



# How do preschoolers express cause in gesture and speech?

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## INTRODUCTION

- Gesture and speech are complementary components of an integrated system (McNeill, 1992).
- Children's early gestures complement and preview information that will later occur in speech (Butcher & Goldin-Meadow, 2000; Iverson & Goldin-Meadow, 2005; Özçaliskan & Goldin-Meadow, 2005, 2009).
- Previous research suggests that children also produce gestures to demonstrate their knowledge about a cognitive task (e.g., Piagetian conservation, math problems, counting, and the Tower of Hanoi problem; Alibali & Goldin-Meadow, 1993; Ehrlich, Levine, & Goldin-Meadow, 2006).

### Our study:

- Although preschoolers' causal understanding has been the target of many studies (e.g., Bullock & Gelman, 1979; Bullock, 1985; das Gupta & Bryant, 1989; Gopnik & Shulz, 2007; Gopnik & Sobel, 2000), children's causal descriptions have not been assessed in speech and gesture modalities (for causal descriptions in motion events see Furman, Özyürek, & Allen, 2006).
- This study explores the relationship between speech and gesture in children's expression of a direct causal event they have just witnessed.

## RESEARCH QUESTIONS

- How do children describe a causal event in speech?  
Hypothesis: Older children will be more likely to use causal sentences compared to younger ones.
- Do children's gestures complement and/or supplement speech in describing causal events?  
Hypothesis: Younger children will use more gestures than older children to complement/supplement their speech.
- Which components of causal events children describe in speech and/or gesture?

## METHOD

### Participants

- 64 monolingual English-speaking children balanced for gender separated evenly into four age groups:
  - 2.5-year-olds (M= 32.91 mo., SD= 1.71 mo.)
  - 3-year-olds (M= 39.91 mo., SD= 2.40 mo.)
  - 4-year-olds (M= 52.76 mo., SD= 4.36 mo.)
  - 5-year-olds (M= 65.16 mo., SD= 4.19 mo.)

### Materials and Procedure

- The experimenter used a stick to push an object (either a ball or a ring) across a pool of water (see Figure 1).
- Children were asked to describe the causal event.

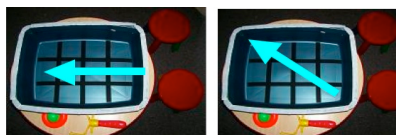


Figure 1. Experimental procedure and the directions used in test trials.

## Coding

### Speech

- Causal verbs (e.g., make, push, hit) and non-causal verbs (e.g., go, float) were coded
- Speech-only expressions were divided into components: *agent* (i.e., you), *patient* (the ball or the ring), *instrument* (i.e., the stick), nonobligatory components: the *location* (e.g., there, here, other side) and *direction* (i.e., this way, across here).

### Gesture

#### Type of gesture:

- *Pointing:* showing an object or location
- *Representational:* indicating attributes or actions of an object's direction (e.g., moving the hand away from self in a diagonal direction).
- *Gesture categories* (Özçaliskan & Goldin-Meadow, 2005, 2009):
  - *Complementary gestures:* gesture and speech conveyed same information (e.g., pointing at the ball while saying "ball")
  - *Supplementary gestures:* gesture added information to speech (e.g., holding a stick gesture while saying "when you pushed it")
  - *Gesture only expressions:* gesture produced without speech
- For each category, gesture referents were coded: *agent* (i.e., you), *patient* (i.e., the ball or the ring), *instrument* (i.e., stick), *location* (i.e., endpoint), or *direction* (i.e., the vector of the movement).

## RESULTS

### How do children describe a causal event in speech?

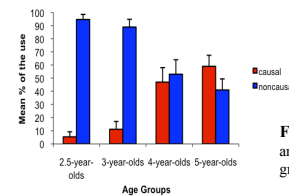


Figure 2. Children's use of causal and non-causal verbs in each age group.

- As children age, they described the causal events in causal sentences ( $p < .01$ ).

	Causal	Non-Causal
<b>Younger Children (n=32)</b>	5	27
<b>Older Children (n=32)</b>	22	10

Table 1. The number of children who used causal and non-causal sentences in their descriptions.

### Do children's gestures complement and/or supplement speech in describing causal events?

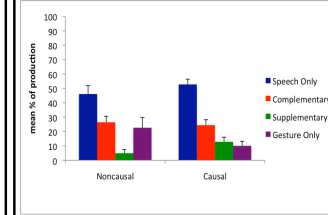


Figure 3. Children's use of speech, gesture, and speech-gesture combinations in non-causal and causal sentences

- **In causal sentences:** Regardless of age children used more complementary gestures compared to supplementary gestures and gesture only expressions ( $p = .024$ ).
- Contrary to the hypothesis, younger and older children produced equal amounts of gestures.
- In general, children used more pointing gestures compared to representational gestures ( $p < .05$ ). Only the instrument and direction were produced as representational gestures.

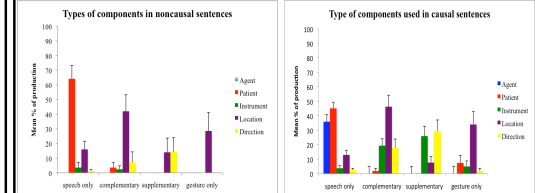


Figure 4. Children's use of agent, patient, instrument, location, and direction in non-causal and causal sentences across age groups

- **In non-causal sentences:** younger children mostly used "location" gestures. The patient of the causal sentence "the ball" was used as the agent of non-causal sentences.
- **In causal sentences:** direction and instrument were used significantly more as supplementary to speech compared to other types of gestures ( $p < .05$ ). Location was produced as complementary to speech more than other types ( $p < .05$ ).

## DISCUSSION

- This study examined children's verbal and gestural expressions for causal events. Results indicated that only older preschoolers frequently produced causal sentences to describe a causal event.
- Children's gestures facilitate their causal descriptions: in half of their expressions, children use at least one form of gestures (complementary, supplementary or gesture-only). The instrument and spatial components (location and direction) appear mostly in gestural modality.
- By forming a coherent system with language (McNeill, 1992), this study suggests that children's gestures might signal upcoming changes in speech for causal descriptions.