A Case for Property-Type Semantics

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Target

A view about intensional constructions: **Propositionalism**

Intensional constructions: natural language sentences that have at least one of properties (i)–(iii):

(i) their complement resists substitution of semantic equivalents
(ii) DPs in their complement allow for a non-specific reading
(iii) DPs in their complement lack existential import

(∗) Ida believes [$_{\text{CP}}$that there is [$_{\text{DP}}$a unicorn] in her garden].

⇏ (i) Ida believes [$_{\text{CP}}$that there is [$_{\text{DP}}$a griffin] in her garden].
⇏ (ii) There is [$_{\text{DP}}$a unicorn] of which Ida believes [$_{\text{CP}}$that it is in her garden].
⇏ (iii) There are [$_{\text{DP}}$unicorns].

Target & Objective

Propositionalism: all intensional constructions can be interpreted as relations to propositions/to truth-evaluable clausal meaning

(∗) $[\![$Ida believes $\underbrace{[_{\text{CP}}\text{that there is a unicorn in her garden}]}]\!]^{i}$

Target & Objective

Propositionalism: all intensional constructions can be interpreted as relations to propositions/to truth-evaluable clausal meaning

(∗) $[\![\text{Ida believes } \underbrace{[_{\text{CP}}\text{that there is a unicorn in her garden}]}_{\text{a proposition}}]\!]^i$

$= \textit{believe}(i)\overbrace{(\lambda w \exists x.\, \textit{unicorn}(w)(x) \wedge \textit{in-gdn}(w)(x))}(\textit{ida})$

Target & Objective

Propositionalism: all intensional constructions can be interpreted as relations to propositions/to truth-evaluable clausal meaning

(∗) $[\![\text{Ida believes } \overbrace{[_{\text{CP}}\text{that there is a unicorn in her garden}]}^{\text{a proposition}}]\!]^i$

$= \textit{believe}(i)\overbrace{(\lambda w \exists x.\, \textit{unicorn}(w)(x) \wedge \textit{in-gdn}(w)(x))}(\textit{ida})$

vs. **Intensionalism:** some intensional complements are irreducibly non-propositional

(†) Bill adores $[_{\text{DP}}\text{Mary}]$.

Objective: Provide a viable alternative to **Propositionalism** that

. . . extends the empirical **domain/scope** of Propositionalism

. . . preserves the (emp'l & method'l) **merits** of Propositionalism

Propositionalism: empirical domain

Paradigm for a propositionalist analysis: want/need-type verbs, which posit phonologically null elements and hidden structure:

(1) a. Bill wants/needs [$_{DP}$a laptop].
≡ b. Bill wants/needs [$_{CP}$FOR PRO to HAVE [$_{DP}$a laptop]].
(≡ c. Bill wants [$_{CP}$that he (himself) has [$_{DP}$a laptop]].)

(2) a. Bill seeks [$_{DP}$a unicorn]. (Quine 1956)
≡ b. Bill strives [$_{CP}$FOR PRO to FIND [$_{DP}$a unicorn]].
(≡ c. Bill strives [$_{CP}$that he finds [$_{DP}$a unicorn]].)

Propositionalism: empirical domain (cont'd)

want/need-type verbs posit phonologically null elements and hidden structure:

(1) a. Bill wants/needs [$_{DP}$a laptop].
≡ b. Bill wants/needs [$_{CP}$FOR PRO to HAVE [$_{DP}$a laptop]].
(≡ c. Bill wants [$_{CP}$that he (himself) has [$_{DP}$a laptop]].)

➥ **Support** for the presence of this structure: (see Schwarz 2006)

- the implicit predicate HAVE can be modified by temporal adverbials:

(3) Bill needs [$_{DP}$a laptop] now.
a. now is the time of Bill's need
b. now is when Bill needs to HAVE a laptop

Propositionalism: merits

The structural similarity b/w DP- and CP-taking occ's of want ...

- enables a uniform analysis of DP/CP-neutral verbs:

  (4) a. Bill wants [$_{DP}$a laptop].
  b. Bill wants [$_{CP}$that he gets a laptop soon].

- facilitates an easy analysis of embedded DP/CP coordinations:

  (5) Bill wants [[$_{DP}$a laptop] and [$_{CP}$that he get it soon]].

- captures inferences from propositional to 'objectual' attitudes:

  (6) a. Bill expects [$_{CP}$that he will get a laptop].
  ⇒ b. Bill expects [$_{DP}$something] (viz. a laptop/ that he will get a laptop).

+ methodological merit: ontological parsimony

Empirical challenge 1: want/need-constructions

Observation: some want/need-constructions are not analyzed through HAVE. These constructions lack evidence for concealed clausal structure (see Schwarz 2006):

(7) John needs [$_{DP}$ a marathon]. (#HAVE/✓**run** a mthon)

(8) ?? John needs to **run** a marathon in 30 mins.

Proposal: interpret object DPs as (type-$(s;(e;t))$) **properties**
(see Deal 2007, following Zimmermann 1993)

(9) J. needs [***BE*** [a marathon]] $\rightsquigarrow$ $need(i)(\textbf{\textit{marathon}})(john)$

Motto: *The concealed clauses that can creep in with want/need verbs should not obscure from view the widespread applicability of the property-type analysis* [...]. (Deal 2007, p. 37)

A note on typing

We use Tichý's (1982) rule for the formation of multiary function types (see also Montague 1970b):

Definition (Tichý types)

Basic types: e (individuals), s (indices), t (truth-values)
Complex types: $(\alpha_1 \times \ldots \times \alpha_n) \rightarrow \alpha_{n+1}$ (n-ary functions)

We abbreviate $(\alpha_1 \times \ldots \times \alpha_n) \rightarrow \alpha_{n+1}$ as $(\alpha_1 \ldots \alpha_n; \alpha_{n+1})$

Example types

$(s; t)$	propositions (coded as sets of indices)
$(s\,e; t)$	centered propositions (sets of index/individual-pairs)
$(s; (e; t))$	properties
$(s; e)$	individual concepts

Challenge 2: *de se*-reports

Observation: on its *de se*-reading, (a) is not equivalent to (b):
(see a.o. Castañeda 1966, Lewis 1979, Perry 1979)

(10) a. Bill believes$_{de\ se}$ [$_{\mathrm{CP}}$that he is a coffee addict].
$\equiv$ b. Bill believes [$_{\mathrm{CP}}$that PRO_s is a coffee addict].
$\not\equiv$ c. Bill believes [$_{\mathrm{CP}}$that Bill is a coffee addict].

Proposal: interpret *de se*-complements as (type-$(se; t)$) **centered propositions** (see Lewis 1979, Chierchia 1989)

(11) $[\![\text{Bill believes [}_{\mathrm{CP}}\text{that PRO}_s \text{ is a coffee addict}]]\!]^i$
$= \mathit{believe}(i)\big(\lambda\langle j, x\rangle[\mathit{coffee\text{-}addict}(j)(x)]\big)(\mathit{bill})$
$= 1 \Leftrightarrow (\forall\langle j, x\rangle)[\mathrm{Dox}_{\mathit{bill}, i}(j, x) \rightarrow \mathit{coffee\text{-}addict}(j)(x)]$

↵ this captures Bill's self-identification as a coffee addict

Challenge 2 (cont'd): control constructions

Observation: PRO in (1b) is often taken to be obligatorily controlled by the matrix subject:
(see Chierchia 1989, Anand & Nevins 2004, Stephenson 2010)

(1) a. Bill wants $[_{DP}$a laptop]/b. [PRO to have a laptop].
$\not\equiv$ d. Bill wants $[_{CP}$that Bill has a laptop].

Proposal: interpret control-complemts as **centered propositions**:

(12) $[\![(1a)]\!]^i \equiv [\![\text{Bill wants } [_{DP}\text{a laptop}]]\!]^i$
$\equiv [\![\text{Bill wants } [_{CP}\text{FOR } [_{TP}\text{PRO}_s \text{ to HAVE a laptop}]]]\!]^i$
$= \mathit{want}(i)(\lambda\langle j, y\rangle(\exists x)[\mathit{laptop}(j)(x) \wedge \mathit{have}(j)(x)(y)])(\mathit{bill})$

↩ This is pretty convincing evidence **against** Propositionalism and **for** a property-type semantics!

Challenge 3: objectual attitude reports

Observation: the direct object DPs in objectual attitude reports typically resist the extension to a full CP: (see a.o. Forbes 2006, Zimmermann 2016; *pace* Parsons 1997)

(13) Klimt adored (/loved/worshipped/feared) [$_{\text{DP}}$Emilie].

adore is DP-biased, s.t. (13a) is ungrammatical:

≠ a. *Klimt adored [$_{\text{CP}}$that Emilie was . . .].

(13) is not equiv. to the result of supplementing Emilie w. the infinitive to be (i)/w. a contextually given VP (ii):

≠ b. i. . . . [$_{\text{DP}}$the fact [$_{\text{CP}}$that Emilie **was there**]].
ii. . . . [$_{\text{DP}}$the fact [$_{\text{CP}}$that Emilie **was beautiful**]].

Challenge 3: objectual attitude reports (cont'd)

Proposal: interpret the DPs as (type-$\langle s, e\rangle$) **individual concepts**:
(see Forbes 2006; Grzankowski 2016)

(14) $[\![(13)]\!]^i = \mathit{adore}(i)(\mathit{emilie}^{\langle s,e\rangle})(\mathit{klimt})$

or as (type-$\langle s, \langle\langle s, \langle e, t\rangle\rangle, t\rangle\rangle$) **intensional general'd quantifiers**:
(see Moltmann 1997; cf. Montague 1970)

(15) $[\![(13)]\!]^i = \mathit{adore}(i)\big(\lambda j \lambda P[P(j)(\mathit{emilie}(j))]\big)(\mathit{klimt})$

(16) a. $[\![\text{Klimt adored } [_{\text{DP}}\text{a woman}]]\!]^i$
$= \mathit{adore}(i)\big(\lambda j \lambda P(\exists x)[\mathit{woman}(j)(x) \wedge P(j)(x)]\big)(\mathit{klimt})$

b. $[\![[_{\text{DP}}\text{a woman}]\ [\lambda_1\ [\text{Klimt adored } t_1]]]\!]^i$
$= (\exists x)\big[\mathit{woman}(i)(x) \wedge \mathit{adore}(i)\big(\lambda j \lambda P[P(j)(x)]\big)\big](\mathit{klimt})$

Challenge 4: depiction/resemblance reports

Observation: the quantifier-analysis of object DPs fails to account for missing readings of reports with a strong quantificational object DP:

(see Zimmermann 1993; cf. Deal 2007)

(17) Uli painted [$_{\text{DP}}$every penguin].

= a. specific: Uli painted a portrait of each Humboldt penguin in Frankfurt Zoo

≠ b. unspecific: ?Uli painted an image of all penguins (whichever they are)

Proposal: interpret these DPs as (type-$(s;(e;t))$) **properties**:
(Zimmermann 1993, v. Geenhoven & McNally 2005, Schwarz '06)

Challenge 4: depiction/resemblance reports (cont'd)

Proposal: interpret these DPs as (type-$\langle s, \langle e, t\rangle\rangle$) **properties**:
(Zimmermann 1993, v. Geenhoven & McNally 2005, Schwarz '06)

(18) a. $[\![\text{Uli paints } [_{\text{DP}} \text{a penguin}]]\!]^i$
$\equiv [\![\text{Uli paints } [\boldsymbol{BE} \text{ [a penguin]}]]\!]^i$
$= \mathit{paint}(i)(\boldsymbol{\mathit{penguin}})(\mathit{uli})$

b. $[\![[_{\text{DP}} \text{a penguin}] [\lambda_1 \text{ [Uli paints } t_1]]]\!]^i$
$= (\exists x)\left[\mathit{penguin}(i)(x) \wedge \mathit{paint}(i)\left(\boldsymbol{\lambda j \lambda y\,[x = y]}\right)(\mathit{uli})\right]$

(19) $[\![\text{Uli paints } [_{\text{DP}} \text{every penguin}]]\!]^i$ (requires scoping)
$= (\forall x)[\mathit{penguin}(i)(x) \rightarrow \mathit{paint}(i)(\boldsymbol{\lambda j \lambda y\,[x = y]})(\mathit{uli})]$

Recap & Strategy

➥ **Conclusion:** many intensional complements RESIST an interpretation as propositions, contra Propositionalism:

verb	complement	type
want/need	centered proposition	$(se; t)$
believe (*de se*)	centered proposition	$(se; t)$
adore/love/fear	individual concept	$(s; e)$
	intensional quantifier	$(s; ((s; (e; t)); t))$
paint/resemble	property	$(s; (e; t))$
need – HAVE	property	$(s; (e; t))$

Proposal: interpret all int. complements as $(s; (e; t))$ **properties**

➥ intens'l verbs uniformly have type $(s; (\mathbf{(s; (e; t))}; (e; t)))$

Motivation: the denotations of all intensional complements can be coded as properties through established type-shifts

Type-shifts: overview

verb	complement	type
want/need	centered prop'n	$(se; t)$
believe (*de se*)	centered prop'n	$(se; t)$
	CURRY	$:= \lambda p^* \lambda j \lambda y [p^*(j, y)]$
believe (non-*de se*)	proposition	$(s; t)$
	EGN	$:= \lambda p \lambda \langle j, y \rangle [p(j)]$
adore/love/fear	individual concept	$(s; e)$
	KAP	$:= \lambda c \lambda j \lambda y [c(j) = y]$
	intensional quantifier	$(s; ((s; (e; t)); t))$
	BE	$:= \lambda \mathcal{Q} \lambda j \lambda y [\mathcal{Q}(j)(\lambda k \lambda z.\, y = z)]$
paint/resemble	property	$\mathbf{(s; (e; t))}$
need – HAVE		

Shift 1: $(se; t)$-to-$(s; (e; t))$

We shift the complements of want/need and *de se*-believe through the type-shifter **CURRY**: (see Schönfinkel 1924)

$$\textbf{CURRY} := \lambda p^{*\,(se;t)} \lambda j \lambda y\, [p^*(j, y)]$$

(20) $[\![\text{want}]\!]^i_{\text{control}} = \lambda p^* \lambda x\, [\texttt{want}(i)(\textbf{CURRY}(p^*))(x)]$

(21) $[\![\text{believe}]\!]^i_{\textit{de se}} = \lambda p^* \lambda x\, [\texttt{believe}(i)(\textbf{CURRY}(p^*))(x)]$

(22) $[\![(1b)]\!]^i \equiv [\![\text{Bill wants } [_{\text{CP}} \text{FOR PRO}_s \text{ to HAVE a laptop}]]\!]^i$

$= \texttt{want}(i)\big(\textbf{CURRY}\big(\lambda\langle j, y\rangle(\exists x)[\mathit{laptop}(j)(x) \wedge \mathit{have}(j)(x)(y)]\big)\big)(\mathit{bill})$

$= \texttt{want}(i)\big(\lambda j \lambda y\,(\exists x)[\mathit{laptop}(j)(x) \wedge \mathit{have}(j)(x)(y)]\big)(\mathit{bill})$

Caveat: centered propositions are a very special kind of property that is truth-evaluable (s. Zimmermann's current work)

Shift 2: $(s; t)$-to-$(s; (e; t))$

Observation: want/believe are ambiguous between property- and proposition-taking occurrences:

(12) $[\![(1b)]\!]^i \equiv [\![\text{Bill wants } [_{\text{CP}} \text{FOR PRO}_s \text{ to HAVE a laptop}]]\!]^i$
$= \mathit{want}(i)\big(\boldsymbol{\lambda j \lambda y}(\exists x)[\mathit{laptop}(j)(x) \wedge \mathit{have}(j)(x)\boldsymbol{(y)}]\big)(\mathit{bill})$

(23) $[\![(1c)]\!]^i \equiv [\![\text{Bill wants } [_{\text{CP}} \text{that Bill has a laptop}]]\!]^i$
$= \mathit{want}'(i)\big(\boldsymbol{\lambda j}(\exists x)[\mathit{laptop}(j)(x) \wedge \mathit{have}(j)(x)\boldsymbol{(bill)}]\big)(\mathit{bill})$

To avoid this ambiguity, we use the type-shifter **EGN**: (Egan 2006)

$$\textbf{EGN} := \lambda p \lambda \langle j, y \rangle [p(j)]$$

(24) $[\![\text{want}]\!]^i_{\text{non-control}} = \lambda p \lambda x\, [\texttt{want}(i)(\textbf{CURRY}(\textbf{EGN}(p)))(x)]$

(25) $[\![\text{believe}]\!]^i_{\text{non-}de\ se} = \lambda p \lambda x\, [\texttt{believe}(i)(\textbf{CURRY}(\textbf{EGN}(p)))(x)]$

Shift 2 (cont'd): $(s; t)$-to-$(s; (e; t))$

(24) $[\![\text{want}]\!]^i_{\text{non-control}} = \lambda p \lambda x\,[\texttt{want}(i)(\textbf{CURRY}(\textbf{EGN}(p)))(x)]$

(25) $[\![\text{believe}]\!]^i_{\text{non-}de\ se} = \lambda p \lambda x\,[\texttt{believe}(i)(\textbf{CURRY}(\textbf{EGN}(p)))(x)]$

To ensure that want preserves the truth-conditional contribution of *want*, resp. *want*′, we posit the following axioms:

(Ax1) $(\forall x)(\forall p^*)\big[\mathit{want}(i)(p^*)(x) \Leftrightarrow \texttt{want}(i)(\textbf{CURRY}(p^*))(x)\big]$

(Ax2) $(\forall x)(\forall p)\big[\mathit{want}'(i)(p)(x) \Leftrightarrow \texttt{want}(i)(\textbf{CURRY}(\textbf{EGN}(p)))(x)\big]$

(26) $[\![\text{Bill wants } [_{\text{CP}}\text{that Bill has } [_{\text{DP}}\text{a laptop}]]]\!]^i$

$= \texttt{want}(i)\big(\textbf{CURRY}\big(\textbf{EGN}\big(\lambda j\,(\exists x)[\mathit{laptop}(j)(x) \wedge \mathit{have}(j)(x)(\mathit{bill})]\big)\big)\big)(\mathit{bill})$

$\equiv \texttt{want}(i)\big(\boldsymbol{\lambda j \lambda y}\,(\exists x)[\mathit{laptop}(j)(x) \wedge \mathit{have}(j)(x)(\boldsymbol{\mathit{bill}})]\big)(\mathit{bill})$

➥ There are semantic relations between the complements of control- and non-control-uses of want

Shift 3: $(s; e)$-to-$(s; (e; t))$

We shift the complements of adore/love/fear through the type-shifters **KAP** and/or **BE**: (see Kaplan 1975; Zimmermann 1993)

$$\textbf{KAP} := \lambda c^{(s;e)} \lambda j \lambda y [c(j) = y]$$
$$\textbf{BE} := \lambda \mathcal{Q} \lambda j \lambda y [\mathcal{Q}(j)(\lambda k \lambda z.\, z = y)]$$

(27) $[\![\text{Klimt adores } [_{\text{DP}} \text{Emilie}]]\!]^i = \texttt{adore}(i)(\textbf{KAP}(\mathit{emilie}))(\mathit{klimt})$
$\equiv \texttt{adore}(i)(\lambda j \lambda y.\, \mathit{emilie}(j) = y)(\mathit{klimt})$
$\equiv \texttt{adore}(i)\big(\textbf{BE}\big(\lambda j \lambda P [P(j)(\mathit{emilie}(j))]\big)\big)(\mathit{klimt})$

(28) $[\![\text{Klimt adores } [_{\text{DP}} \text{a woman}]]\!]^i$
$= \texttt{adore}(i)\big(\textbf{BE}\big(\lambda j \lambda P (\exists x)[\mathit{woman}(j)(x) \wedge P(j)(x)]\big)\big)(\mathit{klimt})$
$\equiv \texttt{adore}(i)\big(\lambda j \lambda y\, (\exists x)[\mathit{woman}(j)(x) \wedge x = y]\big)(\mathit{klimt})$
$\equiv \texttt{adore}(i)(\mathit{woman})(\mathit{klimt})$

Shift 4: $(s;((s;(e;t));t))$-to-$(s;(e;t))$

To obtain properties from the standard interpretation of DPs in depiction reports, we also use **BE**:

(Zimmermann 1993; cf. Partee 1987)

$$\textbf{BE} := \lambda\mathcal{Q}\lambda j\lambda y[\mathcal{Q}(j)(\lambda k\lambda z.\, z = y)]$$

(29) $[\![\text{Uli paints } [_{\text{DP}} \text{a penguin}]]\!]^i$

$\equiv [\![\text{Uli paints } [\textit{BE} \text{ [a penguin]}]]\!]^i$

$= \texttt{paint}(i)\big(\textbf{BE}\big(\lambda j\lambda P(\exists x)[\mathit{penguin}(j)(x) \wedge P(j)(x)]\big)\big)(\mathit{uli})$

$\equiv \texttt{paint}(i)\big(\lambda j\lambda y\,(\exists x)[\mathit{penguin}(j)(x) \wedge x = y]\big)(\mathit{uli})$

$\equiv \texttt{paint}(i)(\mathit{penguin})(\mathit{uli})$

Support

Recall (objective): preserve the merits of Propositionalism

Our property-type semantics accounts for DP/CP coordinations, cross-attitudinal coordination/quantification & inferences:

(4)′ a. Bill wants [$_{DP}$a laptop].
b. Bill wants [$_{CP}$that Mary stops whining].

(5)′ Bill wants [[$_{DP}$a laptop] and [$_{CP}$that Mary stops whining]].

(30) a. Klimt [adored and painted] [$_{DP}$a woman].
b. Klimt [wanted and sought] [$_{DP}$Emilie's attention].
(challenging for Schwarz 2006)

(31) Bill wants [$_{DP}$something (that) Mary fears].

(6) a. Bill expects [$_{CP}$that he will get a laptop].
⇒ b. Bill expects [$_{DP}$something] (viz. a laptop).

Support (cont'd)

(5)′ $[\![$Bill wants [$_{\text{DP}}$a laptop] and [$_{\text{CP}}$that Mary stops whining]$]\!]^i$

$\equiv$ $[\![$Bill wants [[FOR PRO$_s$ to HAVE a laptop] and [that Mary stops whining]]$]\!]^i$

$= \texttt{want}(i)\big(\lambda j \lambda y\,(\exists x)[(\mathit{laptop}(j)(x) \wedge \mathit{have}(j)(x)(y)) \wedge (\mathit{stop}(\mathit{whine}))(j)(\mathit{mary})]\big)(\mathit{bill})$

(34) a. $[\![$Klimt [adored and painted] [$_{\text{DP}}$a woman]$]\!]^i$

$= (\texttt{adore}(i) \wedge \mathit{paint}(i))(\mathit{woman})(\mathit{klimt})$

b. $[\![$Klimt [wanted and sought] [$_{\text{DP}}$Emilie's attention]$]\!]^i$

$\equiv$ $[\![$[Emilie's attention] [Klimt [λ_1 [wants FOR PRO$_s$ HAVE t_1] & [seeks t_1]]]$]\!]^i$

$= \texttt{want}(i)\big(\lambda j \lambda y\,[\mathit{have}(j)(\mathit{emilie's\text{-}attent'n}(j))(y)]\big)(\mathit{klimt}) \wedge \texttt{seek}(i)\big(\lambda k \lambda z\,[\mathit{emilie's\text{-}attent'n}(k) = z]\big)(\mathit{klimt})$

Support (cont'd 2)

(35) $[\![\text{Bill wants } [_{\text{DP}}\text{something Mary fears}]]\!]^i$
$= \texttt{want}(i)\big(\lambda j\lambda y(\exists x)\big[\texttt{fear}(j)(\lambda k\lambda z.\, z = x)(mary) \wedge have(j)(x)(y)\big]\big)(bill)$

(6) a. $[\![\text{Bill expects } [_{\text{CP}}\text{that he will get } [_{\text{DP}}\text{a coffee}]]]\!]^i_{\text{control}}$
$\equiv [\![\text{Bill expects } [_{\text{CP}}\text{FOR PRO}_s \text{ to get } [_{\text{DP}}\text{a coffee}]]]\!]^i$
$= \texttt{expect}(i)(bill)\big(\lambda j\lambda y(\exists x)[coffee(j)(x) \wedge get(j)(x)(y)]\big)$

$\Rightarrow$ b. $[\![\text{Bill expects } [_{\text{DP}}\text{something}] \text{ (viz. a coffee)}]\!]^i$
$= \texttt{expect}(i)\big(\lambda j\lambda y(\exists x)[get(j)(x)(y)]\big)(bill)$

Further support

Our semantics can still distinguish between

- truth-evaluable intensional complements (coded [centered or uncentered] propositions):

$$\lambda j \lambda y\,(\exists x)[\mathit{laptop}(j)(x) \wedge \mathit{have}(j)(x)(\mathit{bill})]]$$
$$\lambda j \lambda y\,(\exists x)[\mathit{laptop}(j)(x) \wedge \mathit{have}(j)(x)(y)]]$$

- non-truth-evaluable intensional complements:

$$\lambda j \lambda y[\mathit{penguin}(j)(y)]\ ,\ \lambda j \lambda y[c(j) = y]$$

➥ Our semantics can explain the different behavior of $\mathrm{want}/\mathrm{need}(+\,\mathrm{HAVE})$, $\mathrm{want}/\mathrm{need} - \mathrm{HAVE}$, and other verbs:

Stipulation: temporal adverbials (e.g. now) can only modify truth-evaluable attitude complements

Novel support

Our semantics can explain (some) differences w.r.t. the acceptability of different kinds of co-predication:

(see Schwarz 2006, Moltmann 2008)

(32) ✓✓ Bill [[wants and needs] [$_{\text{DP}}$a laptop]].
≡ B. [wants and needs] [FOR PRO to HAVE a laptop]
use: **EGN** + **EGN**

(33) ✓ John [needed and was looking for] [$_{\text{DP}}$a hammer].
≡ John [[needed and was lookg for] [*BE* [a hammer]]].
≡ John [[needed to **use**] and [was TRYING to **find**]] [a hammer]]]
use: (non-st.) **BE** + **BE**

(34) (✓) John [needed and crafted] [$_{\text{DP}}$a birdhouse].
≡ John [[needed [$_{\text{CP}}$FOR PRO to HAVE [$_{\text{DP}}$a birdhse]] and [crafted [$_{\text{DP}}$a birdhouse]]].
use: **CURRY** + **BE**

Achieving ontological parsimony

Observation: a compositional property-type semantics still requires a large number of different intensional objects

➥ **Problem:** the semantics isn't ontolog'y parsimonious, but lavish

Ways out: **Alternative 1:** restrict the domain of evaluation for parsimony to the complements of intensional verbs (only p'ties)

Alternative 2 (more appealing)**:** further restrict the intensional objects that are assumed by compositional property-type semantics

- restrict intensional objects to the denotations of attitude verbs (type $((\boldsymbol{s};(\boldsymbol{e};\boldsymbol{t}));(e;t))$) and of attitudinal modifiers
- apply the denotations of attitude verbs to the denotations of their $(\boldsymbol{e};\boldsymbol{t})$-complements through **IFA**: (see Heim & Kratzer)

Property-type semantics with IFA

Definition (Intensional Functional Application, IFA)

If α is a branching node with daughters β, γ, and $[\![\beta]\!]^{i,g}$ is a functn whose domain contains $(\lambda j.[\![\gamma]\!]^{j,g})$, then $[\![\alpha]\!]^{i,g} = [\![\beta]\!]^{i,g}(\lambda j.[\![\gamma]\!]^{j,g})$

Salient instance: IFA forms (type-$(s;(e;t))$) properties from (type $(e;t)$) sets of individuals that are parametrized by indices

Preceding this step, we then only need to . . .

1. give the standard extensional interpretation of complements
2. shift these interpretations to type-$(e;t)$ objects by extensional variants of EGN, KAP, and BE: (+ ❸ IFA)

$$\textit{ext}\text{-}\mathbf{EGN} := \lambda\xi^t\lambda x^e[\xi]$$
$$\textit{ext}\text{-}\mathbf{KAP} := \lambda y^e\lambda x^e[x = y]$$
$$\textit{ext}\text{-}\mathbf{BE} := \lambda O^{((e;t);t)}\lambda x^e[O(\lambda y.x = y)]$$

Property-semantics with IFA: examples

(35) $[\![\text{Bill wants } [_{\text{CP}}\text{FOR PRO}_s \text{ to HAVE } [_{\text{DP}}\text{a laptop}]]]\!]^{i,g}$

$\equiv \left([\![\text{want}]\!]^{i,g}\left(\lambda j.[\![\lambda y(\exists x)[\text{laptop}(x) \wedge \text{have}(x)(y)]]\!]^{j,g}\right)\right)\left([\![\textit{bill}]\!]^{i,g}\right)$

(36) $[\![\text{Bill wants } [_{\text{CP}}\text{that he has } [_{\text{DP}}\text{a laptop}]]]\!]^{i,g}_{\text{non-control}}$

$\equiv \left([\![\text{want}]\!]^{i,g}\left(\lambda j.[\![\textit{ext}\textbf{-EGN}\left((\exists x)[\text{laptop}(x) \wedge \text{have}(x)(\textit{bill})]\right)]\!]^{j,g}\right)\right)\left([\![\textit{bill}]\!]^{i,g}\right)$

$\equiv \left([\![\text{want}]\!]^{i,g}\left(\lambda j.[\![\lambda y(\exists x)[\text{laptop}(x) \wedge \text{have}(x)(\textit{bill})]]\!]^{j,g}\right)\right)\left([\![\textit{bill}]\!]^{i,g}\right)$

(37) $[\![\text{Klimt adored } [_{\text{DP}}\text{Emilie}]]\!]^{i,g}$

$\equiv \left([\![\text{adore}']\!]^{i,g}\left(\lambda j.[\![\textit{ext}\textbf{-KAP}(\text{emilie})]\!]^{j,g}\right)\right)\left([\![\textit{klimt}]\!]^{i,g}\right)$

$\equiv \left([\![\text{adore}']\!]^{i,g}\left(\lambda j.[\![\lambda x.\, x = \text{emilie}]\!]^{j,g}\right)\right)\left([\![\textit{klimt}]\!]^{i,g}\right)$

$\equiv \left([\![\text{adore}]\!]^{i,g}\left(\lambda j.[\![\textit{ext}\textbf{-BE}(\lambda T\,[T(\text{emilie})])]\!]^{j,g}\right)\right)\left([\![\textit{klimt}]\!]^{i,g}\right)$

Property-semantics with IFA: examples (cont'd)

(38) $[\![\text{Klimt adored } [_{\text{DP}}\text{a woman}]]\!]^{i,g}$

$= \left([\![\text{adore}]\!]^{i,g}\left(\lambda j.[\![\textbf{\textit{ext}-BE}\left(\lambda T(\forall x)[\text{woman}(x) \wedge T(x)]\right)]\!]^{j,g}\right)\right)\left([\![\textit{klimt}]\!]^{i,g}\right)$

$= \left([\![\text{adore}]\!]^{i,g}\left(\lambda j.[\![\lambda y(\forall x)[\text{woman}(x) \wedge y = x]]\!]^{j,g}\right)\right)\left([\![\textit{klimt}]\!]^{i,g}\right)$

(39) $[\![\text{Uli paints } [_{\text{DP}}\text{a unicorn}]]\!]^{i,g}$

$= \left([\![\text{paint}]\!]^{i,g}\left(\lambda j.[\![\textbf{\textit{ext}-BE}\left(\lambda T(\forall x)[\text{unicorn}(x) \wedge T(x)]\right)]\!]^{j,g}\right)\right)\left([\![\textit{uli}]\!]^{i,g}\right)$

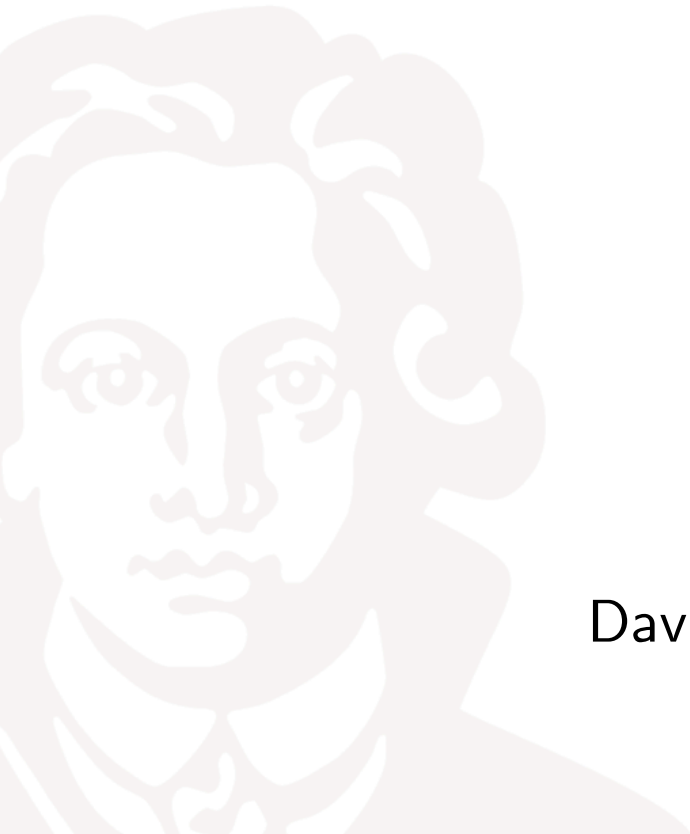
$= \left([\![\text{paint}]\!]^{i,g}\left(\lambda j.[\![\lambda y(\forall x)[\text{unicorn}(x) \wedge y = x]]\!]^{j,g}\right)\right)\left([\![\textit{uli}]\!]^{i,g}\right)$

Summary

- We have presented an alternative to Propositionalism, viz. **property-type semantics**
- We have shown that this semantics ...
  - ... preserves the merits of Propositionalism (a.o. the uniform interpretation of attitude complements, ontological parsimony)
  - ... avoids its empirical shortcomings (i.e. the inability to interpret objectual and *de se*-reports & depiction reports)
- We have achieved this by **incorporating type-shifters** to properties into the semantics of attitude verbs

➥ Property-type semantics facilitates the modelling of DP/CP-neutral verbs and of (different kinds of) co-predication

➥ This semantics gives us a sense of what a Propositionalist semantics might look like & which requirements it must meet



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