Students reflect their level of understanding through non-verbal backchanneling

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Abstract

We explored the role of non-verbal behaviors that students exhibit in the classroom, with the goal of testing whether NVBs can "leak" information about one's level of understanding. Results showed that head nods and one-hand activity were more prevalent for easier material. Self-adapters were more frequent for difficult material, especially for males. Posture shifts and the overall frequency of NVBs were not informative.

Background

Non-verbal behaviors (NVBs) can communicate information between a sender and receiver (Ekman & Friesen, 1969; Kendon, 2004). In addition, they can provide an indirect or implicit indication of an individual's cognitive state of mind (Argyle, 1988; Goldin-Meadow, 2003; Kendon, 2004; McNeill, 1992, 2005).

In the classroom setting, most research has focused on the role of teachers' gestures that accompany speaking (e.g., Goldin-Meadow, Kim, & Singer, 1999). When student or learner gestures are examined, the focus is typically on active, more equal exchanges between conversation partners (e.g., Gullberg, 2006; Stam & McCafferty, 2008). Few studies have examined **students' gestures** when they are in the **listener role**.

Even when a listener is not communicating vocally, their non-verbal behaviors can provide valuable information to the speaker or other conversation partners. **Backchanneling** cues provided by the listener are typically not dependent on speech for their meaning. Such movements can inform the speaker whether their message is being successfully communicated.
- e.g., head nods or tilts, postural congruence with the speaker, hand gestures, self-adapter gestures, facial expressions
- motor mimicry, interaction synchrony; Bernieri & Rosenthal, 1991; Charney, 1966; Chartrand & Bargh, 1999; Bavelas, Black, Chovil, Lemery, & Mullett, 1988

A few studies have focused on whether teachers and naïve judges are sensitive to students' non-verbal displays and have found that they by in large can detect the relative level of difficulty that students are experiencing (Hrubes & Feldman, 2001; Jecker, Maccoby, & Breitrose, 1964; Machida, 1986; Patterson, Cosgrove, & O'Brien, 1980). However, none of these studies have examined **which** non-verbal displays are informative.

One previous study examined a small sample of students' NVBs in a mock classroom setting (Abassi, Dailey, Afzulpurkar, & Uno, 2008). They found a significant relationship between particular hand gestures and the students' cognitive state. However, a videotape of a teacher was used, and the sample size was very small (4).

The current study examined students' non-verbal behaviors
(a) when they were in a passive listener role, and
(b) in a typical classroom setting.

We also focused on a wide variety of NVBs: head and hand movements, self-adapters, and posture shifts.

Hypotheses

1. Overall frequency of NVBs should be greater for easier material, due to more idle activity (Hrubes & Feldman, 2001).
2. Some types of NVBs are likely to be more informative about one's cognitive state than others.
3. More head moves, idle hand activity, and posture shifts for easier material.
4. More self-adapters (self-touching) for difficult material, indicating a greater level of frustration or discomfort (Heaven & McBrayer, 2000; Mehrabian & Friedman, 1986).

Method

- within-subjects experimental design
- 2 conditions of lecture material
  - **Easy** vs. **Difficult**
  - 2 trials of each level of difficulty
  - designed to affect cognitive state
- 15 participants (10 female; mean age = 21)
- Participants were videotaped in their regular classroom.
  - 4 different camera angles

Materials & Procedure

- 4 descriptions of design flaws
  - chosen by the professor based on past experience
  - from Pelham & Blanton (2007)
1. Participants read a design scenario first.
2. The teacher then lectured for 3 minutes to explain and set up the scenario.
3. Participants then provided possible improvements for each design scenario, one at a time, for 4-5 minutes.
4. The process was repeated for the other 3 scenarios.
   - easy, difficulty, easy, difficult
5. Participants completed a self-report questionnaire assessing perceived difficulty of the class material.

Coding

- Footage was coded for the different NVB types by 2 coders
  - 86% reliability for NVB occurrence
  - 98% reliability for classification
- Annotation and coding of the non-verbal behaviors consisted of
  (a) a physical description, such as "scratching face with fingers," or "tapping pen on desk"
  (b) assignment to a category: one-hand activity, head movement, self-adapter, or posture shift.
- Excluded were periods when a student was talking or engaging in some purposeful hand activity (e.g., writing, drinking something, texting).

Perceived Difficulty of Materials

Summary score of 4 questions, 7 point scale

"Easy" scenarios were perceived as easier.

- Easy 1 was perceived to be significantly harder than Easy 2.
- There were individual differences, with some students reporting little difficulty with the difficult scenarios.
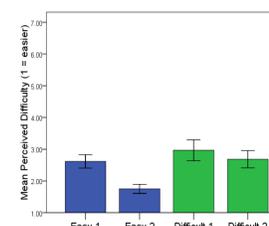

Results

- No effects for overall frequency of non-verbal behaviors, Fs < 1.
- The last scenario showed marginally less activity, interaction, $F (1, 14) = 3.41, p = .09$.
- Trend for more posture shifts as the class went on, $F (1, 14) = 2.92, p = .11$. No other differences for posture shifts, Fs < 1.
- Order of the scenarios had no effect and did not interact with difficulty level, Fs < 1.
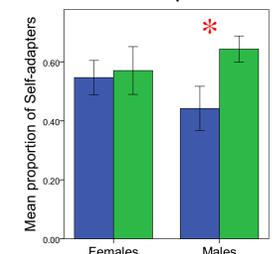 - Figures below sum over order.

Overall Frequency of NVBs
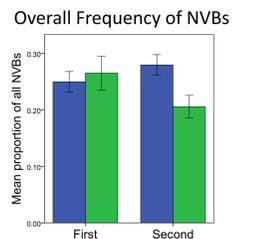
For easier material: More one-hand activity, $t (14) = 2.07, p = .06$. More head nods, $t (14) = 2.66, p = .02$.

For more difficult material: More self-adapters, $t (14) = 1.93, p = .07$, mostly due to males producing more, interaction $F (1, 14) = 4.85, p = .05$.

Head nods
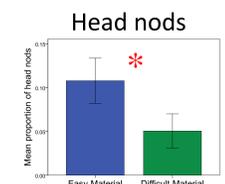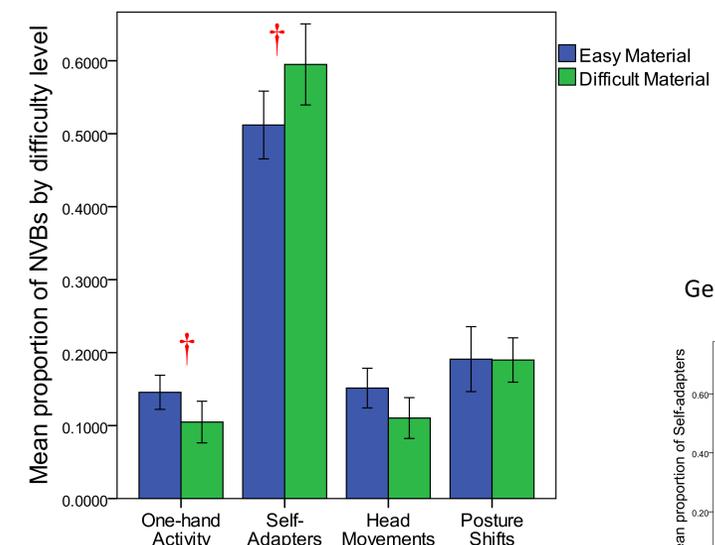
Gender Differences for Self-adapters

Conclusions

1. Overall frequency of non-verbal behaviors, of undifferentiated type, did not vary with level of difficulty.
2. Some types of non-verbal behaviors were more informative about a student's cognitive state of understanding than others.
3. Head movements, particularly head nods, were more prevalent for easier material.
4. Idle one-hand activity, such as pencil flickering or drumming the fingers, was also more prevalent for easier material.
5. Self-adapters were the most common type. They were more prevalent for difficult material, and males exhibited the difference more.

Non-verbal backchanneling such as head and hand movements are relatively easy to perceive peripherally and for many students at once. Therefore, they may be useful for teachers to use as a source of information about students' level of understanding.