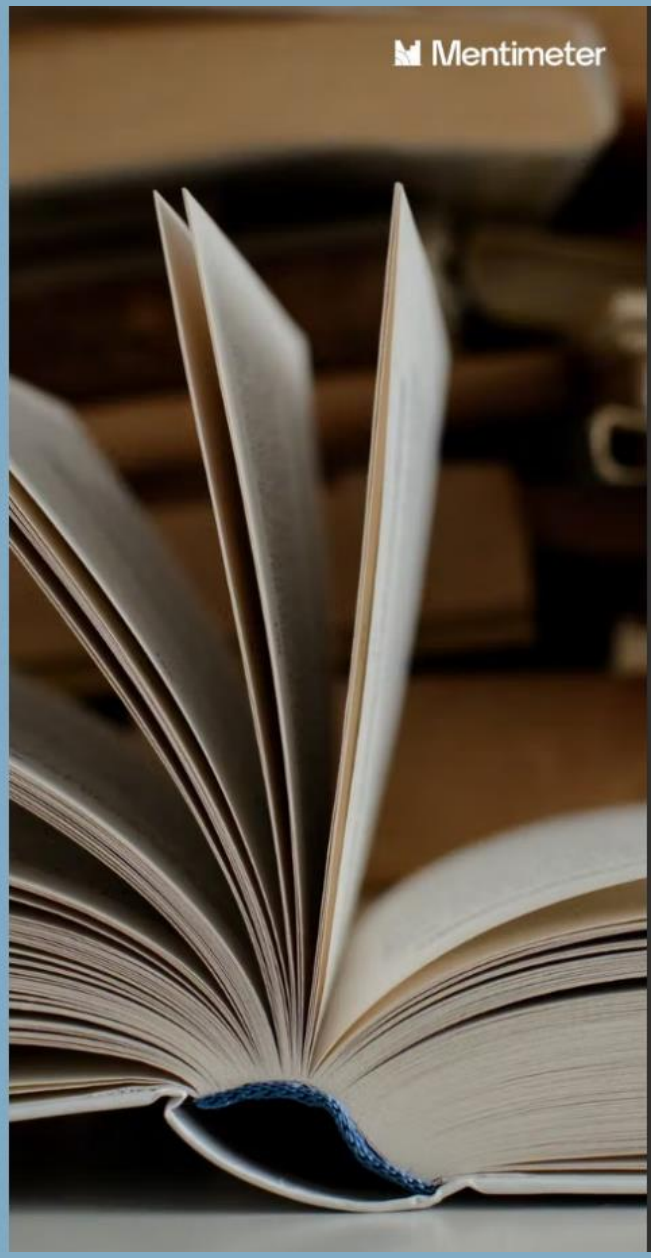
- I know it when I see it

Not everything written explicitly

- A good story make me want to come back and leaves room for the reader to think and come to their own conclusions

Complexity/Theme

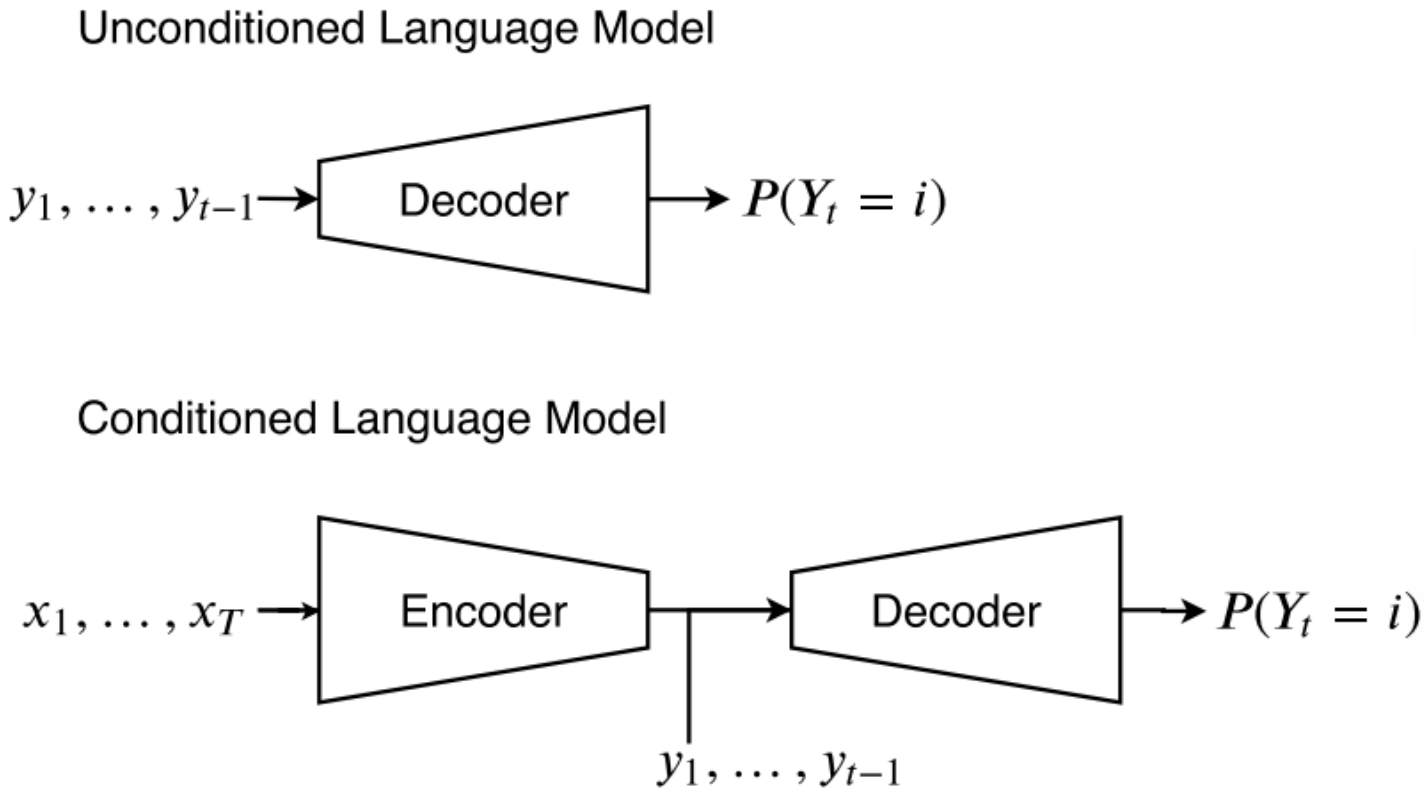
- Underlying ideas/themes
- Multiple plot elements
- underlying deep / philosophical themes
- Satisfying to read, gives interesting insights



Neural Systems

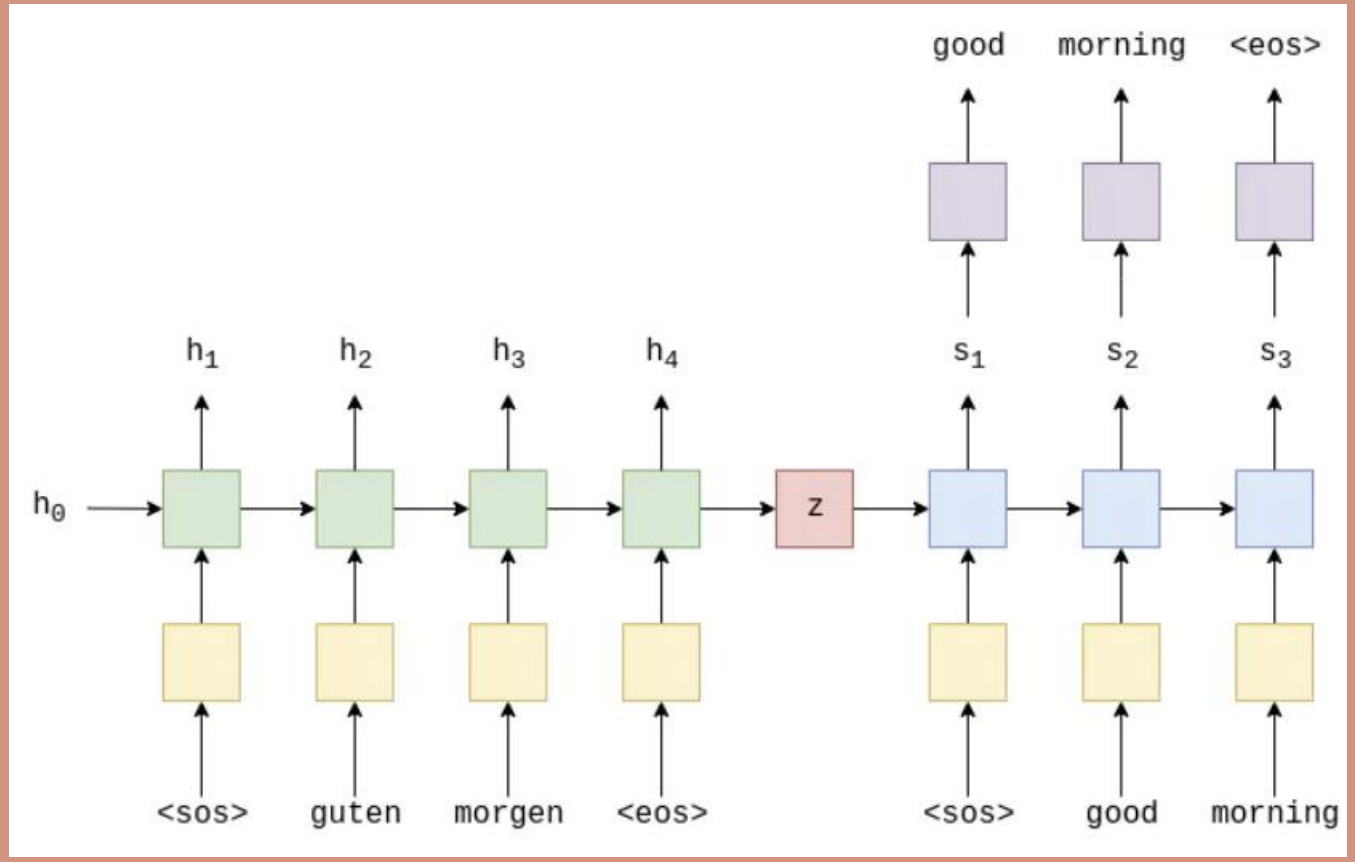
Neural Generation

- Probabilistic
  - Unconditioned
    $P(Y)$
  - Conditioned
    $P(Y \mid X)$



From Daphne Ippolito's lecture

RNNs (Sequence-to-Sequence)



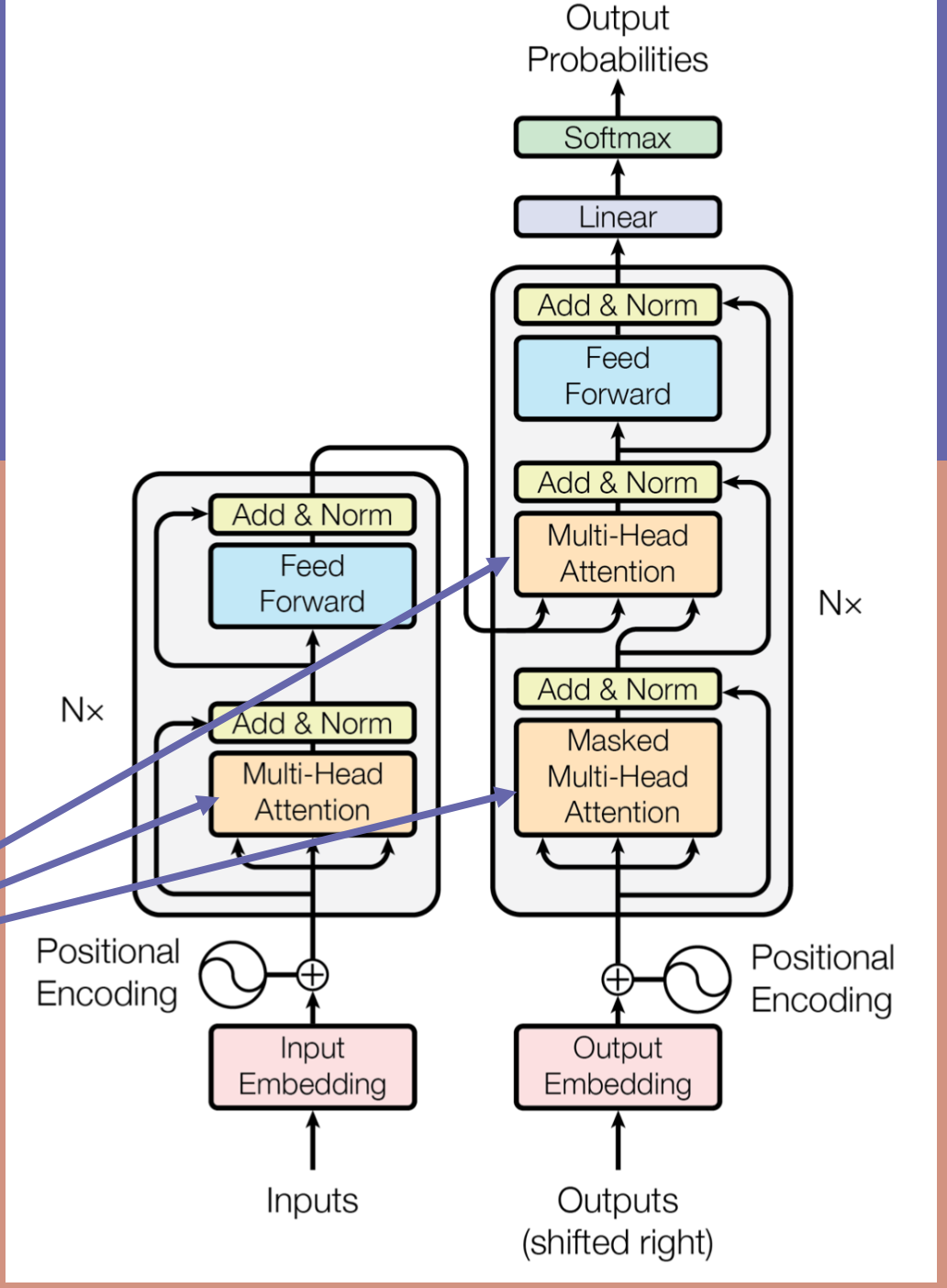
https://www.jianshu.com/p/5b06a91d4f3d

Transformers

Query Q – what you're "searching" for
Key K – what you compare the query against
Value V – the results that is paired to the key

Attention is All You Need!

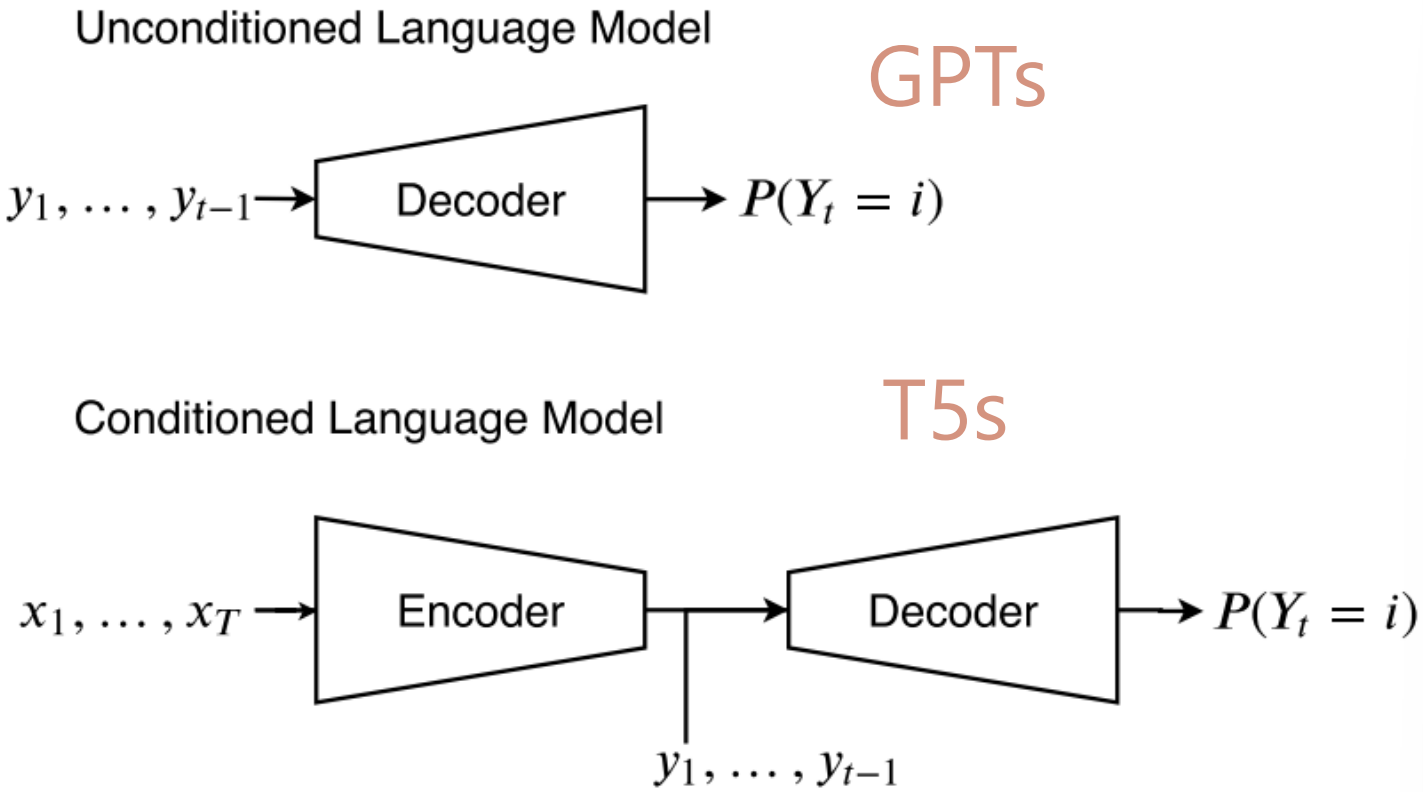
$$softmax\left(\frac{QK^T}{\sqrt{d_k}}\right)v$$



From "Attention is All You Need"

Transformer Types

Encoder-Only:
BERTs



From Daphne Ippolito's lecture

Neural Story Generation

The hungry dog licked her lips as she watched her owner eat.
"You've been a good girl," he told her. "I think you deserve a reward."
Once she was done, she jumped back on the couch and waited patiently.
Her owner took a piece of steak out of the fridge and gave it to her.
"Thank you," he said. "I'm glad you're my dog."
She wagged her tail and ate the steak.
"If you're good, you can have a treat later," he said. "But for now, you have to sleep. I have a long day tomorrow."
She nodded and lay down on the floor.
Her owner got up, turned off the lights, and lay down on the bed.

On Theme ✓

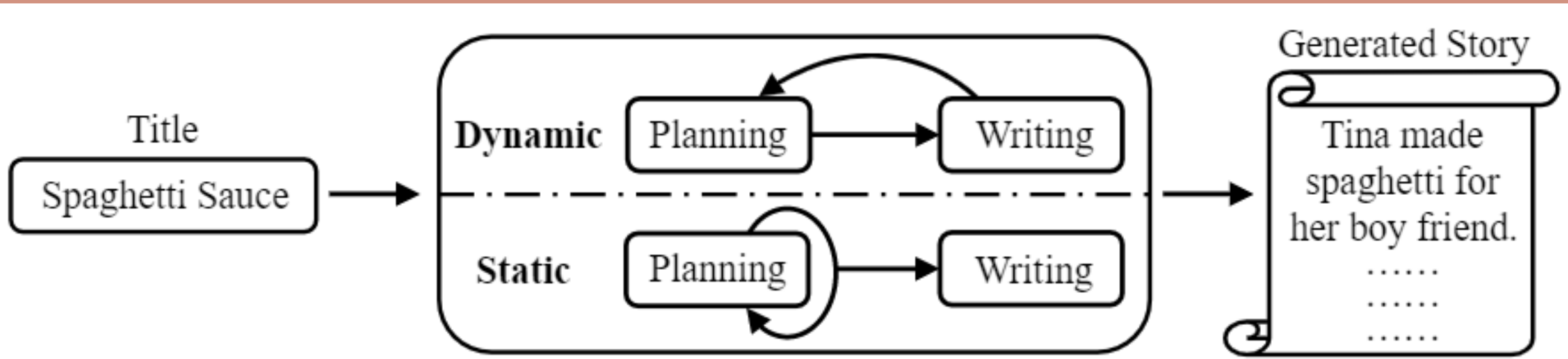
Grammar ✓

Remembering Story State ✗

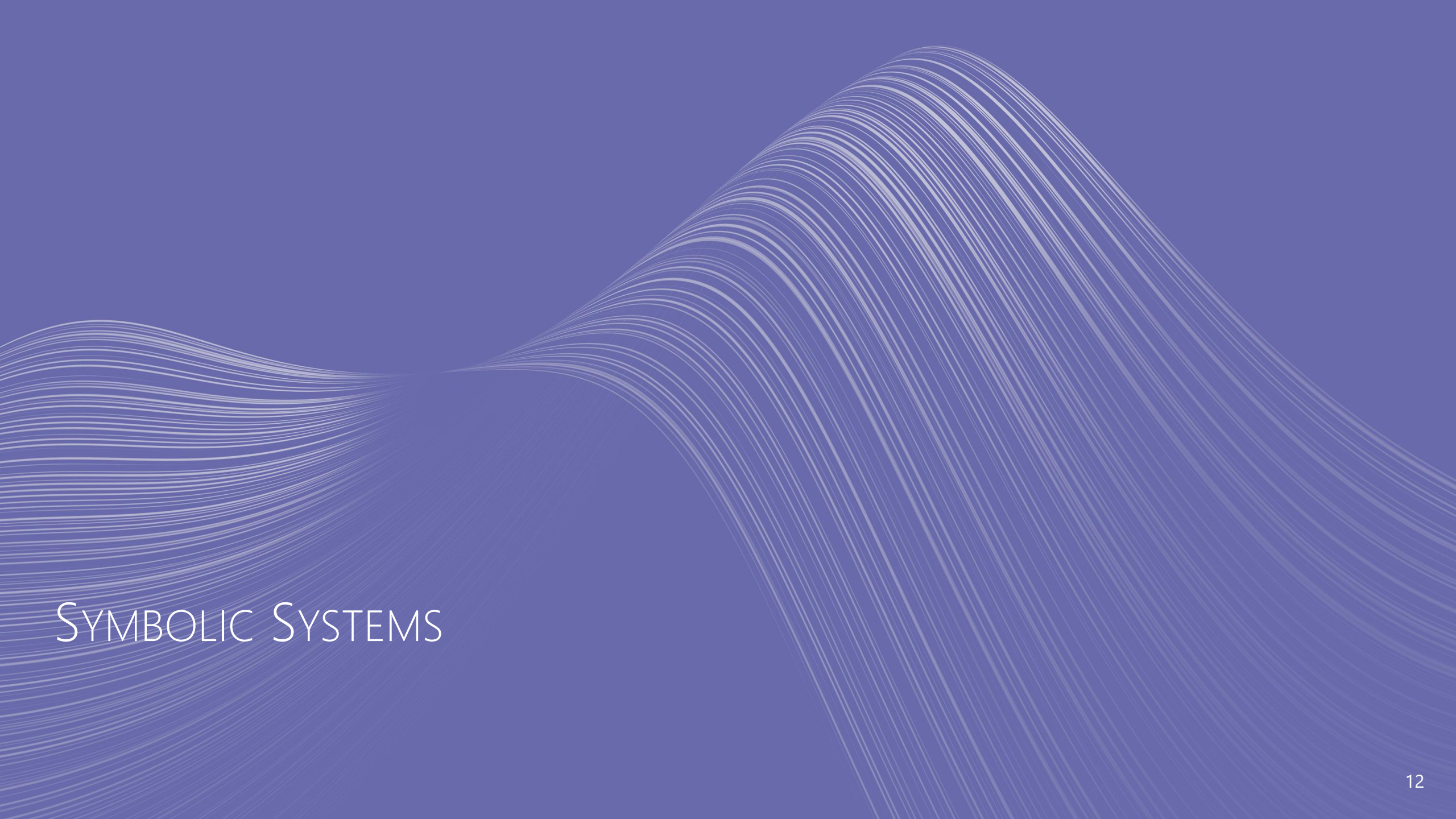
Commonsense Reasoning ✗

Guided Neural Story Generation

Integrating ways of including structure



Yao, L., Peng, N., Weischedel, R., Knight, K., Zhao, D., & Yan, R. (2019). Plan-And-Write: Towards Better Automatic Storytelling. *AAAI Conference on Artificial Intelligence (AAAI)*, *33*(1), 7378–7385. https://aaai.org/ojs/index.php/AAAI/article/view/4726

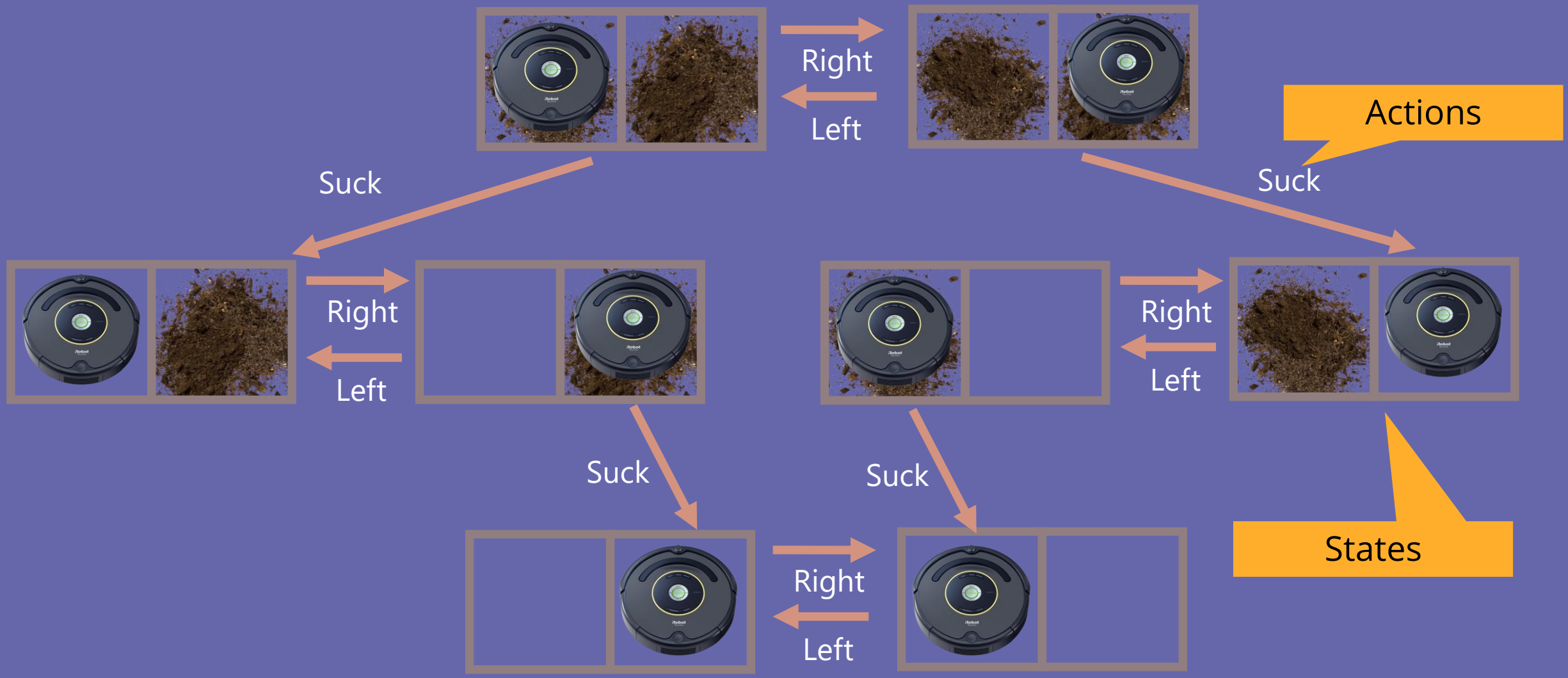


Symbolic Systems

Symbolic Systems: Planning

- Planning = *search* for a *plan*
- In story generation, this means we're looking for a plan where the goal is reached
- What's the goal? Depends on the story you're telling
  - E.g. Ending a conflict between characters, Robber steals from player character

Search


Right
Left
Suck
Suck
Actions
Right
Left
Right
Left
Suck
Suck
Right
Left
States

What are we planning over?

Structure (Schemas)

- KB Schemas
- Scripts
- Procedures

} Organization of Commonsense Knowledge

States

VerbNet Schema

Jen sent the book to Remy from Atlanta.

Atlanta : location
book : concrete
Jen : animate or organization
!has_location(book, Atlanta)
has_location(book, Remy)

COMET-ATOMIC Schema

HW 5: Schemas

In this homework, you will create your own schema to represent the state of a story world as it goes through the story line by line. A **schema** is a structured reprensentation made to hold facts or a plan, which in this case, can be used to track change over time.

The purpose of this homework is to test your understanding of schemas and get hands-on experience with a state-of-the-art tool in commonsense reasoning.

Your Task

You will be creating a schema using ATOMIC to track the state of a fictional world. For each sentence of the story, you will parse it (provided), call COMET (provided, but what you input is up to you), create preconditions to determine if a sentence can be added (TODO), and create effects to use to update your schema (TODO).

Let's teach your agent some basic information about the world!

Formally, the task is:

Given an input sentence at time *t* (*In_t*), produce a schema *S_t*. Do this for each sentence in the story.

For example, using VerbNet:

What are we planning over?

Structure (Schemas)

KB Schemas

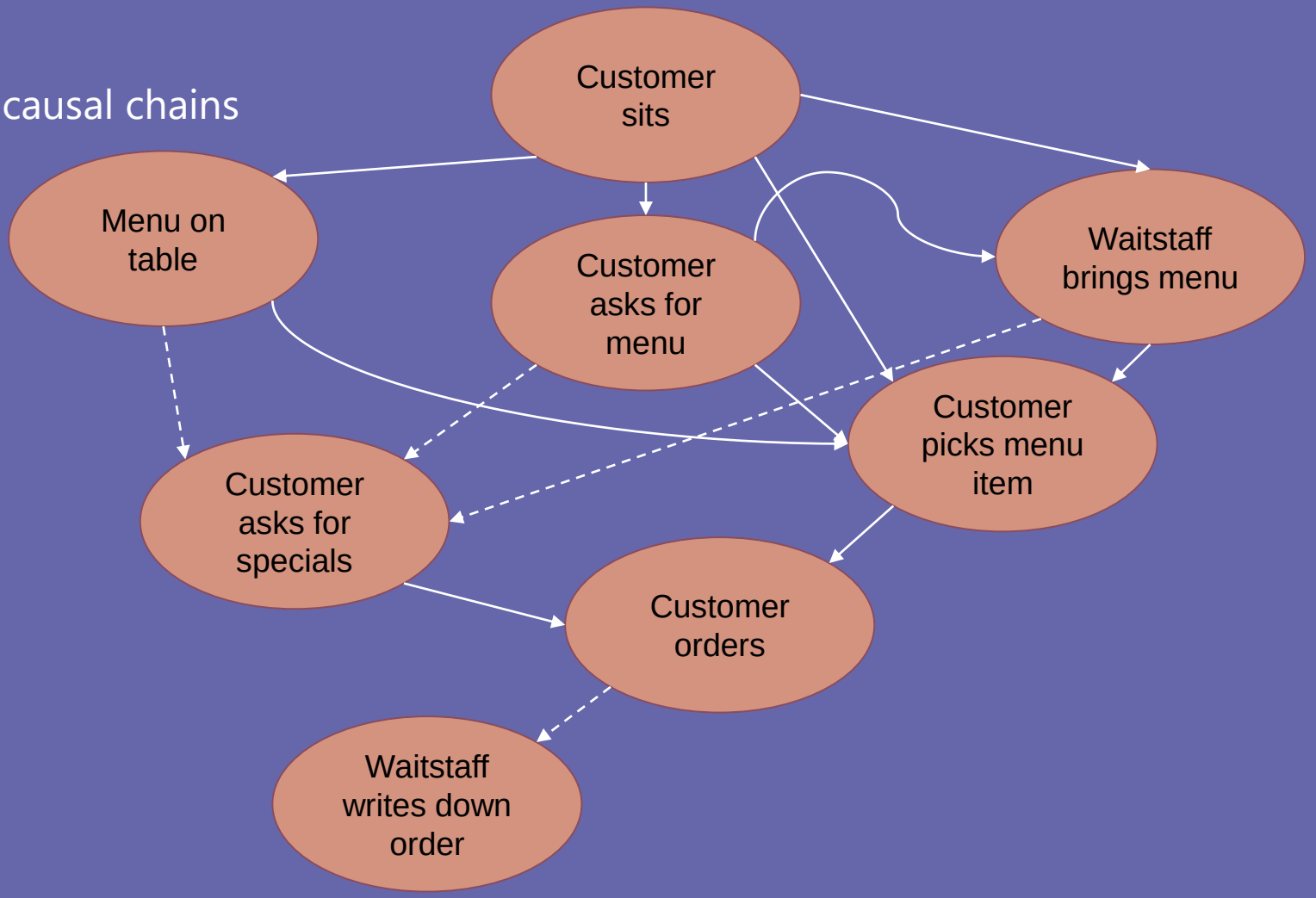
Scripts

Procedures

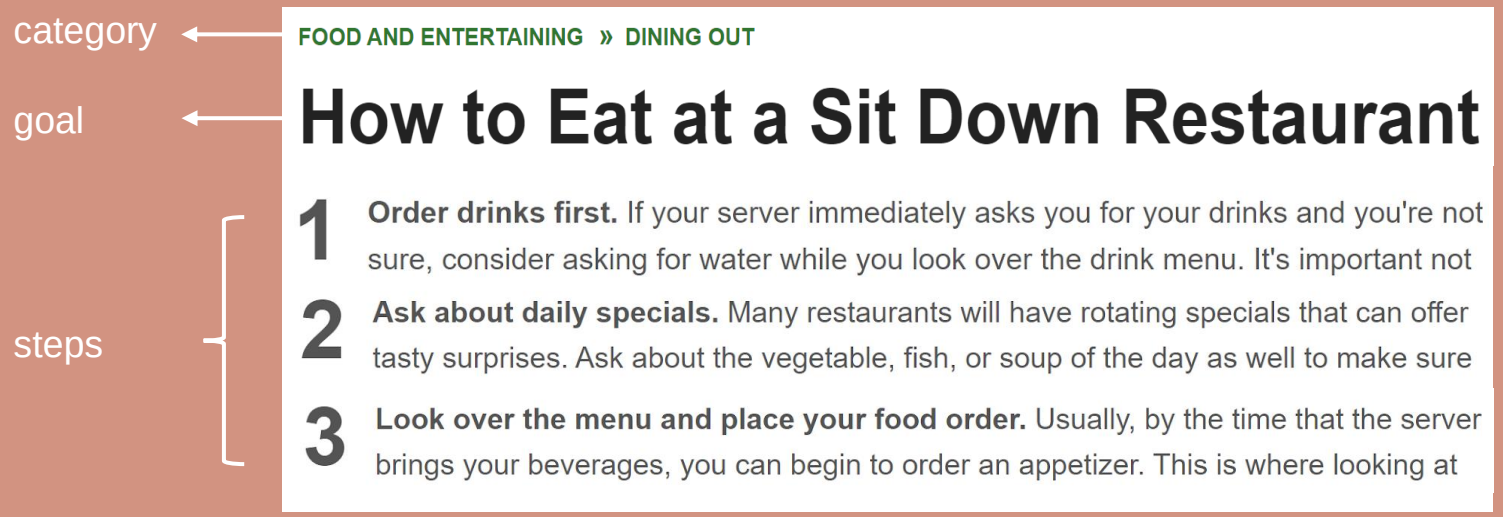
} Organization of Commonsense Knowledge

Scripts

Common sequence of causal chains

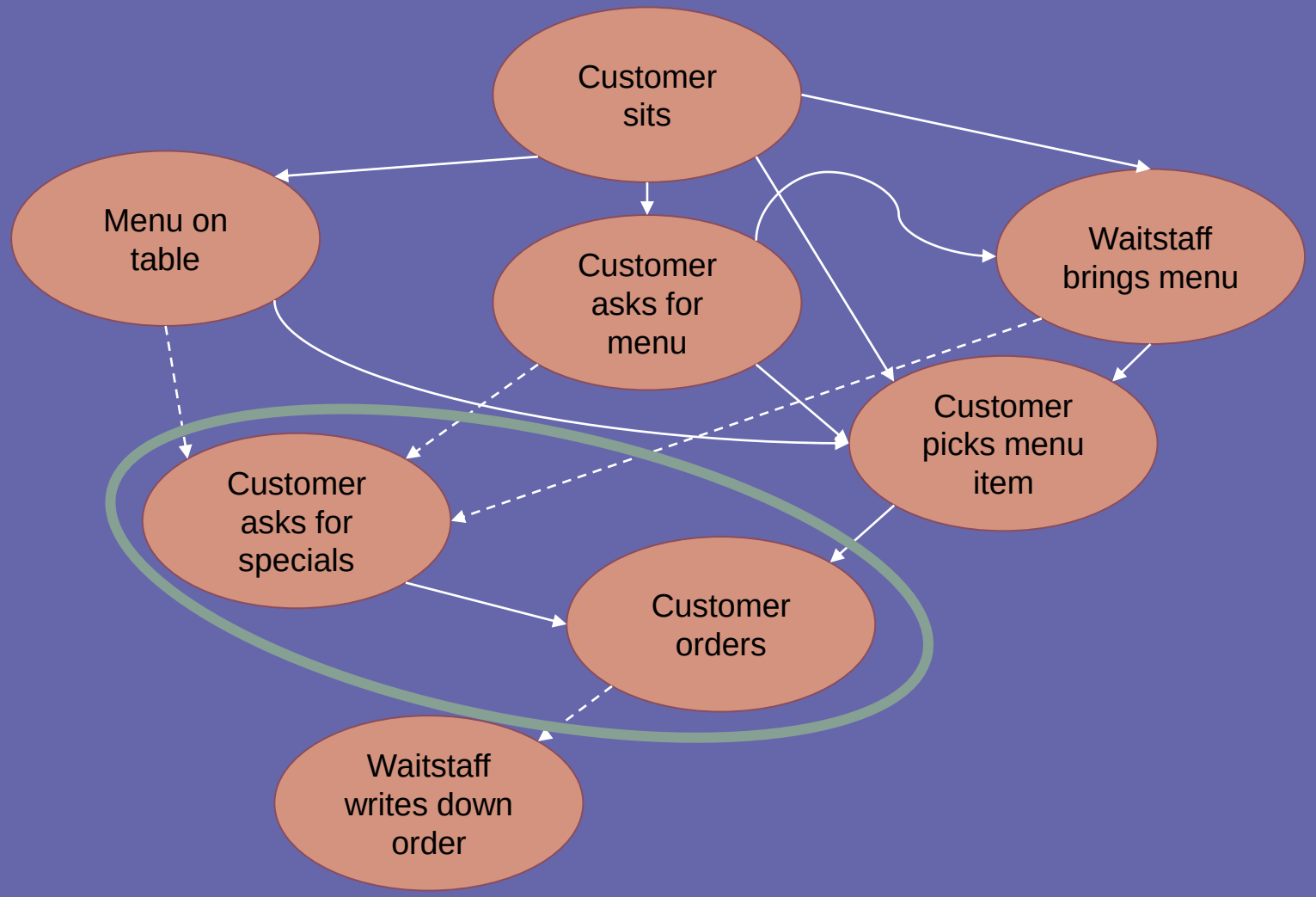


Procedures: Script with a goal

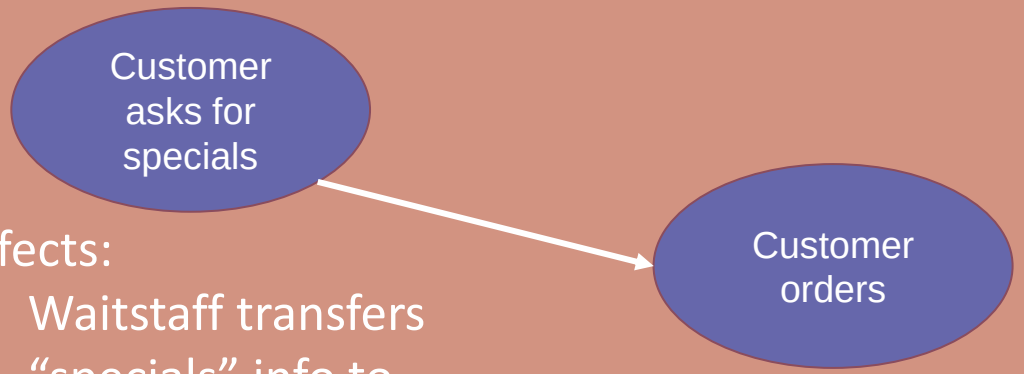


From Veronica Qing Lyu & Harry Li Zhang's lecture

Scripts


Customer sits
Menu on table
Customer asks for menu
Waitstaff brings menu
Customer picks menu item
Customer asks for specials
Customer orders
Waitstaff writes down order

Causal Links



Effects:

- Waitstaff transfers “specials” info to customer
- Customer knows what they want to order

Precondition:

- Customer knows what they want to order

Causal Links→ **Actions** for Planning

$$\boldsymbol{a}\text{:}\quad \boldsymbol{buy(Tom, Potion, Merchant, Market)}$$

$$\text{PRE}(a)\text{:}\quad at(Tom) = Market \land at(Merchant) = Market \land$$
$$at(Potion) = Merchant \land wealth(Tom) \geq 1$$

$$\text{EFF}(a)\text{:}\quad at(Potion) = Tom \land wealth(Merchant) \mathrel{+}= 1 \land$$
$$wealth(Tom) \mathrel{-}= 1$$

From Stephen Ware's lecture

Representation Language

Planning Domain Definition Language (PDDL) express **actions** as a **schema**

Action name

Variables

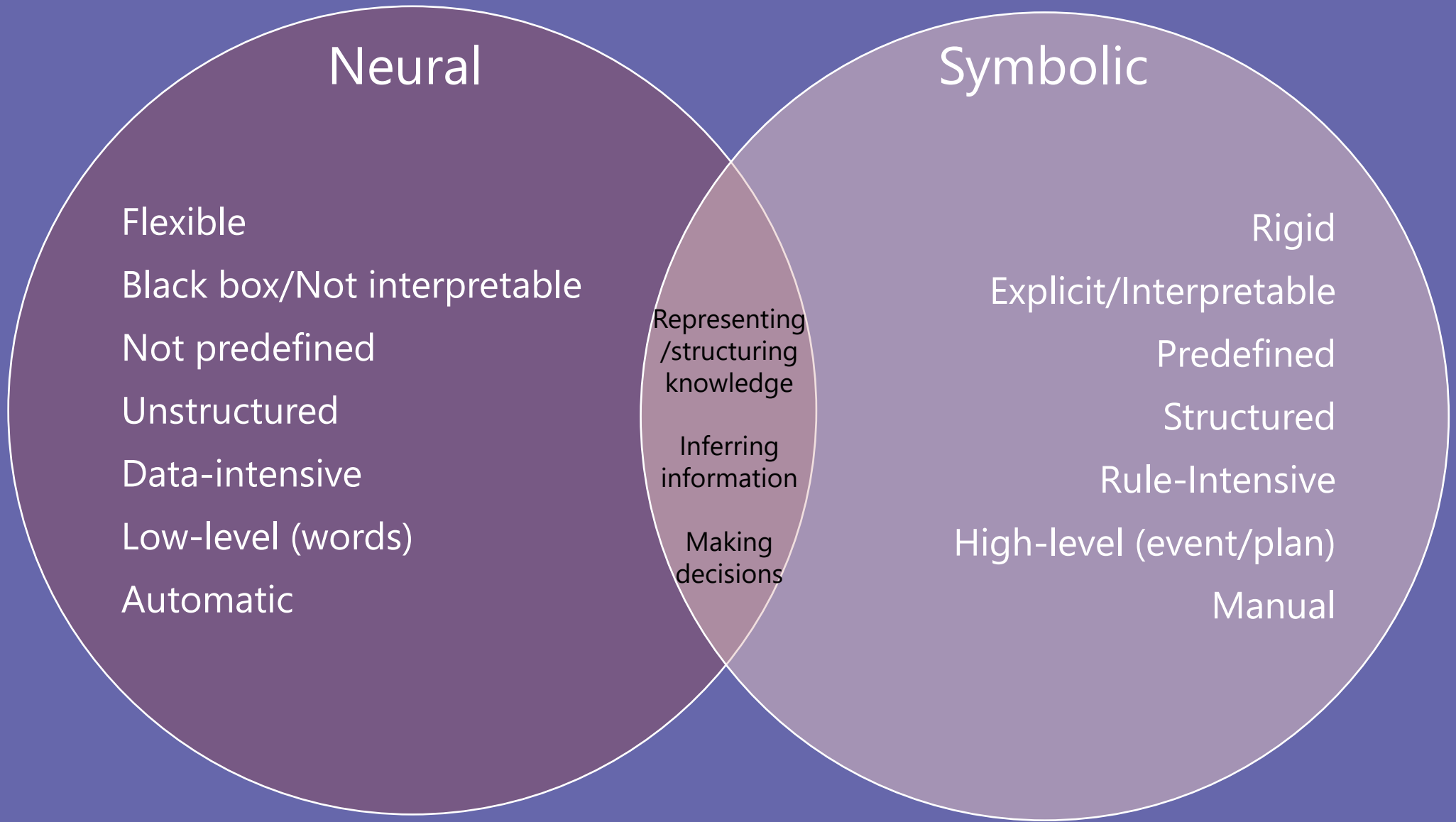
```
(:action go
   :parameters (?dir - direction
                ?p - player
                ?l1 - location ?l2 - location)
   :precondition (and
                  (at ?p ?l1)
                  (connected ?l1 ?dir ?l2)
                  (not (blocked ?l1 ?dir ?l2)))
   :effect (and
                  (at ?p ?l2)
                  (not (at ?p ?l1)))
)
```

Preconditions

Preconditions and effects are **conjunctions** of logical sentences

Effects

These logical sentences are **literals** – positive or negated atomic sentences


Neural
Flexible
Black box/Not interpretable
Not predefined
Unstructured
Data-intensive
Low-level (words)
Automatic
Representing /structuring knowledge
Inferring information
Making decisions
Symbolic
Rigid
Explicit/Interpretable
Predefined
Structured
Rule-Intensive
High-level (event/plan)
Manual

ONTOLOGIES

Susan W. Brown

03/22/2022

Semantic representations and predicate logic

- *Franco likes Frasca.*
- First order logic:

$$\exists e Liking(e) \wedge Liker(e, Franco) \wedge Liked(e, Frasca)$$

- VerbNet:

The lion tamer jumped the lion through the hoop.

has_location(e1, Theme, Initial_Location)
do(e2, Agent)
motion(e3, Theme, Trajectory)
has_location(e4, Theme, Destination)
cause(e2, e3)

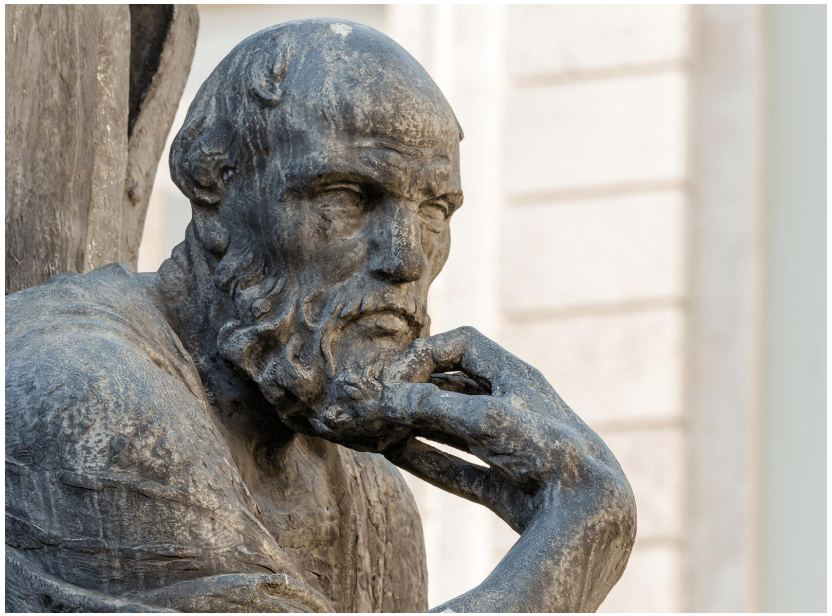
Semantics

- Let's start with the basics of what we might want to say about some world.
  - There are entities in this world.
  - We'd like to assert properties of these entities.
  - And we'd like to assert relations among them.
- Let's call a scheme that can capture these things *a model*
- And let's claim that we can use basic *set theory* to represent such models.
- We can do this with *an ontology.*

Outline

- What is an ontology?
- Ontology basics
- Generic ontologies vs. application ontologies
- An event ontology
- Wikidata

What is an ontology?



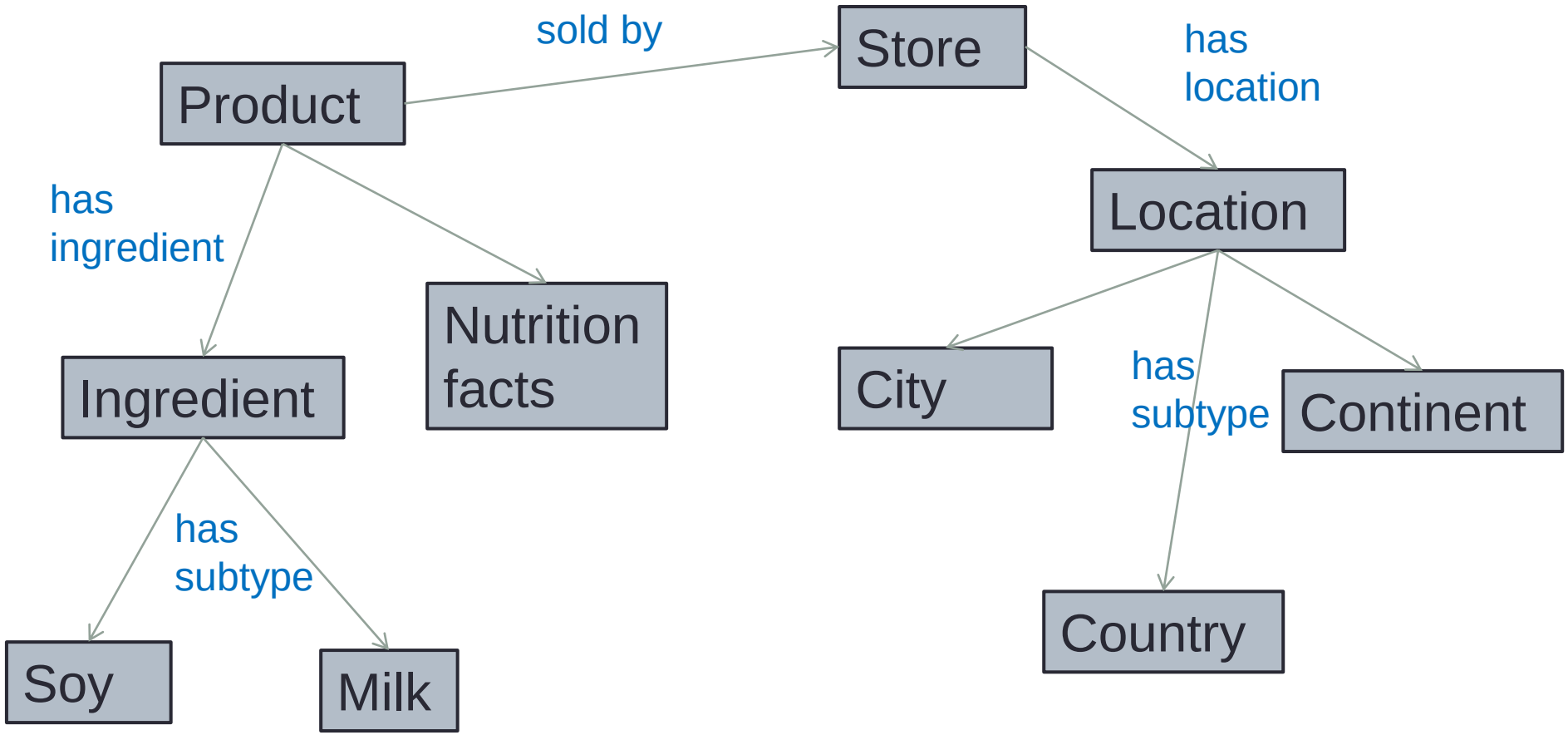
From vocabulary to ontology

- Vocabulary
- Taxonomy
- Ontology
- Logic-based ontology

What is an ontology

- Describes a domain
  - concepts
  - properties and attributes of those concepts
  - constraints on properties and attributes
  - individuals
- Defines
  - a common vocabulary
  - a shared understanding
- Can be used with reasoning agents
  - to infer new facts from existing definitions

Imagine a mind map for the domain



Ontology basics (using OWL)

Axioms — Basic statements in an ontology. An ontology is a set of axioms

Entities — Used to refer to basic things in the domain of interest.

Class Expressions — Combinations of entities that form more complex descriptions out of simpler ones.

Axioms specify the relationships between entities and class expressions

OWL Axioms

Some examples...

Cat SubClassOf Animal

SubClassOf
Cats are Animals

Cat DisjointWith Dog

DisjointClasses
Cats are not Dogs

Tibbs Type Cat

ClassAssertion
Tibbs is a Cat

Betty hasPet Tibbs

PropertyAssertion
Betty has Tibbs as a pet

hasPet Domain Person

Domain
Anything that has a pet is Person

Class expressions

Some examples...

Cat or Dog

The class of individuals that instances of Cat or Dog (or both!)

Person and PetOwner

The class of individuals that are both instances of Person and PetOwner

hasPet some Cat

The class of individuals that have at least one hasPet relationship to an individual that is an instance of Cat

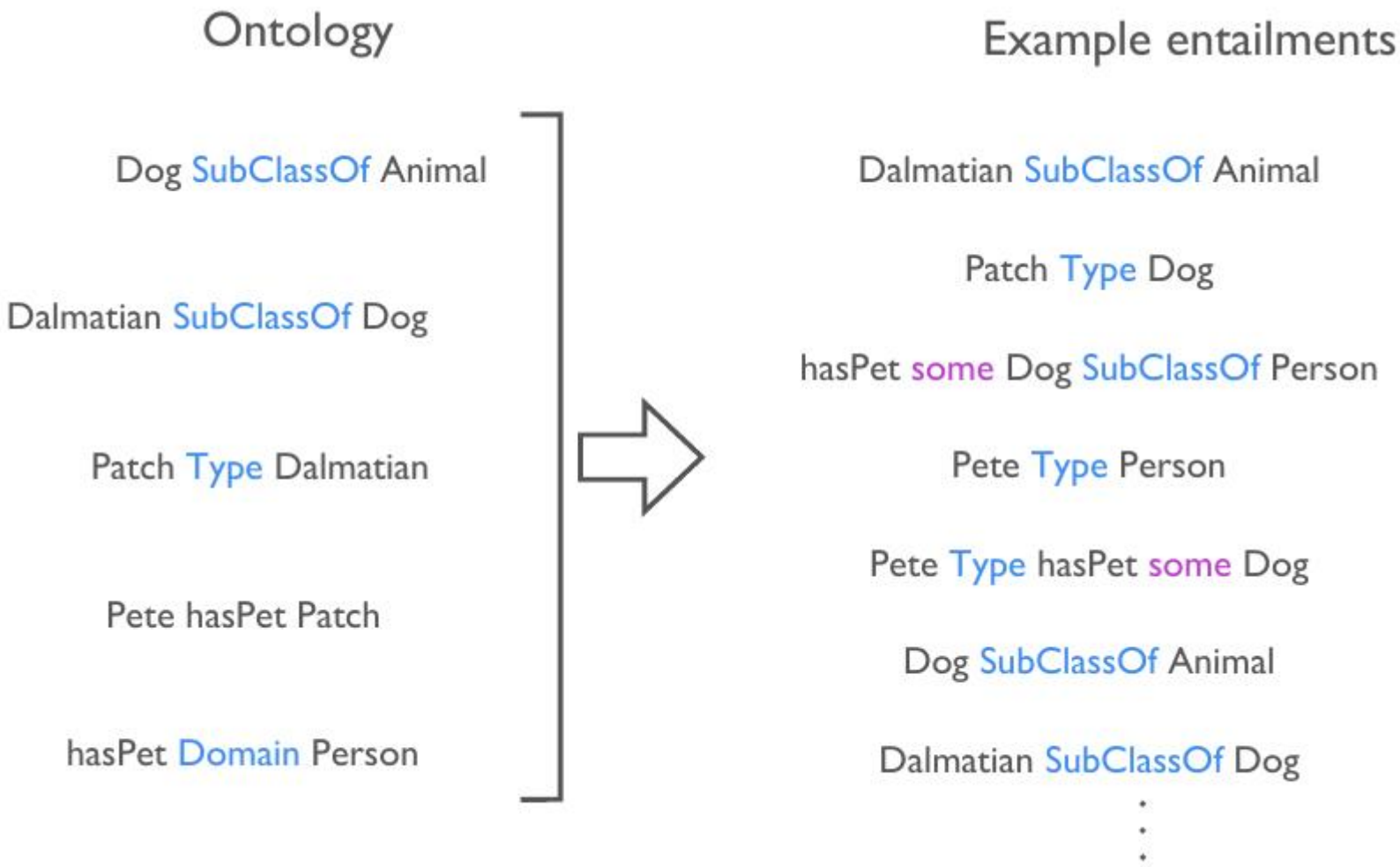
Person and hasPet some Cat

The class of individuals that are both instances of Person and hasPet some Cat

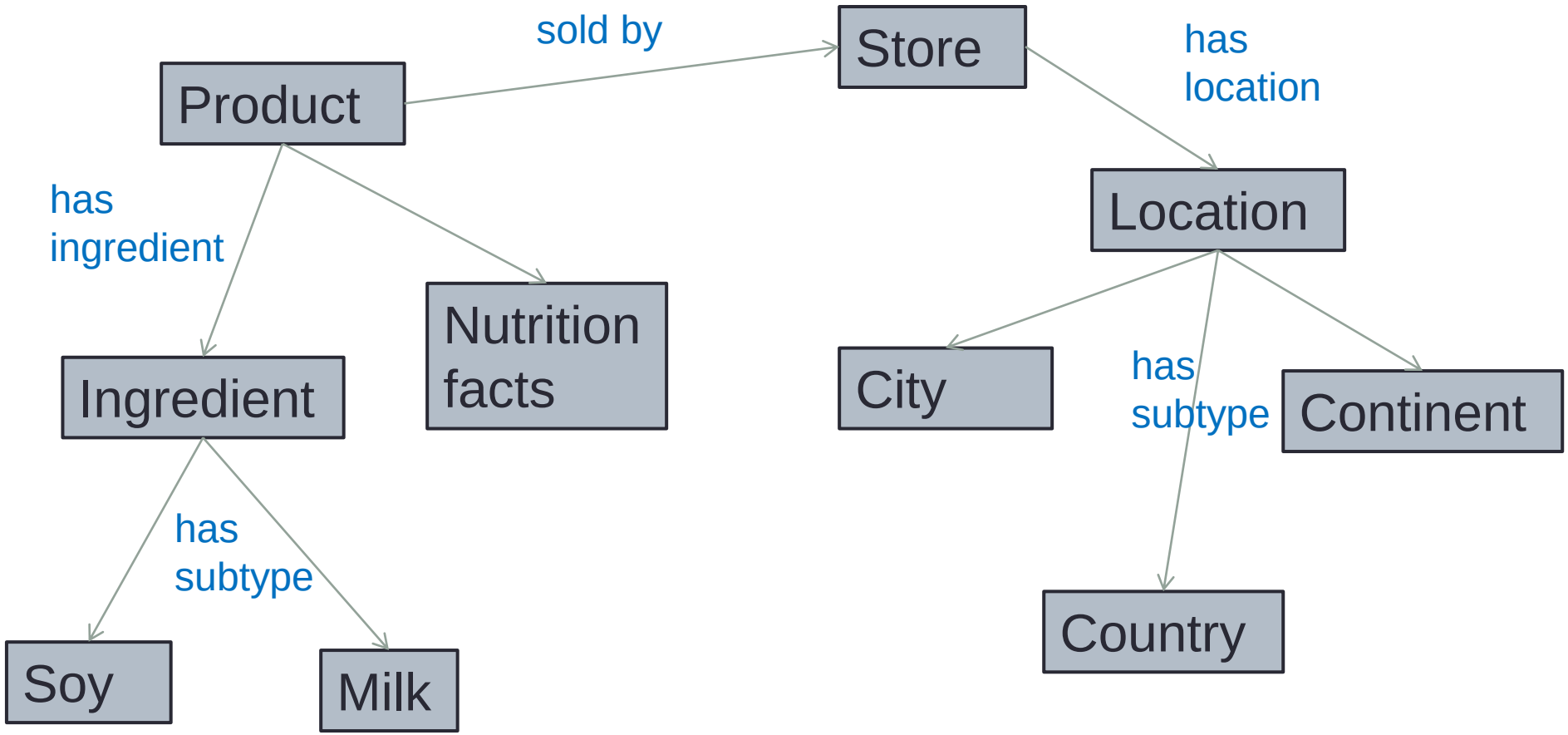
Person and not (hasPet some (Cat or Dog))

The class of individuals that are instances of Person but not instances of the class of individuals that have at least one hasPet relationship to and individual that is an instance of the class Cat or Dog

Entailment

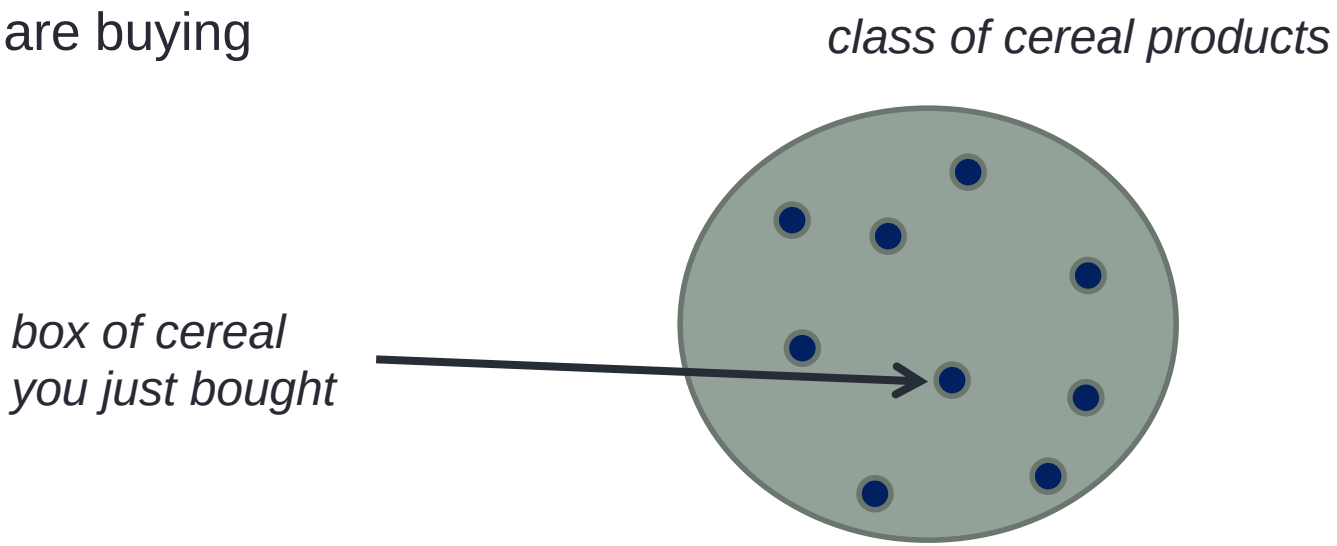

Ontology
Dog SubClassOf Animal
Dalmatian SubClassOf Dog
Patch Type Dalmatian
Pete hasPet Patch
hasPet Domain Person
Example entailments
Dalmatian SubClassOf Animal
Patch Type Dog
hasPet some Dog SubClassOf Person
Pete Type Person
Pete Type hasPet some Dog
Dog SubClassOf Animal
Dalmatian SubClassOf Dog

Imagine a mind map for the domain



Defining classes

- A class is a concept in the domain
  - a class of products
  - a class of ingredients
  - a class of dairy products
- A class is a set of elements with similar properties
- Instances of classes
  - a box of cereal that you are buying

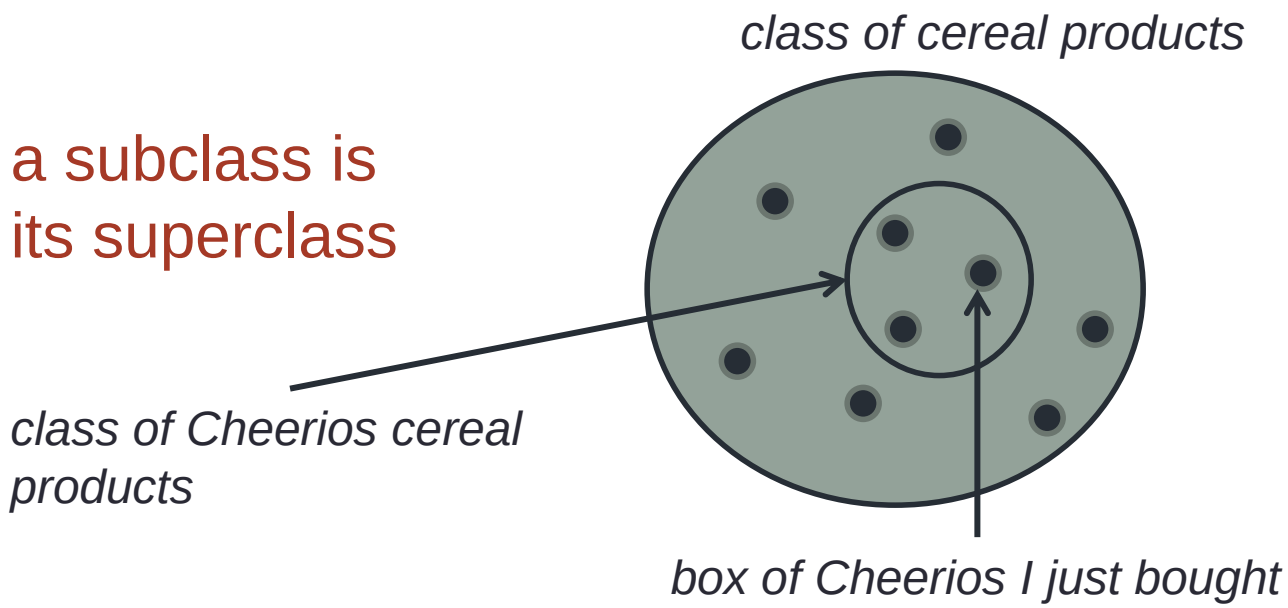


Class inheritance

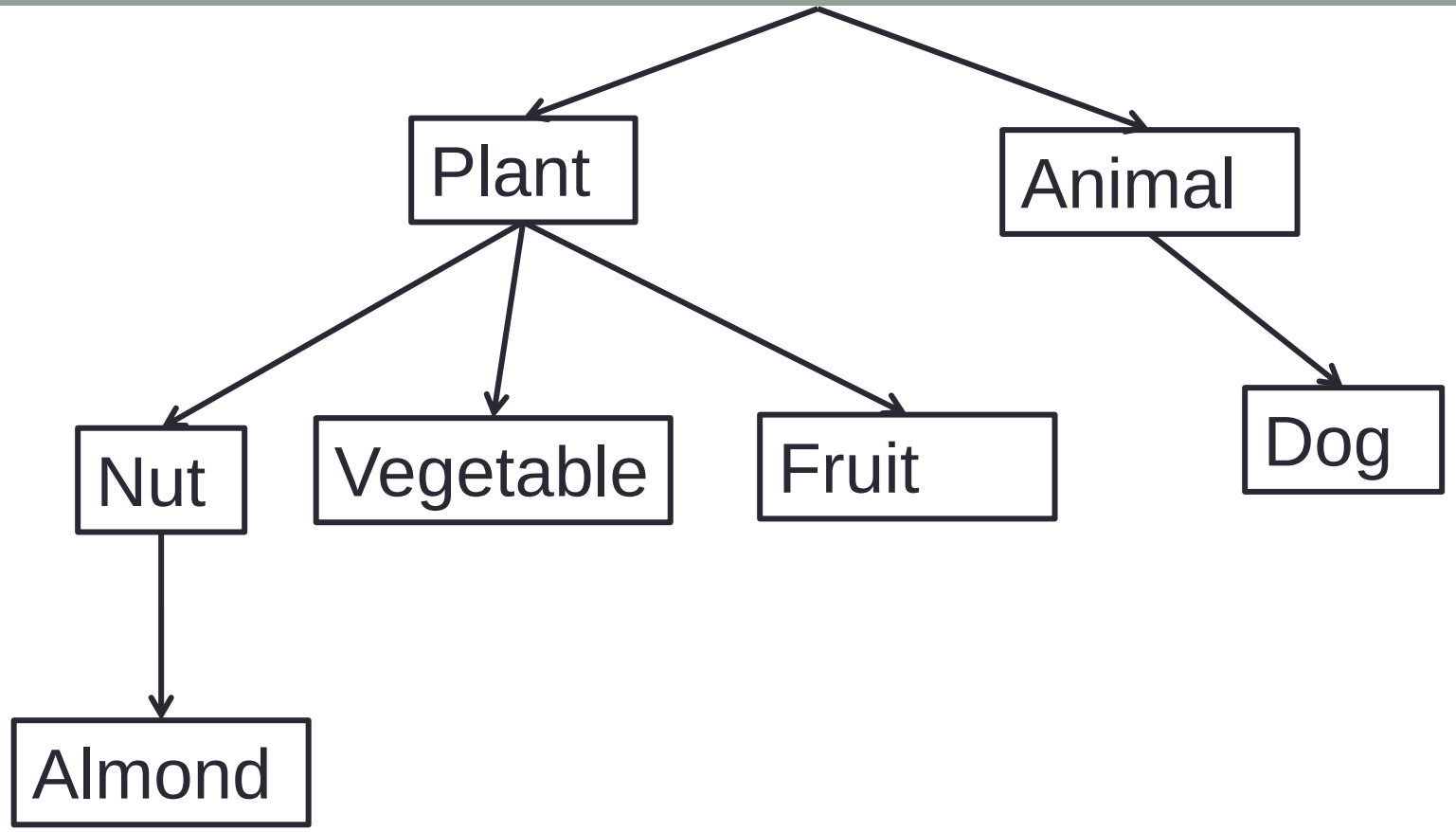
Classes usually constitute a taxonomic hierarchy (a subclass-superclass hierarchy)

an IS-A hierarchy:

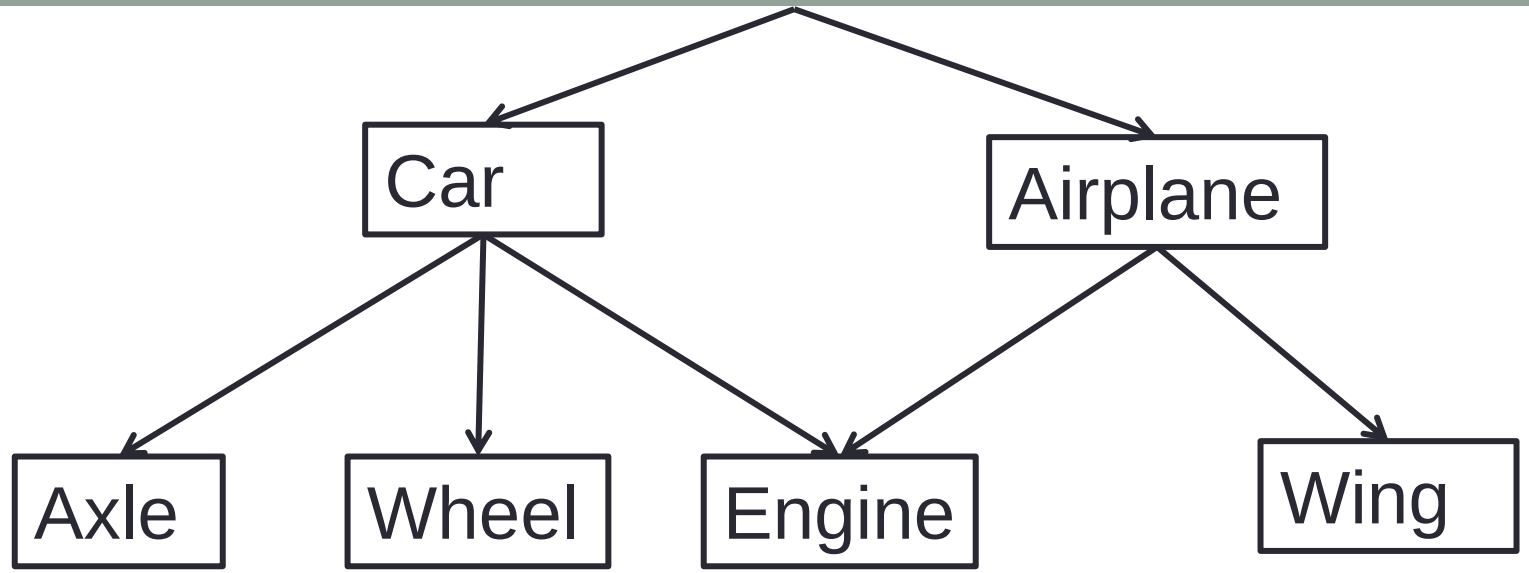
an instance of a subclass is
an instance of its superclass



- If you think of a class as a set, a subclass is a subset



Subclass-Superclass relations?



Subclass-Superclass relations?

Defining properties

Products ***have a price*** → price

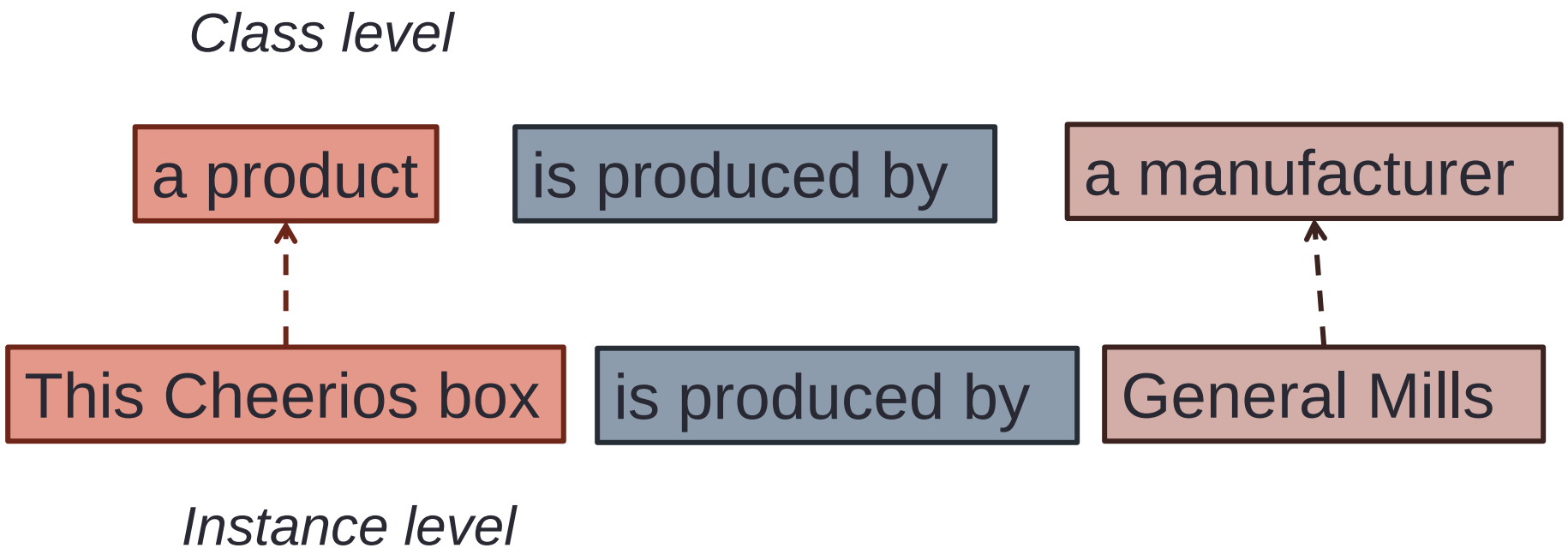
Products ***are produced by*** a manufacturer → produced by

Products ***have an expiration date*** → has expiration date

Products ***have ingredients*** → has ingredient

Properties describe instances

- Properties associated with a class describe the attributes and relationships of the instances of the class



Individuals

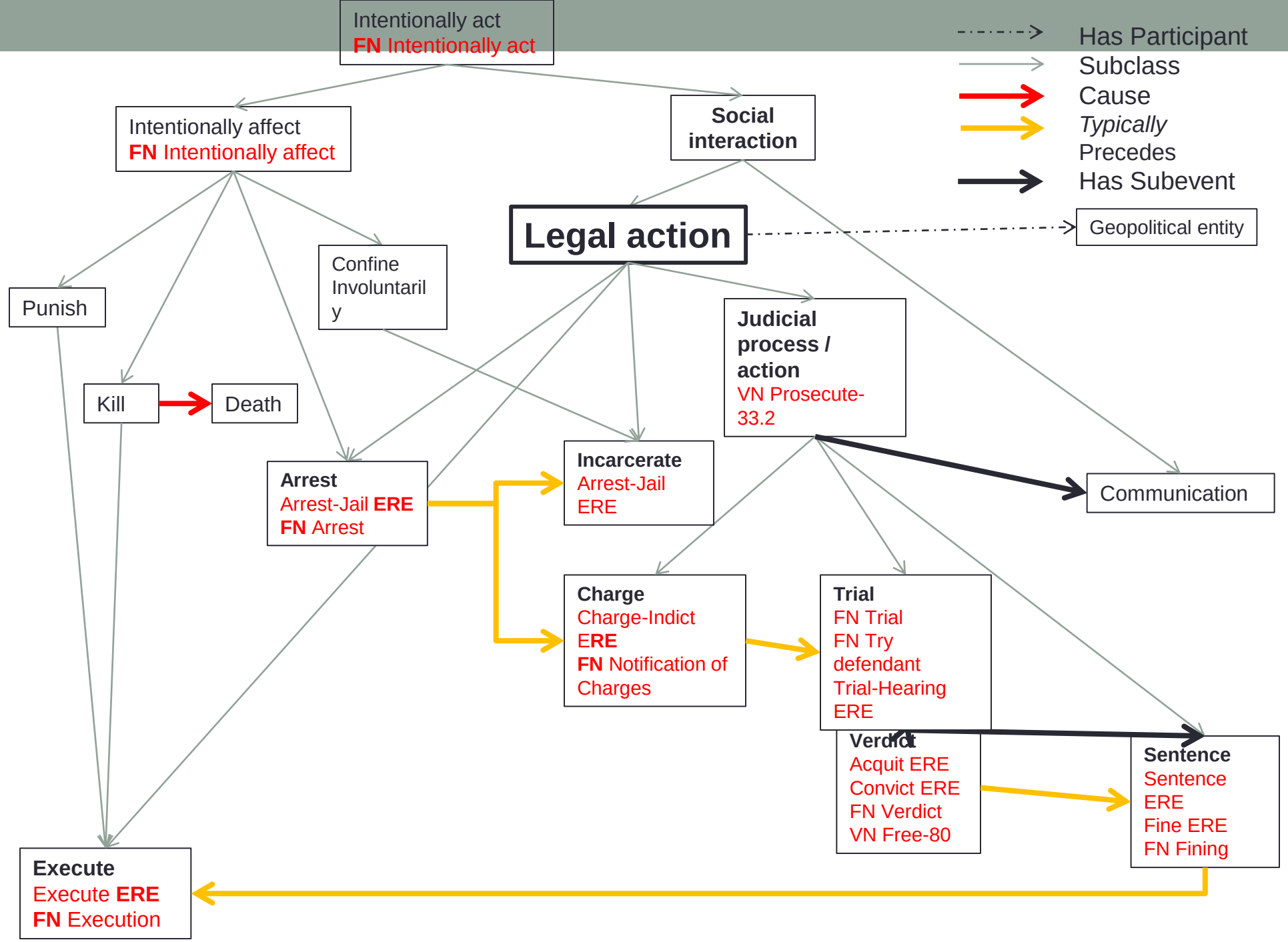
- Individuals are the last level of the ontology; they cannot be further specified
- They represent a materialization of the descriptions at the class level
- This is the level at which the actual data is put in
- The data depends on the application
  - grocery app?
  - tracking terrorist organizations?

Ontologies for NLP

- Move from words to concepts/entities underlying the words
- A conceptual ontology with links to lexical items c
- Bio-NLP
- Event extraction and participant tracking

Events in ontologies

- Events difficult to model in an ontology
  - is-a relations tricky to determine (killing, crime, murder, death)
  - where does an event start and end? (surgical event)
- Usually represented as relations between entities
  - relations can’t have links to lexical items
  - relations can’t have individuals (you might want to make lexical items the individuals or instances in annotation)
- Existing ontologies have shallow models of events
  - WordNet
  - SUMO (Suggested Upper Merged Ontology)


Intentionally act
FN Intentionally act
Intentionally affect
FN Intentionally affect
Social interaction
Legal action
Geopolitical entity
Punish
Confine Involuntaril y
Kill
Death
Judicial process / action
VN Prosecute-33.2
Arrest
Arrest-Jail ERE
FN Arrest
Incarcerate
Arrest-Jail
ERE
Communication
Charge
Charge-Indict
ERE
FN Notification of Charges
Trial
FN Trial
FN Try defendant
Trial-Hearing
ERE
Verdict
Acquit ERE
Convict ERE
FN Verdict
VN Free-80
Sentence
Sentence
ERE
Fine ERE
FN Fining
Execute
Execute ERE
FN Execution
Has Participant
Subclass
Cause
Typically Precedes
Has Subevent

AIDA and KAIROS

- AIDA: From multimedia information sources, develop differing hypotheses of events that took place
- KAIROS: Create schemas of complex events in order to predict future events

Social Interaction

Communication

Gesture

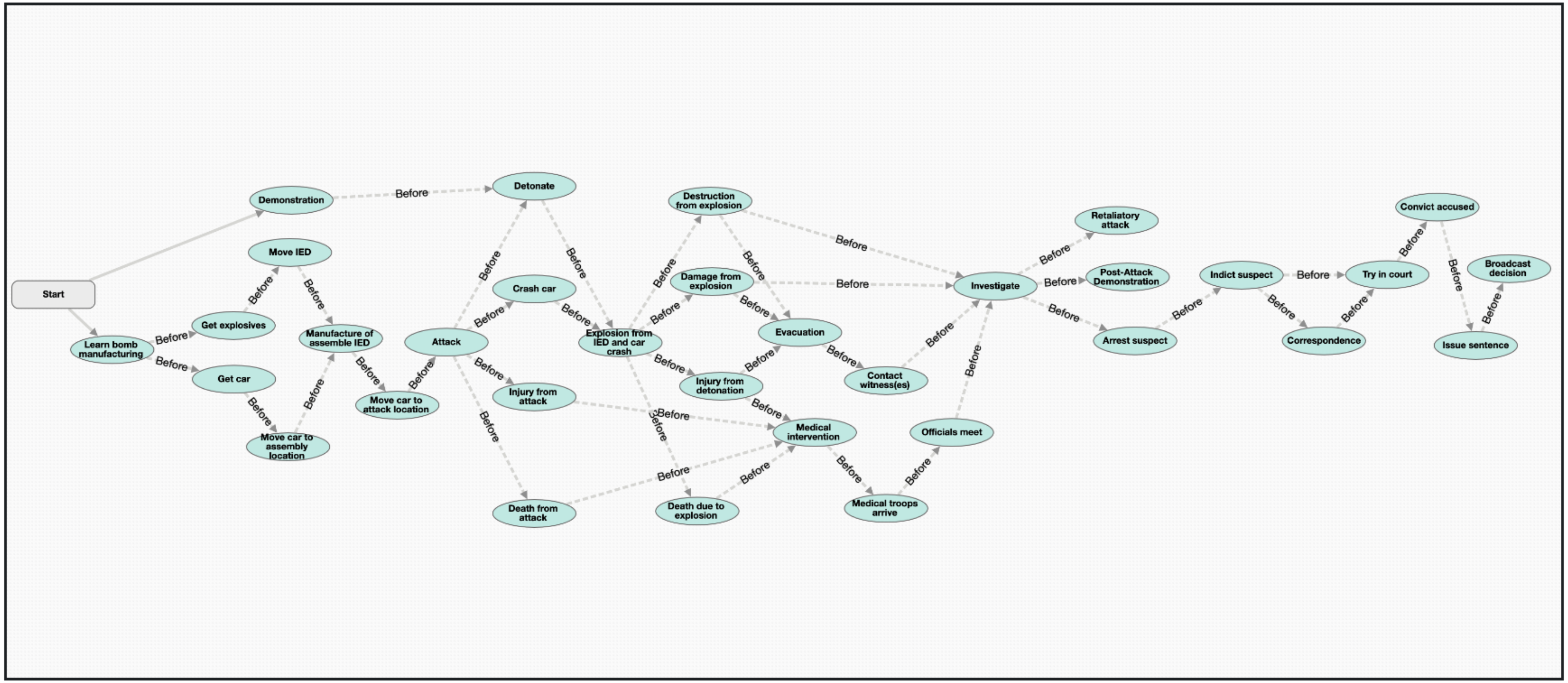
Verbal Communication

Meet

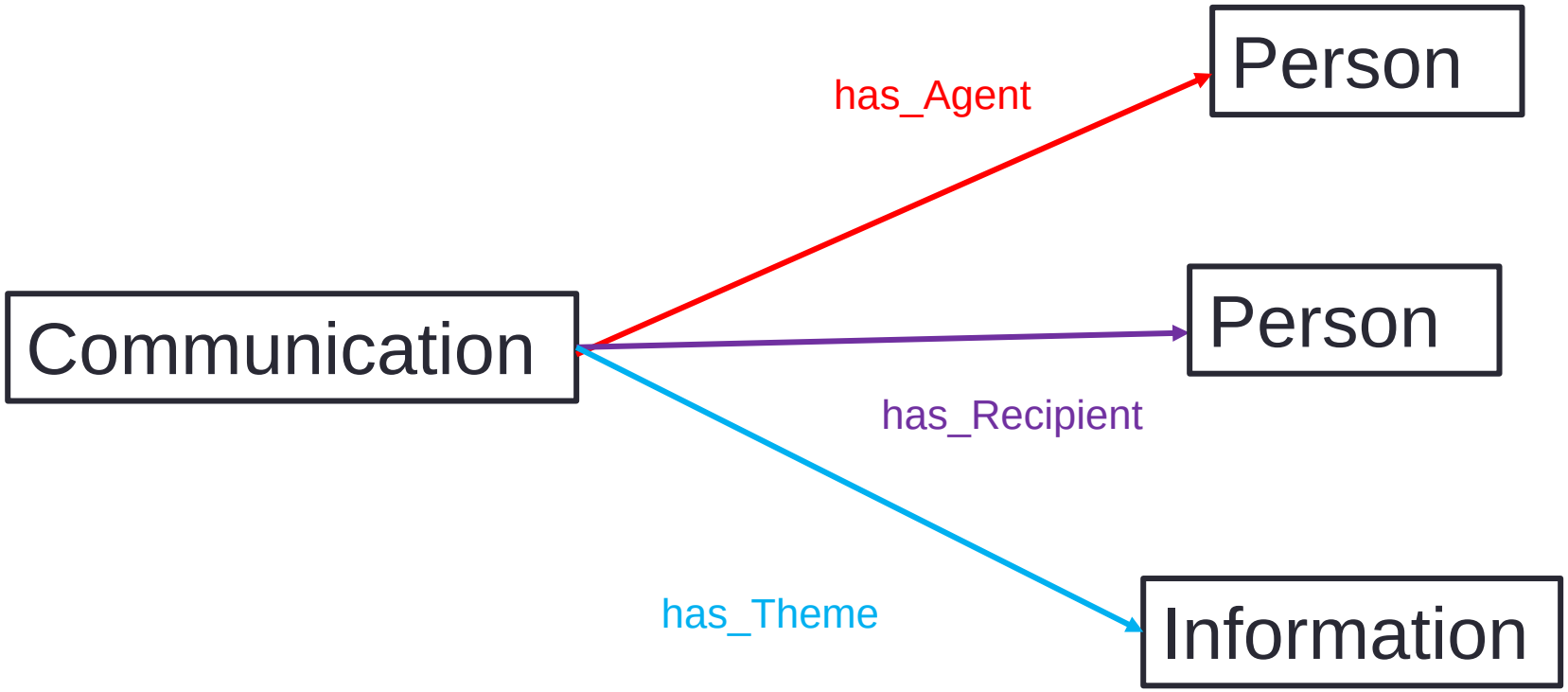
Opponents of President of Turkey Recep Tayyip Erdogan rally in Lafayette Park as Erdogan met with and President Donald Trump at the White House in Washington on May

US President Donald Trump shakes hands with Turkish President Recep Tayyip Erdogan in the Oval Office

KAIROS schema: Car Improvised Explosive Device Attack



Event-Object Relations



Creation

Label	ArtifactExistence.Creation
Description	The act of creation or invention in which an entirely novel and unique physical or informational entity (or event) is formed for the first time from raw materials or components, either intentionally or through a causative event

Slot Role	Slot Argument Constraints
Creator	per, org, gpe, sid, event
Thing created	abs, fac, com, veh, wea, pth, inf, event?
Components/Materials	com, nat
Place	fac, loc, gpe
Temporal	
Start and End	(times specific to event)
Duration	1 minute through multiple years

Wear

Label	Wear (new social behavior top level?)
Description	Bearing or having clothing or other objects on the person

Slot Role	Slot Argument Constraints
Wearer	per
Thing worn	com
Body_Location	bod
Place	fac, loc, gpe
Temporal	
Start and End	(times specific to event)
Duration	1 minute through multiple years

Sanitize

Label	Sanitize
Description	Rendering pathogens harmless through methods including use of heat, antiseptics and antibacterial agents

Slot Role	Slot Argument Constraints
Agent/Sanitizer	per, org, gpe, sid
Sanitized object	fac, com, veh, wea
Sanitizing substance	com, nat
Pathogen	pth
Place	fac, loc, gpe
Temporal	
Start and End	(times specific to event)
Duration	1 minute through multiple years

What is the problem with this approach?

Why recreate the wheel?

- WikiData

KAIROS/AIDA event tags → Wikidata Q nodes

KAIROS/AIDA event tag	Wikidata Q node
Life.Die	Death Q4 (permanent cessation of vital functions)
Attack. Unspecified	Attack Q1174599 (action to injure another organism)
Justice.ChargeIndict	Criminal charge Q329525 (formal accusation of wrongdoing in common law)
Movement.Transport	Transport Q7590 (human-directed movement of things or people between locations)

Questions?