national center for ontological research
ncor

Disambiguation

John Beverley

Assistant Professor, *University at Buffalo*
Co-Director, *National Center for Ontological Research*
Affiliate Faculty, *Institute of Artificial Intelligence and Data Science*

Outline

- Design Pattern Review
- Recipe Refresher
- The Secret Structure of the World

Outline

- Design Pattern Review
- Recipe Refresher
- The Secret Structure of the World

1. Is this relation reflexive, i.e., for every x is xRx
    1. The game Perfection - each puzzle piece fits into its own slot, i.e. star in star slot, and triangle in triangle slot, etc.
2. Is this relation irreflexive, i.e. no x is such that xRx
    1. The act of lending money would require (in the most basic terms) an outside entity, i.e., a bank, another person, organization, etc., to 'borrow from'. So an irreflexive relation would be 'borrowing' or 'lending' money to oneself.
3. Is this relation symmetric, i.e., for every x and y, if xRy, then yRx
    1. Giving someone a high-five would be a symmetric relation (given they reciprocate – or at least don't leave you hanging).
4. Is this relation antisymmetric, i.e. for every x and y, if xRy and yRx then x=y
    1. My children are siblings, and they share that relationship between them (i.e. it goes both ways).
5. Is this relation asymmetric, i.e. for every x and y, if xRy then it is not the case that yRx
    1. Matryoshka dolls are an example of an antisymmetric relationship as each doll 'fits' inside the previous one, but the opposite does not apply.
6. Is this relation functional, i.e. for every x, y and z, if xRy and xRz then y=z
    1. This awesome homework due on Friday is a relational function, as this specific homework is due 21FEB2025.
7. Is this relation inverse functional, i.e. for every x, y, z, if xRy and zRy then x=z
    1. An example of a relation inverse functional would be Stormtroopers and Darth Vader – Darth Vader leads the Stormtroopers, and the Stormtroopers are led by Darth Vader.
8. Is this relation transitive, i.e. for every x, y, and z, if xRy and yRz then xRz
    1. The song 'Dem Bones' is an example of relation transitive i.e. the head bone's connected to the neck bone, neck bone's connected to the shoulder bone, etc. etc.

Owning a car (Person [x] to car [y]):

1. Is this relation reflexive, i.e. for every x is xRx - True
2. Is this relation irreflexive, i.e. no x is such that xRx - False
3. Is this relation symmetric, i.e. for every x and y, if xRy then yRx - False
4. Is this relation antisymmetric, i.e. for every x and y, if xRy and yRx then x=y - False
5. Is this relation asymmetric, i.e. for every x and y, if xRy then it is not the case that yRx - True
6. Is this relation functional, i.e. for every x, y and z, if xRy and xRz then y=z - False
7. Is this relation inverse functional, i.e. for every x, y, z if xRy and zRy then x=z - False
8. Is this relation transitive, i.e. for every x, y, and z, if xRy and yRz then xRz - True

Marriage (person [x] to person [y]):

1. Is this relation reflexive, i.e. for every x is xRx - True
2. Is this relation irreflexive, i.e. no x is such that xRx - False
3. Is this relation symmetric, i.e. for every x and y, if xRy then yRx - True
4. Is this relation antisymmetric, i.e. for every x and y, if xRy and yRx then x=y - False
5. Is this relation asymmetric, i.e. for every x and y, if xRy then it is not the case that yRx - False
6. Is this relation functional, i.e. for every x, y and z, if xRy and xRz then y=z - False
7. Is this relation inverse functional, i.e. for every x, y, z if xRy and zRy then x=z - False
8. Is this relation transitive, i.e. for every x, y, and z, if xRy and yRz then xRz - True

Owning a pet (person [x] to pet [y]):

1. Is this relation reflexive, i.e. for every x is xRx - True
2. Is this relation irreflexive, i.e. no x is such that xRx - False
3. Is this relation symmetric, i.e. for every x and y, if xRy then yRx - False
4. Is this relation antisymmetric, i.e. for every x and y, if xRy and yRx then x=y - False
5. Is this relation asymmetric, i.e. for every x and y, if xRy then it is not the case that yRx - False
6. Is this relation functional, i.e. for every x, y and z, if xRy and xRz then y=z - False
7. Is this relation inverse functional, i.e. for every x, y, z if xRy and zRy then x=z - False
8. Is this relation transitive, i.e. for every x, y, and z, if xRy and yRz then xRz - False

Ontological Relationships

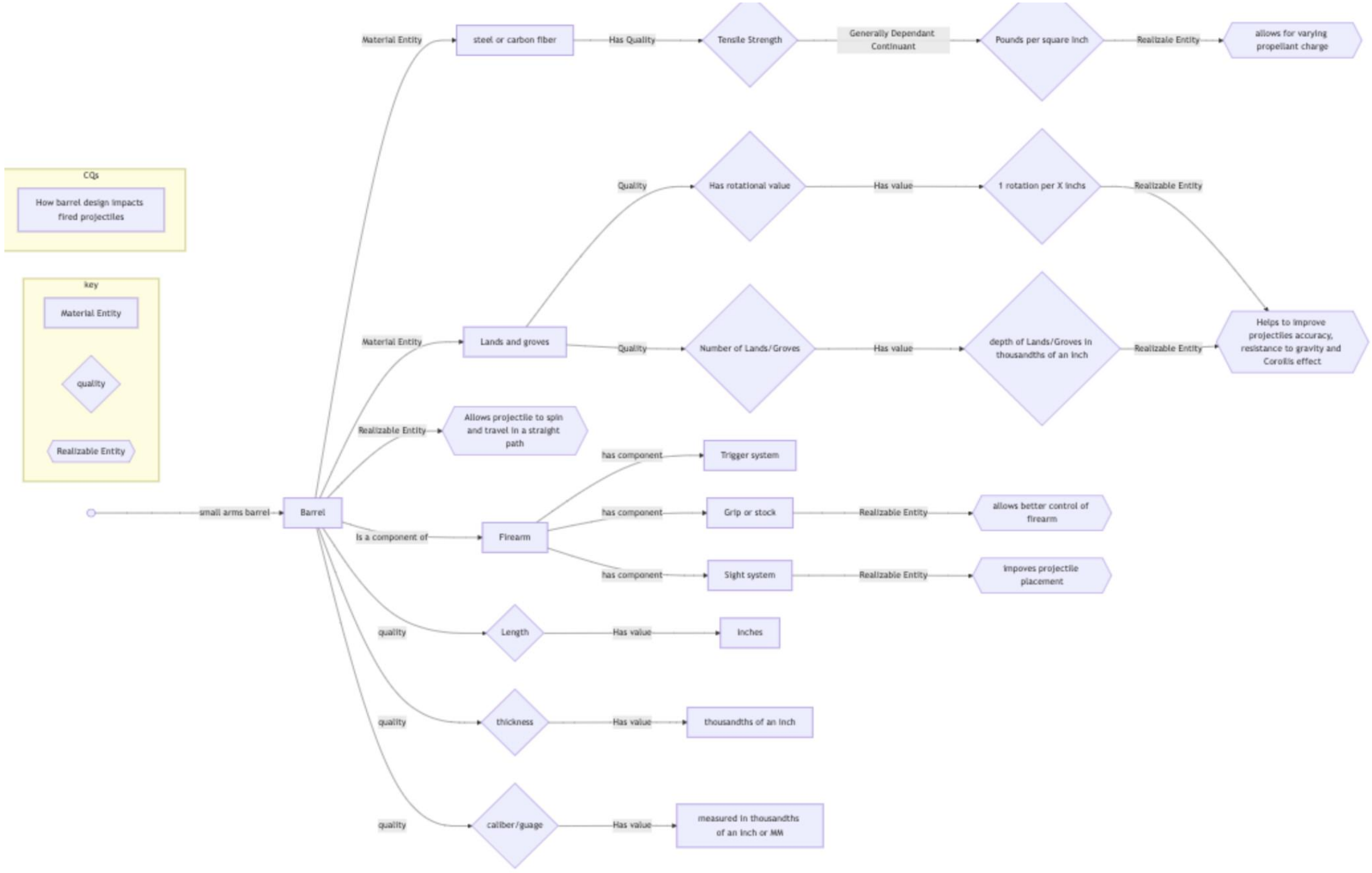
Formal Properties of Relationships

This document outlines the fundamental properties/charaterisics of relationships within an ontology.

Relationships

Relationships define connections between entities.

- **Input:** Relationships establish connections between different entities.
  - *Example:* "Part of" – An orange peel is part of an orange.
- **Directionality:** Relationships can be unidirectional or bidirectional.
  - *Example (Unidirectional):* "Has parent" – A son has a father.
  - *Example (Unidirectional):* A data point has a parent dataset.
- **Reflexivity:** Every entity is related to itself.
  - *Example:* Any entity is equivalent to itself (A = A).
- **Symmetry:** If entity A is related to entity B, then entity B is related to entity A.
  - *Example:* "Siblings" – If a brother is related to a sister, then the sister is related to the brother.
- **Transitivity:** If entity A is related to entity B, and entity B is related to entity C, then entity A is related to entity C.
  - *Example:* If 10 is greater than 5, and 5 is greater than 3, then 10 is greater than 3.


CQs
How barrel design impacts fired projectiles
key
Material Entity
quality
Realizable Entity
small arms barrel
Barrel
Material Entity
steel or carbon fiber
Has Quality
Tensile Strength
Generally Dependant Continuant
Pounds per square inch
Realizale Entity
allows for varying propellant charge
Material Entity
Lands and groves
Quality
Has rotational value
Has value
1 rotation per X inchs
Realizable Entity
Quality
Number of Lands/Groves
Has value
depth of Lands/Groves in thousandths of an inch
Realizable Entity
Helps to improve projectiles accuracy, resistance to gravity and Corollis effect
Realizable Entity
Allows projectile to spin and travel in a straight path
Is a component of
Firearm
has component
Trigger system
has component
Grip or stock
Realizable Entity
allows better control of firearm
has component
Sight system
Realizable Entity
impoves projectile placement
quality
Length
Has value
Inches
quality
thickness
Has value
thousandths of an inch
quality
caliber/guage
Has value
measured in thousandths of an inch or MM

Competency Questions for the Ontology

General Information

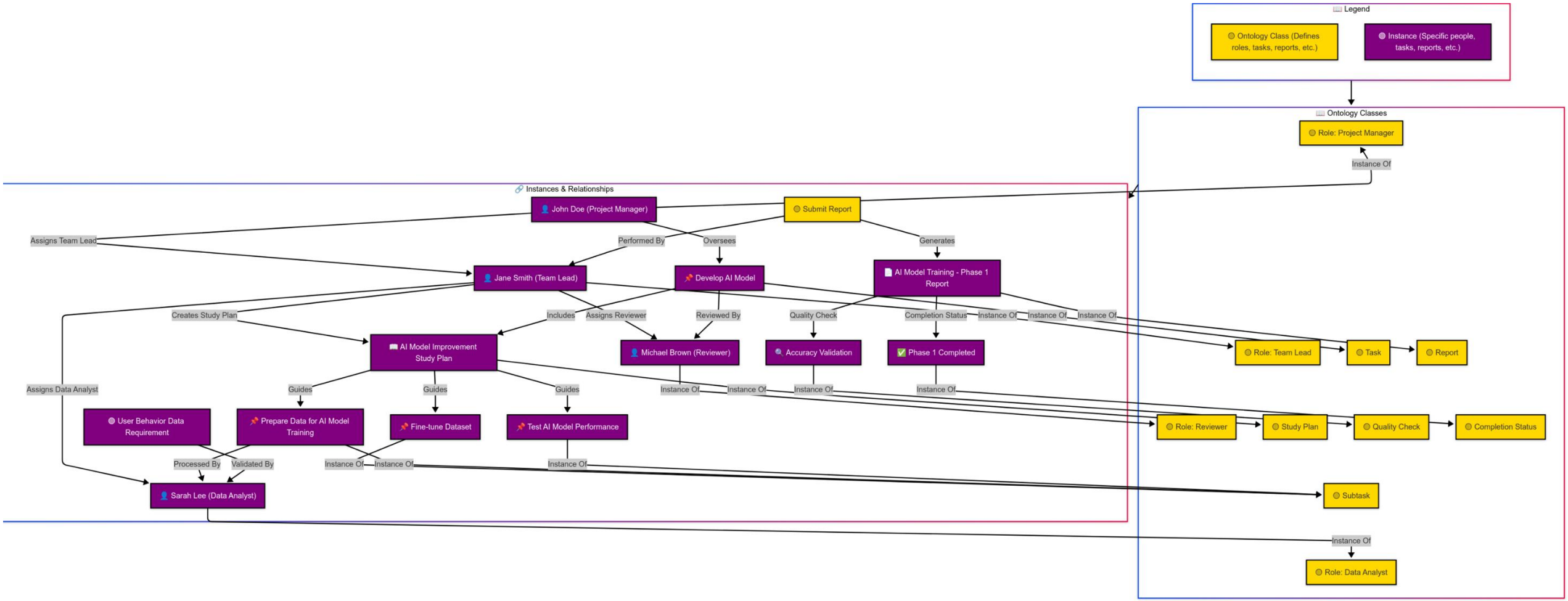
- What types of information are defined in the ontology?
- What roles are associated with a person in this ontology?

Task Management

- Who is responsible for creating a task (ActOfCreatingTask)?
- What are the steps involved in assigning a sub-task (ActOfAssigningSubTask)?
- What progress reports (ProgressReport) have been submitted under a given task?
- Who is allowed to submit a progress report (ActOfSubmitProgressReport)?
- What is the role of a person in a particular task assignment?

Role and Responsibility

- What occupational roles (OccupationalRole) are defined in the ontology?
- What tasks are assigned to a particular role?
- How is an occupational role related to a person in the ontology?


📖 Legend
Ontology Class (Defines roles, tasks, reports, etc.)
Instance (Specific people, tasks, reports, etc.)
📖 Ontology Classes
Role: Project Manager
Instance Of
🔗 Instances & Relationships
👤 John Doe (Project Manager)
Submit Report
Assigns Team Lead
Performed By
Oversees
Generates
👤 Jane Smith (Team Lead)
📌 Develop AI Model
📄 AI Model Training - Phase 1 Report
Creates Study Plan
Includes
Assigns Reviewer
Reviewed By
Quality Check
Completion Status
Instance Of
Role: Team Lead
Task
Report
📖 AI Model Improvement Study Plan
👤 Michael Brown (Reviewer)
🔍 Accuracy Validation
✅ Phase 1 Completed
Assigns Data Analyst
Guides
Role: Reviewer
Study Plan
Quality Check
Completion Status
User Behavior Data Requirement
📌 Prepare Data for AI Model Training
📌 Fine-tune Dataset
📌 Test AI Model Performance
Processed By
Validated By
👤 Sarah Lee (Data Analyst)
Subtask
Role: Data Analyst

Relation	Definition	Is Reflexive	Is Symmetric	Is Transitive
Work with (NOTE: assumes an agent, person or machine that is the subject)	To use some material in the creation of one's work;			
	To utilize some tool, instrument, or other apparatus in the p	Person works with Oneself = True; Ex.: Work with Oneself to adopt a health habit	Counterexample: Person works with wood = True; Wood works with Person = False	Counterexample: PersonA works with PersonB; PersonB works with MaterialA; PersonA works with MaterialA = FALSE
	To cooperate with someone in order to perform some task,	Distinguishing this term and def. from "Works with" as in "work together with" as in Ex: Tool A works with (works well together with) tool B.		Counterexample: PersonA works with PersonB; PersonB works with PersonC; PersonA works with PersonC = FALSE
	(Source: https://idioms.thefreedictionary.com/work+with)	Since for this term we assume an agent must be the subject it would not make sense to say "Wood material works with wood material" for example, which would be False		
Work For	To work for someone (for any motivation: intrinsic or extrinsic);			**TRUE?**
	To work in order to accomplish something (for any motivation: intrinsic or extrinsic)	Person works for Oneself (in an act of self employment for example)	Counterexample: Let: PersonA works for EmployerA = True; then: EmployerA works for PersonA = False	PersonA works for OrganizationA = True; OrganizationA works for umbrella OrganizationB = True; then: PersonA works for umbrella OrganizationB = ? True (but indirectly?)
	(Sources: https://www.typesof.net/a/types-of-motivation-with-definitions; https://idioms.thefreedictionary.com/work+for)	Person works for Oneself (for one's benefit to improve a skillset for example)		**NOT SURE! If the mission statement is the object than YES, but if a formal payroll process is taken into account then FALSE; NOTE: the formal definition of "Work For" includes employment clause**
Collaborate with (alt: work together with)	To work on a task with another person or group.			
	(Sources: https://idioms.thefreedictionary.com/collaborate+with, https://dictionary.cambridge.org/us/dictionary/english/collabo with-to)	Since most definitions exclude relation to oneself, assumes "Other" must be the object	If AgentA (or agent aggregateB) Collaborates with AgentB (or agent aggregateB) then reverse must be TRUE	Counterexample: Let: PersonA collaborates with PersonB = True; PersonB collaborates with PersonC (on a different matter) = True; then: PersonA collaborates with PersonC = False
Responsible For	be responsible for someone/something/doing something;	**TRUE?**		**TRUE (unless roles change over time)**
	to have control and authority over something or someone and the duty of taking care of it, him, or her	One is responsible for oneself is always True (regardless of context, though others may also share roles of responsibility over the same One)	Counterexample: ParentA is responsible for ChildB = True while ChildB is responsible for ParentA = False	OrganizationA is reponsible for ParticipantManagerB = True; ParticipantManagerB is responsible for EmployeeC = True; OrganizationA is resposible for EmployeeC = True
	(Source: https://dictionary.cambridge.org/us/dictionary/english/respo	**What about severe disability or inablity to execute on the responsibility? Would this still hold on some intrinsic level even if not exerted externally?**		Counterexample: ParentA is reponsible for ChildB = True; WHEN ChildB has their ChildC, ChildB (now a parent) is responsible for ChildC = True; BUT ParentA is responsible for ChildC = False
				The key here is taking time frame and change of resonsibility ROLES into account = these may change, but within the same time frame (stasis) this property should hold
LEGEND: the separate rows within the same term are only there to help read the text easier and not to align with the corresponding cells in the other columns for the same term				

Relation	Definition	Is Reflexive	Is Symmetric	Is Transitive
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	To utilize some tool, instrument, or other apparatus in the performance of some labor or activity;	Person works with Oneself = True; Ex.: Work with Oneself to adopt a health habit	Counterexample: Person works with wood = True; Wood works with Person = False	Counterexample: PersonA works with PersonB; PersonB works with MaterialA; PersonA works with MaterialA = FALSE
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Outline

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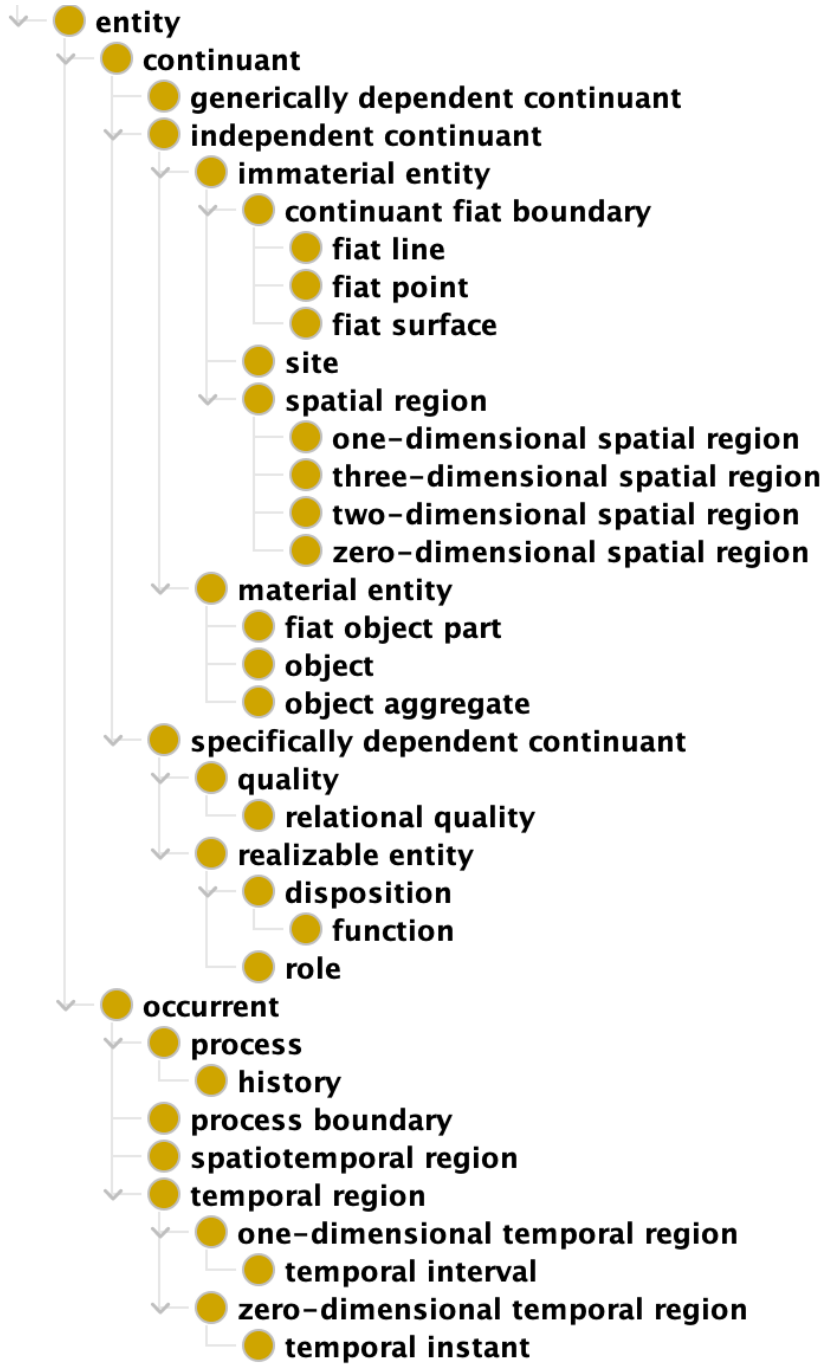
- Recipe Refresher
- The Secret Structure of the World


entity
continuant
generically dependent continuant
independent continuant
immaterial entity
continuant fiat boundary
fiat line
fiat point
fiat surface
site
spatial region
one-dimensional spatial region
three-dimensional spatial region
two-dimensional spatial region
zero-dimensional spatial region
material entity
fiat object part
object
object aggregate
specifically dependent continuant
quality
relational quality
realizable entity
disposition
function
role
occurrent
process
history
process boundary
spatiotemporal region
temporal region
one-dimensional temporal region
temporal interval
zero-dimensional temporal region
temporal instant


concretizes
continuant part of
member part of
environs
exists at
first instant of
generically depends on
has continuant part
has member part
has first instant
has history
has last instant
has material basis
has occurrent part
has temporal part
has participant
has realization
history of
is carrier of
is concretized by
last instant of
located in
location of
material basis of
occupies spatial region
occupies spatiotemporal region
occupies temporal region
occurrent part of
temporal part of
occurs in
participates in
preceded by
precedes
realizes
spatially projects onto
specifically depended on by
bearer of
specifically depends on
inheres in
temporally projects onto

Disambiguation

- **Information** vs what that information **is about**, e.g. occupation code vs a holder of an occupation
- **Material** vs **immaterial** things, e.g. a given river vs the site where the river used to flow
- **Bearing properties** vs **bearers of properties**, e.g. apple's redness vs the apple
- **Processes** vs **product**, e.g. ontology engineering vs ontology produced

Rules of Thumb

- When identifying classes, describe:

1. Material entities within scope, i.e. **Material Entity**
2. Qualities these material entities have, i.e. **Quality**
3. What these material entities could do, i.e. **Realizable Entity**
4. What these material entities actually do, i.e. **Process**
5. Where these material entities and boundaries are located, i.e. **Immaterial Entity**
6. When these entities exist, i.e. **Temporal Region**
7. Information we use to talk about 1-6, i.e. **Generically Depedent Continuant**

https://github.com/BFO-ontology/BFO-2020

Classes

- Material Entities –
- Qualities –
- Processes –
- Realizables –
- Sites & Boundaries –
- Temporal Region –
- Information –

At what speed does a patrol boat move in knots over an hour?

Classes

- Material Entities – **Patrol boat**
- Qualities –
- Processes –
- Realizables –
- Sites & Boundaries –
- Temporal Region –
- Information –

At what speed does a patrol boat move in knots over an hour?

Classes

- Material Entities – Patrol boat
- Qualities –
- Processes – **Act of motion**
- Realizables –
- Sites & Boundaries –
- Temporal Region –
- Information –

At what speed does a patrol boat move in knots over an hour?

Classes

- Material Entities – Patrol boat
- Qualities –
- Processes – Act of motion, **speed?**
- Realizables –
- Sites & Boundaries –
- Temporal Region –
- Information – **speed?**

At what speed does a patrol boat move in knots over an hour?

Classes

- Material Entities – Patrol boat
- Qualities –
- Processes – Act of motion, speed*
- Realizables –
- Sites & Boundaries –
- Temporal Region –
- Information – speed*

use * to note ambiguity then move on; we will revisit

At what speed does a patrol boat move in knots over an hour?

Classes

- Material Entities – Patrol boat
- Qualities –
- Processes – Act of motion, speed*
- Realizables –
- Sites & Boundaries –
- Temporal Region –
- Information – speed*, **knots measurement**

At what speed does a patrol boat move in knots over an hour?

Classes

- Material Entities – Patrol boat
- Qualities –
- Processes – Act of motion, speed*
- Realizables –
- Sites & Boundaries –
- Temporal Region – **hours***
- Information – speed*, knots measurement, **hours***

use * to note ambiguity then move on; we will revisit

At what speed does a patrol boat move in knots over an hour?

Revisiting Ambiguity

- “speed” as a process vs information about a process

Revisiting Ambiguity

- "speed" as a process vs information about a process

- Speed is the magnitude of a change in position over time

INFORMATION

Revisiting Ambiguity

- "speed" as a process vs information about a process

- Speed is the changing of position over time

PROCESS

Revisiting Ambiguity

- "speed" as a process vs information about a process

At what speed does a patrol boat move in knots over an hour?

WHICH DO WE CARE ABOUT FOR THIS COMPETENCY QUESTION?

Simplify

- Material Entities – Patrol boat
- Qualities –
- Processes – Act of motion, speed*
- Realizables –
- Sites & Boundaries –
- Temporal Region – hours*
- Information – speed*, knots measurement, hours*

At what speed does a patrol boat move in knots over an hour?

Simplify

- Material Entities – Patrol boat
- ~~Qualities –~~
- Processes – Act of motion, speed*
- ~~Realizables –~~
- ~~Sites & Boundaries –~~
- Temporal Region – hours*
- Information – ~~speed*,~~ knots measurement, ~~hours*~~

simplify the list

At what speed does a patrol boat move in knots over an hour?

Relations

- Material Entities – Patrol boat
- Processes – Act of motion, speed
- Temporal Region – hours
- Information – knots measurement

and reflect on relationships among the listed entities

At what speed does a patrol boat move in knots over an hour?

Rules of Thumb

- When identifying relations, describe:

1. Qualities to material entities, i.e. **inheres in**
2. Realizables to material entities, i.e. **inheres in**, **has material basis**
3. Processes to material entities, i.e **participates in**
4. Realizables to processes, i.e. **has realization**
5. Immaterial location of material entity, i.e. **located in**
6. When any such entities exist, i.e. **exists at**, **datatype property**
7. When any such entities carry information, e.g. **generically depends on**

https://github.com/BFO-ontology/BFO-2020

Relations

- Material Entities – **Patrol boat**
- Processes – **Act of motion**, speed
- Temporal Region – hours
- Information – knots measurement

patrol boats participate in processes

https://github.com/BFO-ontology/BFO-2020

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- Design Pattern Review
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Classes

- Material Entities –
- Qualities –
- Processes –
- Realizables –
- Sites & Boundaries –
- Temporal Region –
- Information –

On what day(s) of the week does the UK prime minister have tea?

Relations

- Qualities to Material Entities –
- Realizables to Material Entities –
- Processes to Material Entities –
- Realizables to Processes –
- Location to Material Entities –
- Entities to Temporal Region –
- Information to Carriers –

On what day(s) of the week does the UK prime minister have tea?