

How Infant Looking Patterns to Trivalent Events Change from Object to Person Interaction



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Introduction

How do pre-linguistic infants parse events into the argument structures required for language?

- **Home signers:** deaf children of hearing parents invent gestural communication systems with argument structure, even without linguistic input (Goldin-Meadow, 1985).
- This suggests the human conceptual system constructs event representations with argument-like structures *independent of language*.
- **Trivalent events** like *giving* [source, theme, goal] and *showing* [agent, theme, recipient] both require three arguments, but SHOW involves more complex intentional understanding. Do infants parse these events differently across development?

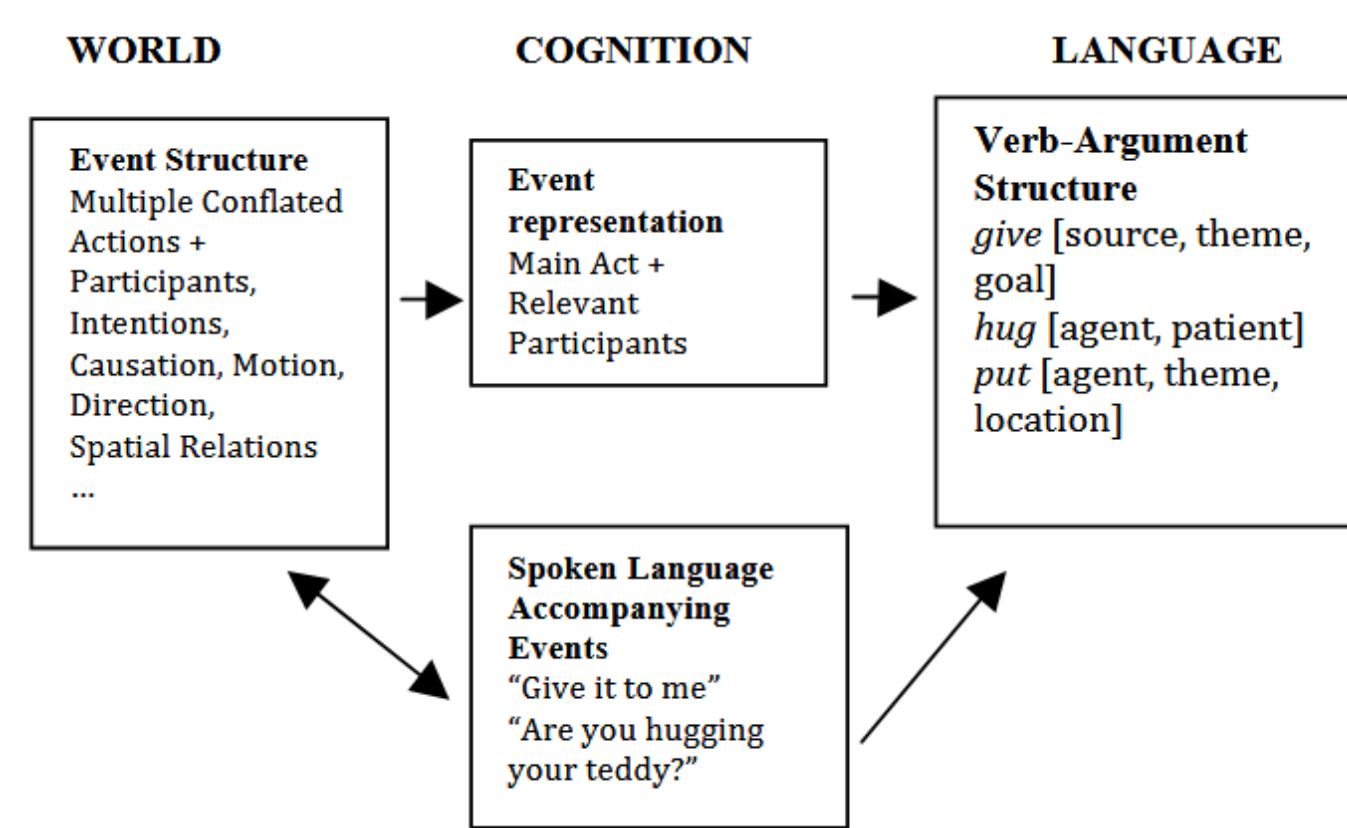


Figure 1. Mapping relations between events and language in the acquisition of verb-argument structure (Gordon, 2003).

Prior Work: Gordon (2003)

Using a **habituation paradigm** with looped event videos:

- In GIVE vs. HUG, **10-month-olds** dishabituated when the toy was removed from GIVE but *not* from HUG, suggesting infants represent the toy as relevant to GIVE's argument structure.
- **8-month-olds** showed a marginal effect for GIVE ($p=.07$); **6-month-olds** showed no effect.
- In a separate SHOW experiment, even **10-month-olds** failed to dishabituate when the toy was removed, suggesting SHOW may require conceptualization of intention.



Figure 2. Stimulus video frames. Rows 1-4: GIVE w/ toy, GIVE w/o, HUG w/ toy, HUG w/o. Rows 5-6: SHOW w/ toy, SHOW w/o (Gordon, 2003).

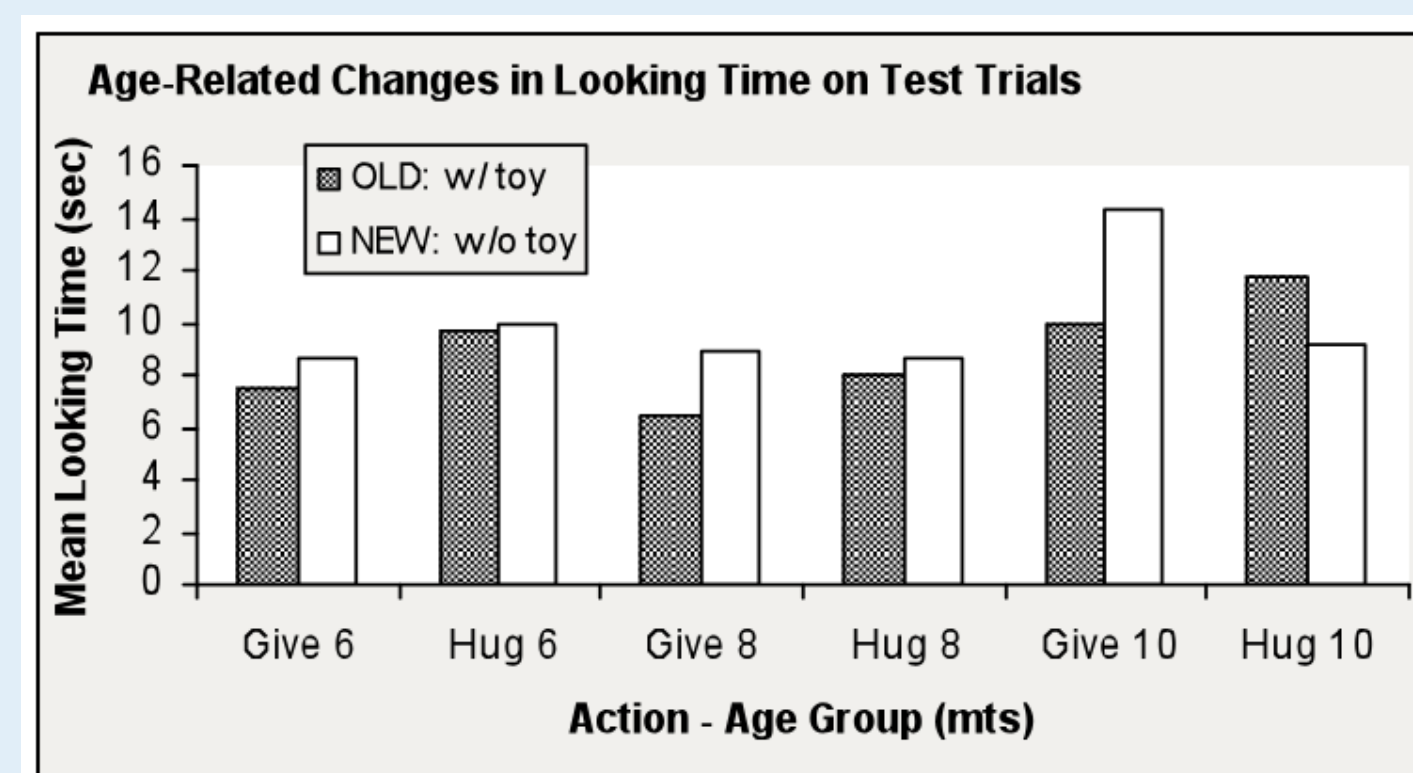


Figure 3. Age-related changes in looking time on test trials for GIVE and HUG across 6, 8, and 10 months (Gordon, 2003).

Research Questions

1. Do gaze transition patterns change from 7 to 11 months, specifically away from Toy \leftrightarrow Body transitions and toward Face \leftrightarrow Face transitions?
2. Do GIVE and SHOW differ in the developmental trajectory of these gaze patterns?

Methods

Participants

40 infants (7-11 months) and 15 adults in a within-subjects design. All participants viewed both GIVE and SHOW events; usable sample sizes varied by condition after data-quality screening (GIVE: $n=40$, SHOW: $n=45$).

Stimuli & EOI Coding

Participants viewed looped videos of GIVE and SHOW events. Rather than screen-based AOIs, we applied a custom computer-vision pipeline (**Eye-Track-ML**; Gushiken, Li, & Gordon, 2025) to detect and segment event elements frame by frame, yielding dynamic **Elements of Interest (EOIs)**.



Figure 4. GIVE stimulus frame with Eye-Track-ML SAM overlay showing segmented EOIs: body, head, and hand regions for each person, and the toy.

Statistical Approach

Gaussian GEE weighted by trial transition count, testing linear age trends (7-11 months). Fixation threshold: ≥ 3 consecutive frames; trial inclusion: $\geq 50\%$ on-screen looking.

Results: GIVE Condition

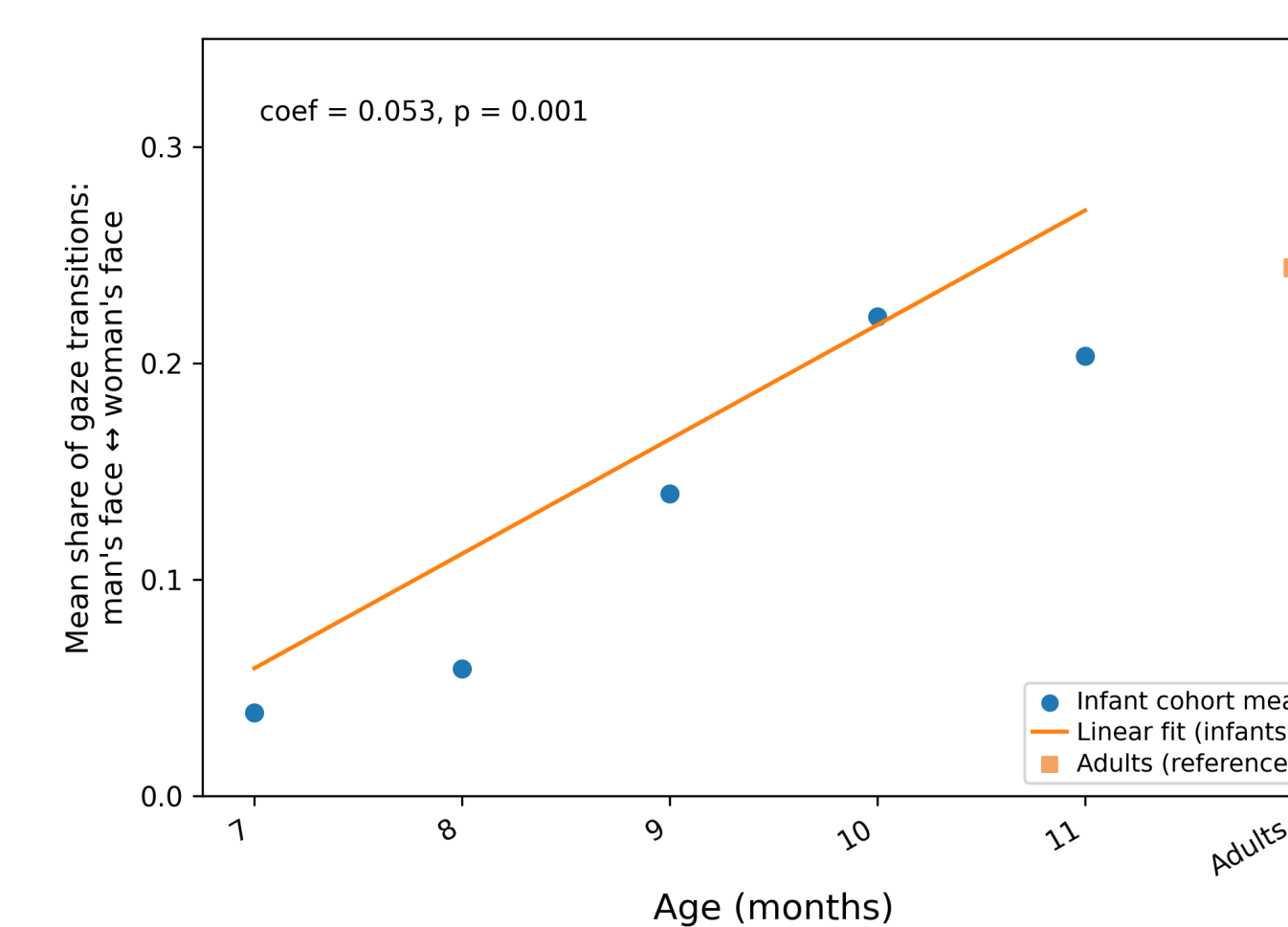


Figure 5. GIVE: Face \leftrightarrow Face transitions increase with age ($\beta=0.053$, $p=.001$). By 10-11 months, infants approached adult levels (20-22% vs. 24.4%).

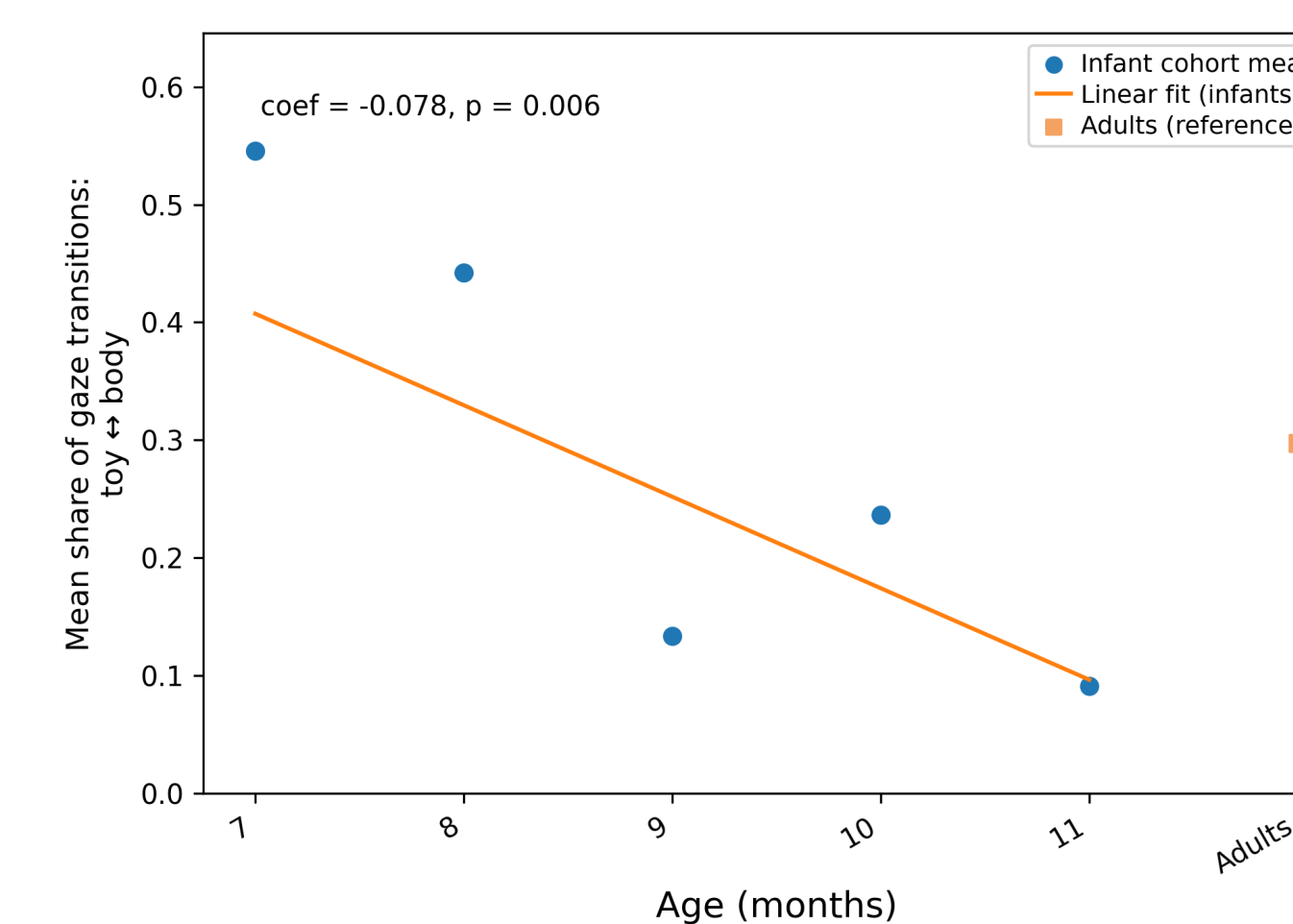


Figure 6. GIVE: Toy \leftrightarrow Body transitions decrease with age ($\beta=-0.078$, $p=.006$).

Results: SHOW Condition

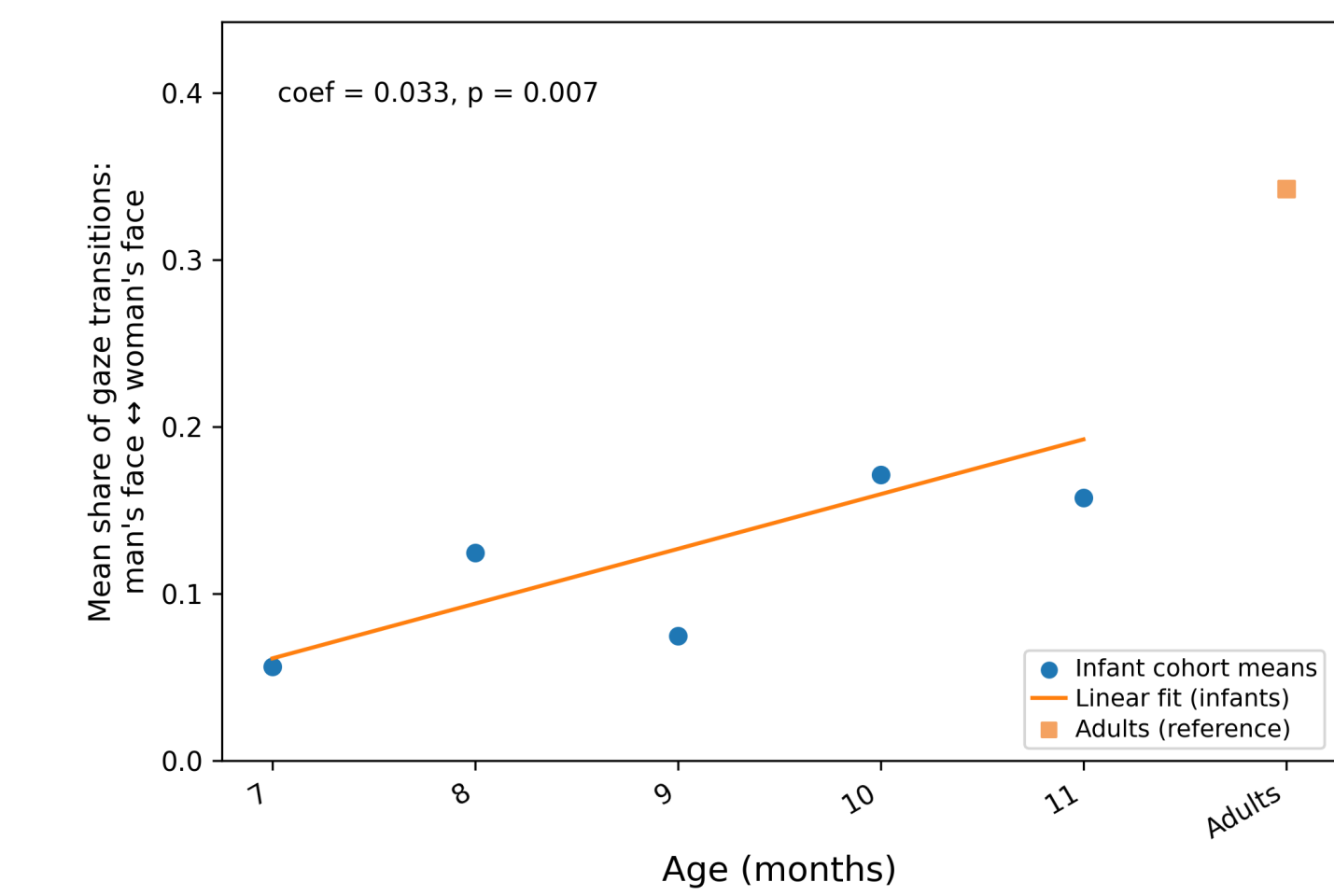


Figure 7. SHOW: Face \leftrightarrow Face transitions increase with age ($\beta=0.033$, $p=.007$), but infants don't reach adult levels (15.8% vs. 34.3%).

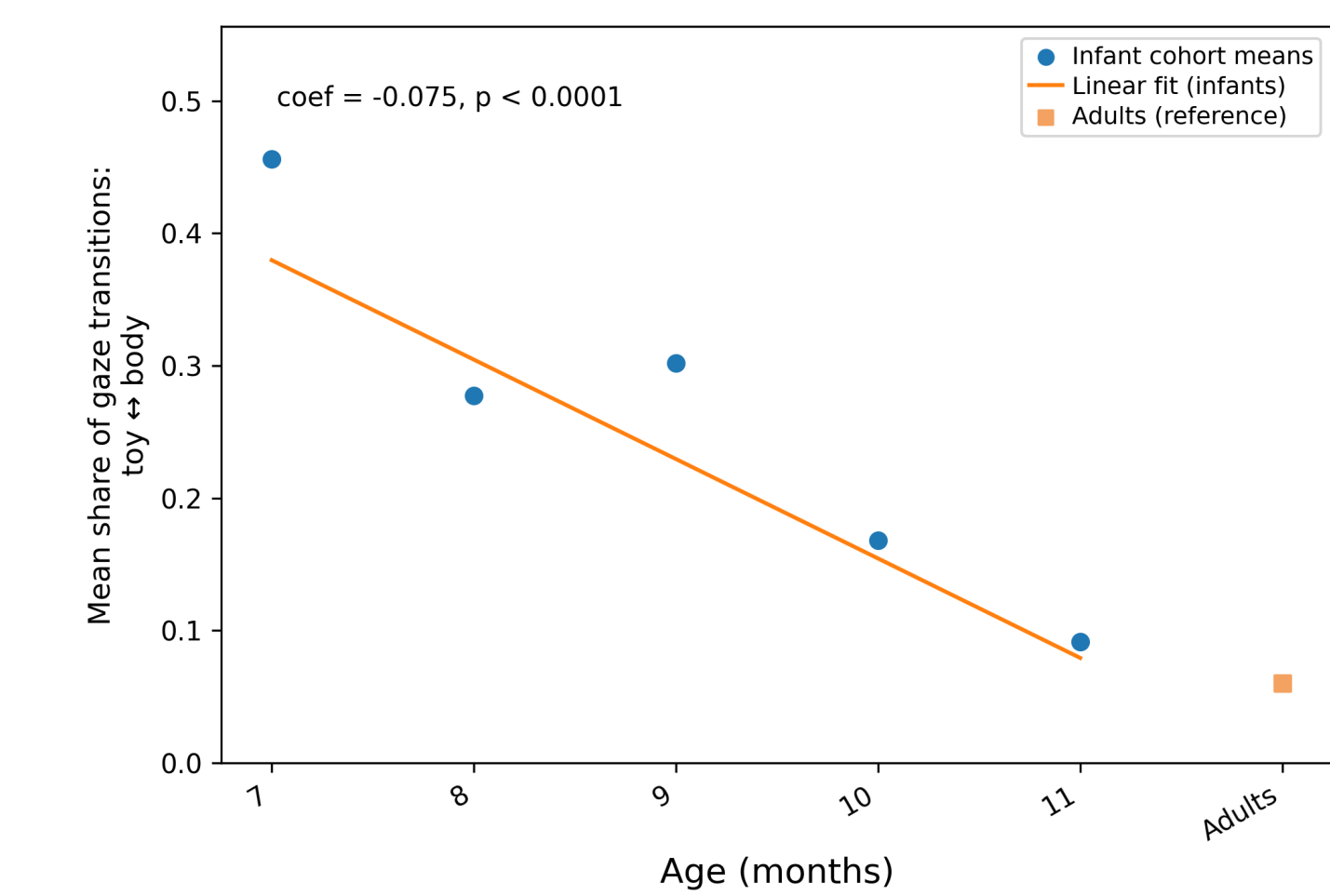


Figure 8. SHOW: Toy \leftrightarrow Body transitions decrease with age ($\beta=-0.075$, $p<.0001$). By 11 months, infants approached adult levels (9.2% vs. 6.0%).

GIVE vs. SHOW Comparison

Transition	Cond.	β	p
Face \leftrightarrow Face	GIVE	0.053	.001
Face \leftrightarrow Face	SHOW	0.033	.007
Toy \leftrightarrow Body	GIVE	-0.078	.006
Toy \leftrightarrow Body	SHOW	-0.075	<.0001
Toy \leftrightarrow Face	GIVE	0.045	.088
Toy \leftrightarrow Face	SHOW	0.057	<.0001

Table 1. Summary of linear age trends across GIVE and SHOW conditions.

Infants approach adult-like gaze patterns for GIVE by 10-11 months but *not* for SHOW, converging with Gordon (2003): GIVE event structure is parsed earlier than SHOW.

Take-Away

Infants develop adult-like event parsing for GIVE by around 10-11 months but not for SHOW, suggesting that *physical transfer* is parsed before events requiring *understanding of intention*. This converges with Gordon (2003), where infants dishabituated to toy removal in GIVE but not SHOW. The shift from Toy \leftrightarrow Body to Face \leftrightarrow Face transitions may reflect emerging understanding of **intentionality** and developing **theory of mind**, and may scaffold verb-argument structure acquisition.

References

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