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Thematic separation in light of sentence comprehension

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Thematic relations are traditionally analysed as projecting into derivations of sentence meanings from the lexical content of verbs. Thematic separation, a natural outgrowth of event semantics, proposes an alternative to this tradition: thematic relations are introduced into derivations by verb-independent elements and are, therefore, grammatically separate from the lexical content of verbs. Although critical to theories of meaning and lexical representation, the evidence for thematic separation has not been reckoned with widely in linguistic theory, and the consequent implications for psycholinguistic theories have not received proper consideration. This is surprising as the representations permitted by thematic separation comport quite well with evidence for pre-verbal thematic interpretation during real-time sentence comprehension. Psycholinguistic theories, therefore, stand to benefit from engagement with separationist alternatives to thematic relations, and may, in turn, shed light on the representations semantic theory should provide. After briefly defending the utility of events in semantic representation, this paper motivates thematic separation with evidence from the cumulative interpretations and adnominal modal adverbs; two cases where a semantic operator intervenes between a thematic relation and a verbal predicate. Psycholinguistic results investigating pre-verbal thematic interpretation then follow, where

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thematic separation is argued to furnish theories with coherent incremental representations without commitment to specific verbal predicates. The timecourse of verb predictability is also shown to intersect with ongoing debates on the granularity of thematic relations, suggesting further connections between semantic and psycholinguistic theory to be explored.

1 | INTRODUCTION

Event semantics proposes that the core of clausal meanings are descriptions of events. (1) entails a melting event by virtue of the verb *melt*. How the meanings of *John* and *the ice* are incorporated into this melting event description will be our main concern. Traditionally, transitive *melt* is analysed as a three place predicate shown in (1a),¹ assigning *the ice* to its ‘melted’ position, and *john* to its ‘melter’ position (with the event variable *e* taking its event position) in the course of deriving (1). Many analyses in event semantics, however, have opted for a decompositional alternative where relations distinct from the verb-specific predicate assign *the ice* and *john* their respective roles. (1b) Provides an event-description with generalised thematic relations *THEME* and *AGENT* that associate their argument to the event, entail how their argument participates in that event, and possibly act as further instructions to our nonlinguistic conceptual systems (Knowlton et al., 2021). Generalised thematic relations represent common entailments of a group of predicates with respect to one of their arguments (Dowty, 1991). Agents act/cause the event. Themes change in condition/state because of the event.

- (1) John melted the ice.
- a. $\exists e[\text{MeltingOfBy}(e, \text{the ice}, \text{john})]$
 - b. $\exists e[\text{Melting}(e) \ \& \ \text{THEME}(e, \text{the ice}) \ \& \ \text{AGENT}(e, \text{john})]$

How these relations are linguistically introduced and which representational commitments are more closely aligned with evidence from incremental sentence comprehension will be our main concern. *Projectionist* responses to these questions have been the norm in linguistic theory and appear, at least on first inspection, to also dominate the psycholinguistics literature. On projectionist accounts, verbs encode thematic relations as part of their lexical content and apply them to arguments in the course of the derivation. These accounts also guided classic psycholinguistic theories. Head-driven approaches, for example, delayed thematic interpretation until the verb itself was parsed (Abney, 1989; Pritchett, 1992), an approach that continued within other frameworks (Carlson & Tanenhaus, 1988; Trueswell & Tanenhaus, 1994).

This paper adopts an alternative stance, focussing on *separationist* responses to these questions and their consistency with incremental sentence comprehension. Separation is a natural outgrowth of event semantics, analysing structurally separate parts of a clause as semantically separate predicates of the same event. On separationist accounts, thematic relations are introduced into the derivation by elements apart from lexical verbs. While such analyses have been argued for in linguistic theory, the congruence of thematic separation with psycholinguistic theory has not been explored. Modern theories of sentence comprehension, however, frequently propose that the thematic interpretation occurs ahead of the verb (Bornkessel-Schlesewsky & Schlewsky, 2009; Kamide & Mitchell, 1999; Knoeferle et al., 2005; MacDonald et al., 1994) and that such information can be used to affect verb predictability itself

(Chow et al., 2016, 2018; Liao et al., 2022). Thus, theories of sentence comprehension have at least implicitly recognised the need for thematic interpretation apart from verbs, but often have not explicitly considered what the format of these representations is, or how these results reflect back on linguistic theory.

This paper examines some of the evidence in favour of thematic separation, both from the viewpoint of linguistic theory and of psycholinguistics. Section 2 provides a brief overview of events in semantic representation and presents two cases in support of thematic separation where semantic operators can be shown to intervene between thematic relations and verbal predicates in Section 2.2. Section 3 turns to evidence from psycholinguistics concerning the role played by thematic relations apart from verbs in sentence comprehension. Section 3.2 reviews evidence for pre-verbal thematic interpretation, demonstrating that the representations underlying highly incremental interpretation are well-served by explicitly adopting a separationist analysis of thematic relations. Effects on verb predictability in Section 3.3 then relates the granularity of thematic relations to resolution of those relations over different time scales. Section 4 offers a brief conclusion and highlights some open questions.

2 | EVENTS, DECOMPOSITION, AND SEPARATION

Event semantics proposes that the meanings of clauses in natural languages are descriptions of events. Events were first introduced in Davidson (1967) to capture the conjunctive behaviour of adverbial constituents like *slowly* in (2) with the meaning given in (2a). The idea of extending such analyses to other arguments was suggested by Castañeda (1967), for example, for subject arguments as in (2b) or both subject and object arguments as in (2c) via general thematic relations.

- (2) John slowly melted the ice.
- a. $\exists e[\text{MeltingOfBy}(e, \text{the ice, john}) \ \& \ \text{Slow}(e)]$
 - b. $\exists e[\text{MeltingOf}(e, \text{the ice}) \ \& \ \text{AGENT}(e, \text{john}) \ \& \ \text{Slow}(e)]$
 - c. $\exists e[\text{Melting}(e) \ \& \ \text{THEME}(e, \text{the ice}) \ \& \ \text{AGENT}(e, \text{john}) \ \& \ \text{Slow}(e)]$

The introduction of a silent event variable e might seem a luxury, but such approaches have become popular as a way of formalising certain entailment patterns as a logical consequence of their meanings, matching the absence of a syntactic constituent to the absence of a semantic conjunct (Carlson, 1984).² (2) entails (3a), which drops the adverb, and (3b) which drops the subject. When represented as events, these entailments follow as a syntactic consequence from the proof rule of conjunction elimination in the scope of an existential quantifier (\exists CE). Taking (2) as the meaning for (2), the meanings in (4a) and (4b) directly result from conjunction elimination, deriving the entailments in (3a) and (3b), respectively.

- (3) John slowly melted the ice.
- a. $\models \text{John melted the ice.}$
 - b. $\models \text{The ice slowly melted.}$
- (4) $\exists e[\text{Melting}(e) \ \& \ \text{THEME}(e, \text{the ice}) \ \& \ \text{AGENT}(e, \text{john}) \ \& \ \text{Slow}(e)]$
- a. $\vdash \exists e[\text{Melting}(e) \ \& \ \text{THEME}(e, \text{the ice}) \ \& \ \text{AGENT}(e, \text{john})]$ (by \exists CE)
 - b. $\vdash \exists e[\text{Melting}(e) \ \& \ \text{THEME}(e, \text{the ice}) \ \& \ \text{Slow}(e)]$ (by \exists CE)

Alternative frameworks that lack events struggle to account for these facts in a straightforward manner (Davidson, 1967). Without events, verbs are required to express as many arguments as they have possible relations with, which can lead to unwanted meanings (Parsons, 1990). We have seen that *melt* in (2) takes at least three arguments, given in (2), but attempting to derive entailments, for example, via existential generalisation over missing arguments (EG), sometimes yields appropriate meanings and sometimes goes astray. (3a) Entails some rate of melting, consistent with (5a), but existential generalisation fails to capture the meaning of (3b); there is no required melter in (3b), though (5b) says otherwise.

- (5) MeltingOfByRate(the ice, john, slow)
- a. $\exists d[\text{MeltingOfByRate}(\text{the ice, john, } d)]$ (by $\exists G$)
- b. $\exists x[\text{MeltingOfByRate}(\text{the ice, } x, \text{slow})]$ (by $\exists G$)

2.1 | Projectionist and separationist event semantics

Events are useful tools to capture clausal meanings. However, event semantics itself does not distinguish between projectionist and separationist approaches. Even if we adopt an event-description approach to thematic relations, (de)composition may just take place inside the lexicon. A projectionist account for the entailments in (2) simply has *melt* access one of the lexical meanings in (6) depending on transitivity (Williams, 2015, p. 203).

- (6) a. $[[\text{melt}_2]] = \lambda y \lambda x \lambda e[\text{Melting}(e) \ \& \ \text{THEME}(e, y) \ \& \ \text{AGENT}(e, x)]$
- b. $[[\text{melt}_1]] = \lambda y \lambda e[\text{Melting}(e) \ \& \ \text{THEME}(e, y)]$

An alternative approach proposes that these relations, or at least some important subset of these relations, are separated from the lexical content of verbs. Even if they are entailed by the verb's meaning, these relations are introduced into the derivation by some other element. AGENT is frequently argued to be severed from the verb and introduced by an independent element (Kratzer, 1996), here called AG. The meaning of AG is given in (7), and its role in deriving the meaning of (3a) is shown in (8) using the compositional rules of Function Application (FA) and Predicate Modification (PM) from Heim and Kratzer (1998).

$$(7) \quad [[\text{AG}]] = \lambda x \lambda e[\text{AGENT}(e, x)]$$

- (8) $[[[\text{John AG}][\text{melt}_1 \text{ the ice}]]]$
- a. $[[[\text{melt}_1 \text{ the ice}]]] = \lambda e[\text{Melting}(e) \ \& \ \text{THEME}(e, \text{the ice})]$ (by FA)
- b. $[[[\text{John AG}]]] = \lambda e[\text{AGENT}(e, \text{john})]$ (by FA)
- c. $[[[[\text{John AG}][\text{melt}_1 \text{ the ice}]]]] = \lambda e[\text{Melting}(e) \ \& \ \text{THEME}(e, \text{the ice}) \ \& \ \text{AGENT}(e, \text{john})]$ (by PM)

Generally, a separationist analysis done in the syntax can be translated into a projectionist analysis done in the lexicon. To empirically distinguish between these approaches, more needs to be shown.³

2.2 | Semantic wedges and thematic separation

Adopting event semantics naturally leads to decomposed meanings. Where projectionist and separationist accounts diverge is in whether these decomposed meanings are packaged together. On projectionist accounts, multiple parts of a meaning are packaged together in the lexicon and introduced into a derivation via a single lexical item. This predicts that it is not possible for one part of the meaning to fall into the scope of some operator without the other(s) because they are introduced together as a single unit. On separationist accounts, multiple parts of a meaning are introduced into a derivation as separate elements. This predicts that semantic operators may be introduced between them and treat these separate elements distinctly.

Williams (2015) argues that the existence of *semantic wedges*, semantic operators shown to have one part of a meaning in its scope but not another, is strong evidence in favour of separationist accounts.⁴ Consider the introduction of a semantic operator to the separationist derivation in (8). The operator defined in (9) intervenes between the agent relation and the verbal predicate in (10), with the operator taking scope only over the verbal predicate. This requires the agent relation and the verbal predicate to be in two distinct events, e_1 and e_2 , that are mediated by the meaning of the operator, \mathcal{O} . John is, therefore, the agent of an event, e_1 , that is related to an event of melting the ice, e_2 , via \mathcal{O} .

$$(9) \quad [\text{Op}] = \lambda P_{(s,t)} \lambda e_3 \exists e_2 [\mathcal{O}(e_3, e_2) \ \& \ P(e_2)]$$

- (10) [[John AG] [Op [melt₁ the ice]]]
- a. [[melt₁ the ice]] = $\lambda e_2 [\text{Melting}(e_2) \ \& \ \text{THEME}(e_2, \text{the ice})]$ (by FA)
 - b. [[Op [melt₁ the ice]]] = $\lambda e_3 \exists e_2 [\mathcal{O}(e_3, e_2) \ \& \ \text{Melting}(e_2) \ \& \ \text{THEME}(e_2, \text{the ice})]$ (by FA)
 - c. [[John AG]] = $\lambda e_1 [\text{AGENT}(e_1, \text{john})]$ (by FA)
 - d. [[[[John AG] [Op [melt₁ the ice]]]]] = $\lambda e_1 [\text{AGENT}(e_1, \text{john}) \ \& \ \exists e_2 [\mathcal{O}(e_1, e_2) \ \& \ \text{Melting}(e_2) \ \& \ \text{THEME}(e_2, \text{the ice})]]$ (by PM)

A projectionist analysis, like (6a) that packages the agent relation with the verb, is unable to use a semantic operator to wedge these two pieces of meaning apart because that are introduced into the derivation via the same event. The association of the agent relation and verbal predicate to one event, e_2 , is maintained throughout the derivation in (12), making John the agent of an event of melting the ice, e_2 , that is related to some other event, e_1 , via \mathcal{O} .

$$(11) \quad [\text{Op}] = \lambda P_{(e,(s,t))} \lambda x \lambda e_1 \exists e_2 [\mathcal{O}(e_1, e_2) \ \& \ P(x)(e_2)]$$

- (12) [John [Op [melt₂ the ice]]]
- a. [[melt₂ the ice]] = $\lambda x \lambda e_2 [\text{Melting}(e_2) \ \& \ \text{THEME}(e_2, \text{the ice}) \ \& \ \text{AGENT}(e_2, x)]$ (by FA)
 - b. [[Op [melt₂ the ice]]] = $\lambda x \lambda e_1 \exists e_2 [\mathcal{O}(e_1, e_2) \ \& \ \text{Melting}(e_2) \ \& \ \text{THEME}(e_2, \text{the ice}) \ \& \ \text{AGENT}(e_2, x)]$ (by FA)
 - c. [[[[John [Op [melt₂ the ice]]]]] = $\lambda e_1 \exists e_2 [\mathcal{O}(e_1, e_2) \ \& \ \text{Melting}(e_2) \ \& \ \text{THEME}(e_2, \text{the ice}) \ \& \ \text{AGENT}(e_2, \text{john})]$ (by FA)

Evidence from semantic wedges is critical to distinguishing between projectionist and separationist accounts. While demonstrating that such cases exist unambiguously is difficult, Williams (2015) promotes two from the literature, cumulative interpretations and adnominal modal adverbs.⁵

2.2.1 | Cumulative interpretations

(13b) has an interpretation, brought out by the context in (13a), where each of the three coaches did some teaching, and between the three coaches they taught all of the quarterbacks (Schein, 1993). This interpretation is distinct from several others. The three coaches need not have taught the quarterbacks together (the collective reading), nor was each coach necessarily involved in teaching each quarterback (the distributive reading), nor must there have been three different coaches per quarterback (the inverse scope reading).

- (13) a. Context: Coach A taught Quarterback I, and Coach B and Coach C taught Quarterback II. Quarterback I learns Play 1 and Play 2, and Quarterback II learns Play 3 and Play 4.
- b. Three coaches taught every quarterback two new plays.

Schein argues that the cumulative interpretation requires *every* to scope over the verbal predicate but exclude the agent relation assigned to the subject. Therefore, *every* acts as a semantic wedge described above. He proposes an analysis similar to (14).

- (14) $\exists e[\exists x[3(x) \ \& \ \text{Coach}(x) \ \& \ \text{AGENT}(e, x)] \ \& \ \forall y[\text{Quarterback}(y) \rightarrow \exists e'[e' \leq e \ \& \ \text{Teaching}(e') \ \& \ \text{RECIPIENT}(e', y) \ \& \ \exists z[2(z) \ \& \ \text{NewPlay}(z) \ \& \ \text{THEME}(e', z)]]]]$
- ‘There was an event e such that three coaches x acted as agents of e and for every quarterback y there was a subevent e' of e such that each e' was a teaching of y and y learned two new plays z in e' ’

Importantly in this analysis, the subject and object quantifiers, \exists and \forall respectively, have independent scopes, each scoping over its own parts of the meaning and associated with different events, that is, *AGENT* with e , and *Teaching* (and *RECIPIENT*, *THEME*, etc.) with e' . While the event e involving the coaches and the events e' involving the quarterbacks are distinct, they are ultimately related to one another by a part-whole relation, $e' \leq e$, without saying which coaches are part of which subevent. What (14) says is that three coaches were the agents of an event, and each quarterback got taught two (different) plays in some events that were part of this overarching event. Fundamentally, it is the underdetermination of which coaches taught which quarterbacks that permits the cumulative interpretation to emerge.

We can furthermore show that the cumulative reading fails to emerge if *every* scopes over both the agent relation and the verbal predicate, as it must on a projectionist account where the verb introduces the agent relation and verbal predicate together.⁶ Consider the two resulting meanings below in which the agent relation is introduced with *Teaching* and thus falls inside *every*'s scope. (15a) represents a distributive reading ($\exists x > \forall y$) where there are only three coaches, but all three are agents of each subevent. (15b) represents an inverse scope reading ($\forall y > \exists x$) where each subevent has three different coaches. The cumulative interpretation cannot emerge because the agent relation is directly tied to the *Teaching* events e' in the scope of the object quantifier.

- (15) a. $\exists e[\exists x[3(x) \ \& \ \text{Coach}(x) \ \& \ \forall y[\text{Quarterback}(y) \rightarrow \exists e'[e' \leq e \ \& \ \text{Teaching}(e') \ \& \ \text{RECIPIENT}(e', y) \ \& \ \exists z[2(z) \ \& \ \text{NewPlay}(z) \ \& \ \text{THEME}(e', z)] \ \& \ \text{AGENT}(e', x)]]]$
 ‘There was an event e with three coaches x such that for every quarterback y there was a subevent e' of e such that each e' was a teaching of y , y learned two new plays z in e' , and the xs were agents of each e' ’
- b. $\exists e[\forall y[\text{Quarterback}(y) \rightarrow \exists e'[e' \leq e \ \& \ \text{Teaching}(e') \ \& \ \text{RECIPIENT}(e', y) \ \& \ \exists z[2(z) \ \& \ \text{NewPlay}(z) \ \& \ \text{THEME}(e', z)] \ \& \ \exists x[3(x) \ \& \ \text{Coach}(x) \ \& \ \text{AGENT}(e', x)]]]]$
 ‘There was an event e such that for every quarterback y there was a subevent e' of e such that each e' was a teaching of y , y learned two new plays z in e' , and three coaches x were the agents of each e' ’

The existence of cumulative interpretations, therefore, stand as strong evidence for thematic separation. Accounting for them requires the object quantifier to act as a semantic wedge, forcing the separation of the agent relation from the rest of the verbal predicate.

2.2.2 | Adnominal modal adverbs

(16), containing the modal adverb *possibly* in the second conjunct of the subject, has a reading where there is a single collective surrounding-the-quad event where the students were certainly agents and allows for the possibility that the professors were agents as well (Collins, 1988).

- (16) The students and possibly the professors surrounded the quad.

Such cases are puzzling in that modal adverbs are usually understood to scope over events, not individuals. (18) provides an analysis similar to Schein (2017) that allows the possibility operator, defined in (17), to scope over the agent relation assigned to the professors, but exclude the agent relation assigned to the students and the verbal predicate. $\Diamond[\text{AGENT}(e, \text{the professors})]$ can be paraphrased as ‘possibly, the professors were agents of the event e ’.⁷

$$(17) \llbracket \text{possibly} \rrbracket = \lambda P_{(s,t)} \lambda e \Diamond[P(e)]$$

- (18) $\exists e[\text{Surrounding}(e) \ \& \ \text{THEME}(e, \text{the quad}) \ \& \ \text{AGENT}(e, \text{the students}) \ \& \ \Diamond[\text{AGENT}(e, \text{the professors})]]$

Importantly, the agent relation appears twice in (18), but the verbal predicate only once. This is only possible on an account where thematic relations are separated from verbal predicates. On projectionist analyses, each agent relation must co-occur with its verbal predicate, leading to incorrect meanings for (16). For example, (19a) introduces the agent relation with the verbal predicate only once in the course of the derivation, requiring the students and the professors to share the same agent relation.⁸ Having been projected into the derivation at the same point, the possibility operator must scope over both the verbal predicate and the agent role. Therefore, the possibility of the event itself is in question, not just the professors' participation. (19b) introduces the agent relation twice, once for the students and once for the professors, requiring that the verbal predicate also be introduced twice. The possibility operator, again scoping over the verbal predicate, isolates the event e_2 involving the professors from

the event e_1 involving the students, but this fails to capture single collective event reading, requiring instead that there was one surrounding event, and possibly a (distinct) second.

- (19) a. $\Diamond \exists e [\text{Surrounding}(e) \ \& \ \text{THEME}(e, \text{the quad}) \ \& \ \text{AGENT}(e, \exists x [\text{Students} \sqcup \text{Professors}(x)])]$
 b. $\exists e_1 [\text{Surrounding}(e_1) \ \& \ \text{THEME}(e_1, \text{the quad}) \ \& \ \text{AGENT}(e_1, \text{the students})] \ \& \ \Diamond \exists e_2 [\text{Surrounding}(e_2) \ \& \ \text{THEME}(e_2, \text{the quad}) \ \& \ \text{AGENT}(e_2, \text{the professors})]$

Williams (2015) observes that adnominal modals also occur with direct objects. (20a) has a single collective event reading in which it was possible that the professors were also patients of a single collective encircling event of the students by the cops. Such examples can also be extended to instruments (20b) and sources and goals (20c), suggesting that thematic separation may be grammatically available in a wide range of cases.

- (20) a. The cops encircled the students and possibly the professors.
 b. The army surrounded the village with their tanks and possibly their armored Humvees.
 c. The mob stretched from the Ellipse and possibly the White House to the Capitol and maybe the Supreme Court.

2.3 | Summary

Ultimately, whether any lexical verb encodes any particular thematic relation is subject to empirical inquiry, with the best analyses likely being that some relations are projected from the verb. Evidence from semantic wedges, however, provides strong support that certain thematic relations must be introduced separately into the derivation of some sentence meanings. Importantly, although the examples which require separation seem subtle and complex, there is little reason to think thematic relations behave differently in the absence of plurals and quantifiers or conjunction and adnominal modals. If the analysis of (13b), (16), and (20a) requires separation, then seemingly simpler cases like those in (21) should as well.

- (21) a. The coach taught the quarterback.
 b. The students surrounded the quad.
 c. The cops encircled the students.

3 | SENTENCE COMPREHENSION AND THEMATIC INTERPRETATION

Theories of sentence comprehension, often investigating seemingly simpler cases like (21), tend to adopt a projectionist perspective, discussing thematic relations alongside lexical verbs. There is, however, also a long tradition in the literature that argues for the incremental thematic interpretation of arguments, even for those arguments that occur prior to the verb.⁹ While such incrementality is uncontested, what has been missing is a clear commitment to what the representations that underlie these interpretations amount to. A separationist event semantics appears well-suited to address this missing specificity, describing incremental representations in terms of unfolding event descrip-

tions at a necessary level of detail without committing to particular verbal predicates. Evidence from sentence comprehension may also, in turn, be useful for exploring issues that arise from the decompositional commitments required by separationist accounts, including the granularity of thematic relations. Before turning to the evidence, however, a quick word on the link between parsing and interpretation.

3.1 | Incremental parsing strategies

Sentences unfold incrementally during real-time language processing, with the input often being consistent, at least temporarily, with multiple analyses. This ambiguity requires comprehenders to make decisions about which analysis to pursue, even when such decisions are premature. Initial parsing decisions may ultimately be incorrect, forcing comprehenders to revise their analyses, which is reflected in, for example, reading time disruptions and deflections in event-related potential (ERP) components.

Parsing strategies guide these decisions. Early research proposed that comprehenders strategically interpret sentence-initial noun phrase-verb (NP-V) sequences as agent-action (Bever, 1970; Boland & Tanenhaus, 1991; Ferreira, 2003; McRae et al., 1997; Trueswell & Tanenhaus, 1994). Although this strategy includes verbs as part of the sequence, many proposals actually assume a highly incremental process in which the NP itself is initially interpreted as an agent (e.g. MacDonald et al., 1994, p. 687). Such strategies may be seen as an alignment of the thematic hierarchy (22a) with the accessibility hierarchy (22b) (Keenan & Comrie, 1977). Subjects are the highest NP and agents are the highest thematic relation. Aligning these guides the parser to take the first NP to be the subject and agent of the current clause. Other strategies incorporate alignment with the case hierarchy (22c) (Blake, 2001). Parsing a clause-initial but accusative marked nominal guides the parser away from an agent-first strategy to a lower thematic relation, like patient/theme. Here I will adopt the idea that alignment generally guides parsing decisions.

- (22) a. Thematic Hierarchy: Agent > Experiencer > Patient > Theme
 b. Accessibility Hierarchy: Subject > Indirect Object > Direct Object
 c. Case Hierarchy: Nominative > Dative > Accusative

3.2 | Comprehending pre-verbal arguments

Observations from head-final constructions provide a rich source of evidence that pre-verbal arguments are interpreted before the verb. Inoue (1991) noted that Japanese speakers encounter conscious difficulty at the verb *tabeta* 'ate' in (23). This difficulty indicates that the parser commits to an analysis of arguments and their relations under ambiguity before it encounters the first verb, initially deciding that the accusative-marked argument *ringo-o* 'apple-ACC' acts as the theme of a simple ditransitive clause. The transitive verb *tabeta* 'ate', however, is incompatible with this analysis, triggering a costly revision resulting in an appropriate relative clause structure (see also Kamide and Mitchell (1999) and Aoshima et al. (2004) on incremental interpretation in Japanese).

- (23) *Bob-ga Mary-ni ringo-o tabeta inu-o ageta.*
 Bob-NOM Mary-DAT apple-ACC ate dog-ACC gave
 "Bob gave Mary the dog which ate the apple."

Concerning the representation of (23) formed before the verb, a separationist event semantics offers (24) in which *ringo-o* ‘apple-ACC’ is related to the main event via *THEME*, without also requiring some particular verbal predicate that satisfies this event-description (e.g. Giving, Taking, Selling, etc.), as required on a projectionist account. When then parsing *tabeta* ‘ate’ in (23), the degree to which the event relations entailed by the predicate Eating are not consistent with this initial event-description may act as one cue, among others, that guides revision.

- (24) *Bob-ga Mary-ni ringo-o...*
 Bob-NOM Mary-DAT apple-ACC...
 [[Bob AG] [Mary RP] [apple TH]]
 $\exists e[\text{AGENT}(e, \text{bob}) \ \& \ \text{RECIPIENT}(e, \text{mary}) \ \& \ \text{THEME}(e, \text{apple})]$

Evidence that compatibility with an initial event-description factors into revision comes from contrasts between active versus object-experiencer constructions in German, taking advantage of (mis) alignment between thematic and case hierarchies. These constructions share nominative-dative case marking, but differ in the thematic relations assigned to those case-marked arguments. Active constructions like (25a) congruently assign their higher agent relation to their higher nominative-marked argument, consistent with parsing strategy. Object-experiencer constructions like (25b) are misaligned, assigning their higher experiencer relation to their lower dative-marked argument. Bornkessel et al. (2003) reported an early (300–600 ms) parietal positivity on object-experiencer verbs compared to active verbs. They argued that the arguments must have been thematically ranked before the verb was encountered, with this positivity reflecting the thematic revision required for object-experiencer verbs.

- (25) a. *Maria glaubt dass der Priester dem Gärtner folgt und...*
 Maria believes that the.NOM priest the.DAT gardener follows and...
 “Maria believes that the priest_{AG} is following the gardener_{PT} and...”
- b. *Maria glaubt dass der Priester dem Gärtner imponiert und...*
 Maria believes that the.NOM priest the.DAT gardener impresses and...
 “Maria believes that the priest_{STIM} impresses the gardener_{EXP} and...”

Following an alignment-driven parsing strategy, a separationist event semantics provides the representation in (26) in which the parser analyzes the nominative-marked argument as the agent and the dative argument as the patient; an interpretation that must be revised after encountering the object-experiencer verb.

- (26) *Maria glaubt dass der Priester dem Gärtner...*
 Maria believes that the.NOM priest the.DAT gardener...
 [[the priest AG] [the gardener PT]]
 $\exists e[\text{AGENT}(e, \text{the priest}) \ \& \ \text{PATIENT}(e, \text{the gardener})]$

While the effects above are elicited by verbs, other studies elicit effects of thematic interpretation before the verb. The animacy requirement for agent interpretation has made animacy an important factor in demonstrating pre-verbal thematic interpretation. Frisch and Schleewsky (2001) reported a greater N400 response on nominative-marked inanimate arguments when they followed an accusative-marked argument compared to when they followed a nominative-marked argument, (27a)

versus (27b) (see also Kamide et al. (2003) and Weckerly and Kutas (1999) for similar results with English object-relative clauses).

- (27) a. *Peter fragt sich, welchen Förster der Zweig streifte.*
 Peter asked himself, which.ACC forester the.NOM twig brushed.
 “Peter asks himself which forester the twig brushed against.”
- b. *Peter fragt sich, welcher Förster der Zweig streifte.*
 Peter asked himself, which.NOM forester the.NOM twig brushed.

This effect is also consistent with parsing strategies driven by alignment. Being lower than nominative on the case hierarchy, the early accusative-marked argument sets an expectation for the following nominative-marked argument to receive a higher thematic relation and thus be of higher animacy than the accusative-marked argument. This suggests that comprehenders initially analyse *welcher Förster* ‘which.ACC forester’ as a patient, shown in (28), with the expectation that the nominative argument will be an agent, and therefore high on an animacy scale.

- (28) *Peter fragt sich, welchen Förster...*
 Peter asked himself, which.ACC forester...
 $[[\text{which.ACC forester}]_i \ [\text{[NP.NOM AG]} \ [t_i \text{ PT}]]]$
 $\lambda x?y[\text{Forester}(y) \ \& \ \exists e[\text{PATIENT}(e, y) \ \& \ \text{AGENT}(e, x)]]$

While the prior two studies rely on differences in prominence between arguments, single arguments have also been shown to elicit thematic-related effects pre-verbally. Bovolenta and Husband (2022) investigated the relationship between animacy, agents, and their structural requirements, using Italian auxiliaries *avere/essere* in sentences like (29) as probes for non-agent-related structure building ahead of the verb. *Avere* selects active verb phrases with subjects receiving an agent/causer interpretation, while *essere* selects verb phrases where the subject is derived from the direct object position where it is assigned a theme interpretation (Burzio, 1986). Subject animacy was manipulated, with inanimate subjects making poor agents/causers and guiding expectations for a theme-assigning derived subject structure requiring *essere*, not *avere*. As a violation of this expectation, *avere* elicited a frontal ERP from 400 to 600 ms whose amplitude was more negative for more inanimate subjects like (29a) compared to (29b).

- (29) a. *Le impronte hanno condotto la polizia al colpevole.*
 The footprints AVERE.3PL led the police to.the culprit
 “The footprints have led police to the culprit.”
- b. *Un boscaiolo ha trovato la volpe ferita.*
 A lumberjack AVERE.3SG found the fox wounded
 “A lumberjack has found the wounded fox.”

This frontal negativity suggests that the parser initially committed to a theme interpretation for more inanimate subjects, derived from a direct object of an unknown and possibly very large class of verbs with the only requirement that an auxiliary, if present, takes the *essere* form, shown in (30). The presence of *avere*, incompatible with the structural requirements of a theme subject, triggers revision, with the subject reinterpreted as an agent/causer.

- (30) *Le impronte...*
 The footprints...

$$[[\text{The footprints}]_i [\text{AUX}_{\text{ESSERE}} [\text{VP V } [t_i \text{ TH}]]]]$$

$$\exists e[\text{THEME}(e, \text{the footprints})]$$

The evidence reviewed above is consistent with thematic interpretation of arguments apart from verbs. A separationist event semantics provides an account of these incremental representations at the right level. Each argument is analysed as a participant of an event-relation, with no need to directly posit a particular verbal predicate, even if verb-related structure is built ahead of the input.

3.3 | Thematic granularity and the time course of interpretation

The cases above have relied on standard generalised thematic relations. However, the abstractness of these relations remains an open question. Traditionally, relations like AGENT, PATIENT, INSTRUMENT, SOURCE, GOAL, etc. have been used to encode event-related argument distinctions that appear to repeat across event types (Fillmore, 1968; Gruber, 1965; Jackendoff, 1972). What this set of relations is, however, remains an open and debated issue. At one extreme, all arguments might be simply considered to be participants in the event encoded by the clause. Schein (2012), for example, has proposed that all arguments are interpreted by a single thematic relation, PARTICIPANT, with specificity arising from other elements of event structure. Dowty (1991) proposes two relations, proto-agent and proto-patient. At the other end of the spectrum, relations might be quite fine-grained, based on the idiosyncratic meanings of verbs (McRae et al., 1997), for example, *melt* may have a MELTER and a MELTED relation, distinct from a FREEZER and a FREEZED relation for *freeze*, though they share much else.

Interestingly, current psycholinguistic evidence from verb predictability studies suggests that differences in representational grain are related to the timecourse of interpretation. Liao et al. (2022) used reduction of N400 amplitude as an index of increased verb predictability. One study compared (31a), where two arguments associated with the verb 殺了 ‘killed’ are in different clauses, to (31b) where they are in the same clause. Liao et al. reported no N400 difference at normal presentation speed (600 ms/word) but a reduced N400 at slower presentation speed (800 ms/word). This suggests that comprehenders require time to establish which clause an argument is in, and therefore which event it participates in. In a further study using normal presentation speed, they compared (31b) to the more implausible (31c), which reversed the arguments' thematic relations. They found no difference in the N400, suggesting that comprehenders were unable to use order to distinguish the arguments thematically. Chow et al. (2018), however, found that N400 reduction emerged when an adverbial like 在昨天晚上 ‘ZAI last night’ occurred before the verb in (31b) versus (31c). This additional adverbial arguably gave comprehenders enough time to assign thematic relations to the clausal arguments and affect verb predictability.

- (31) a. 皇帝 認為 貪官 殺了 親信 之後 就會 倒戈
 Emperor thought corrupt.officials killed cronies after will defect
 “The emperor thinks corrupt officials will defect after killing their cronies.”
- b. 皇帝 把 貪官 殺了 之後 , 任命了 新的 官員
 Emperor BA corrupt.officials killed after , appoint new officials
 “After the emperor killed the corrupt officials, he appointed new officials.”
- c. 貪官 把 皇帝 殺了 之後 , 任命了 新的 官員
 Corrupt.officials BA emperor killed after , appoint new officials
 “After the corrupt officials killed the emperor, new officials were appointed.”

In line with this evidence, Liao et al. (2022) proposed three temporal stages for argument interpretation. In Stage 1, verb predictability is guided merely by association with surrounding arguments regardless of the clause they occur in. In Stage 2, the parser restricts association to clausal arguments without specifying their thematic interpretations. In Stage 3, the parser assigns thematic relations to clausal arguments, which fine-tunes verb predictability.

These stages represent a refinement in the granularity of thematic relations over time. After Stage 1, Stage 2 may deploy Schein's (2012) PARTICIPANT relation, shown in (32a), which relates arguments to a single event, but differentiates them no further.¹⁰ Stage 3 occurs when comprehenders have time to deploy finer-grained thematic interpretations, shown in (32b).¹¹ How fine grained these relations can be is an open question. Evidence from Inoue (1991) suggests that we need at least three thematic relations, and further research may support the need for others.

- (32) Emperor BA corrupt.officials ...
- a. Stage 2: $\exists e[\text{PARTICIPANT}_i(e, \text{emperor}) \ \& \ \text{PARTICIPANT}_j(e, \text{corrupt.officials})]$
- b. Stage 3: $\exists e[\text{AGENT}(e, \text{emperor}) \ \& \ \text{PATIENT}(e, \text{corrupt.officials})]$

A hypothetical Stage 4 may further refine argument interpretation via the verb's lexical content, including event structural components. Consider the verb *kill* which entails a process such that the patient comes to be in a dead state (Lakoff, 1970). The meaning in (33) applies the predicate Dead to *kill*'s *x* argument and says that a process occurred in which *x* becomes dead, enriching the interpretation from (32b) to (34).

- (33) $\llbracket \text{kill} \rrbracket = \lambda x \lambda e_1 \exists e_2[\text{PROCESS}(e_1, e_2) \ \& \ \exists e_3[\text{BECOME}(e_2, e_3) \ \& \ \text{Dead}(e_3, x)]$

- (34) Emperor BA corrupt.officials killed ...
- Stage 4: $\exists e_1[\text{AGENT}(e_1, \text{emperor}) \ \& \ \text{PATIENT}(e_1, \text{corrupt.officials})] \ \& \ \exists e_2[\text{PROCESS}(e_1, e_2) \ \& \ \exists e_3[\text{BECOME}(e_2, e_3) \ \& \ \text{Dead}(e_3, \text{corrupt.officials})]]$

Such refinement adopts properties of projectionist analysis while continuing to support a separationist account of thematic relations. General thematic relations work compositionally with specific information encoded in verbs (Goldberg, 2006). Williams (2015) calls this redundant separationism, though the temporal order of different information sources suggests that representations are only redundant in their final analysis. Incremental access and incorporation of verb-specific predicates also addresses how rich event and world knowledge, which is central to language comprehension, enters

into representations of sentence meaning and may further instruct the conceptual system (Knowlton et al., 2021). Once accessed, verb-specific meanings entail certain thematic requirements, possibly via their event structure components (e.g. PROCESS, BECOME in (33)) and sometimes priming representations, guiding upcoming ambiguity resolution, or triggering revision (Bornkessel et al., 2003; McKoon & Macfarland, 2002; McKoon & Ratcliff, 2008; McRae et al., 1997; Trueswell & Kim, 1998). Priming between event-related nouns and (inflected) verbs may be further mediated by verb-specific predicates and their associates in long-term memory (e.g. Dead in (33) to living entities) (Hare et al., 2009; McRae & Matsuki, 2009).

In sum, comprehenders can use general thematic relations to interpret pre-verbal arguments and constrain their predictions for upcoming structural and lexical representations without committing to particular lexical verbs. They may also use verb-specific information, once accessed, to further enrich and constraint these analyses and interpretations. A separationist event semantics provides representations that fit the theoretical bill on both accounts.

4 | CONCLUSION

While event semantics is a major player in linguistic theory, some of its developments have not become widely known. Thematic separation is one of these. As such, it is perhaps unsurprising that adjacent fields like psycholinguistics have not considered the possibility of adopting separationist event semantic representations.

Within linguistic theory, semantic wedges play an important role identifying that thematic relations, traditionally a component meaning of lexical verbs, require a separationist treatment. Cumulative interpretations and adnominal modal adverbs offer two strong cases for separation, using the scope of quantifier and modal operators to show that a thematic relation and verb predicate need not cohabit in semantic derivations. Importantly, the separationist analysis needed when operators wedge a thematic relation apart from a verbal predicate remains in the absence of those operators, suggesting that even seemingly simple cases may hide more complexity than meets the eye. What remains for semantic theory is to understand the extent of separation and its limits.

As it becomes more widely appreciated, separationist event semantics will hopefully attract more attention from psycholinguistics. Its representational format provides an elegant way to capture the incremental thematic interpretation of arguments without requiring access to any verb's lexical content. That such representations are empirically needed seems clear, but raises questions concerning how the parser builds and deploys such representations in the service of sentence comprehension. For example, the N400 effects reported in Bornkessel et al. (2003) seem incongruent with Chow et al. (2018) and Liao et al. (2022) as both are related to (pre-verbal) thematic interpretation, but differ in their timecourse. Bornkessel et al.'s effects appear earlier than expected under Liao et al.'s model, though there are differences in their particulars which remain to be worked out.

It is also still unclear just how granular thematic relations need to be, with many hypotheses currently available to semantic theory and relatively little psycholinguistic evidence supporting distinctions beyond (proto-)agent and (proto-)theme. As suggested above, thematic granularity may be in part a question of timecourse during sentence comprehension, starting very generally but becoming more specific as comprehenders use structural and semantic cues to refine their interpretations. It is hoped that the evidence from semantics and psycholinguistics concerning the granularity and timecourse of thematic relations inspires further fruitful integration between the two fields.

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ENDNOTES

- ¹ Predicates, including those representing verb-specific meanings, are capitalised, arguments are lower case, variables are italicised, and thematic relations are in small caps.
- ² Double turnstiles stand for semantic consequences ($\phi \models \psi$ means that ψ is true whenever ϕ is), and single turnstiles for syntactic consequences ($\phi \vdash \psi$ means that there is a proof of ψ given ϕ).
- ³ Complement coercion, for example, *John began his book*, may offer a distinct case for thematic separation as no lexical verb is introduced in their derivation (Pylkkänen, 2008), a possibility for future exploration.
- ⁴ Williams (2015:Ch. 9) discusses five other cases consistent with separationist accounts, but where projectionist alternatives are also possible.
- ⁵ Williams (2015:326–331) argues that Mandarin and Igbo resultatives, where verbs fail to inherit the argument structure of their non-resultatives counterparts, are also cases of a semantic wedge between verbs and thematic relations.
- ⁶ Schein (1993:Ch. 4) also argues against several additional, more complex analyses that attempt to rescue a projectionist account by invoking plural variables and branching quantifiers.
- ⁷ Associating two agent relations to the same event in (18) stands in tension with Role Exhaustion, that thematic relations are exhaustive and unique to an event (Williams, 2015). Schein (2017:§1.5.2) conforms to Role Exhaustion via silent plural event pronominals that connect the subevents that the arguments participate in separately to a single (plural) event bearing a single agent relation. The subevent participant relations are separated from the verbal predicate in his account.
- ⁸ As plural and conjunction semantics is not this article's focus, the join operator, \sqcup , is used to conjoin predicates P and Q applying to the same variable, such that each member of that variable is either a P or a Q. However, see Schein (2017) for a much deeper analysis.
- ⁹ Space precludes discussion of other areas in psycholinguistics which have a natural fit with separationist accounts. Interpretation of novel verb sentences like *Kermit blicketed Miss Piggy*, where Kermit is interpreted as the agent and Miss Piggy the patient (Lidz et al., 2003; Naigles, 1990), is one case as *blicket* is not stored in the lexicon and therefore there is no lexical verb to project these thematic relations.
- ¹⁰ Subscripts indicate that the PARTICIPANT roles are distinct, respecting Role Exhaustion (see fn. 7).
- ¹¹ Note that Dowty's (1991) proto-agent/patient may be sufficiently fine-grained for (32b) given Chow et al.'s (2018) manipulations, a question for future research.

REFERENCES

- Abney, S. P. (1989). A computational model of human parsing. *Journal of Psycholinguistic Research*, 18(1), 129–144. <https://doi.org/10.1007/bf01069051>
- Aoshima, S., Phillips, C., & Weinberg, A. (2004). Processing filler-gap dependencies in a head-final language. *Journal of Memory and Language*, 51(1), 23–54. <https://doi.org/10.1016/j.jml.2004.03.001>
- Bever, T. G. (1970). The cognitive basis for linguistic structures. In J. J. Hayes (Ed.), *Cognition and the development of language* (pp. 279–362). Wiley.
- Blake, B. J. (2001). *Case*. Cambridge University Press.
- Boland, J. E., & Tanenhaus, M. K. (1991). The role of lexical representations in sentence processing. *Advances in Psychology*, 77, 331–366.

- Bornkessel, I., Schlesewsky, M., & D Friederici, A. (2003). Eliciting thematic reanalysis effects: The role of syntax-independent information during parsing. *Language & Cognitive Processes*, 18(3), 269–298. <https://doi.org/10.1080/01690960244000018>
- Bornkessel-Schlesewsky, I., & Schlesewsky, M. (2009). *Processing syntax and morphology: A neurocognitive perspective* (Vol. 6). Oxford University Press.
- Bovolenta, G., & Husband, E. M. (2022). Structural prediction during language comprehension revealed by electrophysiology: Evidence from Italian auxiliaries. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 49(1), 116–129. <https://doi.org/10.1037/xlm0001115>
- Burzio, L. (1986). *Italian syntax: A government-binding approach* (Vol. 1). D Reidel Publishing Company.
- Carlson, G. (1984). Thematic roles and their role in semantic interpretation. *Linguistics*, 22(3), 259–279. <https://doi.org/10.1515/ling.1984.22.3.259>
- Carlson, G., & Tanenhaus, M. K. (1988). Thematic roles and language comprehension. In W. Wilkins (Ed.), *Thematic relations. Syntax and Semantics* (Vol. 21, pp. 263–288). Academic Press.
- Castañeda, H.-N. (1967). Comments on D. Davidson's "The logical form of action sentences". In N. Rescher (Ed.), *The logic of decision and action*. University of Pittsburgh Press.
- Chen, S. Y., & Husband, E. M. (2019). Event (de)composition. In C. Cummins & N. Katsos (Eds.), *Oxford handbook of experimental semantics and pragmatics* (pp. 62–82). Oxford University Press. <https://doi.org/10.1093/oxfordhdb/9780198791768.013.10>
- Chow, W.-Y., Lau, E., Wang, S., & Phillips, C. (2018). Wait a second! delayed impact of argument roles on on-line verb prediction. *Language, Cognition and Neuroscience*, 33(7), 803–828. <https://doi.org/10.1080/23273798.2018.1427878>
- Chow, W.-Y., Smith, C., Lau, E., & Phillips, C. (2016). A "bag-of-arguments" mechanism for initial verb predictions. *Language, Cognition and Neuroscience*, 31(5), 577–596. <https://doi.org/10.1080/23273798.2015.1066832>
- Collins, C. (1988). *Conjunction adverbs*. MIT. Unpublished manuscript. Retrieved from: <https://ordinaryworkinggrammarian.blogspot.com/2020/09/conjunction-adverbs-1988.html>
- Davidson, D. (1967). The logical form of action sentences. In N. Rescher (Ed.), *The logic of decision and action* (pp. 216–234). University of Pittsburgh Press.
- Dowty, D. (1991). Thematic proto-roles and argument selection. *Language*, 67(3), 547–619. <https://doi.org/10.2307/415037>
- Ferreira, F. (2003). The misinterpretation of noncanonical sentences. *Cognitive Psychology*, 47(2), 164–203. [https://doi.org/10.1016/s0010-0285\(03\)00005-7](https://doi.org/10.1016/s0010-0285(03)00005-7)
- Fillmore, C. J. (1968). The case for case. In E. Bach & R. T. Harms (Eds.), *Universals in linguistic theory*, 1–90. Holt, Rinehart and Winston.
- Frisch, S., & Schlesewsky, M. (2001). The N400 reflects problems of thematic hierarchizing. *NeuroReport*, 12(15), 3391–3394. <https://doi.org/10.1097/00001756-200110290-00048>
- Goldberg, A. (2006). *Constructions at work*. Oxford University Press.
- Gruber, J. S. (1965). *Studies in lexical relations*. Massachusetts Institute of Technology dissertation.
- Hare, M., Jones, M., Thomson, C., Kelly, S., & McRae, K. (2009). Activating event knowledge. *Cognition*, 111(2), 151–167. <https://doi.org/10.1016/j.cognition.2009.01.009>
- Heim, I., & Kratzer, A. (1998). *Semantics in generative grammar*. Wiley-Blackwell.
- Inoue, A. (1991). *A comparative study of parsing in English and Japanese*. The University of Connecticut dissertation.
- Jackendoff, R. S. (1972). *Semantic interpretation in generative grammar*. MIT Press.
- Kamide, Y., & Mitchell, D. C. (1999). Incremental pre-head attachment in Japanese parsing. *Language & Cognitive Processes*, 14(5–6), 631–662. <https://doi.org/10.1080/016909699386211>
- Kamide, Y., Scheepers, C., & Gerry, T. M. A. (2003). Integration of syntactic and semantic information in predictive processing: Cross-linguistic evidence from German and English. *Journal of Psycholinguistic Research*, 32(1), 37–55. <https://doi.org/10.1023/a:1021933015362>
- Keenan, E. L., & Comrie, B. (1977). Noun phrase accessibility and universal grammar. *Linguistic Inquiry*, 8(1), 63–99.
- Knoefler, P., Crocker, M. W., Scheepers, C., & Pickering, M. J. (2005). The influence of the immediate visual context on incremental thematic role-assignment: Evidence from eye-movements in depicted events. *Cognition*, 95(1), 95–127. <https://doi.org/10.1016/j.cognition.2004.03.002>
- Knowlton, T., Hunter, T., Odic, D., Wellwood, A., Halberda, J., Paul, P., & Lidz, J. (2021). Linguistic meanings as cognitive instructions. *Annals of the New York Academy of Sciences*, 1500(1), 134–144. <https://doi.org/10.1111/nyas.14618>

- Kratzer, A. (1996). Severing the external argument from its verb. In J. Rooryck & L. Zaring (Eds.), *Phrase structure and the lexicon* (pp. 109–137). Kluwer.
- Lakoff, G. (1970). *Irregularity in syntax*. Holt, Rinehart & Winston of Canada Ltd.
- Liao, C.-H., Lau, E., & Chow, W.-Y. (2022). Towards a processing model for argument-verb computations in online sentence comprehension. *Journal of Memory and Language*, 126, 104350. <https://doi.org/10.1016/j.jml.2022.104350>
- Lidz, J., Henry, G., & Gleitman, L. (2003). Understanding how input matters: Verb learning and the footprint of universal grammar. *Cognition*, 87(3), 151–178. [https://doi.org/10.1016/s0010-0277\(02\)00230-5](https://doi.org/10.1016/s0010-0277(02)00230-5)
- MacDonald, M. C., Pearlmuter, N. J., & Seidenberg, M. S. (1994). The lexical nature of syntactic ambiguity resolution. *Psychological Review*, 101(4), 676–703. <https://doi.org/10.1037/0033-295x.101.4.676>
- McKoon, G., & Macfarland, T. (2002). Event templates in the lexical representations of verbs. *Cognitive Psychology*, 45(1), 1–44. [https://doi.org/10.1016/s0010-0285\(02\)00004-x](https://doi.org/10.1016/s0010-0285(02)00004-x)
- McKoon, G., & Ratcliff, R. (2008). Meanings, propositions, and verbs. *Psychonomic Bulletin and Review*, 15(3), 592–597. <https://doi.org/10.3758/pbr.15.3.592>
- McRae, K., Ferretti, T. R., & Amyote, L. (1997). Thematic roles as verb-specific concepts. *Language & Cognitive Processes*, 12(2–3), 137–176. <https://doi.org/10.1080/016909697386835>
- McRae, K., & Matsuki, K. (2009). People use their knowledge of common events to understand language, and do so as quickly as possible. *Language and Linguistics Compass*, 3(6), 1417–1429. <https://doi.org/10.1111/j.1749-818x.2009.00174.x>
- Naigles, L. (1990). Children use syntax to learn verb meanings. *Journal of Child Language*, 17(2), 357–374. <https://doi.org/10.1017/s0305000900013817>
- Parsons, T. (1990). *Events in the semantics of English: A study in subatomic semantics*. MIT Press.
- Pritchett, B. L. (1992). *Grammatical competence and parsing performance*. University of Chicago Press.
- Pylkkänen, L. (2008). Mismatching meanings in brain and behavior. *Language and Linguistics Compass*, 2(4), 712–738. <https://doi.org/10.1111/j.1749-818x.2008.00073.x>
- Schein, B. (1993). *Plurals and events*. MIT Press.
- Schein, B. (2012). Event semantics. In G. Russell & D. Graff Fara (Eds.), *The Routledge companion to philosophy of language*, 280–294. Routledge.
- Schein, B. (2017). *'And': Conjunction reduction redux*. MIT Press.
- Trueswell, J. C., & Kim, A. E. (1998). How to prune a garden path by nipping it in the bud: Fast priming of verb argument structure. *Journal of Memory and Language*, 39(1), 102–123. <https://doi.org/10.1006/jmla.1998.2565>
- Trueswell, J. C., & Tanenhaus, M. K. (1994). Toward a lexicalist framework of constraint-based syntactic ambiguity resolution. In C. Clifton Jr., L. Frazier, & K. Rayner (Eds.), *Perspectives on sentence processing*, 155–179. Lawrence Erlbaum Associates, Inc.
- Weckerly, J., & Kutas, M. (1999). An electrophysiological analysis of animacy effects in the processing of object relative sentences. *Psychophysiology*, 36(5), 559–570. <https://doi.org/10.1111/1469-8986.3650559>
- Williams, A. (2015). *Arguments in syntax and semantics*. Cambridge University Press.

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