

Far from independent: Matrix-driven temporal shift interpretations of English and German past-under-past relative clauses

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Complex sentences allow speakers to describe multiple events, and express relations between them: In “the girl kissed the boy who was next to the traffic light”, the kiss and the boy’s situation relate to each other. One dimension of this relationship is temporal. In two pre-registered studies using English and German, we investigate which interpretations are available for past-under-past relative clauses: is the sentence true if the girl kisses the boy after (Fig.1A, back-shifted) or before (Fig. 1B, forward-shifted) he is next to the traffic light?

Formal accounts of embedded tense conceive of the interpretation of tense in relative clause as only dependent on utterance time, not on the matrix clause’s tense [1-3]. Therefore, these approaches predict that back-shifted (1A) and forward-shifted (1B) interpretations for the situation described in a relative clause (*standing next to a traffic light*), relative to a matrix event (*being kissed*), should be acceptable: Both are past relative to utterance time.

Semantically however, relative clauses can be conceptualized as anchored to a main event [4-5]: the relative clause tense (“who was next to the traffic light”) is interpreted relative to that anchoring event’s tense (“kissed”). This account predicts forward-shift interpretations (1B) in past-under-past relative clauses to be unacceptable because here, the embedded past tense describes a situation (*standing next to a traffic light*) that happens after the anchor (*kissing*).

Conceptually building on a French acquisition study [6], in **Exp.1**, 50 native English speakers watched 8 clips (+20 fillers) of events like 1A and 1B, then read descriptions (like in Fig.1), and rated whether they matched the movie. *While*-clauses (Fig.1), which should always be rated unacceptable, served as controls. **Results** (statistical analysis: mixed-effects models, significance assessed using pairwise model comparisons): As predicted, *while*-descriptions were rated worse than relative clause descriptions (Fig. 2, left panel, main effect of clause-type: $Df=1$, $\chi^2=129.5$, $p<0.001$). There was also a main effect of shift: forward shifts were less acceptable than backward shifts ($Df=1$, $\chi^2=29.4$, $p<0.001$). Crucially, the interaction between clause-type and shift-type was significant ($Df=1$, $\chi^2=17.65$, $p<0.001$), and pairwise comparisons revealed that it was driven by the relative clauses: While *while*-clauses were unacceptable across shift-types, ($\beta=-.08$, $t=-0.9$, $p>0.37$), participants rated sentences containing relative clauses significantly higher when they described back-shifted clips compared to forward-shifted clips ($\beta=-.06$, $t=-5.9$, $p<0.001$). **Exp.2:** replication in German (N=18), resulting in a similar pattern of results (Fig.2, right panel: main effect of clause-type: $Df=1$, $\chi^2=28.1$, $p<0.001$, main effect of shift-type: $Df=1$, $\chi^2=10.9$, $p<0.001$, interaction: $Df=1$, $\chi^2=10.4$, $p<0.01$), with the interaction driven by the relative clause (*while*-clauses: $\beta=-.001$, $t=-0.17$, $p>0.87$, relative clauses: $\beta=-.07$, $t=-3.7$, $p<0.001$).

Our results indicate that tense interpretation in relative clauses is dependent on the matrix clause – at least when the matrix sentence describes a salient anchoring event, and the relative clause a backgrounded situation. Further experiments will assess whether the same pattern holds when this mapping between syntax and semantics is switched (“The boy who the girl kissed stood next to the traffic light”), and whether forward shifts are ameliorated in contexts with discourse focus on relative clauses (“This story is about a boy”). Whereas none of these manipulations are predicted to change interpretations under a syntactic account, a semantic account [5] predicts an amelioration of forward shifts for discourse-salient relative clauses as they can serve as conceptual anchors for past-under-past sentences.

Overall, our findings provide insight into the representation of events and how temporal semantic features are linked to main and dependent clauses. Using language to describe mental representations is a selective process in which speakers must decide which information they want to communicate, and choose their expressive means accordingly. In this regard, complex sentences convey a temporal perspective on event structure which is not solely determined by grammatical principles. By contrast, our results suggest that speakers take factors of event structure into consideration when they map temporal relations onto linguistic structure.

Relative Clause: *The girl kissed the boy who was next to the traffic light.*
 while-Control: *The girl kissed the boy while he was next to the traffic light.*

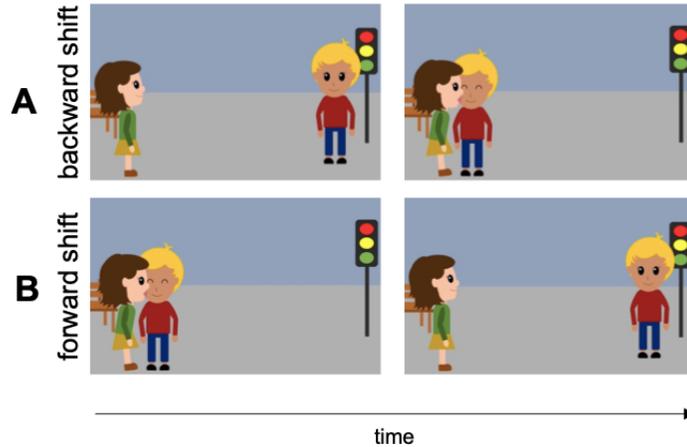


Figure 1. Temporal arrangements of the embedded situation (*standing next to a traffic light*) relative to the main event (*kissing*) in the video clips. Videos under https://osf.io/6ae5m/?view_only=fa7a501f340d4a538ee604c3faa3be7c.

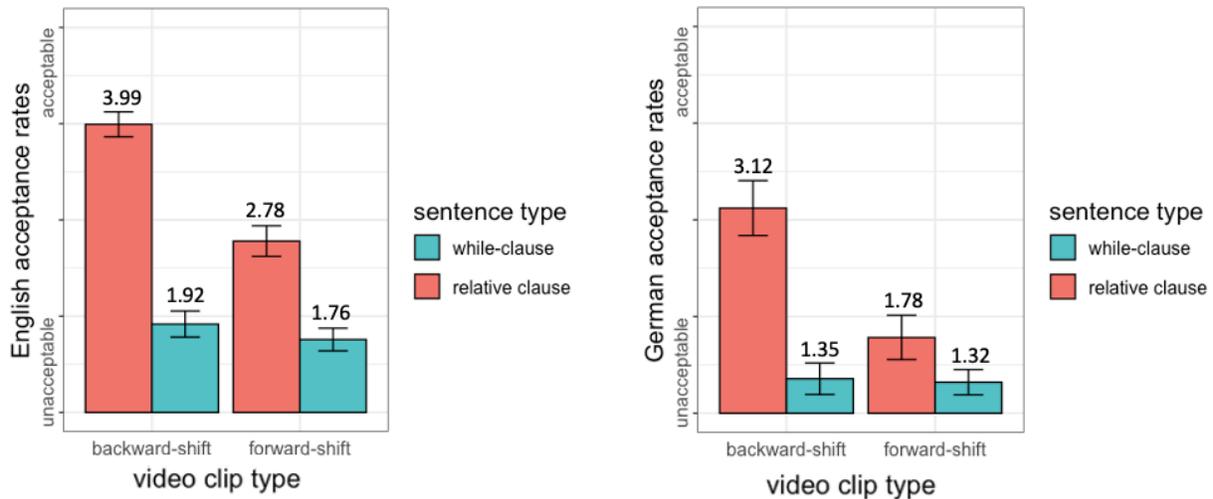


Figure 2. Mean ratings in Experiment 1 (left, English) and Experiment 2 (right, German). Error bars denote Standard Errors.

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