Horn clauses and strict NPIs under negated matrix clause

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Introduction

Starting point

- Traditional wisdom 1: strict Negative Polarity Items can only be licensed locally or in a Neg-Raising constellation, non-strict NPIs are more flexible:

  (1) a. I don't think/*claim [that Chris has lifted a finger to help].
  b. I don't think/claim [that Chris has ever helped].

- Traditional wisdom 2: strict NPIs are strong NPIs.

  (2) a. Nobody has lifted a finger to help.
  b. *Not everybody has lifted a finger to help.

- Traditional wisdom 3: Embedded "negative" inversion (so-called Horn clauses) are restricted to Neg-Raising:

  (3) Neg. Inv.: Never before have the babies slept so peacefully.

  (4) Horn clause:
  I don't think/*claim [that ever before have the babies slept so peacefully].

Overview

1. Introduction
2. Changing traditional wisdom
   - Strict NPIs $\neq$ strong NPIs
   - Strict NPIs are not restricted to Neg-Raising
   - Horn clauses are weak regular strict NPIs
3. Semantic analysis
   - NPI licensing: strength and at-issueness
   - Matrix predicates
4. HPSG analysis
   - NPI licensing
   - Negative Inversion/Horn clauses
5. Conclusion

Changing traditional wisdom

Strict NPIs $\neq$ strong NPIs

Three dimensions of NPI classification

- Negativity of the required licenser (Zwarts, 1981):
  - strong NPIs require licensing by negation (*not*, *nobody*, ...)
  - weak NPIs also admit licensing by *not everyone*, *few*, ...

(5) a. Nobody/Not everybody has ever helped Kim.

b. Nobody/*Not everybody has lifted a finger to help Kim.

- At-issueness of the licensing (Sedivy, 1990):
  - ⌜regular NPIs⌝^{r} require licensing in the at-issue content,
  - ⌜lexical NPIs⌝^{l} can be licensed in the at-issue or the non-at-issue content.

(6) a. * Alex DID ⌜ever⌝^{r} help me.

b. Alex DID ⌜lift a finger⌝^{l} to help me.

- Restrictedness of non-clausemate licensing (Horn, 1978):
  - strict NPIs are not licensing under *not claim*
  - non-strict NPIs are licensing under *not claim*

(7) a. I don't think/*claim [that Chris has lifted a finger to help].

b. I don't think/claim [that Chris has ever helped].

Strict $\neq$ strong

- NPI-*need* is a weak NPI:

  (8) a. That this is so, I think few people need go far from home to be convinced

- NPI-*need* is a strict NPI:

  (9) I don't think/*claim people need go far from home to be convinced.

Example NPIs

	strength	at-issueness	strictness	
ever, *any*	weak	⌜regular⌝^{r}	non-strict	(Sedivy, 1990)
NPI *need*	weak	⌜regular⌝^{r}	strict	
all that	weak	⌜lexical⌝^{l}	strict	(Horn, 2014)
until, *either*	strong	⌜regular⌝^{l}	strict	
lift a finger	strong	⌜lexical⌝^{l}	strict	(Sedivy, 1990)

Missing combinations:

- no lexical non-strict NPI!
- no strong non-strict NPI!

Strict NPIs are not restricted to Neg-Raising

Independence of Neg-Raising inference and NPI licensing 1

Horn (2014); Hoeksema (2017): Licensing of strict NPIs without Neg-Raising reading

(10) I do**n't** know [that it ⌜need⌝^{r} create any serious difficulties].

≠ I know [that it ⌜need⌝^{r} **not** create any serious difficulties].

(11) But that does**n't** mean [that she ⌜need⌝^{r} correspond to contemporary notions of what a feminist should be]

≠ that means [that she ⌜need⌝^{r}**not** correspond ...]

(12) I'm **not** sure [he's done ⌜a damn thing⌝^{l} to correct it] ...

≠ I'm sure [he has**n't** done ⌜a damn thing⌝^{l} to correct it] ...

If the negated matrix VP is such that the complement clause is non-factive/non-veridical, strict or non-strict NPIs can occur.

Independence of Neg-Raising inference and NPI licensing 2

Neg-Raising inference, but no licensing of strict NPIs (Zeijlstra, 2017):

(13) I am **not** of the opinion [that Alex will win].
=? I am of the opinion [that Alex will **not** win].

(14) I am **not** of the opinion ...
a. Non-strict: [that it would ⌜ever⌝^{r} be used ...]
b. Strict: *[that Carolyn will ⌜breathe a word⌝^{l} about it.]

(15) * It is **not** true/the case [that he'll get there ⌜until⌝^{r} Sunday]. (Horn, 1978, 207)
= It is true/the case [that he wo**n't** get there ⌜until⌝^{r} Sunday].

Strict NPIs are not licensed in content clauses, even if the matrix predicate is negated and might allow for a Neg-Raising inference, though non-strict NPIs are.

Other negated matrix predicates: Speech report

Speech report: neither strict nor non-strict NPIs licensed (Hoeksema, 2017)

- NPIs found in non-speech report uses:

(16) a. Strict: I would**n't** say that it was ⌜at all⌝^{r} likely.

b. Non-strict: I'm **no**t saying [there is ⌜anything⌝^{r} the matter with him]

- But no data in speech report use reported in Hoeksema (2017)

(17) *I'm **no**t reporting/ *Alex did**n't** say ...
[that there is ⌜anything⌝^{r} the matter with him].

Summary: Matrix negation and NPI licensing

- Neg-Raising: both strict and non-strict NPIs licensed
- Non-factive/non-veridical: both strict and non-strict NPIs licensed
- Factive: only non-strict NPIs licensed
- *be of the opinion*/ *be the case*: only non-strict NPIs licensed
- Speech report: neither strict nor non-strict NPIs licensed

Horn clauses are weak regular strict NPIs

NPI status of Negative Inversion/Horn clauses

- Negative Inversion: With topicalized weak NPI licensers:

(18) a. Not every time did his arrow hit the mark
b. Not a single paper did he finish on time.
c. Only two of them did he find useful.

- Horn clauses: with Neg-Raising and negated non-factive/non-veridical matrix predicates, not with content clauses, factives, speech reports:

(19) a. I don't think [that ever before had all three boys slept simultaneously]. (Horn, 2014)
b. I don't know [that ever before had all three boys slept simultaneously]. (Horn, 2014)
c. * I am not of the opinion [that ever before have the media played such a major role in a kidnapping.]
d. * I didn't realize [that ever before had all three boys slept simultaneously]. (Horn, 2014)

Striking distributional similarity to weak regular strict NPIs!

⌜Negative Inversion/Horn clauses⌝^{r}

NI/HC-NPI Constraint: ***The scope of the fronted constituent in Negative Inversion/Horn clauses is a strict weak NPI***

- Negative Inversion: The fronted constituent takes scope over (most of) the clause, satisfying the NI/HC-NPI Constraint.
- Horn clauses: The fronted constituent must not be an intervener for NPI licensing.

  (20) I don't think that ...
  [ever before]/*[every year]/*[in some years]
  has Alex submitted a paper to this conference.

- Horn clauses: The fronted constituent must not be a definte NP, as these are not scopal.

  (21) I don't think that *[this year] has submitted a paper to this conference.

Semantic analysis

NPI licensing: strength and at-issueness

Strong vs. weak NPIs

- Zwarts (1981, 1986): Defining strength through semantic entailment
- Sailer & Richter (2002): Configurational re-definition

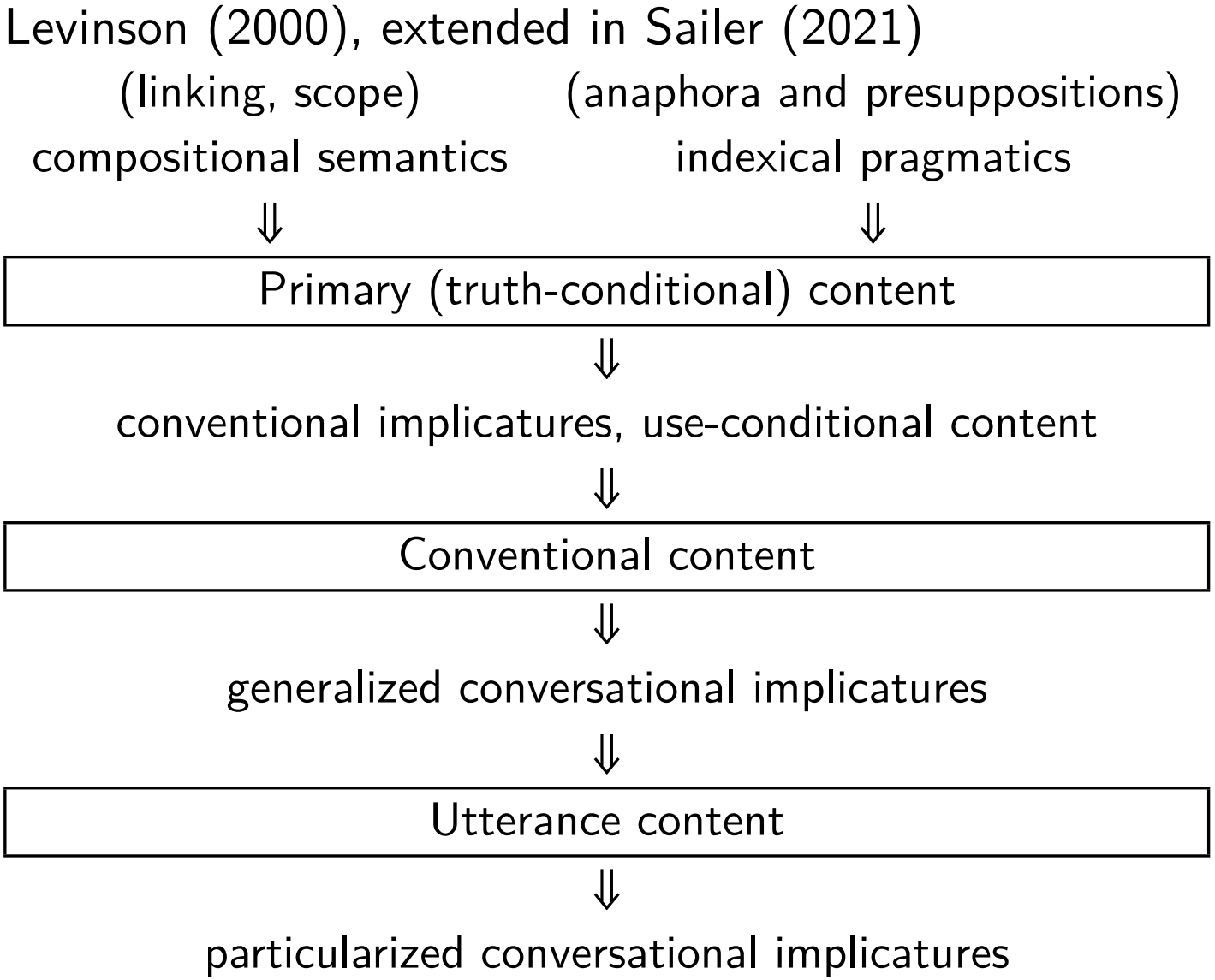
strength	entailment	example	representation
super-strong	antimorphic	*not*	$\neg(\ldots\textbf{NPI}\ldots)$
strong	anti-additive	*nobody*	$\neg\exists x(\ldots\textbf{NPI}\ldots)$
weak	downward entailing	*few*	$\neg\textbf{Many}x(\ldots\textbf{NPI}\ldots)$

- A strong NPI must be in the scope of negation with at most an existential quantifier intervening.
- A weak NPI must be in the scope of negation with at most one quantifier intervening.

⌜Regular⌝^{r} vs. ⌜lexical⌝^{l} NPIs

- Sedivy (1990): lexical NPIs can be licensed through semantic side messages.
- Recent adaptation in Sailer (2021): such side messages can be
  - conventional implicatures
  - generalized conversational implicatures

Semantics-pragmatics interface



⌜Regular⌝^{r} vs. ⌜lexical⌝^{l} NPIs

- ⌜regular NPIs⌝^{r} must be licensed in the primary content

(22) a. Alex hasn't called ⌜anyone⌝^{r}. $\neg(\ldots\textbf{NPI}\ldots)$

b. * Alex HAS ⌜ever⌝^{r} called.

$(\ldots\textbf{NPI}\ldots)\wedge\textbf{reject}(\neg(\ldots\textbf{NPI}\ldots))$

- ⌜lexical NPIs⌝^{l}: must be licensed in the utterance content

(23) a. Alex hasn't ⌜lifted a finger⌝^{l} $\neg(\ldots\textbf{NPI}\ldots)$

b. Alex HAS ⌜lifted a finger⌝^{l}

$(\ldots\textbf{NPI}\ldots)\wedge\textbf{reject}(\neg(\ldots\textbf{NPI}\ldots))$

NPI licensing so far

- Different dimensions of classifications can be expressed in terms of configurational requirements on the semantic representation of an utterance.
- Both primary and utterance content play a role in NPI licensing.
- ⌜Lexical NPIs⌝$^{/}$: side messages expand the licensing contexts!
- Needed: analogous representational expression of the strict/non-strict distinction
- Strategy: motivate "disturbing" side messages for strict NPIs!

Matrix predicates

Long-distance NPI licensing as the default

- Quantification over individuals blocks NPI licensing (Linebarger, 1980)

  (24) Alex didn't give an/*every apple to any student. *$\neg > \forall >$ NPI

- But: Quantification over possible worlds does not block NPI licensing.

  (25) The user is not required to lift a finger. $\neg > \forall >$ NPI

  $\neg\forall w(w \in \textbf{OBLIGATION}(x) : \textbf{lift-finger}_w(x)$

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  $\neg\forall w(w \in \textbf{OBLIGATION}(x) : \textbf{lift-finger}_w(x)$

- Neg-Raising predicates are usually analyzed as quantification over possible worlds.

  (26) Alex doesn't think [that Kim won].

  $\neg\forall w(w \in \textbf{BELIEVE}(\textbf{alex}) : \textbf{win}_w(\textbf{kim}))$

- Similar modal analysis for other matrix predicates:

  (27) I don't know [that this is important]

  $\neg\forall w(w \in \textbf{Know}(x) : \ldots)$

$\Rightarrow$ **Predict licensing of strict NPIs in embedded clauses!**

Factive/veridical predicates

- Romoli (2015); Montero & Romero (2023): Factivity as a scalar inference (i.e., generalized conversational implicature)
  - Factive *know* triggers scale: $\langle \textbf{know}(x, p), p \rangle$
    knowing p entails that p holds
  - Primary content of negated factive *know*: $\neg \textbf{know}(x, p)$
  - Triggers scalar implicature (exhaustification)
    Enriched representation: $\neg \textbf{know}(x, p) \underset{\ldots}{\wedge} p$
- Non-factive *know* lacks relevant scalar alternative!
- Homer (2008): non-at-issue content can block NPI licensing (though applied to presuppositons and weak, reguar NPIs)

Consequences for strict NPIs

Strict NPIs must be licensed wherever they occur in the semantic enrichment:

- Licensing through side message:

(28) a. Alex didn't ⌜lift a finger⌝$^{/}$. ¬(...**NPI**...)

b. Alex DID ⌜lift a finger⌝$^{/}$. (...**NPI**...)∧**reject**(¬...**NPI**...)

- Licensing inside embedded clause:

(29) Alex doesn't know$_{\text{non-fact}}$ [that Kim ⌜lifted a finger⌝$^{/}$].
¬∀w($w \in$ **Know**(**alex**) : (...**NPI**...))

- Blocking through side message (scalar implicature):

(30) * Alex doesn't know$_{\text{fact}}$ [that Kim ⌜lifted a finger⌝$^{/}$].
¬∀w($w \in$ **Know**(**alex**) : (...**NPI**...))∧(...**NPI**...)

Be of the opion-type predicates

- The content clause of *be of the opinion* etc is part of the *Common Propositional Space*, i.e. a superset of the Common Ground, containing propositions that are relevant to the conversation, though not necessarily settled.
- Enrichment: $\ldots \wedge^{\wedge} \phi \in \mathbf{CPS}$
- Non-strict NPIs are licensed:

  (31) Alex is not of the opinion [that Kim has ⌜ever⌝^{r} helped].

  $\neg \forall w(w \in \mathbf{Opinion}(\mathbf{alex}) : (\ldots \mathbf{NPI} \ldots)) \wedge^{\wedge} (\ldots \mathbf{NPI} \ldots) \in \mathbf{CPS}$

- Strict NPIs are blocked:

  (32) *Alex is not of the opinion [that Kim has ⌜lifted a finger⌝^{l}].

  $\neg \forall w(w \in \mathbf{Opinion}(\mathbf{alex}) : (\ldots \mathbf{NPI} \ldots)) \wedge^{\wedge} (\ldots \mathbf{NPI} \ldots) \in \mathbf{CPS}$

Speech report

- Potential problem: Montero & Romero (2023) propose a modal treatment of speech report.
  ⇒ NPIs should be licensed!
- Basic idea: reported utterance not in the scope of negation (Hoeksema, 2017)
- Possible analysis:
  - Semantic objects of type u (utterance) (Potts, 2007)
  - Predicate **Content**(x_u, p_{st}): x is an utterance whose content entails p

(33) * Alex didn't say [that Kim had ⌜ever⌝^{l} submited a paper].

$$\exists x_u : \textbf{Content}(x, (\ldots \textbf{NPI} \ldots) \wedge \neg \textbf{report}(\textbf{alex}, x)$$

Semantic analysis: Summary

- NPI licensing conditions:
  - Strong NPIs: licensing only by strong licenser
    Weak NPIs: licensing also by weak licenser
  - ⌜Regular NPIs⌝^{r}: licensing in primary content
    ⌜Lexical NPIs⌝^{l}: licensing in utterance content
  - Strict NPIs: every occurrence triggered by enrichment must be licensed
    Non-strict NPIs: a single, properly licensed occurrence is sufficient.
- Matrix predicates:

	semantic representation	non-strict	strict
Neg-Raising	$(\neg\forall w\phi)$	ok	ok
non-factive *know*	$(\neg\forall w\phi)$	ok	ok
factive *know*	$(\neg\forall w\phi)\underset{\cdots}{\wedge\phi}$	ok	*
be of the opinion	$(\neg\forall w\phi)\underset{\cdots\cdots\cdots}{\wedge\exists p.p=\hat{}\phi}$	ok	*
speech report	$\exists y_u(\mathbf{Cont}(y,\phi)\wedge\neg\mathbf{say}(x,y)$	*	*

HPSG analysis

NPI licensing

Neg-Raising

- Sailer (2006): Neg-Raising as scope ambiguity:

  (34) I don't think [that Alex won].

  Surface scope: $\neg \forall w(w \in \mathbf{BEL}(\mathbf{speaker}) : \mathbf{win}_w(\mathbf{alex}))$

  Neg-Raising: $\forall w(w \in \mathbf{BEL}(\mathbf{speaker}) : \neg \mathbf{win}_w(\mathbf{alex}))$

  Strict NPIs require clause-mate licensing, and are, thus only licensed in the Neg-Raising reading.
- Problem: Independence of Neg-Raising inference and licensing of strict NPIs
- Solution: Just surface scope reading, but wider licensing domain for strict NPIs!

NPI-licensing in HPSG

- Richter & Soehn (2006)
- NPI licensing as a collocational requirement (van der Wouden, 1997; Sailer & Richter, 2002)
- NPI imposes constraint on the semantic representation (CONT) of a constituent containing it.
  - Strength of the licenser:
    strong NPIs: (`anti-additive-strength-operator`)
    weak NPIs: (`downward-entailing-strength-operator`)
  - Syntactic domain:
    strict NPIs: licensing within sem. representation of the clause containing the NPI
    non-strict NPIs: licensing within the sem. representation of the overall utterance containing the NPI.
- Treatment of strict/non-strict NPIs not adequate in the light of the date discussed today.

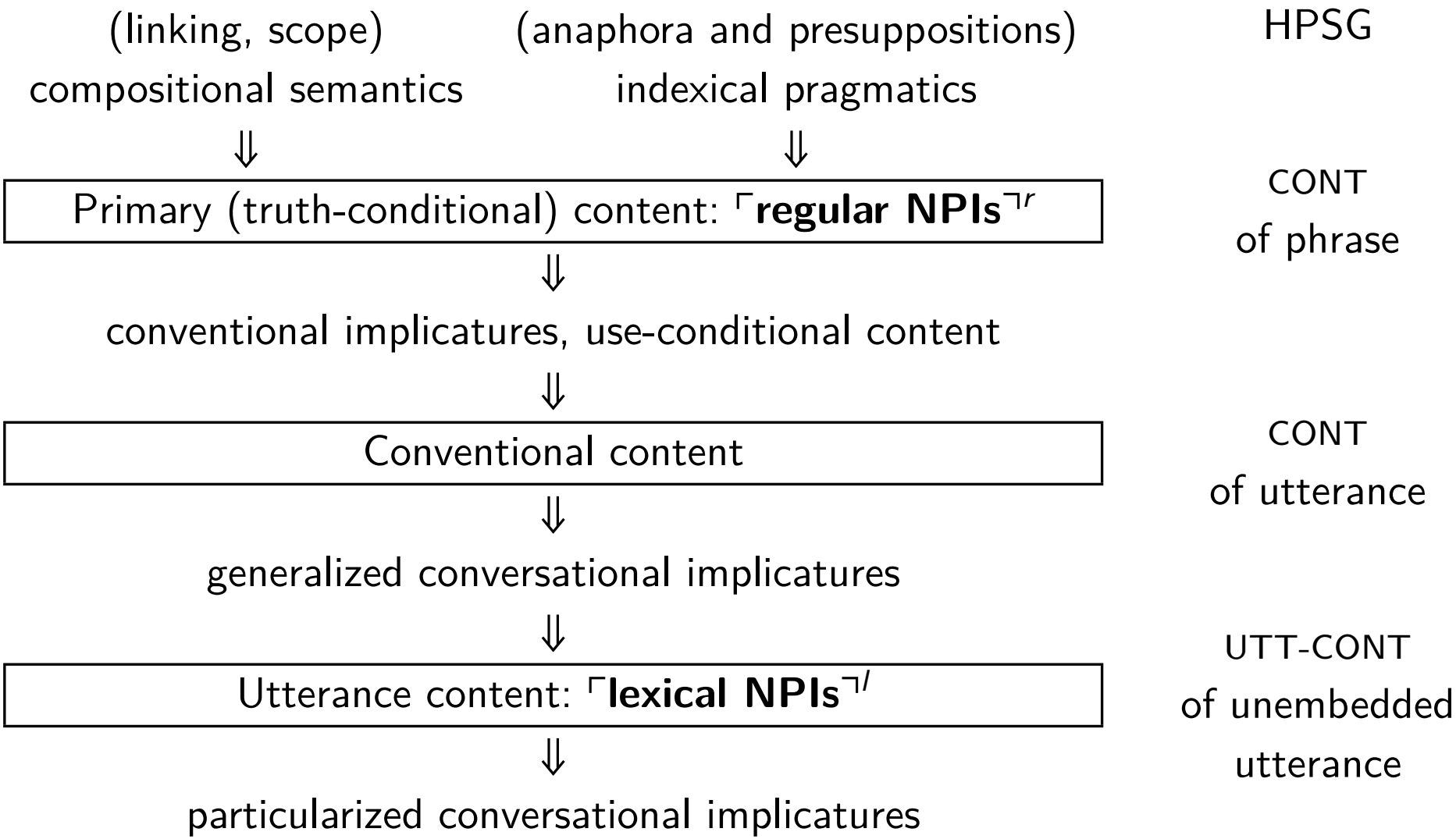
Analysis in Richter & Soehn (2006) (strength and domain)

$$\left[\begin{array}{l}\text{phon}\ \left\langle \underline{\textit{ever}} \right\rangle \\ \text{cont}\ \boxed{1} \\ \text{coll}\ \left\langle \left[\begin{array}{l}\textit{complete-clause} \\ \text{lf-lic}\ \left[\ \text{cont}\ \alpha\ \right]\end{array}\right] \right\rangle\end{array}\right] \ \&\ \texttt{de-str-op}(\boxed{1}, \alpha)$$

$$\left[\begin{array}{l}\text{phon}\ \left\langle \underline{\textit{budge (an inch)}} \right\rangle \\ \text{cont}\ \boxed{1} \\ \text{coll}\ \left\langle \left[\begin{array}{l}\textit{utterance} \\ \text{lf-lic}\ \left[\ \text{cont}\ \alpha\ \right]\end{array}\right] \right\rangle\end{array}\right] \ \&\ \texttt{aa-str-op}(\boxed{1}, \alpha)$$

Extension to regular/lexical distinction

Sailer (2021): Role of semantic enrichment for NPI licensing



Analysis in Sailer (2021) (regular/lexical distinction)

$$\left[\begin{array}{ll} \textsc{phon} & \left\langle \ulcorner \textit{ever} \urcorner^{r} \right\rangle \\ \textsc{cont} & \boxed{1} \\ \textsc{coll} & \left\langle \left[\begin{array}{l} \textit{complete-clause} \\ \textsc{lf-lic} \left[\textsc{cont} \ \alpha \right] \end{array}\right] \right\rangle \end{array}\right] \ \& \ \texttt{de-str-op}(\boxed{1}, \alpha)$$

$$\left[\begin{array}{ll} \textsc{phon} & \left\langle \ulcorner \textit{budge (an inch)} \urcorner^{l} \right\rangle \\ \textsc{cont} & \boxed{1} \\ \textsc{coll} & \left\langle \left[\begin{array}{ll} \textit{utterance} & \\ \textsc{lf-lic} & \left[\begin{array}{ll} \textsc{cont} & \alpha \\ \textsc{utt-cont} & \beta \end{array}\right] \end{array}\right] \right\rangle \end{array}\right] \ \& \ \texttt{aa-str-op}\Big(\boxed{1}, \beta \Big)$$

NPI-licensing in HPSG: Adaption of strict/non-strict distinction

- Idea: Existential vs. universal quantification over NPI occurrences.
- So far: restrictions on licensing strength and at-issueness require the existence of a licenser.
- Non-strict NPIs: no further specification needed
- Strict NPIs: every occurrence of the NPI in the enriched semantic representation has to be licensed (i.e., every occurrence that is not present in the primary content but only in the utterance content).

New analysis (strictness)

$$\left[\begin{array}{l}\text{phon} \left\langle \underline{\ulcorner \textit{ever} \urcorner^{r}} \right\rangle \\ \text{cont} \quad \boxed{1} \\ \text{coll} \quad \left\langle \left[\begin{array}{l}\textit{complete-clause} \\ \text{lf-lic} \left[\text{cont} \ \alpha\right]\end{array}\right] \right\rangle\end{array}\right]$$

& for some occurrence γ of $\boxed{1}$ in α: $\texttt{de-str-op}(\gamma,\alpha)$

$$\left[\begin{array}{l}\text{phon} \left\langle \underline{\ulcorner \textit{budge (an inch)} \urcorner^{l}} \right\rangle \\ \text{cont} \quad \boxed{1} \\ \text{coll} \quad \left\langle \left[\begin{array}{l}\textit{utterance} \\ \text{lf-lic} \left[\begin{array}{ll}\text{cont} & \alpha \\ \text{utt-cont} & \beta\end{array}\right]\end{array}\right] \right\rangle\end{array}\right]$$

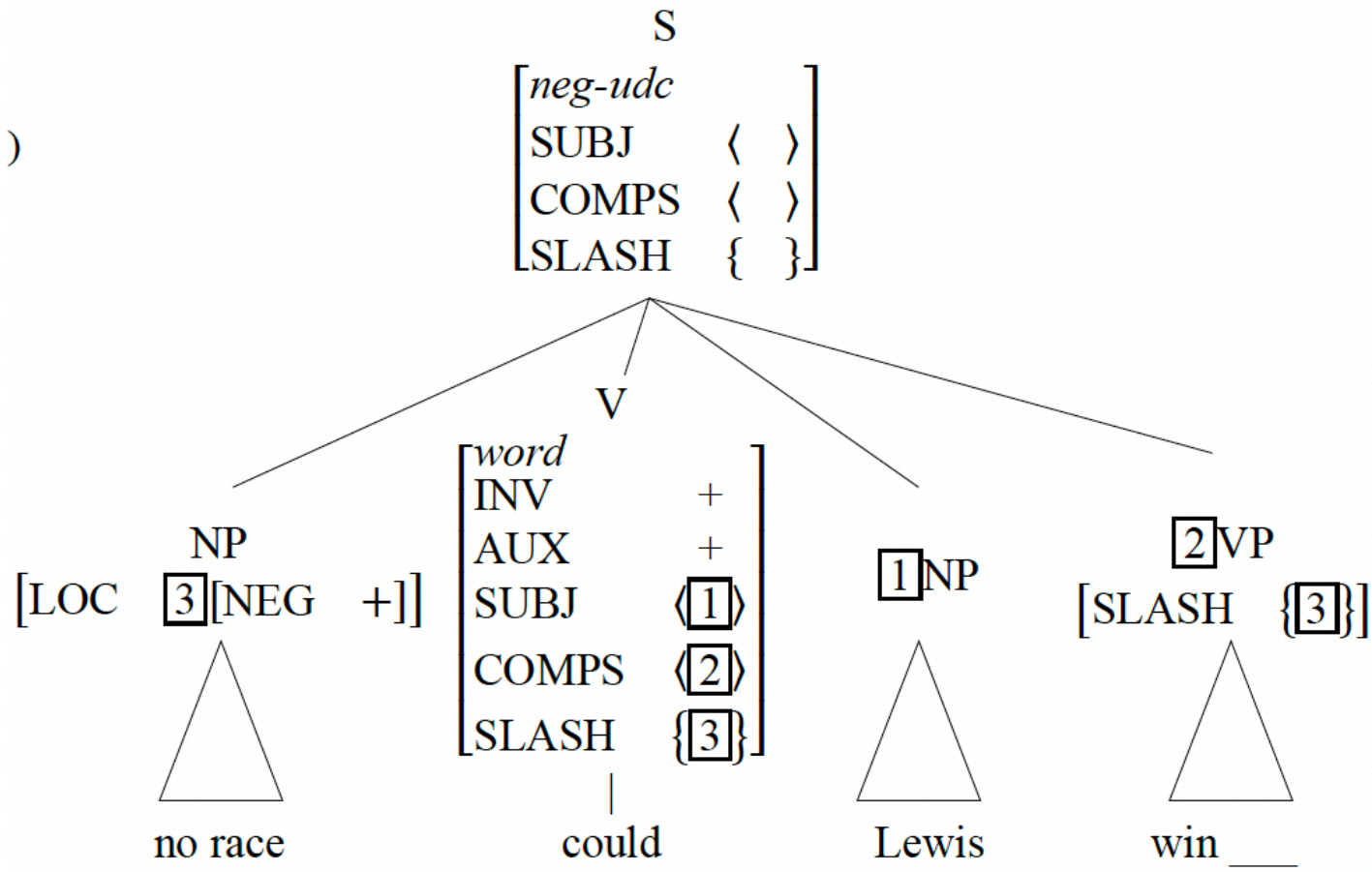
& for some occurrence γ of $\boxed{1}$ in β: $\texttt{aa-str-op}(\gamma,\beta)$

& for each occurrence γ of $\boxed{1}$ in β, which is not in α: $\texttt{aa-str-op}(\gamma,\beta)$

Negative Inversion/Horn clauses

Negative Inversion

- Maekawa (2012):



- What needs to be adjusted:
  - Fronted constituent need not be morpho-syntactically negative (NEG+).
  - Semantically negative for Negative Inversion,
  - just an indefinite for Horn clauses.

Phrasal lexical entry of the NI/HC construction

- Syntax as in Maekawa (2012)
- The scope of the fronted constituent behaves like a weak regular strict NPI:
  - It must be licensed by a weak licenser in the primary content (CONT)
  - Every additional occurrence within the utterance content must also be licensed by a weak licenser.

Phrasal lexical entry of the NI/HC construction

$$\left[\begin{array}{l}
\textit{ni/hc-phrase} \\
\text{head} \quad \boxed{5}\left[\begin{array}{ll}\text{aux} & + \\ \text{inv} & +\end{array}\right] \\
\text{cont} \quad \left[\begin{array}{ll}\text{nucleus} & \delta\end{array}\right] \\
\text{h-dtr} \quad \boxed{2}\left[\begin{array}{ll}\text{head} & \boxed{5} \\ \text{subj} & \left\langle \boxed{3} \right\rangle \\ \text{comps} & \left\langle \boxed{4}\ \text{VP}\left[\begin{array}{ll}\text{subj} & \left\langle \boxed{3} \right\rangle\end{array}\right] \right\rangle\end{array}\right] \\
\text{all-dtrs} \quad \left\langle \left[\begin{array}{ll}\text{cont} & \left[\begin{array}{ll}\text{nucl} & \ulcorner \boxed{1} \urcorner^{r}\end{array}\right]\end{array}\right], \boxed{2}, \left[\begin{array}{ll}\text{syns} & \boxed{3}\end{array}\right], \left[\begin{array}{ll}\text{syns} & \boxed{4}\end{array}\right] \right\rangle \\
\text{coll} \quad \left\langle \left[\begin{array}{ll}\textit{utterance} & \\ \text{lf-lic} & \left[\begin{array}{ll}\text{cont} & \alpha \\ \text{utt-cont} & \beta\end{array}\right]\end{array}\right] \right\rangle
\end{array}\right]$$

& δ is a subexpression of $\boxed{1}$

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\text{coll} \quad \left\langle \left[\begin{array}{ll}\textit{utterance} & \\ \text{lf-lic} & \left[\begin{array}{ll}\text{cont} & \alpha \\ \text{utt-cont} & \beta\end{array}\right]\end{array}\right] \right\rangle
\end{array}\right]$$

& δ is a subexpression of $\boxed{1}$

Weak regular NPI: & for some occurrence γ of $\boxed{1}$ in β: $\texttt{de-str-op}(\gamma,\beta)$

Phrasal lexical entry of the NI/HC construction

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\text{h-dtr} \quad \boxed{2}\left[\begin{array}{ll}\text{head} & \boxed{5} \\ \text{subj} & \left\langle \boxed{3} \right\rangle \\ \text{comps} & \left\langle \boxed{4}\ \text{VP}\left[\begin{array}{ll}\text{subj} & \left\langle \boxed{3} \right\rangle\end{array}\right] \right\rangle\end{array}\right] \\
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\end{array}\right]$$

& δ is a subexpression of $\boxed{1}$

Weak regular NPI: & for some occurrence γ of $\boxed{1}$ in β: `de-str-op`(γ,β)

Strict NPI: & for every occurrence γ of $\boxed{1}$ in β that is not in α: `de-str-op`(γ,β)

Conclusion

Summary

- Surface-scope oriented approach to the licensing of embedded strict NPIs and Horn clauses.
- Expressing surface-scope analysis within existing HPSG analyses of negative inversion and NPI licensing.
- Reducing the strict/non-strict distinction to universal vs. existential quantification over the licensing requirement within a semantic representation
- Example of a constructional NPI
- Future directions:
  - Generalizations over possible NPI classes?
  - Is licensing in the enriched representation always strong?

NegLaB
Negation in Language and Beyond

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Thank you for your attention!

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