What is an Ontology?

What do you understand about the ontology that has been presented for your reading this week? Could you attempt to define an ontology that would be relevant to the system that you are designing for the summative assessment?

You can share your responses for formative feedback from your tutor or share the next seminar.

My response:

Ontology is a branch of study that explores the existence of entities or things in the universe. In computer science, it refers to a model of entities and their interactions within a particular domain of knowledge or practice. Developing an ontology involves creating a vocabulary of terms and definitions that structure the domain and limit possible interpretations. An ontology aims to establish a shared vocabulary and semantic structure for exchanging information about the domain. Ontologies consist of concepts, relations, instances, and axioms. Concepts can be primitive or defined, and relations describe the interactions between concepts, such as taxonomies, specialisation, partitive, and associative relationships. Other relationships, such as causative, also exist (The University of Manchester (N.D.).

The University of Manchester (N.D.) explains that concepts can be organised into taxonomies that capture knowledge about their relationships. These taxonomies can have universality, optionality, restrictions, cardinality, and transitivity. Ontologies capture conceptualisations of domains, whereas knowledge bases combine ontologies with associated instances. Axioms are used to limit values for classes or instances.

However, Ontotext (N.D.) states that ontologies are formal descriptions of knowledge that create a knowledge graph capturing data. They express relationships and enable linking multiple concepts. Ontologies ensure a common understanding of information, improve metadata and provenance, and aid in automated reasoning. The Web Ontology Language (OWL) defines equivalence and differences between instances, classes, and properties. Ontologies have limitations regarding property constructs and constraints but are used in various applications for knowledge management, early hypotheses testing, semantic web mining, fraud detection, and semantic publishing. Overall, ontologies provide a framework for representing shareable and reusable knowledge, providing high-quality, linked and coherent data.

As explained by Noy & McGuinness (N.D.), ontologies are formal definitions of terms and relationships within a specific domain, and they are becoming increasingly prevalent on the web. They provide a shared vocabulary for researchers to exchange information and promote the reuse of domain expertise. Additionally, ontologies make domain assumptions explicit and separate domain knowledge from operational knowledge. Many fields now create standardised ontologies that specialists can use to annotate and share information within their respective fields. For instance, ontologies are essential for creating a shared understanding of information structure between individuals and software agents. They promote the reuse of domain expertise, allow for explicitly specifying domain assumptions, and enable formal terms analysis. Furthermore, ontologies allow for separating domain knowledge from operational knowledge, making them valuable for problem-solving techniques, domain-independent applications, and software agents.

To create a stable, ontological system, categories must have transparent relationships. Developing an ontology requires clear definitions, limited scope, coherence, and

compatibility with literature. Systems Thinking, specifically Cabrera's DSRP framework (The 'DSRP' acronym stands for Distinction-making (D), Organising Systems (S), Inter-relating (R), and Perspective-taking (P).), can help overcome challenges in ontology development (Rousseau et al. 2018).

According to Noy and McGuinness (N.D.), creating an ontology for a system involves identifying the specific kind of system the plan focuses on, such as programming languages, as the first crucial step. Key concepts or entities within this area, such as algorithms or syntax, should be defined and used as building blocks for the ontology. Describing relationships between these concepts and specifying properties or attributes is also essential. A hierarchical classification of ideas helps organise them into broader categories and subcategories. Logical axioms and constraints should be defined to ensure consistency. It is vital for validation and usability to populate the ontology with real-world data and use a formal language or ontology modeling tool to represent it. Additionally, comprehensive documentation of the ontology's structure, purpose, and usage is necessary for others to understand it.

References:

The University of Manchester (N.D.). *What is an Ontology?* [online] Available at: https://www.cs.man.ac.uk/~stevensr/onto/node3.html

Ontotext (N.D.). *What are Ontologies and What are the Benefits of Using Ontologies*. [online] Available at: https://www.ontotext.com/knowledgehub/fundamentals/what-are-ontologies/.

Noy, N. F. & McGuinness, D. L. (N.D.). *Ontology Development 101: A Guide to Creating Your First Ontology.* [online] Available at: https://protege.stanford.edu/publications/ontology_development/ontology101.pdf.

Rousseau, D., Billingham, J. & Calvo-Amodio, J. (2018). *Systemic Semantics: A Systems Approach to Building Ontologies and Concept Maps*. doi:https://doi.org/10.3390/systems6030032.