The pointing gesture and language learning

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Preverbal communication

1. Dyadic > Triadic
When and how do infants discover that they can communicate with others about the external world?
Origins of the pointing gesture

2. Triadic > Conventional
When and how do infants discover that words can be used to direct attention and regulate interaction?
Gestural and vocal predictors of word learning

Overview

1. Pre-schoolers’ reliance on pointing for reference
2. The origins of the pointing gesture in infancy
3. The relations between pointing, babbling and word learning

Pre-schoolers’ reliance on pointing in referential communication

Learning from repair

• Needing to repair leads to more informative subsequent first attempts (integrating speech and gesture)
• Observing repairs is also effective (but training in a comprehender role is relatively unhelpful)
• 2-year-olds only really learn from repair when set size is small, contrast is maximally obvious and feedback is specific. In more complex settings, they fail to learn
• This kind of feedback exists in the real world!

(Matthews, Lieven & Tomasello, 2007, 2012; Sarilar, Matthews, Küntay, 2013; Carmiol & Matthews, in prep)
The origins of the pointing gesture in infancy

What’s so special about pointing?

• Infants start learning about dyadic communication early
  Trevarthen (1979), Rochat et al. (1999)
• They even start learning about words early (6 months)
  Bergelson & Swingley (2012)
• But pointing is argued to be the first instance of
  Intentional Triadic Communication
  - Communication as action  Woodward (2004)
  - Sets pragmatics foundations for language learning  Tomasello (2008)

Foundations for language

• Effective means of:
  - achieving definite reference
  - eliciting speech from caregiver
• Predictor of later vocabulary (Colonnese et al, 2010)
• When used in combination with words, precursor of
  combinatorial speech  (Iverson & Goldin Meadow, 2005)
• Forms the basis of the topic-comment structure of
  language  (Balco, 1976)

Pointing as a complex behaviour

Multiple components:

1. **Motoric** - extending the arm and index finger in the
   direction of object of interest (palm down or vertical, other fingers curled back)
2. **Motivational** – want to engage an interlocutor
   (imperative or declarative motivation)
3. **Social-cognitive** – need to understand that pointing will
   direct the attention of another

Socialization

• Bates et al. (1975) Declarative pointing emerges when
  two lines of development converge:
  - Contemplating objects
  - Engaging with a caregiver
• Infant begins to point at objects they are contemplating >
  elicits a response > infant learns to point for
  communicative purposes
• Rests on evidence of early solitary pointing (Carpendale &
  Carependale, 2010. Also: Brune & Woodward, 2007; Delgado, Gomez, &
  Samia, 2009; Desrochers, Morissette, & Ricard, 1995; Gomez, 2007;
  Lempert & Kinbowme, 1995; Masur, 1983; Schafter, 1984; Werner &
  Kaplan, 1963)

Imitation

• Cochet & Vauclair (2010) Infants observe others pointing
  with communicative intent and, when they have the same
  goal, imitate this means of directing attention
• This is plausible since:
  - Infants recognise pointing gestures by 8 months
    (Gredebach, Melinder & Daum, 2010)
  - Caregivers tend to increase their rating of pointing just
    before the onset of their own infant’s points  (Looij et al., 1993)
  - Caregivers produce salient pointing gestures  (Murphy &
    Meeseer, 1977)
Spontaneous onset

- Butterworth (2003) Pointing ‘develops spontaneously given the appropriate social context rather than being taught or otherwise socially transmitted to the infant’
- Key precursors are proposed to be:
  - Ability to follow gaze (‘geometric’ gaze following)
  - Pincer grip

Tomasello, Carpenter & Liszkowski (2007)

Prerequisites:
- Means end reasoning
- Understanding others as having intentions about attention
- Proficiency in engaging in joint attention
- Motivation to share and help

Origins of the pointing gesture

No learning Learning

1. Spontaneous onset
   Given:
   - Easiest to falsify
   - Infant pointing should not be affected if experimentally manipulate exposure to pointing

2. Socialization
   Infant points for contemplation > caregivers respond > infant learns to point communicatively

3. Imitation
   Infant observes others pointing, understands means-end, and imitates when has same goal

Training study

- N = 102 infants aged 9-11 months

- Training condition: Parents spent 15 minutes each day for a month engaged in pointing activities with infant

- Control condition: Parents spent 15 minutes each day for a month engaged in musical activities

Test of declarative pointing

Coding pointing gestures

- Each pointing gesture was coded for whether it was:
  - with an index finger or open hand
  - with gaze checking of the interlocutor
  - with the right or the left hand
  - accompanied by vocalization

- Free play sessions coded for:
  - maternal pointing
Outcome measures

**Ability**: Whether the infant pointed at least once on visit 3
- with index finger
- with open hand
- while gaze checking (regardless of posture)

**Frequency**: How often the infant pointed on visit 3
- with index finger
- with open hand
- while gaze checking (regardless of posture)

Questions

Is ability and/or frequency affected by:
- experimental condition?
- rate of maternal pointing in free play?
- gaze following ability?

Ability to point: Condition

<table>
<thead>
<tr>
<th>Type of pointing</th>
<th>Effects on onset</th>
<th>Effects on frequency</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Training</td>
<td>Maternal rate</td>
</tr>
<tr>
<td>Index finger</td>
<td>✔️</td>
<td>✔️</td>
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<tr>
<td>Open hand</td>
<td>✔️</td>
<td>✔️</td>
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<tr>
<td>Gaze check</td>
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Matthews, Behne, Lieven & Tomasello, 2012, Developmental Science

Handedness, gender & vocalisations

- Index finger pointing: Mean Handedness Index was higher for males (0.558) than females (0.406).
- Open hand pointing: Mean Handedness Index was higher for males (0.411) than females (MHI: 0.186)
- Infants were generally silent when pointing. 19% of open handed and 29% of index finger points were accompanied by a vocalization….
  ….. yet they did vocalise

What does this tell us about the transition to triadic and to conventional communication?

The relations between pointing, babbling and early word learning
Pointing, babbling and the lexicon

1. Do children who learn to point early also babble early?
   - Proposal that early gestural and verbal communication reflect a shared underlying construct indicative of the communicative maturity of the infant (Bates & Dick, 2002)

2. Is either babble or pointing a better predictor of individual differences in early word learning?

Longitudinal study of individual differences

- 46 infants videoed from 9-18 months at home for 30 mins at least once a month (from Vihman dataset)
- Re-analyzed data to answer 4 questions:
  - Are early pointers early babblers?
  - How do pointing and babbling combine to predict onset of word production (4 word point)
  - word production at 18 months
  - word comprehension at 18 months

Measures

- Videos coded month of onset of:
  - index finger pointing
  - babble
  - production of 4 words
- Parents reported receptive & expressive vocabulary at 18 months
- Questionnaire measured maternal education

Findings

- Babble and pointing onset are not correlated
- Babble alone predicts 4 word point
- Pointing and maternal education predict 18 month word comprehension (babble borderline)
- Babble and maternal education predict 18 month word production (pointing borderline)

Conclusions

- Timing matters: pointing onset is a strong predictor of word learning around 18 months
- Cascading set of predictors for the development of each communicative behaviour
- Answers to the questions of how infants make the shift to triadic and convention communication, need to take both gestures and vocalisations into account
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