

Miniature Language Acquisition: A Touchstone for Cognitive Science

**Jerome A. Feldman, George Lakoff,
Andreas Stolcke and Susan Hollback Weber**

Slides: Dana Dahlstrom

CSE 258A, UCSD

2002.06.03

A Unifying Question

*How could we **learn** to **describe** what we **see**?*

Miniature Language Acquisition

Given pictures with true statements about them in natural language,

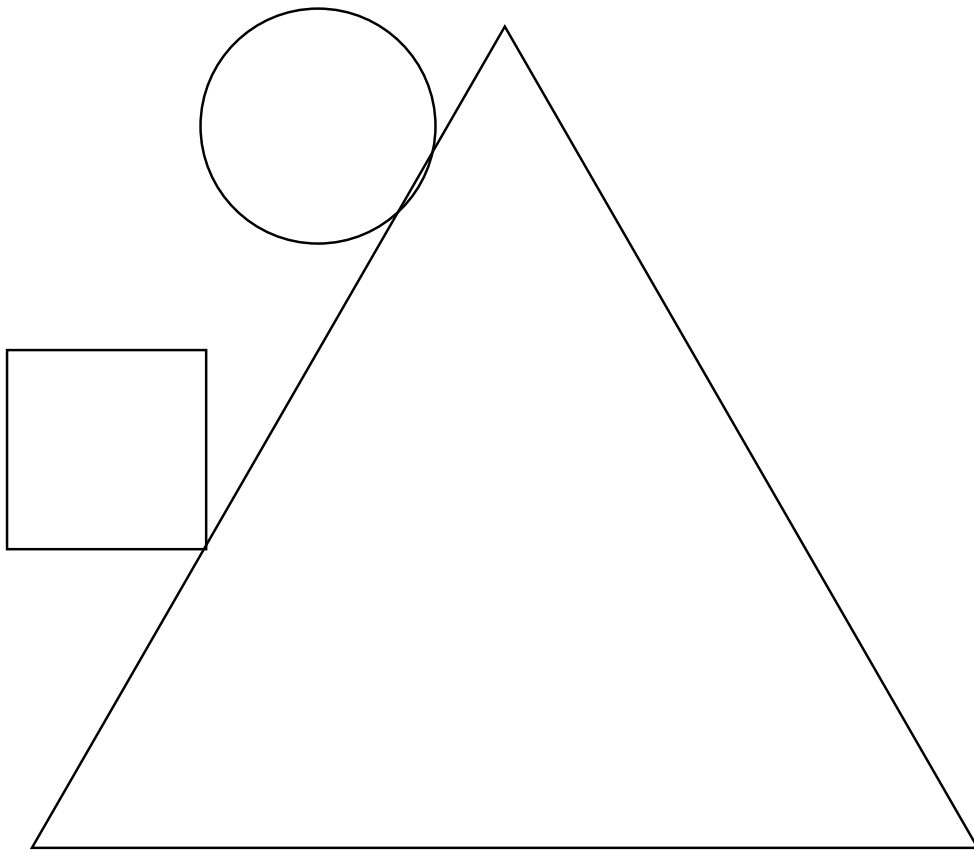
learn to tell whether new statements are true of new pictures.

L_0 : A Specific Formulation

L_0 is acquisition of language to describe simple 2-D scenes.

- The sentences are generated by a simple grammar of English words.
- The visual inputs are scenes of (up to 4) idealized geometric figures.

S → NP | NP VP
 NP → DET NP1 | DET NP1 and DET NP1
 VP → VI PP | VT NP
 NP1 → OBJ | SHADE OBJ | SIZE OBJ | SIZE SHADE OBJ
 PP → REL NP
 VI → is | are
 VT → touches | touch
 DET → a
 OBJ → circle | square | triangle
 SHADE → light | dark
 SIZE → small | medium | large
 REL → REL1 | far REL1
 REL1 → above | below | to the left of | to the right of



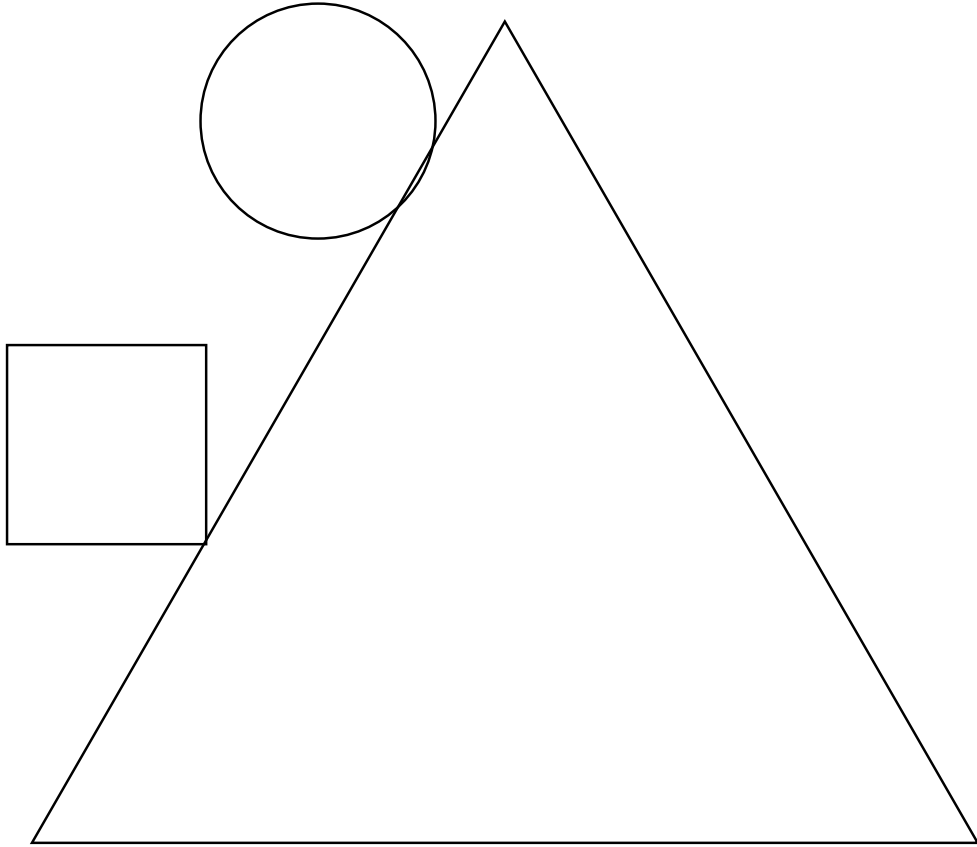
The L_0 Training Regime

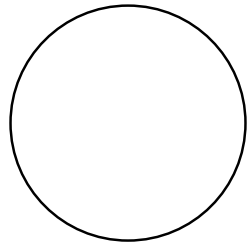
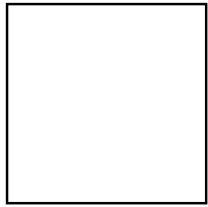
A picture and one or more true sentences about it are presented.

- The order and repetition of examples are up to the designer.
- The system trains on no more than half the examples before testing.
- The grammar is hidden; it is known only to the example generator.

Variants

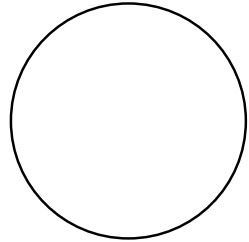
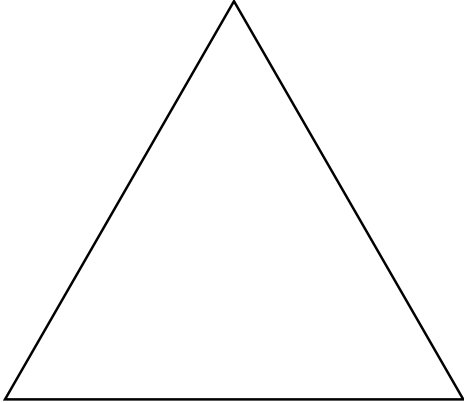
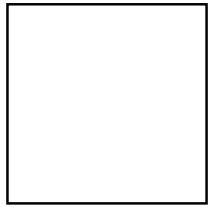
1. synonyms
2. abstraction
3. predicate negation
4. sentence inversion
5. plurals
6. verb conjuncts
7. conjunctive attributes
8. relative sizes
9. definite article
10. **over and under**
11. quantifiers





Motion and Time Variants

1. single object motion
2. single object change
3. single object contact
4. temporal non-change
5. pronoun
6. trajectories



Conclusions

- L_0 requires learning syntax and spatial semantics.
- The spatial semantics must be linked to visual input.
- The solution must work for any of the world's languages.
- L_0 encourages researchers in vision, language, inference, and learning to take one another's work and constraints seriously.