The role of philosophy

Philosophy provides a consistent logical framework through which we choose to view the world. We need a philosophy …

• Of Language
  – How do words/symbols/expressions acquire meaning?
  – What is information?

• Of Knowledge and Existence
  – What can we know, what is possible to exist, what is real, what else is there?
  – How do we represent knowledge?
  – What distinguishes sense from non-sense?
  – What is the difference between sense and significance?

• Of Truth
  – What is true? what is the difference between fact, opinion, and belief?

• Of Logic
  – How do we infer what is true and determine consequences?
Philosophical choices …

• There is no “right answer” to philosophy - which approach will enable the most useful military knowledge-bases to be built?

• No one philosophy meets the requirement. The solution proposed is to separate knowledge into 4 “Worlds” with different philosophies:


  – The **Subjective World** (opinions, motivations, …) – superficially like facts with significant differences in logic and truth.

  – **Alternative Worlds** – Either of the above with reference to a planned, or hypothetical situations rather than the real-world.

  – The **Universal World** (classes, what is necessarily so) – Ontological Nominalism
Logical Positivism / Logical Atomism

What is so in the world

Facts

What we think we know about the world

Knowledge

What we are told about the world.

Information
Simple Example

Conceptual Model
(Universal World)

Entities-classes:
- People
- Locations

Attributes:
People: first-name, last-name
Location: place-name, grid-location, postcode

Relations:
person is-located-at location
person is-associate-of person

Message describing the real-world
Message-ID: ABC123hG23
From: Jo Bloggs
Date-20-Feb-2010
Time: 13:15
I saw Alex Carter talking to John Roberts in Rotherham at 11 am.
**Simple Example**

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Message-ID: ABC123hG23
From: Jo Bloggs
Date: 20-Feb-2010
Time: 13:15

I saw Alex Carter talking to John Roberts in London at 11 am.
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The role of language

A means of communicating.
- How can we make communications “machine understandable”?
- Why do we communicate? (how much is implicitly stated?)

A means of knowledge representation.
- How can we record “known-facts” in a manner that is unambiguous, with as much “context” as is necessary to prevent misinterpretation?
- How can we do this in a way that supports machine-reasoning (as well as human reasoning, and hybrid human-machine teams)?

In either case we need to understand how the words and symbols used acquire their meaning.
What do we communicate?

Information-Exchange Types) After Searle: Speech-Acts

1. Inform (the input of newly extracted “known-facts” into a knowledge-base)
2. Direct (the opposite of inform: the export of information derived from the knowledge-bases’s internal representation of “known-facts”).
3. Query – Response & Question – Answer
4. Mediated Information Exchange:
   - Propose - approve/reject/counter-propose
   - Command – Acknowledge (with implied commitment)/ Clarify
   - Request – Response
   - Transaction (an atomic commitment to a set of changes, not necessarily related to the exchange of goods for money)
   - Poll
   - Vote
   - Auction
5. Knowledge-Base Directive
6. Notify
7. Synchronisation
How can we make communications “machine understandable”?

Using “propositions” as the basis for forming expressions.

A proposition is here defined as a statement that can true of false.

Not all sentences are propositions: but all can be expressed as proposition(s) plus a pragmatic element. The pragmatic element defines what the recipient is supposed to do with the propositions, which can be defined for each information-exchange-type.

- E.g. The Command: “Unit X go to location Y at date-time Z” can be re-expressed as:
  - Proposition: “Unit X, at-location Y, at date-time Z, True”
  - Pragmatic element: “Make the above proposition so (in the real world)”. 
- This pragmatic element is common to all information-exchanges of the type “Command”, and can be represented by a standardised token.
How can we record “known-facts” in a manner that is unambiguous, with as much “context” as is necessary to prevent misinterpretation?

All “known-facts” can be represented as propositions, and propositions about propositions (and having this common-basis for the language of communication and the language of knowledge representation is essential).

Every proposition in a knowledge-base needs to be “qualified” to void ambiguity.

– This is a consequence of pooling knowledge extracted from information-exchanges: the meaning of a proposition can be dependent on the context of its being said.

– Take the proposition: “Unit X, at-location Y, at date-time Z, True”

– Is this a reported observation or declaration of intent?
Confusions to be recorded for every known-fact:

- True / False / Possible / Impossible (handles conflicting views of truth)
- Hypothetical / Asserted / Declared (handles authority & confidence)
- Categorical / Probabilistic / Implication (handles uncertainty*)
- Simple / Alternate / Combined (handles ambiguity & logic*)
- Historical / Latest / Future / Defined (handles time)
- Objective / Subjective / Alternative / Universal Worlds (handles frames of reference, including hypothetical situations, plans, options)

*probabilities and logical combinations are defined in associated 2nd-order propositions.
An “atom” of knowledge – a “proposition”
Some Uses of 2nd-Order Propositions

- provide additional information about the referenced first-order propositions(s), e.g. its provenance, perishability, sensitivity, accuracy, and confidence-level (or probability).
- describe the conditions under which the referenced first-order proposition(s) are valid.
- link statements qualified as being “Alternative World” with a specific instance of such a world as an object, upon which other facts can be dedicated including labels (e.g. Plan-A, Plan-B), provenance etc.
- affirm that a given person, group/community, or automated assessment process, believes the referenced first-order proposition to be so or not-so, with or without a level of confidence.
- record other “attitudes” (other than belief) towards a proposition by someone, e.g. “A hopes that xyz” where xyz is a 1st-order proposition.
- form a logical combination of first-order propositions, e.g. to express that Proposition A OR Proposition B is true.
- link an implied 1st order statement to its operands (the statements from which it is implied, and the logic operator(s) used to form the implication).
Taking it all together – human and machine interaction with knowledge-bases

Multiple-Languages

- Message Interaction
- Form Interaction
- Controlled Natural Language Input
- Symbolic Interaction
- Other User Interaction Modes ...
- Messaging (For different Interaction-Modes & Languages)

Common-Language

- Null Processing
- Processing Service #1
- Processing Service #2
- Processing Service ...
- Mediated Info Exchange
- Question/Answer

KB-Specific Language

- Inform
- Fact-Query/Response
- VKB Directive
- Notify
- Synchronise

Adaptor

Knowledge-Base