

Reading Comprehension: Reading, Learning, Teaching

Lynette Hirschman

781-271-7789 • lynette@mitre.org

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Problem

- **Can we define a new research paradigm for natural language processing by testing systems with measures for human comprehension?**
 - **Reading: Can we build a natural language processing system that can pass a 3rd grade reading comprehension test (> 65% score)?**
 - **Learning: Can we create a system that learns as it “reads” – new words, concepts, facts?**
 - **Teaching: Can we create a reading companion that interacts with a student so that both system & student learn new things?**

Background

Library of Congress Has Books for Everyone

(WASHINGTON, D.C., 1964) - It was 150 years ago this year that our nation's biggest library burned to the ground. Copies of all the written books of the time were kept in the Library of Congress. But they were destroyed by fire in 1814 during a war with the British. That fire didn't stop book lovers. The next year, they began to rebuild the library. By giving it 6,457 of his books, Thomas Jefferson helped get it started. The first libraries in the United States could be used by members only. But the Library of Congress was built for all the people. From the start, it was our national library. Today, the Library of Congress is one of the largest libraries in the world. People can find a copy of just about every book and magazine printed. Libraries have been with us since people first learned to write. One of the oldest to be found dates back to about 800 years B.C. The books were written on tablets made from clay. The people who took care of the books were called "men of the written tablets."

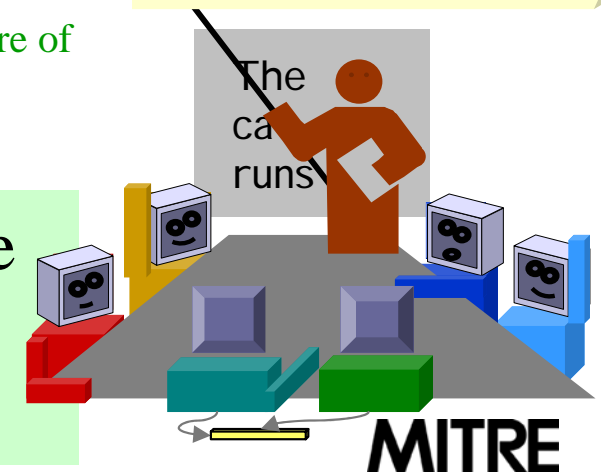
1. Who gave books to the new library? Thomas Jefferson
2. What is the name of our national library? Library of Congress
3. When did this library burn down? 1814
4. Where can this library be found? Washington, DC
5. Why were some early people called "men of the written tablets"? They took care of the first books written which were tablets made from clay

Reading comprehension offers a new challenge and a human-centric evaluation paradigm for human language technology.

What kinds of information are needed to answer questions?

What makes some questions harder than others?

Can humans guide machines toward understanding?



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Objective

Establish an ambitious research agenda using “found” human test materials to test machines:

- Level 1 **Learning to read:** pass reading comprehension tests of progressive difficulty
- Level 2 **Reading to learn:** build a system that gains knowledge and improves performance through reading
- Level 3 **Teaching to learn:** create human-system team where the person and the system interact to provide improved performance

Activities

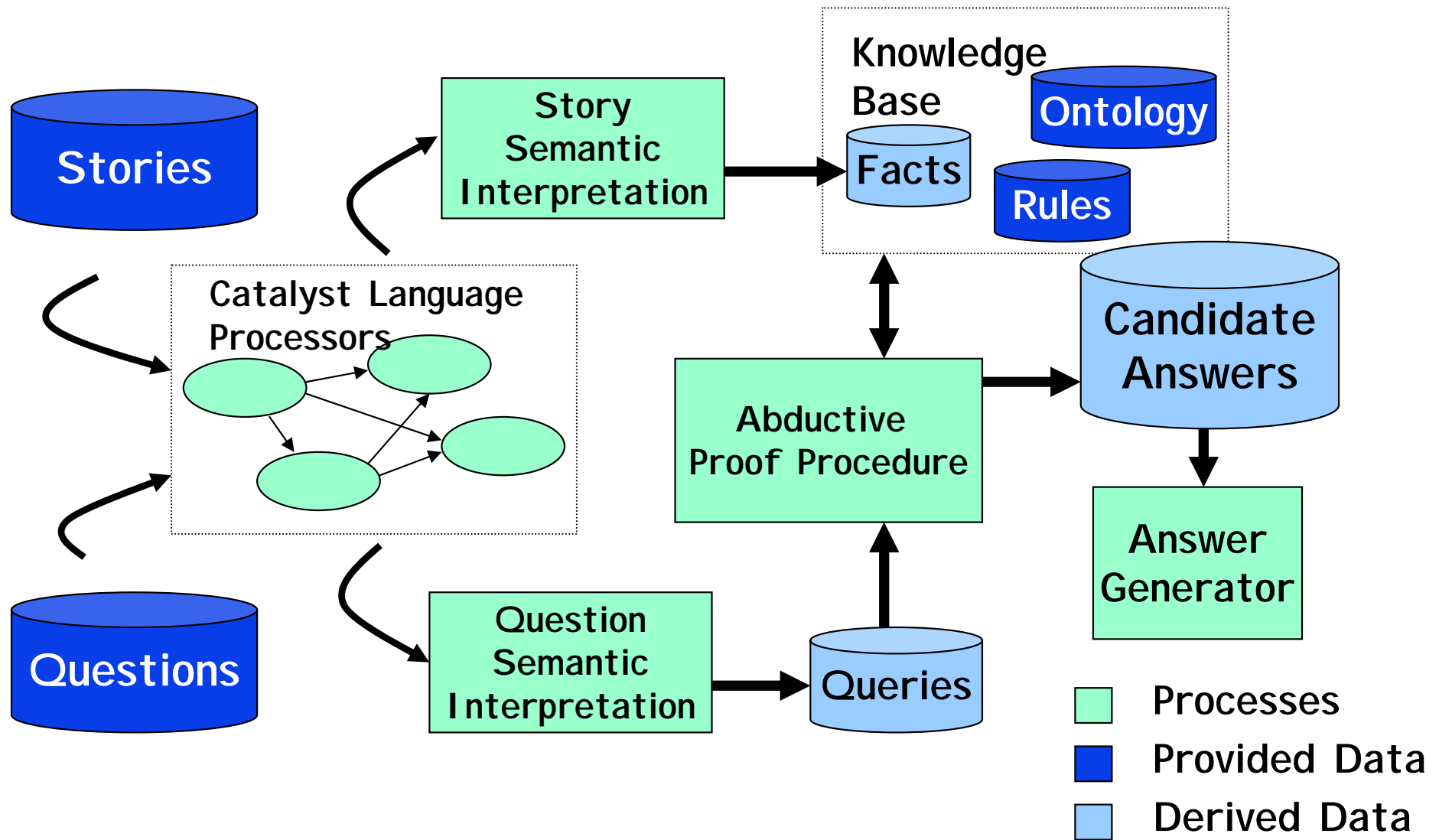
■ FY01–FY03:

- Reciprocal teaching demo (English, Spanish)
- ABCs: Novel abduction-based architecture for reading comprehension test taking
 - Journal article submitted: Evaluating Language Understanding Through Reading Comprehension Tests
 - IJCAI and KDD workshop papers given on co-reference

■ FY04:

- Automated trainable coreference module added to ABCs
- Initial question generation capability
- Paper at HLT/NAACL:
 - A Probabilistic Rasch Analysis of Question Answering Evaluations

Highlight: Architecture



ABCs Reading Comprehension System

Demonstration

1989 Remedia Publications, Comprehension/5W

Owens Wins 4th Gold Medal!


(MUNICH, GERMANY, 1936) - Jesse Owens is the fastest man in the world. He runs and wins for the United States team. Today, Jesse won his fourth gold medal in **the Olympics**.


Each time he wins a medal, it is placed around his neck. A band plays the "Star-Spangled Banner."


This is not the first time Jesse has shown his speed. A few years ago, he broke five world records. In fact, he did this in one hour.


Jesse's future was not always bright. As a


Dialog:


 Click on an action to work with this story.

 Please ask a question about the story.

 Where did Jesse win his medal?

 --> Is [the, Olympics] an instance of a location?

 yes

 --> Is [the, Olympics] the correct answer?

Choose an Action:

Your input:

Dialogue with Spot

Impacts

- **Demonstrated the feasibility of using reading comprehension tests as a grand challenge for natural language processing:**
 - **Other groups evaluating their systems using our data, including U Edinburgh**
 - **DARPA interested in using reading comprehension as a grand challenge**
- **Developed methodology for decomposition of reading comprehension system performance**
- **Cross-fertilization: psychometric/educational testing analytical methodology applied to QA technology evaluation**

Future Plans

- Question generation to model comprehension
- Starting text:
 - *Some fishermen have already seen otters in trouble.*
- Simple transformation to question:
 - *Who has already seen otters in trouble?*
 - Need to know “fishermen” are people => “who”
 - *What have some fishermen already seen [] in trouble?*
- Better (leave out modifiers):
 - *Who has [] seen otters in trouble?*
 - *What have [] fishermen seen in trouble?*
- Better still (generalize, substitute classifiers):
 - *What animals are in trouble?*
- Research:
 - What makes a good question?
 - What makes a question harder?