Discourse structure affects reference resolution to events

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Referring expressions (REs) are integral to discourse structure, yet little is known about how people resolve **reference to events**. According to [4], only events on the right frontier of the discourse structure are available for reference, but when multiple events are present, as is often in natural discourse, reference can be ambiguous. It is an open question how hearers resolve this ambiguity. Work on sentence processing shows that **elaboration** can facilitate referent retrieval, due to increased activation ([2]). Research on personal pronouns suggests that **aspectual factors** can also have an effect: imperfective aspect facilitates access to the participants of an event, while perfective focuses attention on the result state, or the event as a whole ([1],[3]). We report results from two preregistered replication experiments investigating reference resolution when multiple events are available in the discourse, using nominal ("it/that"; Exp1) and adverbial REs ("so/thus"; Exp2) (analyses will be collapsed over RE type). We ask if the structure of discourse has an effect on the referent chosen: Are right frontier events *with nested elaborations* (**hierarchical**, purple in Fig. 2) more salient for reference than events *without elaboration* (**linear)**? We predict that hierarchical discourse will lead to more intermediate events (vs. root (red) or last (green) events) being considered as referents than in linear discourse. Second, we ask if the aspectual environment of an RE has an effect on the referent chosen. On analogy with personal pronouns, we predict that **imperfective** will lead to more resolution to intermediate events (blue & purple), while **perfective** will lead to more resolution to the root event or the last event. **Methods: Exp1:** We modified how-to instructions from the internet to include a subordinate clause with "do" in imperfective or perfective form, followed by "it" or "that" (e.g., "after doing it"). We created two versions ("it/that") of 12 sets of instructions (+24 fillers), crossed for ASPECT (perfective/ imperfective) and STRUCTURE (hierarchical/linear). Participants saw instructions with a Gantt chart showing the sequence of steps (Fig. 1). Each step contained one event. Charts had unfilled rows corresponding to underlined events (1 critical item and 2-3 distractors), which participants were asked to fill in according to when they thought the underlined event occurred. The cells filled for the step containing "do" + RE indicate which portions of the instructions participants took the RE to be referring to. All participants (N=160) saw all 36 instructions, pseudorandomized. **Exp2:** Same as Exp1, using "so" and "thus". N=160. **Results:** We predicted selection of intermediate events with a linear mixed-effects models (STRUCTURE = fixed effect, ITEM and SUBJECT = random effects) and selection of event type (root/intermediate/inter-nested/last) with multinomial logistic models (ASPECT = fixed effect, last event = reference). Hierarchical and linear structures were analyzed separately in multinomial models. P-values corrected for multiple comparisons. **Exp1:** Hierarchical STRUCTURE (vs. linear) leads to selection of significantly more intermediate events ($p<.01$, $\beta=-.83$, Fig. 3); imperfective ASPECT (vs. perfective) leads to selection of significantly more intermediate events in hierarchical ($p<.001$, $\beta=.41$, Fig. 4) and marginally more in linear structure ($p=.06$, $\beta=.31$, Fig. 5) . **Exp2:** Hierarchical STRUCTURE (vs. linear) leads to selection of marginally more intermediate events ($p=.08$, $\beta=-.57$, Fig. 6); imperfective ASPECT (vs. perfective) leads to selection of significantly more intermediate events in hierarchical ($p<.001$, $\beta=.32$, Fig. 7) and linear structure ($p<.001$, $\beta=.61$, Fig. 8). **Discussion:** Results show that both elaboration and aspect play a role in resolving event reference. Elaboration increases referent salience, supporting findings that elaborations raise activation levels in working memory. Imperfective aspect leads to more resolution to intermediate events. Aspect not only affects personal pronoun access to the internal participants of simple events, but also access by other types of REs to the subevents of more complex events. The results provide insight into the heretofore elusive domain of event reference.

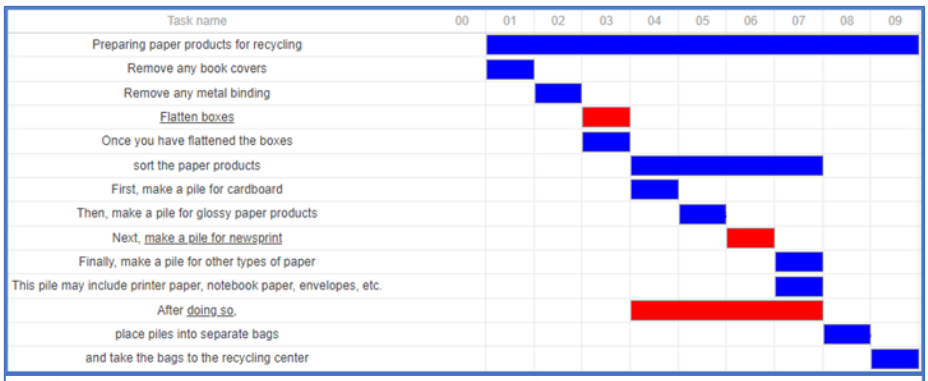

Figure 1: Example stimuli, showing hierarchical structure and imperfective aspect with "so". Blue cells are pre-filled and unmoveable. Red cells are interactive and placed by participants.

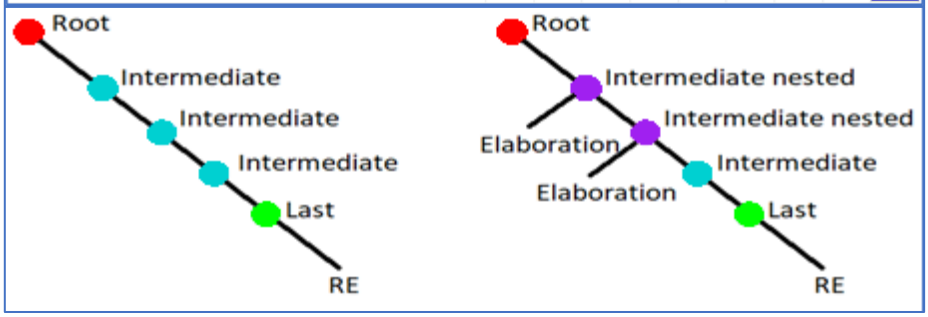

Figure 2: Schemata of Linear (left) and Hierarchical (right) structure.

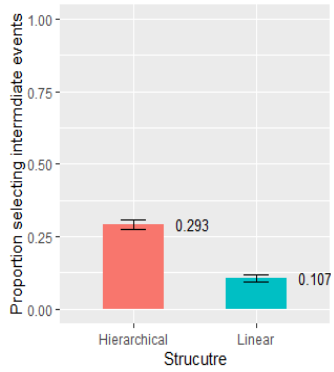

Figure 3: Proportion of intermediate events in hierarchical and linear stimuli. Exp1 (it/that)

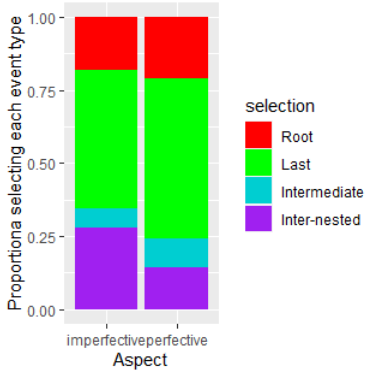

Figure 4: Proportion of event selections by aspect, for hierarchical stimuli. Exp1 (it/that)

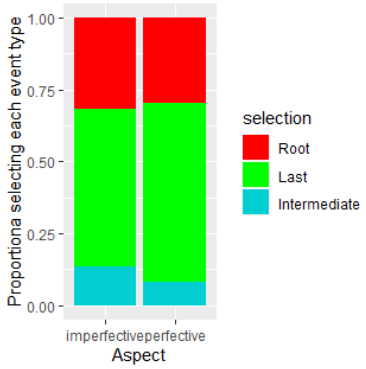

Figure 5: Proportion of event selections by aspect, for linear stimuli. Exp1 (it/that)

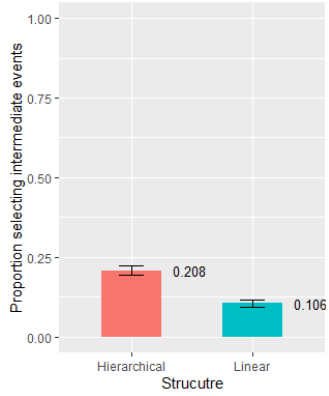

Figure 6: Proportion intermediate events in hierarchical and linear stimuli. Exp2 (so/thus)

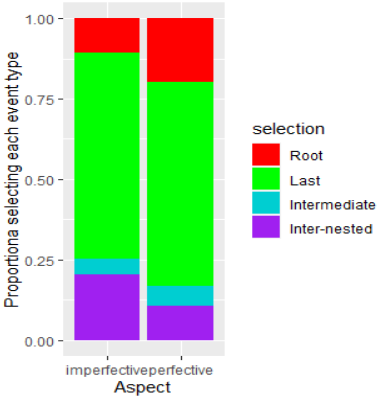

Figure 7: Proportion of event selections by aspect, for hierarchical stimuli. Exp2 (so/thus)

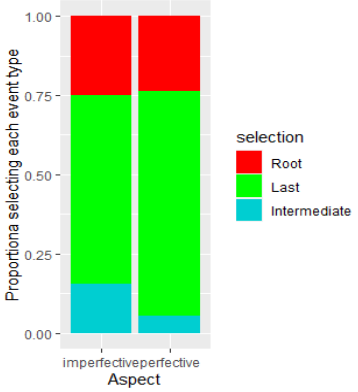

Figure 8: Proportion of event selections by aspect, for linear stimuli. Exp2 (so/thus)

[1] Ferretti et al. 2009. Verb aspect, event structure, and coreferential processing. *J of Memory and Language.* 61(2):191-205. [2] Troyer et al. 2016. Elaboration over a discourse facilitates retrieval in sentence processing. *Front. in Psych*. 7: 374. [3] Wampler (in review). Do thus: An investigation into anaphoric event reference. [4] Webber. 1991. Structure and ostension in the interpretation of discourse deixis. *Language & Cognitive Processes.* 6(2): 107-135.