Gesture in Learning and Teaching

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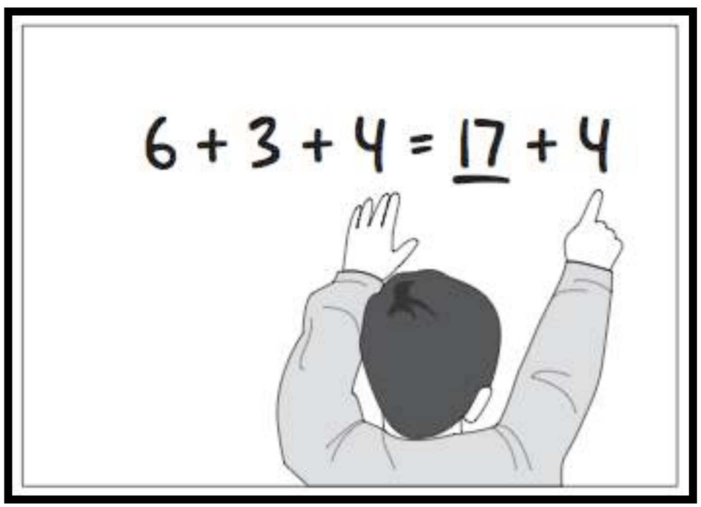
Basics

- 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



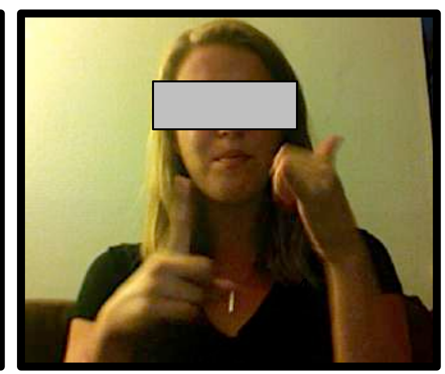
- Not functional actions, self-adaptors, fidgeting

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)

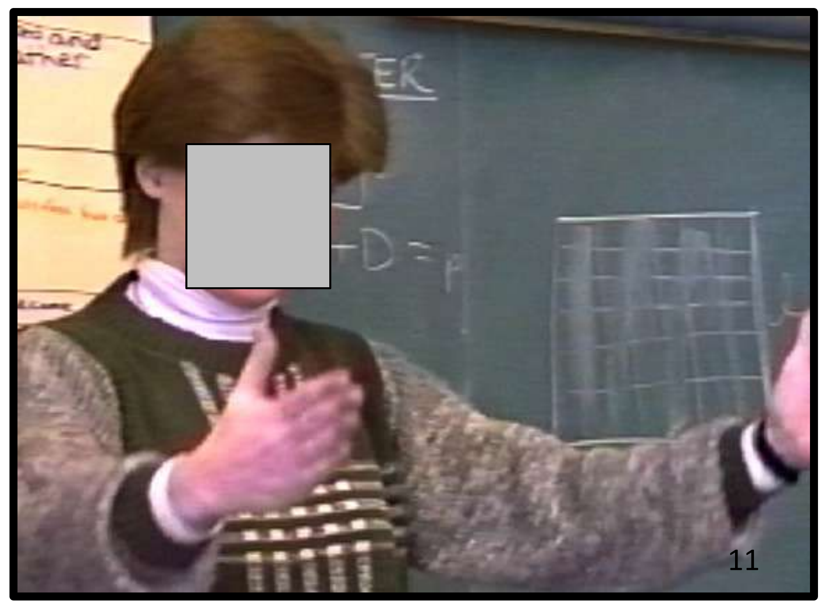
- Points
- Representational gestures
  - Iconics
  - Metaphorics
- Beats
- Interactive gestures (Bavelas , 1992)

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

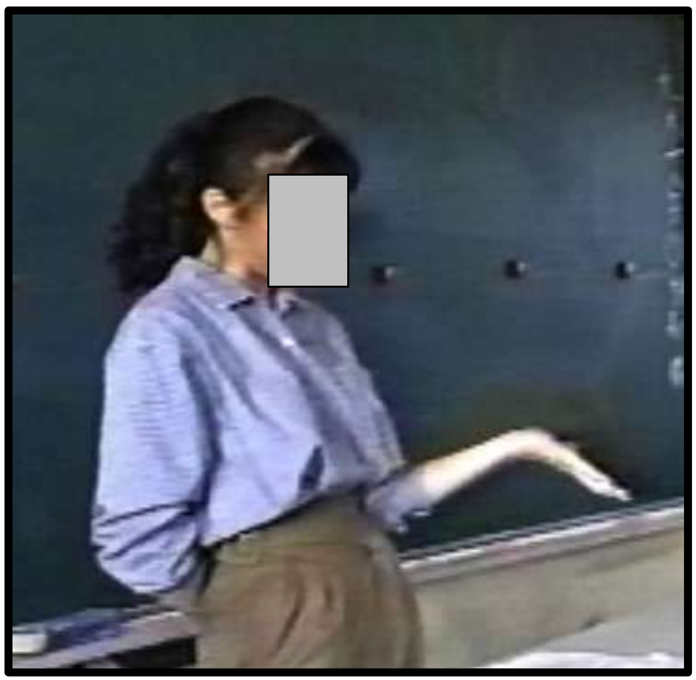


Beats

- 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

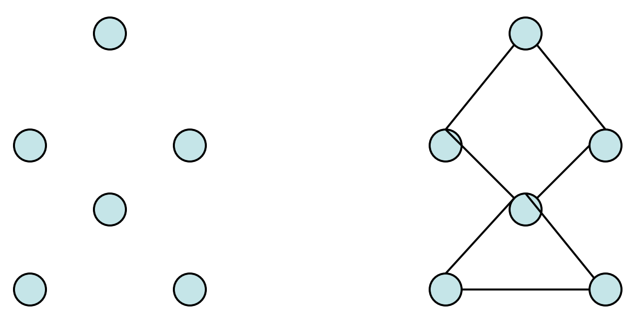
- Speaking
- Thinking
- Communicating

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)

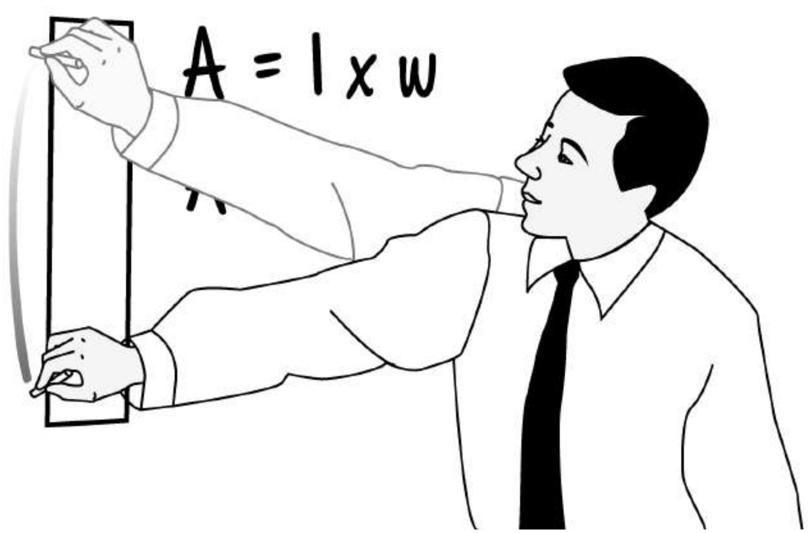
Gesture Function: Speaking

- 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”



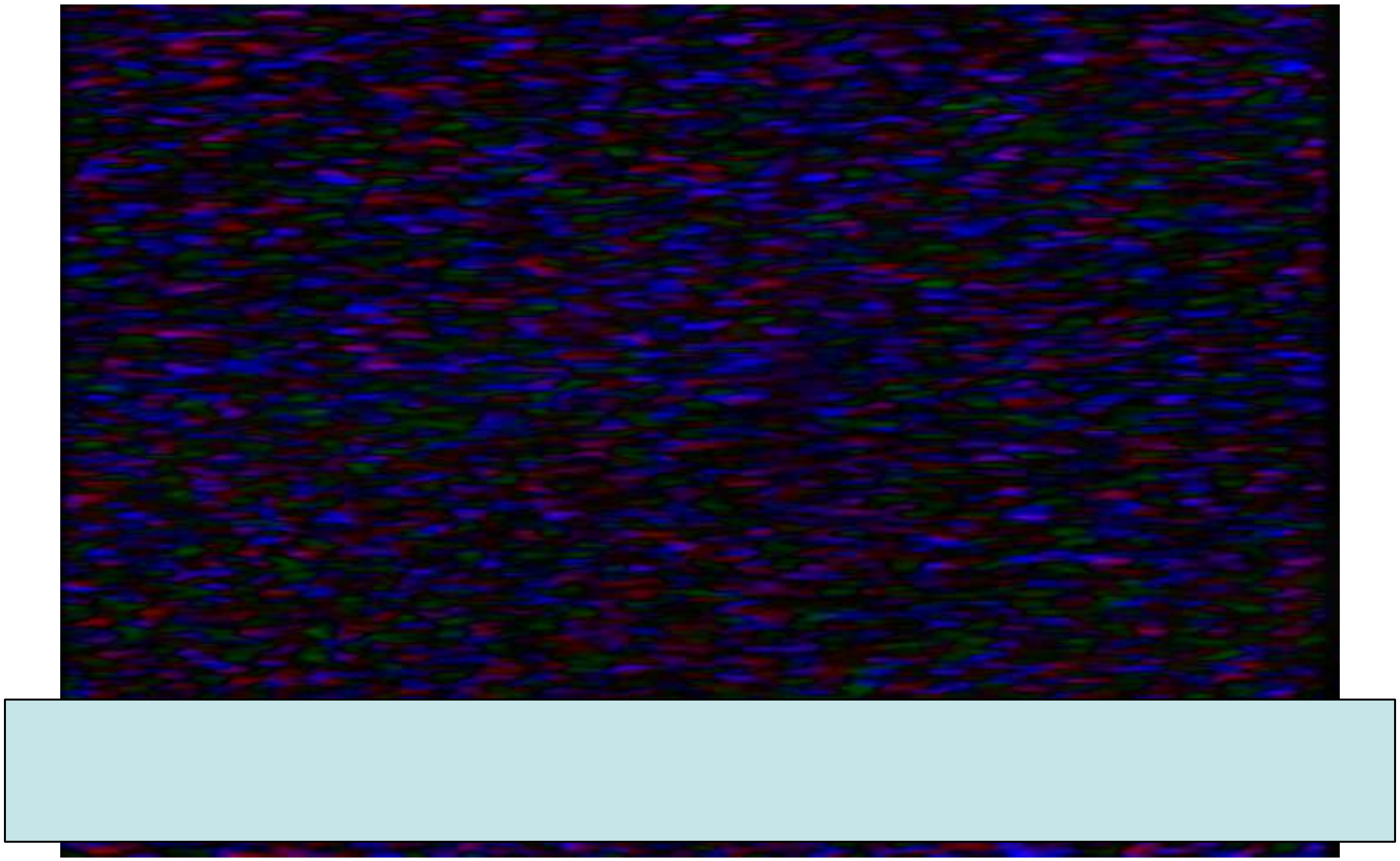
Why do gestures communicate?

- 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

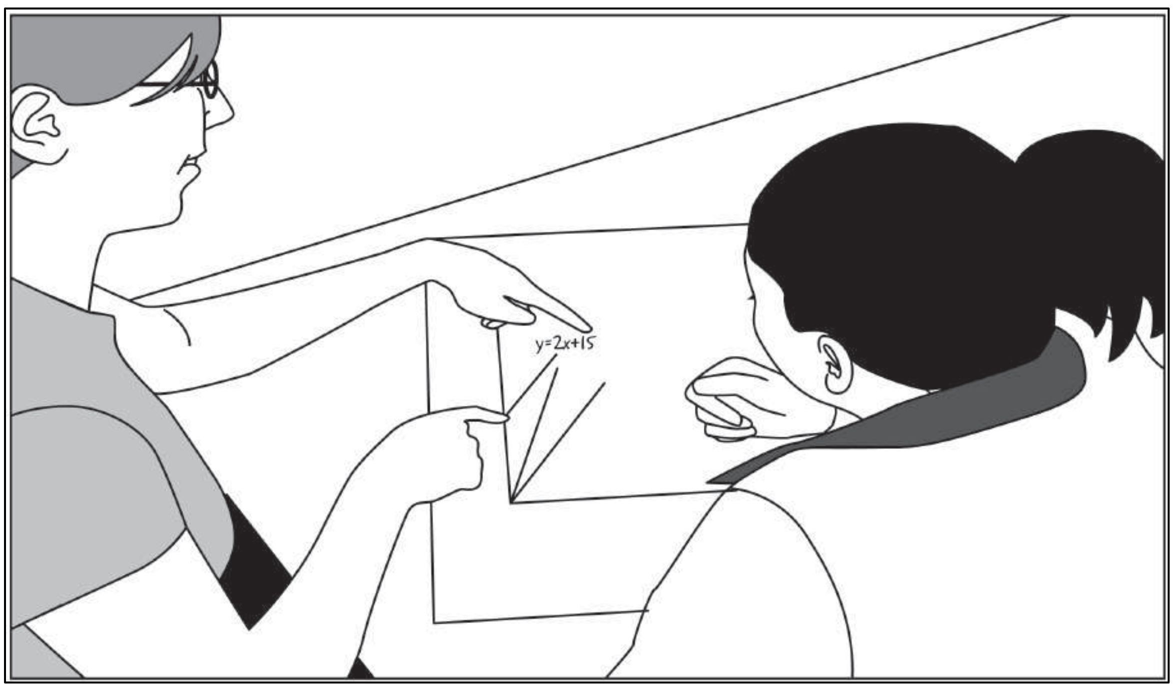
  (Stevens & Hall, 1998)

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)

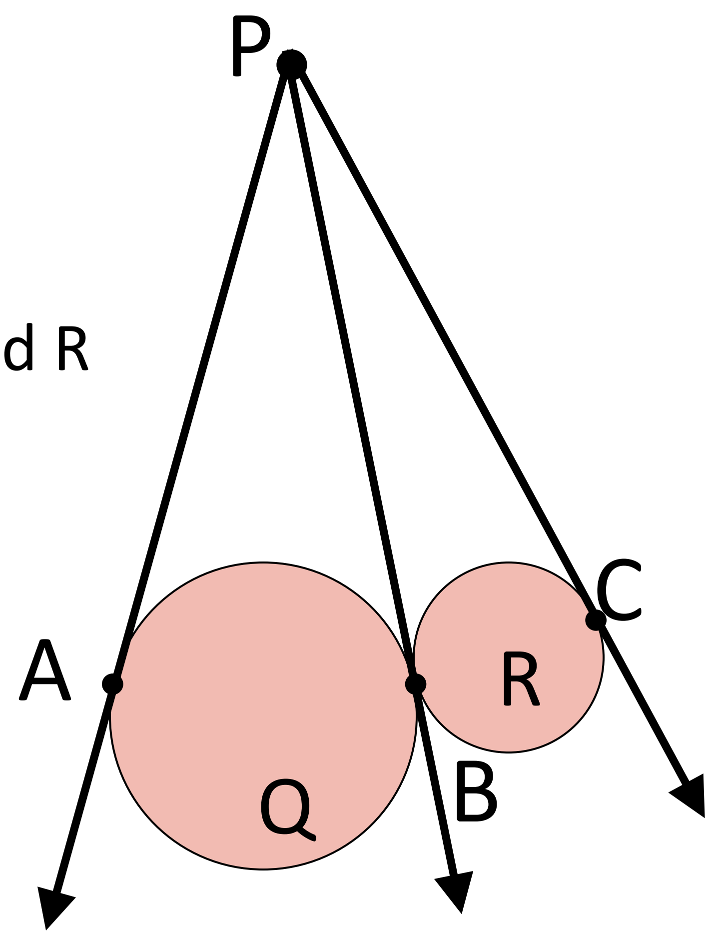
Guide learners' attention

- 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 ≅ PB ≅ 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

Alibali, et al., *Cognition & Instruction,* 2014

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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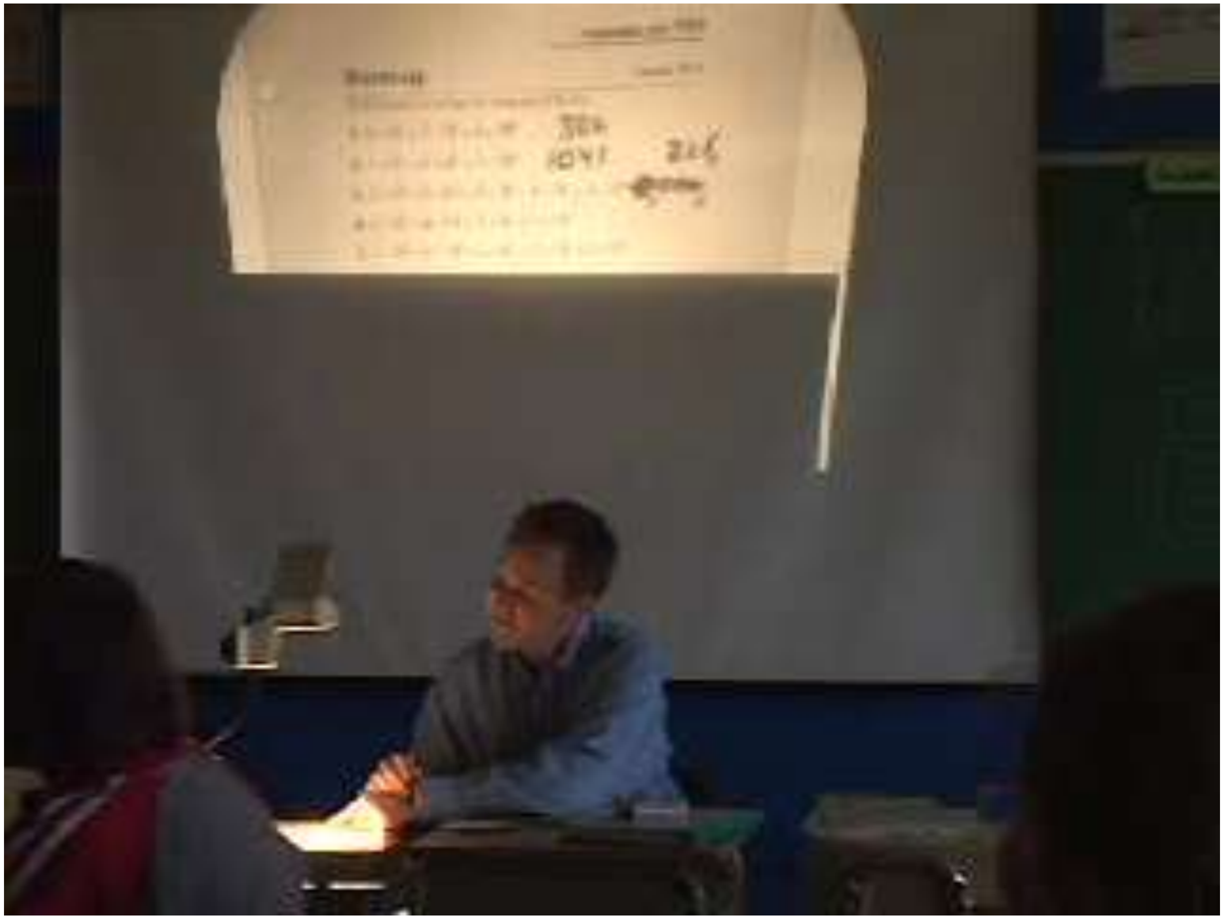
Gestures link related representations



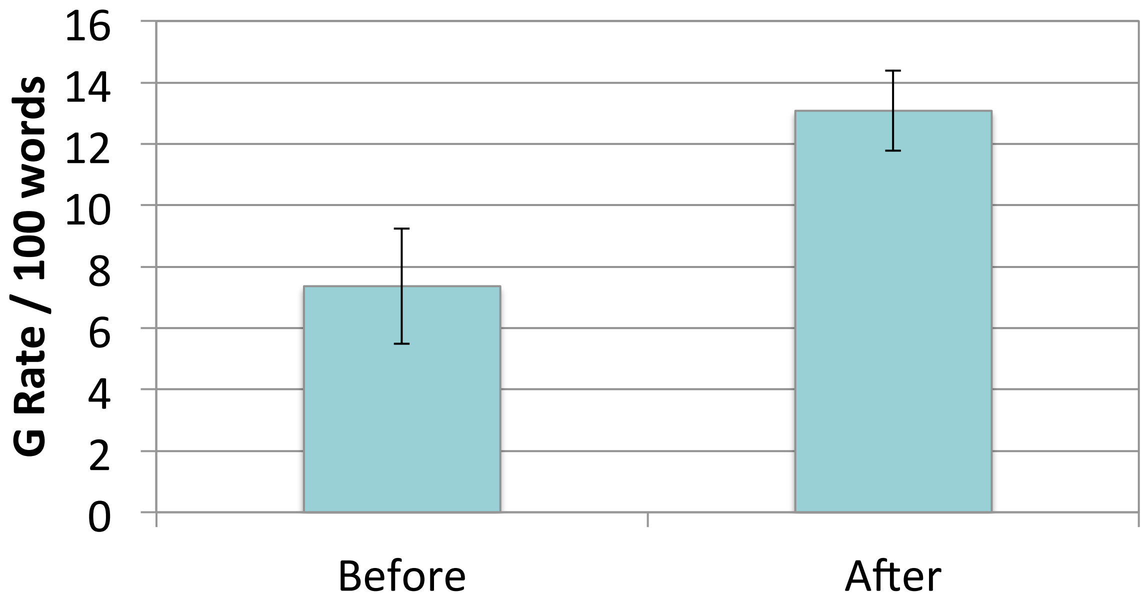
Gestures link related representations

- 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

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

Forging "common ground"

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

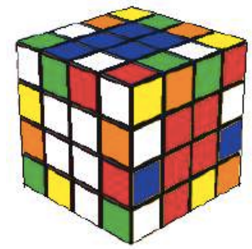


Alibali, et al., *ZDM*, 2013

Side Length and Numbers of Cubes

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

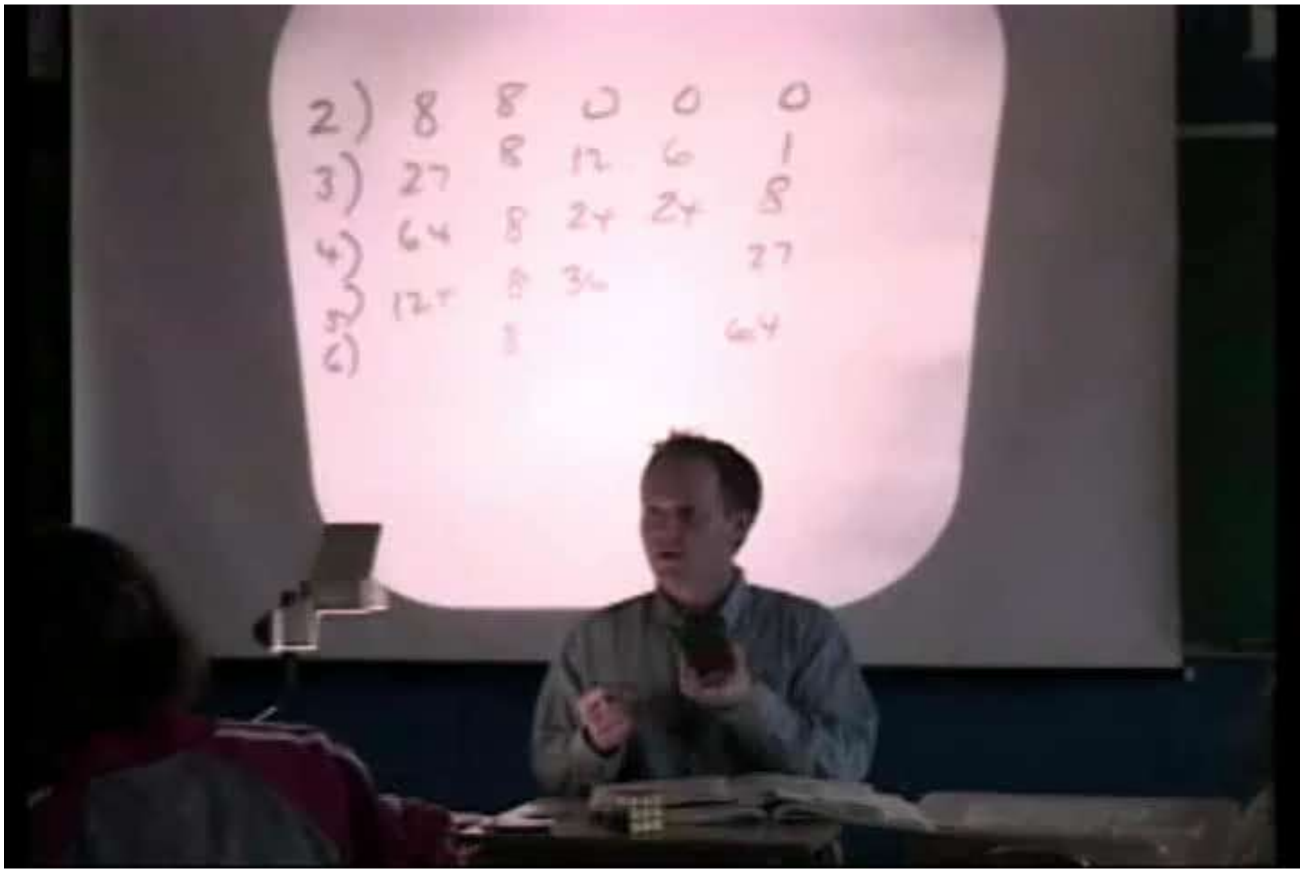
2)	**8**	**8**	**0**	**0**	**0**
3)	**27**	**8**	**12**	**6**	**1**
4)	**64**	**8**	**24**	**24**	**8**
5)	**125**	**8**	**36**	**??**	**27**
6)		**8**			**64**



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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