



Semantic Interoperability: Revisiting the Theory of Signs and Ontology Alignment Principles

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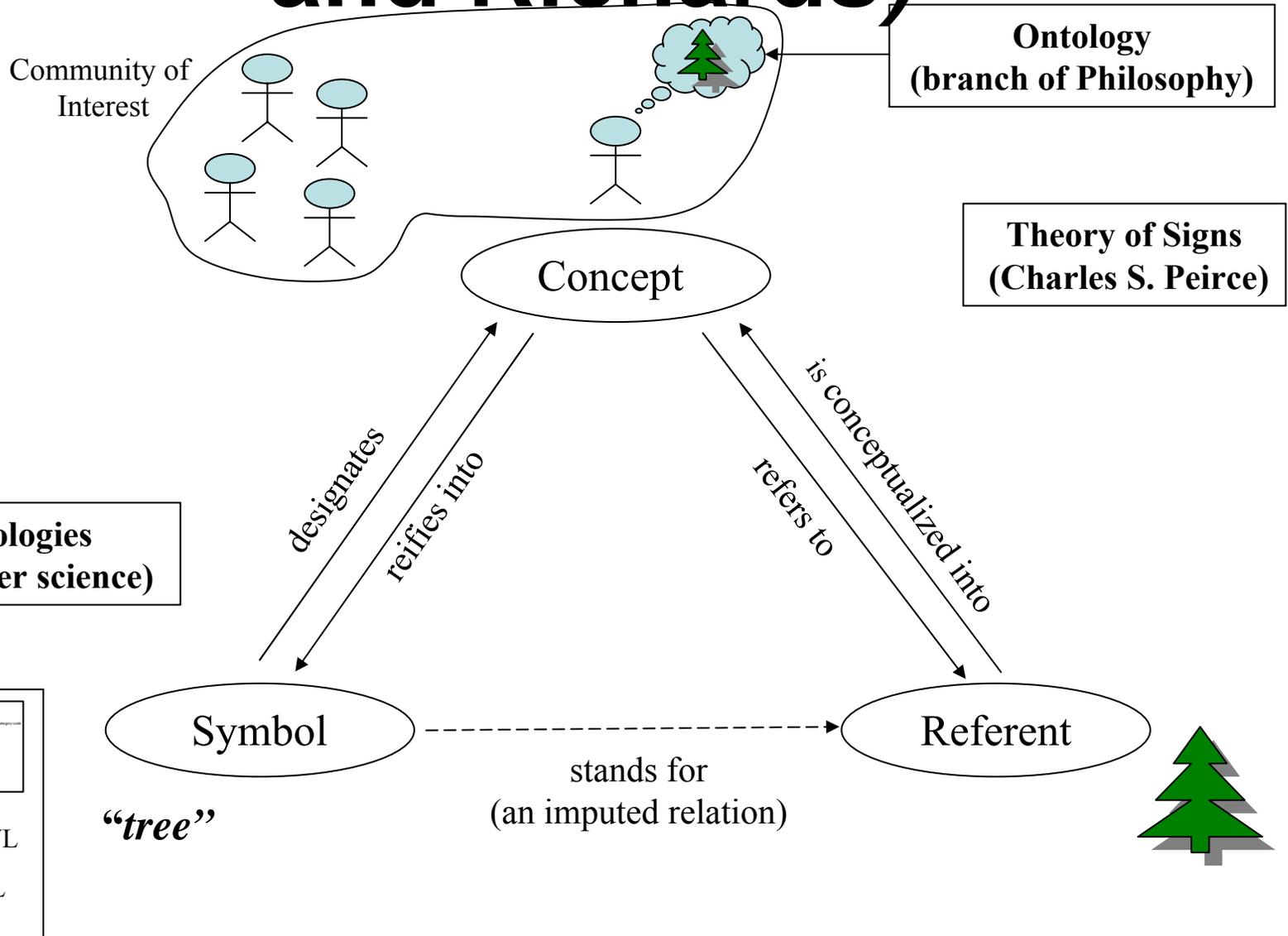
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Presentation Layout

- Revisiting the Semiotic Triangle.
- The Case for Systems Interoperability.
- The Case for Semantic Interoperability.
- The Concept of Ontology Alignment.
- The Concept of Semantic Distance.
- Work ahead.

The Semiotic Triangle (Ogden and Richards)





Definition of “Ontology” (computer science).

- An *ontology* is a formal, explicit specification of a shared conceptualization (Gruber, Borst and Studer)
 - “Conceptualization” = Abstract model of some phenomenon in the world.
 - “Explicit” = The concepts and the constraints on their use are explicitly defined.
 - “Formal” = Machine-readable.
 - “Shared” = Consensual knowledge

Find the next logical symbol.



...

1, 1, 2, 3, 5, 8, ...13



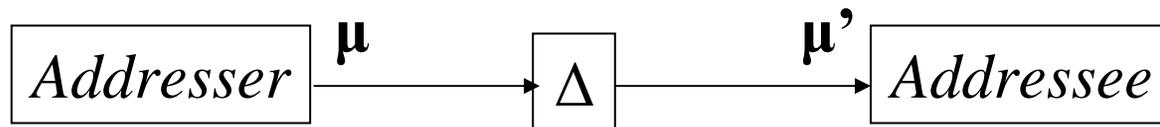
The Case for Systems Interoperability

- MIP Goal
 - *The aim of the MIP is to achieve international interoperability of Command and Control Information Systems (C2IS) at all levels from corps to the lowest appropriate level, in order to support multinational, combined and joint operations and the advancement of digitisation in the international arena, including NATO.*
- Common Interface + Exchange Mechanism



The Case for True Interoperability

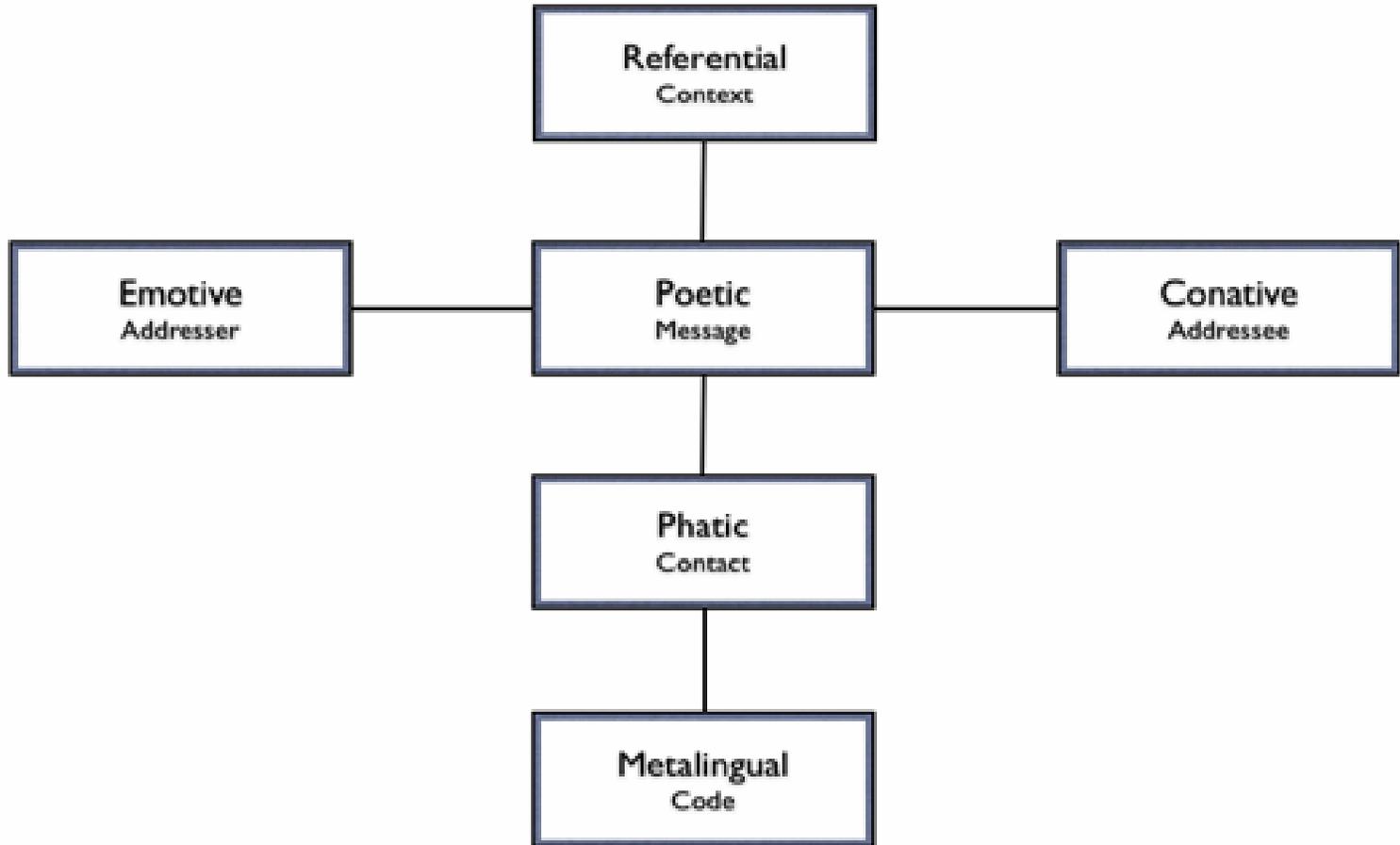
- At a more abstract level:



$$\Delta = f(r, p, e, c, ph, m)$$



Theory of Communicative Functions (R. Jakobson)





Theory of Communicative Functions (continued).

- **Emotive function**
 - Related to the “addresser”. It refers to the initial intention, the idea and/or message to be transmitted by the addresser.
- **Conative function**
 - Related to the “addressee”. It shapes the message according to certain mental processes of the addressee.



Theory of Communicative Functions (continued).

- **Referential function**
 - Refers to the context or the referent.
- **Poetic function**
 - Refers to the form of the message where it carries an expressive value. This function will materialize the signs and codes of the communication into a message that will generate indirect messages. This is often seen in sentences having a double meaning.

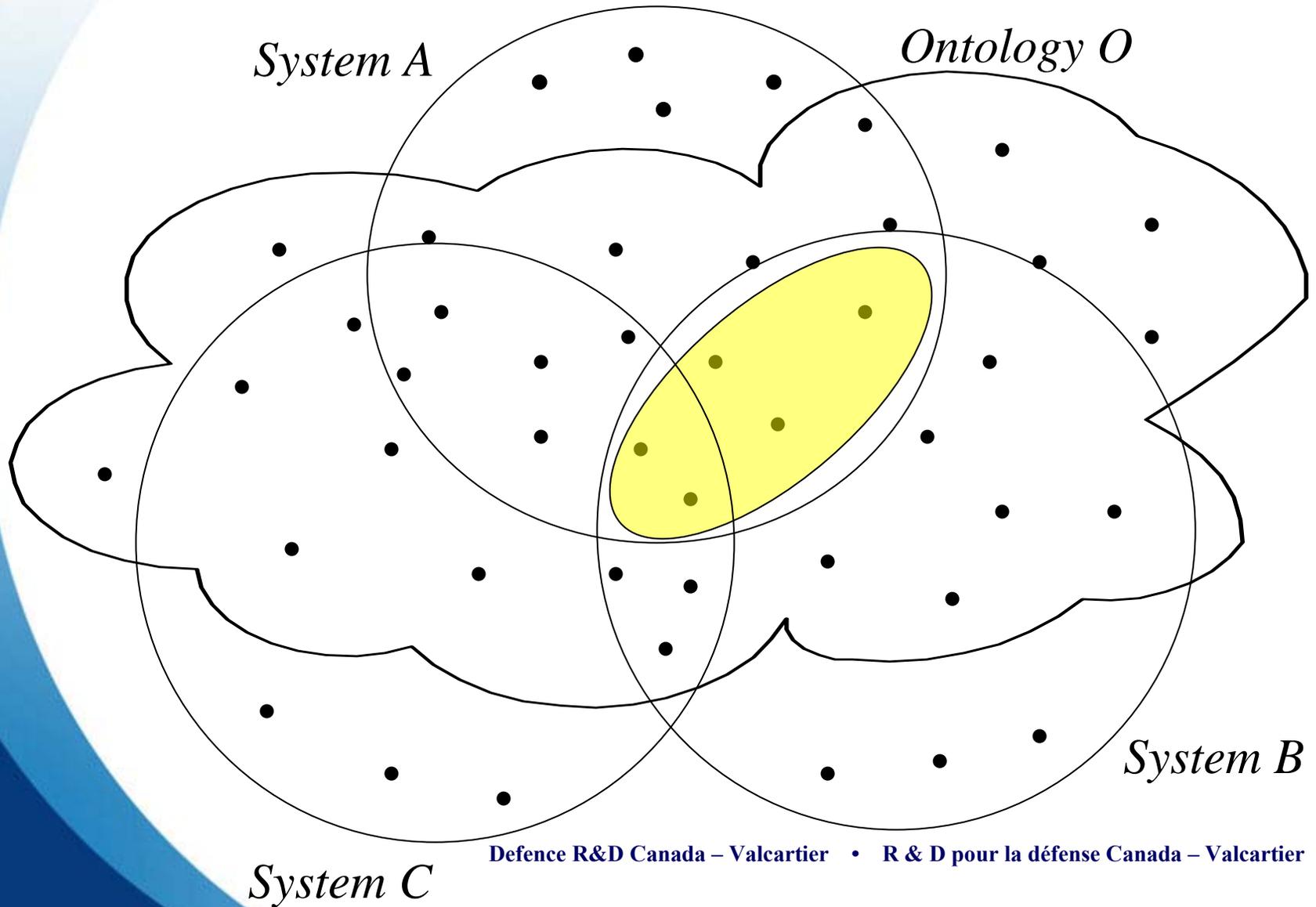


Theory of Communicative Functions (continued).

- **Phatic function**
 - Refers to the channel of communication. It acts as a mean to establish, maintain or end the communication. (e.g. “Hello” at the beginning of a conversation, “Roger” or “Over” in military radio communications).
- **Metalinguistic function**
 - Refers to the code itself. Direct link to the symbols in an ontology.



The Case for Semantic Interoperability





The Concept of *Ontology Alignment*.

- Definition:
 - *The act of establishing a relation of correspondence between two or more symbols from distinct ontologies, for those symbols that denote concepts that are semantically identical, or similar.*
- *Semantic Distance* is a natural consequence of aligning ontologies together.



Models of *Semantic Distance*

- ***Feature-based models*** define the semantic similarity by comparison of concept characteristics such as properties, roles, rules, etc.
- ***Models based on semantic relations*** : *How far are two nodes in a semantic network.*
- ***Models based on information content*** establish semantic similarity between concepts by comparison of how much information there is to support the concept and how specific it is.
- ***Context-based models*** consider syntactic, semantic, pragmatic and stylistic factors to establish how words can be substituted within a sentence. The higher this degree of substitution the higher the semantic similarity.



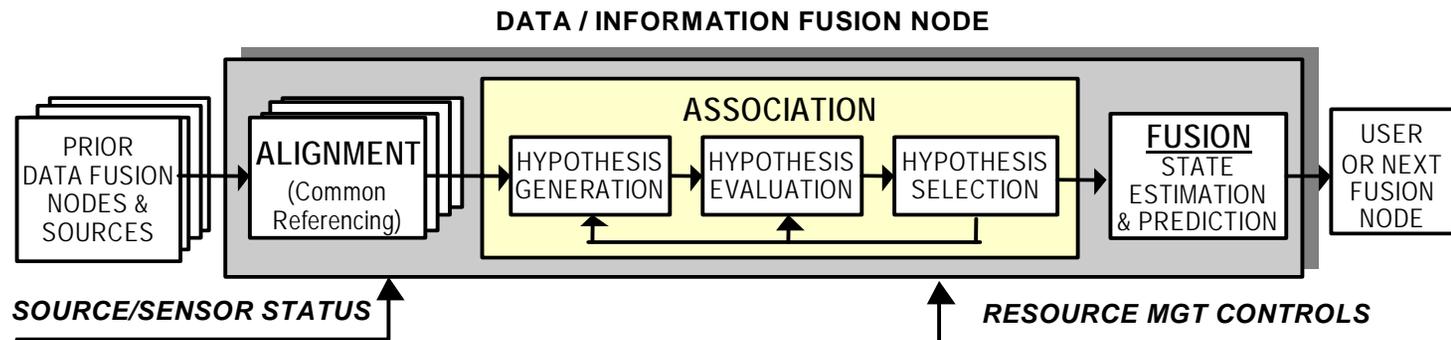
Models of *Semantic Distance* (cont.)

- Rodriguez also proposes the *matching-distance* model and tries to integrate the advantages of all previous approaches while avoiding the pitfalls. One of its underlying assumptions however is that it only considers the concepts of a single ontology, which seems to limit its applicability to semantic interoperability.



Work Ahead

Multi-source Semantic Integration



Questions???

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Questions???

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