Overview

- Moses' illusion
- Gerrig and Healy's result for metaphor comprehension
- ACT-R model that attempts to unify the two phenomena

Note: work in progress.

Moses Illusion

- People have a high error rate for detecting distortions in Moses type questions, even when warned in various ways.
- Good distortions and bad distortions:
  - *How many animals of each kind did Moses take on the ark?*
  - *How many animals of each kind did Adam take on the ark?*
- It is not clear what makes a distortion good.

Typical Moses Experiment

- Subjects are asked to give the answer to a distorted or undistorted question: *correct answer, don't know, cannot say*
- Sometimes good and bad distortions are used
- Typical illusion rates (data taken from *Ayers, Reder & Anderson, 1996*):

Undistorted	*.06*
Good Distortions	*.46*
Bad Distortions	*.29*

Moses Illusion Theories

- Apparently Moses illusion is **not** due to:
  - cooperation with the speaker
  - imperfect encoding
  - racing between distortion detection and answering the question
  - insufficient allocation of attention to matching the critical term to memory

  (*Reder & Kusbit, 1991; Kamas, Reder & Ayers, 1996*)
- Subjects do not spend less time reading the distortions.
- Accentuating the distinguishing features decreases illusion rate ⇨ partial matching

Metaphor Comprehension

- Context facilitates metaphor comprehension.
- Gerrig and Healy (1983) measured reading times for sentences like:

Drops of molten silver filled the night sky.

The night sky was filled with drops of molten silver.

- Context-second sentences took longer to understand.

Metaphor comprehension

- Reaction times (from *Gerrig & Healy, 1983*):

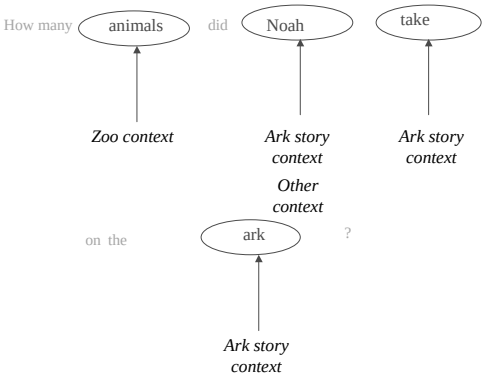
Context First	*3.53(sec)*
Context Second	*4.21(sec)*

- This result was not an artifact of sentence structure (it does not hold for literal sentences).
- Explanation: schematic information can help interpreting a metaphor without attempting full integration of the inappropriate literal meaning

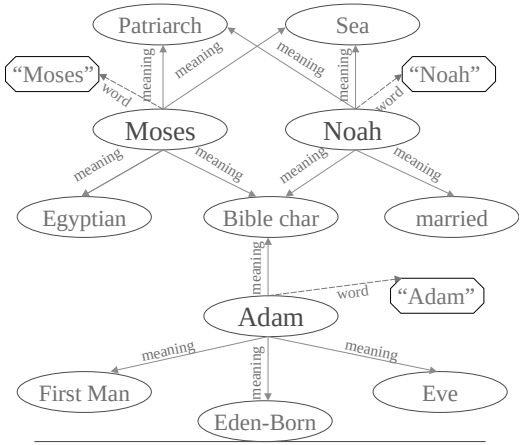
ACT-R Model

- Unified model based on meaning overlap and incomplete meaning processing.
- Basic assumptions of the model:
  - meaning overlap of the critical terms (distorted and undistorted, vehicle and topic)
  - incomplete processing
    - for meaning retrieval
    - for matching sentence to memory
  - as the sentence is processed, a candidate context is retrieved

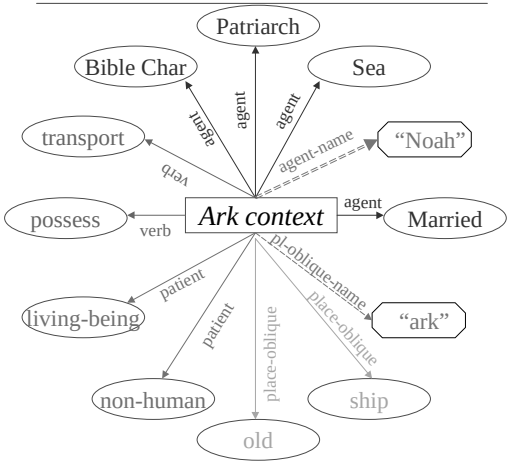
Moses Example



Meaning Representation



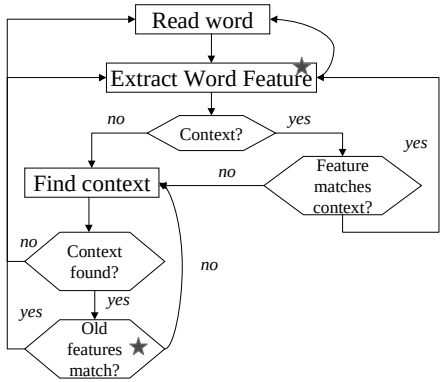
Context Representation



Representation Implications

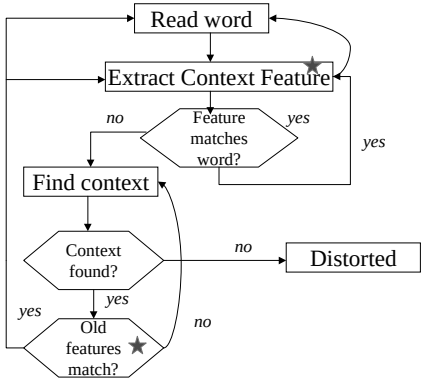
- A model based on this representation will not benefit from ACT-R's partial matching or activation spreading mechanisms.
- However, a local representation would make too specific assumptions about the nature of word meaning (e.g. the number of features should be fixed).

Algorithm for Low Context Confidence



★ *Sources of error*

Algorithm for High Confidence Context



Undistorted = end of sentence + context

Style Issues

- Since we need realistic reading times for the sentence, we need to avoid high matching latencies due to production failure.
- Elegant face of the solution: use partial matching for retrievals, and then check if the chunk retrieved satisfies all conditions.
- Ugly face: turn partial matching on and off for each production that retrieves and is failure prone

Why Does It Work For Metaphors?

"Drops of molten silver filled the sky."

Container context

Doesn't match; look for another context (extra time)

"The sky was filled with drops of molten silver."

Stars context

Matches due to features common with *stars*

Predictions

- Moses illusion: illusion rates

Good distortions	*0.5*
Bad distortions	*0.25*
Undistorted	*0.08*

- Metaphor comprehension

Context first	*2.35(sec)*
Context second	*3.28(sec)*

Downside: 40% error rates for context-second metaphoric sentences.

Instead of Conclusions

- The model reasonably accounts for basic Moses illusion and metaphor comprehension data.
- Feature overlap assumption lacks fundament; we can relax it to feature overlap between distortion and context
- Can this model be extended for:
  - gist task (Moses experiments)?
  - error recovery for metaphors ?
  - other schema effects ?