# Revisiting, Reviewing, and Revising Taxonomies

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# About the Speaker

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Semantic Web Company

Over 25 years of experience in developing and managing taxonomies, metadata, and other knowledge organization systems for various organizations and applications.

Instructor of self-paced online taxonomy courses.

Prior taxonomy consultant and staff taxonomist.

Author of *The Accidental Taxonomist*.

# Outline

- Introduction to reviewing taxonomies
- Taxonomy quality review
- Concept and label issues
- Hierarchy issues
- Taxonomy integration, linking, and mapping

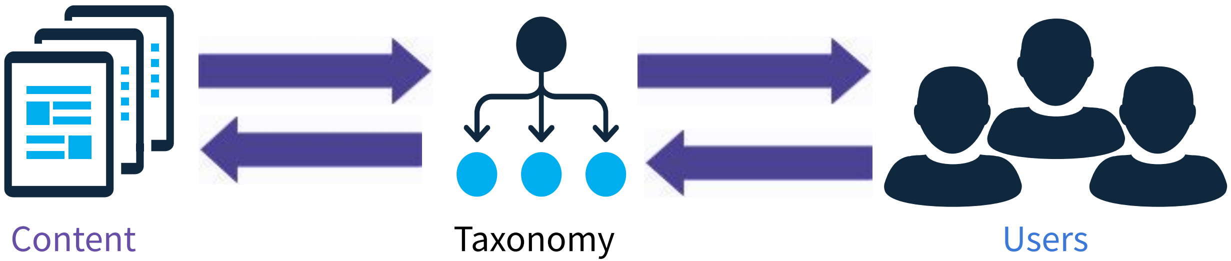
poolparty®

# Introduction to Reviewing Taxonomies

# Introduction to Taxonomies

## Why taxonomies?

- Concepts/terms are used to tag/index/categorize content to make it easier to be found and retrieved
  - supporting better findability than search alone
- The taxonomy is an intermediary that links the user to the desired content.



- Taxonomies are a kind of controlled vocabulary or knowledge organization system

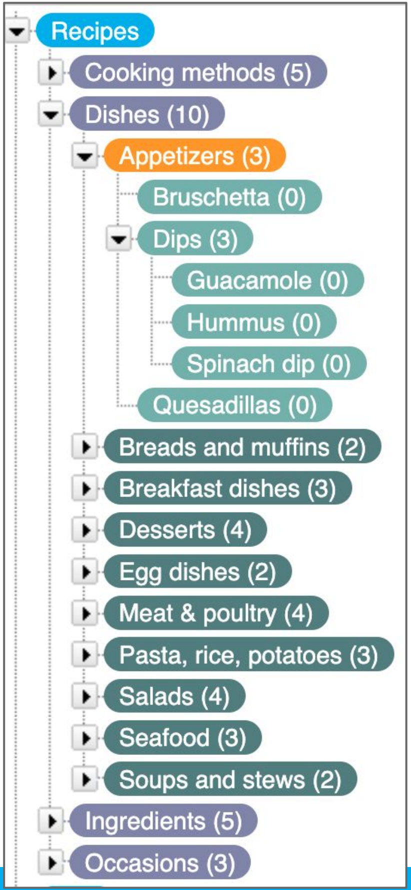
# Introduction to Taxonomies

## What is a taxonomy?

*Controlled* and *organized*

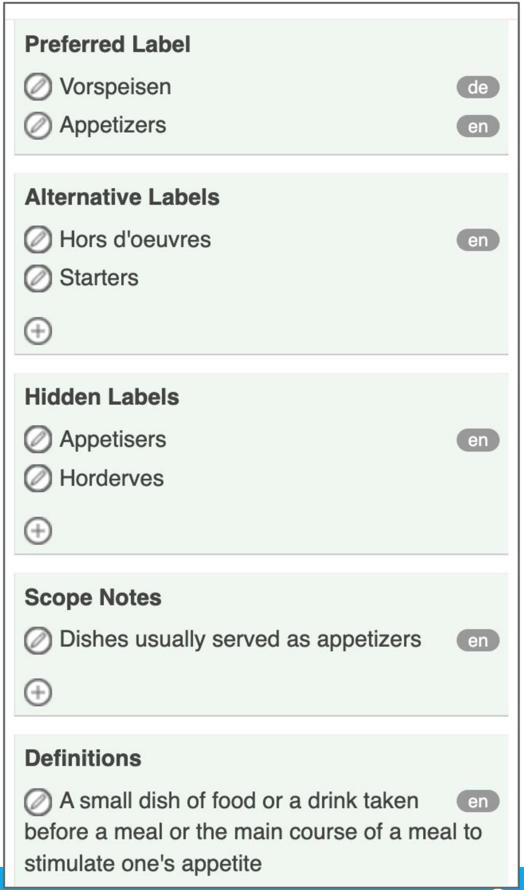
1. A kind of controlled vocabulary or knowledge organization system, based on unambiguous concepts, not just words:
   **things, not strings**
2. Concepts are arranged in a structure of hierarchies, categories, or facets to organize them.

*organized*



- Recipes
  - Cooking methods (5)
  - Dishes (10)
    - Appetizers (3)
      - Bruschetta (0)
      - Dips (3)
        - Guacamole (0)
        - Hummus (0)
        - Spinach dip (0)
      - Quesadillas (0)
    - Breads and muffins (2)
    - Breakfast dishes (3)
    - Desserts (4)
    - Egg dishes (2)
    - Meat & poultry (4)
    - Pasta, rice, potatoes (3)
    - Salads (4)
    - Seafood (3)
    - Soups and stews (2)
  - Ingredients (5)
  - Occasions (3)

*controlled*



**Preferred Label**

Vorspeisen de

Appetizers en

**Alternative Labels**

Hors d'oeuvres en

Starters

**Hidden Labels**

Appetisers en

Horderves

**Scope Notes**

Dishes usually served as appetizers en

**Definitions**

A small dish of food or a drink taken before a meal or the main course of a meal to stimulate one's appetite en

# Introduction to Taxonomies

## Benefits of taxonomies

1. As a controlled vocabulary

   Brings together different wordings (synonyms) for the same concept

   ▹ Helps people search for information by different names

2. Having classification and structure

   Organizes information into a logical structure

   ▹ Helps people browse or navigate for information

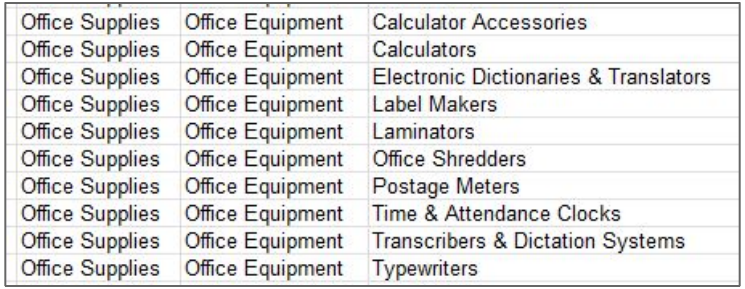
   ▹ Provides context and meaning for concepts for indexing and retrieval

# Reviewing Taxonomies

## Reviewing  and Updating Taxonomies Currently in Use

Changes impacting taxonomies:

- *Certain types of concepts*
  - Terminology changes (e.g. reducing bias)
  - New concepts (e.g related to technology)
  - User feedback suggesting improvements



| | | |
|---|---|---|
| Office Supplies | Office Equipment | Calculator Accessories |
| Office Supplies | Office Equipment | Calculators |
| Office Supplies | Office Equipment | Electronic Dictionaries & Translators |
| Office Supplies | Office Equipment | Label Makers |
| Office Supplies | Office Equipment | Laminators |
| Office Supplies | Office Equipment | Office Shredders |
| Office Supplies | Office Equipment | Postage Meters |
| Office Supplies | Office Equipment | Time & Attendance Clocks |
| Office Supplies | Office Equipment | Transcribers & Dictation Systems |
| Office Supplies | Office Equipment | Typewriters |

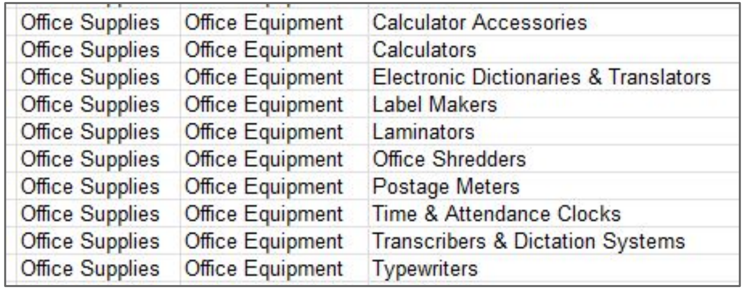
- *Broader, taxonomy-level changes*
  - New content, bringing up new concepts
  - Content  sets that get dropped
  - New requirements, users, needs, trends, markets, etc.
  - Examples:
    - Adding related-concept relationships, definitions, scope notes, etc.
    - Integrating multiple taxonomies, or with a terminology or glossary
    - Implementing a new taxonomy management system
    - Extending the taxonomy to a new application or website

# Reviewing Taxonomies

## Reviewing  and Updating Taxonomies Currently in Use

Changes impacting taxonomies:

- *Certain types of concepts*  - usual governance policies
  - Terminology changes (e.g. reducing bias)
  - New concepts (e.g related to technology)
  - User feedback suggesting improvements



| | | |
|---|---|---|
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- *Broader, taxonomy-level changes*  - special taxonomy review projects
  - New content, bringing up new concepts
  - Content  sets that get dropped
  - New requirements, users, needs, trends, markets, etc.
  - Examples:
    - Adding related-concept relationships, definitions, scope notes, etc.
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# Reviewing Taxonomies

## Evaluating and Revising Other Taxonomies for Re-Use

- Taxonomies licensed, acquired, adopted on the subject area
    - From published sources or as linked open data
- Taxonomies from different internal systems
- Legacy controlled vocabularies from former projects or purposes
- Taxonomies from acquired/merged companies, businesses

## Taxonomy evaluation comprises:

- Ensuring the taxonomy is suitable for **the content**
    - Check the scope and level of detail
    - Perform sample test tagging and test retrieval
- Ensuring the taxonomy is suitable for **the users**
    - Also evaluate the taxonomy quality

# Taxonomy Quality Review

# Taxonomy Quality Checks

## Taxonomy management system quality reporting

- Duplicate labels (if not enforced upon creation)
- Orphan concepts

## Taxonomy management system metrics

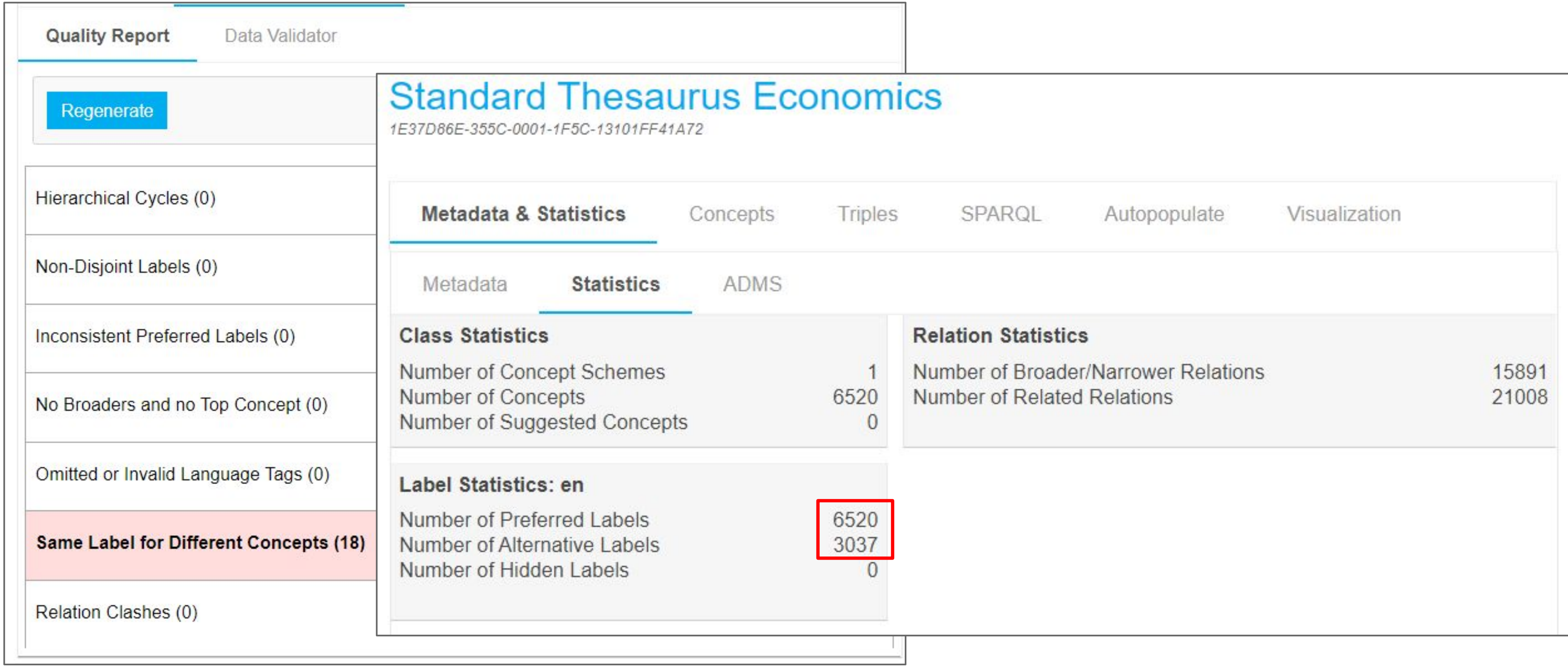
- Numbers of preferred vs. alternative labels
- Numbers of hierarchical and associative relationships
- Number of levels of hierarchy depth

## Taxonomy management system reports or queries

- *Missing* alternative labels, certain relationships, scope notes, etc.,
  - So they can be added
- Only concepts *with* alternative labels, certain relationships, scope notes, etc.
  - So, they can be comprehensively reviewed

## Taxonomy management system spreadsheet exports for review

# Taxonomy Quality Checks



Hierarchical Cycles (0)

Non-Disjoint Labels (0)

Inconsistent Preferred Labels (0)

No Broaders and no Top Concept (0)

Omitted or Invalid Language Tags (0)

**Same Label for Different Concepts (18)**

Relation Clashes (0)

## Standard Thesaurus Economics

*1E37D86E-355C-0001-1F5C-13101FF41A72*

**Class Statistics**

| | |
|---|---|
| Number of Concept Schemes | 1 |
| Number of Concepts | 6520 |
| Number of Suggested Concepts | 0 |

**Relation Statistics**

| | |
|---|---|
| Number of Broader/Narrower Relations | 15891 |
| Number of Related Relations | 21008 |

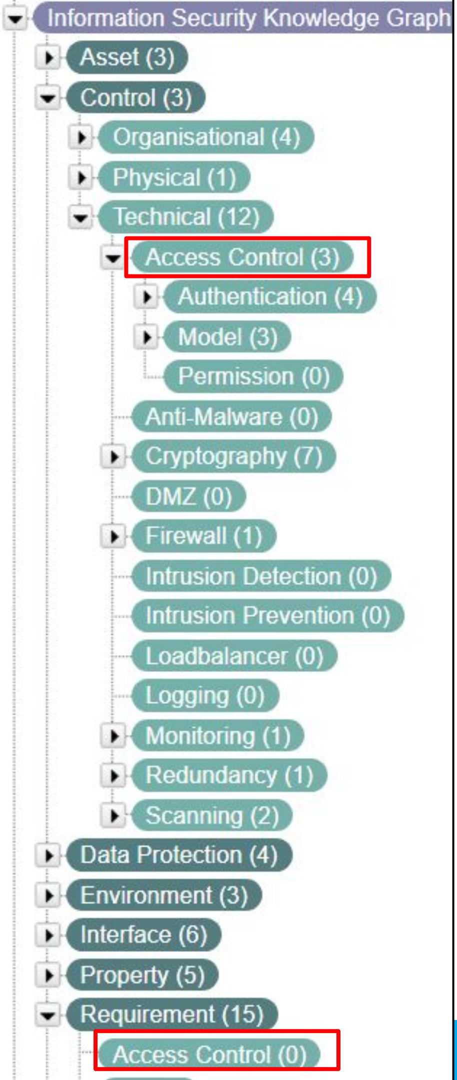
**Label Statistics: en**

| | |
|---|---|
| Number of Preferred Labels | 6520 |
| Number of Alternative Labels | 3037 |
| Number of Hidden Labels | 0 |

# Quality Checks

Duplicated preferred label.

Can also be identified as different concepts, due to presence of narrower concepts.



- Information Security Knowledge Graph
  - Asset (3)
  - Control (3)
    - Organisational (4)
    - Physical (1)
    - Technical (12)
      - Access Control (3)
        - Authentication (4)
        - Model (3)
        - Permission (0)
      - Anti-Malware (0)
      - Cryptography (7)
      - DMZ (0)
      - Firewall (1)
      - Intrusion Detection (0)
      - Intrusion Prevention (0)
      - Loadbalancer (0)
      - Logging (0)
      - Monitoring (1)
      - Redundancy (1)
      - Scanning (2)
  - Data Protection (4)
  - Environment (3)
  - Interface (6)
  - Property (5)
  - Requirement (15)
    - Access Control (0)

# Concept and Label Issues

# Taxonomy Concepts and Labels

## Concept label format and style best practices

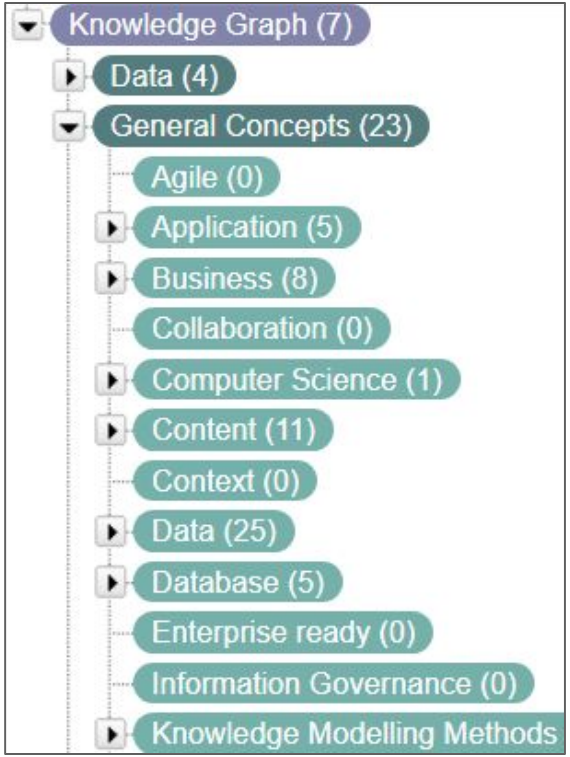
- Unambiguous; understood even out of context of the hierarchy.
  *Example:* **Nursing Certification**, rather than **Certification** as narrower to Nurses
- Consistent capitalization: initial capitalization is recommended.
  *Example:* **Corporate finance**, rather than corporate finance, or Corporate Finance
- Countable nouns are usually plural
  *Example:* **Occupational accidents** (countable), **Occupational health** (not countable)
- Adjectives alone may exist within term lists of characteristics/properties (metadata or attributes), but not within hierarchical taxonomies or thesauri. For example, colors, sizes, status.
- Parenthetical qualifiers may be used for disambiguation, not modification.
  *Example:* **Walnut (wood)**
- Avoid term inversions (e.g. noun, adjective) because labels are searchable
  *Example:* **Racial discrimination**, not Discrimination, racial

# Concept and Label Issues

“Concepts” that are single, vague words:

*Application, Business, Content, Context, Data*

Concepts need to be unambiguous,
and specific for tagging a specific set of content.

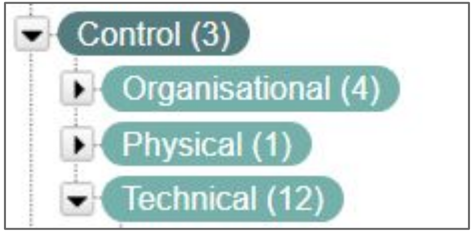


- Knowledge Graph (7)
  - Data (4)
  - General Concepts (23)
    - Agile (0)
    - Application (5)
    - Business (8)
    - Collaboration (0)
    - Computer Science (1)
    - Content (11)
    - Context (0)
    - Data (25)
    - Database (5)
    - Enterprise ready (0)
    - Information Governance (0)
    - Knowledge Modelling Methods

# Concept and Label Issues

Concepts that are adjectives
Adjectives are only suitable as

Attributes, but not in a hierarchical taxonomy



Control (3)
Organisational (4)
Physical (1)
Technical (12)

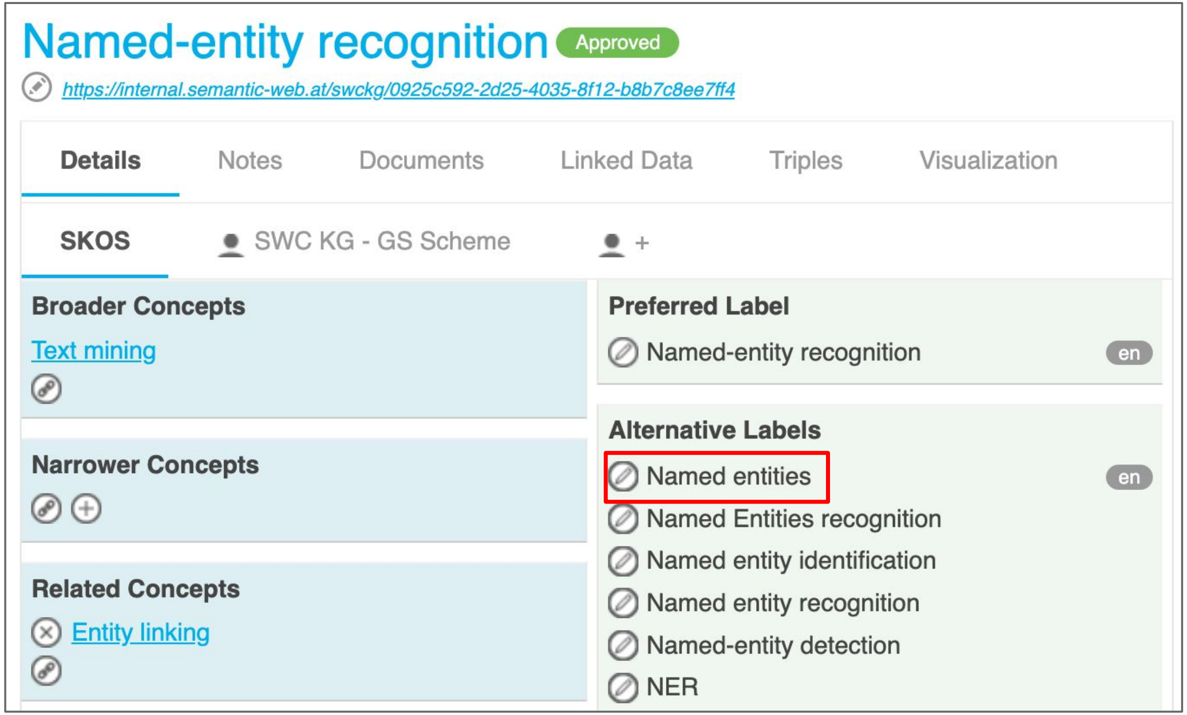
# Concept and Label Issues: Alternative Labels

- Ensure there are *sufficient* alternative labels to match:
  - different possible user search search strings for the same concept
  - different wordings of the concept in the text
- Don’t have *too many* alternative labels that might:
  - match text with different meaning
  - complicate and confuse users when displayed
- Consider converting some to Hidden Labels instead so as not to display.

# Concept and Label Issues: Alternative Labels

Alternative label with different meaning:

Named entity recognition vs. Named entities



Named-entity recognition Approved

https://internal.semantic-web.at/swckg/0925c592-2d25-4035-8f12-b8b7c8ee7ff4

**Broader Concepts**

Text mining

**Narrower Concepts**

**Related Concepts**

Entity linking

**Preferred Label**

Named-entity recognition en

**Alternative Labels**

Named entities en

Named Entities recognition

Named entity identification

Named entity recognition

Named-entity detection

NER

# Concept and Label Issues: Alternative Labels

Alternative label with narrower meaning

Problematic scenario:

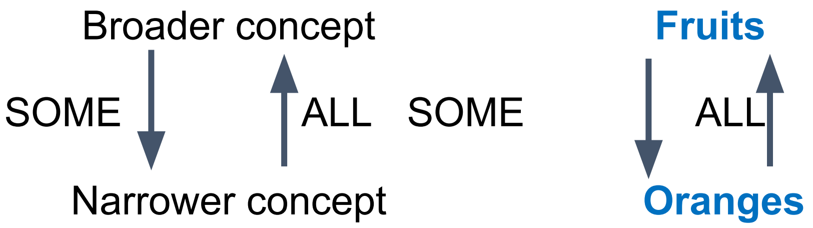
- **Laptops** is an alternative label for **Computers**
- Document on Supercomputers is tagged with **Computers**.
- End-user looks up term “Laptops,” and is taken to result set of all documents tagged with **Computers**.
- Result set includes documents on supercomputers and other computers that are not laptops, in addition to documents on laptops.
- End-user thinks the tagging or taxonomy is wrong by retrieving documents on other kinds of computers besides the selected “laptops.”

# Hierarchy Issues

# Hierarchical Relationship

## Hierarchical relationship from ANSI/NISO guidelines

Reciprocal (bi-directional) relationship, but asymmetrical



**Fruits** (has narrower concept) **Oranges**

**Oranges** (has broader concept) **Fruits**

Three subtypes:

1. Generic – Specific: “is/are a kind of”
2. Generic – Instance: “is an instance of”
3. Whole – Part: “is/are within”

| | | |
|---|---|---|
| **Hospitals** | *Narrower Concept:* | **Children's hospitals** |
| **Hospitals** | *Narrower Concept:* | **Boston Medical Center** |
| **Hospitals** | *Narrower Concept:* | **Emergency rooms** |

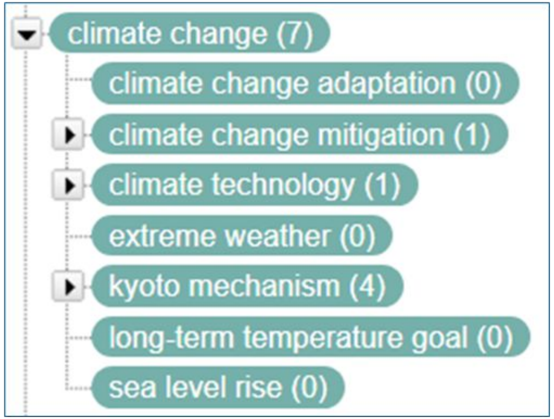
# Hierarchy Issues

Bending the rules for hierarchical relationships is acceptable, if:

1. It is a hierarchical taxonomy, not a thesaurus (esp. without related-concept relationships)

   *and*

2. The incorrect hierarchical relationships are limited to grouping categories, especially at the higher levels of a taxonomy



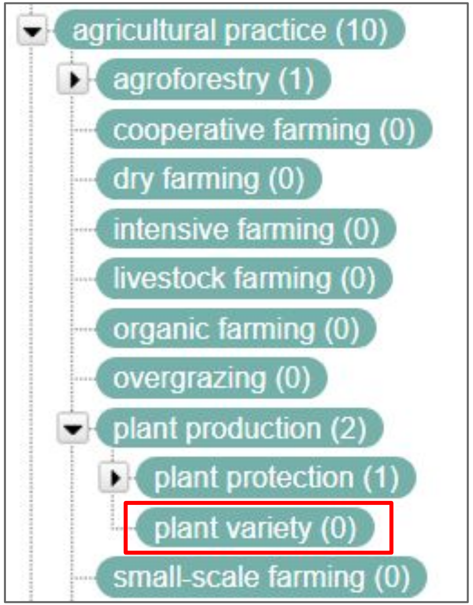
- climate change (7)
  - climate change adaptation (0)
  - climate change mitigation (1)
  - climate technology (1)
  - extreme weather (0)
  - kyoto mechanism (4)
  - long-term temperature goal (0)
  - sea level rise (0)

# Hierarchy Issues

If a concept does not fit the “is a” rule,
Perhaps it’s just a labelling problem,
and the concept is correct.

Example:

Change the label **plant variety**
to **plant diversification**

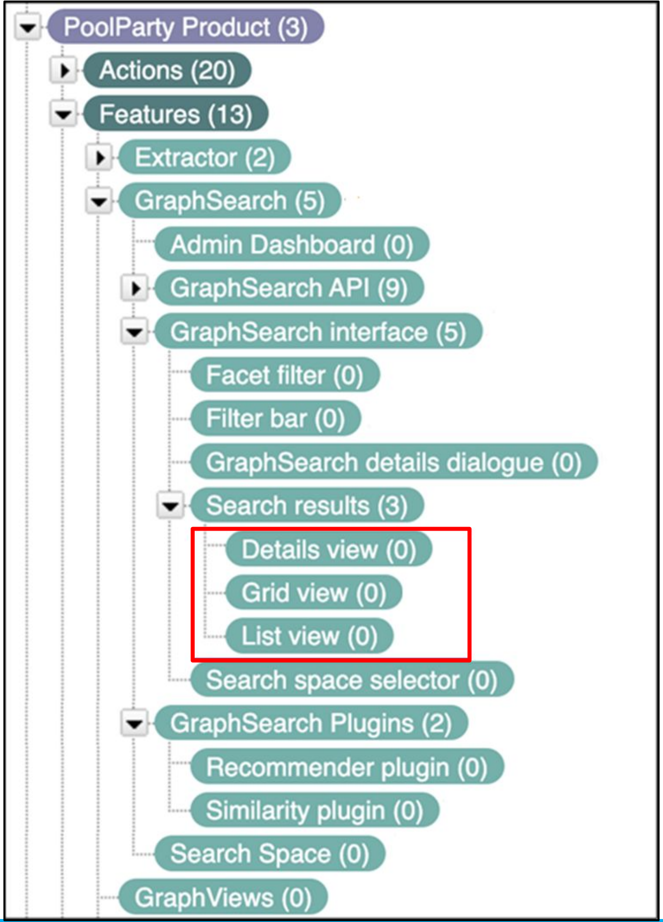


- agricultural practice (10)
  - agroforestry (1)
  - cooperative farming (0)
  - dry farming (0)
  - intensive farming (0)
  - livestock farming (0)
  - organic farming (0)
  - overgrazing (0)
  - plant production (2)
    - plant protection (1)
    - plant variety (0)
  - small-scale farming (0)

# Hierarchy Issues

Error of context-based narrower concepts, which are actually more generic

Example: Details view, Grid view, List view

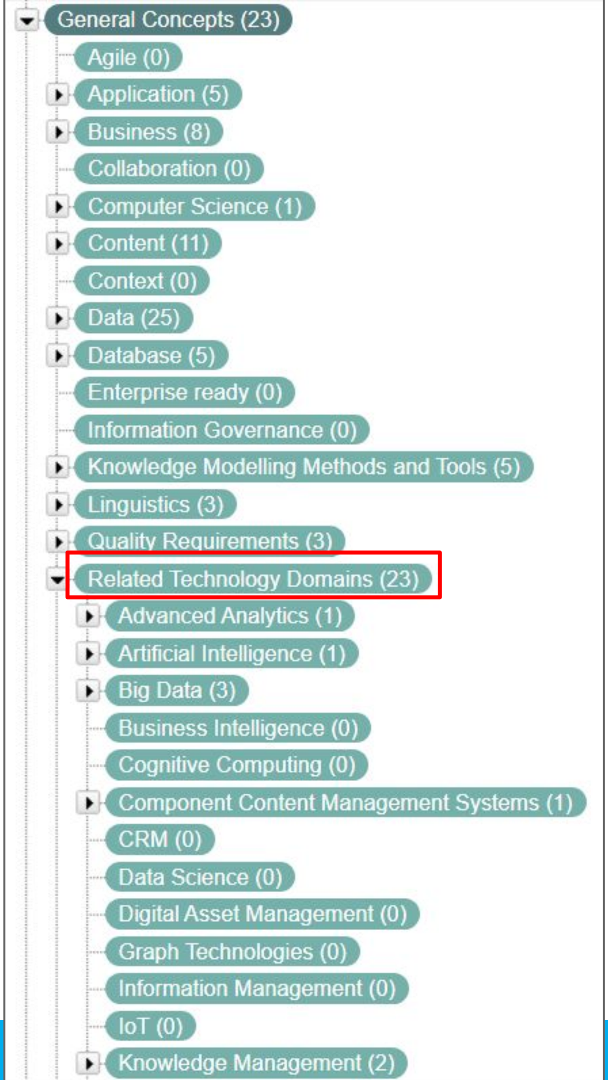


- PoolParty Product (3)
  - Actions (20)
  - Features (13)
    - Extractor (2)
    - GraphSearch (5)
      - Admin Dashboard (0)
      - GraphSearch API (9)
      - GraphSearch interface (5)
        - Facet filter (0)
        - Filter bar (0)
        - GraphSearch details dialogue (0)
        - Search results (3)
          - Details view (0)
          - Grid view (0)
          - List view (0)
        - Search space selector (0)
      - GraphSearch Plugins (2)
        - Recommender plugin (0)
        - Similarity plugin (0)
      - Search Space (0)
    - GraphViews (0)

# Hierarchy Issues

Problem of non-intuitive hierarchy

Example: Related Technology Domains



- General Concepts (23)
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  - Business (8)
  - Collaboration (0)
  - Computer Science (1)
  - Content (11)
  - Context (0)
  - Data (25)
  - Database (5)
  - Enterprise ready (0)
  - Information Governance (0)
  - Knowledge Modelling Methods and Tools (5)
  - Linguistics (3)
  - Quality Requirements (3)
  - Related Technology Domains (23)
    - Advanced Analytics (1)
    - Artificial Intelligence (1)
    - Big Data (3)
    - Business Intelligence (0)
    - Cognitive Computing (0)
    - Component Content Management Systems (1)
    - CRM (0)
    - Data Science (0)
    - Digital Asset Management (0)
    - Graph Technologies (0)
    - Information Management (0)
    - IoT (0)
    - Knowledge Management (2)

# Taxonomy Integration, Linking, and Mapping

# Integrating Existing Taxonomies

## Reusing & Extending

- Simplest way to integrate existing taxonomies is reusing them and extending them based on need.

## Linking & Mapping

- Taxonomies are linked at individual concepts, and the taxonomies are retained as distinct, but can be used in combination, extending each other.
  - Mapping is a form of linking for exact or close matches
    - One taxonomy can be *used for* another (not alongside each other)
    - One is the backend, and one is the frontend

## Merging

- Taxonomies are combined permanently, removing duplicates, without any longer retaining them as distinct.
- First step is to link the taxonomies, then incorporate the unlinked concepts.

# Project Linking Relationships

SKOS relationships within a Concept Scheme (a single taxonomy, thesaurus, or controlled vocabulary), also known as “thesaural” relationships:

- Broader concept
- Narrower concept
- Related concept

SKOS relationships across two different taxonomy projects:

- Exact match
- Close match
- Narrow match
- Broad match
- Related match

# Project Linking Use Cases

## Possible reasons to link taxonomy projects:

- Link to a standard, published vocabulary/classification scheme for alignment.
  - Involves **Exact Match** only
- Use one taxonomy in the user interface to retrieve additional content already tagged with a different taxonomy (also called “mapping”).
  - Involves **Exact Match**, possibly **Close Match**, and **Narrow Match** in one direction
- Enrich a taxonomy with concepts from another controlled vocabulary (“mapping”).
  - Involves **Exact Match**, possibly **Close Match**, and **Narrow Match** in one direction
- Combine two or more taxonomies to extend them, but each still remains intact.
  - May involve all match types
- Compare and align taxonomies prior to fully merging them (with one absorbed into the other taxonomy).
  - May involve all match types

# Resources

# Further Information

- ANSI/NISO Z39.19-2005 (2010) *Guidelines for Construction, Format, and Management of Monolingual Controlled Vocabularies*.
  www.niso.org/publications/ansiniso-z3919-2005-r2010

- “Testing Taxonomies” Taxonomy Boot Camp, November 5, 2013
  www.hedden-information.com/wp-content/uploads/2019/07/Testing_Taxonomies.pdf

- “Mapping Taxonomies, Thesauri, and Ontologies” SEMANTiCS conference, September 11, 2019
  www.hedden-information.com/wp-content/uploads/2019/09/Mapping-Taxonomies-Thesauri-Ontologies.pdf

- “How Many Synonyms Should You Have?” Taxonomy Boot Camp, November 14, 2016
  www.hedden-information.com/wp-content/uploads/2019/07/How-Many-Synonyms-Should-You-Have.pdf

- “Evaluating Taxonomies” blog post
  http://accidental-taxonomist.blogspot.com/search/label/Heuristic%20evaluation

# Upcoming Taxonomy Workshops and Tutorials

Heather Hedden will be teaching about taxonomies at:

- Knowledge Graph Conference, May 3, New York, NY (hybrid) www.knowledgegraph.tech
  "Foundation for a Knowledge Graph: Taxonomy Design Best Practices"
- Data Day Texas, June 13, Austin, TX https://datadaytexas.com
  "Introduction to Taxonomies for Data Scientists"
- SEMANTiCS conference, September 13-15, 2022, Vienna (hybrid) https://2022-eu.semantics.cc
  Tutorial: "Knowledge Engineering of Taxonomies, Thesauri, and Ontologies"
- LavaCon, October, October 23 - 25, 2022, New Orleans, LA https://lavacon.org
  "Using Taxonomies and Tagging to Connect Content Across the Enterprise"

# Q&A / Contact

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