PACKAGED AND READY-TO-GO
Linguistic Tools for Communication and Mental Processing

ICLC 2013
University of Alberta, Edmonton

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Culturally evolved and transmitted, linguistic “tools for thinking” shape, facilitate, and enhance human cognition.
• background: language > thought
• evolutionary perspective
• case study: reasoning with kinship terms

Culturally evolved and
Language > thought

‘The conventions of our languages commit us to categorising the world in a specific way, which then determines our thinking’

Benjamin Whorf (1956)

‘Word meanings are not (well) decomposable in atomic concepts, so they must themselves be the born-in atomic concepts of our mind’

cf. Jerry Fodor (1975)

‘Different languages demand from their speakers different observations and thinking processes, which leads to differences in performance on and approach to certain tasks.’

cf. Lera Boroditsky (2011)

‘Word meanings can be decomposed into the born-in atomic concepts that form the “language of thought”. Natural languages hardly influence the language of thought.’

cf. Steven Pinker (2007)
Premises:

• humans communicate and reason about complex concepts
• through conventional meanings, lexical units express complex concepts
• there are natural limits to our (brain's) reasoning capacity

Hypothesis:
Premises:

- humans communicate and reason about complex concepts
- through conventional meanings, lexical units express complex concepts
- there are natural limits to our (brain's) reasoning capacity

Hypothesis:

complex concepts are processed as 'conceptual wholes' in reasoning tasks
Human cognition

1. genetically transmitted traits
2. individual experience

3. culturally transmitted traits
   especially: implicit through language

Michael Tomasello (1999)

Language does not determine thought, but can enhance cognitive processing

cf. apps on an iPad
Human cognition

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Culturally evolved and transmitted, linguistic “tools for thinking” shape, facilitate, and enhance human cognition.
enhance human cognition

- background: language > thought
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- case study: reasoning with kinship terms
**Case**

**Motivation**

Variation in complexity between concepts

- If "packaging" holds, then processing of more complex concepts is not (much) more demanding

Domain: kinship terms

**Method (1)**

Participants have more difficulties processing complex kinship terms as opposed to simple ones?

- **Design:**
  - Independent groups
  - Visual performance in a virtual environment

- **Task:**
  - Judge possibility of sequences that are equally long (is correct) but vary in complexity (is incorrect)

**Method (2)**

- **Design:**
  - Kinematics of hand's, elbow, forearm
  - Visual performance in a virtual environment
  - SIDT in one group measured via MYOG, LDA, action gestures of fingers

**Results: reaction time**

- Linear model: ANOVA ($F_{1,7} = 10.41, p = 0.01$
  - Reaction time: $r = -0.6$

- Logistic regression:
  - ANOVA ($F_{1,7} = 5.52, p = 0.05$
  - Reaction time: $r = 0.6$

**Discussion (1)**

Participants process case concepts better than the non-case concepts in the virtual environment.

- Some participants struggle with the kinematic forces.
- Different behaviors in different groups.
- Further experimentation planned.

- Case-based: More errors and slow performance.
Motivation

variation in complexity between concepts

>> if "packaging" holds, then processing of more complex concepts is not (much) more demanding

domain: kinship terms
Čech & Shoben (1980)

- method: judge possibility of statements such as "my father's uncle's mother is my grandmother"
- H0: componential reasoning with 'features'
- H1: short-cuts and heuristics
- some evidence for the use of certain short-cuts and heuristics

'design' kinship system reflects communicative efficiency:
Kemp & Regier (2012)
Case

Motivation
variation in complexity between concepts
-- if "packaging" holds, then processing of more complex concepts is not (much) more demanding

Method (1)
By participants have more difficulties processing complex kinship terms as opposed to simple ones?

Method (2)

Results: reaction time

Results: accuracy

Discussion (1)
Participants process case complete correctly in the non-change case, but not in the change case:
- Session 1: Case Complete, Start time: 00:00
- Session 2: Case Complete, Start time: 00:00

Discussion (2)
Results provided new insights, but also new questions:
- New experiment planned
- Session 3: Case Complete, Start time: 02:00

Method (1)

Do participants have more difficulties processing complex kinship terms as opposed to simple ones?

>> Operationalisation:

complexity term = minimal # knots in kinship graph
processing costs = reaction time and accuracy

>> Task:

judge possibility of statements that are equally long (4 terms) but vary in complexity (4-9 knots)
Method (2)

>> Design:

- 16 statements: 6 'true', 6 'false', 4 controls
- webexperiment in custom environment
- 32 (36) participants acquired via MTurk, USA, native speakers of English
Can it be true that

John's mother's son's father's daughter is John's brother?

[yes] [no]
Results: reaction time

Lineair model:
ANOVA: $F(1) = (7.931), p < 0.01$
$R^2 = 0.013$
function = +1.6

Breakpoint analysis:
ANOVA: $F(1,17.183), p < 0.001$
$R^2 = 0.044$
function $[4,5] = +13.8$; function $[5,9] = -1.1$
Results: accuracy

Logistic regression:
estimate = -0.048
SE = 0.066
z = -0.718
p > 0.05
Discussion (1)

participants process more complex terms not slower or less accurate than simple ones

>> consistent with:
   1. humans reason with wholes/packages
   2. they are no less capable to access/apply contents of these packages accurately

note: break point between 4 and 5-9
Discussion (2)

results provided new insights, but also new complexities

new experiments planned:
  • test between Dutch/English: 'nephew'/'cousin' vs. 'neef'/'neef'
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Thank you