

Restrictions on copredication: a situation theoretic approach*

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Abstract This paper proposes a situation theoretic account of polysemy: polysemous nouns denote situations that witness (i.e. contain) multiple entities of different types. For instance, *lunch* denotes situations that contain an eating event and some food where these stand in a *patient* relation. A puzzle regarding more than two-ways polysemous nouns such as *statement* is the restrictions on copredication they exhibit, namely, where multiple, potentially incompatible predicates are applied based on a single antecedent, but not all combinations of readings are possible. Such restrictions fall naturally out of the situation theoretic account of polysemy provided.

Keywords: copredication, mereology, polysemy, situation theory, Type Theory with Records

1 Introduction

This section sets out the principal aims of this paper: (i) to develop a formal semantic account of polysemous expressions within a theory that does not assume any bespoke tool that is motivated solely by the polysemy and copredication data; (ii) to provide an explanation for the restrictions there are on copredication as a part of this analysis (see section §2). I begin, in §§1.1-1.2, by outlining some working assumptions regarding what polysemy and copredication are. This includes assumptions regarding the differentiation of polysemy from lexical ambiguity and from cases of coercion. §1.3 gives an overview of restrictions on copredication for

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expressions that are more than two ways polysemous. In §1.4, I raise a challenge for some of the leading accounts of polysemy regarding their use of bespoke tools to explain this phenomenon. In §3, I compare the account with other proposals.

1.1 Polysemy

A polysemous lexical item has more than one sense. To this extent, polysemy and lexical ambiguity are related. Although there is no precise way to draw the line between polysemy and lexical ambiguity, for the purposes of this paper, it will be convenient to make some assumptions. Let us assume that a lexical item is ambiguous, if it has multiple, unrelated senses that are not present for comparable expressions in even closely related languages.¹ For example, *party* is ambiguous in English between a group of people (especially travelling together), a celebration, and a political group, however, in German these three senses are expressed by different lexical items, namely, *Reisegruppe*, *Feier* and *Partei*, respectively. Polysemous expressions, on the other hand, have closely related senses that (frequently) can be found in single lexical items of other languages. For instance, *statement*, in English is a noun that can denote a physical object (e.g., a written statement), an event (of making a statement), or the informational contents of such an event or written statement (1), and the German *Stellungnahme* also has these three senses as we see in (2). Some other examples of polysemous items in English are given in Table 1.

- (1) The witnesses' statement was true/lasted half an hour/is in the filing cabinet.
- (2) Die Stellungnahme ist sachlich / ist in dem Umschlag / hat eine halbe
 the statement is factual / is in the envelope / has a half
 Stunde gedauert.
 hour lasted
 'The statement is factual/is in the envelope/lasted half an hour'

The primary evidence for whether a noun has different senses comes from how felicitously it combines with other expressions (e.g., modifiers) that have selectional restrictions. For example, in (3a) the attributive adjective *thick*, the PP *on the table* and the VP *was picked up (by Alex)* all constitute evidence that *book* has a sense denoting a physical entity (i.e., a physical book), and in (3b) the attributive adjective *interesting* and the use of *book* as the direct object to the verb *memorise* is evidence that *book* has a sense denoting the informational contents of a book.²

1 This is a variation on a test for ambiguity proposed in Kripke 1977. For a comprehensive overview of other tests for ambiguity, see Sennet 2021 and references therein.

2 Even these tests are not completely clear-cut insofar as, for instance, physical entities can be memorised (e.g., in a game where one memorises as many inanimate objects as possible), and books can be interesting in virtue of more than just their contents.

Noun	Senses include
<i>book</i>	informational content, physical object
<i>city</i>	population, area, (local) government
<i>evidence</i>	eventuality, informational content, physical object
<i>lunch</i>	eventuality, physical object
<i>recipe</i>	instructions, event, physical object (food)

Table 1 Examples of polysemous items in English

- (3) a. The thick book on the table was picked up by Alex.
 b. Alex memorised an interesting book.

However, some care must be taken with this test. The example in (4), for instance, is not typically taken to show that *book* has a sense that denotes an eventuality, namely that of reading or writing a book. Instead, this is a case of *coercion*, also called *selectional polysemy*, in contrast to *inherent polysemy* (Pustejovsky 2008, 2011).

- (4) Mary began the book. (Pustejovsky 1995)

This type of coercion is assumed to involve an implicit operation that shifts the meaning of *book* into something denoting an eventuality, triggered as a result of a type mismatch. Although it is not likely that completely clear-cut conditions can be given for all such cases, let us make the further working assumption that we can separate out coercion from polysemy by looking at a wider arrange of modifiers, especially in out-of-the-blue contexts. For example, temporal modification of some sort is usually possible for nouns denoting eventualities (modulo whether this is an event, process or state), but out of the blue, such modifications with *book* as we have in (5) are much less natural than the modifiers *thick* and *interesting*.³

- (5) War and Peace is a thick/interesting/?six-month book.

In summary, I assume polysemy involves non-accidental, inter-related senses of a single lexical item such that these senses can be straightforwardly brought out by modifiers even in out of the blue contexts.

³ It is however possible to find examples of such constructions in richer contexts:

- (i) He has actually set it up to be read in 40 days (no comparison though to that other 40 day book) (enTenTen)

1.2 Copredication

An instance of copredication is where, based on a single antecedent, the different senses of a lexical item are expressed within a single sentence, facilitated by the selectional restrictions of expressions in the linguistic context. For example, in (6)⁴, we have an example of copredication for *lunch*: based on a single antecedent, *delicious* selects for the physical entity-denoting (i.e., food-denoting) sense of *lunch*, and *fast* selects for the event-denoting sense.

- (6) Following a quick but delicious lunch, we were on the ferry back home [...] (enTenTen20)⁵

In (7) and (8) comparable attested examples in German from the deTenTen20 corpus, suggest that *Mittagessen* ('lunch') behaves similarly to *lunch* with respect to polysemy and copredication.

- (7) In St. Ulrich (1236m) gibt es ein leckeres aber leicht verspätetes
in St. Ulrich (1236m) give it a tasty but light delayed
Mittagessen an einer Imbissbude.
lunch on a snack.stall
'In Urtijëi (1236m), we had a tasty but slightly delayed lunch at a snack bar'
- (8) Ein absoluter Geheimtipp für das schnelle aber qualitativ hochwertige
a absolute secret.tip for the fast but qualitatively high.value
Mittagessen.
lunch
'An absolute insider's tip for a quick, but high-quality lunch'

Copredication also provides a further means of discriminating polysemy from lexical ambiguity (Asher 2011). *Party* is ambiguous between a group and a celebration, but any attempt at copredication over these senses is zeugmatic.

- (9) ?The party was boozy and so left basecamp later than planned.

1.3 Restrictions on copredication

Although much of the copredication literature focusses on two-ways polysemous expressions, interesting restrictions on copredication arise for expressions with more senses (Ortega-Andrés & Vicente 2019). For instance, in the following examples, it

⁴ This is similar to an example given by Asher & Pustejovsky 2006.

⁵ Corpus examples are taken from the TenTen corpus series (Jakubíček, Kilgarriff, Kovář, Rychlý & Suchomel 2013), enTenTen20 for English and deTenTen20 for German, using the Sketch Engine tool (Kilgarriff, Rychlý, Smrz & Tugwell 2004)

seems that the physical entity (Phys) and eventuality (Ev) senses of *statement* are incompatible for copredication (10b and 12b), even if each of these senses can be combined with the informational content sense (Inf):

- (10) a. The statement in the envelope is inaccurate. (Phys, Inf)
 b. ?The statement in the envelope lasted half an hour. (Phys, Ev)
- (11) a. The inaccurate statement lasted half an hour. (Inf, Ev)
 b. The inaccurate statement was sealed in an envelope. (Inf, Phys)
- (12) a. ?The half-hour statement was sealed in an envelope. (Ev, Phys)
 b. The half-hour statement was inaccurate. (Ev, Inf)

Furthermore, this phenomenon is not restricted to English. The German *Stellungnahme* ('statement') also has Phys, Ev and Inf senses (see (2)), and shows the same restrictions on copredication:

- (13) a. Die Stellungnahme in dem Umschlag ist sachlich. (Phys, Inf)
 the statement in the envelope is factual
 'The statement in the envelope is factual.'
- b. ?Die Stellungnahme in dem Umschlag hat eine halbe Stunde (Phys, Ev)
 the statement in the envelope has a half hour
 gedauert.
 lasted
 'The statement in the envelope took half an hour.'
- (14) a. Die sachliche Stellungnahme hat eine halbe Stunde gedauert. (Inf, Ev)
 the factual statement has a half hour lasted
 'The factual statement took half an hour'
- b. Die sachliche Stellungnahme ist in einen Umschlag gesteckt (Inf, Phys)
 the factual statement is in a envelope put
 worden.
 got
 'The factual statement was placed in an envelope'
- (15) a. ?Die halbstündige Stellungnahme ist in einen Umschlag (Ev, Phys)
 the half-hour statement is in a envelope
 gesteckt worden.
 put got
 'The half-hour statement was placed in an envelope.'
- b. Die halbstündige Stellungnahme war sachlich (Ev, Inf)
 the half-hour statement was factual
 'The half-hour statement was factual.'

These and similar data are challenging, since even if we can account for polysemy, we may need to say more in order to predict which senses of a polysemous item can enter into copredication.

1.4 Challenges for previous analyses and main goals

A point of almost universal consensus within formal semantic analyses of polysemy is that the standard tools of predicate modal logic and the simply typed λ -calculus are not sufficient to capture the data.⁶ For a systematic look at some of the options for attempting to do so, and why they do not work, see Asher 2011, but as an example of one such challenge, take *lunch*, which is polysemous between an eventuality and a physical entity (the food). In the simply typed λ -calculus, it is common to assume basic types v (for eventuality) and e (for physical entity). However, there is no way of expressing combinations of these types (i.e., no variable x such that $\lambda x.\phi$ can express a function from something that is either an eventuality or a physical entity). Furthermore, underspecification (i.e. allowing variables to have a polymorphic type) does not help, since, were we, for example, to analyse *lunch* as $\lambda x[lunch(x) \wedge food(x)]$ with *lunch* of type $\langle v,t \rangle$ and *food* of type $\langle e,t \rangle$, then, even if x is underspecified between being of type e and type v , any in-context specification of x as either type e or type v will lead to a type clash with one of the predicates.

The response to this problem has in general been to enrich the semantic theory sufficiently to be able to model polysemy and copredication. In this section, just two such examples will be discussed. More detail regarding comparisons between the analysis laid out here and other accounts will be given in §3.

Aspects and dot types. A long-running and influential research programme addressing polysemy, copredication and coercion defends the idea that entities denoted by polysemous nouns have different *aspects* (Pustejovsky 1995; Asher & Pustejovsky 2006; Asher 2011; Cooper 2011; Chatzikyriakidis & Luo 2015, 2020, amongst many others). This idea is implemented in a richer type theory than the simply-typed λ -calculus, e.g., Type Compositional Logic (TCL, Asher & Pustejovsky 2006; Asher 2011), that has a dot type constructor, such that from any two types, one can form a dot type. For example, *book* denotes entities that have an informational and a physical aspect. From the types p (physical object) and i (information), one can construct the type $p \bullet i$, and *book* denotes entities of this type. A worry about this approach, however, is that this dot type constructor is motivated by the very phenomena that it is meant to explain and, ideally, we should prefer to explain polysemy and copredication in terms of an independently motivated semantic theory.

⁶ A recent exception are Liebesman & Magidor (2017) who also deny that nouns such as *book* are polysemous. This view is discussed in §3.

Mereology. An alternative to dot types instead appeals to mereology (Gotham 2014, 2017, 2021). The main idea is that polysemous expressions denote sums of entities such as sums of eventualities, physical entities, and informational contents. Gotham assumes all such entities are of basic type e , a not uncontroversial assumption, especially without a theory of subtypes of e . However, one could instead provide a similar theory in terms of a richer domain of types. For example, if *book* denotes a sum of an informational entity and a physical object, then we could say that if a is of type PHYS and p is of type INF , then $a \sqcup p$ is a sum of type $\text{PHYS} \sqcup \text{INF}$. Mereological semantics assumes that the domains of, e.g., physical entities and eventualities are each structured as a Boolean semilattice closed under mereological sum (minus the bottom element). This is motivated by, among other things, the conjunctions of noun and verb phrases, plurality, the count-mass distinction, and partitive constructions. In other words, for each type τ (at the very least for some basic types), we have a sum operator \sqcup_{τ} . This, type-enriched version of Gotham's analysis would make the further assumption that we have a sum operator that can form sums of entities across disjoint types (such as physical entities and eventualities). However, this assumption would be motivated solely by polysemy and copredication.

Main goals. The main goals of this paper are twofold: (i) to develop a formal semantic account of polysemous expressions within a theory that does not assume any bespoke tool that is motivated solely by the polysemy and copredication data; (ii) to provide an explanation for the restrictions there are on copredication as a part of this analysis. The analysis and potential challenges for the analysis are given in §2. Comparisons with other proposals are given in §3

2 Analysis

My analysis combines a situation theoretic approach to formal semantics along with the use of neo-Davidsonian thematic roles familiar from event semantics. In situation theoretic semantics, expressions such as common nouns denote situations that witness (i.e., contain) individuals, stuff etc. As discussed above, polysemy provides a challenge for semantic theories built upon the simply-typed λ -calculus, since it is unclear what type expressions could be. However, from a situation theoretic stance, this is no puzzle at all. Situations can be complex insofar as they may contain many things of different types, and so whereas non-polysemous nouns denote situations, each of which must contain one (type of) thing, polysemous expressions denote situations that denote more than one entity, possibly of different

types.⁷ The challenge of copredication is not only to explain how we can apply *prima facie* incompatible predicates based upon some single antecedent, but also how to constrain copredication as we have seen to be required in §1.4. This is where neo-Davidsonian thematic roles (and similar relations) come in. In order for copredication to be felicitous in out of the blue contexts, entities that are contained in situations denoted by common nouns must be connected in the right kind of way, where these connections are part of the lexical semantics of the common noun. For example, for *statement*, written statements are connected to informational contents by a *contents* relation and stating events are likewise connected to informational contents by a *contents* relation, but there is no such connection between the event and the physical object provided by the lexical semantics of *statement*. Indeed, statements need not be instances of both stating events and written artefacts, although they surely must have an informational contents and be either an event or a written artefact.

2.1 Type Theory with Records

I set out my analysis within *Type Theory with Records* (TTR) (Cooper 2023, however, see also Cooper 2012 among many others). TTR has two desirable features that make it a good choice for articulating my analysis: it is richly typed and situation theoretic. I discuss these in turn. For further details, please consult Cooper 2023.

Beyond the simply typed λ -calculus. The aforementioned problems for modelling polysemy within a simply typed semantics have led most scholars working on the semantics of polysemy and copredication to adopt a theory based upon a richer system of types.⁸ It must be stressed, however, that polysemy is not the only motivation for adopting a richer type theory. Other motivations include the following (the references given are purely exemplifications of a much broader literature): analysing attitude and perception verbs (Cooper 2005); modelling semantic learning (Cooper, Dobnik, Larsson & Lappin 2015); integrating semantic and perceptual information (Dobnik, Cooper & Larsson 2012); and modelling dialogue (Purver, Gregoromichelaki, Meyer-Viol & Cann 2010; Ginzburg 2012).

A situation theoretic approach. TTR evolved out of a tradition of situation theoretic semantics, starting with Situation Semantics (Barwise & Perry 1983). In TTR and situation theoretic approaches to semantics in general, expressions such as common nouns are interpreted as denoting situations. That is to say that, instead of assuming

⁷ From a more richly typed-perspective, these entities will almost undoubtedly be of different types, even if they are of the same simple type such as *e*.

⁸ See, for example, Type Composition Logic (TCL) (Asher 2011; Asher & Pustejovsky 2006); Modern Type Theories (MTT) (Chatzikyriakidis & Luo 2015, 2018); mereological semantics with individuation relations (Gotham 2017); TTR (Cooper 2007, 2011).

that *cat* denotes single cats, we assume it denotes situations that *witness* (i.e., contain) single cats. For instance, (16) is a record type (i.e., a situation type). It is the type of situation in which some physical entity is a cat. In other words, the type in (16) has an existential force similar to the first-order logic expression $\exists x_e[CAT(x)]$, since (16) is the type of situation in which some physical entity is a cat. In this sense, record types in TTR are like propositions: a record type is false if nothing is of that type.

$$(16) \quad \left[\begin{array}{l} x \quad : \quad Phys \\ c_{cat} \quad : \quad cat(x) \end{array} \right]$$

On the left of the matrix in (16) are labels, on the right are types. *Phys* is a basic type, that of physical entities.⁹ *cat(x)* is a predicate type constructor. That is to say that, given e.g., *felix* as the value for the label *x*, we will get the predicate type *cat(felix)*, the type of those slices of the world (situations) in which *Felix* is a cat. Predicates in TTR have *arities*. For example, assuming a basic type *Phys* (for physical entity), the arity of the predicate *cat* is $\langle Phys \rangle$. The arity of a 2-place predicate such as *contents*, that returns a type in which some informational entity is the contents of some physical entity would have an arity $\langle Phys, Inf \rangle$.

In TTR terminology, situations are represented with *records*, sets of label-entity pairs. For example, (17) is a record given in AVM format¹⁰, with labels on the left and values on the right. In (17), the label *x* is a means of picking out the value *felix* (the physical cat) in the record. *c_{cat}* is a means of picking out a *proof* of the predicate type *cat(x)*.

$$(17) \quad \left[\begin{array}{l} x \quad = \quad felix \\ c_{cat} \quad = \quad p \end{array} \right]$$

Finally, in a manner familiar from Montague semantics, we can express functions from records of some type to record types. E.g. instead of $cat \mapsto \lambda x[CAT(x)]$, we have the expression in (18), a function from situations that witness some physical entity to the record type (type of situation) in which that physical entity is a cat. *r.x* is a path that picks out the value of *x* in *r*.¹¹

$$(18) \quad cat \mapsto \lambda r : [x : Phys]. [c_{cat} \quad : \quad cat(r.x)]$$

For readers who are unfamiliar with situation theoretic semantics, it may help to elucidate what role situations and records play within TTR via the following analogy

⁹ I use *Phys* in place of Cooper's *Ind* since I wish to include undifferentiated stuff in this basic type, as well as to retain separate basic types for eventualities and informational entities etc.

¹⁰ An alternative notion is as a set of ordered pairs $\{\langle x, felix \rangle, \langle c_{cat}, p \rangle\}$.

¹¹ The notation here is a slight simplification. For the field labelled *c_{cat}*, the type is $\langle \lambda v : Phys.cat(v), \langle r.x \rangle \rangle$, a type that is dependent on the value of the label *x* in *r*.

with neo-Davidsonian event semantics. In neo-Davidsonian event semantics, we may have e_1 , an event in the domain, e_1 , a variable over events, and nothing would prohibit one from having constants for events, e.g., e_1 . Furthermore, we have means of classifying events with predicates e.g., $\lambda e_1[RUN(e_1) \wedge AGENT(e_1, a)]$. In TTR, we may take situations as basic. Variables over records, r , along with a type specification (e.g., $r : [x : Phys]$) are analogous to variables over events. The record in (17) is therefore analogous to a constant (though really, it is a set of labelled values). Record types are then comparable, at least by analogy, to sets of events under some description insofar as record types classify situations. For instance the record type in (16) will only be non-empty if there is some situation in which some physical entity is a cat, just as, by analogy, $\lambda e_1[RUN(e_1) \wedge AGENT(e_1, a)]$ is non-empty if its existential closure is true. So, in TTR, we have, as in other formal semantic theories, things in the world (e.g., situations) and classifications of the way the world is (record types). One key difference between the neo-Davidsonian approach and TTR, however, is that whereas variables over events are simplex, variables over situations can be restricted, via type specifications made possible by the rich type theory, to being of arbitrarily complex types. This after all, should not be surprising, given that situations may themselves be arbitrarily complex. One feature of TTR that will be exploited here in the analysis of polysemy, that is not expressible within a neo-Davidsonian framework, is exemplified in (19), in which the variable r may only pick out situations that witness both a physical entity and an eventuality.

$$(19) \quad r : \left[\begin{array}{l} x : Phys \\ e : Ev \end{array} \right]$$

2.2 Analysing Polysemy

From a situation theoretic point of view, if non-polysemous nouns denote situations that witness some particular sort of entity (e.g., a physical entity, an informational entity, or an event), then there is nothing mysterious about polysemy, since there is nothing that prevents a noun from denoting situations that witness more than one sort of entity. After all, situations can be (in fact, usually are) complex things and so contain entities of many different types. Of course, these entities should be related in some way and we need a means of constraining this set of relations. To this end, I propose to adopt a part of neo-Davidsonian event semantics, and constrain the set of relations to thematic role relations, and other comparable relations. *Other comparable relations* should be taken to mean extending these relations to holding between physical entities and something else where appropriate. In particular, given that we may have subtype of *theme* relation between an eventuality and some informational contents (as in with propositional attitudes, and speech act verbs), I shall also allow for such a contents relation between a physical entity and

its informational contents (e.g., for written artefacts). The proposal here can be summarised as follows:

Polysemy: Polysemous expressions denote situations that contain more than one sort of entity. The lexical entry of the polysemous expression expresses what relations hold between these entities.

To flesh out this proposal, three example cases will be given: *lunch*, *book*, and *statement*.

Lunch. My proposal for the analysis of *lunch* is given in (20). First, based on the kinds of modifiers that are straightforwardly felicitous with *lunch*, we can motivate the type of *r* in (20). For example, *half-hour lunch* motivates something of type *Ev* and *delicious lunch* motivates something of type *Phys*. Second, the predicates *food* and *eat_lunch* encode what sort of physical entity and eventuality is being denoted *viz.* food and a lunch-eating event. Third, we consult the set of thematic roles to see which relation best describes how the food and the lunch-eating eventuality are related. In this case, it is clearly a *patient* relation.

$$(20) \quad \textit{lunch} \mapsto \lambda r : \left[\begin{array}{l} x : \textit{Phys} \\ e : \textit{Ev} \end{array} \right] \cdot \left[\begin{array}{l} c_{\textit{food}} : \textit{food}(r.x) \\ c_{\textit{eat}} : \textit{eat_lunch}(r.e) \\ c_{\textit{pat}} : \textit{patient}(r.x, r.e) \end{array} \right]$$

The function in (20) does, however, presuppose that lunches always involve an eating event and some food. This may seem at odds with examples such as (21).

(21) Alex made lunch but never ate it.

Although this is a thorny issue, one possibility is that the meaning of *lunch* in *make lunch* is coerced.¹² It still seems to involve an eventuality, but now one of creation, rather than eating. Notice, for example, how zeugmatic (22) is when we allow *long lunch* to mean a long lunch-eating event and compose this with *make*.

(22) ?Alex made a long lunch.

Book. As a second example, take *book*, the analysis of which is given in (23). Predications like *thick book* are evidence for something of type *Phys*, where this thing is a physical book made up of e.g., paper. Predications like *factual book* rather modify the informational contents of some book, an informational book. The relation that best characterises these two entities is that the information is the informational

¹² Thanks to Laura Kallmeyer and Rainer Osswald for helpful discussion of this point.

contents of the physical entity.

$$(23) \quad book \mapsto \lambda r : \left[\begin{array}{l} x : Phys \\ p : Inf \end{array} \right] . \left[\begin{array}{l} c_{phys} : phys_book(r.x) \\ c_{inf} : inf_book(r.p) \\ c_{thm} : contents(r.x, r.p) \end{array} \right]$$

Similarly to the case with lunch, it has been claimed that *book* need not always refer to a physical book and an informational book. Liebesman & Magidor (2017: 140) claim, in relation to the proper name *War and Peace* (and not the common noun *book*) that *War and Peace was written by Tolstoy* can be true if “Tolstoy had never bothered transcribing the book”. Extrapolating, the idea seems to be that, for example, that someone with very good memory, could “write” a book solely in their head. I set aside such seemingly marginal cases here.

Statement. Finally, consider a more complex case, *statement* which is at least three-ways polysemous between an eventuality (a stating event), the informational contents of the statement, and a written artefact. As a first pass, we could assume that all three of these entities must be in the type restriction on r as in (24).

$$(24) \quad statement \mapsto \lambda r : \left[\begin{array}{l} x : Phys \\ p : Inf \\ e : Ev \end{array} \right] . \left[\begin{array}{l} c_{phys} : phys_statement(r.x) \\ c_{inf} : inf_statement(r.p) \\ c_{ev} : ev_statement(r.e) \\ c_{thm1} : contents(r.x, r.p) \\ c_{thm2} : contents(r.e, r.p) \end{array} \right]$$

However, (24) is problematic. Unlike with books and lunches, statements do not have to involve, even in a default case, both something written and something, say, spoken. There can be written statements and spoken statements in a normal and unmarked way that seems of a different sort to lunches that go uneaten and books that have no physical copies outside of the heads of the authors. What does seem needed for every statement is an informational contents. This can be captured in TTR via the join type $Phys \vee Ev$, such that something is of type $Phys \vee Ev$ iff it is of type $Phys$ or of type Ev . We can also define a predicate *phys_or_ev_statement*, that has an arity $\langle Phys \vee Ev \rangle$ such that a situation is of this type if it witnesses a physical entity that is a physical statement or an eventuality that is a spoken statement. The *contents* relation relates the written or spoken statement to its contents.

$$(25) \quad statement \mapsto \lambda r : \left[\begin{array}{l} i : Phys \vee Ev \\ p : Inf \end{array} \right] . \left[\begin{array}{l} c_{phys\vee ev} : phys_or_ev_statement(r.i) \\ c_{inf} : inf_statement(r.p) \\ c_{thm} : contents(r.i, r.p) \end{array} \right]$$

In words, (25) is a function from a record that witness some informational contents and either something physical or an eventuality, to the type of situation in which

there is either a physical statement or a statement event which has this informational contents. The analysis in (24) is less constrained than the one in (25). (24) allows for two relations, one between the event and its contents and the other between the physical statement and its contents. (25) allows for only one relation that holds either between the event or the physical statement and its contents. Although I believe (25) to be a better representation than (24) in terms of catching the use conditions of *statement*, relatively little turns on this choice when it comes restrictions on copredication.

2.3 Analysing copredication

The analysis of polysemous expressions above involves, in part, specifying how entities of different types are related (if at all), as part of the lexical semantics of the expression. Following the proposal in Ortega-Andrés & Vicente 2019 that copredication requires a kind of relation between the relevant entities, this suggests the following hypothesis:

Copredication is licensed for a polysemous expression w over entities e_1 and e_2 iff the lexical semantics of w specifies a direct relation (e.g., a thematic role relation or equivalent) between e_1 and e_2 .

Consider the three examples of *lunch*, *book* and *statement*. For *lunch* in (20), copredication over the eventuality and the food (e.g., *long and delicious lunch*) is licensed because the interpretation of *lunch* specifies a *patient* relation between the former and the latter. For *book* in (23), copredication over the physical and informational books (e.g., *thick, interesting book*) is licensed because the interpretation of *book* specifies a *contents* relation between the former and the latter. For *statement* in (25) (or in (24)), the *contents* relation holds either between the physical entity and informational contents or between the event and informational contents. There is no direct connection between the event and the physical object. This predicts that copredication will be degraded between the physical entity and the event, which is what we saw in (10b) and (12a), but felicitous when over the event and contents or the physical entity and contents as we saw for the other examples in (10)-(12).

2.4 Further predictions and support

Further predictions. This account also makes two further predictions. First, if the context makes some connection between the physical entity and event salient, then copredication should become more felicitous. For instance, we can construct examples for *statement* which include the verbal phrases *read out* or *transcribe*,

the semantics of which plausibly specify, minimally, a reading/transcribing event, and a physical object (the thing being read/the result of the transcription) under a *theme* relation (on the assumption that the transcript created is the theme of the transcription). In both cases, copredication across an eventuality and a physical statement seems to be much improved. In (26) and (27), *half-hour* modifies an eventuality, the stating events took half an hour. However, *read out* and *transcribed*, respectively, introduce relations between these eventualities and some physical entity, thus seemingly facilitating copredication in contrast to (10b) and (12a).

(26) The witness's half-hour statement was read out and then sealed in an envelope.

(27) The witness's half-hour statement was transcribed and is in the filing cabinet.

Second, the analysis in (25) correctly predicts that copredication over all three senses should not be possible unless the linguistic or non-linguistic context makes salient a relation between the event and the physical entity.

(28) The witness's factual half-hour statement ?(was transcribed and) is in the filing cabinet.

Further support for the analysis. Further evidence for the analysis can be found if we return to the data for *party*. As we saw in (9), repeated below in (29a), when we attempt to copredicate over non-related senses of ambiguous items, such as *party*, the result is zeugmatic, however, as we see in (29b), when we use related senses of *party*, such as the celebration event and the people at the celebration (Eventuality-Agents)¹³, the result is far more natural.

(29) a. ?The party was boozy and so left basecamp later than planned

b. The party was friendly, but devastatingly long.

2.5 Challenges for the analysis

Does the theory over-generate? We may ask whether relations such as *patient* and *contents*, a type of *theme* over-generate regarding copredication predictions. For example, as shown in (30a) and (30b), respectively, *construction*¹⁴ has an eventuality denoting sense and a physical entity denoting sense. Given that *construction* is a nominalisation of *construct*, a verb of creation with a *patient/incremental* theme (Krifka 1989; Dowty 1991), it is plausible to assume that *construction* has a similar thematic structure. However, as we see in (30c) copredication across these senses is at best degraded.

13 The basis upon which I have assumed that the people at the party are agents is that this seems to be the case for the verbal form as in *Everyone partied hard*.

14 Thanks to an anonymous SALT reviewer for raising this example.

- (30) a. (The) construction (of the house) took nine months. (Ev)
b. The construction stands 50m tall. (Phys)
c. ?The construction took nine months and stands 50m tall. (Ev, Phys)

One possible explanation for this may be that copredication is degraded on independent grounds. Unlike *lunch*, there is a countability distinction across the senses of *construction*, with the eventuality (process) sense being mass (31a), and the physical entity denoting sense being count ((31b) is from the enTenTen20 corpus):

- (31) a. Construction(#s) of the houses took nine months. (Ev)
b. Dharma Cave and the Saint's Chapel in the middle of the Red Palace are the only two constructions preserved since the seventh century. (Phys)

This countability distinction makes copredication more difficult. For example, *stone* is a count/mass dual-life noun that can refer to a single stone (count) or stone stuff (mass) and it is hard to express these senses simultaneously with a single antecedent:

- (32) ?The stone in my pocket and that the statue is made of came from the same quarry.

The source of polysemy. Another issue is that the analysis leaves unexplained why expressions have the polysemous senses that they do.¹⁵ For example, *operation* (in the medical sense) does not denote the *patient* (contrast *The operation took two hours* with *?The operation survived*). However, given that operations clearly involve patients (and a *patient!*), the analysis does not predict why, say, *lunch* can denote the *patient* (the food), but *operation* cannot. Another case concerns *experiencers*. There do not appear to be nouns that denote both an eventuality and an *experiencer*, but there are plenty of cases where a noun denotes an eventuality and a *theme*, *patient* or *stimulus*. For instance *love* denotes a state, but can also denote the stimulus: *Jo's one true love* has a reading where Jo is the experiencer, but no reading where Jo is the stimulus. It is unclear why this is the case.

Limited scope. A potential shortcoming of the account is that it is overly focused on nouns that denote eventualities or those, like *book*, that have thematic role-like contents relations in their lexical semantics. Yet, we see restrictions on copredication for other classes of nouns. Take *school*:

- (33) The school that caught fire was celebrating 4th of July when the fire started. (Ortega-Andrés & Vicente 2019: 13)

Given the copredication over the school-qua-buildings and the school-qua-people, a challenge for the analysis is to find a principled, non-arbitrary way to extend

¹⁵ Thanks to Alexis Wellwood for raising this issue.

the set of copredication-licensing relations to nouns like *school* that do not denote eventualities. In this case, *location* seems to be the most relevant, but relations between these and other cases such as school-qua-pseudo-agent (insofar as schools as institutions make decisions and announcements etc.) are more challenging.

3 Comparisons with other proposals

Aspects. In §1.4, I claimed that analyses based upon dot types and aspects employ a specific type constructor that is motivated solely by the data it is meant to explain. The analysis provided in this paper does not do this. Situation theoretic semantics, an enrichment of the type theory, and neo-Davidsonian thematic roles are all independently motivated and the account of polysemy and copredication provided does not need any further enrichments.

That said, as already shown in Cooper 2007, 2011, one can give an aspect-based analysis of polysemy and copredication in TTR that does not assume a dot type constructor. In (34) from Cooper 2011 the dependent predicate type $lunch_ev_fd(r.x, e, f)$, encodes the notion of an entity with different aspects.

$$(34) \quad lunch \mapsto \lambda r : [x : Ind] . \left[\begin{array}{l} f \quad : \quad food \\ e \quad : \quad event \\ c_{lunch} : \quad lunch_ev_fd(r.x, e, f) \end{array} \right]$$

Leaving aside whether we need to adopt aspects of entities into a theory of polysemy, Cooper’s approach would not extend transparently to cases such as *statement* with respect to capturing restrictions on copredication. Transposing this analysis to *statement*, we would have something like:

$$(35) \quad statement \mapsto \lambda r : [x : Ind] . \left[\begin{array}{l} d \quad : \quad document \\ e \quad : \quad event \\ i \quad : \quad information \\ c_{statement} : \quad statment_doc_ev_inf(r.x, d, e, i) \end{array} \right]$$

The dependent predicate type $statement_doc_ev_inf(r.x, d, e, i)$ connects the entity of type *Ind* (individual) to all of its aspects, but then we must still explain why we cannot copredicate over the eventuality and the document.

Mereology. A type-enriched version of Gotham’s (2014; 2017; 2021) mereological account (see §1.4), posits a sum formation operation across domains that are traditionally conceived of as disjoint. The proposal presented here avoids positing operators that are motivated solely by the polysemy and copredication data. That said, Gotham’s work makes major progress in accounting for puzzles relating to counting with polysemous expressions. For instance, that in most cases, *three thick, interesting books* have to be each physically and informationally non-identical. I

have not offered an explanation of these data here, and this is something that must be done in future work before our two approaches can be reasonably compared. Also, at least for polysemous expressions denoting entities of the same type, a mereological account does seem to be on the right track. For instance, in [Sutton & Filip 2021](#), we defended such an approach to container+contents polysemy for pseudopartitive expressions such as *a glass of wine* which are polysemous between the container reading, *a glass containing wine*, and the contents reading, *a (portion) of wine, the contents of a glass* (see, among others [Partee & Borschev 2012](#); [Khrizman, Landman, Lima, Rothstein & Schvartz 2015](#)).

Düsseldorf-style frame semantics. In [Babonnaud, Kallmeyer & Osswald 2016](#) and [Kallmeyer & Osswald 2017](#), Pustejovskyan aspects are reinterpreted as attributes in a frame. For *book*, the attribute CONTENT, links the physical book to the contents (as the *formal* meaning component of the Generative Lexicon). Frames, even for polysemous nouns, have one central node (indicated by the double ring) determining reference of the concept e.g., the physical book for *book*.



Although there are links between this approach and my own, unlike Babonnaud, Kallmeyer and Osswald, I do not assume that every polysemous item has a ‘primary’ reference dictated by what one takes to be the central node. For nouns such as *evidence* and *statement*, however, it is not clear what should count as ‘primary’ in this sense.

Property inheritance. As noted above, [Liebesman & Magidor \(2017\)](#) claim that there is no need to revise formal semantic theory to account for nouns such as *book*. The main idea is that such nouns are not polysemous. For example, *book* “has a single sense and, used with this sense, it designates both physical and informational books” ([Liebesman & Magidor 2017](#): 133, L&M). In addition to this is the claim that via *property inheritance*, one can explain away cases of apparent type clashes.

Informational books are distinct from physical books, but there are many properties that both can instantiate. [...] For instance, a physical book may be informative, but in typical cases, when it is informative, that is in virtue of the fact that it is an instance of an informative informational book. ([Liebesman & Magidor 2017](#): 137)

There is a similarity between L&M’s account and the one proposed here insofar as I also assume that physical and informational books are distinct and that *book* denotes both, albeit indirectly via denoting situations that witness both. However, contra L&M’s claim that their approach requires no revisionary semantics, I doubt

that L&M's proposal really does not require any enrichment of standard, simply typed, semantic theory. Standardly, physical objects, informational entities and eventualities etc. are not assumed to be of the same type. However, if the analysis of *book* is supposed to be something like $\lambda x.BOOK(x)$, as we saw above in section 1.4, within a simply typed theory, there is no type we can assign the variable x such that $\lambda x.BOOK(x)$ applies to entities of different types.¹⁶

Explanatory and realisation relations. A proposal related to the one presented here, albeit from a more psychology-oriented perspective, is [Ortega-Andrés & Vicente 2019](#), part of which seeks to explain restrictions on copredication in terms of *explanatory and realisation relations*. For example, the copredication in (33) is licensed, in part, because “a school-institution is located in a building because being so located contributes to bringing the school into existence; it involves a process because its telos requires some temporal articulation” ([Ortega-Andrés & Vicente 2019](#): 14), and so *school* co-activates both the school-qua-institution and school-qua-buildings. In contrast, I have proposed to limit the relevant relations to those akin to neo-Davidsonian thematic roles. For both of our accounts, more work must be done to hone the set of relations that govern restrictions on copredication, whilst continuing to make clear predictions.

4 Conclusion

From a situation theoretic standpoint, polysemy becomes less mysterious. Expressions denote situations, albeit restricted in some way, and polysemous expressions require such situations to witness multiple entities, possibly of different types. Furthermore, each formal element of this approach is motivated by phenomena beyond polysemy and copredication. I have also provided a constrained hypothesis regarding restrictions on copredication. Although there is still work to be done fine-tuning this hypothesis, as well as determining if other factors (such as count/mass polysemy) play a role in blocking copredication, the observations made here complement those in [Ortega-Andrés & Vicente 2019](#) and form the basis for further research.

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¹⁶ One option would be for Liebesman and Magidor to allow for join types such that x could be of type $\tau \vee \sigma$ (where τ is the type of physical books and σ is the type of informational books). However, this raises the question of whether something can be both a physical book and an informational book if ‘informational books are distinct from physical books’.

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