

# **Commonsense Aspects of Story Understanding**

**by Nemecio R. Chavez, Jr.**

**New Mexico State University**

**February 13, 2003**

**SH124, 12:00 - 1:00 PM**

**nchavez@cs.nmsu.edu**

# What is story understanding?



- **Written text is read.**
- **As it's read comprehension occurs.**
- **A comprehender is then able to demonstrate their knowledge of what they read in many ways, such as: answering questions, determining point of view, generating inferences, constructing explanations, etc.**

## What is story understanding (Continued)?

- **Example [Aesop1954]:**

*Down at the very bottom of the pitcher there was a little water and the thirsty crow tried every way to reach it with her beak. But the pitcher was much too tall. The crow got thirstier and thirstier. At last she thought of a clever plan. One by one she dropped pebbles into the pitcher. Every pebble made the water rise a little higher. When the water reached the brim, the thirsty crow was able to drink with ease.*

- **After reading the text, a comprehender might be able to answer the following questions:**

Why does the crow want the water?

How come the crow is thirsty?

What did the crow pick the pebbles up with?

What was the plan the crow thought of?

Why did putting the pebbles in the pitcher make the water rise?

## **What is story understanding (Continued)?**

- **Based on their understanding of the world, a comprehender may do the following as a part of the understanding process [Asselin2002, Grasser1997]:**

Set a purpose

Determine the point of view

Resolve referring expressions

Relate text to prior knowledge

Find the meaning of new words based on context

Form connections between statements

Summarize

Revise prior knowledge

Generate inferences

Construct explanations

Create questions and then answers

- **Background knowledge plays a vital role.**

# The Comprehension Process

- **Meaning is achieved through five levels of understanding [Grasser1997].**

1. Surface Code

*One by one she dropped pebbles into the pitcher.*

2. Textbase

*P1: dropped(AGENT = she, OBJ = pebble, TAR = pitcher)*  
*P2: repeat( PROP1 )*

3. Referential Situation Model

4. Pragmatic Context

5. Text Genre

# Coherence and Deep Comprehenders

- **Within and between these levels there should be coherence.**

*The water level rose before each pebble was dropped into the pitcher.*

- **“Deep comprehenders construct rich representations at the levels of the situation model, pragmatic communication, and discourse genre, whereas the textbase and surface code have a secondary status.” [Grasser2002]**

# **Where Does Story Understanding Stand?**

- **A majority of the work was accomplished in the 1970's and early 1980's.**
- **During the 1990's natural language processing focused in two areas:**
  1. Information Extraction;
  2. and Word Sense Disambiguation.
- **Only a limited understanding of a story is possible [Mueller2002].**

# Script-based Understanding

- **Views language understanding as a matter of recognition.**
- **Our lives are filled with stereotypical events or situations: purchasing tickets, going to restaurants, etc.**
- **Helps explain things like:**

*John walked into a restaurant and waited to be seated. The hostess sat him, told him the specials, and then gave him a menu. After 20 minutes, John hadn't order and left very upset.*

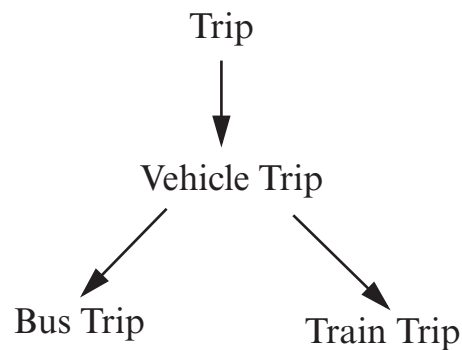
# Script-based Understanding (Continued)

- **Criticisms [Mallery1988]:**

1. The knowledge is typically tailor-made for the story at hand;
2. Finding the right set of primitives to build a script upon can be difficult or impossible;
3. Forces a literal interpretation of the story;
4. scripts are dependent on the available background knowledge;
5. We understand things without having scripts for them.

# Recent Suggestions for Story Understanding

- One solution suggest that understanding can occur via a set of interacting understanding agents. [Mueller2002]
- Another model extends previous script-based models by introducing a new model of semantic memory called the *intergrated schema model*.



# Commonsense Databases

- **What's common sense?**

*If I throw a rock up, it will come down.*

- **Current focus is on concepts of the world and relations on those concepts [Mueller2002]:**

**ako:** Cars are a kind of motor-vehicle.

**isa:** Boston is a city.

**part-of:** Cars have ignition-switches.

**material-of:** T-shirts are made of cotton.

**used-for:** Cars are used to drive.

**used-at:** Frying-pans are used in the kitchen.

**color-of:** Grass is green.

**size-of:** Chairs are 3 feet tall.

**duration-of:** Plays last 2 hours.

**typical-subject-of:** Dogs bark.

**typical-object-of:** Food is eaten.

**implies:** Cry implies sad.

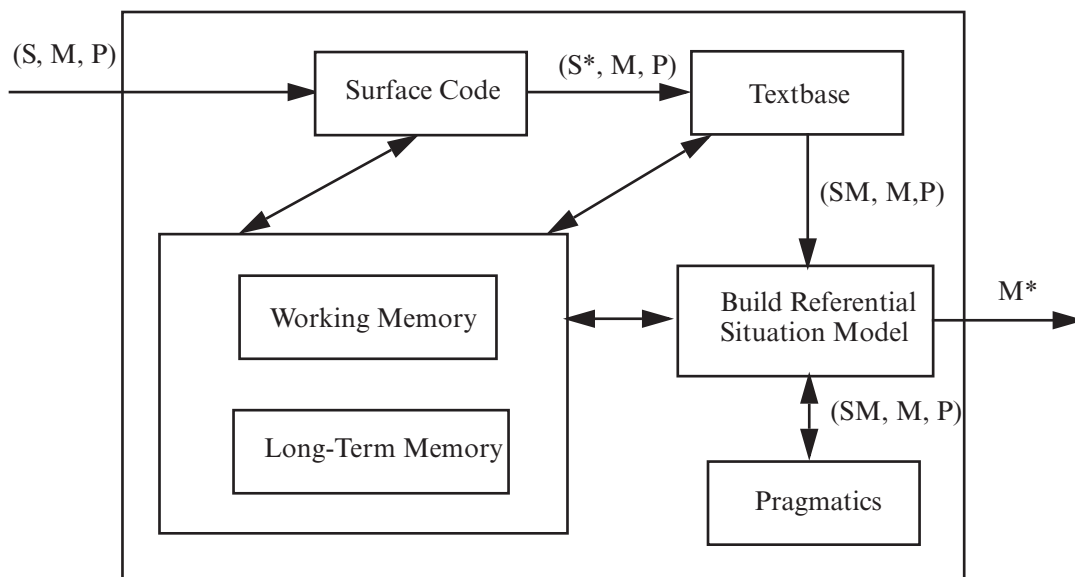
**causes:** Cheer-up causes happy.

## **What's Next?**

- **It's clear the amount of knowledge needed to do story understanding is large.**
- **SOPIA extended previous script-based systems by organizing knowledge in a coherent taxonomic structure.**
- **Object-oriented techniques have been considered for related areas such as commonsense reasoning and non-monotonic logic [Amir1999, Gustafsson2001].**
- **What could object-oriented techniques offer script-based story understanding?**

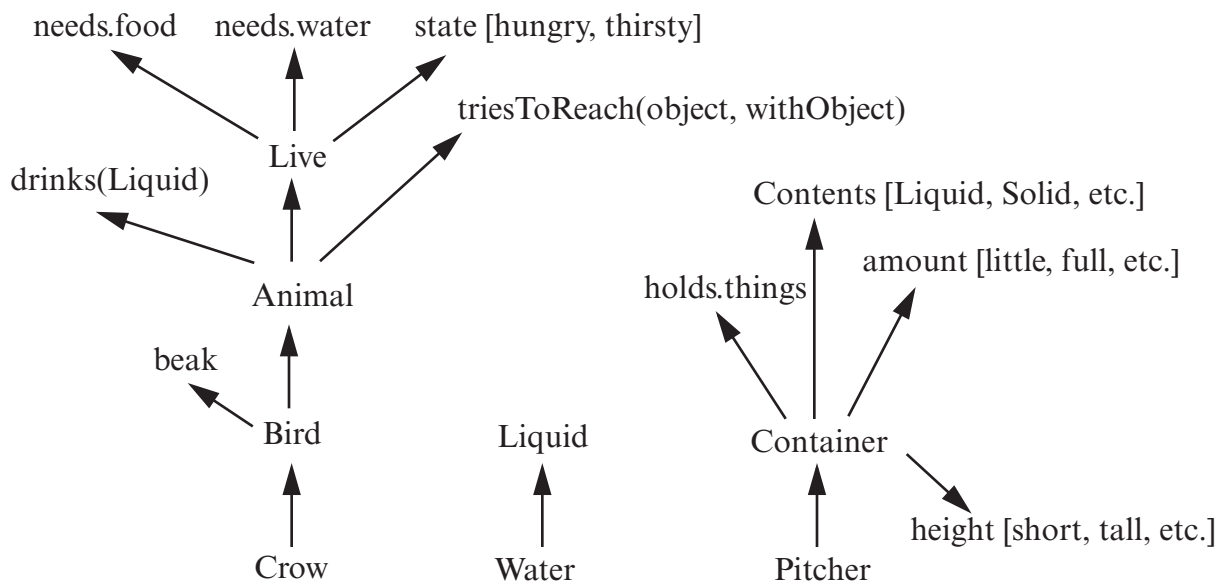
# The Proposal

- **Model story understanding at a high-level very much like psychologists believe humans do:**



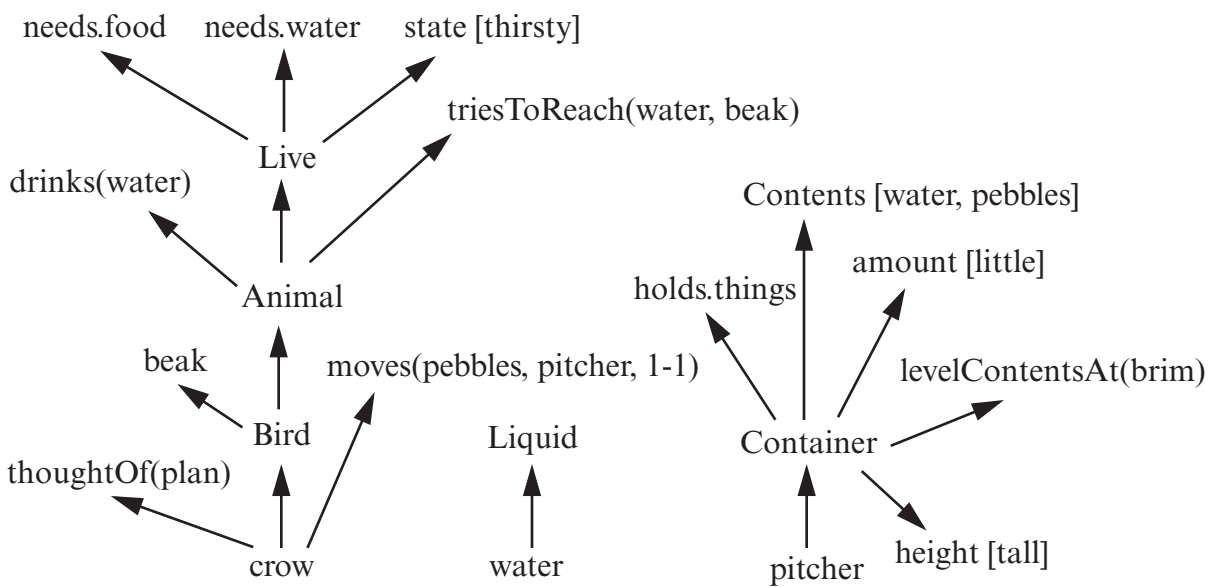
## The Proposal (cont.)

- **Organize the knowledge base with respect to object-orientation:**



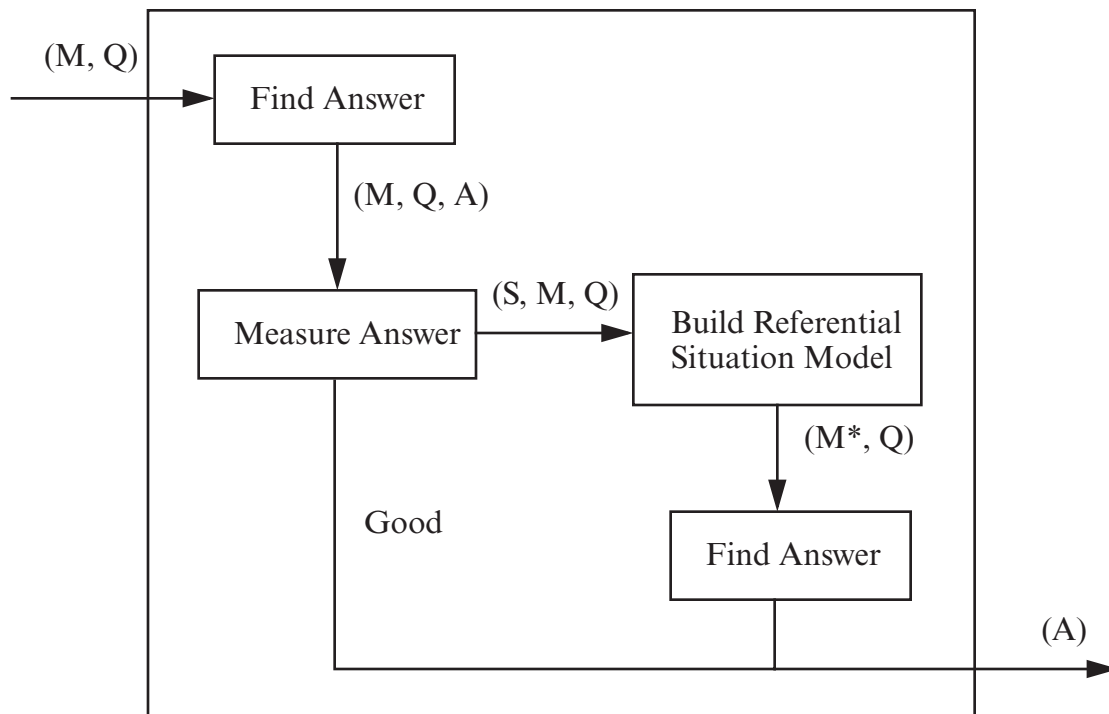
# The Proposal (cont.)

- Output a situation model that represents the given text:



# Validation

- Will occur via a question and answering system:



- **Evaluation of responses**

1. The response will be compared to expected responses;
2. or, measured for correctness by live participants.

# The Proposal (continued)

- **Limitations:**

1. The knowledge used and represented will not exceed that of common sense;
2. The knowledge will come from one of the commonly available commonsense databases;
3. The representation will be based on objects, their properties, and relationships between objects;
4. Only written discourse will be considered;
5. Only work agreed upon by the Ph.D. committee will be examined.

- **Expected deliveries:**

1. A story understanding system that uses a commonsense database for knowledge, and that will be validated as previously described;
2. Three papers that detail some aspect of this research;
3. A dissertation.

# The Proposal (continued)

- **Time Table:**

1. First 6 months: research;
2. Second 6 months: research and writing;
3. Third 6 months: writing and fine tuning the system;
4. Fourth 6 months: dissertation.

# References

- [1] Aesop's, *Aesop's Fables*, Doubleday & Company, Garden City Books, 1954.
- [2] Amir, E., Object-Oriented First-Order Logic, *Workshop on Non-monotonic Reasoning, Action and Change*, IJCAI, 1999.
- [3] Asselin, M., Literacy Links: Comprehension instruction: Directions from research, *Teacher Librarian*, Volume 29, Number 4, Pages 60 - 62, 2002.
- [4] Gernsbacher, M.A., *Precis of: Language Comprehension as Structure Building*, *Psychology*, Volume 3, Number 69, 1992.
- [5] Graesser, A.C., Millis, K.K., Zwaan, R.A., Discourse Comprehension, *Annual Review of Psychology*, 1997, Volume 48, Pages 163-190.
- [6] Graesser, A.C., Person, N. P., (2002), Discourse: Cognitive perspective, *Encyclopedia of Education*, New York: Macmillan, 2002.
- [7] Gustafsson, J., Object-Oriented Reasoning about Action and Change, *Proceedings of the Seventh Scandinavian Conference on Artificial Intelligence*, 2001
- [8] Lee, C.H., *Natural Language Understanding*, <http://islab7.cis.nctu.edu.tw/~ai/ai90b>, 2001.
- [9] Mallery, J.C., Thinking About Foreign Policy: Finding an Appropriate Role for Artificially Intelligent Computers, *Cambridge: Master's Thesis*, M.I.T. Political Science Department, 1988.
- [10] McCarthy, J., An example for natural language understanding and the AI problems it raises, *Formalizing common sense*, Pages 70-76, Norwood, NJ: Ablex, 1990.
- [11] Mueller, E.T., Story understanding, *Encyclopedia of Cognitive Science*, London: Nature Publishing Group, 2002.
- [12] Riesbeck, C.K., Fitzgerald, W., Language Understanding is Recognition, Not Construction, *Psychology*, Volume 5, Number 38, 1994.
- [13] Schank, R.C., Abelson, R., *Scripts, Plans, Goals and Understanding*, Lawrence Erlbaum, Hillsdale, N.J, 1977.