

The Semantic Web Story 2004

Where are we?

What is possible?

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Uncertainty, Semantic Web, and Me

- Always ask myself: do I have enough that is important to say?
- Similar question: “Is there enough about the Semantic Web (SW) that is important to say?”
- Having co-authored a paper on SW (with Hendler), tracking and updating might be useful.
- Might even learn something in searching.

My Search for Enlightenment Among Buddhists in Tibet



The Path to Enlightenment

- I looked for “*killer applications*”, working end-user apps, or at least powerful *demos*.
- I found not much software I could learn from.
- I found many interesting *slide shows* about semantic web research ideas and how great they were *going to be*.
- I decided to interview some of the leading researchers in the Semantic Web area.

The 7-fold Way to the SW

1. What the Gurus said.
2. Right thinking: about the Knowledge Principle of Intelligent Behavior
3. Right vision: about distributed knowledge acquisition (KA).
4. The *Middle Way* in the Rule of Logic

The 7-fold Way to the SW (2)

5. Respect *semantic ghosts* of the WWW and use them for the vision of KA.
6. Find *spiral road* to SW understanding.
7. Build merit for SW and Web AI by powerful demo.

Warning about Reincarnation

If you do not build merit in *this* incarnation of AI, you might return as a data-base administrator, librarian, or accountant.

“Inside Semantic Web”

What Some *Scientists* Said

- (On Sundays, Tuesdays, and Thursdays)
“The SW is moving fast!”
- (Same person on Mondays, Wednesdays) “It may be driving itself off a cliff.”
- Expectations: “Don’t expect too much too soon; “Like AI, SW will take years to do.
- The focus on language and infrastructure implies: it is too early for demos, apps to emerge.

“Inside Semantic Web”

What Some *Engineers* Said

- Real Value of SW beyond what search engines offer?? Is it one Order of Magnitude?
- Crucial is the Benefit to Burden (cost) ratio.
- Logic (and the Logic research community are heavy burdens to bear (complex, slow)
 - Need means of discovering “nuance” vs necessity
- Borrow from Logic, but also be *practical*. “A little semantics goes a long way.”
- Remember *heuristics*: “work good enough most of the time.”

“Inside Semantic Web” (Key Insight)

- “The Web has touched many facets of modern life, from the way we buy things to the way we find directions. But it has not changed the way we write programs. That is because the WWW does not contain machine-understandable information. The Semantic Web is about making the Web useful for programs.”
(Guha, 2004)

Stories Revealed and Retold

- Much of 1970s-80s work is being revisited.
- “Learn from past or be condemned to repeat “
- “Knowledge is Power” principle: a story of discovery
- Thousands of experiments have validated the Knowledge Principle
- The SW as web-scale expert system(s)
- Large Knowledge Bases, WWW, and AI

Dreams of Guha, Hendler + Myself and Many Others

- Widely distributing semantic markup tools and assistance
 - Will it work? Ever?
 - Living with error and partial truths
 - Why insist on 100%
 - We live with and love some services that are logically impoverished
 - Isn't there an intelligent user in the loop?

The Rule of Logic and Its Role

- AI researchers play a big role and logic is “in their genes.”
- Logic: “less there than meets the eye”
- Does logic give us the *best set of tools* for developing the *practical* semantic web?
- The evidence is mostly lacking (even over decades).
- Path of maximal return: more K not more L.
- Simple is better: languages; heuristics.

“Ghosts” in the Web

- The goal is a KB to realize “I know what you mean.”
- We don’t need a full logic-based description to accomplish the goal.
- Our first approximation of the WWW is that it is information&data-rich but knowledge-free or knowledge-poor.

“Ghosts” in the Web (2)

- But intelligent people have layered “meaning” (knowledge about entities)
- All over the WWW
 - E.g. in forms and schemas of all kinds (Halevy), in presentation formats (McCool), etc.
- These are the “ghosts” of the “real” logic-based web, and can be “materialized.”
- Much has been done and now much is being given away by companies and other users!

Progress as Spiral Development

- Robot soccer and Gossamer Condor
- “Build a little, test a little”
- “Incremental Approach to Competence”
- Find a task domain that has real-world importance, is rich with possibilities. Then do series of experiments, bottom up (mostly), ascending the spiral.

The Personal Archive Assistant (PAA)

- What is a PAA?
 - A Web-based library of biographical data
 - Great Example: US national Library of Medicine, “Profiles in Science”, Joshua Lederberg(JL) (and about ten others).
- The need: intelligent assistant to historian or scholar doing research on JL’s life (could go beyond facts, to hypotheses, analyses, etc.)

PAA (2)

- Example research queries:
 - What role did velvet play in JL's Nobel Prize research? Did JL write computer programs? LISP?
- Semantic markup of the NLM JL site?
- Ontologies of the entities of an individual's life, professional life, researcher's career, biologist's work, professor's life and work, university president's life and work, etc.

PAA (3)

- Then, add the other ten NLM “Profiles” plus the web-based biographies of other scientists, e.g. Carl Djerassi’s and my own.
- Now, some deeper questions possible:
 - How did Djerassi meet Feigenbaum to collaborate on the DENDRAL Project?
 - (requires inferences and data from JL site)

PAA (4)

- What work of Allen Newell was an early influence on the DENDRAL Project?
- How old was Feigenbaum when he first became interested in computers?
(actually a subtle question)

PAA Example: Conclusions

- Difficult, meaningful task
 - Validated by enthusiastic participation of end-users (in PAA, Historians, Archivists)
 - Task should be understandable and useful.
- Start somewhat beyond current abilities and Increase incrementally to significant challenges.
- If successful, PAA can have a big impact
 - Interest from Foundations, Museum,, ACM, American Academy of Arts and Sciences.

PAA Example: Conclusions (2)

- May have unintended consequences
 - May change the way people “remember”
 - Will family histories be kept by PAAs?

Summary and Action

1. Define “experimental Computer Science” path to WWW intelligence, and propose funding.

If Asia-Pacific region, contact US Air Force Office of Scientific Research (AFOSR). AOARD

“”Man’s Flight Though Life Is Sustained By The Power of His Knowledge” (USAF Academy)

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Summary and Action (2)

- Find a high impact **domain of application** in which to do experiments.
- “Language” And “Infrastructure” should not precede the search for “killer apps.”
- Perhaps the entrepreneurs and venture capitalists should take on the SW R&D task because traditional research communities and government funders have been too slow.

Summary and Action (3)

- Spiral from “bottom up”, emphasizing content (knowledge) rather than form (logic and languages); remember the mantra: “Knowledge is Power”.
- Believe in and distribute tools and infrastructure for semantic markup but..
- Believe in and compute the “semantic ghosts” of the WWW.

Summary and Action (4)

- Believe that the SW is possible and will lead to the next generation of intelligent search, intelligent assistance, and intelligent web services.
- View the (amazing) WWW as the information foundation of the Large Knowledge Base that AI must have to achieve its long-range goal of human-level intelligence and beyond.

Envision What Is Possible

- “When a distinguished and elderly scientist says something is possible, his is almost certainly correct; when he sways something is impossible, he is very probably wrong.”
-Arthur C. Clarke