Language and Cognition

BCS153 Week 10.1
3/19/2019
Roadmap

• The role of language in cognition
  ➢ Sapir-Whorf Hypothesis
  ➢ Mental representation
  ➢ Perception

• Impact of language on abstract concepts - time
  ➢ Two studies by Boroditsky
    o Boroditsky (2000): monolinguals
    o Boroditsky (2001): cross-linguistic comparisons

• Abstract and concrete concepts
  o Gillette et al. (1999): identification of nouns and verbs from contexts
Is cognition shaped by language?

• Lexical invention

➤ Cognitive development before and after lexical invention?

• Verbalization of thoughts

• Reading and writing
Is cognition shaped by language?

• Edward Sapir and Benjamin L. Whorf
  ➢ Strong version
    Our thoughts are determined by language.

  ➢ Weak version
    Different languages generate different cognitive structures.
Language and mental representations

- Language required for mental representations?

- Once we develop language, what kind of representation is linguistic and what is not?
Language and perception

• Underrepresentation of the perceived world by language
  ➢ Time: earlier, later, month, year, day,…
  ➢ Space: big, small, large, above, below, behind….
  ➢ Color: red, blue, black, white…
  ➢ Sound: loud, quiet, sharp, harmonious, high- and low-frequency…

➔ How many words do we have for each category?
➔ What factors could influence one’s concept of each category?
How do we think about *time*?

• Is language required?
  Ø Thinking about a past or future event
  Ø Thinking about the temporal relation between two events (e.g., A occurs before B.)

• Use of spatial knowledge: metaphorical
e.g., ahead, back
How do we think about time?

• Two schema of how we talk about time (Boroditsky 2000)

- Ego-moving
  - Past
    - Moving
  - Future
    - Moving
- Time-moving
  - Past
    - Moving
  - Future
    - Moving
How do we think about *time*?

• Use of spatial knowledge to think/talk about time (Boroditsky 2000)

➢ Priming paradigm

○ Spatial primes

○ Target: ambiguous temporal sentence (e.g. ‘Next Wednesday's meeting has been moved forward two days’)

Q: Which day the meeting had been rescheduled?
How do we think about *time*?

- Use of spatial knowledge to think/talk about time (Boroditsky 2000)
  - Priming results
    - Ego-moving prime: 73.3% answered Friday; 26.7% answered Monday
    - Time-moving prime: 30.8% answered Friday; 69.2% answered Monday

→ Influence of spatial descriptions on interpretation of time in language
How do we think about time?

• Can we obtain the same priming effect without verbal descriptions of the event?

• Universal across languages?

• How do bilinguals think in two languages?
Representation of time in English

Boroditsky (2001)
  ahead
  behind
  forward

→ Used to describe both time and space in a horizontal dimension
Representation of time in Mandarin

Boroditsky (2001)

- Up
- Down
- Front
- Back

→ Used to describe both time and space in both vertical and horizontal dimension

e.g., next week → “down one week” (literal)
the previous day → “front/forward one day”
Influence of native language on representation of time

Boroditsky (2001)

• Priming paradigm

➢ Two types of prime: Horizontally vs. Vertically arranged objects

The black worm is ahead of the white worm.

The black ball is above the white ball.
Influence of native language on representation of time

Boroditsky (2001)
• Priming paradigm
  ➢ Two types of targets
    o Metaphorical: A comes before B. (horizontal representation)
    o Purely temporal: A comes earlier than B
  → Test the covert effect of spatial metaphor
  → Chinese primed by vertical primes on purely temporal targets; not Americans.
Influence of native language on representation of time

- Boroditsky (2001)
- Priming results (Experiment 1)
Influence of native language on representation of time

- Boroditsky (2001)
- Priming results (Experiment 1)
Influence of native language on representation of time

Boroditsky (2001)

• What about bilinguals? Does learning a second language change the way we think?

• Experiment 2: Mandarin-English bilinguals (L1 Mandarin, L2 English)
  – Same types of primes as in Experiment 1
  – Only targets with purely temporal terms (earlier, later)
Influence of native language on representation of time

Boroditsky (2001)

• Experiment 2: Mandarin-English bilinguals (L1 Mandarin, L2 English)

• Vertical bias = Target RT (horizontal prime) – Target RT (vertical prime)
Influence of native language on representation of time

Boroditsky (2001)

• What about English speakers? Can they be *trained* to think about time in a horizontal representation like Mandarin speakers?

• Experiment 3: same paradigm as in Experiment 1 but training English speakers to use above/higher rather than before/earlier.

Monday is above Friday. \(\rightarrow\) Monday is earlier than Friday.
Monday is higher than Friday \(\rightarrow\) Monday is earlier than Friday.
Influence of native language on representation of time

• Boroditsky (2001)
• Experiment 3 results:
Influence of native language on representation of time

• Boroditsky (2001)

• Experiment 3 results:
Implications of Boroditsky’s study

• Temporal relations could be represented as spatial relations.

• Even just after some linguistic training, the new system can affect how we think about time.

• For bilinguals, age of acquisition matters!

• Language more useful for abstract than concrete concepts?
Identifying lexical concepts from contextual cues

• Gillette et al. (1999)
• Adults watching silent videos of mother-infant talk
• Targets: nouns and verbs (signaled by a beep)
• Task: identify the target words from the scenes
  ➢ Each target word identified 7 times (6 contexts + 1 final guess)
Identifying lexical concepts from contextual cues

- Gillette et al. (1999)
Abstract vs. concrete concepts

- Gillette et al. (1999)
- Some sample proportion of correct responses

<table>
<thead>
<tr>
<th>Noun targets</th>
<th>Final conjecture</th>
<th>Verb targets</th>
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<tbody>
<tr>
<td>Piggy</td>
<td>89.3</td>
<td>Go</td>
<td>3.6</td>
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<tr>
<td>Ball</td>
<td>78.6</td>
<td>Do</td>
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<td>3.6</td>
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<td>28.6</td>
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<td>25.0</td>
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<tr>
<td>Drum</td>
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<td>Play</td>
<td>21.4</td>
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<td>39.3</td>
<td>Hammer</td>
<td>14.3</td>
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<tr>
<td>Nose</td>
<td>67.9</td>
<td>Have</td>
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Abstract vs. Concrete concepts

- Gillette et al. (1999)
- Some sample responses

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Take-home messages

• Language influences how people represent and think about time.

• Short-term training could change how people think about time.  
  ➢ Turning into long-term effect? Unclear.
  ➢ Lab effect?

• People can identify words with concrete concepts even without audio cues.