

Questions

- Can children use **external spatial timelines** to represent deictic (past/future) and sequential temporal relations?
- Do children make **implicit co-speech gestures** when talking about time?
- Are these phenomena correlated?

Background

English-speaking adults often associate leftward space and past/earlier events, and rightward space with future/later events. This model of time is expressed in conventional left-to-right (LTR) timelines and is also reflected in adults' implicit use of temporal gestures when talking about time. For instance, adults point leftward to refer to the past, and rightward to the future (1,2). However, it is unknown how or when comprehension of external timelines emerges, or whether children produce spontaneous temporal gestures.

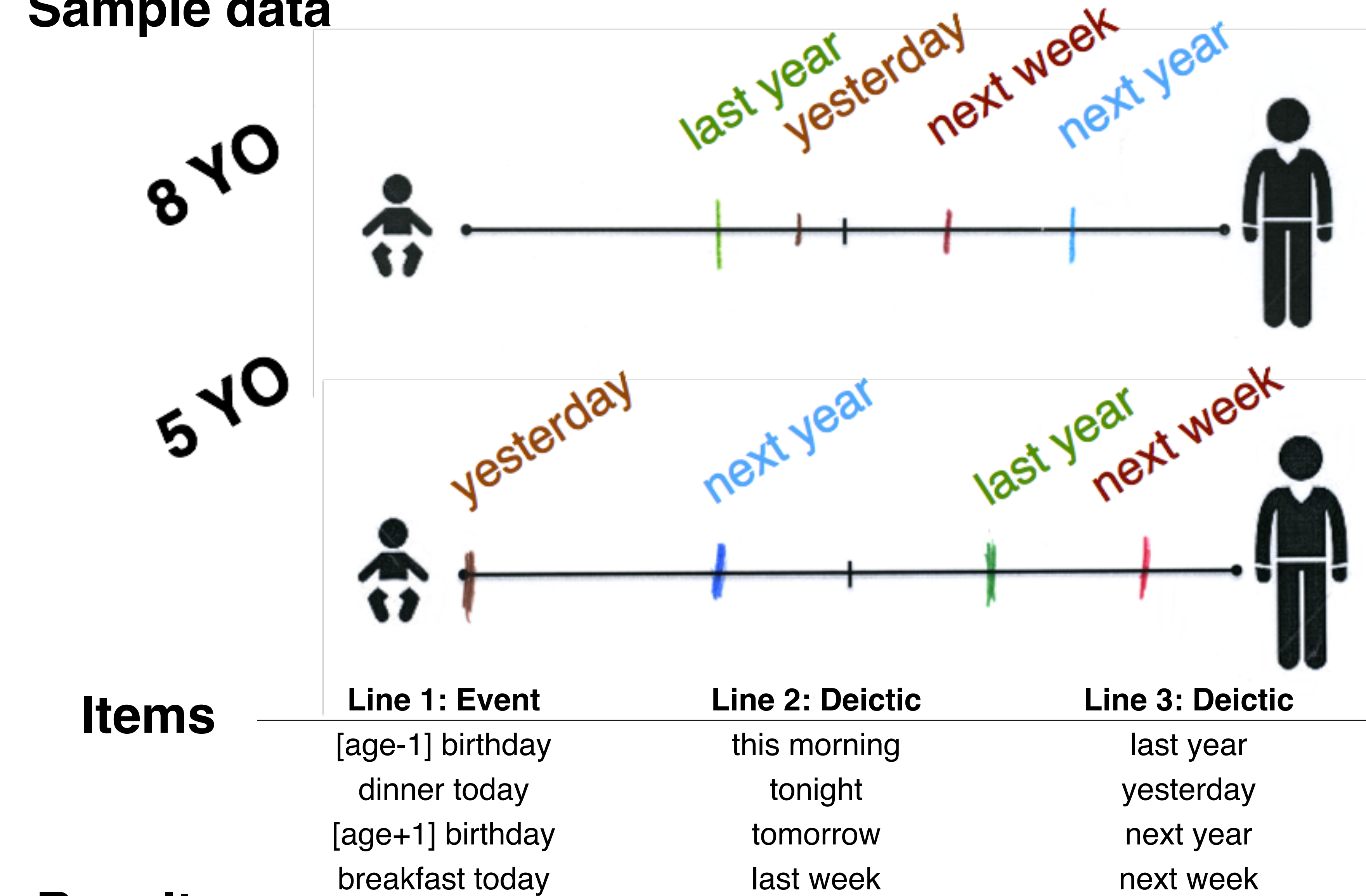
Timelines and gesture can be used to express both sequential (before/after) and deictic (past/future) time. Prior work has shown that preschool children can use spatial artifacts to depict the temporal order of past events (3,4), while older children can do so with future events and time words (5). However, the templates used were not conventional LTR timelines, and could not separately measure representation of deictic and sequential time.

Here we assess (1) children's ability to represent deictic and sequential temporal on a continuous, bidirectional, LTR timeline and (2) their production of conventional temporal gestures when talking about time.

Timeline: Methods & Results

Timeline task. Adults (n=36) and 3- to 8-year-old children (n=90) used colored pencils to mark the locations of events and deictic time words, relative to the midpoint "now," on timelines extending from the past ("when you were a baby") to the future ("when you'll be a grown-up").

Sample data



Results

Fig 1A. 1-back sequence

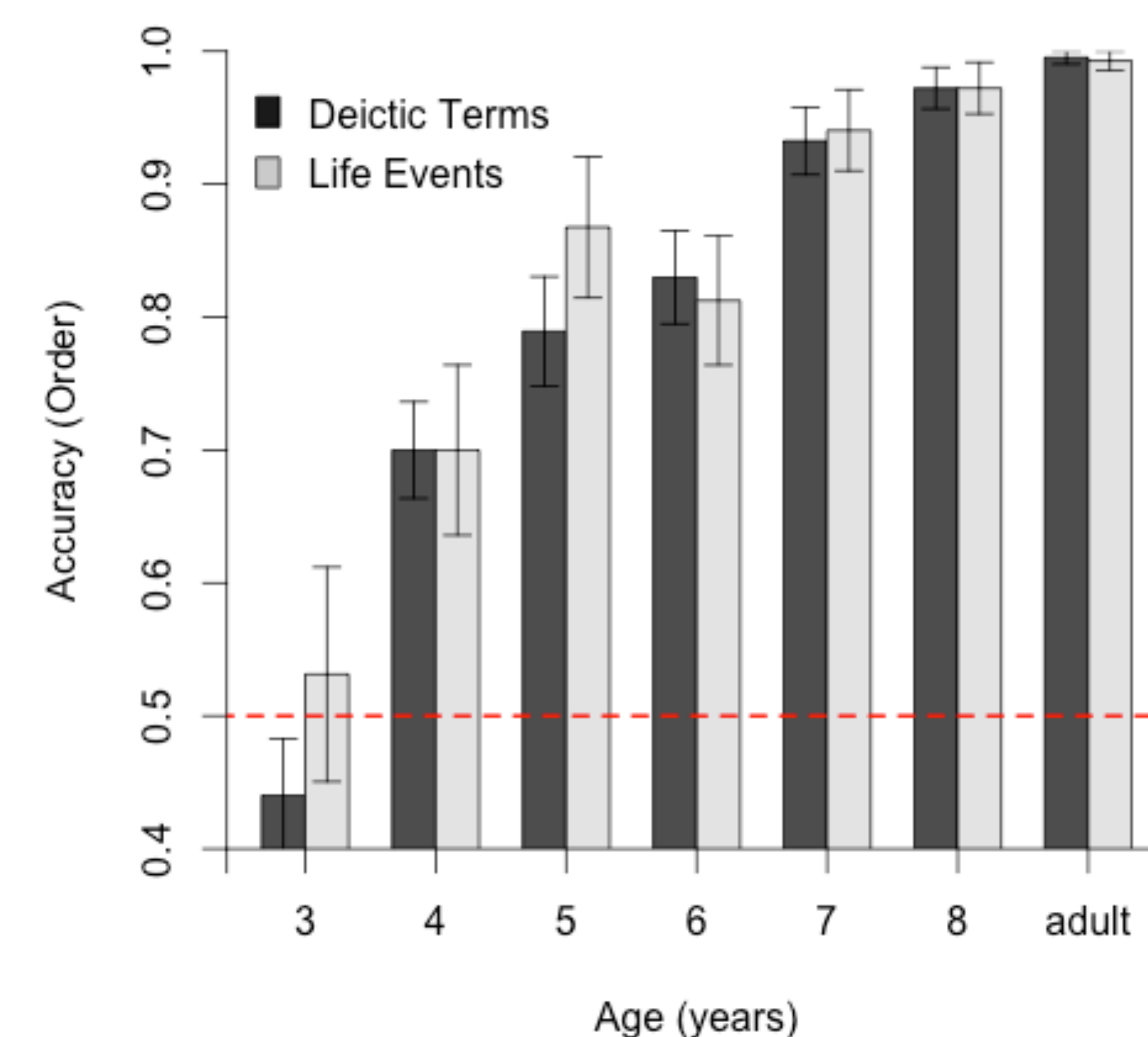


Fig 1B. overall sequence

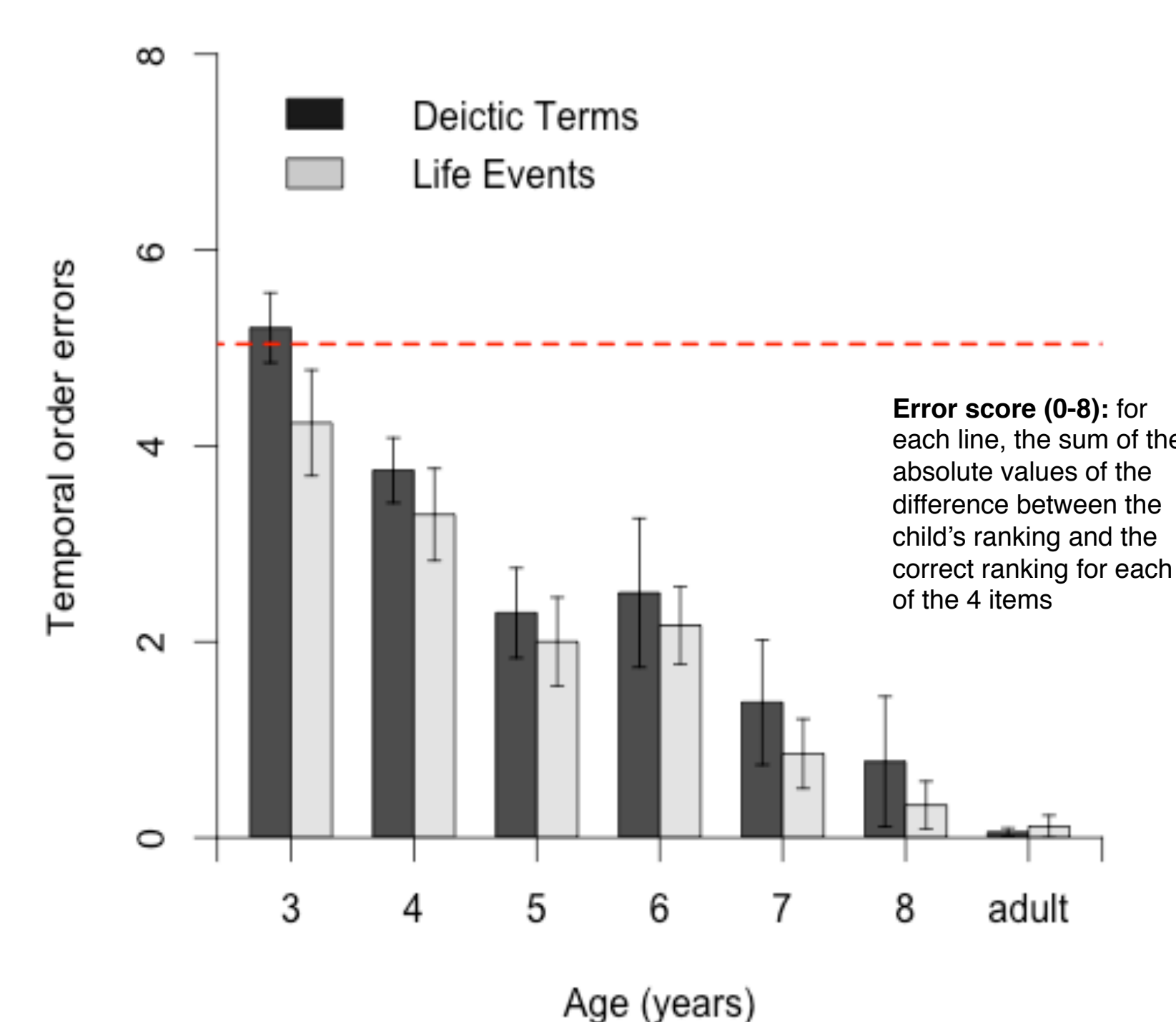
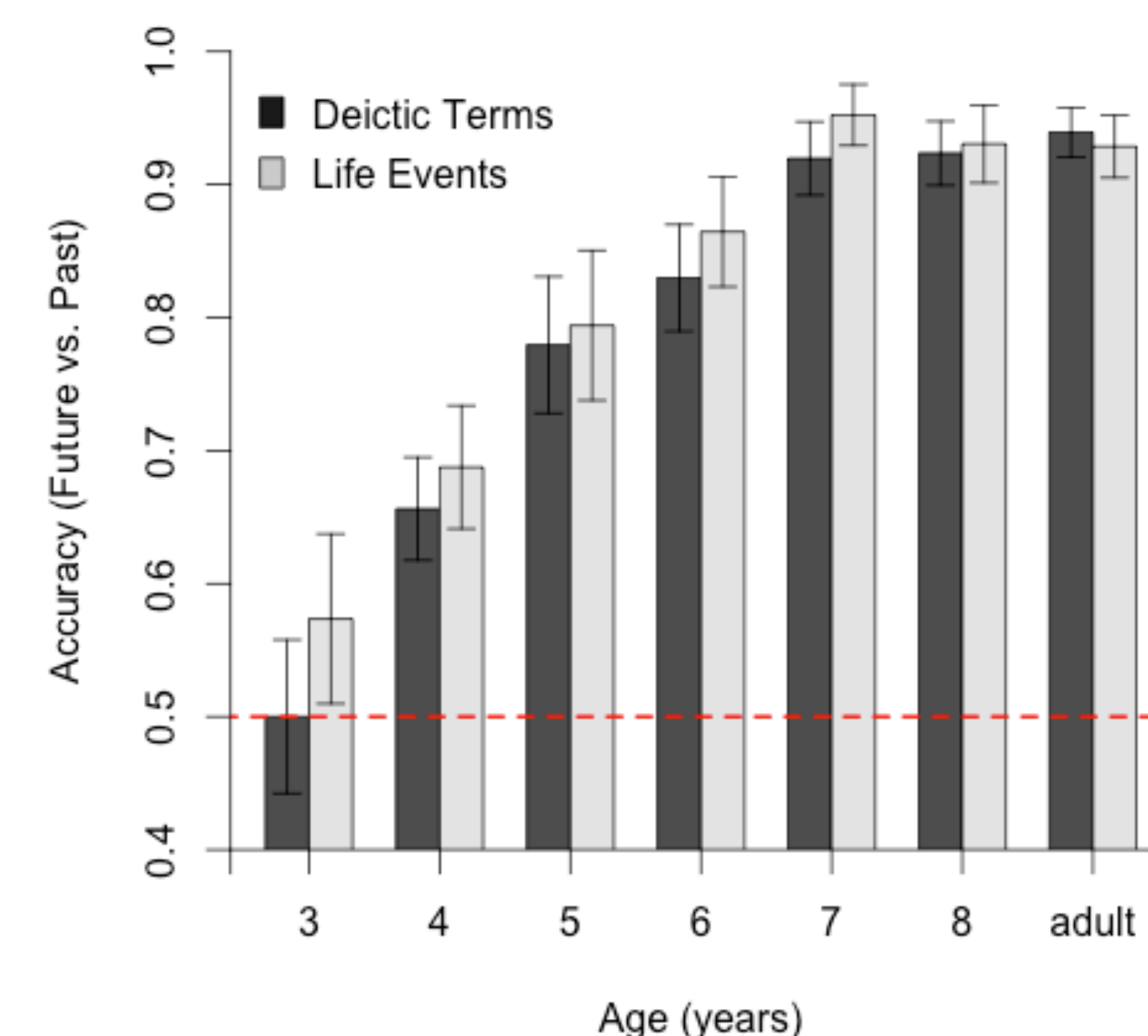


Fig 2. Deictic past/future assignment



- Non-random timeline use as early as age 4, Adult-like timeline use by age 7 or 8
- Across ages, events and time words are mapped to space equally well

Children represent each item's:

- sequence: correct direction on line, relative to the previous item placed (Fig 1A)
- rank ordering: correct rank relative to all items on the line (Fig 1B)
- past or future status relative to 'now' (Fig 2)

Gesture: Methods & Results

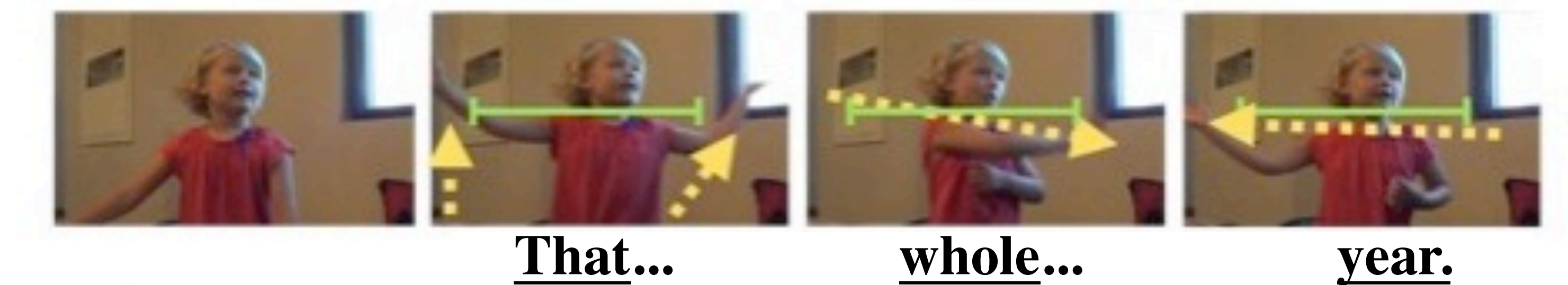
Gesture elicitation task. Adults (n=36) and 5- to 8-year-old children (n=61), who also participated in the timeline task (order counterbalanced), explained the meanings of contrasting temporal terms, while their spontaneous gestures were videotaped. Audio and video data were separately coded for temporal language and gesture content.

"What's the difference between [tomorrow] and [yesterday]?"
When is [tomorrow] and when is [yesterday]?"

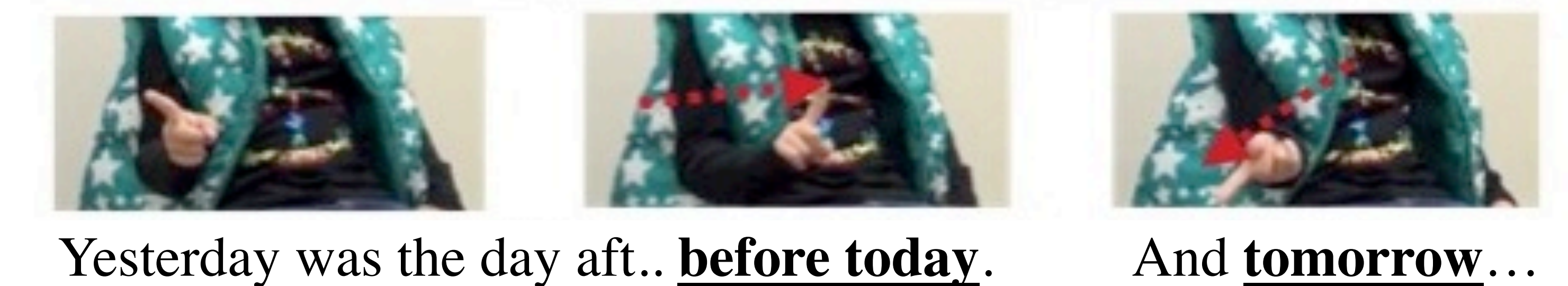
Terms tested:
tomorrow v. yesterday
tonight v. last year
last week v. next week
tomorrow v. next week
this morning v. yesterday
last week v. next year

Types of temporal gesture observed in children:

Duration: spatial length represents duration, as early as 5 years old



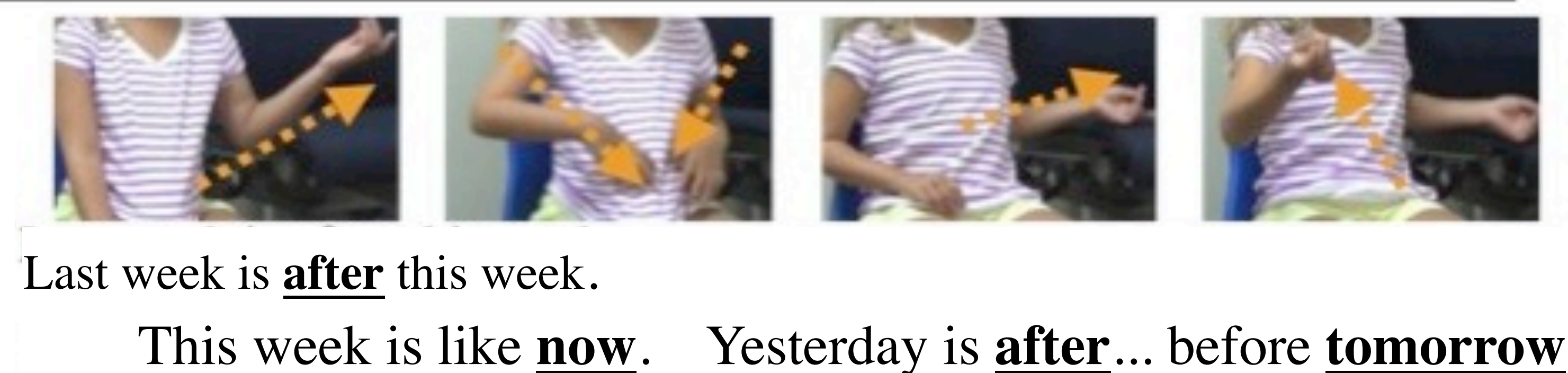
Pointing left for the past, right for the future, as early as 5 years old



Deictic center: 'now' is co-located with the body, as early as 5 years old



Gesture before language? Canonical gestures despite incorrect temporal language



In 8YO, over 75% of temporal co-speech gesture was congruent with cultural norms guiding use of both the sagittal (front-to-back) and transversal (left-to-right) axis. Congruency analyses are ongoing for other age groups.

Conclusions

- By age 4, children are able to use external timelines to represent the sequential and deictic relations among both life events and abstract time words.
- By age 5, children spontaneously gesture about time in systematic ways, which have previously been described only in adults.
- Ongoing work is investigating the correlation between these measures.

Questions or comments?
Contact katillman@ucsd.edu
or tmarghet@cogsci.ucsd.edu

References:

- Casanto, D., & Jasmin, K. (2012). The hands of time. *Language and Cognition*, 23, 643-674.
- Cooperrider, K., & Nunez, R. Across time, across the body. *Gesture*, 9, 181-674.
- Friedman, W. J., & Kemp, S. (1998). The effects of elapsed time and retrieval on young children's judgments of the temporal distances of past events. *Cognitive Development*, 13(3), 335-367.
- Grant, J., & Suddendorf, T. (2009). Preschoolers begin to differentiate the times of events from throughout the lifespan. *European Journal of Developmental Psychology*, 6(6), 746-762.
- Hudson, J. A., & Mayhew, E. M. (2011). Children's temporal judgments for autobiographical past and future events. *Cognitive Development*, 26(4), 331-342.