Polysemy and copredication: implications for compositional and lexical semantics

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Outline

Polysemy and Copredication (focussing on common nouns)

- Differentiating polysemy from other phenomena

Chomsky's argument

- Why polysemy and copredication are alleged to provide a challenge to semantic theory

Comparing two proposals for analysing polysemy and copredication

- Rich type vs. Simple type responses
- Polysemy as evidence for a more richly typed semantics

Register and not-at-issue content within rich type theories

- Slurs as a case study

Lexical ambiguity

In English, *party* is lexically ambiguous

- One form – Many meanings
- But the sameness of form is, in some sense accidental

(1) a. The party last night was wild. [*celebration*]
b. The party elected a new leader. [*polit. org.*]
c. The party set off at dawn. [*travel group*]

At least three forms in German:

(2) a. Die Feier/Fete/Party letzte Nacht war wild. [*celebration*]
b. Die Partei hat eine neue Vorsitzende gewählt. [*polit. org.*]
c. Die Reisegruppe ist in der Morgendämmerung losgefahren. [*travel group*]

Zeugma

For expressions with multiple senses, evoking more than one often gives rise to Zeugma

(3) a. ?This product is suitable for home freezing and vegans.
b. ?Alex and his nose ran.

(4) a. ?Dieses Product ist für die Tiefkühltruhe und Veganer geeignet.
b. ?Alex und seine Nase sind gelaufen.

Copredication

Usually only defined for common nouns

- One instance of the noun
- Used of modifiers to evoke different senses of the noun
  - Verbs, VPs, and adverbials
  - Adjectives

Some examples (Ortega-Andrés and Vicente 2019):

(5) The best university of the country has caught fire.

(6) The beer Susan was drinking fell out of her hands.

Zeugma as a test for lexical ambiguity

Attempting copredication with lexically ambiguous expressions, gives rise to zeugmatic effects, e.g., Asher 2011

(7) ?The party chose a new leader and left base camp in the morning.

(8) ?The party lasted all night and left base camp in the morning.

(9) ?The party lasted all night and chose a new leader.

Polysemy

In English, *lunch* is arguably polysemous

- One form – Many meanings (like lexical ambiguity)
- But the sameness of form is, in some sense **non**-accidental

(10) a. Lunch was delicious. [*food*]
b. Lunch lasted two hours. [*eventuality*]

- Something like describing two sides of the same coin

Other examples of nominal polysemy:

Noun	Senses include
statement	eventuality, informational content, physical object
book	informational content, physical object
evidence	eventuality, informational content, physical object
city	population, area, (local) government
university	buildings, institution, population
beer	container, contents

Polysemy and copredication

No Zeugmatic effects with copredication e.g., (Pustejovsky, 1995; Asher, 2011)

- At least in some cases

(5) The best university of the country has caught fire.

(6) The beer Susan was drinking fell out of her hands.

(Ortega-Andrés and Vicente 2019)

(10) Lunch was delicious and lasted for two hours.

(11) Lunch lasted for two hours and was delicious.

(Adapted from Asher and Pustejovsky 2006)

Predicates select for domains that are normally considered disjoint

- *lasted two hours*: domain = *Ev*entualities
- *was delicious*: domain = *Phys*ical objects (esp. food)

Copredication beyond English

German (deTenTen20 corpus):

(12) Ein absoluter Geheimtipp für das schnelle aber
a absolute secret.tip for the fast but
qualitativ hochwertige Mittagessen.
qualitatively high.value lunch
'An absolute insider's tip for a quick, but high-quality lunch'

Finnish (fiTenTen14 corpus):

(13) ... nähtävyyksien uuvuttama matkustaja voi nauttia
... sight.PL.GEN exhaust.PRTCPL traveller can enjoy
nopean ja herkullisen lounaan
fast.ACC and delicious.ACC lunch.ACC
'... an exhausted sightseer can enjoy a fast and delicious lunch'

Restrictions on co-predication

There can be restrictions on copredication for more than two-ways polysemous nouns, e.g., *statement* (Sutton, 2022)

(14) a. The statement in the envelope is inaccurate. (Phys, Inf)
b. ?The statement in the envelope lasted half an hour. (Phys, Ev)

(15) a. The inaccurate statement lasted half an hour. (Inf, Ev)
b. The inaccurate statement was sealed in an envelope. (Inf, Phys)

(16) a. ?The half-hour statement was sealed in an envelope. (Ev, Phys)
b. The half-hour statement was inaccurate. (Ev, Inf)

(17) Ortega-Andrés and Vicente 2019; Copestake and Briscoe 1995
a. ?The newspaper fired its editor and fell off the table.
b. ?That newspaper is owned by a trust and is covered with coffee.

Conclusion: Felicitous copredication entails polysemy, but a failure of copredication does not entail a noun is not polysemous.

Polysemy versus Lexical ambiguity (Summary)

Lexical ambiguity:

e.g., $party_{political}$ *vs.* $party_{group}$ *vs.* $party_{celebration}$

- Either non-related senses (*bank*) or less related senses (*party*)
- Accidental homophony: *Partei* vs. *Reisegruppe* vs. *Feier* (German)
- Zeugma with copredication

Polysemy:

e.g., $statement_{eventuality/information/physical\ object}$

- Inter-related senses
- Non-accidental homophony
- Not always zeugma with copredication

Coercion

Meanings that are not lexicalized, but expressed in context

- Normally requires a trigger
- E.g., semantic type clash (Pustejovsky, 1995)

Is (18) evidence that *book* has a sense that denotes an eventuality, namely that of reading or writing a book?

(18) Mary began the book. (Pustejovsky 1995)

Standard answer: No

- The eventuality reading is coerced
- Type clash: selectional restrictions of *began* and the type of *the book*

Polysemy vs. Coercion: Terminology

	Pustejovsky 2008	Weinreich 1964; Pustejovsky 1995
polysemy	inherent polysemy	complementary polysemy
coercion	selectional polysemy	contrastive polysemy

Evidence for separating coercion from polysemy

Out of the blue contexts

- E.g., out-of-the-blue temporal modification for *book* is much less natural than the modifiers *thick* and *interesting*:

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

(20) ?That book is at least two months too long!

But context helps

(21) He has actually set it up to be read in 40 days (no comparison though to that other 40 day book) [enTenTen18]

(22) Context: A 24-hour RPG writing competition and national book writing month:
Follow your one day game with a one month book. [enTenTen21]

Polysemy vs. Lexical Ambiguity and Coercion

Clearly not possible to completely demarcate these phenomena

- Polysemy and Lexical ambiguity
  - Vagueness in how inter-related senses are
  - Senses of *party* are closer than the senses of *bank*
- Polysemy and coercion
  - Highly routinised coercions arguably are in the process of being lexicalized as polysemy
  - *2 pints* (UK Eng) – measure, glasses of beer

Chomsky's argument

(Chomsky, 2000; Collins, 2017; Pietroski, 2003, among others)

Most explicit version in Collins 2017: Polysemy and copredication force one to abandon externalist, truth-conditional semantics

- Nouns such as *book* are polysemous, not lexically ambiguous.
- However, some but not not all of the following uses of *book* evoke both senses:

(23) Collins 2017, p. 679

a. Bill memorised the book

b. Bill burnt the book

c. Bill memorised and (then) burnt the book

If polysemous nouns had an invariant, truth-conditional meaning, then cases of copredication like (23c) would be anomalous, contrary to fact.

- Therefore, nouns like *book* do not have an invariant, truth-conditional meaning.

Formalising the argument

Extrapolating a bit, we can make the argument more acute wrt semantic theory

(a) Polysemous nouns denote functions e.g., from worlds/situations to sets of entities.

(b) Informational entities, eventualities and physical entities etc. are of a different type.

(c) There is no function expressible in the simply-typed λ-calculus that can characterise a set of entities that are, say physical and/or informational/eventualities.

- Let's unpack (c) a little

Unpacking conclusion (c)

(c) There is no function expressible in the simply-typed λ-calculus that can characterise a set of entities that are, say physical and/or informational/eventualities.

(24) **Types.** (e.g., Carpenter 1997)
From a non-empty set **BasTyp** of basic types, the set **Typ** of types is the smallest set such that:
a. **BasTyp** $\subseteq$ **Typ**
b. $\langle \sigma, \tau \rangle \in$ **Typ** if $\sigma, \tau \in$ **Typ** (functional types)

- Example: *lunch*
  - Assumption: eventualities and physical stuff (food) are of different types (in disjoint domains)
- $\lambda w_{:s}.\lambda x_{:\sigma}.LUNCH_w(x) \quad : \langle s, \langle \sigma, t \rangle \rangle$
- What type is σ?
  - Can't be *v* or *e* (this would exclude some readings of *lunch*)
  - Can't be a functional type (wrong truth conditions)

Responding to the argument

(a) Polysemous nouns denote functions e.g., from worlds/situations to sets of entities.

(b) Informational entities, eventualities and physical entities etc. are of a different type.

(c) There is no function expressible in the simply-typed λ-calculus that can characterise a set of entities that are, say physical and/or informational/eventualities.

Options:

- The argument is valid, so we must deny at least one premise or explain away the severity of the conclusion

Line by line

- deny (a) – we'll set this aside
- deny (b) – the *simple type response*
- Shrug regarding (c) and use a richer type theory

Simple Type Theory

(24) **Types.**
From a non-empty set **BasTyp** of basic types, the set **Typ** of types is the smallest set such that:

a. **BasTyp** $\subseteq$ **Typ**

b. $\langle \sigma, \tau \rangle \in$ **Typ** if $\sigma, \tau \in$ **Typ** (functional type constructor)

	BasTyp	**Type constructors**
Montague (IL)	$\{e, t\}$	(24b) and $\langle s, \sigma \rangle \in$ **Typ** if $\sigma \in$ **Typ**
Gallin (TY2)	$\{e, t, s\}$	(24b)
Degree semantics	$\{e, t, s, d\}$	(24b)
Neo-Davidsonian	$\{e, t, s, v\}$	(24b)

So two possible ways to amend (traditional) simple type theory

- Adjust **BasTyp**
- Add type constructors

Types or type constructors?

(24) From a non-empty set **BasTyp** of basic types, the set **Typ** of types is the smallest set such that:

a. **BasTyp** $\subseteq$ **Typ**

b. $\langle \sigma, \tau \rangle \in$ **Typ** if $\sigma, \tau \in$ **Typ** (functional type constructor)

Additional basic types common in formal semantics

- Degrees, Eventualities, Roles, Concepts, Tropes, . . .

But adding a type constructor is an alternative possibility

- Some examples:
  - Product types (e.g., Pustejovsky, 1995; Gotham, 2014; Rothstein, 2010; Sutton and Filip, 2020; Windhearn, 2021)
  - Dot types (e.g., Asher and Pustejovsky, 2006; Asher, 2011)

No in-principle reason not to go for type constructors

- Common in programming languages
  - tuples, lists, dataframes etc.

Two enrichment strategies

(a) Polysemous nouns denote functions e.g., from worlds/situations to sets of entities.

(b) Informational entities, eventualities and physical entities etc. are of a different type.

(c) There is no function expressible in the simply-typed λ-calculus that can characterise a set of entities that are, say physical and/or informational/eventualities.

Add at least one type constructor, e.g., dot types

- (c) is true, but harmless
- Keep a simply typed semantics, add at least one type constructor

Rich type theories

- Polysemy is one of many phenomena that indicates the need for more structure in semantics
- Richly typed semantics adds this structure
- Move from a system of simple types to a system of rich types

The role of types in simply typed semantics

- Types are metalanguage descriptions of categories of expressions

(25) If $\phi \in ME_t$ and u is in Var_a, then $[\![\exists u\phi]\!]^{M,g} = 1$ iff for some e in D_a, $[\![\exists u\phi]\!]^{M,g^e_u} = 1$ (Dowty et al., 1981, p. 92)

- Types feature in the metalanguage as subscripts on sets
- We cannot refer to types directly in the object language
- But if types reflect our basic ontological categories, why can we not refer to them within the object language of our semantic theory?

From simple to rich type theory

Background

- Seminal work by Ranta (1994)
- Implementing a NL semantics based on Martin-Löf 1984
- Often, but not always more proof theoretic

Move 1: Let types feature as part of the object language

- Simply Typed Semantics: Construct arbitrarily complex expressions of some type which are then interpreted (e.g. in a model)
- Richly typed semantics: Construct types themselves of arbitrary complexity
  - Types have witnesses (things of that type)
  - But are individuated also in terms of their structure (fine-grained intensionality)

Example

Simple types: Expressions of some type

alex	$\lambda x.\lambda y.Mother_w(x, y)$	$\lambda y.Mother_w(alex, y)$
e	$\langle e, \langle e, t\rangle\rangle$	$\langle e, t\rangle$

- The predicate $\lambda y.Mother_w(alex, y)$ **depends** on the value *alex*

Rich types: Types with a structure

- Structured types with entities as witnesses
- $Mother(alex), Mother(billie)$ are types
- $Mother$ is a type constructor
  - It maps individuals to the type of being that individual's mother
- e.g. *billie* : $Mother(alex)$
  - *billie* witnesses the type of being Alex's mother
- The type $Mother(alex)$ **depends** on the value *alex*

From simple to rich type theory

Move 1: Let types feature as part of the object language

Move 2: Treat propositions as types

- Curry-Howard Correspondence (Curry and Feys, 1958; Howard, 1980)

Simple Type Theory (STT)	Rich Type Theory (RTT)
Sets of worlds	Types
Flat	Structured
Individuated by set membership	Individuated by witness set *and* structure

Hyperintensionality:

- The types $2 + 2 = 4$ and $5 - 3 = 2$ have the same witnesses (situations, worlds etc.)
- But can be individuated in terms of structure (and the manner of construction)

Treating Polysemy in RTT semantics

Modern Type Theories (MTT)

- Luo 2010; Chatzikyriakidis and Luo 2020

Type Theory with Records Cooper 2012, 2023

- Pustejovskian 'aspects' based analysis without dot types Cooper 2011
- Multi-participant situations Sutton 2022
  - Polysemy without aspects

Very short introduction to TTR

Record Types

(26)
$$\begin{bmatrix} \mathrm{x} & : & \mathit{Ind} \\ \mathrm{c}_1 & : & \mathit{cat}(x) \end{bmatrix}$$

- *There is a cat*
- Pred logic analogue: $\lambda w.\exists x.cat_w(x)$

- Propositions in TTR (situation types)
- Witnesses are records (situations)
- Labels x, c_1 are like discourse referents
- *Ind* is a basic type
- $cat(x)$ is a type constructor: constructs a type given a value for the label x

Records

- Situations

(27)
$$\begin{bmatrix} \mathrm{x} & = & \mathit{felix} \\ \mathrm{c}_1 & = & s_1 \end{bmatrix}$$

- (27) : (26) iff
  - $\mathit{felix} : \mathit{Ind}$
  - $s_1 : cat(\mathit{felix})$

Non-Polysemous Common Nouns in TTR

CNs denote Properties of situations

- Not functions from worlds to sets of entities
- Functions from situations to situations types

(28) $[\![\text{cat}]\!] = \lambda r : \left[\text{x} \quad : \quad Ind \right] . \left[\text{c}_{\text{cat}} \quad : \quad \text{cat}(r.\text{x}) \right]$

- Functions from records of some type: $\lambda r : [\text{x} : Ind]$
  - I.e., situations that contain some individual
- to a proposition
  - I.e., the type of situations in which the entity labelled x in r (r.x) is a cat

Simplified example

- We can treat proper names as GQs: functions from a property to the proposition that some individual has that property

(29) $[\![\text{Felix}]\!] = \lambda P : \mathit{Ppty}.P([\text{x} = \mathit{felix}])$

(30) $[\![\text{cat}]\!] = \lambda r : \left[\text{x} : \mathit{Ind} \right]. \left[\text{c}_{\text{cat}} : \text{cat}(r.\text{x}) \right] : \mathit{Ppty}$

(31) $[\![\text{Felix is a cat}]\!] = \begin{bmatrix} \text{x} = \mathit{felix} & : & \mathit{Ind} \\ \text{c}_{\text{cat}} & : & \text{cat}(\mathit{felix}) \end{bmatrix}$

Important theoretical point:

- CNs do not (directly) denote as properties of individuals
- CNs denote properties of situations that contain individuals
  - Inherited view from Situation Semantics e.g., Barwise and Perry 1983

Multi-participant situations (Sutton, 2022)

Polysemous nouns denote situations that contain multiple participants

- polysemous Ns constrain situations to witness at least two entities
- e.g., *lunch*: to witness at least some event and some physical entity
- the resulting record type constrains the event to be an event (underspecified between eating and making lunch) and the individual to be the food
- Additionally neo-Davidsonian inspired thematic role relations

(32) $$[\![\text{lunch}]\!] = \lambda r : \begin{bmatrix} \text{x} & : & Phys \\ \text{e} & : & Ev \end{bmatrix} . \begin{bmatrix} \text{c}_{\text{food}} & : & \text{food}(r.\text{x}) \\ \text{c}_{\text{do}} & : & \text{do\_lunch}(r.\text{e}) \\ \text{c}_{\text{pat}} & : & \text{patient}(r.\text{x}, r.\text{e}) \end{bmatrix}$$

Copredication

(33) $$[\![\text{delicious}]\!] = \lambda\mathcal{P} : ([\text{x} : \mathit{Phys}] \to \mathit{RecType}).\lambda r : [\text{x} : \mathit{Phys}]. \mathcal{P}(r) \wedge [\text{c}_{\text{del}} : \mathit{delicious}(r.\text{x})]$$

(34) $$[\![\text{two-hour}]\!] = \lambda\mathcal{P} : ([\text{e} : \mathit{Ev}] \to \mathit{RecType}).\lambda r : [\text{e} : \mathit{Ev}]. \mathcal{P}(r) \wedge [\text{c}_{\text{time}} : \mu_{\mathit{hours}}(r.\text{e}, 2)]$$

(35) $$[\![\text{delicious two-hour lunch}]\!] = \lambda r : \begin{bmatrix} x : \mathit{Phys} \\ e : \mathit{Ev} \end{bmatrix}. \begin{bmatrix} \text{c}_{\text{food}} & : & \text{food}(r.\text{x}) \\ \text{c}_{\text{do}} & : & \text{do\_lunch}(r.\text{e}) \\ \text{c}_{\text{pat}} & : & \text{patient}(r.\text{x}, r.\text{e}) \\ \text{c}_{\text{del}} & : & \mathit{delicious}(r.\text{x}) \\ \text{c}_{\text{time}} & : & \mu_{\mathit{hours}}(r.\text{e}, 2) \end{bmatrix}$$

Features of the multi-participant analysis

(32) $[\![\text{lunch}]\!] = \lambda r : \begin{bmatrix} \text{x} & : & Phys \\ \text{e} & : & Ev \end{bmatrix} . \begin{bmatrix} \text{c}_{\text{food}} & : & \text{food}(r.\text{x}) \\ \text{c}_{\text{do}} & : & \text{do\_lunch}(r.\text{e}) \\ \text{c}_{\text{pat}} & : & \text{patient}(r.\text{x}, r.\text{e}) \end{bmatrix}$

Nothing to see here

- If CNs only indirectly denote entities, via denoting situations then we only have pretty vanilla entities here
  - situations, physical entities, eventualities

Relations like Patient explain restrictions on copredication

(36) The statement in the envelope is inaccurate. (Phys, Inf)

(37) ?The statement in the envelope lasted half an hour. (Phys, Ev)

(38) The inaccurate statement lasted half an hour. (Inf, Ev)

- (Phys, Ev) is bad because there is no *contents* relation between them
- See also Ortega-Andrés and Vicente (2019) (realization relations)

Copredication can improve with context support

(39) a. Context: The police took verbal statements from witnesses, but all were simultaneously transcribed. The shorter transcriptions are on the desk.

b. Every statement that took less than 5 minutes is on the desk

- What does *transcribe* contribute to the context?
- Plausibly: a relation between the stating eventuality and a physical entity (the transcription)
- I.e., exactly what was missing, thereby licensing copredication

Summary: Rich type theoretical approaches

Advantages

- No special machinery that is bespoke to polysemy
  - Cf. richer simply typed approaches
- Sufficient structure to be able to distinguish between senses
  - But also to relate them (copredication)

A simple-types response to the Chomskyan argument

Standard assumption:

- At least some of the types for informational content, eventualities, physical entities etc. are distinct

Solution:

- Deny the standard assumption

One option: Monotyped semantics

- Liefke 2014; Liefke and Werning 2018, see also Partee 2007

Monotyped semantics: Motivations

Interpretations of DP and S and CP are of the same type

(40) (Liefke and Werning, 2018, p. 646)

a. [$_{\mathrm{DP}}$ Bill] destroyed his friendship with John.

b. [$_{\mathrm{CP}}$ That Bill suspected John of courting Pat] destroyed his friendship with John.

(41) Pat remembered [[$_{\mathrm{DP}}$ Bill] and [$_{\mathrm{CP}}$ that he was waiting for her]]. (Liefke and Werning, 2018, p. 647)

Example

(42) a. **BasTyp** $= \{o\}$ (the type for $[\![[_{DP} \cdot]]\!]$ and $[\![[_{S} \cdot]]\!]$)

b. Functional types constructed recursively

(43) a. $[\![[_{DP}$ lunch $]]\!] : o$

b. $[\![[_{VP}$ was delicious $]]\!] : \langle o, o \rangle$

c. $[\![[_{VP}$ took ages $]]\!] : \langle o, o \rangle$

d. $[\![[_{VP}$ was delicious but took ages $]]\!] : \langle o, o \rangle$

e. $[\![[_{S}$ Lunch was delicious but took ages $]]\!] : o$

No problem with two types for propositions and informational entities any longer!

Types and sorts

Traditionally semantic types perform two roles

- avoiding paradoxes (e.g., Curry's paradox)
- marking conceptual distinctions between entities

But these roles can be separated e.g., Kohlhase 1992, 1994

- **Types** to avoid paradoxes
- **Sorts** to mark conceptual distinctions between entities

Same type responses and sorts

Do same type responses need sorts? — Selectional restrictions

(44) a. The book was brown/was inaccurate/?started at 1pm.
b. Lunch was brown/started at 1pm/?was inaccurate.

Canonical treatment with types:

- Modifiers and predicates can be of different types, e.g.,
  - $\langle s, \langle e, t \rangle \rangle$ for predicate of physical entities
  - $\langle s, \langle v, t \rangle \rangle$ for predicate of eventualities

Alternative with sorts:

- Predicates are of the same type, but can presuppose different sorts
  - E.g. $[\![[_{VP} \text{ was delicious }]]\!] : \langle o, o \rangle = \lambda x_{:x \in \textbf{phys}} \mathit{Delicious}(x)$

A re-emergence of the polysemy problem for sorts

For some sort **S**:

- $[\![\ [_{DP}\ \text{lunch}\ ]\ ]\!] = \iota x_{:x \in \mathbf{S}} Lunch(x) \quad : o$
- $[\![\ [_{VP}\ \text{was delicious but took ages}\ ]\ ]\!] =$
  $\lambda x_{:x \in \mathbf{S}} Delicious(x) \wedge Took\_Ages(x) \quad : \langle o, o \rangle$

What sort is **S**?

- It should cover both **phys** and **ev**
- E.g., $Phys + Ev$ for some sort combinator $+$?
- Sorts start to look a lot like types
- I.e. we have base sorts and sort constructors

Interim Summary

- Polysemy and finding a response to Chomsky's argument is a prima facie motivation for enriching the basis of our semantic theories.
- Next step: does this added structure buy us anything in addressing other phenomena
  - Slurs as a case study

Slurs as a case study

Slurs and register

- Slurs typically have an alternative, neutral term (e.g., *poof* vs. *gay man*)
- Baseline hypothesis: Slurs have the same extension as the neutral counterpart, but have some kind of additional derogatory content
  - As such, slurs are at least comparable to minimal pairs which differ in register (Mihaela Popa-Wyatt)

Properties of slurs

A challenge for the baseline hypothesis: Subset and superset uses

(45) 'faggot didn't mean gay when I was a kid, you called someone a faggot for being a faggot, you know? [. . .] "you're not supposed to use those for that" [said in an annoying voice as if from another person, then Szekely replies normally] "shut up faggot!" [. . .] I would never call a gay guy a faggot, unless he was being a faggot. But not because he's gay, you understand.' (quoted in Croom 2015, p. 32)

Reclamation

- *queer*, *maricón* (Spanish), *schwul*

Re-derogation under nominalization

- *a queer*, *ein Schwuler*

Analyses of slurs

Analyses of slurs

- Derogatory content is in some sense not-at-issue
  - Conventional implicature (Nunberg, 2018; McCready, 2010)
  - Presupposition (Camp, 2018)
  - Mixed expressives (Davis and McCready, 2020)
  - Social meaning (Burnett, 2020)
  - Meta-move in a conversational game (Popa-Wyatt, 2021)

Proposal in brief

- Encode speaker personae as not-at-issue content
- Personae as inference
- sub- and superset uses as conversational implicatures (metaphor)

Kaplanian Contextualism in a Rich Type Theory (Kaplan, 1989; Cooper, 2023)

(46) $$cntx = \begin{bmatrix} \mathsf{spk} & : & \mathit{Ind} \\ \mathsf{add} & : & \mathit{Ind} \\ \mathsf{loc} & : & \mathit{Loc} \\ \ldots & \ldots & \ldots \end{bmatrix}, \quad \mathsf{c}_@ = \begin{bmatrix} \mathsf{spk} & = & \mathsf{peter} \\ \mathsf{add} & = & \mathsf{alex} \\ \mathsf{loc} & = & \mathsf{berlin} \\ \ldots & = & \ldots \end{bmatrix}$$

(47) $[\![\mathsf{I}]\!] = \lambda c : \mathit{contx}.\lambda \mathcal{P} : \mathit{Ppty}.\mathcal{P}([x = c.\mathsf{spk}])$

(48) $[\![\mathsf{run}]\!] = \lambda r : [x : \mathit{Ind}].[\mathsf{c}_{\mathsf{run}} : \mathsf{run}(r.x)]$

(49) $[\![\mathsf{I\ run}]\!] = [\![\mathsf{I}]\!]([\![\mathsf{run}]\!]) = [\mathsf{c}_{\mathsf{run}} : \mathsf{run}(\mathsf{peter})]$

Persona information updated in context

$$\left[\begin{array}{lcl} \mathsf{cx} & = & \left[\begin{array}{lcl} \mathsf{sp} & : & \mathit{Ind} \\ \ldots & : & \ldots \end{array}\right] \\ \mathsf{bg} & = & [\mathsf{x} : Ind] \\ \mathsf{fg} & = & \lambda c : \mathsf{cx}.\lambda r : \mathsf{bg}.[\mathsf{c}_{\mathsf{l}_1} : \mathsf{P}(r.\mathsf{x})] \end{array}\right]$$

Adding at-issue and not-at-issue content

$$\left[\begin{array}{lcl}
\mathsf{cx} & = & \left[\begin{array}{lcl} \mathsf{sp} & : & \mathit{Ind} \\ \ldots & : & \ldots \end{array}\right] \\
\mathsf{bg} & = & [\mathsf{x} : Ind] \\
\mathsf{at_iss} & = & \lambda c : \mathit{Cntx}.\lambda r : [\mathsf{x} : Ind].\left[\begin{array}{lcl} \mathsf{c}_{\mathsf{hmsxl}} & : & \mathsf{hmsxl}(r.\mathsf{x}) \\ \mathsf{c}_{\mathsf{man}} & : & \mathsf{man}(r.\mathsf{x}) \end{array}\right] \\
\mathsf{not_at_iss} & = & \left[\begin{array}{lcl} \mathsf{c}_{\mathsf{persona}} & : & \mathsf{homophobe}(\mathsf{cx.sp}) \\ \mathsf{c}_{\mathsf{derog}} & : & \mathsf{bad!}(\mathsf{at_issue}) \end{array}\right]
\end{array}\right]$$

Persona and reasoning

Breitholtz & Sutton: Dogwhistles

- Hearer personae analysed in terms of reasoning patterns
- *Racist*: For a salient social problem p and a salient ethnic group g, the agent considers g blameworthy for p

Unpacking the *homophobic* personae

- Homophobe: Gay man $\rightsquigarrow$ Effeminate

Sub- and Superset uses as Gricean implicatures

(50) A: Billie is a faggot, but isn't gay.

(51) A: Billie is gay, but isn't a faggot.

Flouting maxim of quality

- A's utterances are literally false
- They communicate A's homophobic persona
- The hearer knows that a homophobic persona is associated with beliefs about the effeminacy of gay men
- Licenses the inferences:
  - That A considers Billie as effeminate (50)
  - That A considers Billie as non-effeminate (51)

Same type vs. Richer type responses

What does enriching the type theory do?

- At base level, it introduces *structure*
- E.g., structured types such as complex situation types

What does simplifying the type theory do?

- At base level, it *destroys structure*
- eventualities, physical objects, propositions etc. are treated a alike from the perspective of what the semantics can 'see'
  - It is an open question how much structure we need to reimport into our theory of sorts

The effects of polysemy on semantic theory

Polysemy and copredication are challenging, given traditional assumptions

- Chomsky's argument, distinctions between basic types etc.

This seems to force a choice:

- Impoverish: eradicate at least some type distinctions
- Enrich: Introduce finer grained types, but most importantly, new ways of putting types together

Open question: How substantial is the difference?

- Options for treating polysemy (Hogeweg and Vicente, 2020):
  - Richer lexicon (add structure)
  - Thinner (remove structure)
  - "very thin view and a very rich view may turn out to be indistinguishable in the long run"

Rich types and not-at-issue content

- Structure lexicons allow for tracking and updating
  - Contexts
  - At-issue content
  - Not-at-issue content
- Combined with a social meaning component, we can account for some of the puzzling behaviours of slurs

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Crosslinguistic support

These effects do not appear to be language specific (Sutton, 2022)

(52) a. Die Stellungnahme in dem Umschlag ist sachlich.
the statement in the envelope is factual
'The statement in the envelope is factual.'

b. ?Die Stellungnahme in dem Umschlag hat eine halbe
the statement in the envelope has a half
Stunde gedauert
hour lasted
'The statement in the envelope took half an hour.'

Types and sorts

Traditionally semantic types perform two roles

- avoiding paradoxes (e.g., Curry's paradox)
- marking conceptual distinctions between entities

Curry's paradox (Curry, 1942; Löb, 1945)

Suppose p is the proposition $p \rightarrow q$ (that q is true if p is true)

If p is false, then $p \rightarrow q$ is false, and so p is true (a contradiction).

Therefore p is true and so q is true.

But that means we can prove the truth of any formula that we substitute for q, even those that are false.

But these roles can be separated e.g., Kohlhase 1992, 1994

- **Types** to avoid paradoxes
- **Sorts** to mark conceptual distinctions between entities

Liebesman & Magidor's proposal

- Informal suggestion made in the philosophical literature (Liebesman and Magidor, 2017, 2019)
  - Semantics unchanged, revise the metaphysical assumptions

Idea 1: Indications of a single type view

"accounting for copredication requires no revisionary semantics or metaphysics, and that copredication is perfectly compatible with standard referential semantics . . . we'll argue that book has a single sense and it designates both informational and physical books" (Liebesman and Magidor, 2017, p.132)

Idea 2: Property inheritance

"Informational books are distinct from physical books, but there are many properties that both can instantiate." (Liebesman and Magidor, 2017, p.137)

Property inheritance

(53) Three interesting books are on the shelf.

- Properties can be inherited via association relations
- (53) do not force us to explain how we can copredicate over different sorts of entities
  - This sentence can straightforwardly be about physical books described as interesting based on an inheritance of the properties of their contents
- And vice versa: *book* can denote informational books and prima facie physical predicates can apply to these based on property inheritance

(54) Mao's red book brought about many political changes despite being small.

Implementation within simple type theory

- **BasTyp** $= \{e, t, s\}$
- Functional types constructed recursively ($\langle e, t\rangle$, $\langle s, \langle e, t\rangle\rangle$, etc.)

Possible implementation

- Polysemous nouns denote properties of type $\langle s, \langle e, t\rangle\rangle$
- Physical entities, eventualities etc. in the domain of type e
  - I.e. we expand the domain of type e to include whatever we need

(55)
a. $[\![[_{DP} \text{ lunch }]]\!] : \langle\langle s, \langle e, t\rangle\rangle, \langle s, t\rangle\rangle$
b. $[\![[_{VP} \text{ was delicious }]]\!] : \langle s, \langle e, t\rangle\rangle$
c. $[\![[_{VP} \text{ took ages }]]\!] : \langle s, \langle e, t\rangle\rangle$
d. $[\![[_{VP} \text{ was delicious but took ages }]]\!] : \langle s, \langle e, t\rangle\rangle$
e. $[\![[_{S} \text{ Lunch was delicious but took ages }]]\!] : \langle s, t\rangle$

Challenges for this approach

Challenge

- Informational/propositional denoting nouns e.g., *statement*?
  - We have both propositions of type $\langle s, t \rangle$ and informational entities of type e

Possible response

- Assume that informational entities are in $\mathcal{D}_e$
- Assume mapping functions from $\langle s, \langle e, t \rangle \rangle$ to e (and vice versa?)
- I.e. meaning postulates

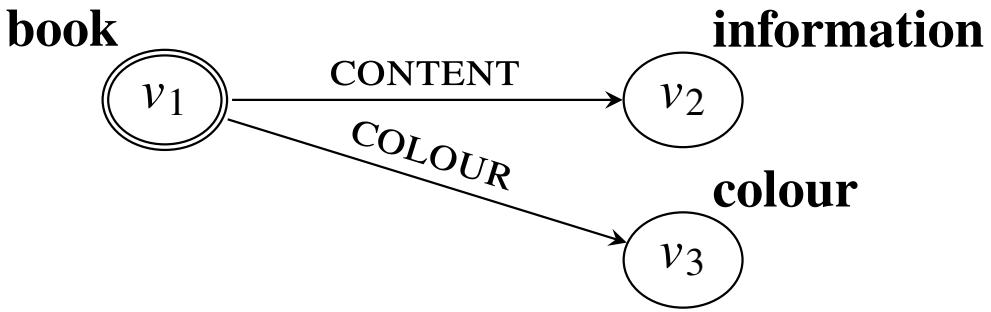
But there may be a way to avoid positing these mapping functions

Düsseldorf-style frame semantics

Babonnaud et al. 2016 and Kallmeyer and Osswald 2017

- A frame theory inspired by the work of Barsalou (1992)
- Building on e.g., Petersen 2015; Löbner 2015

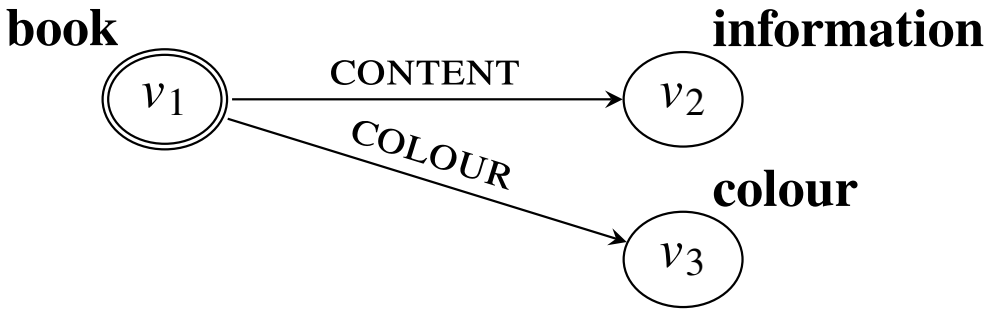
(56)



v_1, v_2	Values	E.g., physical books, informational contents, red
CONTENT, COLOUR	Attributes	Functions from values to values
book, **information**, **colour**	Types	Types of values in a type hierarchy

Frames and polysemy

(56)

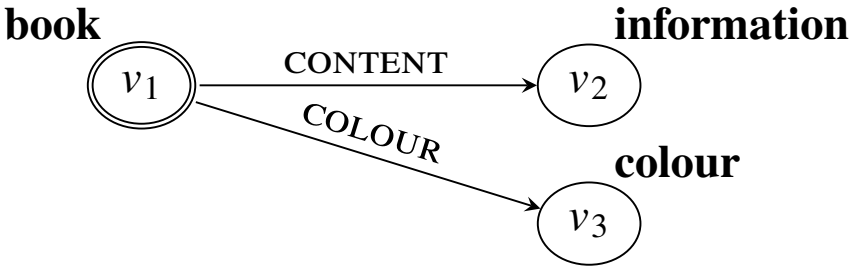


- For *book*, the attribute CONTENT, links the physical book to the contents (as the *formal* meaning component of the Generative Lexicon).
- Modifiers that e.g. add an attributes to the v_1 node (or fill in a value for v_3) modify physical books
- Modifiers that add an attributes to the v_2 node modify physical books
- Assumes that the core meaning of *book* is 'physical book'

Polysemy or coercion?

- Still an open question: Can we treat polysemy as (systematised) coercion?

(56)

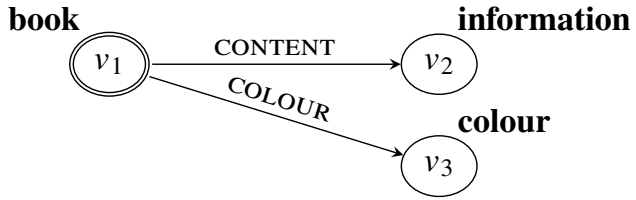


The central node is the physical book

- What about contexts that describe only informational books (allowing e.g. multi-volume books)?
- Shifting the central node?
- Something like: Frames as structures to constrain systematic coercions (constrained by what counts as the formal meaning component)

Frame semantics as a monotyped theory?

(56)



Types and Attributes

- Semantic types as we know them characterise ATTRIBUTES
- For some type σ, every attribute is of type $\langle \sigma, \sigma \rangle$
- Frames are structures of attributes

Types or Sorts?

- E.g., Petersen 2015 refers to **book**, **information** etc. as types in a type hierarchy
- However, these are better thought of as *sorts*
  - They stand in containment relations in the hierarchy e.g., **book** $\sqsubset$ **physical**
  - But they are not input into type constructors
- So, arguably, this is a mono-typed, multi-sorted semantics, with extra structures (frames)

Dot types

Background

- Original proposal: Pustejovsky 1994, 1995
- Developed into Type Compositional Logic (TCL, Asher and Pustejovsky 2006; Asher 2011)
  - More type constructors and more basic types

Philosophical grounding

- Polysemous expressions refer to entities that have different *aspects*
- E.g., *lunch* refers to something that has a food aspect and an eating-event aspect
- Modifiers like *delicious* draw on the food aspect
- Modifiers like *half-hour* draw on the event aspect

Formalising dot types

Minimally: An additional type constructor

- Construct dot types from any two other types

(57) From a non-empty set **BasTyp** of basic types, the set **Typ** of types is the smallest set such that:

a. **BasTyp** $\subseteq$ **Typ**

b. $\langle \sigma, \tau \rangle \in$ **Typ** if $\sigma, \tau \in$ **Typ** (functional type constructor)

c. $\sigma \bullet \tau \in$ **Typ** if $\sigma, \tau \in$ **Typ** (dot type constructor)

- For types *p* ($phys$) and *v* (ev)
- . . . *lunch* denotes entities of type $p \bullet v$
  - entities that have a physical entity aspect and an eventuality aspect

(58) $[\![\text{lunch}]\!] = \lambda w.\lambda x_{:p \bullet v}.LUNCH(x)$

A puzzle about the denotations of dot-type expressions

Question:

- Suppose a, a lunch, is of type $p \bullet v$ (event dot physical entity)
- What is a? An object? If so, what sort?

Complex Objects?

- E.g. Asher and Pustejovsky (2006) deny this

Regular objects?

- Okay, but in what sense are, say lunches, regular objects?

Dot types and modification

Example: *book*

- where p is the type for physical object and i is the type for informational entity
- $[\![\text{book}]\!] \mapsto$ a property of entities, namely books, that have both a physical and informational aspect:

(59) $book \mapsto \lambda w.\lambda x_{:p \bullet i}.BOOK_w(x)$

Elaboration functions (simplified)

- Intuitive idea: to elaborate on/pick out an aspect of an object

(60) $[\![\text{lunch was delicious}]\!] =$
$\lambda w.\exists x_{:p} \exists v_{:v \bullet p}[LUNCH(v) \wedge O\text{-}Elab(x, v) \wedge DELICIOUS(x)]$

- The full system of TCL uses type presuppositions and subtyping relations
  - Beyond our scope

Note on dot-type based responses

Only a simplified picture

- The options for implementing a semantics with dot types are wide:

1. A richer, but nonetheless simple type theory
2. Implementation in category theory (Asher, 2011)
3. Richly typed approaches with dot types (Chatzikyriakidis and Luo, 2015)

Take home message

- It is possible, to model polysemy with a semantics based upon a conservatively extended simple type theory

Aspects modelled with type constructors (Cooper, 2011)

- No dot type constructor needed to represent aspects
- lunch_ev_fd($r.x, e, f$) constructs a type given values for r.x, e, and f
- I.e. the type of situation in which the entity labelled by x in r has two aspects:
  - that of being f of type $food$
  - that of being e of type $event$

(61) $$lunch \mapsto \lambda r : \left[\text{x} : Ind \right] . \left[\begin{array}{lcl} \text{f} & : & food \\ \text{e} & : & event \\ \text{c}_{\text{lunch}} & : & \text{lunch\_ev\_fd}(r.x, e, f) \end{array} \right]$$

In words:

- A property of situations that contain some individual
  - Individual understood rather broadly
- Returns the proposition that there is some food and some event that are aspects of the individual contained in the relevant situation

Comments on Cooper's analysis

Advantages:

- No special type constructor to model polysemy
- Predicates are anyway treated as type constructors, and aspects are a special kind of ternary relation

Puzzle:

- As with the Asher-Pustejovsky approach
  - We can't really say what *the* individual that is the lunch is

Alternative:

- As with the Asher-Pustejovsky approach
  - We can't really say what *the* individual that is the lunch is
- We could treat polysemous nouns as denoting less mysterious entities