Gesture,
Conceptualization, and
Distributed Cognition

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Approach

Distributed Cognition

Cognitive Semantics
Studying Human Cognition

Classical View
Cognitive Functional Systems: Everyday Examples

- Tracking attendance
- Determining order of service
- Counting objects
- Telling time
Functional System

Coordination  ←  Conceptualization
Questions

• How do people accomplish cognitive activities?
  – coordination of representational media => computation

• How do they construct relevant meanings?
  – conceptualization

• How do they guide the meaning of others?
  – instructional discourse (multimodal)

• How do they reason collaboratively?
  – group discourse (multimodal)
Methods

• Data collection
  – Ethnographic study (cognitive ethnography)
  – Quasi-experimental situations

• Analysis
  – Distributed cognition: how activities are accomplished
  – Cognitive semantics: conceptual structures/processes; guiding conceptualization

=> role of bodily actions (gestures, manipulations, enactments, etc.)
Example: Counting Objects

How many?

“one, two, three…”

Coordinating action

#
Functional Systems for Counting

one, two, three...

six, seven, eight...

one, two, three...

A, B, C...
Functional Systems for Counting

Sequential Touching
(Pointing / Looking)

Moving Objects

Using Finger Proxies

Coordination:
Use of the body to coordinate spoken representations with material objects
Functional Systems for Counting

**SEQUENTIAL TOUCHING**
(POINTING / LOOKING)

Already counted

To be counted

"one" "two" "three"

$S \rightarrow G? \rightarrow TR$

**MOVING OBJECTS**

"six" "four" "two"

Already counted

**USING FINGER PROXIES**

Already counted

[b] [c]

To be counted

[a]

Conceptualization:

Image-schematic structure (SOURCE-PATH-GOAL, PROXIMITY, CONTAINER)

Material/spatial anchoring of conceptual categories
Instructional Discourse: Counting on the Clock
## Selecting Episodes for Analysis

<table>
<thead>
<tr>
<th>Activity</th>
<th>Focus</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presentation</td>
<td>Review dividing a circle into halves and fourths on felt board</td>
<td>0:34</td>
</tr>
<tr>
<td>Presentation</td>
<td>Equate one fourth to one quarter by analogy to money</td>
<td>0:30</td>
</tr>
<tr>
<td>Presentation</td>
<td>Divide the clock face into quarters</td>
<td>0:33</td>
</tr>
<tr>
<td>Presentation</td>
<td>Read a time as “quarter past”</td>
<td>0:41</td>
</tr>
<tr>
<td>Group practice</td>
<td>Read a quarter past eight with prompting</td>
<td>0:15</td>
</tr>
<tr>
<td>Group practice</td>
<td>Read a quarter past ten and a quarter past three</td>
<td>0:15</td>
</tr>
<tr>
<td>Presentation</td>
<td>Count on the clock face to read the time as “_ fifteen”</td>
<td>0:26</td>
</tr>
<tr>
<td>Group practice</td>
<td>Read five fifteen and a quarter past five</td>
<td>0:17</td>
</tr>
<tr>
<td>Group practice</td>
<td>Read a quarter past seven and seven fifteen</td>
<td>0:13</td>
</tr>
<tr>
<td>Individual practice</td>
<td>Read eight fifteen and a quarter past eight</td>
<td>0:29</td>
</tr>
<tr>
<td>Individual practice</td>
<td>Read a quarter past two and two fifteen</td>
<td>0:28</td>
</tr>
<tr>
<td>Presentation</td>
<td>Write two fifteen as ‘2:15’</td>
<td>0:14</td>
</tr>
<tr>
<td>Individual practice</td>
<td>Read a quarter past four and four fifteen; write 4:15</td>
<td>0:46</td>
</tr>
<tr>
<td>Individual practice</td>
<td>Read six fifteen and a quarter past six; write 6:15</td>
<td>1:23</td>
</tr>
<tr>
<td>Individual practice</td>
<td>Read ten fifteen and a quarter past ten; write 10:15</td>
<td>1:52</td>
</tr>
</tbody>
</table>
Transcribing

3fifteen (0:31)

1    (4.0)

2  Ss:  A QUARTER PAST THREE

3    (0.8)

4  Teacher:  now another way that we say it

5    (1.0)

6  is we count by fi:ves

7    (0.3)

8  when we move this,

9  from number to number = there's five minutes

10  between each number

11    (0.6)
so if we were going to count by *fives* it would be:

12
13
14
15 S:  
16
17 Ss:  
18 Teacher:  
19
20 Ss:  
21 Teacher:  
22
23

so this is *quarter past three* but~it~is also
Transcribing

24
25
26  Ss:  three:: (0.4)
27  Teacher:  fifteen::
Analyzing

• Diagramming conceptual inputs and operations step-by-step in the unfolding discourse

• Analyzing the roles of bodily movements, their relation to speech, coupling with environment, etc.
Prompting for a New Conceptualization

now another way that we say it
Activating a Cognitive Model

“five, ten, fifteen…”

Counting by Fives

is we count by fi:ves
Mapping #1

“five, ten, fifteen…”

when we move this,
Mappings #2 and #3

“five, ten, fifteen…”

from *number* to *number* =
Mapping #4 (and #5)

“five, ten, fifteen…”

there’s **five minutes** between each **number**
so if we were going to count by *fives* it would be:
Counting on the Clock

“five, ten, fifteen…”

12 1 0 11

“five, ten, fifteen…”

5 1 0 11

S “five”

S “ten”

S “fifteen”

days

hours

minutes

(0.5) five

(0.6) ten

(0.4) fifteen
“five, ten, fifteen…”

Counting by Fives

Time Measurement

Counting on the Clock
Group Reasoning

Explaining the phases of the moon
Group Reasoning

Reasoning about the seasons
Methodological Issues

• Capturing phenomena
  – Ethnography provides “real” data & warrants
    access, time, equipment, when/what to record, missed data
  – Quasi-experimental situations provide control & capture
    less natural, lack ethnographic warrants for interpretations
Methodological Issues

• Transcribing (distilling)
  – Coding gesture highlights types & patterns
    isolates gestures, may mask functions
  – Annotated images highlight gesture functions
    no support for categorical analysis
Methodological Issues

• Interpreting / analyzing
  – Distributed cognition & cognitive semantic analysis
    \textit{can’t be automated (requires expert analyst), hard to generalize}
  – Quantitative / statistical analysis
    \textit{bleaches out situated aspects of cognition & communication}
What can be done?

• For now
  – Multiple avenues: match approach to question

• For the future: new digital tools
  – Transcripts with embedded videos & metadata?
  – Links to analyses?
  – Searchable databases or gesture corpora?

• And then: …?
Selected References


Thank You

Natural Media & Engineering
Human Technology Centre (HumTec)
RWTH Aachen University

Interdisciplinary Center for Clinical Research
University Hospital Aachen
RWTH Aachen University