Event apprehension and argument roles during sentence production: An individual differences approach to the role of linguistic knowledge

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Adults rapidly extract agent-patient roles from 2-participant events, demonstrating efficient carving of complex scenes into dimensions that are useful for language processing[1,2]. Infants interpret events using animacy cues[3], but it remains unclear whether early sensitivity to event properties support linguistic processes[4,5]. The current study investigates the extent to which school-aged children draw on animacy cues in events to facilitate production of passive sentences, extending prior work grounded in verb knowledge. To assess linguistic knowledge, prior research has demonstrated variable interpretation of passives in the school-age years in children with typical development (TD) and with Developmental Language Disorder (DLD)[6,7]. One hypothesis is that children, regardless of linguistic knowledge, rely on event-related animacy cues during sentence production, facilitating planning of passive structures with inanimate patients compared to animate patients. Alternatively, it may be that encoding events during production depends on prior distributional learning, leading to increased sensitivity to animacy cues for children with greater linguistic knowledge. To understand profiles of individual differences in linguistic knowledge, Exp. 1 applied data-driven methods to categorize children's performance on a picture-matching comprehension task. To evaluate whether linguistic knowledge relates to sentence production, Exp. 2 assessed performance on a picture-description production task.

Participants were 160 4-9-year-old monolingual English-speaking children (DLD N = 120, Age *M* = 5.97, *SD* = 1.48; TD N = 40, Age *M* = 6.35, *SD* = 1.57); data collection is ongoing. DLD diagnosis aligned with Bishop et al., (2016); parents of TD children did not report functional concerns and standardized test scores were in the typical range. To assess **comprehension,** children saw 2 animate-animate pictures that corresponded to 24 reversible items in a transitive frame. They heard an active (n=12) or passive (n=12) sentence and matched it to the correct scene that varied in role assignment (Fig 1a). Responses were coded as correct (1) or incorrect (0) (Fig 1a). **Production probes** used a syntactic priming paradigm[9], children heard a passive model for one picture and were prompted to describe the second (Fig. 1b). Across 20 pairs of 2-participant events, patients were animate (n=10) or inanimate (n= 10), agents were animate. Responses were either fully (1), partially (.5) or not (0) correct (Table 1).

In Exp. 1, we identified performance bands in the comprehension task using hierarchical clustering (*hclust* from the *stats* R-package) and k-means clustering. Clusters were empirically defined resulting in high, mid and low comprehension for active and passive structures. On this basis, we placed children in four groups: *Group 1 (all high)*, *Group 2 (mixed), Group 3 (high active low passive), Group 4 (all mid-low)* (see Table 2/Fig. 2). In Exp. 2, we evaluated the relation between comprehension profiles and sensitivity to animacy during production. We ran a *glm* mixed effects model with animacy and comprehension group as fixed effects, and random effects for item and participant (Fig. 3). Children who were highly accurate at comprehending both structures (*Group 1)* had the greatest accuracy benefit from inanimate patients ($\beta = 1.30$, $p = .003$). Children with poor sentence comprehension (Group 4) demonstrated no benefit of animacy on accuracy ($\beta = 0.18$, $p > .05$), and were overall less sensitive to animacy compared to Group 1 ($\beta = -1.11$, $p < .0002$). Between these extremes, children in Group 3 showed a similar animacy benefit ($\beta = 1.02$, $p > .05$) as Group 1, with a non-significant difference in sensitivity compared to Group 1 ($\beta = -.27$, $p > .05$). Group 2 had a reduced animacy compared to Group 1 ($\beta = -.65$, $p < .01$) but the difference was not significant ($\beta = .65$, $p > .05$). This implies that children's ability to leverage animacy cues for production improves with linguistic knowledge. This trajectory applies to both TD and DLD groups and is made visible by broadly sampling children across ability levels and data-driven analysis of individual differences, rather than relying on diagnostic status alone[10]. This approach provides tools to uncover how linguistic knowledge supports sentence production.

Table 1. Production Coding

Prompt:	Example Correct Score (1)	Example Partially Correct (.5)	Example Incorrect Score (0)
Look, here's a goose, a fox, a seal, and a dolphin. The goose was hugged by the fox. What happened to the seal?	The seal was/got kissed by the dolphin.	the seal was/got kissen/kissed-ed/kiss by the dolphin	the dolphin kissed/was kissing the seal
	The seal was/got kissed	the seal was/got kissen/kissed-ed/kiss	the seal kissed the dolphin
		The goat was being dried off from his bath	

Table 1. Bin Characteristics

Group	#TD (%)	Age in years (SD)	#DLD (%)	Age in years M (SD)
Group 1	33 (83%)	6.67 (1.47)	43 (36%)	6.88 (1.38)
Group 2	5 (13%)	5.20 (1.17)	35 (29%)	6.14(1.29)
Group 3	0 (0%)	NA	11 9%)	5.36 (1.07)
Group 4	2 (5%)	4.00 (0)	31 (26%)	4.71 (0.77)

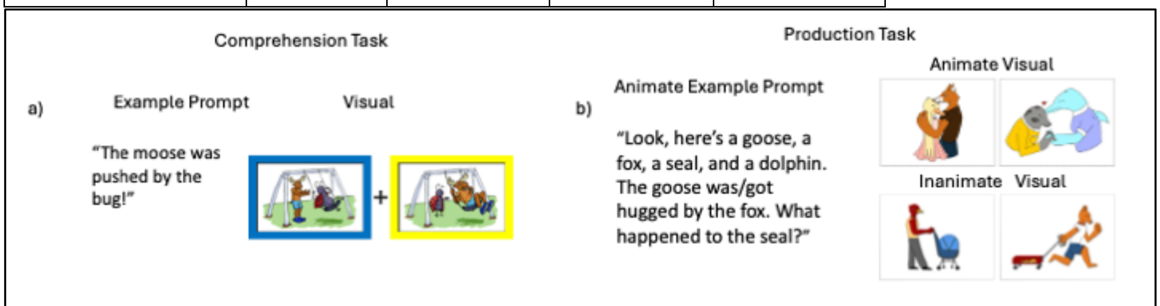
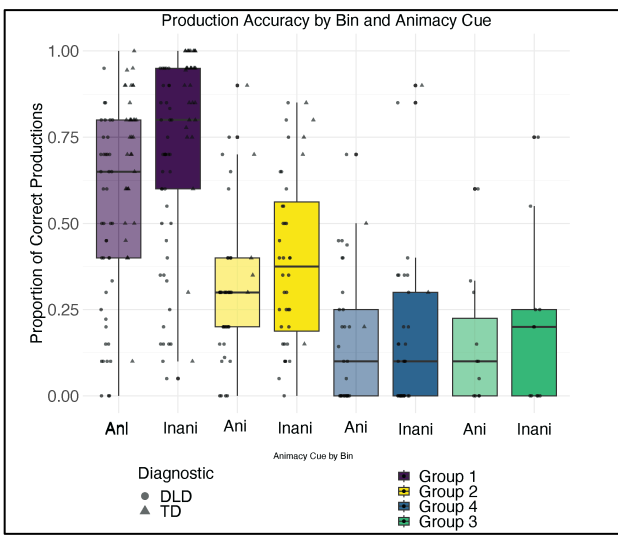
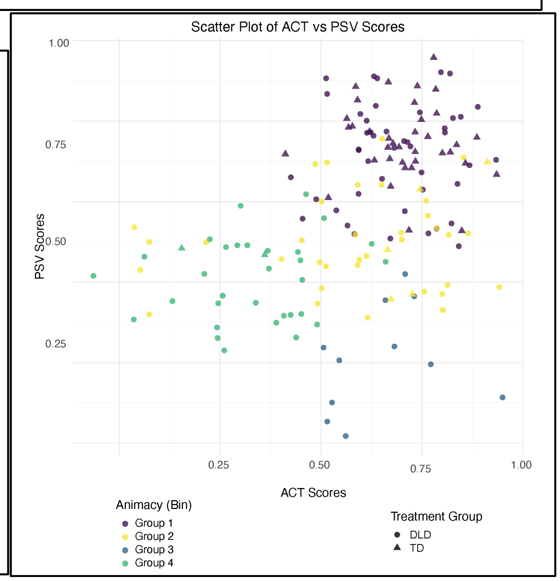


Figure 1: Examples of the Comprehension and Production Tasks





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