Comprehending with Language

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A Tale of two Dogs

• “Look out for that dog!”
A Tale of two Dogs

- “Look out for that dog!”
A Tale of two Dogs

• “Look out for that dog!”
A Tale of two Dogs

• All of a sudden he exclaimed, “Look out for that dog!”
Embedded vs. Displaced Comprehension
Embedded vs. Displaced Comprehension

• Embedded
  – Communicative = referential situation.
  – Affords perception & action.
  – More basic.
  – Situated.
Embedded vs. Displaced Comprehension

• Displaced
  – Communicative ≠ referential situation.
  – Does not afford perception & action.
  – Less basic.
  – Essential to human language use.
  – Most studied by linguists and psychologists.
Linguistics
Linguistics

Colorless green ideas sleep furiously.
Psychology
Psychology

The horse raced past the barn fell.
Psychology

The horse raced past the barn fell.
Main Claims

- Displaced comprehension
  - is “re-situated” comprehension.
  - affords covert action and perception.
  - involves mental simulation.
  - is comprehension with language rather than comprehension of language.
Comprehension without Language

• Motor control.
• Action observation.
Motor Control

- Delay
  - Visual processing (100 ms)
  - Efferent signal
- Solution: mental simulation (Wolpert)
  - Predicting sensory consequences of actions (forward models)
  - Comparing sensory information to predicted state (inverse models)
Action Observation

• Observer uses mental simulation to predict.
• Anticipatory eye movements in block-stacking task (Flanagan & Johansson, 2003).
Mental Simulation as “Presonance”

- “Current input from the senses resonates with experiential memory traces to facilitate the processing of likely changes to the self or the environment” (Zwaan & Kaschak, forthcoming).
- “… using implicit knowledge of one's own body mechanics as a mental model to track another person's actions in real time” (Wilson & Knoblich, 2005).
Back to the Reading Chair

• Visual and motor representations in displaced comprehension.
Visual Representations
(Zwaan, Stanfield, & Yaxley, 2002, Psych. Science)

• The ranger saw the eagle in the nest.
• The ranger saw the eagle in the sky.
- The ranger saw the eagle in its nest.
- The ranger saw the eagle in the sky.
Match Advantage on Picture Recognition and Naming Latencies
Visual Representations

(Aveyard, Zwaan, Radach, & Vorstius, in revision)

• The Visual Memory Paradigm
  – Memory Phase
    • Word-picture verification (4 times)
  – Reading Phase (ostensibly unrelated)
    • Eye movements tracked
Memory Phase

eagle
Memory Phase
The ranger was in the park on his morning round. It was a bright day. In the sky there was an eagle, soaring above the prairie.
First-pass Durations

In the sky an eagle was soaring above the...
In the sky an eagle was soaring above the
As predicted, we find longer TVD for Match sentences where the implied shape of the object in the text matched pictures of the same object in the first phase of the experiment. This difference shows up most strongly in the first region, where disambiguating shape information is most strongly provided. T-tests and Cohen's d effect sizes are provided for each comparison. For graphic purposes, different scales are shown for TVD and FPD measures.
Interim Conclusion

• Incidentally acquired visual traces impinge upon language comprehension.
• These traces are routinely activated during comprehension.
Motor Representations

• What is the role of motor representations in language comprehension?
  – Instrumental (Glenberg)
  – Ornamental (many skeptics)
  – Useful/necessary in specific cases (Jackendoff, 2002)
Language and Motor Processes

- Semantic information affects motor planning
  - Lexical access (e.g., Gentilucci & Gangitano, 1998; Glover et al. 2003; Lindemann et al. 2006; Boulenger et al., 2006).
  - Sensibility judgments (e.g., Glenberg & Kaschak, 2002).
- Motor stimulation facilitates lexical access for action words (Hauk et al., 2005).
Motor Resonance

- What is the role of motor representations in language comprehension?
  - Useful/necessary when actions are
    - Concrete
    - Punctate
    - Simple
  - Point-action verbs
Online Comprehension

• Does motor resonance occur during sentence processing?
• Does motor resonance occur as a result of semantic integration?
Motor Resonance during Sentence Comprehension

(Zwaan & Taylor, 2006, JEP General)

• Reading by rotating.
  – Every 5 deg. new frame.
• He /realized /that /the music /was /too loud/so he /turned down/the /volume.
Reading-by-Rotation (Zwaan & Taylor, 2006, Experiment 4)

He...he turned down the volume
Is Motor Resonance Short-lived or Focus-bound?

(Taylor & Zwaan, in press, QJEP)

• Prior result due to perspective change.
  – He/realized/that/the music/was/too loud,/so he/turned down/the/volume.

• Experiment 1: Maintaining focus on the action.
  – Action-modifying adverb:
    – His father/complained/about/the noise./John/walked up/to the/stereo/which he/turned down/quickly.
Action-modifying Adverb

Match
Mismatch

Match
Mismatch

Match
Mismatch

Match
Mismatch

Match
Mismatch
Is Motor Resonance Short-lived or Focus-bound?

• Experiment 2: Shifting focus away from the action.
  – Agent-modifying adverb
  – *His father/complained/about/the noise./John/walked up/to the/stereo/which he/turned down/obediently.*
Agent-modifying Adverb

The graph shows the response times (in milliseconds) for different adverb combinations. The x-axis represents the adverbs: /stereo, which he turned down, obediently. The y-axis represents the response times, ranging from 400 to 500 milliseconds.

- **Match**: Represented by the red line. The response times for the match condition are consistently lower than those for the mismatch condition.
- **Mismatch**: Represented by the yellow line. The response times for the mismatch condition are generally higher, especially for the adverb combinations /stereo and which he turned down.

The data suggests that mismatch in adverb combinations results in longer response times, indicating a potential difficulty or delay in processing.

Note: The exact values for each condition are not provided in the image.
Does Motor Resonance Occur during Inferencing?

(Taylor, Lev-Ari, & Zwaan, in prep.)

- The cook/decided to/adjust the/temperature/of the oven,/so he turned/the dial./The oven/had been too/hot.
Motor Resonance during Inferencing

The oven had been too hot.
Conclusion from these Experiments

- Motor resonance is immediate;
- subject to linguistic focus;
- closely associated with semantic integration.
Overall Conclusions

• Displaced comprehension involves the immediate activation of perceptual and motor representations.
• Comprehension with language is a lot like comprehension without language.
• But there are obvious differences…
Differences

• Without language
  – Continuous input.
  – Input changes as a result of actions.
  – Situation observed.

• With language
  – Discrete input.
  – Input does not change as a result of actions.
  – Situation “construed.”
On the Agenda

• How does language orchestrate mental simulations in displaced comprehension?
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