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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

Presentational

Building & Running Models

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

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 (*etc.*)
 - Discourse level:
 - establishing common ground
 - building models
 - generating inferences (*etc.*)



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