
Gesture in Learning and Teaching

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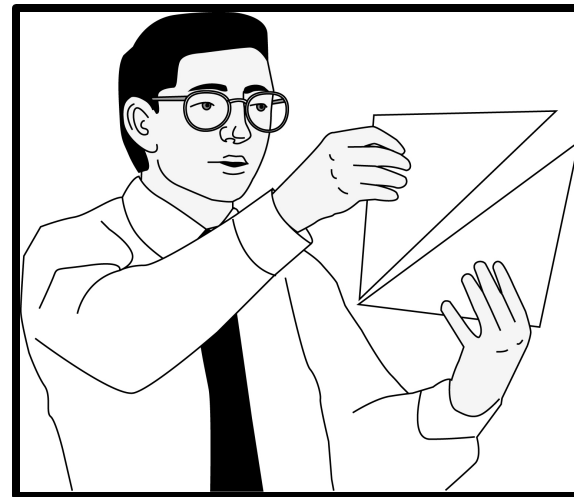
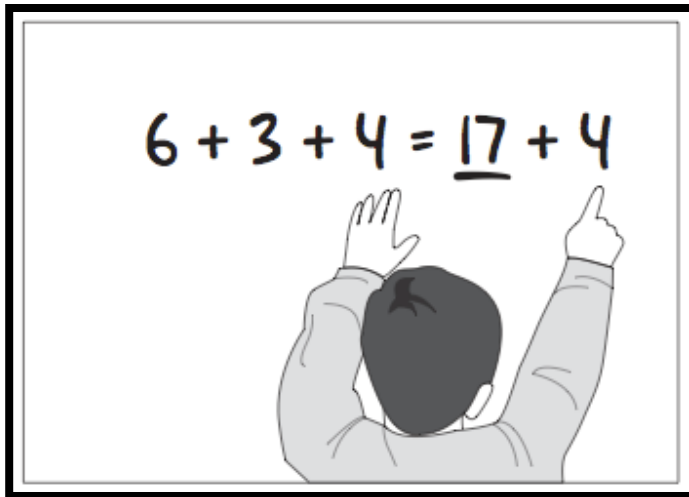
Basics

- What are gestures?
 - Definition
 - Classification
- Why do speakers produce gestures?
 - Self-oriented functions
 - Other-oriented functions



What are gestures?

- Spontaneous body movements produced when speaking (or in place of speech)
- Most produced with hands or arms



- **Not** functional actions, self-adaptors, fidgeting

Kendon's Continuum

Gesticulation ↔ Pantomime ↔ Emblem ↔ Sign Language

- Moving left to right,
 - Speech becomes less obligatory
 - Gesture becomes more systematized
 - Gesture becomes more conventionalized



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- My focus today: gesticulation

Non-conventional Gestures

- Not socially regulated – therefore, nonconventional and idiosyncratic
- Spontaneously created at the moment of speaking
- Do not have standards of form
- Used to indicate, convey information, emphasize, and regulate interaction

Why study gestures?

- A window on the mind
- Insights into language and communication
- Insights into thinking, learning, teaching
- Insights into development



Classification Schemes

- There are many!
- Categories vs. dimensions
- Key features
 - Indexicality
 - Iconicity
 - Rhythmicity

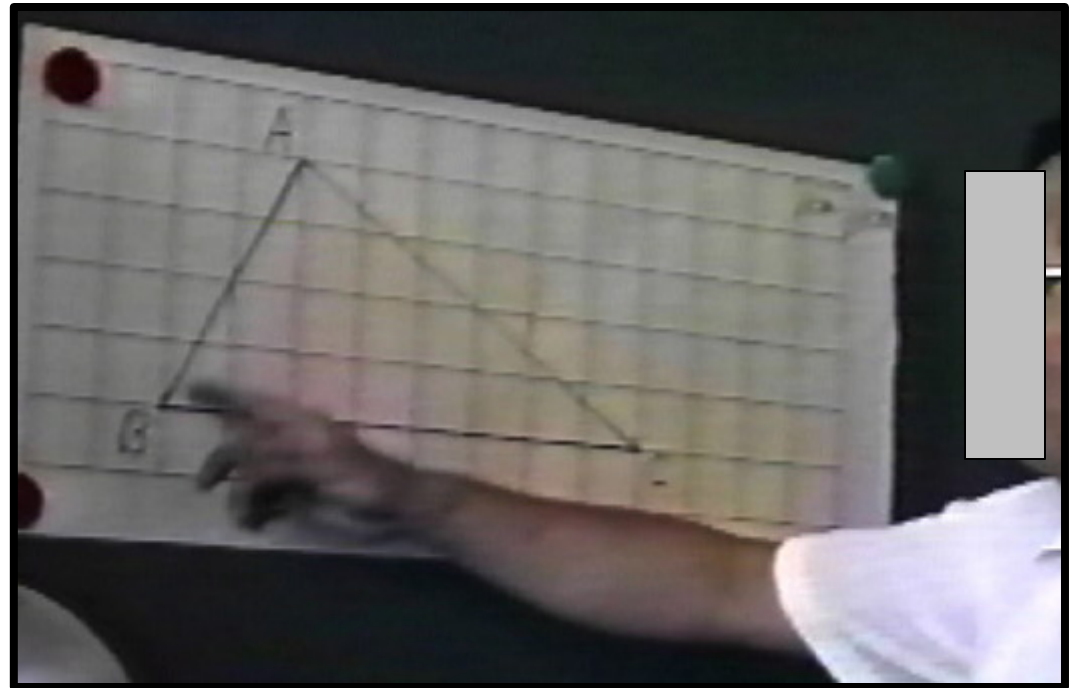
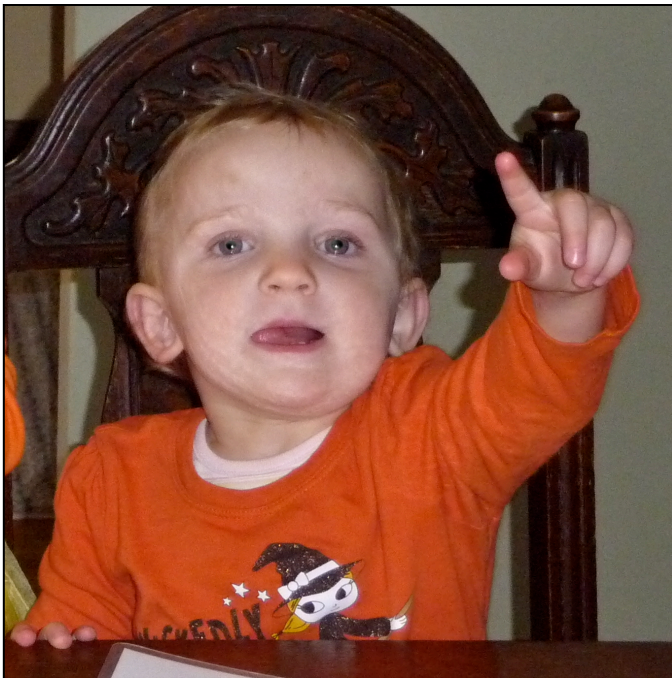
Basic Scheme

Based on McNeill (1992)

- Points
- Representational gestures
 - Iconics
 - Metaphorics
- Beats
- Interactive gestures (Bavelas , 1992)

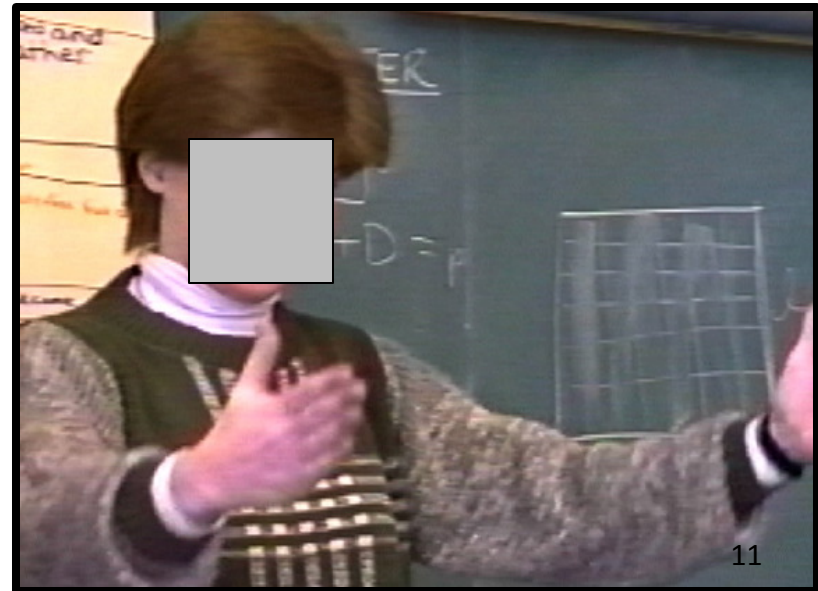
Pointing (Deictic) Gestures

- Indicating gestures that refer to objects or locations
- Can be used literally or metaphorically



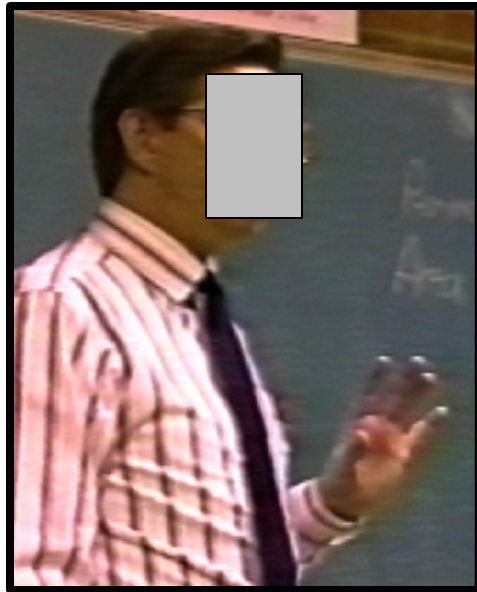
Representational Gestures

- Depict semantic content of speech via handshape or motion trajectory
- Related to speech content iconically or metaphorically



Beats

- Motorically simple gestures
- Linked to rhythm or prosody of speech, or used to mark discourse structure



Interactive Gestures

- Used to regulate social interaction
 - Manage turn-taking, acknowledge previous contributions, involve listener



When do people gesture?

- Whenever they talk!
- Commonly studied situations:
 - Conversation
 - Problem explanation
 - Narrative monologue
 - Instructional settings (tutorials, classrooms)
- Varying methodological approaches: experimental, ethnographic, mixed

Why do people gesture? *Function*

- For the speaker
- For the listener

- Speaking
- Thinking
- Communicating

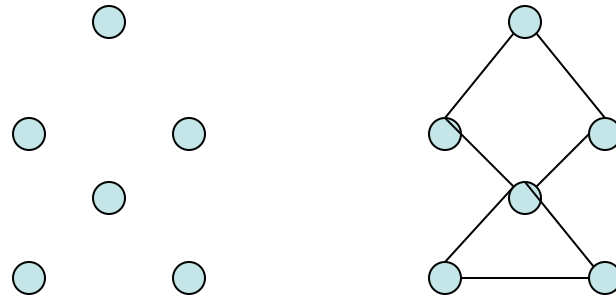
Gesture Function: Thinking

- Activates mental images (e.g., de Ruiter, 1998)
- Helps to manage cognitive load of speaking (e.g., Goldin-Meadow, Nusbaum, Kelly & Wagner, 2001)
- Promotes focus on perceptual-motor information (e.g., Alibali & Kita, 2010)



Gesture Function: Speaking

- Facilitates access to lexical items (e.g., Krauss, 1998)
- Helps speakers package information into verbalizable syntactic units (e.g., Kita, 2000)



Gesture Function: Communicating

- Supports comprehension of accompanying speech
 - Especially true for complex speech, degraded speech, noisy environments, younger listeners
- Expresses additional information
- Helps to foster shared understanding or “common ground”



Why do gestures communicate?

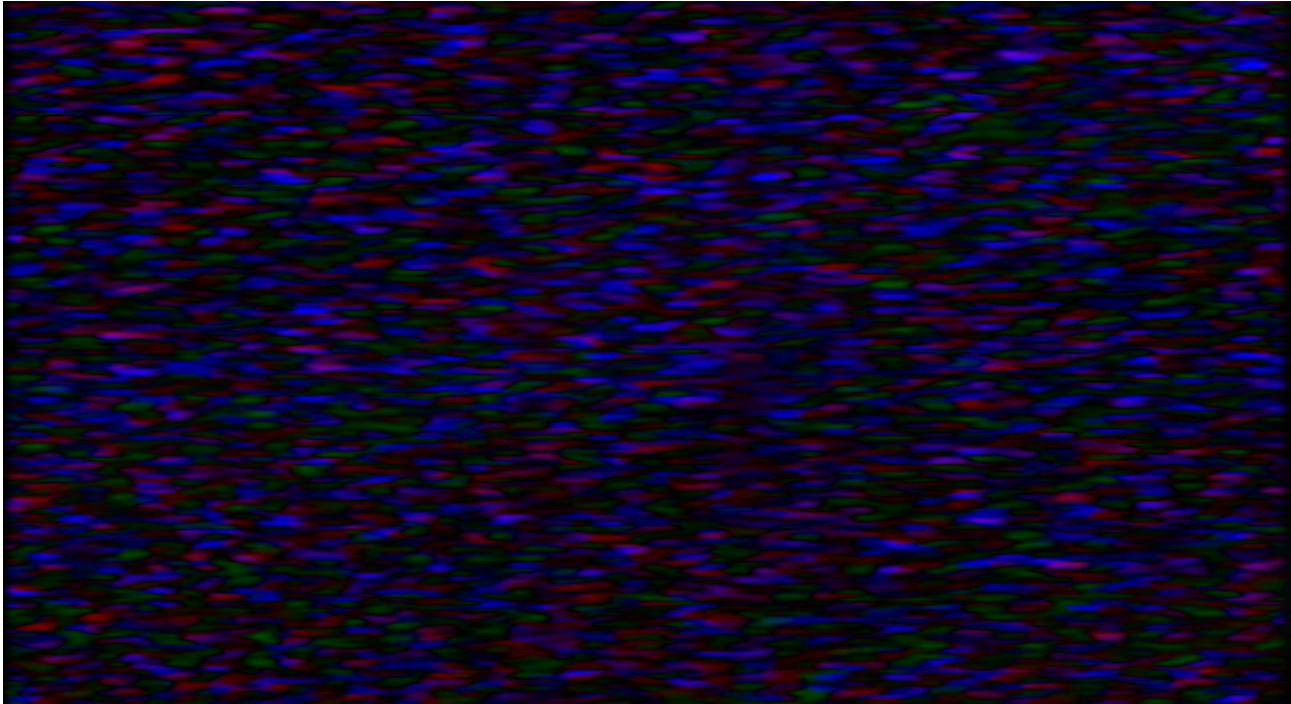
- Pointing gestures *ground speech* in environment
- Representational gestures *guide mental simulations* in listeners
- Some representational gestures reveal body-based metaphors



Learners' gestures. . .

- Increase activation on perceptual, motoric, spatial knowledge
- Help learners “redescribe” such knowledge into more explicit, verbal form
- Highlight inconsistencies in knowledge
- Provide interaction partners with information about the “leading edge” of children’s knowledge
 - Contents of the ZPD

Learners



For discussion

- What sorts of information are best expressed or most effectively communicated in gestures?
- Can the same gestures simultaneously serve self-directed and other-directed functions?
- Do all learners rely equally on gesture in expression and communication?
- How are gestures integrated with other systems for making meaning?

Teachers' gestures. . .

- Guide learners' attention to crucial elements of complex visual displays
- Link related representations
- Resolve “trouble spots” in classroom communication, forge common ground

Learning to See

- Acquiring “professional vision” (Goodwin, 1994)
 - Archaeologists learn to recognize traces of ancient civilizations in color patterns in dirt
 - Math learners learn to recognize key elements of mathematical problems, inscriptions
- Disciplined perception (Stevens & Hall, 1998)

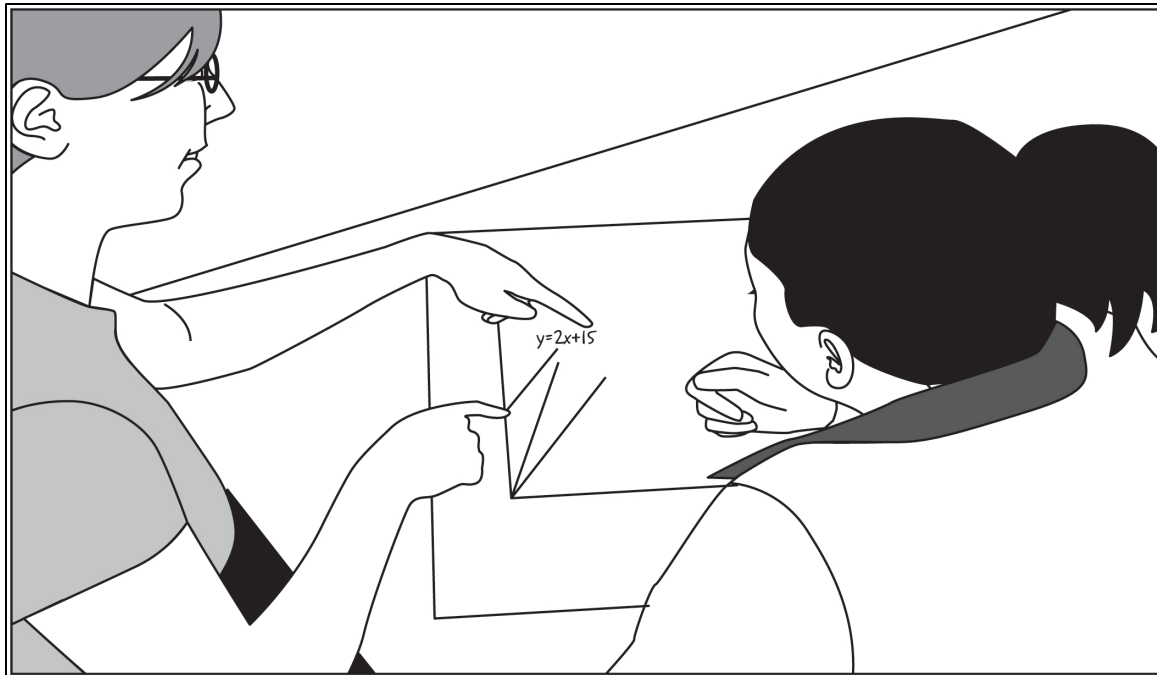


Highlighting

- Making specific phenomena in a complex perceptual field salient by *marking* them
 - “Through these practices structures of relevance in the material environment can be made prominent”, both for self and others (Goodwin, 1994)
- Talk, pointing, other gestures, structure of artifacts and inscriptions
 - *Focusing* phenomena (Lobato, Ellis, & Muñoz, 2003)

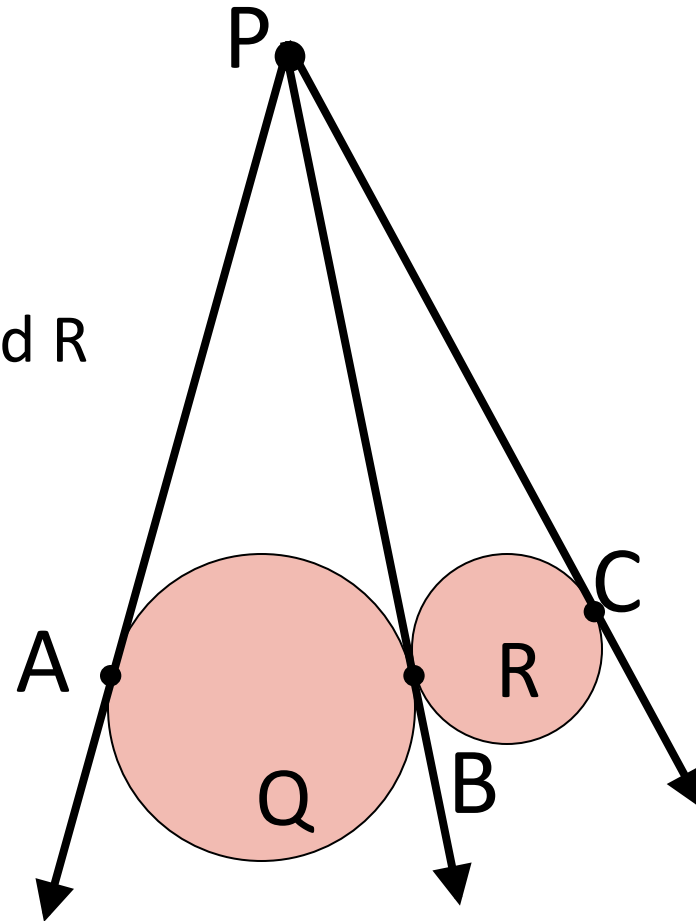
Guide learners' attention

- Instructional gestures guide learners' attention, highlight relevant information (Alibali, Nathan, & Fujimori, 2012)



Learning to “See” in the Classroom

- Example
 - High school geometry
 - Going over homework
 - PB tangent to circles Q and R
 - Prove $PA \cong PB \cong PC$



Watch for

- Highlighting with deictic gestures
- “Anti-highlighting” by covering up what *not* to look at

Highlighting



Gestures link related representations

- Highlight corresponding elements
 - Sequentially or simultaneously
- Express similarity, cohesion



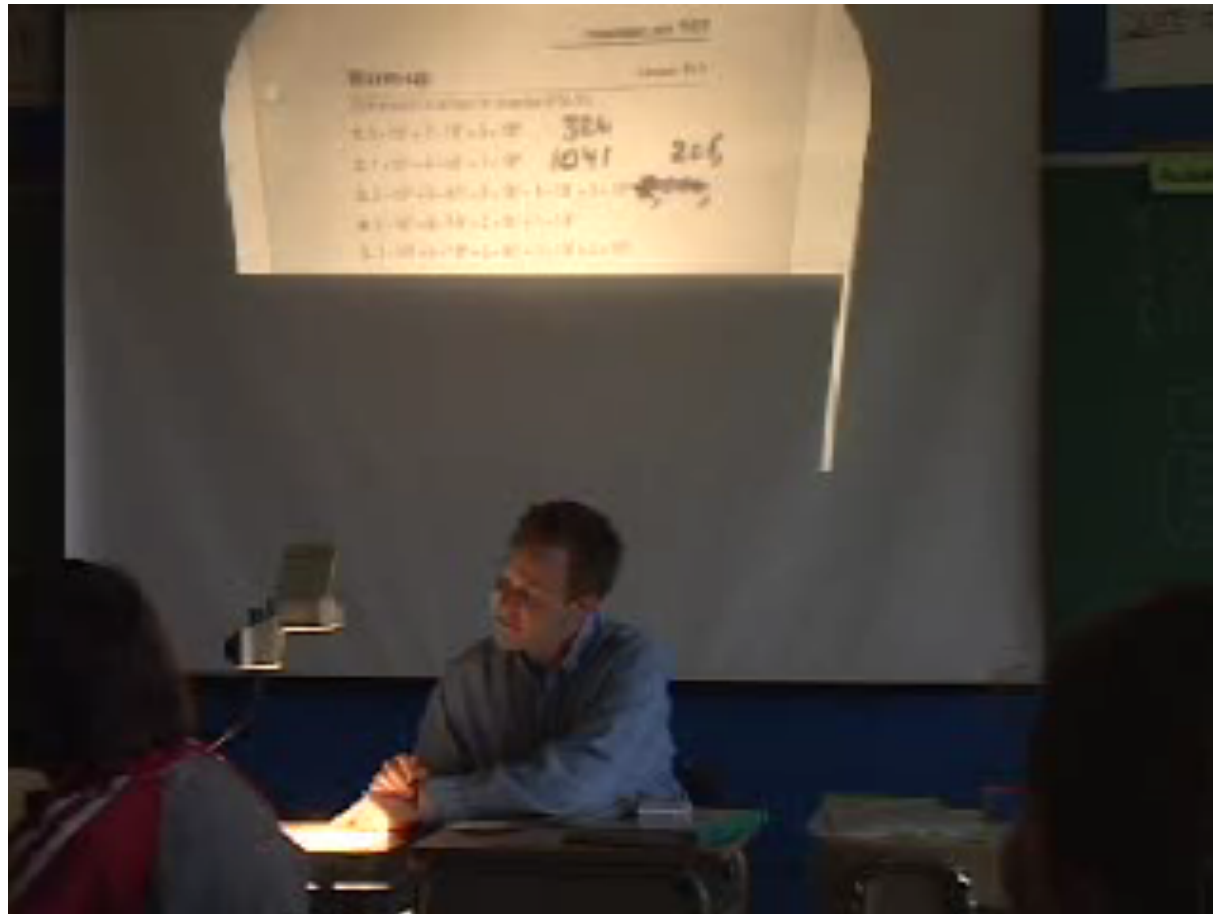
Example Link

- Linked representations
 - Standard notation of a number 206,895
 - Corresponding expanded notation
$$2 * 10^5 + 6 * 10^3 + 8 * 10^2 + 9 * 10^1 + 5 * 10^0$$
- *Element by element* linking
 - Note: 0 place holder for 10^4
- Initially sequential, then simultaneous pointing

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Gestures link related representations



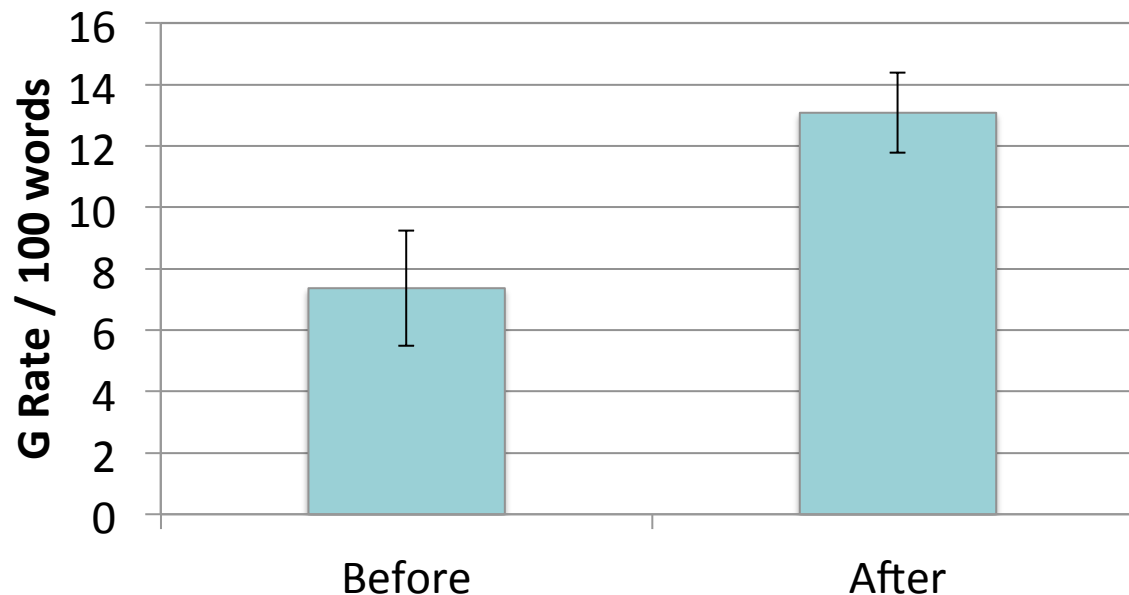
Gestures link related representations

- T's gestures ground complex mathematical language in two inscriptions simultaneously
 - E.g., term “ten to the fifth” is connected both to its explicit written form in expanded notation (10^5) *and* to the hundred thousands place in standard notation

$$2 * 10^5 + 6 * 10^3 + 8 * 10^2 + 9 * 10^1 + 5 * 10^0 \quad 206,895$$

Forging “common ground”

- When classroom communication breaks down, do teachers adjust their use of gesture?
- Quantitative data suggests “yes”

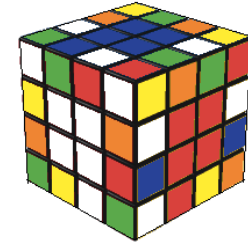




Side Length and Numbers of Cubes

How many cubes total? 3 faces showing? 2 faces showing? 1 face showing? No faces showing?

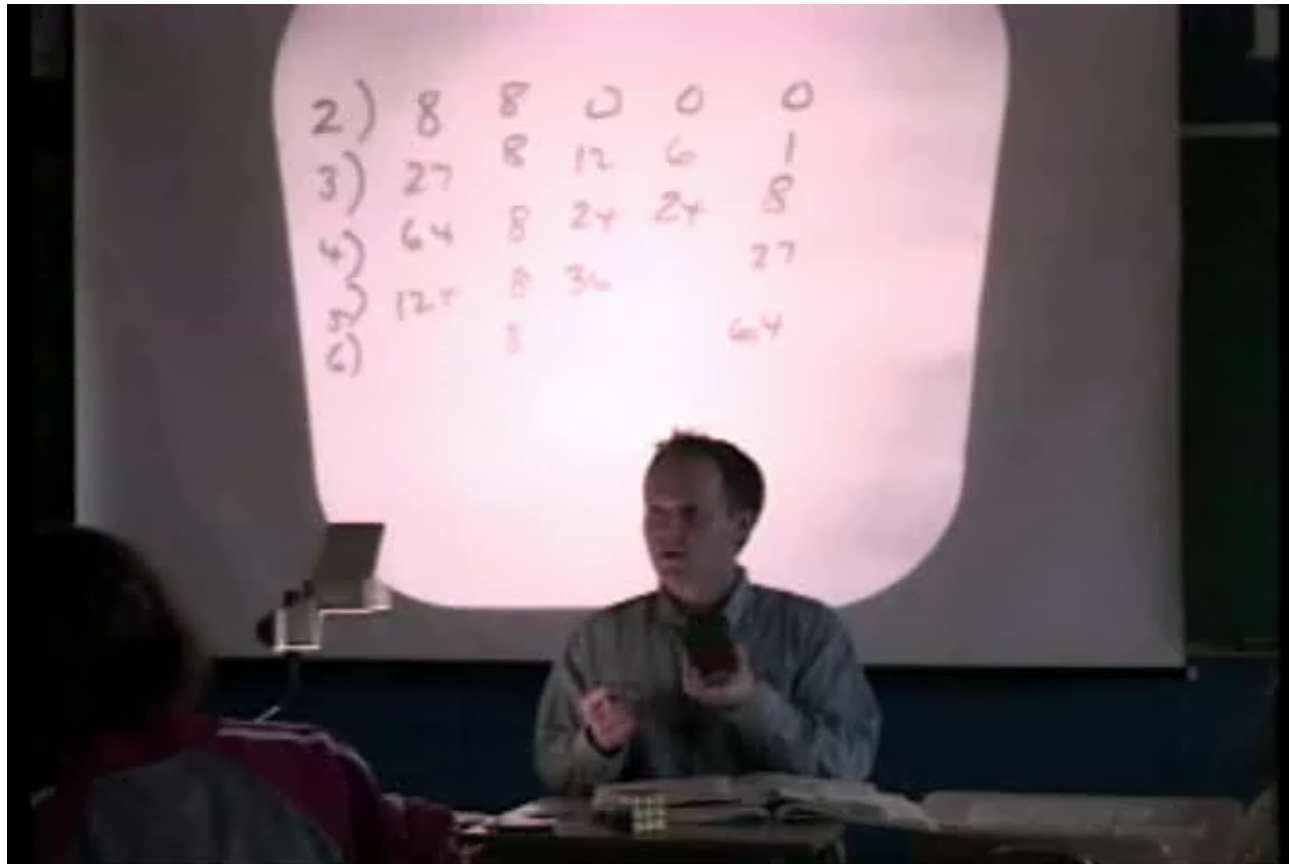
2)	8	8	0	0	0
3)	27	8	12	6	1
4)	64	8	24	24	8
5)	125	8	36	??	27
6)		8			64



Trouble spot

- T holding 4x4 cube
- Q: If we have a 5x5 cube, how many blocks would there be in the middle of the face?
 - Gesture to middle blocks of (hypothetical) 5x5
- *Student answers for 4x4 cube: 4? (trouble spot)*
- Watch for T's elaborated gesture of 5x5 cube, middle blocks

Trouble spot and Response



For discussion. . .

- How can we tell whether gestures help students attend to key information, make links among representations?
- How do gestures foster shared understanding?
- How are gestures integrated with other systems for making meaning?

Thanks to . . .

- Mitchell Nathan
- Breckie Church
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Cognition and Student Learning Program



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