

## 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



(Matthews, Lieven & Tomasello, 2007, 2012; Sarilar, Matthews, Kuntay, 2013; Carmiol & Matthews, in prep)

## 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, Kuntay, 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 (Colonnesi 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 (Bates, 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, & Sarria, 2009; Desrochers, Morisette, & Ricard, 1995; Gomez, 2007; Lempert & Kinsbourne, 1985; Masur, 1983; Schaffer, 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 (Gredeback, Melinder & Daum, 2010)
  - Caregivers tend to increase their rating of pointing just before the onset of their own infant's points (Lock et al., 1990)
  - Caregivers produce salient pointing gestures (Murphy & Messer, 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



## Spontaneous onset

- 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

#### 1. Spontaneous onset

Given the evidence, the easiest to falsify > Infant pointing should not be affected if experimentally manipulate exposure to pointing

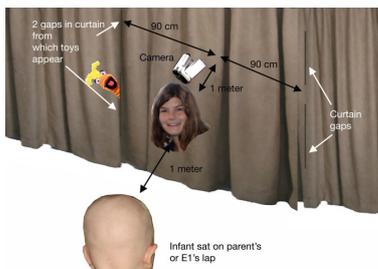
### Learning

- 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

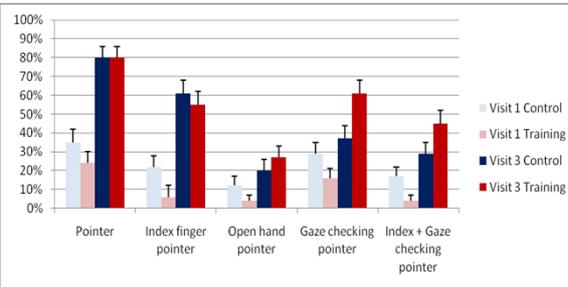
- with index finger
- with open hand
- while gaze checking (regardless of posture)

## Questions

Is **ability** and/or **frequency** affected by:

- experimental **condition**?
- rate of **maternal pointing** in free play?
- **gaze following ability**?

## Ability to point: Condition



Type of pointing	Effects on onset			Effects on frequency		
	Training	Maternal rate	Gaze follow	Training	Maternal rate	Gaze follow
Index finger			✓		✓	✓
Open hand		✓			✓	
Gaze check	✓	✓		✓	✓	

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

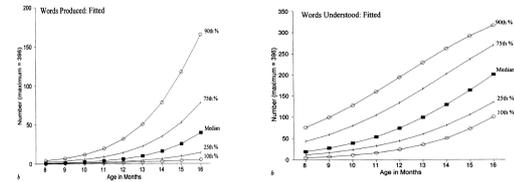
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CAT	SET	PART	BOY	WEAR	MY	GO	
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## Pointing, babbling and the lexicon

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

## Predicting individual differences in vocab



Countless studies explain about 30% of variance!

## 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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