Parts of propositions

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Today’s talk

• **Core observation**: cumulative readings of sentences like (1) with a *de dicto* reading of the lower plural, (Schmitt 2015, 2019, Pasternak 2018).

(1) *Ada und Bea glauben, dass zwei Monster in der Burg unterwegs sind.*

here: ‘monster’ -sentences

• Problem for ‘traditional’ accounts of cumulation.
  Gist: lower plural cannot be interpreted *in situ*.

• Data can be accounted for by adapting the ‘plural projection’ framework for cumulation (Schmitt 2017, Haslinger and Schmitt 2018).
  Gist: lower plural can be interpreted *in situ*.

• We observe a very general problem that surfaces in all potential analyses (essentially going back to Quine 1943, Geach 1967 a.o.):
  How do we individuate individual concepts (Haslinger and Schmitt 2019)?
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3 The flattening problem and monster sentences

4 The flattening problem and plural projection (very informally)

5 Monster-sentences and plural projection (very informally)

6 Independent motivation

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Cumulativity

Sentences with two or more plural DPs can display cumulativity: Langendoen (1978) a.o.

(2) **SCENARIO:** Ada is feeding Carl, Bea is feeding Dean.

(3) \textit{Die zwei Mädchen füttern die zwei Hunde.} \textcolor{red}{true} in (2)

(4) Each of the two girls fed at least one of the two dogs & each of the two dogs was fed by at least one of the two girls

(5) \textit{Die zwei Mädchen füttern zwei Hunde.} \textcolor{red}{true} in (2)

(6) There is a plurality $X$ of two dogs & each member of $X$ was fed by at least one of the two girls & each of the two girls fed at least one of the members of $X$
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Here I focus on a special case: The two plurals are ‘separated’ by an intensional predicate and the lower plural must be interpreted in the scope of this predicate.

(7) [.. plural 1... [ INT [ ... plural 2...]]]

I.e. cases like the following:

(8) a. SCENARIO Ada and Bea spent the night at Joe’s castle. Ada believes in griffins, Bea in zombies. Around midnight, Ada heard a sound in her bedroom and was certain that it was caused by a griffin. Later, Bea heard a sound in her bedroom, and took it to be caused by a zombie. In the morning, they each told Joe what they believed was going on. Later, Joe tells me:
Well, I had invited Ada and Bea to spend the night at the castle. Bad idea! I know, of course, that people find it a little spooky here, but guess what...

b. diese Idioten haben echt geglaubt, dass da zwei Monster unterwegs waren! true in (8-a)
‘monster’- sentences

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b. *Ada und Bea haben geglaubt, dass da zwei Monster unterwegs waren!*

This seems to be an instance of cumulativity: Neither Ada nor Bea individually believe that two monsters are roaming the castle.

But we don’t relate Ada and Bea cumulatively to real-world objects: Their belief is *de dicto*.

So we find a cumulative relation between the plurality of Ada and Bea and a *de dicto* object.
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2. Introduce plural projection analysis of cumulativity (informally)  
   Schmitt 2017, Haslinger and Schmitt 2018

3. Provide analysis in terms of plural projection

4. Provide further motivation for such an analysis

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The predicate analysis

I spell out the analysis for predicates of individuals, (Link 1983, Beck and Sauerland 2000, Sternefeld 1998 a.o.). The problem that I point out extends to analyses based on predicates of individuals and events, (Kratzer 2003 a.o.)

Basic idea of the predicate analysis

- Cumulativity is the result of enriching predicate denotations by pointwise sum.
  (10)  
  \[ \text{Die zwei Mädchen füttern die zwei Hunde.} \]

  (11)  
  a.  \[ [\text{füttern}] = \{\langle a, c\rangle, \langle b, d\rangle\} \]
  b.  \[ **[\text{füttern}] = \{\langle a, c\rangle, \langle b, d\rangle, \langle a + b, c + d\rangle\} \]

- If we find cumulativity w.r.t. n-many pluralities, we must find a corresponding n-ary relation that we can enrich (cumulate)

- This means we sometimes have to derive the required relation syntactically.

  (12)  
  a.  \text{scenario Ada wanted to feed Carl. Bea wanted to feed Dean.}
  b.  \text{The two girls wanted to feed the two dogs.} \hspace{1cm} \text{true in (12-a)}
  (Beck and Sauerland 2000)
  c.  \lambda x_0.\lambda y_0. y \text{ wanted to feed } x \hspace{1cm} \Leftarrow \text{required input relation}
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The predicate analysis and monster-sentences

If we find cumulativity w.r.t. n-many pluralities, we must find a corresponding n-ary relation that we can enrich (cumulate)

(13)  *Ada und Bea* haben geglaubt, dass *da zwei Monster* unterwegs waren!

This leaves us only one option:

(14)  a.  

\[
\lambda x \lambda y. \lambda e. y \text{ hat geglaubt dass } x \text{ unterwegs war}
\]

b.  

\[
[X] = \lambda x \lambda y. \lambda e. y \text{ hat geglaubt dass } x \text{ unterwegs war}
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Problem: *zwei Monster* outscopes INT – we only derive the *de re* reading.

But couldn’t we get around this problem by modifying the denotation of *zwei Monster* (as in e.g. (Condoravdi et al. 2001))?  

- would require ambiguity of *zwei Monster*
- and... we run into independent problem of predicate analysis
The predicate analysis and monster-sentences

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(13) Ada und Bea haben geglaubt, dass da zwei Monster unterwegs waren!

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(14) a. $[[A \text{ and } B] [\text{zwei Monster}] [x \ 2 \ 1 \ [t_1 \ \text{glaubt dass } t_2 \ \text{unterwegs waren }]]]$
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(13)  *Ada und Bea haben geglaubt, dass da zwei Monster unterwegs waren!*

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b. \([X] = \lambda x_e. \lambda y_e. y \text{ hat geglaubt dass } x \text{ unterwegs war} \)

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Background

The predicate analysis of cumulativity and monster sentences

The flattening problem and monster sentences

The flattening problem and plural projection (very informally)

Monster-sentences and plural projection (very informally)

Independent motivation

Distinguishing individual concepts
The predicate analysis and the flattening problem

- Consider a particular problem for the predicate analysis: ‘flattening’ problem
  Schmitt 2013, 2017, Haslinger and Schmitt 2018

- Show how it extends to monster-sentences

- Conclude that we cannot employ the predicate analysis for monster-sentences, irrespective of our assumptions about the DP-denotation
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Predicate analysis: **If we find cumulativity w.r.t. n-many pluralities, we must find a corresponding n-ary relation that we can enrich (cumulate)**

We consider cumulative sentences where one plurality-denoting expression is syntactically contained within another one

\[(15) \quad \text{A..... [}_P \text{ ... B... ] and [}_Q \text{... ]} \]

- A cumulates with B
- A cumulates with P and Q (conjunction behaves like plurality of predicates)

We cannot form the required relation for cumulation (syntactic embedding) \(\Rightarrow\) Predicate analysis cannot derive these cases.


b. *Die zwei Mädchen haben den Gene gezwungen, [ [}_P \text{ die beiden Hunde zu füttern ] und [}_Q \text{ die Katze zu bürsten! }] \]

true in (16-a)

‘Double’ cumulativity: Neither girl made Gene do both P and Q. And neither girl made Gene feed both dogs.
The flattening problem

gist

- Predicate analysis: **If we find cumulativity w.r.t. n-many pluralities, we must find a corresponding n-ary relation that we can enrich (cumulate)**
- We consider cumulative sentences where one plurality-denoting expression is syntactically contained within another one
  
  \[(15) \quad A \ldots [P \ldots B \ldots] \text{ and } [Q \ldots] \]
  
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We cannot form the required relation for cumulation (syntactic embedding) \(\Rightarrow\) **Predicate analysis cannot derive these cases.**

\[(16) \quad \begin{align*}
\text{a. } & \text{Ada owns a dog, Carl. Bea owns another dog, Dean, and a cat, Eric. Ada made Gene feed Carl. Bea made Gene feed Dean and brush Eric.} \\
\text{b. } & \text{Die zwei Mädchen haben den Gene gezwungen, } [P \text{ die beiden Hunde zu füttern }] \text{ und } [Q \text{ die Katze zu bürsten! }] \\
\end{align*} \]

‘Double’ cumulativity: Neither girl made Gene do both P and Q. And neither girl made Gene feed both dogs.
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(16)  


b. *Die zwei Mädchen haben den* Gene *gezwungen, [ [P die beiden Hunde zu füttern ] und [Q die Katze zu bürsten! ]]*

\( \text{true in (16-a)} \)

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‘Double’ cumulativity: Neither girl made Gene do both P and Q. And neither girl made Gene feed both dogs.
Extending the flattening problem to monster sentences

We can extend the problem to monster sentences: We insert an intervening intensional operator \textbf{INT} and make sure that the embedded plurality B gets a \textit{de dicto} reading.

(17) \textbf{A...INT...} \ [P ... B...] \text{ and } \ [Q... ]

(18) a. Ada and Bea have strange beliefs about Joe. Ada believes Joe owns a griffin. Bea is sure that Joe owns a zombie. Bea also thinks that Joe himself sleeps in an open coffin. Gene hears about this and tells me: \textit{Ada and Bea, they are completely nuts!}

b. \textit{Diese beiden Idioten glauben tatsächlich, dass Joe [}[P zwei Monster hält ] und [Q in einem offenen Sarg schläft ]] true in (18-a)

‘Double’ cumulativity: Neither Ada nor Bea believes that Joe is \textit{both} P and Q. And neither Bea nor Carl believes that Joe owns \textit{two} monsters.

- Predicate analysis cannot account for flattening problem
- Flattening problem occurs also in monster sentences
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A...\textbf{INT}.. \left[ P \ldots B \ldots \right] \text{ and } \left[ Q \ldots \right]
\end{equation}

\begin{enumerate}
  \item \quad (18a) Ada and Bea have strange beliefs about Joe. Ada believes Joe owns a griffin. Bea is sure that Joe owns a zombie. Bea also thinks that Joe himself sleeps in an open coffin. Gene hears about this and tells me: \textit{Ada and Bea, they are completely nuts!}
  \item \quad (18b) \textit{Diese beiden Idioten glauben tatsächlich, dass Joe} \left[ [P \text{ zwei Monster hält }] \text{ und } [Q \text{ in einem offenen Sarg schläft }] \right] \text{ true in (18-a)}
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What we will do now...

- Informal sketch of an alternative mechanism for cumulativity: plural projection
  Schmitt 2017, Haslinger and Schmitt 2018
- Informal sketch of how this can be expanded to our monster cases
- Further motivation for this type of analysis
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1 Background

2 The predicate analysis of cumulativity and monster sentences

3 The flattening problem and monster sentences

4 The flattening problem and plural projection (very informally)

5 Monster-sentences and plural projection (very informally)

6 Independent motivation

7 Distinguishing individual concepts
Reconsidering the flattening problem

Flattening effect (standard version)

- Recall:
  
  \[(19)\]
  
  a. A made Gene feed C. B made Gene feed D and brush E.
  b. Die zwei Mädchen haben den Gene gezwungen, [ [p die beiden Hunde zu füttern ] und [ q die Katze zu bürsten! ]]

- Intuitively, we want binary cumulation between \(a+b\) and this predicate plurality:

  \[(20)\] Carl füttern + Dean füttern + Eric bürsten

- Intuitively: the ‘part’-structure of an embedded plurality is preserved by denotation of higher nodes.

- Plural projection is a system that will let us do this - we will look at a very informal version in the following Schmitt 2017, Haslinger and Schmitt 2018.
Reconsidering the flattening problem

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Plural projection, very informally (1/2)

- All semantic domains contain pluralities (indicated here by ‘+’)
  Pluralities correspond to non-empty subsets of atoms of the respective domain
  see Schmitt 2017, Haslinger 2019 for independent motivation

- The part structure of lower pluralities ‘projects’ up to higher pluralities
  Analogy to focus projection / Hamblin sets

(21)  \textit{feed Carl and Dean}

\[
\text{feed} \langle \text{carl} \rangle_{\langle et \rangle} + \text{feed} \langle \text{dean} \rangle_{\langle et \rangle}
\]

\[
\text{feed} \langle e \langle et \rangle \rangle \quad \text{carl}_e + \text{dean}_e
\]

(22)  \textit{feed and brush Dean}

\[
\text{feed} \langle \text{dean} \rangle_{\langle et \rangle} + \text{brush} \langle \text{dean} \rangle_{\langle et \rangle}
\]

\[
\text{feed} \langle e \langle et \rangle \rangle + \text{brush} \langle e \langle et \rangle \rangle \quad \text{dean}_e
\]

Crucial step: Cumulativity encoded in projection via \textit{compositional rule CC}
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\[
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\]
\[
\text{feed}_{\langle \text{e} \langle \text{et} \rangle \rangle} + \text{carl}_{e} + \text{dean}_{e}
\]

\[(22) \quad \text{feed and brush } \text{Dean}\]
\[
\text{feed}(\text{dean})_{\langle \text{et} \rangle} + \text{brush}(\text{dean})_{\langle \text{et} \rangle}
\]
\[
\text{feed}_{\langle \text{e} \langle \text{et} \rangle \rangle} + \text{brush}_{\langle \text{e} \langle \text{et} \rangle \rangle} + \text{dean}_{e}
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Crucial step: Cumulativity encoded in projection via compositional rule CC
For this rule to be generalizable – one more level of complexity: Plural sets (indicated here by ‘[...]’)
For every type $a$, there is a type $a^*$ of plural sets – the domains $D_{\langle a, t \rangle}$ and $D_{a^*}$ are disjoint, but have the same algebraic structure

\[
\begin{align*}
\text{(23) feed and brush Carl and Dean} & \quad \text{[ feed(carl)+brush(dean), feed(dean)+brush(carl), … ]} \\
\quad & \quad \text{[ feed}_{\langle e^{\langle et \rangle} \rangle} + \text{brush}_{\langle e^{\langle et \rangle} \rangle} ] \quad \text{[ carl}_{e} + \text{dean}_{e} ]}
\end{align*}
\]

- No syntactically derived predicates needed; in cases of non-lexical cumulation, the composition rule applies at each intervening node
- System is surface compositional
- At the sentence level, we obtain plural set $S$ of pluralities of propositions: Sentence true iff $S$ contains at least one element $p$ such that all atomic parts of $p$ are true.
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\[(23) \quad \text{feed and brush Carl and Dean} \]
\[
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&\quad [ \text{feed}(\text{carl}) + \text{brush}(\text{dean}), \text{feed}(\text{dean}) + \text{brush}(\text{carl}), \ldots ] \\
&\quad [ \text{feed}_{\langle e(e\langle e \rangle) \rangle} + \text{brush}_{\langle e(e\langle e \rangle) \rangle} ] \quad [ \text{carl}_{\langle e \rangle} + \text{dean}_{\langle e \rangle} ]
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[ \text{feed(carl)} + \text{brush(dean)}, \text{feed(dean)} + \text{brush(carl)}, \ldots ]
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System is surface compositional

At the sentence level, we obtain plural set $S$ of pluralities of propositions: Sentence true iff $S$ contains \textbf{at least one} element $p$ such that all atomic parts of $p$ are true.
Some denotations

- Plural definites and indefinites denote plural sets of individuals

\[(24)\] \[\text{[die zwei Mädchen]} = \text{[Ada+Bea]}\]

\[(25)\] \[\text{[zwei Haustiere]} = \text{[Carl+Dean, Carl+Eric, Dean+Eric]}\]

- Conjunction (essentially) forms plural sets of pluralities of conjuncts’ denotations:

\[(26)\] \[\text{[Ada und Bea]} = \text{[Ada+Bea]}\]

\[(27)\] \[\text{[Ada und zwei Haustiere]} = \text{[A+C+D, A+C+E, A+D+E]}\]

\[(28)\] \[\text{[rauchen und tanzen]} = \text{[}\lambda x_\epsilon. \text{rauchen } x + \lambda x_\epsilon. \text{tanzen}(x)\text{]}\]

\[(29)\] \[\text{[dass Burzum auftritt und dass Kiss anreisen]} = \text{[}\lambda w. \text{Burzum tritt auf in } w + \lambda w. \text{Kiss reist an in } w\text{]}\]
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  (29) \[ \text{[dass Burzum auftritt und dass Kiss anreisen]} = \]
  \[ \text{[λw. Burzum tritt auf in w + λw. Kiss reist an in w]} \]
Illustration: Deriving the flattening effect

(30) Die zwei Mädchen zwangen Gene [[ die zwei Hunde zu füttern] und [Eric zu bürsten]]
(30) \textit{Die zwei Mädchen zwangen Gene} [[\textit{die zwei Hunde zu füttern}] und [\textit{Eric zu bürsten}]]
Interim Summary: Plural projection

- Semantic plurality ‘projects’ by means of a cross-categorial operation CC which also encodes cumulativity.
  - This is made possible by assuming pluralities and plural sets of any semantic type.
  - Syntactically derived cumulative relations and the corresponding LF movement not needed: In the case of non-lexical cumulation CC applies at every intervening node.
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- Unlike earlier approaches to cumulativity, the present theory naturally accounts for the flattening effect.
Connection to monster-sentences

- The predicate analysis yields the wrong scope-configuration for monster sentences:

  (31)  *Ada und Bea haben geglaubt, dass zwei Monster unterwegs waren!*

  (32)  a.  \[[A and B] [zwei Monster] [x  2  [ 1 [ t₁  geglaubt  t₂  unterwegs waren ]]]\]
       b.  \[X\] = \(\lambda x_e.\lambda y_e.\ y\) glaubte dass x unterwegs war

- We don’t need to play around with the denotation of the numeral – predicate analysis cannot account for all monster-sentences, anyway: Flattening contexts

- The plural projection system seems intuitively adequate to account for such cases:
  - Can account for flattening problem
  - Lets us interpret expressions *in situ* - no wide scope needed for *zwei Monster*

- So our next step: Provide an analysis for monster-sentences via plural projection (again, very informal)
Connection to monster-sentences

- The predicate analysis yields the wrong scope-configuration for monster sentences:

  (31)   *Ada und Bea haben geglaubt, dass zwei Monster unterwegs waren!*

  (32)   a. $[[A \text{ and } B] [\text{zwei Monster}] [\lambda x.2[1[\lambda t_1 \text{ geglaubt } t_2 \text{ unterwegs waren }]]]]$

  b. $[X] = \lambda x.\lambda y.e.y$ glaubte dass $x$ unterwegs war

- We don’t need to play around with the denotation of the numeral – predicate analysis cannot account for all monster-sentences, anyway: Flattening contexts

  - The plural projection system seems intuitively adequate to account for such cases:
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So our next step: Provide an analysis for monster-sentences via plural projection (again, very informal)
1 Background

2 The predicate analysis of cumulativity and monster sentences

3 The flattening problem and monster sentences

4 The flattening problem and plural projection (very informally)

5 Monster-sentences and plural projection (very informally)

6 Independent motivation

7 Distinguishing individual concepts
basic ideas

- Plural projection account of monster-sentences

  (33) Ada und Bea haben geglaubt, dass da zwei Monster unterwegs waren!

  What we want to end up with: Ada and Bea cumulatively believe a plurality of propositions – one of the propositional pluralities in following plural set:

  (34) [ that a zombie was roaming the castle + that a griffin was roaming the castle, that a vampire was roaming the castle + that a werewolf was roaming the castle, ... ]

  And we want to derive this by zwei Monster ‘projecting’ its part structure to pluralities of propositions

- zwei Monster will denote a plural set of pluralities of individual concepts

- Each plurality in the set will consist of two distinct ‘atomic’ individual concepts, each of which is a monster in every world where it is defined

  (35) [zwei Monster] ≈ \{ f + g | \text{monster}(f) \land \text{monster}(g) \land \forall w \in \text{dom}(f) \cap \text{dom}(g), f(w) \neq g(w)\}
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*basic ideas*
basic ideas

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The mechanism (informally)

- we relativize our compositional rule CC to intensions

(36) \[ \lambda w. \lambda y \in \mathbf{S}(C)(y)(w) + \lambda w. \lambda y \in \mathbf{S}(D)(y)(w) \]

\[ \lambda w. \lambda x \in \mathbf{S}(x)(y)(w) \]

\[ \lambda w. \mathbf{C} + \lambda w. \mathbf{D} \]

schlagen

Carl und Dean

(37) \[ \lambda w. \lambda x \in \mathbf{G}(p)(x)(w) + \lambda w. \lambda x \in \mathbf{G}(q)(x)(w) \]

\[ \lambda w. \lambda r \in \mathbf{G}(r)(x)(w) \]

\[ \mathbf{G}(p_{<s,t>} + q_{<s,t>}) \]

p und q

- we give denotations for the parts of the DP \textit{zwei Monster} that will ensure that
  - we get pluralities of \textit{distinct} individual concepts
  - we count the atoms of such pluralities

CC includes extensional FA

CC includes intensional FA
The mechanism (informally)

- we relativize our compositional rule CC to intensions

Schmitt 2017

\[ \lambda w. \lambda y e S(C)(y)(w) + \lambda w. \lambda y e S(D)(y)(w) \]

CC includes extensional FA

\[ \lambda w. \lambda x e \lambda y e S(x)(y)(w) \]

[ schlagen ]

\[ \lambda w. C + \lambda w. D \]

[ Carl und Dean ]

\[ \lambda w. \lambda x e. G(p)(x)(w) + \lambda w. \lambda x e. G(q)(x)(w) \]

CC includes intensional FA

\[ \lambda w. \lambda r_{(s,t)} \lambda x e. G(r)(x)(w) \]

[ glauben ]

\[ p_{(s,t)} + q_{(s,t)} \]

[ p und q ]

- we give denotations for the parts of the DP \textit{zwei Monster} that will ensure that
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The mechanism (informally)

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\[ \lambda w. \lambda y_e S(C)(y)(w) + \lambda w. \lambda y_e S(D)(y)(w) \]

\[ \lambda w. \lambda x_e. \lambda y_e S(x)(y)(w) \]  
\[ \lambda w. C + \lambda w. D \]

\text{Schlägen}
\text{Carl und Dean}

2. We give denotations for the parts of the DP \text{zwei Monster} that will ensure that

2.1. We get pluralities of distinct individual concepts
2.2. We count the atoms of such pluralities

\[ \lambda w. \lambda r_{\langle s,t \rangle} x_e. G(r)(x)(w) \]
\[ p_{\langle s,t \rangle} + q_{\langle s,t \rangle} \]

\text{Glauben}
\text{p und q}
The mechanism (informally)

- we relativize our compositional rule CC to intensions

\[
\lambda w. \lambda y_e S(C)(y)(w) + \lambda w. \lambda y_e S(D)(y)(w)
\]

\[
\lambda w. \lambda x_e \lambda y_e S(x)(y)(w)
\]

\[
\lambda w. C + \lambda w. D
\]

schlagen

Carl und Dean

CC includes extensional FA

- we give denotations for the parts of the DP *zwei Monster* that will ensure that

  - we get pluralities of distinct individual concepts
  - we count the atoms of such pluralities

\[
\lambda w. \lambda x_e. G(p)(x)(w) + \lambda w. \lambda x_e. G(q)(x)(w)
\]

\[
\lambda w. \lambda r_{\langle s, t \rangle} \lambda x_e. G(r)(x)(w)
\]

\[
\lambda w. \lambda r_{\langle s, t \rangle} + \lambda w. \lambda r_{\langle s, t \rangle}
\]

\[
p_{\langle s, t \rangle} + q_{\langle s, t \rangle}
\]

glauben

\[
p und q
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CC includes intensional FA
Denotations (informally)

• denotation of plural morphem encodes distinctness (see Condoravdi et al. 2001 for similar idea): cross-world non-overlap

(38) \[ \text{[PL monster]} = [f_{(s,e)} : f \text{ is a plurality of individual concepts} \& \text{all atoms of } f \text{ are monsters in every world where they are defined} \& \text{for any two atoms } g, g' \text{ of } f, \text{ there is no world } w \text{ where both } g \text{ and } g' \text{ are defined and where } g(w) = g'(w)] \]

(39) a. \[ \text{[monster]}^{w_1} = \{a, b, c\} \quad [\text{monster]}^{w_2} = \{c, d\} \quad [\text{monster]}^{w_3} = \{b\}, \quad [\text{monster]}^{w_4} = \emptyset \]

b. \[ f_1 = \{\langle w_1, a \rangle, \langle w_2, c \rangle, \langle w_3, b \rangle\}, \quad f_2 = \{\langle w_1, b \rangle, \langle w_2, d \rangle\} \]
\[ f_3 = \{\langle w_1, c \rangle, \langle w_2, d \rangle, \langle w_3, b \rangle\}, \quad f_4 = \{\langle w_1, b \rangle\} \]
\[ f_5 = \{\langle w_1, b \rangle, \langle w_2, e \rangle\} \]

(40) \[ \text{[PL]}([\text{monster}]) = [f_1, f_2, f_3, f_4, f_1 + f_2, f_1 + f_4, f_3 + f_4] \]

• denotation of numerals relativized to plural sets and individual concepts

(41) \[ \text{[two]}([\text{PL monster}]) = [f_{(s,e)} : f \in [\text{PL monster}] \& f \text{ has 2 atomic parts}] \]

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b. $f_1 = \{\langle w1, a \rangle, \langle w2, c \rangle, \langle w3, b \rangle\}$, $f_2 = \{\langle w1, b \rangle, \langle w2, d \rangle\}$, $f_3 = \{\langle w1, c \rangle, \langle w2, d \rangle, \langle w3, b \rangle\}$, $f_4 = \{\langle w1, b \rangle\}$, $f_5 = \{\langle w1, b \rangle, \langle w2, e \rangle\}$

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Derivation, informally

(43)  *Ada und Bea* haben geglaubt, dass *da zwoi Monster* unterwegs waren!

- For the embedded clause, we obtain a set of propositions, which corresponds to our earlier intuitions

\[
\lambda w. U(f_1(w))(w) + \lambda w. U(f_2(w))(w), \lambda w. U(f_1(w))(w) + \lambda w. U(f_4(w))(w), \lambda w. U(f_3(w))(w) + \lambda w. U(f_4(w))(w)
\]

- Combining this with *glauben* and *Ada + Bea* via CC yields plural set in (45) (Ada and Bea must cumulatively believe one of the pluralities in (44))  

\[
\approx [\text{that } f_1 \text{ was roaming the castle } + \text{that } f_2 \text{ was roaming the castle}, \text{that } f_1 \text{ was roaming the castle } + \text{that } f_4 \text{ was roaming the castle}, \ldots ]
\]

(45)  

[ A believes that f1 was roaming the castle + B believes that f2 was roaming the castle, A believes that f1 was roaming the castle + B believes that f4 was roaming the castle, \ldots ]
Derivation, informally

\[ (43) \quad \textit{Ada und Bea} \; \text{haben geglaubt, dass da \text{zwei Monster unterwegs waren!} } \]

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\[
\begin{align*}
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\lambda w. \text{U}(x(w)) & + \lambda w. \text{U}(x(w)) \\
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\end{align*}
\]

\[
[f_1 + f_2, f_1 + f_4, f_3 + f_4] \quad [\lambda w. \lambda x. \text{U}(x(w))]
\]

\[ (44) \quad \approx [ \text{that } f_1 \text{ was roaming the castle } + \text{that } f_2 \text{ was roaming the castle}, \text{that } f_1 \text{ was roaming the castle } + \text{that } f_4 \text{ was roaming the castle}, \ldots ] \]

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\[ (45) \quad [ \text{A believes that } f_1 \text{ was roaming the castle } + \text{B believes that } f_2 \text{ was roaming the castle, A believes that } f_1 \text{ was roaming the castle } + \text{B believes that } f_4 \text{ was roaming the castle, } \ldots ] \]
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\[
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\text{zwei Monster} \quad \text{unterwegs}
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## Interim Summary

### What we have

- In this proposal, *zwei Monster* ‘projects’ pluralities of propositions which are cumulatively believed by Ada and Bea.
- The numeral DP to be interpreted *in situ* (in the scope of INT)
  - we don't need to assume ambiguity of *zwei Monster*
  - we don’t run into the flattening problem

### What we need

- Some wrong predictions (having to do with the fact that I employ *partial* individual functions – can be amended by replacing these by a certain kind of quantifier)
- So far, our motivation was technical (analysis avoids problems for alternative analyses). Is there independent motivation for such a type of system?
- The notion of distinctness employed here is very weak. Should we make it stronger? If so, how?
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1. Background

2. The predicate analysis of cumulativity and monster sentences

3. The flattening problem and monster sentences

4. The flattening problem and plural projection (very informally)

5. Monster-sentences and plural projection (very informally)

6. Independent motivation

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  Yes! Conjunctions of embedded clauses show behavior of pluralities.
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(46)  a. SCENARIO: Joe is organizing a joint birthday party for Abe, Bea and Gene. They each have their private theories about what will happen at the party, based on clues they each think they picked up in conversations with Joe. Ada is certain that Joe hired Burzum. Bea believes that he arranged a performance by Kiss. Gene thinks The Smiths will perform. Joe tells me:

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Cases with propositional conjunction mimic ‘standard’ cases of cumulativity

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\(b.\) Ada und Bea füttern Carl und Dean

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- Just as the relation between Carl and Dean is arbitrary, so is the relation between \(p\) and \(q\) – i.e. they don’t have to be compatible.
- Accordingly, \(p\) and \(q\) seem to denote a plurality with atoms \(p\), \(q\)

\(\Rightarrow\) These cases provide independent evidence for pluralities of propositions

- To the extent that it is testable: Similar lack of restrictions in monster-sentences:

(50)  
\(a.\) scenario Ada and Bea spent the night at Joe’s castle. Ada believes exactly one monster exists, a griffin, and that this griffin was in her bedroom. Bea also believes that exactly one monster exists, a zombie, and that this zombie was in her bedroom. In the morning, they each tell Joe what they believed was going on. Joe tells me:  
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Cases with propositional conjunction mimic ‘standard’ cases of cumulativity

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Cases with propositional conjunction mimic ‘standard’ cases of cumulativity

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        true in (50-a)
Point 2: Connection to plural expressions

- In the system proposed, pluralities of propositions can be derived in two ways:
  - By conjoining proposition denoting expressions:
    \[(51) \quad [\text{dass ich Burzum gebucht habe}] \text{ und } [\text{dass Kiss auftreten werden}]\]
  - Via projection of a plurality-denoting expression
    \[(52) \quad \text{dass zwei Monster in der Burg unterwegs sind}\]

  ⇒ We don’t expect cumulativity if neither is the case (vs. Pasternak 2018).

- This exception seems to be met:
  \[(53)\]
  a. **Scenario** Ada is looking forward to Joe’s party: She is certain that every woman at the party will fall in love with her. Bea is also looking forward to the party: She hates women and is certain that only one woman will attend: Ida.
  
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  b. Die glauben, dass Joe ein deutscher Faschist ist. \(\text{? in (54-a)}\)
Point 2: Connection to plural expressions

- In the system proposed, pluralities of propositions can be derived in two ways:
  - By conjoining proposition denoting expressions:
    \[(51) \quad [\textit{dass ich Burzum gebucht habe}] \text{ und } [\textit{dass Kiss auftreten werden}]\]
  - Via projection of a plurality-denoting expression
    \[(52) \quad \textit{dass zwei Monster in der Burg unterwegs sind}\]

⇒ We don’t expect cumulativity if neither is the case (vs. Pasternak 2018).

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• We considered monster-sentences

(55) Ada und Bea haben geglaubt, dass da zwei Monster unterwegs waren!

• We saw that the predicate analysis cannot derive the facts, because it needs to syntactically derive a binary relation between the two pluralities
  \[ \Rightarrow \text{zwei Monster will scope above INT (only way out: assume ambiguity)} \]
  \[ \Rightarrow \text{Flattening problem} \]

• We considered an alternative system of cumulativity, plural projection, which is motivated independently by the flattening problem

• We extended the system to monster-sentences: zwei Monster ‘projects’ to a set of pluralities of propositions that are cumulatively believed by Ada and Bea

(56) [ that a zombie was roaming the castle + that a griffin was roaming the castle, that a vampire was roaming the castle + that a werewolf was roaming the castle, \ldots ]

• we considered independent motivation for two features of this system
  • Other instances of pluralities of propositions
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Summary

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1 Background

2 The predicate analysis of cumulativity and monster sentences

3 The flattening problem and monster sentences

4 The flattening problem and plural projection (very informally)

5 Monster-sentences and plural projection (very informally)

6 Independent motivation

7 Distinguishing individual concepts
• Final step: Point to the problem of how we distinguish individual concepts based on Haslinger and Schmitt 2019

• This problem is not particular to the analysis provided here

• It also shows up in the analysis of other constructions, e.g. *Hob-Nob*-sentences, (Geach 1967) a.o., objects of opaque predicates (see in particular (Haslinger 2019))

• It has been noted in the literature at various points w.r.t. ‘non-existent objects’ (see e.g. recently (Condoravdi et al. 2001) and lots of philosophical literature, e.g. (Geach 1967))

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The problem (1/2)

- Consider again our monster-sentences

  (57) Ada und Bea haben geglaubt, dass da zwei Monster unterwegs waren!

- In the analysis, I assumed that the ‘monsters’ that Ada and Bea have beliefs about must be somehow distinct. Reason: Contrast between (58-a) and (58-b)

  (58) a. scenario Ada and Bea spent the night at Joe’s castle. Both believe in monsters. Around midnight, Ada heard a sound in her bedroom and was certain that it was caused by a griffin. Later, Bea heard a sound in her bedroom, and took it to be caused by a zombie. (57) true

  b. scenario Ada and Bea spent the night at Joe’s castle. Around midnight, Ada heard a sound in her bedroom and was certain that it was caused by a monster. Later, Bea heard a sound in her bedroom, and took it to be caused by a monster. (57) false

- But how exactly do we describe the required notion of distinctness?
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The problem (2/2)

• Above, I assumed a very weak condition: The individual concepts cannot overlap

\[ \text{\{\text{\textit{zwei Monster}}\}} \approx \{f + g \mid \text{\textit{monster}}(f) \land \text{\textit{monster}}(g) \land \forall w \in \text{dom}(f) \cap \text{dom}(g), f(w) \neq g(w)\} \]

• But note that we must use partial individual concepts (as opposed to other uses of individual concepts, e.g. Aloni 2001, where they they total functions)

• So as long as Ada believes that a monster was present and Bea believes that a monster is present, the sentence in (60) should be true incorrect prediction

(60)  \textit{Ada und Bea haben geglaubt, dass da \textit{zwei Monster} unterwegs waren!}

• So how do we strengthen our condition?
Above, I assumed a very weak condition: The individual concepts cannot overlap

\[ \{ f + g \mid \text{monster}(f) \land \text{monster}(g) \land \forall w \in \text{dom}(f) \cap \text{dom}(g), f(w) \neq g(w) \} \]

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How do we strengthen our condition?

- Whether the domains of the functions overlap does not seem to matter:
  
  (61)  
  a. **Scenario** Ada believes that griffins need oxygen to survive, Bea believes that zombies only exist in environments without oxygen. They also have beliefs about Mars: Ada believes that a griffin lives on Mars. Bea believes that a zombie lives there.  
  b. **Scenario** Ada believes that monsters need oxygen to survive. Bea believes they only exist in environments without oxygen. They also have beliefs about Mars: Ada believes that a monster lives on Mars. Bea believes that a monster lives there.  
  c. *Ada und Bea spinnen ... Die glauben tatsächlich, dass zwei Monster auf dem Mars leben... die wissen doch nicht mal, wo der Mars liegt!*  
  
- Context matters... or what the subjects of the attitude consider relevant

  (62) **Scenario** Ada and Bea are both very interested in different physiological functions of monsters. Ada believes that a monster that requires oxygen lives on Mars. Bea believes that a monster that cannot cope with oxygen lives on Mars.

How do we specify the conditions? How do we implement them? Better examples?
How do we strengthen our condition?

- Whether the domains of the functions overlap does not seem to matter:

  \[(61)\]
  a. **scenario** Ada believes that griffins need oxygen to survive, Bea believes that zombies only exist in environments without oxygen. They also have beliefs about Mars: Ada believes that a griffin lives on Mars. Bea believes that a zombie lives there.
  
  b. **scenario** Ada believes that monsters need oxygen to survive. Bea believes they only exist in environments without oxygen. They also have beliefs about Mars: Ada believes that a monster lives on Mars. Bea believes that a monster lives there.
  
  c. *Ada und Bea spinnen ...* Die glauben tatsächlich, dass zwei Monster auf dem Mars leben... die wissen doch nicht mal, wo der Mars liegt!

  - True in (61-a)
  - False in (61-b)
  - True in (62)

- Context matters... or what the subjects of the attitude consider relevant

  \[(62)\]
  **scenario** Ada and Bea are both very interested in different physiological functions of monsters. Ada believes that a monster that requires oxygen lives on Mars. Bea believes that a monster that cannot cope with oxygen lives on Mars.

How do we specify the conditions? How do we implement them? Better examples?
How do we strengthen our condition?

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  c. Ada und Bea spinnen ... \textit{Die glauben tatsächlich, dass zwei Monster auf dem Mars leben... die wissen doch nicht mal, wo der Mars liegt!} 

  \textbf{true} in (61-a) \textbf{false} in (61-b) \textbf{true} in (62)

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References II

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