Lexical and supra-lexical underspecification rooted in a dm-based theory of word-formation

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Research objectives of B4/D1

- B4: A theory of word-formation and interpretation in context
  - word formation is inspired by principles of the research program 'Distributed Morphology'(DM). Verbs and derived nominals are constructed from 'roots'
  - we assign the roots a semantics
  - constructions are assigned a compositional semantics, determined by their syntactic trees and selectional restrictions of argument phrases.
- D1: Underspecified semantic representations and their disambiguation in context

Phenomena in current focus

- range of possible readings of *ung*-nouns and past participles
- working hypothesis: two sides of the same coin.

die	Biomasse	war	getrocknet	die	Trocknung	der	Biomasse
the	bio-material	be:aux:pst	dried	the	drying	of the	bio-material

die	Zementmasse	war	gemischt	die	Mischung	der	Zementmasse
the	cement-mass	be:aux:pst	mixed	the	mixing	of the	cement-mass

der	Platz	war	gepflastert	die	Pflasterung	des	Platzes
the	area	be:aux:pst	paved	the	pavement	of the	square

- An *ung*-noun has a target state reading if and only if the past particple of the corresponding verb has one.
- an *ung*-noun has an other-reading if the corresponding verb is built from a sortal root

Is the root class decisive?

$\sqrt{}$trocken(dry), $\sqrt{}$sauber(clean), $\sqrt{}$weit(wide)	→	property of individuals	1 e, ts
$\sqrt{}$bild$_{sort}$(build), $\sqrt{}$misch$_{sort}$(mix), $\sqrt{}$samm$_{sort}$(collect)	→	entity which is brought about by the event	2 : e, o
$\sqrt{}$pflaster$_{sort}$ (pavement), $\sqrt{}$würze$_{sort}$ (spice), $\sqrt{}$muster$_{sort}$ (pattern)	→	entity which the internal argument is made to have	3 : e, ts, o

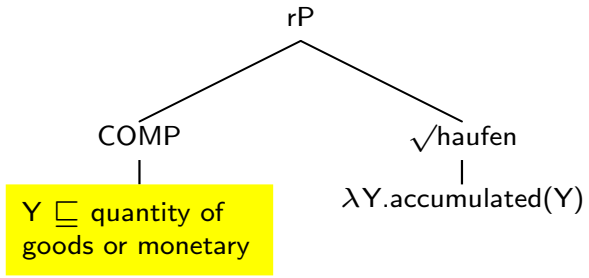
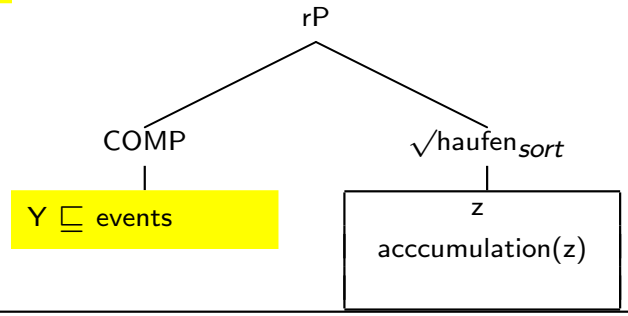
Expectation: the range of readings of *ung*-nouns and past participle depends on the class of the roots

Our experience: We find productive patterns along the lines 1, and 3.

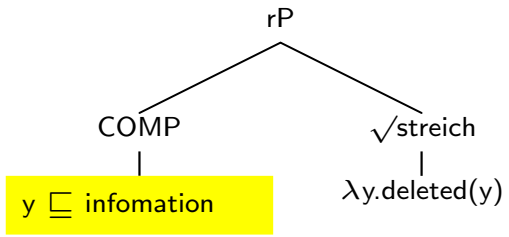
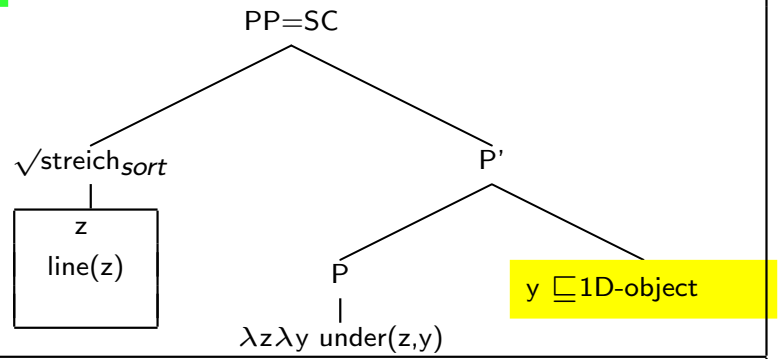
Hypothesis:

Some roots can belong to more than one class at once; they adjust semantics accordingly.

Roots switch semantics wrt. sortal restrictions

1	2	3
		
die Häufung der Vorräte the accumulation of stocks	die Häufung der Unfälle the accumulation of the accidents	
die wieder gehäuften Vorräte (restit.)	die Unfälle häufen sich wieder (repet.)	

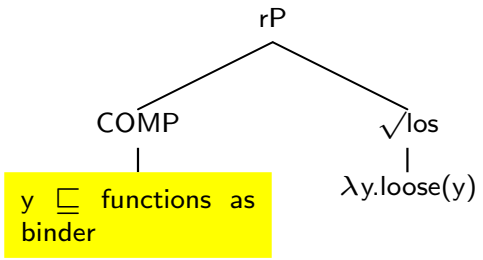
Roots switch semantics wrt. sortal restrictions

1		3
		
die Streichung des **the deletion of the** Absatzes **paragraph**		die Unterstreichung der Zeile **the underlining of the line**

die Wand streichen , durch die Gegend streichen
the wall paint , through the area wander

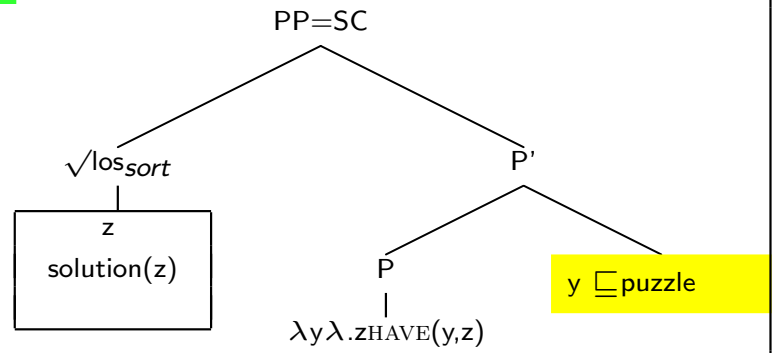
Roots switch semantics wrt. sortal restrictions

1



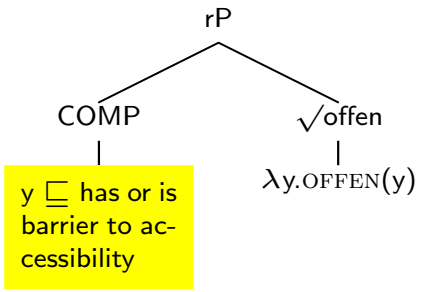
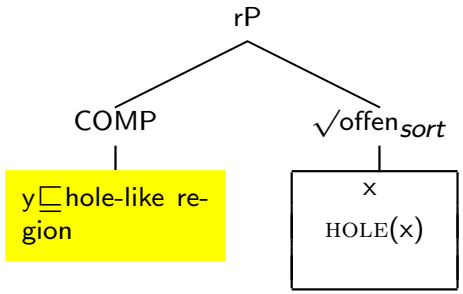
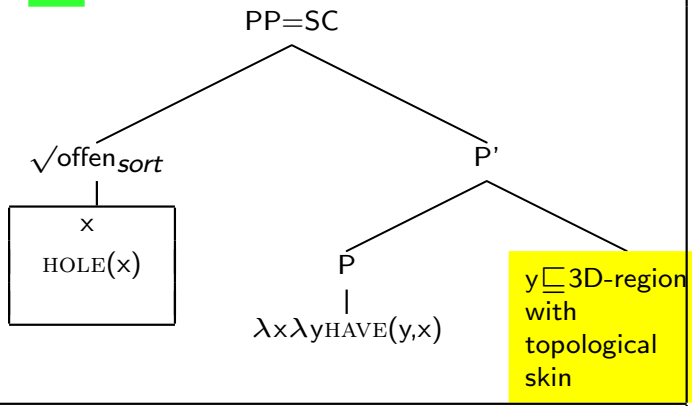
die Lösung der
the undoing of the
Schraube
screw

3



die Lösung des Rätsels
the solution of the puzzle

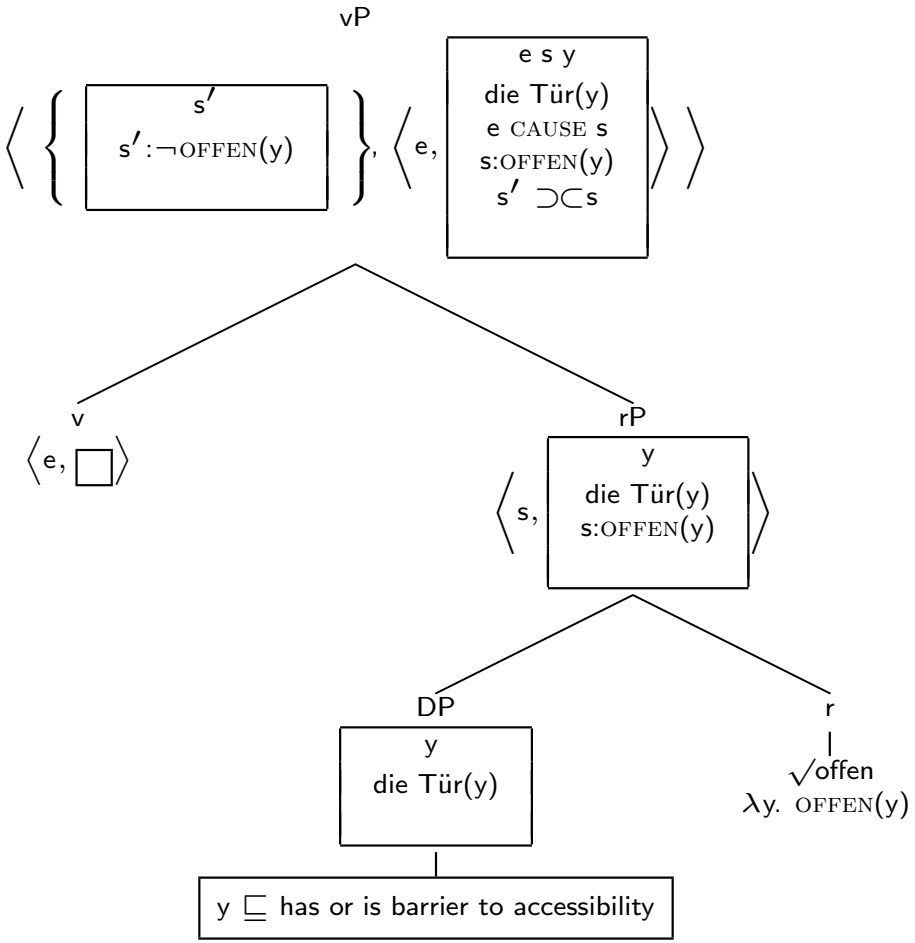
Roots switch semantics wrt. sortal restrictions

1	2	3
		

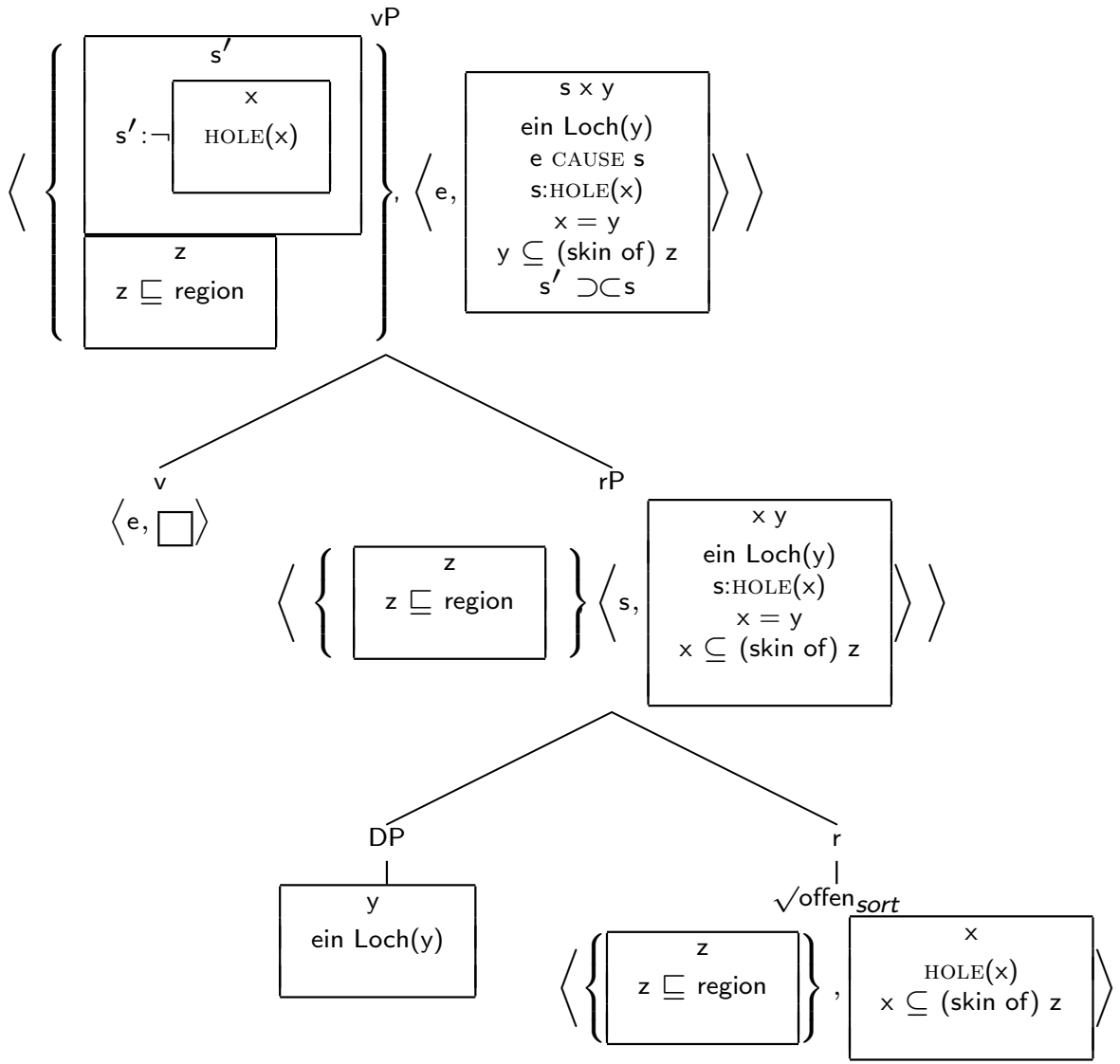
die Öffnung der
`the open+ung of the`
Tür
`door`
	die Öffnung eines
	`the open+ung of a`
	Loches in der
	`hole in the`
	Wolkendecke
	`unbroken cloud`
		die Öffnung einer Leiche
		'a postmortem on a body'

die wieder geöffnete Tür	wieder hat sich ein Loch in der Wolkendecke geöffnet	

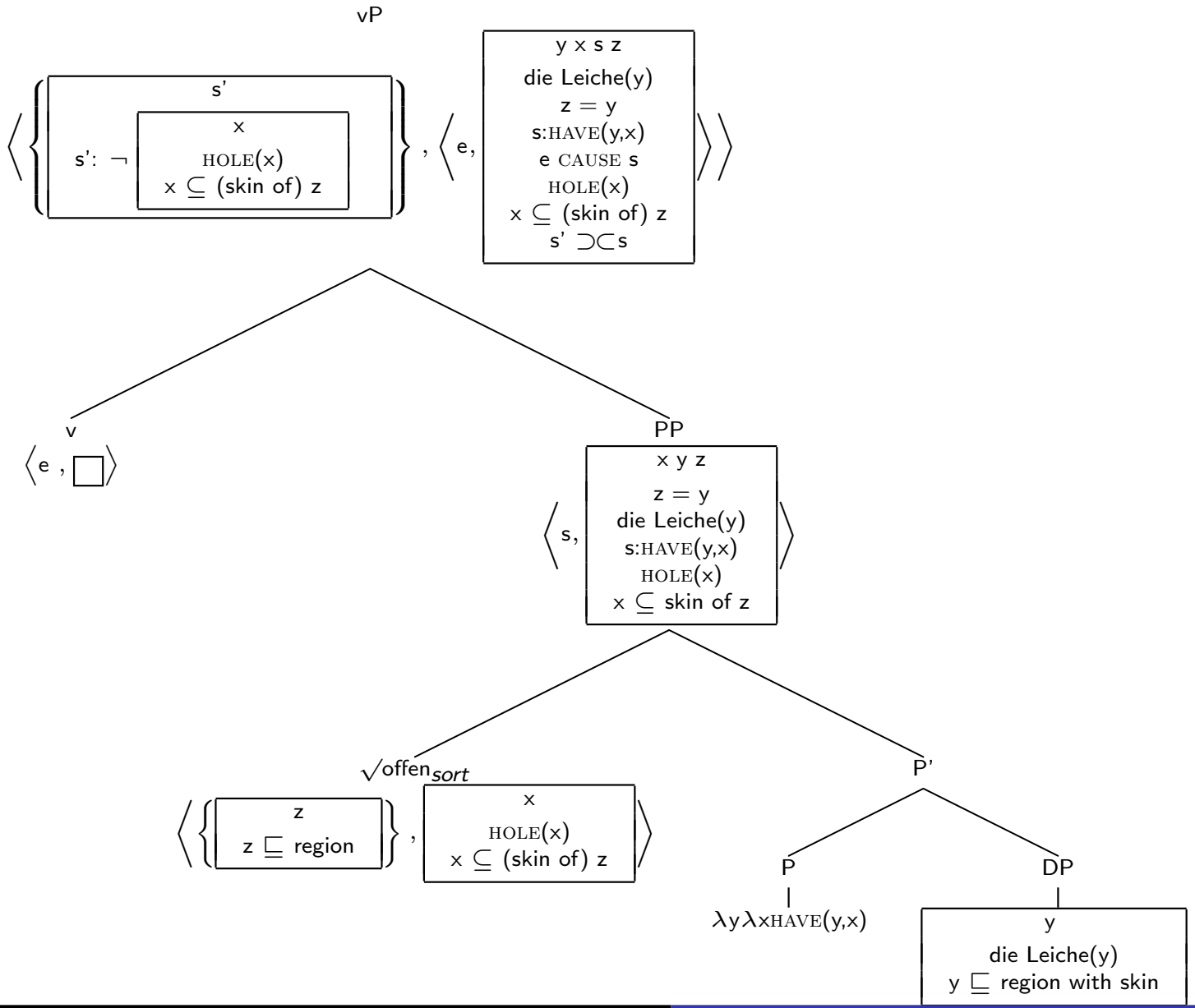
die Tür öffnen 1



ein Loch sich öffnen 2



eine Leiche öffnen 3



Underspecification of vP-Semantics

- Aim: one single underspecified lexical entry for the verbal stem *öffn-*
- *-ung* and *ge-* operators defined on this entry yield underspecified semantics for *Öffnung* and *geöffnet*

$\ddot{o}ffn_1 + ung$	$\ddot{\text{O}}\text{ffnung}_1$	1	e, ts
$\ddot{o}ffn_{2,sort} + ung$	$\ddot{\text{O}}\text{ffnung}_{2,sort}$	2	e, o
$\ddot{o}ffn_{3,sort} + ung$	$\ddot{\text{O}}\text{ffnung}_{3,sort}$	3	e, ts, o

(die) Öffnung der Leiche
(die) Öffnung eines Loches

Underspecified representation of *öffn-*$_{sort}$ and *Öffnung*$_{sort}$

öffn$_{sort}$- $\rightsquigarrow$ $\left\langle \left\{ \boxed{\begin{array}{c} z \\ z \sqsubseteq \text{region} \end{array}} \right\}, \boxed{\begin{array}{c} e\ s\ x \\ e\ \textsc{cause}\ s \\ s{:}\ \textsc{hole}(x) \\ s{:}\ x \subseteq (\text{skin of})\ z \end{array}} \right\rangle$

Öffnung$_{sort}$ $\rightsquigarrow$

$\left\langle \left\{ \boxed{\begin{array}{c} z \\ z \sqsubseteq \text{region} \end{array}} \right\}, \left\langle \alpha\,, \boxed{\begin{array}{c} e\ s\ x \\ (\alpha = e) \overset{!}{\vee} (\alpha = s) \overset{!}{\vee} (\alpha = x) \\ e\ \textsc{cause}\ s \\ s{:}\ \textsc{hole}(x) \\ x \subseteq (\text{skin of})\ z \end{array}} \right\rangle \right\rangle$

Underspecified entry for *Öffnung* including its non-sortal reading

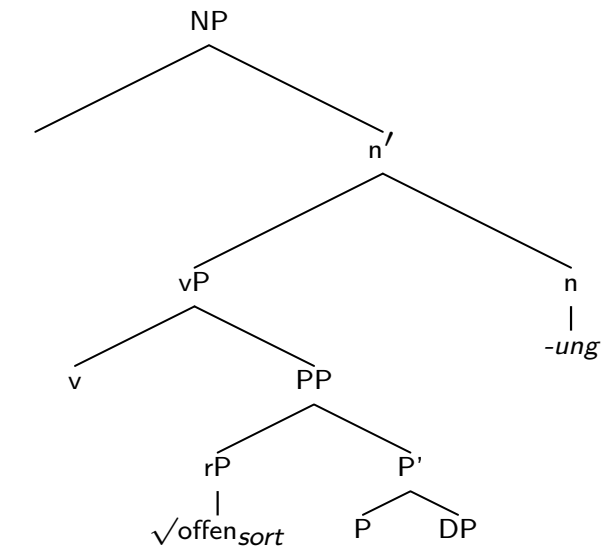
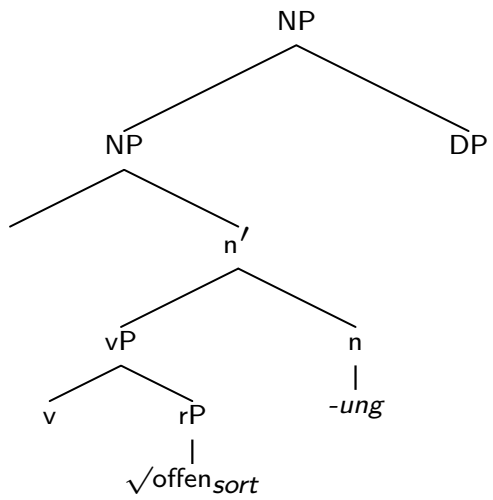
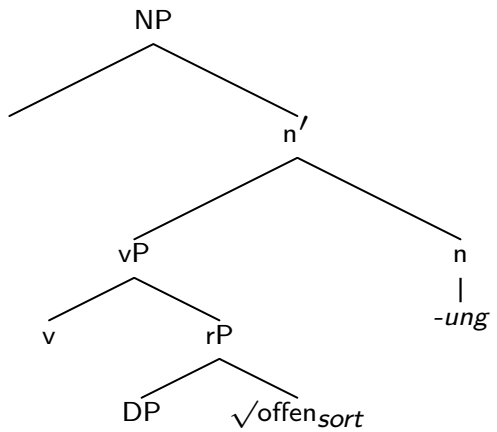
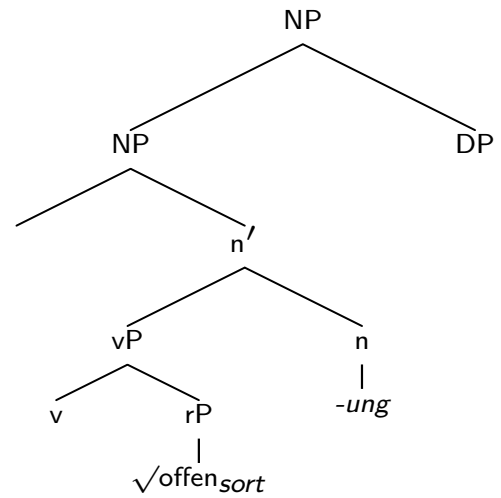
Öffnung $\rightsquigarrow$

$$\left\langle \left\{ \boxed{\begin{array}{c} \mathsf{z} \\ \mathsf{z} \sqsubseteq \text{region} \end{array}} \right\}, \left\langle \alpha\,, \boxed{\begin{array}{c} \mathsf{e\ s\ x} \\ (\alpha = \mathsf{e}) \overset{!}{\vee} (\alpha = \mathsf{s}) \overset{!}{\vee} (\alpha = \mathsf{x}) \\ \mathsf{e}\ \textsc{cause}\ \mathsf{s} \\ \mathsf{s}\colon\ \textsc{hole}(\mathsf{x}) \\ \mathsf{x} \subseteq (\text{skin of})\ \mathsf{z} \end{array}} \right\rangle \right\rangle$$

$$\overset{!}{\vee}$$

$$\left\langle \left\{ \boxed{\begin{array}{c} \mathsf{y} \\ \mathsf{y} \sqsubseteq \text{has or is barrier to accessibility} \end{array}} \right\}, \left\langle \alpha\ , \boxed{\begin{array}{c} \mathsf{e\ s} \\ (\alpha = \mathsf{e}) \overset{!}{\vee} (\alpha = \mathsf{s}) \\ \mathsf{e}\ \textsc{cause}\ \mathsf{s} \\ \mathsf{s}\colon\ \textsc{offen}(\mathsf{y}) \end{array}} \right\rangle \right\rangle$$

Trees for the sortal readings of *Öffnung* DP_{gen}

DP_{gen} occupies an argument position	DP_{gen} does not occupy an argument position
	
	

Relation ρ between the referent y of DP_{gen} and either event, target state s or object x of *Öffnung*

Internal Argument:
ρ given by lexical entry for *Öffnung*

Non-Argument: ρ is some kind of 'POSS'-relation

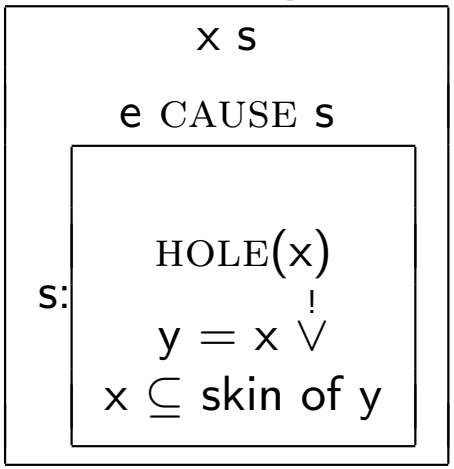
Underspecified Analysis of phrases of the form NP DP_{gen}

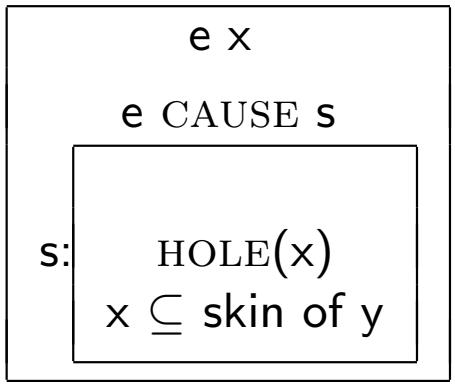
We require the DP_{gen} to establish a non-identity relation between its referential argument, $refArg(DP_{gen})$, and that of the preceding NP.

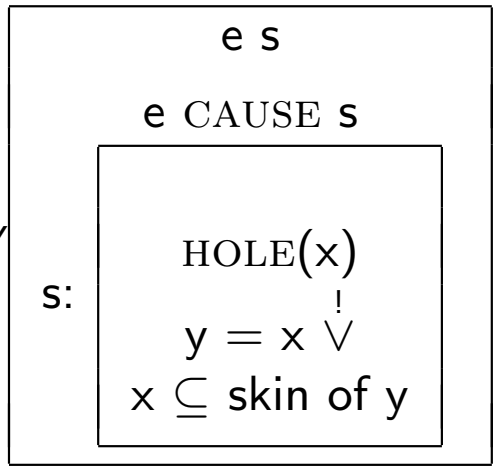
$$\| \text{ NP } DP_{gen} \| =$$

$$\| \text{ NP } \| \text{ ; } \left\langle \left\{ \boxed{\begin{array}{c} \underline{\rho} \\ \rho(refArg(NP), refArg(DP_{gen})) \end{array}} \right\} \| \text{ } DP_{gen} \text{ } \| \right\rangle$$

Internal Argument

$\lambda e \lambda y$


, $\lambda s \lambda y$


, $\lambda x \lambda y$


Underspecified Analysis of phrases of the form NP DP_{gen}

$$|| \text{ NP } DP_{gen} || =$$

$$|| \text{ NP } || \; ; \left\langle \left\{ \boxed{\begin{array}{c} \underline{\rho} \\ \rho(\text{refArg}(NP),\text{refArg}(DP_{gen})) \end{array}} \right\} || \text{ } DP_{gen} \text{ } || \right\rangle$$

Non-Argument

- For non-relational nouns || NP || has the form $N(\alpha)$ and ρ typically instantiates to $\textsc{poss}$ or is resolved in the global discourse context.
- For relational nouns N(refArg(DP_{gen}),α) we normally have $\rho = \text{N}$
- For nominalisations, $\rho = \text{N}$ and N is typically determined by the underlying verb.

Öffnung der Leiche

$$\left\langle \left\{ \boxed{\begin{array}{c} z \\ z \sqsubseteq \text{region} \end{array}} \right\}, \left\langle \alpha\,, \boxed{\begin{array}{c} e\ s\ x \\ (\alpha = e) \overset{!}{\vee} (\alpha = s) \overset{!}{\vee} (\alpha = x) \\ e \text{ CAUSE } s \\ s\text{: HOLE}(x) \\ x \subseteq (\text{skin of})\ z \end{array}} \right\rangle \right\rangle ; \left\langle \left\{ \boxed{\begin{array}{c} \underline{\rho} \\ \rho(\alpha,y) \end{array}} \right\}, \boxed{\begin{array}{c} y \\ \text{Leiche}(y) \end{array}} \right\rangle$$

$$\rightsquigarrow \left\langle \left\{ \boxed{\begin{array}{c} z \\ z \sqsubseteq \text{region} \end{array}}, \boxed{\begin{array}{c} \underline{\rho} \\ \rho(\alpha,y) \end{array}} \right\}, \left\langle \alpha\,, \boxed{\begin{array}{c} e\ s\ x\ y \\ (\alpha = e) \overset{!}{\vee} (\alpha = s) \overset{!}{\vee} (\alpha = x) \\ e \text{ CAUSE } s \\ s\text{: HOLE}(x) \\ s\text{: } x \subseteq (\text{skin of})\ z \\ \text{Leiche}(y) \end{array}} \right\rangle \right\rangle$$

Resolution "z $\rightsquigarrow$ y" is consisitent with "z $\sqsubseteq$ region".

$$\rightsquigarrow \left\langle \left\{ \boxed{\begin{array}{c} \underline{\rho} \\ \rho(\alpha,y) \end{array}} \right\}, \left\langle \alpha\,, \boxed{\begin{array}{c} e\ s\ x\ y \\ (\alpha = e) \overset{!}{\vee} (\alpha = s) \overset{!}{\vee} (\alpha = x) \\ e \text{ CAUSE } s \\ s\text{: HOLE}(x) \\ s\text{: } x \subseteq (\text{skin of})\ y \\ \text{Leiche}(y) \end{array}} \right\rangle \right\rangle$$

where ρ is either POSS or one of (i), (ii), (iii)

(i) $\lambda e \lambda y(\exists s(eCAUSEs \wedge s : \exists x(HOLE(x) \wedge x \subseteq (skin\ of)\ y)\ )\ )$, event

(ii) $\lambda s \lambda y(s : \exists x(HOLE(x) \wedge x \subseteq (skin\ of)\ y\ ))$, target state

(iii) $\lambda x \lambda y(x \subseteq (skin\ of)\ y\ )$ other

Öffnung$_{sort}$ eines Loches

Assumption: Loch(y) $\rightsquigarrow$ y $\sqsubseteq$ hole-like. This is incompatible with "z $\sqsubseteq$ region with skin". So z can't be resolved to y.

$$\rightsquigarrow \left\langle \left\{ \begin{array}{|c|}\hline \text{z} \\ \text{z} \sqsubseteq \text{region} \\ \hline \end{array} \; , \; \begin{array}{|c|}\hline \underline{\rho} \\ \rho(\alpha,\text{y}) \\ \hline \end{array} \right\}, \left\langle \alpha \, , \; \begin{array}{|c|}\hline \text{e s x y} \\ (\alpha = \text{e}) \overset{!}{\vee} (\alpha = \text{s}) \overset{!}{\vee} (\alpha = \text{x}) \\ \text{e CAUSE s} \\ \text{s: HOLE(x)} \\ \text{x} \subseteq (\text{skin of}) \; \text{z} \\ \text{Loch(y)} \\ \hline \end{array} \right\rangle\!\!\right\rangle$$

Internal Argument:

$\text{y} = \text{x} \Rightarrow \left\{ \begin{array}{ll} \sout{\alpha = \text{s}} & ; \text{ Öffnung of type } 2 \\ \sout{\alpha = \text{x}} & ; \text{ 'disjoint reference'} \end{array} \right\}$

Remains:
$\lambda e \lambda y(eCAUSEs \wedge s : \exists x(HOLE(x) \wedge x \subseteq (skin\ of)\ y)\ )$ event

Non-Argument:
ρ is POSS
Without assumption 'y $\sqsubseteq$ hole-like' all of e, s, o possible

Conclusion

- DRT-based lexical semantics for word-structures:
  - compositional semantics for words determined by their roots and structures
  - structural ambiguity of verbs and *ung*-nouns as determined by different types of roots
  - predictions of the meaning ranges of *ung*-nouns from their root based structure
- Underspecified lexical entries for verbs and *ung*-nouns:
  - Reduction of lexical underspecification in context
  - in particular: reduction through interaction between underspecified *ung*-nouns and their DP-complements/adjuncts
  - different analyses of the same expression can yield the same final interpretation