Specific-opaque readings and the temporal interpretation of noun phrases

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1. Introduction

Overview:

This talk focuses on a relatively under-studied reading of DPs in intensional contexts, where certain parts of the DP seem to be interpreted "above" an intensional operator, while other parts seem to be interpreted "below" it.

I examine this phenomenon relative to two parameters, worlds and times, illustrating that these parameters diverge with respect to the phenomenon, thus providing further evidence that worlds and times differ in the mechanisms which introduce them to the semantic composition.

At least three readings for DPs in intensional contexts (Fodor 1970)...

(1) Mary wants to meet a linguistics student.

a. $\lambda w.\ \forall w' \in \text{WANT}_{Mary,w} : \exists x : ling\text{-}student_{w'}(x) \wedge meet_{w'}(Mary, x)$ *de dicto*

b. $\lambda w.\ \exists x : ling\text{-}student_{w}(x) \wedge \forall w' \in \text{WANT}_{Mary,w} : meet_{w'}(Mary, x)$ *de re*

c. $\lambda w.\ \forall w' \in \text{WANT}_{Mary,w} : \exists x : ling\text{-}student_{w}(x) \wedge meet_{w'}(Mary, x)$ *third*

...suggesting at least three possible combinations of (non-)specificity with transparency/opacity:[1]

(2)

	Transparent	Opaque
Specific (wide-scope)	*de re*	?
Nonspecific (narrow-scope)	*the third reading*	*de dicto*

(3) Where the relevant notions are defined as follows:

a. (Non-)specificity: A DP δ is specific relative to an intensional operator ω if it takes wide quantificational scope relative to ω, and non-specific if it takes narrow quantificational scope relative to ω.

b. Transparency/opacity: A DP δ is opaque relative to an intensional operator ω if its restrictor is evaluated in the worlds quantified over by ω, and transparent relative to ω otherwise.

[1] I ignore arguments against accounts of *de re* as transparency, and alternative substitution accounts of *de re* – but am happy to discuss how they relate to the current project in the Q&A!

Szabó (2010, 2011): There is a fourth, specific-opaque reading, that we term *wide-scope de dicto*.[2]

(4) Wide-scope *de dicto* relative to a propositional attitude:
   a. **Context:** While under questioning by the police, Alex is presented with a binder of photos of her neighbors, and is asked to identify thieves. She points to several photos, but does not count how many. The police officer does keep track, and later reports:
   b. Alex believes that eleven thieves live in her building.
   c. There are eleven individuals in the actual worlds such that for each of these individuals x, Alex believes x to be a thief living in her building.

(5) Wide-scope *de dicto* relative to an existential modal:
   a. **Context:** In Alex's district, judges are elected, not nominated. Two candidates are trying to win a single vacancy, neither of whom is a judge. The winner will preside over a hearing in which Alex is a defendant. To make sure that her lawyer prepares for both possible outcomes, Alex says:
   b. There are two judges we could face in this court.
   c. There are two individuals in the actual worlds, each of whom could each be the judge we face in court.

(6) Wide-scope *de dicto* relative to past tense:
   a. **Context:** We are on a guided tour of an eighteenth century courthouse that is no longer in use. The guide says:
   b. There are fifteen judges who presided in this court.
   c. There are fifteen individuals in the actual world such that for each there is a past time interval during which they were a judge that presided in this court.

Szabó's story:

(7) **The observation**: A DP δ seems to take wide quantificational scope relative to an intensional operator ω, while its restrictor is nevertheless evaluated within the intensional environment. This observation cuts across the three primary intensional contexts.

(8) **The claim**: The ubiquity of wide-scope *de dicto* readings suggests that natural language makes available a general mechanism that derives wide-scope *de dicto* LFs.

(9) **Proposed implementation** (my rendition of Szabó's proposal):
Quantifier splitting:
$[_{\text{S}}\,[_{\text{DP}}[D][_{\text{NP}}\,N]][\lambda_\iota][_{\text{S}}\ldots[_{\text{DP}}\,t_\iota]\ldots]]$
$\rightarrow [_{\text{S}}\,[_{\text{DP}}\,[D]\underbrace{[\text{IDENT}]}_{\lambda x.x=x}]\,[[\lambda_\iota]\,[_{\text{S}}\ldots[_{\text{DP}}\,\text{THE}\,\underbrace{[\text{IDENT}_\iota]}_{\lambda y.y=x_\iota}[_{\text{NP}}\,N]]\,\ldots]]]$
(In words: The NP-restrictor of a DP that raised can reconstruct into its pre-raising position and undergo *trace conversion* there (Fox 2003), leaving a determiner in the derived position that is vacuously restricted by an identity function.)

[2]This term is due to Keshet and Schwarz (2019); wide-scope *de dicto*, as opposed to regular *de dicto* which involves narrow quantificational scope for the DP and opaque interpretation of its restrictor.

Roadmap for today's talk:

- ❖ Briefly illustrate how Szabó's data posits a challenge to popular theories of intensionality (e.g., 'the standard approach', Percus 2000, von Fintel and Heim 2021).
- ❖ Focusing on wide-scope *de dicto* readings relative to modals and tense, show that Szabó's proposal overgenerates unattested wide-scope *de dicto* readings.
- ❖ Illustrate that a more restricted account of the reading relative to modals in Benbaji 2021 is too restricted to extend to tense.
- ❖ Offer an account of wide-scope *de dicto* relative to tense that builds on well-known observations by Enç (1982), Musan (1995), with predictions that are more nuanced than Szabó's.
- ❖ Point to a problem that this account highlights for analyses of the temporal interpretation of noun phrases, and explore possible solutions.

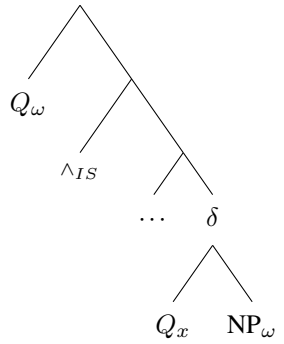
2. Some preliminaries

2.1 Why are wide-scope *de dicto* readings problematic?

A modified scope theory of intensionality (Keshet 2008, 2010 building on Montague 1973, Ladusaw 1977, Ogihara 1996, a.o.):

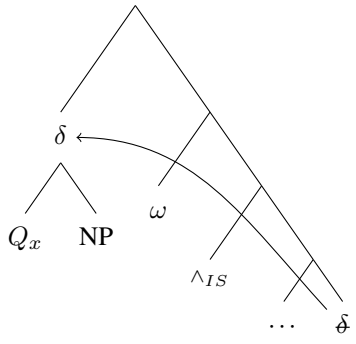
- ❖ Both *non/specificity* and *transparency/opacity* are determined by position at LF.
- ❖ Intensional operators are quantifiers over worlds/times, Q_ω.
- ❖ A quantificational DP δ is headed by a quantifier over individuals Q_x, and its quantificational scope is determined by its syntactic position relative to Q_ω.
- ❖ Each world/time quantifier, Q_ω is associated with a world/time shifter $^\wedge_{IS}$ (for INTENSIONAL SHIFT), which determines the evaluation index of lexical elements they c-command.
- ❖ Below $^\wedge_{IS}$, lexical elements including NP restrictors of Q_x, are interpreted opaquely, in the domain of quantification of Q_ω; above it, they are transparent.

(10) a.



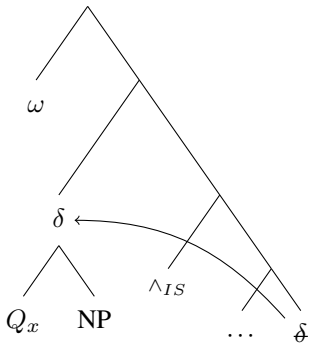
de dicto
$Q_\omega > Q_x, {}^\wedge_{IS} >$ NP$_\omega$

b.



de re
$Q_x > Q_\omega$, NP $> {}^\wedge_{IS}$

c.

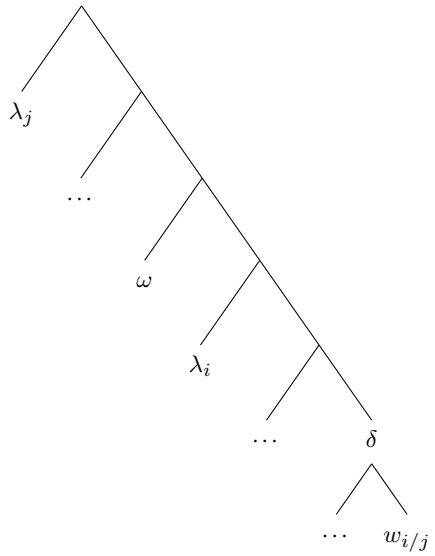


third
$Q_\omega > Q_x$, NP $> {}^\wedge_{IS}$

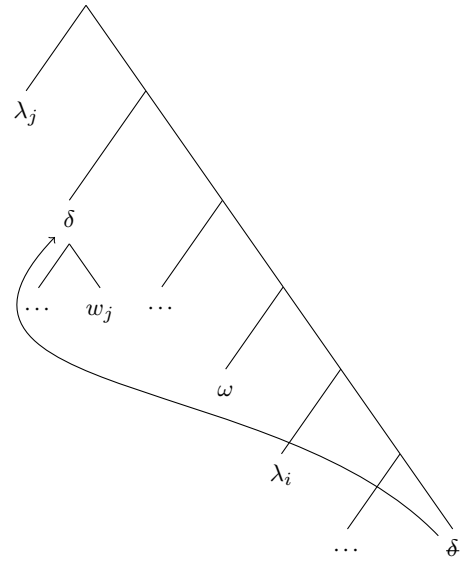
World/time pronouns (Percus 2000, a.o.), i.e., "the standard approach" (von Fintel and Heim 2021):

- ❖ *Non/specificity*, i.e., quantificational scope, is determined by position at LF.
- ❖ Worlds/times are represented as variable arguments of predicates in the object language.
- ❖ These variables are bound by λ-binders, merged immediately under every intensional operator ω and above the entire structure; where binding requires c-command and co-indexation.
- ❖ *Transparency/opacity* is determined by the λ-binder of the variable in the restrictor of δ.
- ❖ A restrictor is opaque relative to ω if its variable is bound by the binder immediately under ω, and transparent relative to ω if its variable is bound by the next-highest binder.

(11) a. *de dicto/third*



b. *de re*



Crucial point: In both theories, narrow quantificational scope for δ does not entail opaque evaluation of its restrictor, but wide quantificational scope does entail transparent evaluation.

2.2 Two observations about the logic of Szabó's examples

Observation #1: Wide-scope *de dicto* relative to attitudes should not be diagnosed in a Hintikkan framework for attitudes, where it entails (narrow-scope) *de dicto* (cf. Keshet and Schwarz 2019).

(12) For any $\phi \in \mathcal{D}_{\langle \tau, \tau t \rangle} : [\exists x \forall y \phi(x, y)] \Rightarrow [\forall y \exists x \phi(x, y)]$
(The expression obtained from scoping an existential above a universal entails the expression obtained from reversing these scopal relations, as long as the scope of the inner quantifier remains constant.)

(13) For any $P, Q \in \mathcal{D}_{\langle s, et \rangle} : \exists x[\forall w : P_w(x) \wedge Q_w(x)] \Rightarrow \forall w[\exists x : P_w(x) \wedge Q_w(x)]$
(The scope of the inner quantifier remains constant across the wide-scope and the narrow-scope *de dicto* readings, and so the former entails the latter on a Hintikkan analysis of attitudes as universal quantifiers over worlds.)

Observation #2: Wide-scope *de dicto* relative to existential modals and tense (assuming *Priorian* tense; i.e., an existential operator over times) should only be detectable if distributivity is involved.

(14) For any $\phi \in \mathcal{D}_{\langle \tau, \tau t \rangle} : [\exists x \exists y \phi(x, y)] \Leftrightarrow [\exists y \exists x \phi(x, y)]$
(Any two existential quantifiers are scopally commutative in the sense of Fox 2000.)

(15) For any $P, Q \in \mathcal{D}_{\langle s, et \rangle} : \exists x[\exists w : P_w(x) \wedge Q_w(x)] \Leftrightarrow \exists w[\exists x : P_w(x) \wedge Q_w(x)]$
(The wide-scope and narrow-scope *de dicto* readings are equivalent when the intensional operators involved have existential force.)

Enter distributivity:

(16) There are two judges we could face in court.

(17) a. $\lambda w.\ \exists w' \in \text{ACC}(w) : \exists_2 x : \textit{judges}_{w'}(x) \wedge \textit{face-in-court}_{w'}(x)$ (narrow-scope *de dicto*)

b. $\lambda w.\ \exists_2 x : \exists w' \in \text{ACC}(w) : \textit{judges}_{w'}(x) \wedge \textit{face-in-court}_{w'}(x)$
(non-distributive wide-scope *de dicto*)

c. $\lambda w.\ \exists_2 x : \forall y \in \text{ATOMS}(x) : \exists w' \in \text{ACC}(w) : \textit{judges}_{w'}(y) \wedge \textit{face-in-court}_{w'}(y)$
(distributive wide-scope *de dicto*)

(Where $\exists_n x$ represents $\exists x : |\text{ATOMS}(x)| = n$, i.e. existential quantification over plural individuals consisting of n atoms.)

In this talk I ignore wide-scope *de dicto* relative to attitudes, and focus on the distributive wide-scope *de dicto* readings relative to tense and modals.

2.3 A prediction of Szabó's proposal

Szabó's story (repeated)

(18) **The claim**: The ubiquity of wide-scope *de dicto* readings suggests that natural language makes available a general mechanism that derives wide-scope *de dicto* LFs.

(19) **Proposed implementation** (my rendition of Szabó's proposal):[3]
Quantifier splitting:
$[_{\text{S}}\ [_{\text{DP}}[D][_{\text{NP}}\ N]][\lambda_\iota][_{\text{S}} \ldots [_{\text{DP}}\ t_\iota] \ldots]]$
$\rightarrow [_{\text{S}}\ [_{\text{DP}}\ [D] \underbrace{[\text{IDENT}]}_{\lambda x.x=x}]\ [[\lambda_\iota]\ [_{\text{S}} \ldots [_{\text{DP}}\ \text{THE}\ \underbrace{[\text{IDENT}_\iota]}_{\lambda y.y=x_\iota}[_{\text{NP}}\ N]]\ \ldots]]]$

Prediction of quantifier splitting: Szabó system is not meaningfully restricted — whenever quantifier raising is permitted, quantifier splitting is also predicted to be felicitous.

[3] Sidenote: Since trace conversion, built into quantifier splitting, places a definite description in the scope of a vacuously restricted quantifier, this analysis of wide-scope *de dicto* must be complemented by a theory of presupposition projection from quantificational sentences. For our purposes, we can make the simplifying assumption that presuppositions project *existentially* from *existential sentences*. Given that all of Szabó's examples involve sentences with cardinal DPs, which we take to denote existential quantifiers over plural individuals, only existential sentences will concern us here, and so our simplifying assumption suffices for the purpose of this talk.

3. Wide-scope *de dicto* relative to modals

Contra Szabó's prediction, wide-scope *de dicto* readings relative to modals *are* meaningfully restricted. In fact, the availability of the wide-scope *de dicto* reading relative to modals is restricted to a particular syntactic environment.

(20) a. **Context:** In Alex's district, judges are elected, not nominated. Two candidates are trying to win a single vacancy, neither of whom is a judge. The winner will preside over a hearing in which Alex is a defendant. To make sure that her lawyer prepares for both possible outcomes, Alex says:

b. # We could face two judges in this court.[4]

c. There are two judges we could face in this court.

(21) a. **Context:** Alex is awaiting the judicial elections as in (20), only this time there are five candidates. Alex believes only two of them stand a chance, and instructs her lawyer to prepare for either of the two winning.

b. Two candidates could end up presiding over our case. (The others have no chance.)

c. # Two judges could end up presiding over our case.

d. There are two judges who could end up presiding over our case. (Benbaji 2021)

Only when the modal is embedded inside a relative clause embedded under the determiner that seems to quantify unrestrictedly (in Szabó's sense), is the wide-scope *de dicto* reading attested.

Proposal in Benbaji 2021: we can derive wide-scope *de dicto* relative to modals without a specialized mechanism, by appealing to the semantics of *reconstructed* raising relative clauses in Bassi and Rasin (2018) (who build on observations by Grosu and Krifka (2007) and Heim (2018)).

(22) Bassi and Rasin's derivation of reconstruction LFs for raising relative clauses:

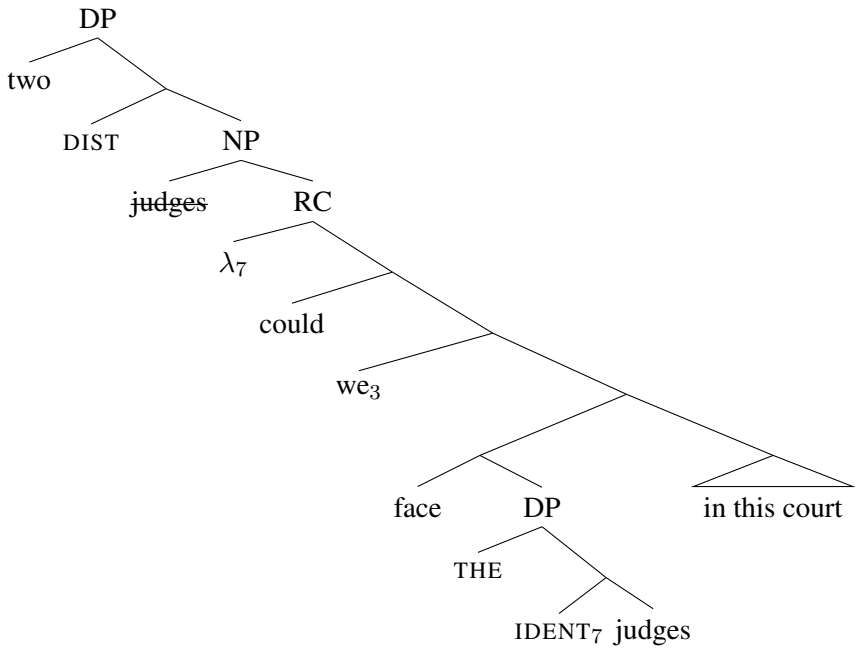
a. *Internal-merge of NP ("raising")*:
$[_{\text{RC}} \dots [_{\text{DP}}[\text{D}][_{\text{NP}}\ \text{N}]]] \rightarrow [[_{\text{NP}}\ \underset{\uparrow}{\text{N}}][[\lambda_i][_{\text{RC}} \dots [_{\text{DP}}[\text{D}][_{\text{NP}}\ \underset{\downarrow}{\text{N}}]]]]]$
(An NP raises from a DP within a relative clause RC.)

b. *Trace conversion:*
i. $[[\lambda_i][_{\text{RC}} \dots [_{\text{DP}}[\text{D}][_{\text{NP}}\ \text{N}]]]] \rightarrow [[\lambda_i][_{\text{RC}} \dots [_{\text{DP}}[\text{D}][_{\text{NP}}\ [\text{N}][\lambda y.y = x_i]]]]]$
ii. $\rightarrow [[\lambda_i][_{\text{RC}} \dots [_{\text{DP}}[\text{THE}][_{\text{NP}}\ [\text{N}][\lambda y.y = x_i]]]]]$
(The DP whose NP restrictor raised is converted into an indexed definite description.)

c. *Higher copy deletion:*
$[[_{\text{NP}}\ \text{N}][[\lambda_i][_{\text{RC}} \dots [_{\text{DP}}[\text{THE}][_{\text{NP}}\ [\text{N}][\lambda y.y = x_i]]]]]]$
$\rightarrow [[\lambda_i][_{\text{RC}} \dots [_{\text{DP}}[\text{THE}][_{\text{NP}}\ [\text{N}][\lambda y.y = x_i]]]]]$
(The higher copy of NP, which is pronounced, is ignored for interpretative purposes.)

[4] This minimal modification of Szabó's example cannot by itself be used to argue against bare quantification, because it has been illustrated independently that inverse-scope object-distributive readings of indefinites are disallowed or dispreferred (Steedman 2011, Križ and Maldonado 2018). So the absence of wide-scope *de dicto* could in principle be attributed to the absence of the distributive reading. This caveat does not extend to the following example in (21).

(23) Application to Szabó's example:



(24) $[\![\text{DIST}]\!] = \lambda f_{\langle e,t\rangle}.\lambda x.\forall y \in \text{ATOMS}(x) : f(y)$

(25) $\lambda f \lambda w.\exists_2 x : \forall y \in \text{ATOMS}(x) : \exists w' : \textit{face-in-court}_{w'}(g(3), \iota z[judge_{w'}(z) \wedge z = y]) \wedge f_w(x)=1$

(In words: There is a plurality of two individuals in the actual world, such that for each of them there is a world in which they are the judge we face in court.[5])

(See Appendix A for an illustration that it is only raising relative clauses that admit wide-scop *de dicto* readings; i.e., that when raising is blocked, the reading is not attested.)

4. Wide-scope *de dicto* relative to tense

The account for wide-scope *de dicto* relative to modals does not extend to tense, where the presence of a raising relative clause is not required for the reading to be attested.

(26) a. **Context:** We are on a guided tour of an eighteenth century courthouse that is no longer in use. The guide says:

b. There are fifteen judges who presided in this court.

c. Fifteen judges presided in this court

[5] I am making here a non-trivial simplifying assumption that the pivot nominal in *there*-sentences denotes a generalized quantifier, and that *there*-constructions end up denoting the proposition derived by feeding this generalized quantifier a vacuous scope argument. For now, this is done for ease of exposition, on the (yet unverified) assumption that if we incorporate a more precise semantic analysis of *there*-sentences, this would not alter the results derived here. However, in the final part of the talk I will have to commit to a particular assumption about *there*-constructions often associated with generalized-quantifier accounts of the pivot (e.g., Barwise and Cooper 1981); namely, that the coda is evaluated at the same index as the pivot nominal; i.e., together with the restrictor of the generalized quantifier.

The felicity of (26b) in Szabó's context can be attributed to the algorithm in (22), but **perhaps (26c) illustrates that we need a general mechanism for wide-scope *de dicto* LFs after all — at least relative to tense operators?**

Claim: The wide-scope *de dicto* reading of (26c) can be shown to result from a series of independently motivated claims about the temporal interpretation of noun phrases.

4.1 Independent observations on the temporal interpretation of noun phrases

Enç 1982

(27) The tense of a noun need not match the tense of its host clause.
   a. Every fugitive is in prison.
   b. ($\Leftrightarrow$ Every person who at some point was a fugitive is now in prison.)

(28) **Enç's proposal:** Tenses are introduced into noun phrases via free variables over time intervals, whose value is assigned by the contextually determined assignement function.
   a. [every [[t_7][fugitive]]]
   b. $[\![$[every [[t_7][fugitive]]]$]\!]^{g,t} = \lambda f_{\langle e,t\rangle}.\, \forall x : \text{fugitive}(x)(g(7)) \rightarrow f(x)(t)$

Musan 1995

(29) Deficiency of Enç's proposal:
   a. **Context:** Some number of prisoners, say fifteen, broke out of prison at different times, such that each of them was caught and imprisoned again shortly before the next one escaped (so there were no simultaneous fugitives).
   b. Every fugitive is in prison.

   So fugitive-times should be able to vary with individuals universally quantified over.

(30) **Musan's generalization:** Temporal in/dependence is determined by the kind of DP a noun is embedded under – nouns are independent under strong DPs but not under weak DPs.
   a. # There is a fugitive in prison.
   b. ($\not\Leftrightarrow$ There is a person who at some point was a fugitive now in prison.)

   (Where strong determiners are those that are barred from the post-copular slot in existential *there*-constructions; Milsark 1974.)

Musan's generalization – implementation #1 (to be revised)

- ❖ Temporal in/dependence is a property determined by determiners, and should therefore be encoded in the semantics of determiners.
- ❖ Thus, we should incorporate existential quantification over time intervals in the semantics of strong determiners, but not in the semantics of weak ones.

(31) $[\![\text{every}]\!]^t = \lambda f_{\langle e,t\rangle} \lambda g_{\langle e,t\rangle}.\ \forall x : (\exists t' : f(x)(t') = 1) \rightarrow (g(x)(t) = 1)$

(32) $[\![\text{a}]\!]^t = \lambda f_{\langle e,t\rangle} \lambda g_{\langle e,t\rangle}.\ \exists x : f(x)(t) = 1 \ \wedge \ g(x)(t) = 1$

❖ This is *not* the implementation in Musan 1995, which employs a richer ontology and involves quantification over "stages" of individuals – but a simplification due to Kusumoto (2005).

Milsark 1974

(33) *Cardinal* determiners, including *many, some* and (crucially for us) numerals like *fifteen*, are weak in certain syntactic environments and strong in others.

a. Fifteen fugitives are in prison. matrix subject = strong

b. # There are fifteen fugitives in prison. pivot of *there*-construction = weak

An overlooked point (as far as I know)

❖ Example (33a) is true in the context of (29a), where there are no simultaneous fugitives.

❖ On our implementation of Musan's generalization, then, strong cardinal DPs should allow the time intervals in which their restrictor is presumed to hold to co-vary with the atomic parts of the plural individuals they quantify over.

❖ I.e., they should encode *distributivity* in their lexical entry as follows:[6]

(34) a. $[\![\text{fifteen}_{\textit{strong}}]\!]^t = \lambda f_{\langle e,t\rangle} \lambda g_{\langle e,t\rangle}.\ \exists_{15} x : \forall y \in \text{ATOMS}(x) : \exists t' \text{:}\ f(y)(t') \wedge g(x)(t)$

b. $[\![\text{fifteen}_{\textit{weak}}]\!]^t = \lambda f_{\langle e,t\rangle} \lambda g_{\langle e,t\rangle}.\ \exists_{15} x : f(x)(t) \wedge g(x)(t)$

❖ Note that the fact one has to posit this ambiguity should already sow some doubts about the plausibility of this approach — this issue is addressed below.

A toy system of tense

❖ We adopt a system where strong determiners introduce existential quantification over time intervals, which can vary with atoms of the individuals being quantified over.

❖ We complement this with the following toy existential-tense account, adapted from the textbook implementation in von Fintel and Heim 2021:

(35) a. $[\![\text{PRES}]\!]^t = \lambda p_{\langle i,t\rangle}.\ 1 \textit{ iff } p(t)$ (vacuous semantics for present tense)

b. $[\![\text{PST}]\!]^t = \lambda p_{\langle i,t\rangle}.\ 1 \textit{ iff } \exists t' < t : p(t') = 1$

(Existential-tense is used primarily to maintain parallelism between wide-scope *de dicto* relative to existential modals and wide-scope *de dicto* relative to tense.[7])

[6] Distributivity in (34a) only applies to the restrictor of $[\![\text{fifteen}_{\textit{strong}}]\!]^t$. I assume that when the cardinal also distributes over its nuclear scope this is due to a distributivity operator over its scope-denoting constituent at LF. I am not concerned at this point with how distributivity and cumulativity interact with this system any further than that.

[7] More work is required to check how an account with referential-tense would work.

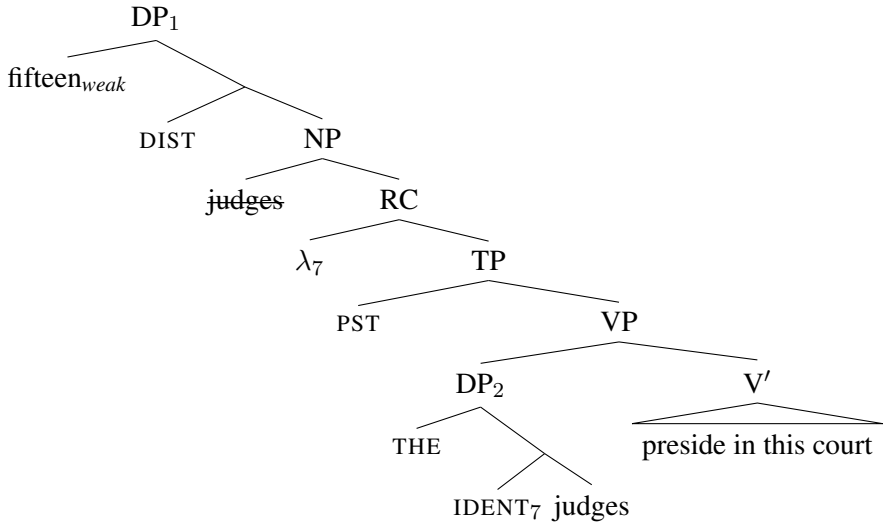
4.2 Back to the problem of wide-scope *de dicto* relative to tense

(36) a. **Context:** We are on a guided tour of an eighteenth century courthouse that is no longer in use. The guide says:
b. There are fifteen judges who presided in this court.
c. Fifteen judges presided in this court

The example in (37) has a cardinal DP in the post-copular position of a *there*-construction, and a raising relative clause. This has two important implications:

- ❖ The cardinal DP is weak in the post-copular position of the *there*-construction, and therefore does not introduce quantification over time intervals in its restrictor.
- ❖ Given that the example contains a raising relative clause, as in the modal case (23), the NP *judges* reconstructs, and its temporal interpretation is parasitic on tense in the relative clause.

(37) Wide-scope *de dicto* LF for (36b)



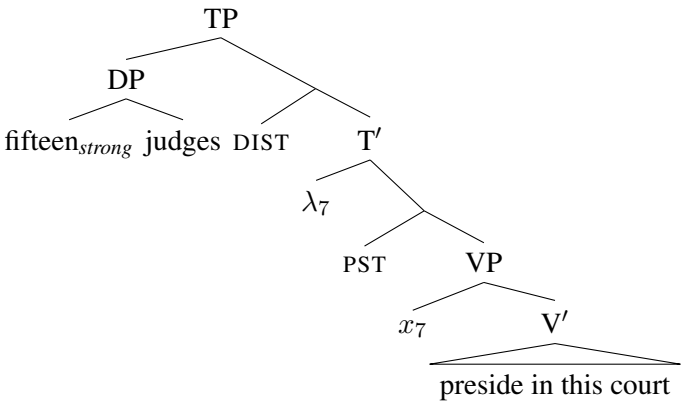
(38) Semantic derivation for (37):

a. $[\![\text{DP}_2]\!]^{g,t} = \iota x[\text{judge}(x)(t) \wedge x = g(7)]$
b. $[\![\text{V}']\!]^{g,t} = \lambda x.\ 1$ *iff* x presides at t
c. $\lambda t.\ [\![\text{VP}]\!]^{g,t} = \lambda t.\ 1$ *iff* $\iota x[\text{judge}(x)(t) \wedge x = g(7)]$ presides at t
(applying intensional functional application to $[\![\text{VP}]\!]^{g,t}$; cf. Heim and Kratzer 1998)
d. $[\![\text{TP}]\!]^{g,t} = 1$ *iff* $\exists t' < t : \iota x[\text{judge}(x)(t') \wedge x = g(7)]$ presides at t'
e. $[\![\text{RC}]\!]^{g,t} = \lambda x.\ 1$ *iff* $\exists t' < t : \iota y[\text{judge}(y)(t') \wedge y = x]$ presides at t'
f. $[\![\text{DIST}]\!]^{g,t}([\![\text{RC}]\!]^{g,t}) = \lambda x.\ \forall y \in \text{ATOMS}(x) : [\![\text{RC}]\!]^{g,t}(y) = [\![\text{DP}_1]\!]^{g,t}$
g. $[\![(37)]\!]^{g,t} = \lambda f_{\langle e,t\rangle}.\ \exists_{15} x : \forall y \in \text{ATOMS}(x) : \exists t' < t : \iota z[\text{judge}(z)(t') \wedge z = y]$ presides at $t' \wedge f(x)(t)$

(In words: there are fifteen individuals such that for each there is a past time interval during which they were the judge presiding at court.)

The example in (36c), on the other hand, has as its matrix subject a cardinal DP, which is able to introduce existential quantification over time intervals in its restrictor, rendering it temporally independent.

(39) LF for (36c), with a strong cardinal determiner and no relative clause:



(40) Semantic derivation for (39):

a. $\lambda t.\ [\![\text{VP}]\!]^{g,t} = \lambda t.\ 1$ *iff* $g(7)$ presides at t
(applying intensional functional application to $[\![\text{VP}]\!]^{g,t}$; cf. Heim and Kratzer 1998)

b. $[\![\text{T}']\!]^{g,t} = \lambda x.\ \exists t' < t : x$ presided at t'

c. $[\![\text{DIST}]\!]^{g,t}([\![\text{T}']\!]^{g,t}) = \lambda x.\ \forall y \in \text{ATOMS}(x) : \exists t' < t : y$ presided at t'

d. $[\![\text{DP}]\!]^{g,t} = \lambda f_{\langle e,t\rangle}.\ \exists_1 5x : \forall y \in \text{ATOMS}(x) : \exists t' : \text{judge}(y)(t')\ \wedge f(x)(t)$

e. $[\![(39)]\!]^{g,t} = 1$ *iff* $\exists_{15} x : \forall y \in \text{ATOMS}(x) : \exists t' : \text{judge}(y)(t')\ \wedge\ \exists t'' < t : \text{presided}(y)(t''))$

(In words: there are fifteen individuals such that for each there is a time interval during which they were a judge and a *past* time interval during which they presided in court.[8])

4.3 On the relationship between *judgeship*-time and *presiding*-time

My proposal for wide-scope *de dicto* relative to tense:

- ❖ We derive wide-scope *de dicto* readings of DPs with weak determiners (i.e., in *there*-constructions) as a byproduct of the semantics of reconstruction into relative clauses, as with modals.
- ❖ When the DP has a strong determiner (in matrix subject position), we derive its wide-scope *de dicto* reading as a byproduct of the temporal independence of strong DPs.

[8] We derive these truth conditions by scoping distributivity above past tense; this way, the atomic parts of the fifteen-sized plural individuals quantified over may vary with respect to their judgeship times. A possible alternative that does not involve a scope this high for distributivity involves scoping distributivity only over VP, as long as we incorporate quantification over time intervals into the denotation of VP.

(1) a. $[\![\text{turn off the stove}]\!]^t(x) = 1$ *iff* x turns-off-stove $\boxed{\text{at}}\ t$ (the turning off takes place throughout t)

b. $[\![\text{turn off the stove}]\!]^t(x) = 1$ *iff* x turns-off-stove $\boxed{\text{in}}\ t$ (the turning off takes place at an interval within t)

There may be independent reasons to adopt the *in-semantics* (51b), discussed in e.g., Kusumoto 1999, von Fintel and Heim 2021, but as far as I can tell this is not required at this point in the discussion; I address it again below.

Szabó's proposal:

- ❖ Szabó's system can derive wide-scope *de dicto* readings relative to tense for any DP, regardless of syntactic configuration.

The approaches differ in predictions regarding the overlap between *judgeship*-times and *presiding*-times of the individuals quantified over in (36b-36c), when the relevant *de re* readings are false:

(41) a. **My prediction:** When the judge-DP has a weak determiner (and the *de re* reading is false), judgeship time is parasitic on presiding time, so the two should overlap. When it has a strong determiner, judgeship time need not overlap with presiding time.

b. **Szabó's prediction:** Regardless of syntactic configuration of the judge-DP, judgeship and presiding times must overlap, as both are interpreted relative to clausal past tense.

Our prediction appears to be verified: overlap only seems obligatory when the determiner is weak, and a past-tense evaluation of its restrictor is thus parasitic on reconstruction into its relative clause.

(42) a. **Context:** We are on a guided tour of an eighteenth century courthouse that is no longer in use (i.e., there are no relevant utterance-time judges). The guide says:

b. i. Fifteen judges presided in this court.

ii. Fifteen judges went to Yale.

c. i. There are fifteen judges who presided in this court.

ii. #[?] There are fifteen judges who went to Yale.

Note that when we use a verb phrase that does not require its argument to be a judge, only the example with a temporally independent DP is felicitous (42b-ii) – contra Szabó's prediction.

4.4 Interim conclusion

- ❖ The phenomenon of wide-scope *de dicto* relative to modals is syntactically restricted to environments with raising relative clauses.
- ❖
  - ➤ The phenomenon of wide-scope *de dicto* relative to tense is less restricted than that, but more restricted than what Szabó's unrestricted mechanism predicts.
  - ➤ In particular, weak DPs only give rise to this reading with a raising relative clause, but strong DPs are not restricted in this way.[9]
- ❖ **We thus observe a dissociation between worlds and times.**
- ❖ Given that we rule out a general mechanism, this dissociation provides further justification for additional, more restricted machinery to introduce times into the semantic composition.

[9] See Appendix A for a brief discussion of how diagnostics for raising, and lack thereof, correlate with the wide-scope *de dicto* relative to tense for weak DPs.

- ➤ The machinery we use, following Musan (1995), Kusumoto (2005) incorporates quantification over times into the meanings of strong determiners, but not of weak ones.
- ➤ This derives the fact that for weak DPs wide-scope *de dicto* readings relative to tense seem more restricted than for strong ones; cf. (42c-i-42c-ii).

❖ But, as is usually the case, things turn out to be more complicated than that.

5. Weak determiners and distributivity over time intervals

(43) a. **Context:** We are on a guided tour of an eighteenth century courthouse that is no longer in use (i.e., there are no relevance utterance-time judges). The guide says:
b. #[?] There are fifteen judges who went to Yale.
c. There were fifteen judges who went to Yale.

- ❖ In (43c) there are two past tense operators, so no reconstruction is required to achieve a past interpretation of *judges*.
- ❖ On the account above, this is arguably why judgeship and Yale times needn't overlap.

But the fact that we have only examined weak DPs under matrix present tense so far obfuscates the fact that weak DPs, e.g., in (43c), can be wide-scope *de dicto* relative to matrix past as well!

(44) a. **Context:** We are on a guided tour of an eighteenth century courthouse that is no longer in use (i.e., there are no relevance utterance-time judges). This was a very small court; at any given point in time the bench only consisted of one judge. Therefore, no two individuals were judges simultaneously. The guide says:
b. There were fifteen judges who went to Yale.
c. There are fifteen individuals, such that for each there is a past time interval during which they were a judge, and a past time interval during which they went to Yale.

The argument:

i. In (44b) (= (43c)), judgeship-time does not overlap with Yale-time, so past-tense evaluation of *judges* cannot be due to reconstruction of *judges* under embedded past tense.
ii. But since the DP in (44b) is weak, it lacks DP-internal quantification over times and must quantify over pluralities of fifteen *simultaneous* past-judges.
iii. So (44b) is wrongly predicted to be infelicitous when there are no simultaneuos judges.

Our current system still seems to undergenerate wide-scope *de dicto* readings relative to past tense.

A more general characterization of the problem

- ❖ Weak cardinals do not introduce existential quantification over times in their restrictor, so all atoms of the individuals they quantify over must satisfy the restrictor at the same interval.

❖ Yet even temporally dependent DPs allow their restrictor-time to vary with the atoms of the individuals they quantify over, as long as this variation is restricted by clausal tense.

(45) a. **Context:** Fifteen prisoners broke out of prison at different times, such that each of them was caught and imprisoned again shortly before the next one escaped (so there were no simultaneous fugitives). We are investigating their escape routes. We find fifteen different pairs of footprints in the woods. We conclude:

b. There were fifteen fugitives in these woods.

❖ In other words, we use existential quantification over time intervals to do two things:

i. Make a DP temporally independent from the tense of its host clause.

ii. Allow the time interval in which the restrictor of a DP is presumed to hold to co-vary with the individuals quantified over by the determiner.

If weak DPs lack temporal independence (i), but can still distribute over (different) time intervals (ii), the same mechanism should *not* derive both (i) and (ii). And given that the ability of to distribute over time intervals is what is required to derive wide-scope *de dicto* readings, the mechanism that is in charge of this property should be active in both strong and weak DPs.

5.1 Exploratory notes on teasing apart temporal independence from DP-internal quantification over times

Musan's generalization – implementation #2 (to be revised)

❖ Weak and strong DPs both introduce existential quantification over time in their restrictor.

❖ Quantification over times in the semantics of weak DPs is restricted by the tense of the host clause, while in the case of strong DPs it is (at most) contextually restricted.

(46) $[\![\text{fifteen}_{\textit{strong}}]\!]^t = \lambda f_{\langle e,t\rangle} \lambda g_{\langle e,t\rangle}.\ \exists_{15} x : \forall y \in \text{ATOMS}(x) : \boxed{\exists t' :}\, f(y)(t') \wedge g(x)(t)$

(47) $[\![\text{fifteen}_{\textit{weak}}]\!]^t = \lambda f_{\langle e,t\rangle} \lambda g_{\langle e,t\rangle}.\ \exists_{15} x : \forall y \in \text{ATOMS}(x) : \boxed{\exists t' \subseteq t :}\, f(y)(t') \wedge g(x)(t)$

We will see below that this approach to temporal dependence requires some further non-trivial assumptions. But regardless of those, our implementations so far are conceptually problematic:

❖ Each cardinal DP is assumed to be lexically ambiguous.

❖ This raises the question of why no language appears to have two different lexical items corresponding to, say, *fifteen*$_{\textit{strong}}$ and *fifteen*$_{\textit{weak}}$ (as far as I know).

Enter Diesing 1992 The strength distinction *vis-a-vis* determiners is due to a structural difference. DPs with weak determiners are lower in the tree than those with strong ones; weak DPs are "trapped" in VP, while strong ones reside at TP.

Musan's generalization – implementation #3 (final, for now)

- ❖ The empirical generalizations to be accounted for:
  i. All DPs allow their restrictor to hold of the individuals in their domain at different times.
  ii. Only strong DPs can be temporally independent from the tense of their host clause.
- ❖ The tools we use to account for them:
  i. Weak and strong DPs both introduce quantification over time intervals in their restrictor.
  ii. The domain of this quantification is restricted to sub-intervals of the tense of the host clause in the case of weak DPs.
- ❖ However, we only posit one entry for cardinal DPs:

(48) $[\![\text{fifteen}]\!] = \lambda t \lambda f_{\langle e,t\rangle} \lambda g_{\langle e,t\rangle}.\ \exists_{15} x : \forall y \in \textsc{atoms}(x) : \exists t' \subseteq t : f(y)(t') \wedge g(x)(t)$

- ❖ Building on Diesing's claim, we assume that temporal in/dependence is the result of binding conditions posited on the determiner's time argument.
  - ➤ The time argument of weak determiners must be locally bound, and since these DPs reside below clausal tense, clausal tense functions as the binder.
  - ➤ Given that strong determiners reside above clausal tense, their time argument is existentially closed, effectively rendering it vacuous.

  (See Appendix B for a very rough draft of an implementation of this idea.)
- ❖ This implementation of Musan's generalization is equivalent to the one above, which posits a lexical ambiguity, but shifts the work of distinguishing the two entries to the syntax.

Important caveat Musan considers a syntactic implementation of the generalization, but rejects it due to scope paradoxes that it arguably gives rise to. However, given that Musan's theoretical assumptions are quite different from what is assumed here, more work is required to re-evaluate the arguments against employing Diesing's observation in the implementation of the generalization.[10]

Loose ends Whether or not this attempt ends up working depends on our approach to the relationship between the pivot nominal and the coda in a *there*-construction. Recall:

(49) a. **Context:** Fifteen prisoners broke out of prison at different times, such that each of them was caught and imprisoned again shortly before the next one escaped (so there were no simultaneous fugitives). We are investigating their escape routes. We find fifteen different pairs of footprints in the woods. We conclude:

b. There were $\underbrace{\text{fifteen fugitives}}_{\text{pivot}}$ $\underbrace{\text{in these woods}}_{\text{coda}}$.

[10] I build on Diesing's syntactic generalization, but do not assume her theoretical framework.

❖ If *in these woods* is taken to be the scope of *fifteen judges*, we derive wrong truth-conditions:

(50) $[\![(49b)]\!]^{g,t} = \exists t' < t : \exists_{15} x : \forall y \in \text{ATOMS}(x) : \exists t'' \subseteq t' : \text{fugitive}(y)(t'') \wedge \text{in-woods}(x)(t')$

(In words: there is a past interval t and fifteen individuals who were all in these woods at t, such that each of them was a fugitive at a sub-interval of t.)

The fifteen fugitives need not have been in the woods throughout the past interval that includes all the sub-intervals in which they were fugitives.

❖ The problem does not go away if we incorporate existential quantification over times into the semantics of the coda and have it scopally interact with distributivity.

(51) a. $[\![\text{in these woods}]\!]^t(x) = 1$ *iff* x is in these woods $\boxed{\text{at}}\, t$ (i.e., throughout t)
b. $[\![\text{in these woods}]\!]^t(x) = 1$ *iff* x is in these woods $\boxed{\text{in}}\, t$ (i.e., at an interval in t)

(52) The *in*-semantics contains implicit existential quantification, which can be made explicit (cf. von Fintel and Heim 2021). For instance,
a. by quantifying over sub-intervals in the metalanguage:
$[\![\text{in these woods}]\!]^t(x) = 1$ *iff* $\exists t' \subseteq t : x$ is in these woods at t'
b. by introducing events to our metalanguage:
$[\![\text{in these woods}]\!]^t(x) = 1$ *iff* $\exists e : e$ is an event of x being in woods & $\tau(e) \subseteq t$
(Where $\tau(e)$ is the exact time-interval occupied by event e.)

(53) $[\![(49b)]\!]^{g,t} = \exists t' < t : \exists_{15} x : \forall y \in \text{ATOMS}(x) : \exists t'' \subseteq t' : \text{fugitive}(y)(t'') \wedge \exists t''' \subseteq t' : \text{in-woods}(y)(t''')$

(In words: there is a past interval t and fifteen individuals, such that each was a fugitive for some sub-part of t and in these woods for some (other) sub-part of t.)

❖ We can show that (53) derives bad results for (49b) by considering Enç-like sentences, in which the pivot nominal is incompatible with the coda of a *there*-construction.

(54) a. **Context:** Fifteen prisoners broke out of prison at different times, such that each was caught and imprisoned again shortly before the next one escaped (no simultaneous fugitives). The following is uttered years later after the last of them has been released for good behavior:
b. # There were fifteen fugitives in prison.

(55) $[\![(54b)]\!]^{g,t} = \exists t' < t : \exists_{15} x : \forall y \in \text{ATOMS}(x) : \exists t'' \subseteq t' : \text{fugitive}(y)(t'') \wedge \exists t''' \subseteq t' : \text{in-prison}(y)(t''')$

(In words: there is a past interval t and fifteen individuals, such that each was a fugitive for some sub-part of t and in prison for some (other) sub-part of t.)

The truth-conditions in (55) are true in the given scenario, in which the sentence they are assumed to be the truth conditions of is infelicitous.

Possible solution:

- ❖ Reject the idea that the coda is mapped onto the scope of the determiner in *there*-constructions.
- ❖ In fact, on Barwise and Cooper's (1981) original analysis, the pivot and the coda are both part of the restrictor argument of a generalized quantifier (see also Williams 1984).

  (56) $[\![\text{fifteen}]\!]^{g,t}([\![\text{fugitives in prison}]\!]^{g,t})(\lambda x.\ \text{exists}(x))$

- ❖ Downside: there are arguments against this approach (see McNally 1997 for an overview).
- ❖ Of course, our analysis of wide-scope *de dicto* only demands pivot and coda to be evaluated relative to the same time index, not any other assumption in Barwise and Cooper's account.

6. Outlook

Szabó's examples of wide-scope *de dicto* posit a serious challenge to standard theories of intensionality – in which wide quantificational scope entails transparent interpretation.

Taking these examples at face value, we must resort to radical assumptions to account for them:

i. Reject the idea that scope is determined structurally.
ii. Reject a basic tenet of generalized quantifier theory (Barwise and Cooper 1981) and allow restrictors not to restrict the determiner under which they appear. (←Szabó's solution)
iii. Reject the idea that opacity is blocked by wide quantificational scope.

The narrow goal of this talk was thus to argue that, in a sense, not all of these examples should be taken at face value; i.e., that some apparent wide-scope *de dicto* readings are due to mechanisms already independently motivated for natural language.

i. Wide-scope *de dicto* relative to modals is only attested when the modal is embedded in a raising relative clause.
ii. Wide-scope *de dicto* relative to tense is more widely attested due to independent mechanisms for quanification over times within DPs.

The discussion serves to highlight two important points:

i. Modal and temporal operators pattern differently with respect to their ability to give rise to wide-scope *de dicto* readings of the DPs they interact with.

   (57) a. Fifteen judges presided in this court.
   b. $\Rightarrow$ Fifteen one-time judges presided in this court.

   (58) a. Two judges could preside over our court case.
   b. $\not\Rightarrow$ Two could-be judges could preside over our court case.

   (i.e., this constitutes further evidence for the difference between the roles worlds and times play in the semantic composition.)

ii. DP-internal existential quantification over times should not be restricted in the way implied by Musan's generalization, and should be available for both temporally dependent and temporally independent DPs.

Several remaining issues:

i. Wide-scope *de dicto* relative to attitude predicates.

ii. How accounts of *there*-constructions interact with this account of wide-scope *de dicto*.

iii. The correct implementation of temporal in/dependence as determined by binding of the restrictor of existential quantification over times.

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7. Appendix A: Diagnostics for raising and wide-scope *de dicto*

Benbaji 2021: A DP can be wide-scope *de dicto* relative to a modal only in a particular configuration; namely, only when it dominates a raising relative clause that embeds the modal, and its NP restrictor raised from within the relative clause and can reconstruct.

Prediction: Wide-scope *de dicto* readings are predicted to be unavailable for DPs with relative clauses in which raising or reconstruction are independently blocked.

(59) Hebrew resumptive pronouns block reconstruction (Sichel 2014 building on Doron 1982)

a. Dani yimtsa et ha- xaver ʃe- hu mexapeʃ ___
Dani will.find ACC the- friend that- he seeks
'Danny will find the friend that he seeks.'
(✓namely, Yossi / ✓whatever friend he has in mind)

b. Dani yimtsa et ha- xaver ʃe- hu mexapeʃ ota
Dani will.find ACC the- friend that- he seeks her.RP
'Danny will find the friend that he seeks.'
(✓namely, Yossi / # whatever friend he has in mind)

(60) jeʃ ʃnej ʃoftim ʃe- ʔanu ʔalulim lifgoʃ ʔotam bevet hamiʃpat
there.are two judges that- we could meet them.RP in.house the.law
'There are two judges we could face in court.' # in Szabó's context

(61) Extraposition blocks raising (Hulsey and Sauerland 2006)

a. Raising diagnostics
i. Det $[_{NP}$ idiom part $\ldots]_j$ $[_{RC}$ $\ldots$ idiomatic environment $t_j \ldots]$ Idiom chunks
ii. Det $[_{NP}$ $\ldots$ anaphor$_i$ $\ldots]_j$ $[_{RC}$ $\ldots$ R-expression$_i$ $\ldots t_j]$ Condition A

b. Absence of raising with extraposition
i. Mary praised the headway (*last year) that John made.
ii. Mary saw the picture of himself$_i$ (*yesterday) that Bob$_i$ likes.

(62) Extraposition blocks wide-scope *de dicto* relative to modals

a. **Context:** Alex is awaiting the results of a judicial elections to see who will preside over her court case. She is a well-known politician and is encouraged by her lawyer to use her political platform to praise all judicial candidates, so that whoever wins will judge her favorably.

b. # I praised every judge yesterday that we could face in court.

c. I praised every judge that we could face in court.

(63) Reconstruction is blocked if it leads to Condition C violations (Romero 1998, Fox 1999)

a. The picture of John$_i$ that he$_i$ likes

b. Det $[_{head}$ $\ldots$ R-expression$_i$ $\ldots]_j$ $[_{clause}$ $\ldots$ pronoun$_i$ $\ldots t_j]$ Condition C

(64) Wide-scope *de dicto* relative to modals is blocked if reconstruction violates Condition C

a. **Context:** Alex is a lawyer accused of wrongdoing and awaiting trial. Two candidates in the judicial elections that will determine who will preside over the trial are currently colleagues of hers at her law firm.

b. #$^?$ There are two judges from Alex's law firm that she could face in court.

c. There are two judges from her law firm that Alex could face in court.

Current proposal *vis-a-vis* tense: Weak DPs embedded under present tense, pattern with respect to the wide-scope *de dicto* reading relative to past tense, like all DPs pattern with respect to that reading relative to modals.

Prediction: The facts above should be reproduced with these instances of weak DPs.

(65) Wide-scope *de dicto* relative to tense seems to be blocked by resumption

a. **Context:** We are on a guided tour of an eighteenth century courthouse that is no longer in use (i.e., there are no relevant utterance-time judges). The guide says:

b. yeʃ xamiʃa-asar ʃoftim ʃe- John Adams mina levet hamiʃpat haze
there.be fifteen judges that- John Adams nominated to.house the.law DEM

c. # yeʃ xamiʃa-asar ʃoftim ʃe- John Adams mina otam levet
there.be fifteen judges that- John Adams nominated them.RP to.house
hamiʃpat haze
the.law DEM
'There are fifteen judges that John Adams nominated to this court.'

(66) Do potential condition C violations block wide-scope *de dicto* relative to tense?

a. **Context:** Same as in (65a).

b. #? There are fifteen officials in John Adams's party that he nominated to this court.

c. There are fifteen officials in his party that John Adams nominated to this court.

(Given that we need to control for the DP being weak – i.e., we must use *there*-constructions – it is difficult to test the prediction with respect to extraposition.)

8. Appendix B: A structural account of Musan's generalization – a very rough draft

An extensional tense system:

(67) Entries for tense operators:

a. $[\![\text{PRES}]\!]^g = \lambda p_{\langle i,t\rangle}\lambda t.\ 1$ *iff* $p(t)$ (vacuous semantics for present tense)

b. $[\![\text{PST}]\!]^g = \lambda p_{\langle i,t\rangle}\lambda t.\ 1$ *iff* $\exists t' < t : p(t') = 1$

(68) Entries for lexical items:

a. $[\![\text{fifteen}]\!]^g = \lambda t'\lambda f_{\langle e,it\rangle}\lambda g_{\langle e,it\rangle}\lambda t.\ \exists_{15} x : \forall y \in \text{ATOMS}(x) : \exists t'' \subseteq t' : f(y)(t'') \wedge g(x)(t)$

b. $[\![\text{judges}]\!]^g = \lambda x\lambda t.\ 1$ *iff* x is a judge at t

c. $[\![\text{preside in this court}]\!]^g = \lambda x\lambda t.\ 1$ *iff* x presided in this court at t

(69) Interpretation rules:

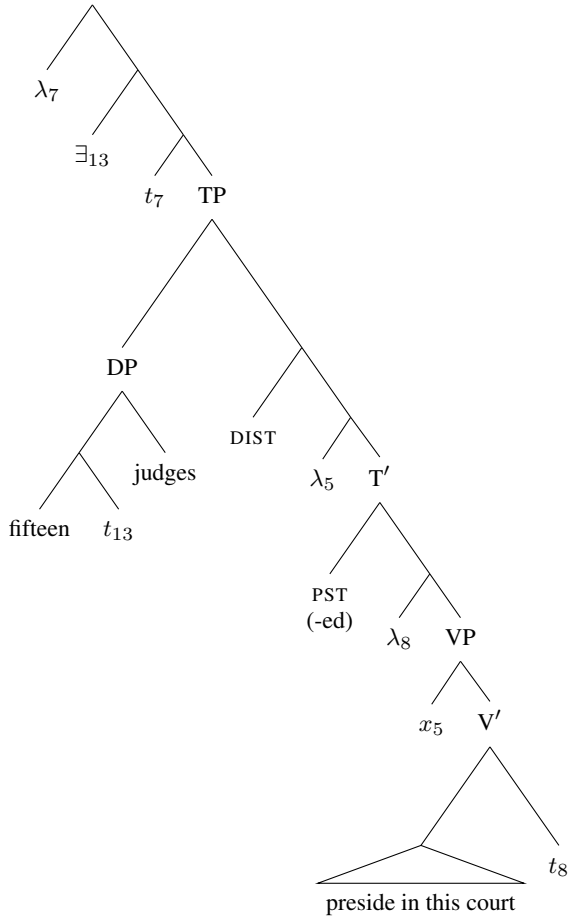
a. Functional application

b. λ-abstraction: $\lambda_i([\![\text{XP}]\!]^g) = \lambda x.\ [\![\text{XP}]\!]^{g[i/x]}$

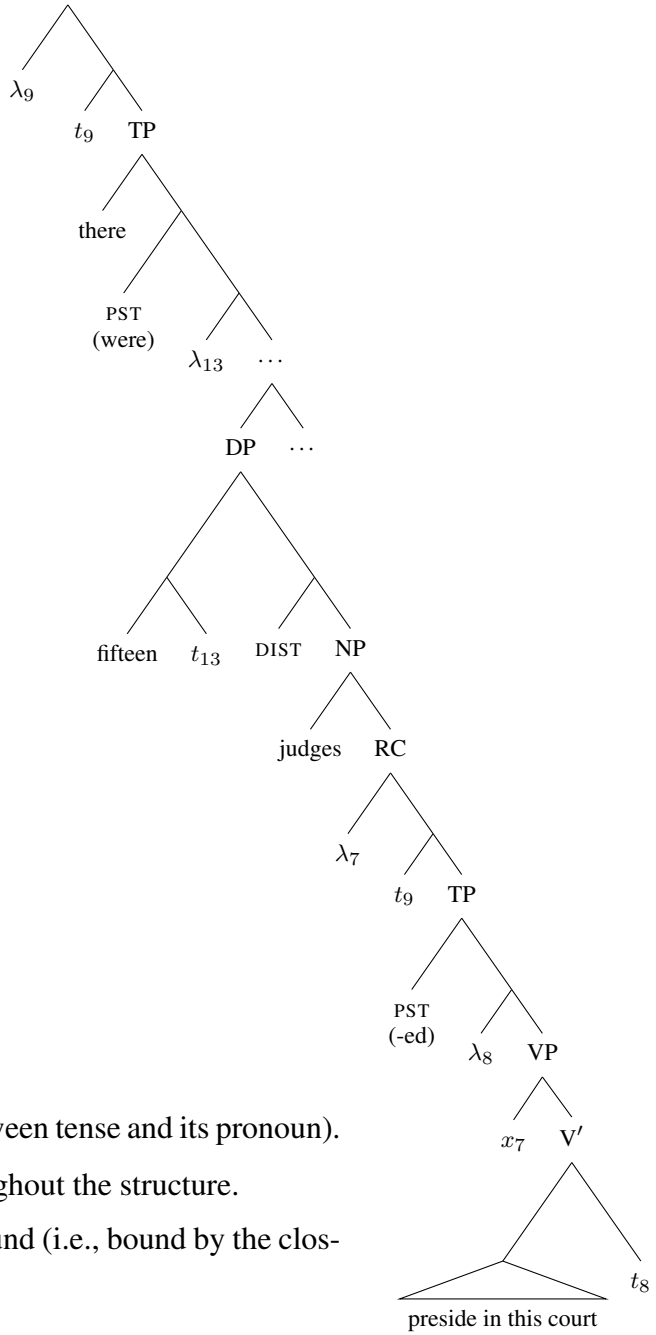
c. $\exists$-closure: $\exists_i([\![\text{XP}]\!]^g) = \exists x.\ [\![\text{XP}]\!]^{g[i/x]}$

d. Ad hoc predicate modification: if α is a node whose daughters are $\{\beta, \gamma\}$, $[\![\beta]\!]$ a function of type $\langle e,t\rangle$ and $[\![\gamma]\!]$ a function of type $\langle e,it\rangle$, $[\![\alpha]\!]$ is a function of type $\langle e,it\rangle$, such that $[\![\alpha]\!] = \lambda x\lambda t.\ [\![\beta]\!](x) \wedge [\![\gamma]\!](x)(t)$

Syntax for strong DPs:



Syntax for weak DPs:



Variables over times are syntactic arguments of:

i. VPs;

ii. determiners (weak and strong); and

iii. tense operators (QRed DPs can intervene between tense and its pronoun).

These pronouns are bound by λ-abstractors throughout the structure.

Time pronouns of determiners must be locally bound (i.e., bound by the closest operator that is able to bind them).