

Reading Comprehension: Reading, Learning, Teaching

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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."

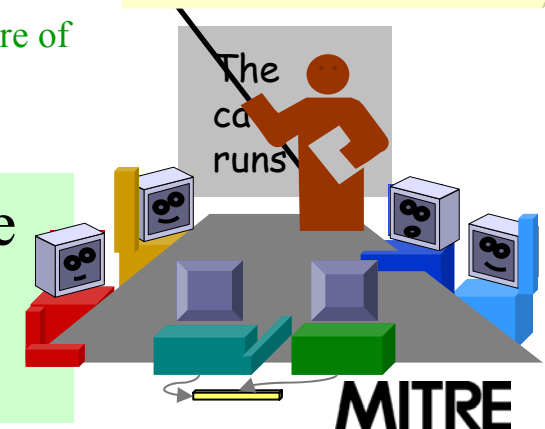
1. Who gave books to the new library? Thomas Jefferson
2. What is the name of our national library? Library of Congress
3. When did this library burn down? 1814
4. Where can this library be found? Washington, DC
5. Why were some early people called "men of the written tablets"? They took care of the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

What kinds of information are needed to answer questions?

Can we grade short answer tests automatically?



Objective

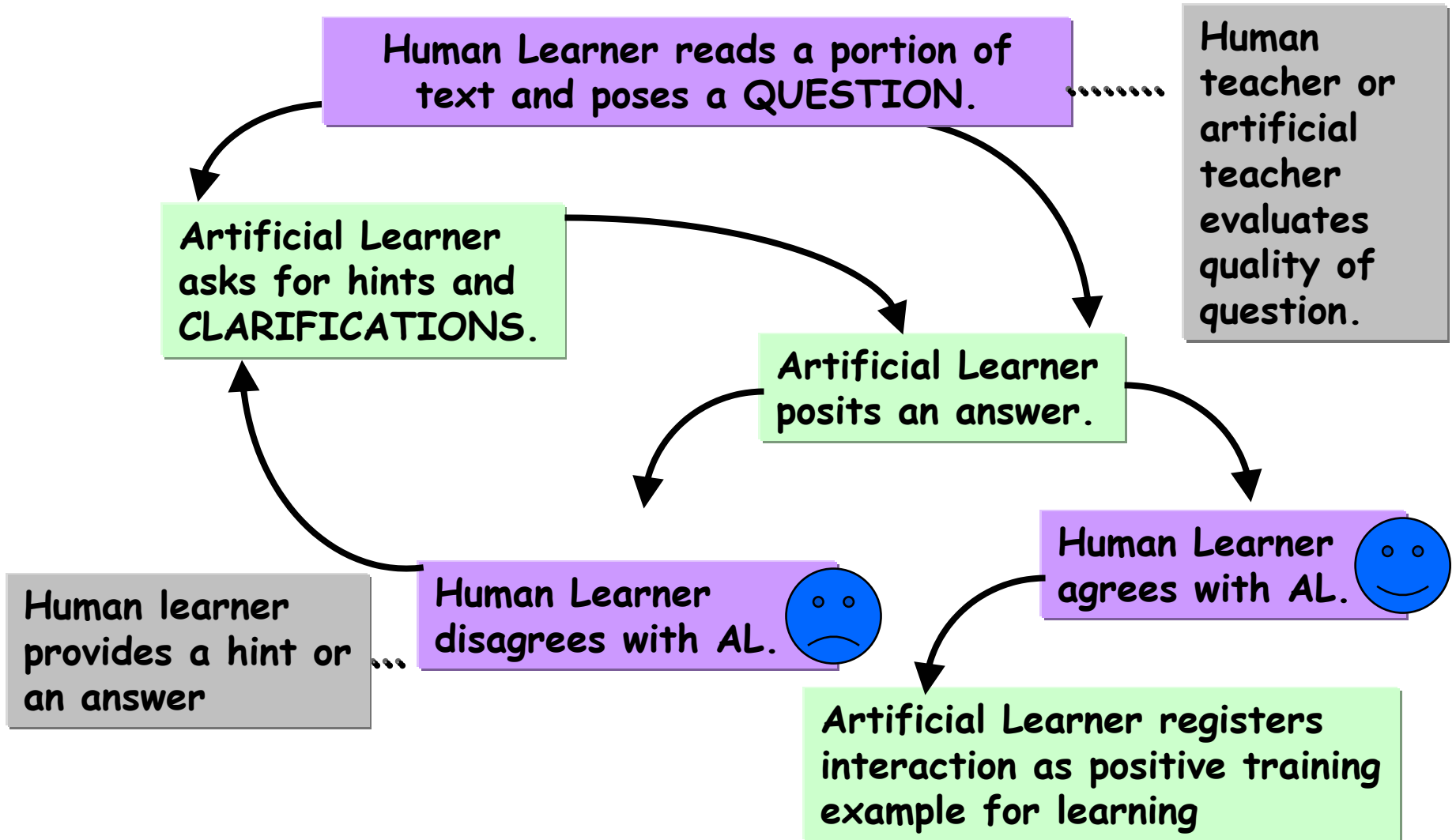
Establish an ambitious research agenda using “found” human test materials to test machines:

- 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

- **FY99-00: Prototype “Learning to Read” System**
 - ✓ End-to-end system for short answer reading tests
 - ✓ 33-40% score finding sentence containing answer using word overlap and limited linguistic processing
- **FY01: Reading, Learning, Teaching**
 - ✓ Initial demo using reciprocal teaching
 - ✓ Joint proposal to NSF with U. of Illinois, focused on learning biology
- **FY02:**
 - ➡ New architecture for “reading to learn” to handle structured patterns (parse, word sense, coreference)
 - ➡ Advanced demo of “teaching to learn”

Highlight: Teaching & Learning



Demonstration

Reading Comprehension Graphical User Interface

You are currently reading **El primer hombre que será enterrado en la luna**
July 30, 1999
Tal vez para Eugene Shoemaker sea posible realizar el sueño de su vida de ir a la luna.

Si todo sale como está planeado el sábado, un recipiente del tamaño de un lápiz labial llevará sus cenizas al polo sur de la luna.

Shoemaker será el primer ser humano enterrado en otro cuerpo celestial. Sus cenizas estarán a bordo del Lunar Prospector de NASA.

Conversation Window

Help from your teacher. Click on an action icon to ask a question.

- Cuál fue el deseo más grande en la vida de Eugene Shoemaker?
- ir a la luna
- Very good!
- De qué tamaño es el recipiente que contiene las cenizas de Shoemaker?

Spanish Virtual Keyboard

á	é	í	ñ	ó	ú	ü
Á	É	Í	Ñ	Ó	Ú	Ü
¿	i					

Close

Unsigned Java Applet Window

I would like to answer a question.

Open New Story | Help | Quit

Unsigned Java Applet Window

Your input: del tamaño de un lá

Virtual Keyboard

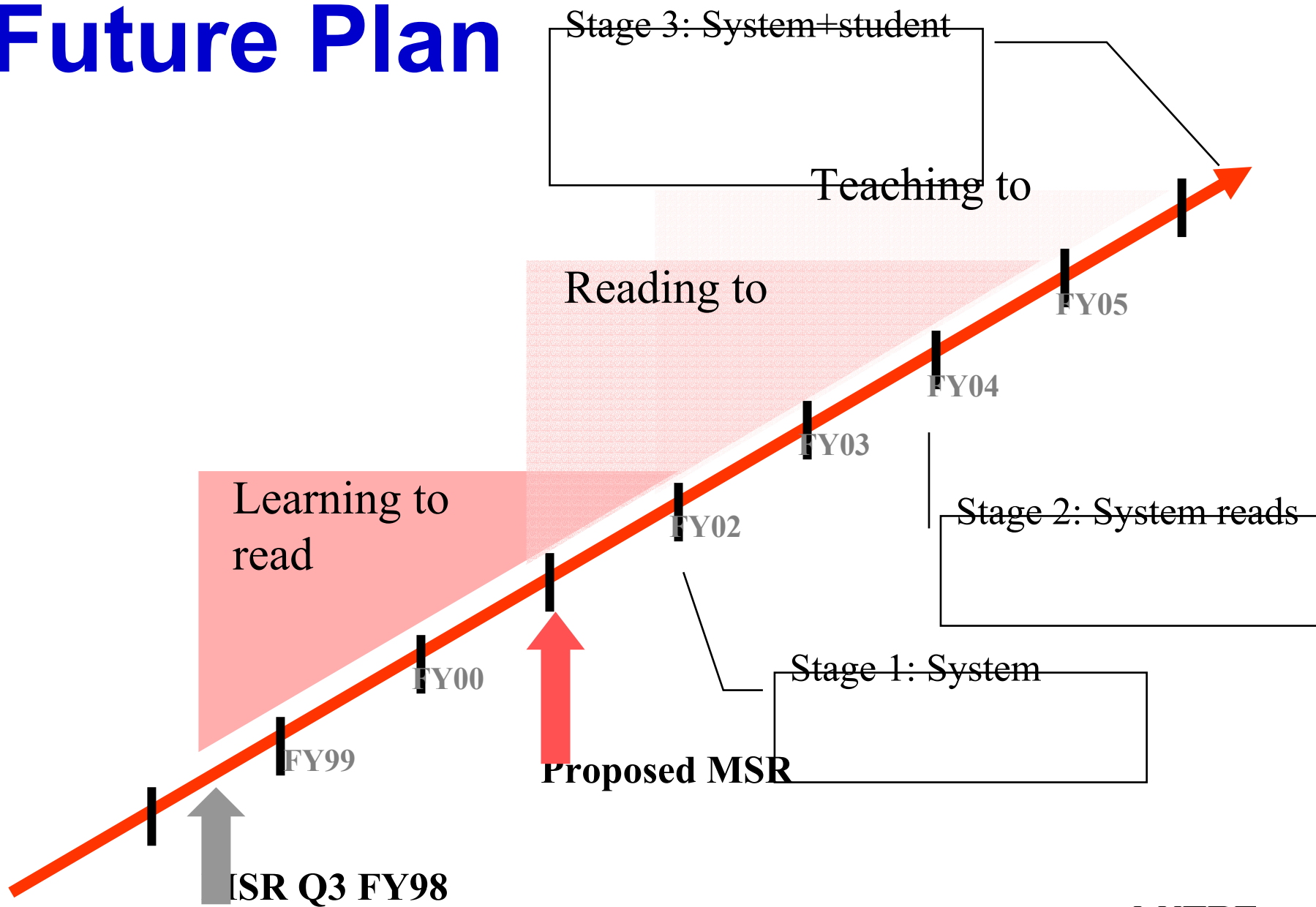
Submit

**Reciprocal Teaching
with Authoring
Environment for
English and Spanish**

Impacts

- **Demonstrated the feasibility of using reading comprehension tests as a grand challenge for natural language processing:**
 - **Many groups now working on problem, including IBM, CyCorp, Utah, Illinois**
- **Developed automated methods of importance to the educational testing community for**
 - **Grading short answer tests**
- **Developing quantitative understanding of question difficulty and types of knowledge needed to answer questions**

Future Plan



Background: Architecture

