Gesture in Everyday Scientific Reasoning and Explanation

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Motivation

Explaining the phases of the moon
Question

How does gesture function in everyday scientific reasoning and explanation?
Explanation vs. Reasoning
(Crowder & Newman 1993; also Roth & Welzel 2001; Singer et al. 2008; etc.)

Describing Models
- Synchronized with speech
- Redundant iconics & simple points
  - illustrate / highlight
- Outside perspective
  - gesture in front of body
  - look at addressee

Building & Running Models
- Often precede speech
- Enhancing iconics & elaborated points
  - add / explore meanings
- Inside perspective
  - inhabit gesture space
  - watch gestures

Presentational
Exploratory
Method

• Posed questions to small groups of college students (3 - 5 students, diverse majors)
  – What causes the seasons? / Why is hot in the summer and cold in the winter?
  – What causes the phases of the moon?
  – What causes the tides? / Why is the tide highest at the full moon?

• Instructed to:
  1. Discuss until they agree
  2. Explain their answer
Choice of Topics

• (Mis)conceptions
  – **Seasons**: tilt of earth vs. distance from sun
  – **Phases**: angle of viewing vs. earth’s shadow
  – **Tides**: moon’s & sun’s gravity vs. moon’s gravity (alone)

• Representational challenges
  – Complex spatial relations (2 or 3 objects, 3D)
  – Multiplicity of motions
  – Force dynamics (gravity)
  – Non-human scale (cosmic)
Analysis

• Macro-level
  – Patterns: group reasoning vs. explaining answers

• Micro-level (*reasoning*)
  – Collaborative building & running of models
    • Conceptual inputs, mappings, and blends
    • Anchoring in the physical environment
    • Enactment of dynamics to generate inferences
  – Functions of gesture
    • Representational gestures & deictic points/traces
Explaining Answers

seasons – phases – tides
Group Reasoning

- Separation of gesture & speech (lack of words)
Group Reasoning

- Mirroring of gestures
Group Reasoning

- Co-inhabiting gesture space
Group Reasoning

- Collaborative gesturing
Collaborative Model-Building

Using facets

- Introducing facets with speech and gesture
- Fitting facets together
- Testing emergent models

What causes the seasons?

- rotation of earth
- angle of axis
- moon / sun / planetary bodies
- magnetic fields
- hours of sunlight
- orbit around sun / position & distance
- earthquakes / geological phenomena
Next Steps

• Documentation of macro-level patterns

• Micro-analysis of episodes
  – Conceptual level:
    • introducing conceptual content
    • anchoring conceptual entities
    • coordinating, mapping, blending
    • enacting dynamics  \textit{(etc.)}
  – Discourse level:
    • establishing common ground
    • building models
    • generating inferences  \textit{(etc.)}
References


