Recursive Adjectival Modification in CLLRS

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A glimpse of adjectival modification

- (1) a. pink unicorn
 - b. invisible pink unicorn
- (2) a. invisible unicorn
 - b. occasionally invisible unicorn
 - c. occasionally entirely invisible unicorn
- (3) a. blond artist
 - b. skillful programmer
 - c. former senator
 - d. alleged president
- (4) a. blond artist
 - b. potentially blond artist

Structure of the talk

- Modification in HPSG: Kasper (1997)
- Modification in (CL)LRS
- Representation and meaning
- Analysis in LRS with implementation in CLLRS
- Concluding thoughts

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Kasper (1997) and modification in HPSG

• Kasper's observation:

- classical HPSG: representation of head-adjunct phrases comes from adjunct daughters
- in blond artist, representation at blond says: an x that is blond and an artist
- in potentially blond artist, potentially then modifies: an x that is blond and an artist (and the entire representation is in potentially)
- but: x is an artist who is potentially blond!
- Kasper's solution in classical HPSG format:
 - distinguish inherent content of lexical items from combinatorics
 - distinguish inherent content from its use in different constructions
 - project the combinatorial behavior from the lexical head
 - uniform semantic principle for all head-modifier structures
 - analysis for operator/intersective meaning and attributive/predicative use of adjectives (and other modifiers)

Doing it in (CL)LRS

- focus in LRS on:
 - scope underspecification
 - quantifiers, polyadic quantifiers, content raising
 - concord phenomena
 - semantics for idiomatic expressions
 - NPI licensing
 - plural semantics, Skolem functions
 - $\blacktriangleright \rightarrow$ semantics of modification is a new area of application
- combination of analysis with implementation in CLLRS, and with development of CLLRS
- reasoning architecture with higher-order logic

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A representation for adjectives

Starting point for the representation of adjectives:

 $\lambda P_{\langle s \langle et \rangle \rangle} \lambda w_s \lambda x_e.tall_{\langle s \langle \langle s \langle et \rangle \rangle \langle et \rangle \rangle \rangle}(w, P, x)$

Motivation:

Uniform syntactic form for intersective, subsective, privative and other types of adjectives. Meaning postulates guarantee the intended inferential behavior.

- blond student (intersective)
- successful student (subsective)
- fake student (privative)
- alleged student

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Representations for adjectival modification

(5)

a.

- (i) controversial plan
 - (ii) controversial'(w, ($\lambda w_2 \lambda y$.(plan'(w_2, y))), x)
- b. (i) invisible pink unicorn
 - (ii) invisible'(w, ($\lambda w_2 \lambda y$.(pink'(w_2 , ($\lambda w_3 \lambda z$.(unicorn'(w_3, z))), y))), x)
- c. (i) potentially controversial plan
 - (ii) $(potential'(controversial'))(w, (\lambda w_2 \lambda y. (plan'(w_2, y))), x)$
- d. (i) occasionally entirely invisible unicorn
 - (ii) $(occasional'(entire'(invisible)))(w, (\lambda w_2 \lambda y. (unicorn'(w_2, y))), x)$

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Meanings for adjectives: Meaning postulates

Classes of adjectives are characterized by the inferences they license. For an adjective α :

intersective adjectives: blond, Scandinavian, Irish, British, female, male

$$P^{1}_{\langle s\langle et\rangle\rangle} \forall w_{s} \forall P^{2}_{\langle s\langle et\rangle\rangle} \forall x_{e}(\alpha(w, P^{2}, x) \leftrightarrow (P^{1}(w, x) \land P^{2}(w, x)))$$

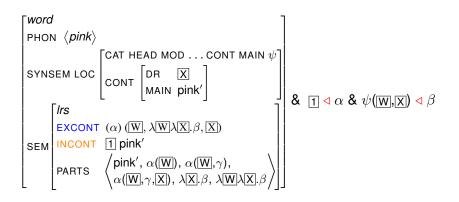
Subsective, non-intersective adjectives: genuine, skillful, successful, interesting, large, small, fat, tall, blue $\forall P_{\langle s \langle et \rangle} \forall x_e \forall w_s(\alpha(w, P, x) \rightarrow P(w, x))$

③ privative adjectives: *fake, former*
$$\forall P_{(s(et))} \forall x_e \forall w_s(\alpha(w, P, x) \rightarrow \neg P(w, x))$$

$$\forall P_{\langle s \langle et \rangle \rangle} \forall x_e \forall w_s^1(alleged(w^1, P, x) \leftrightarrow allegedly(w^1, (\lambda w^2 P(w^2, x))))$$

Words: Attributive adjective

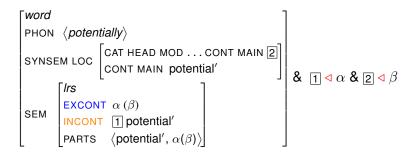
An adjective: *pink*, type $\langle s \langle \langle s \langle et \rangle \rangle \langle et \rangle \rangle$



CLLRS: $(([{pink'}]) (W, \lambda W \lambda X. [\psi (W, X)], X))$

Words: Adverbial modifier

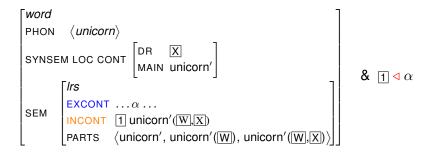
An adverbial modifier: *potentially*, type $\langle \langle s \langle et \rangle \rangle \langle et \rangle \rangle \langle s \langle \langle s \langle et \rangle \rangle \langle et \rangle \rangle \rangle$



CLLRS: ^(([{potential'}]) ([2]))

Words: Count noun

A count noun: *unicorn*, type $\langle s \langle et \rangle \rangle$



CLLRS: ^[{unicorn'(W, X)}]

LRS Projection Principle

In each phrase,

- 1. the EXCONT values of the head and the mother are identical,
- 2. the PARTS value contains all and only the elements of the PARTS values of the daughters,
- 3a. if it's not a head-adjunct phrase, the INCONT values of the head and the mother are identical,
- 3b. if it is a head-adjunct phrase, the EXCONT value of the non-head daughter and the INCONT value of the mother are identical.

Clause for (adverbial) adjectival modification

In a *head-adjunct* phrase with an adjective or and adverbial modifier of adjectives as non-head daughter ([HEAD $adj_adv \lor adjective$]), the INCONT value of the head daughter is a subterm of an argument of the INCONT value of the non-head daughter.

Adjective-noun combinations

Analysis of pink unicorn:

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pink:
adjunct daughter: (([{pink'}]) (W, \lambda W \lambda X. [\psi (W, X)], X))
unicorn:
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head daughter: ^[{unicorn'(W, X)}]

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lexical restriction by pink:

(([{pink'}]) (W, \lambda W \lambda X. [unicorn' (W, X)], X))
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restriction by Semantics Principle:
pink'(...[unicorn'(W, X)]...)
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pink unicorn: ^[{pink' (W, λWλX. [<u>unicorn'</u>(W, X)], X)}]

Adverbial modifiers of adjectives

Analysis of potentially pink

potentially: adjunct daughter: ^(([{potential'}]) ([2]))

pink: head daughter: $(([{pink'}]) (W, \lambda W \lambda X. [\psi (W, X)], X))$

restriction by Semantics Principle: potential' (...[pink'] ...)

potentially pink: $(([{potential'(pink')}]) (W, \lambda W \lambda X. [\psi (W, X)], X))$

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Underspecification of functors in type-logical representations:

- specification in a Montague Grammar format: *λPλwλx.controversial*'(w, P, x)
- specification in HPSG, possible underspecification of arguments: *controversial*'(*w*, *P*, *x*)
- specification in LRS, needed in CLLRS: → ([controversial'])@(w, P, x)
- unabbreviated CLLRS specification:
 - $\rightarrow (([controversial'])@w)@P)@x$

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Underspecification of functors in type-logical representations:

- specification in a Montague Grammar format: *λPλwλx.controversial*'(w, P, x)
- specification in HPSG, possible underspecification of arguments: controversial'(w, P, x)
- specification in LRS, needed in CLLRS: → ([*controversial*'])@(w, P, x)
- unabbreviated CLLRS specification:
 → ((([controversial'])@w)@P)@x

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Next steps

- integration of meaning postulates
- predicative adjectives: Few unicorns are (entirely) pink.
 (([{pink'}]) (W, entity, X))
- observation: predicative nominals obtain an analogous treatment *Alice is a (potentially pink) unicorn.*
- adverbial modifiers of adverbial modifiers: [[very occasionally] invisible] unicorn
- adverbials in the verbal domain: type polymorphism

Conclusions

- revisiting Kasper's guiding intuitions in LRS:
 - LRS by design distinguishes lexical content from combinatorics
 - combinatorics is lexically determined by resources, external content and internal content of the word
 - one clause of SEMANTICS PRINCIPLE for head-adjunct structures
 - attributive/predicative adjectives are systematically related
- unified representation for different classes of adjectives
- LRS analysis and CLLRS implementation go hand in hand
- behavior of inferences under modification (apparently British artist, allegedly fake student)
- more adjectival and adverbial constructions (Huddleston & Pullum 2002, chapter 6)

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