

# Energy in action: The construction of physics ideas in multiple modes

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# Construction of meaning

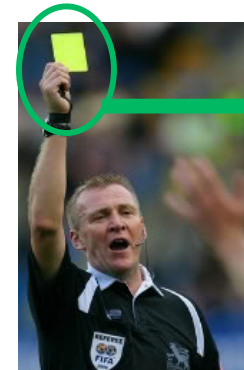
People show what they mean in many ways at the same time



Goodwin  
"Embodiment," 2000

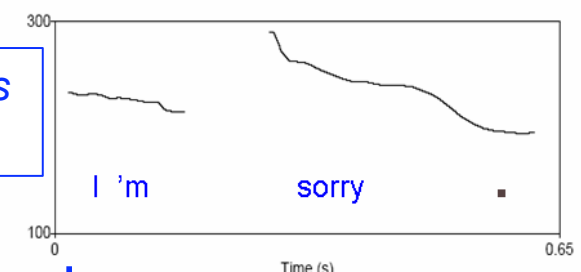
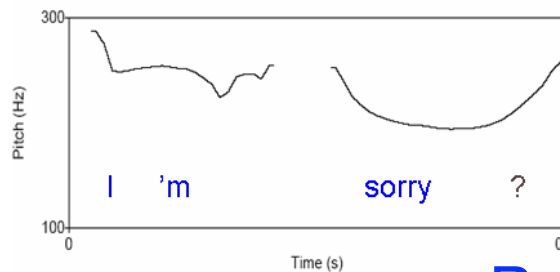


Gesture



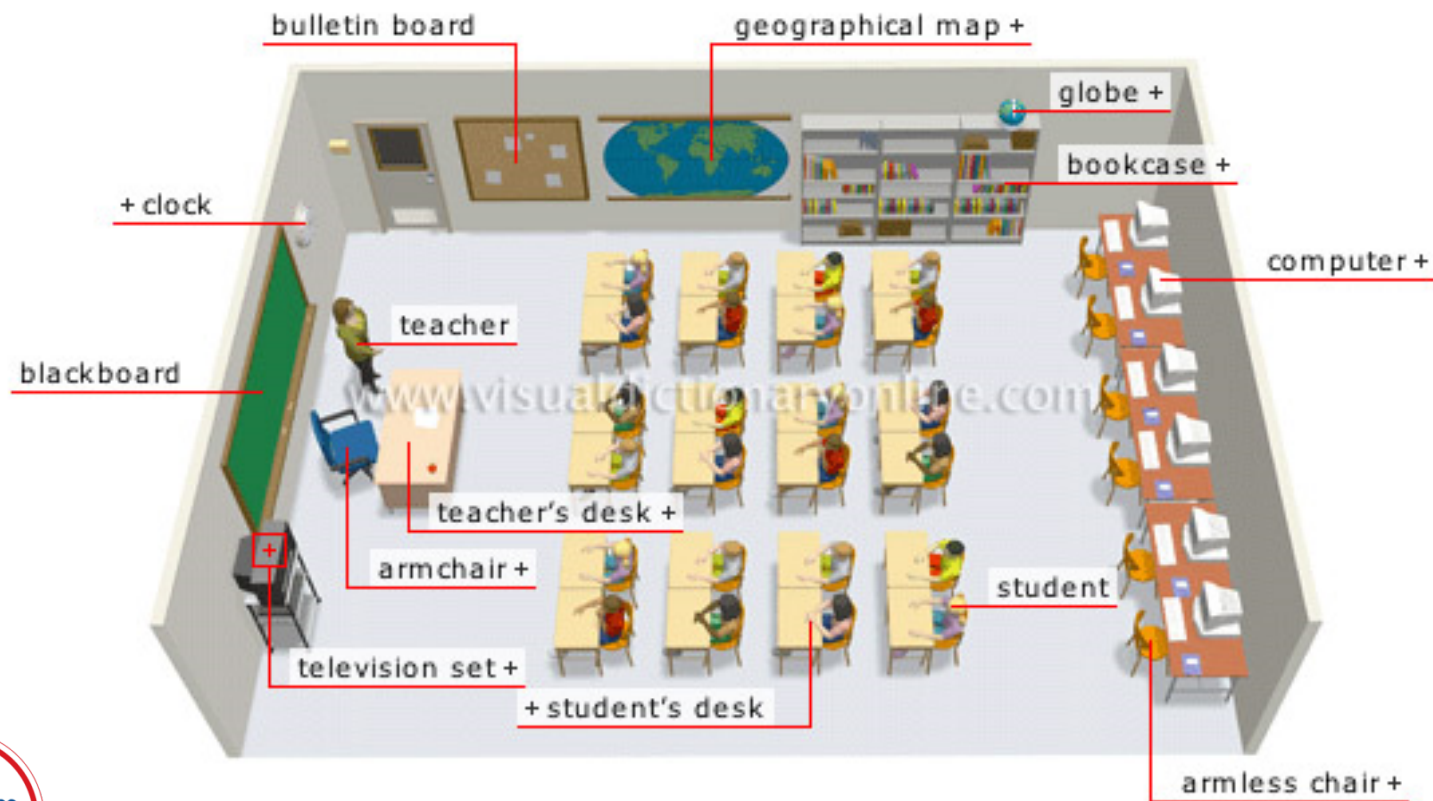
Symbolic objects

Body orientation



Prosody

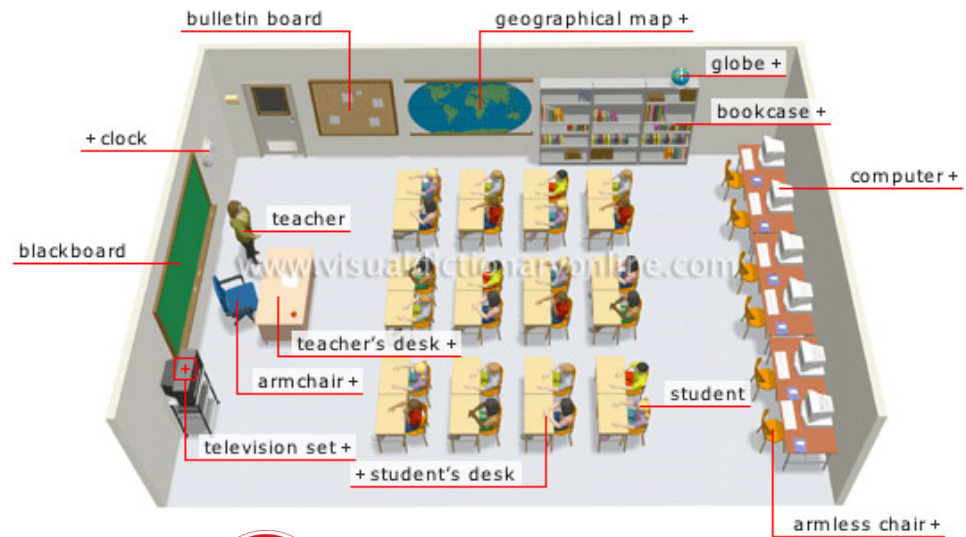
# Traditional classrooms restrict modes of communication



<http://visual.merriam-webster.com/>

# Traditional classrooms

- Restricted communication among learners
  - Few words
  - Limited gestures
  - Fixed body orientation



<http://visual.merriam-webster.com/>

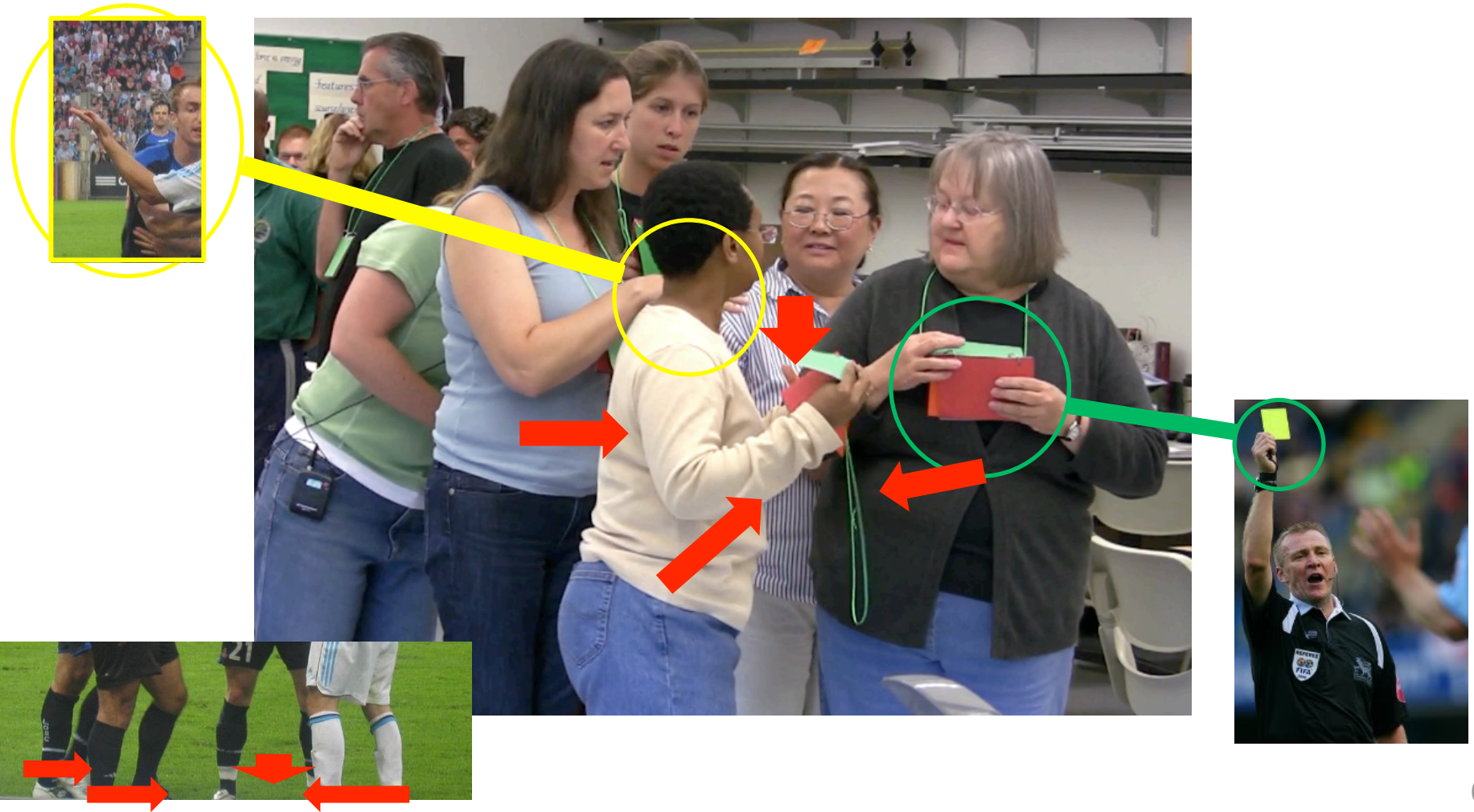
→ Restricted formative assessment

# Tutorial classrooms: Less restrictive, but still limiting

- Communication less restricted
  - More words by students
  - Room for gestures
  - Flexible body orientation
  - Some use of objects
- Words still dominant
- Use of bodies not encouraged



# Energy Theater: lots of modes



# Energy Theater: lots of modes

More ways of showing what you mean

- More ways for students to construct and communicate meaning
- More ways for instructors to assess student understanding



# Show what's going on with the energy

*Scenario:*

**Box shoved suddenly  
across floor.**



- Energy flows from hand to box.
- Energy is transformed from chemical to kinetic.

*Participants:* **Elementary teachers in a summer  
professional development course at SPU**



# (Pseudonyms = shirt colors)



# Look for different ways people are “saying” what they mean

Yellow: Right, we're all the hands  
Blue: We're all the hands  
Yellow: Right  
Green: Okay, so we...



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# Words and what they mean

Words

“As we push, we turn to green...”



- Words indicate what speaker thinks should happen
  - Change from **chemical** to **kinetic**
  - Flip cards to show transformation
- “We” has different meaning in the two parts of the sentence

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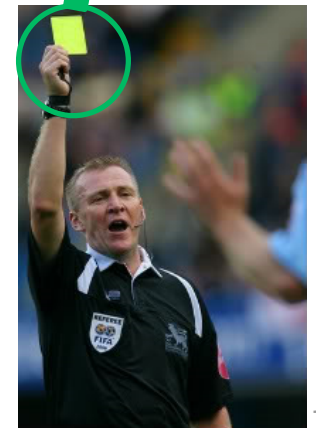
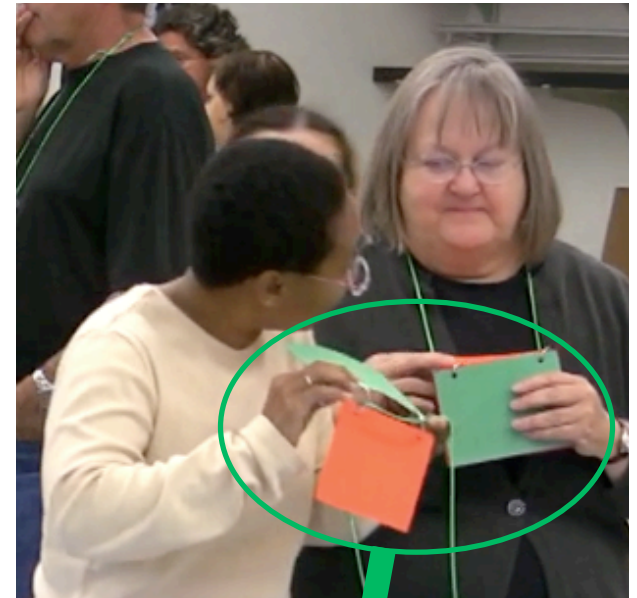
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# Symbolic objects: energy cards

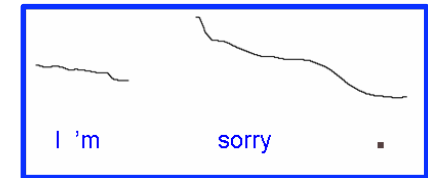
- Participants communicate by:
  - holding their cards up
  - turning from one card to another
  - looking at each others' cards
- Consensus (or lack) is visible
  - to participants
  - to instructors



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# Prosody: rhythm and tone of speech

“As we push, we turn to *gree-eeen...*”



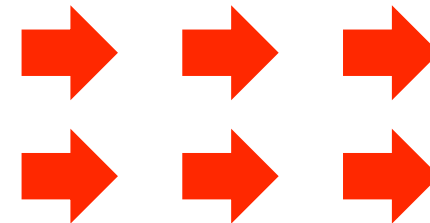
- Stress draws attention
- Contour emphasizes “green” – suggests energy form is the focus
- Length of word:
  - Gives time to respond?
  - Encourages others to follow her lead?



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# Body positions and orientations

Yellow changes her body orientation to hold eye contact with Black → intellectual leadership?



Participants stand in box formation → being the box?

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# Honing our assessment skills

- In Energy Theater, participants are encouraged to say what they mean in many ways at the same time
- All these ways are relevant for assessing the learning taking place – for participants as well as teachers and researchers
- With practice, we can learn to observe and evaluate these ways effectively, in real time