Domain Specific Needs for Context Sessions 1 and 2

Ontology Summit 2018
Summary Created By Ravi Sharma based on presentations and Chat/Discussions
April 3, 2018
Session 1

Intro: David Whitten and Ravi Sharma

- Media: Text, Audio, Audio Visual, Analytics, Dashboards
- Medical/Healthcare Context: Text, Transcription, Entity extraction and NLP. Complex Context such as EHR and clinical events
- Ravi: Various Forms such as Application for Mortgage, New patient Registration and past history for starting activities in a domains set Context.

John Sowa’s October 21, 2017 presentation on context and situation awareness was very comprehensive about context, natural languages, formal and common logic and current tools and applications.

David Whitten presented (Oct 4, 2017) healthcare domains related contexts for
- medical decision support
- patient calendars
- clinical information for caregivers
- drug interaction

Decision support rules =>
When rules are evaluated, the context includes:

- Current Patient, and Demographics
- Age, Age Range, Date of Birth, Date of Death
- Current Vital Signs Weight, Height
- Current Admission, Transfer, and Discharge Dates
- Encounter Diagnosis, Purpose of Visit, Provider
- Existence of Patient behavior change encounters
Grassroots Ontologies
Context Through Multiplicity

Spencer Breiner & Eswaran Subrahmanian

- Use category theory to determine mappings (functors) between ontologies.
- Develop domain-specific libraries.
- Build mixed contexts by inheriting from libraries.
- Categorical Logic: Every logical ontology can be represented as a category.
- Categories support mappings called functors.
- We can use functors to map between ontologies.
- Our vision: Context Everywhere
- Every context has an ontologies.
- Every overlap has a bridge.
- Over time, aggregate, abstract and simplify overlapping domains.
- Develop domain-specific and tool-specific libraries.
- Aggregate libraries for complex contexts, adding context as necessary.
- Translate data and manage workflow through functors.
Why it works
Mathematically:
• Relationship with formal methods (graphs, probability, dynamics, etc.)
• Self-reference (categories & functors form a category)
• Context-relative understanding of syntax & semantics
Pragmatically:
• Logical models are directly tied to applications.
• Iterative construction of bridges and aggregates matches the design process in science and engineering.
Discussion / Chat
Topics ranged from Situation Awareness, Ken Baclawski presentation references, John Sowa’s works, etc.
Gary Berg-Cross: John's most popular work on Google Scholar is a review Philosophy in the Flesh G Lakoff, M Johnson. New York: Basic books15320 hits1999 (2D14) Extending and formalizing the framework for information systems architecture JF Sowa, JA Zachman IBM systems journal 31 (3), 590-616 is 2nd with 1414 hits
Considerable discussion on Category Theory and ontologies, specifically in what situations these are possible.
Session 2

Dov Dori on The Minimal Universal Ontology of Stateful Objects and Processes that Transform Them

- OPM – ISO 19450

- **Universal Ontology**: a *domain-independent* set of concepts for describing systems in the universe, both natural and man-made.

- **Ontology**: a set of *concepts* for describing a *domain* (industry, banking, military, botany, healthcare…) and systems within it.

- **OPM Things (entities, concepts): Objects and Processes**
  - A process affects an object by changing its state.
  - Hence, objects must be stateful – they must have states.
• processes transform objects by.
• creating an object, destroying an object, affecting an object
• The Object-Process Theorem
  Stateful objects, processes, and relations among them constitute a universal ontology
• At each point in time, the object is at one of its states, or in transition from an input state to its output state
• Process can consume an object, create, or affect its state
• Discussed and gave examples of OPM
• OPM has two depictions: Diagrams and OPL language.
• Described The complete System Typology Model as diagram (things and relations) and corresponding OPL statements.
• Provided visuals for OPM ISO 19450:2015
Cory Casanave Model Driven Solutions Cory-c (at) modeldriven.com
Context aware ontologies for information and system integration
• Focus: Integration, Interoperability and Federation Leveraging Reference Ontologies*

* Reference Ontology: A set of concepts intended to be referenced by multiple designs, ontologies and schema in support of integration and interoperability among them.

Different from: Application Ontology, intended to support reasoning in support of a particular application.
• Semantic mediation as been a primary value proposition for Ontologies, but has proved difficult, particularly for most of systems that do not have a formal underpinning.
• Our proposition is that successful semantic mediation requires context. Ontologies to solve these problems must be context aware.
• Being Context aware requires a level of granularity beyond contextualizing ontologies
A context is anything that impacts the interpretation or truth value of something else.

There are different kinds of context, contextual dimensions e.g.,

- **Time**, **Occurrences**, **States**, **Authority**, **Interaction**
- **More Contextual Dimensions**
  - Social Group, Location, Type, System, Design, Source (Provenance)
- Things may be in multiple context at the same time
- Context, such as time, can apply to other statements
- Rights and Obligations are frequently contextual
- Citizens of the U.S.A. have right Protections from Unreasonable Searches and Seizures
  - exists for March 4th, 1789 to Unknown
- (Workers in the U.S.A. must pay Income Tax) exists for Feb. 3rd, 1913 to Unknown
- Implies
- Since March 30, 1867 Citizens of Alaska have rights and as of Feb. 3rd, 1913 must pay taxes
- Ignoring context is dangerous!
  - Improper integration, breach of Trust, non compliance
- Context determines terms & representation (of data) for concepts
- Context of time and data determine data interoperability
Concept of Context: A **context** is anything that impacts the interpretation or truth value of something else

- **Context as predicates**
- **If a context is false, propositions do not hold for what the context contextualizes**

- **Situations as Context**
- **Candidate Situation Model (simplified)**
- **Type as Context**
- **Perspectives and Context**
  - A perspective selects which context are true, for that perspective
  - A perspective can order context by precedence, to resolve conflict
  - A perspective is, its self, a context
- **Relationships as Context**
- **Context, Perspective & “Higher Order” Logics**
- **Many reasoning systems are FOL only, how can we reason about context?**
- **Option 1 Use a rules approach**
- **Option 2 Use a higher order logic**
- **Option 3 Pre-compute the context**
- **Asset perspective**
- **Derive “true” context, recursively**
- **Export context-free (FOL) ontology**
- **Infer exported ontology using FOL**

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Chat/Discussion
Threads emanating from each of the talks are summarized:

• John Sowa: More precisely, every object is a process whose changes are slow relative to the time scale of the context.
• In fact, processes are more fundamental than objects. A process can create an object or another process. But objects cannot create processes.
• Distinctions were made for “what is” vs conceptualizing what is?
• BobbinTeegarden: @MikeB Is the 'conceptualization' itself a context? So you're pointing at the context of the context? Holonic again?
• Cory Casanave: @Bobbin, perhaps the perspective is a context that determines the conceptualization
• David Whitten: Cory's idea of Reference Ontology or any common ontology such as Cyc's BaseKB, might be a way to ground symbols in smaller ontologies to specify the context of the smaller ontologies through the use of the genIMt relation.
• John Sowa: In fact, the concept of reference ontology is so vague that it is indistinguishable from a terminology stated in a natural language.
• MikeBennett: @John reference ontology refers to its function rather than its nature, but in general these would be concept-focused (concepts of real things) as distinct from the kinds of ontology we often see in OWL that tend to be used-case specific application ontologies.
• David Whitten: @johnSowa, do you then think that something like WordNet could be treated as a reference ontology?
• John Sowa: Mike, I agree with you. But that does not distinguish a reference ontology from a terminology. David, WordNet is widely used to align different ontologies. In that regard, it is more universal than any formally defined ontology.
• John Sowa: Re context: Cory is stating many important points. But there is one universal principle that explains and characterizes every type of context: Intentionality.
• John Sowa: The intentions of some human or group/organization/society of humans determines the context. Intentionality is also the determining context for the distinction between objects and processes.
• Mike Benett related context in FIBO perspective.
• Gary Berg-Cross: Perspective and context seem like the same thing at times. Each has some sense of as a limited characterization of reality (by a cognitive agent). They are specific to the peculiarities of a particular circumstance, and contains elements that could not be found easily in other situations or perspectives. Another way of saying this is that it is information that is embedded in a specific domain, conversation or situation.
• Cory Casanave: Gary, perspective seems a special case of context, this is where the intent comes in
• David Whitten: @ravi - the creator of the map has an intended meaning for all the symbols in a key for the map. The viewer of the map must be able to view the map using the perspective of the map-creator.
• Cory Casanave: Considerations of intent and context without human are just not that interesting for the more pragmatic concerns of using these concepts for mediation and reasoning. It is interesting philosophy.
• Ravi Sharma: Notes: seed ontology, intention related components, micro macro or design vs use were some of the topics discussed.