Towards a Semantic Taxonomy

Kurt W. Conrad

The Sagebrush Group

conrad@SagebrushGroup.com

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Roadmap

- How I got here

- Why care about semantics?

- Common issues with semantic formalization

- Issue drivers

- A path forward

Exploring the Meaning of Meaning

- DTD analysis, design, and reengineering

- Cisco Ontology initiative, UBL

- Strategic Planning
  - Search for shared meaning

- DoE Knowledge Continuance

- Communication breakdowns

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Trend: Formalized Semantics

- Topic Maps

- Semantic Web / RDF / W3C architecture

- Web Services

- Knowledge bases

- Dynamic delivery

Problem

Different people mean different things when they use the term 'semantics'.

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Issues

- Basic communication issues
  - Sender vs recipient
  - Who decides meaning?
    - 'Crusade'
    - 'Jihad'
    - Flying American flag
    - Flying Confederate flag
    - <AU> tag

Issues

- Economic considerations
  - Resource scarcity
    - Efficiency
    - Conservation of resources
  - Bounded rationality
    - Time
    - Effort
    - Sufficiency

Issues

- Inherent agent type differences
  - Human
  - Automated
  - Social/organizational

Issues

- Semantic conflict

- Semantic ambiguity

- Semantic drift

Depressed Yet?

Language is like a bumble bee flying. It's amazing that it works at all. And the more that you look at it, the more confusing it gets.

Why are These Problems?

Events have no meaning until we decide how to react to them.

Meaning is an Indirect Relationship

- Thing

- Knowledge about thing

- Representation of knowledge about thing
  - Identification of thing
  - Properties associated with thing
  - Properties of the representation

- Behavioral implications

Property / Behavior Challenges

- Identification of relationship

- Completeness of understanding

- Understanding to articulate / express

- Inherent codification issues

- Interpretation (ontological alignment)

- Logistics (ability to act, affect all change)

- Destabilization (from multi-point learning)

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A Path Forward

Definitional Semantics

- What a term (or other element of syntax) means in context of the overall language

- Not the meaning (behavioral implications) of what the term represents in the real world

  - Can quickly blur into type or class

Identificational Semantics

- Identifies a specific thing (not a class of things)

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Effective Semantics

- Perhaps the most common definition of meaning.

- What something means is usually expressed in terms of the effect that it has on other things.

- Usually expressed in terms of behavior or state change.

Representational Semantics

- How knowledge about a thing is represented

- Includes the symbols used to represent something

- Data types and other syntactic conventions

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Comparative Semantics

- Comparisons with other things

- Classification and typing

- Usually focuses on a subset of the thing's properties and abstracts them

Temporal Semantics

- Past

- Present

- Future

Intentional Semantics

- Why are you telling me this?

- What's your intent?
  - Narrow range of behaviors
  - Broad range of behaviors
  - Unforeseen behaviors

Rational Semantics

- "Does this mean that I should act?"

- Confidence, reflects reality, fiction, imaginary, supposed, assumed, proposed

- Source, origins

- Applies to both properties and association with behaviors

Decompositional Semantics

- Meaning is derived from parts
  - Ore
  - Internal structures or parts that can be manipulated

- Drives new language
  - Identification of new structures and relationships
  - Basis for innovations

Probable Semantics

- How likely or predictive?
  - Certain
  - Expected
  - Probable
  - Likely
  - Possible
  - Unlikely

Conclusions

- In most automated systems, what is formalized is not 'semantics', per se, but properties that describe meaning (behavioral implications) in a given context

- Optimal semantic structures vary by purpose

Conclusions

- Developing and/or choosing concepts to reflect the real world is difficult stuff

- Formalized ontologies and other semantic frameworks have inherent limitations

- Understanding the divergent needs (and limitations) of agents designing and using semantic frameworks can reduce problems

In Closing

The real world isn't an optimized device.

"Never eat more than you can lift"
– Miss Piggy