Two cross-linguistic asymmetries in conjunction: A plural projection account

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(joint work with Nina Haslinger, Eva Rosina, Magdalena Roszkowski, Valentin Panzirsch and Valerie Wurm)

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CRC Colloquium
Universität Düsseldorf
13.6.2019
1. Cross-linguistic evidence for a cumulative lexical meaning of conjunctive coordinating morphemes in conjunctions of individual-denoting phrases
   Flor et al. 2017a,b

(1) *Ada and Bea*

2. An analytical problem: How do we derive the meaning of distributive conjunction structures on the basis of this meaning for the conjunction morpheme?

3. A proposal based on plural projection (informal) Haslinger and Schmitt 2018, 2019

4. Predictions for the cross-linguistic behavior of conjunctions of other semantic categories Haslinger et al. 2019

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(2) Ada and_{COORD} Bea fed exactly four pets.

- But: Does COORD have the same meaning cross-linguistically?
- Put differently: Do cross-linguistic data give us evidence for one of the hypotheses?

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(2) *Ada and* COORD *Bea fed exactly four pets.*

- But: Does COORD have the same meaning cross-linguistically?
- Put differently: Do cross-linguistic data give us evidence for one of the hypotheses?
But why do we wonder about the meaning of COORD?

- Sentences like (3) have at least two readings.

  (3) Ada and Bea fed exactly four pets.

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Which of the two readings reflects the lexical meaning of COORD and which is the ‘derived’ reading? (Assuming that COORD is not lexically ambiguous (Dowty 1987).)
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Which of the two readings reflects the lexical meaning of COORD und which is the ‘derived’ reading? (Assuming that COORD is not lexically ambiguous (Dowty 1987).)
Distributive hypothesis (Partee and Rooth 1983, Winter 2001 a.o.)

- Denotation of COORD recursively derived from $\&$ for all types ending in $t$

$$
\begin{align*}
\left[ \text{COORD}_t \right] &= \lambda p_t. \lambda q_t. p \& q, \\
\text{and for every type } b \text{ ending in } t \text{ and every type } a:
\left[ \text{COORD}_{\langle a, b \rangle} \right] &= \lambda P_{\langle ab \rangle}. \lambda Q_{\langle ab \rangle}. \lambda x_a. \left[ \text{COORD}_b \right] (P(x))(Q(x))
\end{align*}
$$

- In individual conjunction, we shift the conjuncts via $\uparrow$ to quantifier type, so we end up with a distributive conjunction of quantifiers

$$
\left[ [ \uparrow Ada ] [ \text{COORD} \& [ \uparrow Bea ]] ] \right] = \lambda P_{\langle et \rangle}. P(\text{ada}) \& P(\text{bea})
$$

- Which directly gives us the distributive meaning of our sentence

$$
\begin{align*}
\text{Ada and Bea fed exactly four pets.} \\
\left[ [ \uparrow Ada ] [ \text{COORD} \& [ \uparrow Bea ]] ] \right) (\lambda x_e. \text{fed exactly four pets}(x)) &= \text{ada fed exactly four pets } \& \text{bea fed exactly four pets}
\end{align*}
$$

$\Rightarrow$ the distributive reading is primitive

- The cumulative reading of the sentences is derived by additional operations $\text{OP}_K$. They essentially retrieve a plurality of individuals from the quantifier conjunction (see Winter 2001 a.o.)
Distributive hypothesis (Partee and Rooth 1983, Winter 2001 a.o.)

- Denotation of COORD recursively derived from $\land$ for all types ending in $t$

\[(4) \quad \llbracket \text{COORD}_t \rrbracket = \lambda p_t. \lambda q_t. p \land q, \]

and for every type $b$ ending in $t$ and every type $a$:

\[(5) \quad \llbracket \text{COORD}_{\langle a, b \rangle} \rrbracket = \lambda P_{\langle ab \rangle}. \lambda Q_{\langle ab \rangle}. \lambda x_a. \llbracket \text{COORD}_b \rrbracket (P(x))(Q(x))\]

- In individual conjunction, we shift the conjuncts via $\uparrow$ to quantifier type, so we end up with a distributive conjunction of quantifiers

\[(6) \quad \llbracket [ \uparrow Ada ] [ \text{COORD} \land [ \uparrow Bea ]] ] \rrbracket = \lambda P_{\langle et \rangle}. P(\text{ada}) \land P(\text{bea})\]

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\[(7) \quad Ada \text{ and Bea fed exactly four pets.}\]

\[(8) \quad \llbracket [ \uparrow Ada ] [ \text{COORD} \land [ \uparrow Bea ]] ] \rrbracket (\lambda x_\varepsilon. \text{fed exactly four pets}(x)) = ada \text{ fed exactly four pets } \land bea \text{ fed exactly four pets}\]

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- Denotation of `COORD` recursively derived from `∧` for all types ending in `t`

\[
[COORD_t] = \lambda p_t. \lambda q_t. p \land q,
\]
and for every type `b` ending in `t` and every type `a`:
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[COORD_{\langle a,b \rangle}] = \lambda P_{\langle ab \rangle}. \lambda Q_{\langle ab \rangle}. \lambda x_a. [COORD_b] (P(x))(Q(x))
\]

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Ada \text{ and } Bea \text{ fed exactly four pets.}
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$$\llbracket [\uparrow Ada [\text{COORD}_\land [\uparrow Bea]]] \rrbracket = \lambda P_{\langle et \rangle}. P(ada) \land P(bea)$$

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Distributive hypothesis (Partee and Rooth 1983, Winter 2001 a.o.)

- Denotation of \textsc{coord} recursively derived from $\land$ for all types ending in $t$

\begin{equation}
\llbracket \textsc{coord}_t \rrbracket = \lambda p_t. \lambda q_t. p \land q,
\end{equation}

and for every type $b$ ending in $t$ and every type $a$:

\begin{equation}
\llbracket \textsc{coord}_{\langle a, b \rangle} \rrbracket = \lambda P_{\langle ab \rangle}. \lambda Q_{\langle ab \rangle}. \lambda x_a. \llbracket \textsc{coord}_b \rrbracket (P(x))(Q(x))
\end{equation}

- In individual conjunction, we shift the conjuncts via $\uparrow$ to quantifier type, so we end up with a distributive conjunction of quantifiers

\begin{equation}
\llbracket [\uparrow Ada] [\textsc{coord}_\land [\uparrow Bea]] \rrbracket = \lambda P_{\langle et \rangle}. P(\text{ada}) \land P(\text{bea})
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- Which directly gives us the distributive meaning of our sentence

\begin{align*}
(6) & \quad \textit{Ada and Bea fed exactly four pets.} \\
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(6) \quad \text{Ada and Bea fed exactly four pets.} \\
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Cross-linguistic predictions of the distributive hypothesis (very roughly)

If there is an interpretative asymmetry between morpho-syntactically ‘simple’ and morpho-syntactically ‘complex’ strategies for individual conjunction:

‘More morpho-syntactic complexity’ should correlate with the cumulative reading (as it requires an extra operator).
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Cumulative hypothesis (Link 1983 a.o.)

- Background assumption: The domain $D_e$ contains both atoms and pluralities, i.e. it is closed under a sum-operation $\oplus$

\[(8) \quad \llbracket \text{the two girls} \rrbracket = \text{ada} \oplus \text{bea} \]

- $\text{COORD}$ in individual conjunction denotes the sum-operation $\oplus$ on individuals

\[(9) \quad \llbracket \text{COORD} \langle e, \langle e, e \rangle \rangle \rrbracket = \lambda x_e.\lambda y_e. x \oplus y \]

\[(10) \quad \llbracket [\text{Ada} [\text{COORD} \oplus \text{Bea} ]] \rrbracket = \text{ada} \oplus \text{bea} \]

- This directly gives us the cumulative reading of the sentence (assuming that the predicate can hold of pluralities – see below)

\[(11) \quad \llbracket [\text{Ada} \text{COORD} \oplus \text{Bea}] (\lambda x_e. \text{fed exactly four pets}(x)) \rrbracket = \text{ada} \oplus \text{bea fed exactly four pets} \]

$\Rightarrow$ the cumulative reading is primitive

- The distributive reading of the sentences is derived by additional operations $\text{OP}_D$. They essentially apply the predicate to each atomic part of the individual plurality formed by the conjunction (see Link 1987 a.o.)
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\[ \text{the two girls} = \text{ada} \oplus \text{bea} \]  

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\[ \lambda x.e.\lambda y.e. x \oplus y \]

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Cumulative hypothesis (Link 1983 a.o.)

- Background assumption: The domain $D_e$ contains both atoms and pluralities, i.e. it is closed under a sum-operation $\oplus$

\[(8) \quad [\text{the two girls}] = \text{ada} \oplus \text{bea} \]

- COORD in individual conjunction denotes the sum-operation $\oplus$ on individuals

\[(9) \quad [[\text{COORD}]_{\langle e,\langle e,e\rangle \rangle} = \lambda x_e.\lambda y_e. x \oplus y] \]

\[(10) \quad [[ \text{Ada \ COORD} \oplus \text{Bea } ]] = \text{ada} \oplus \text{bea} \]

- This directly gives us the cumulative reading of the sentence (assuming that the predicate can hold of pluralities – see below)

\[(11) \quad [[\text{Ada \ COORD} \oplus \text{Bea}]] (\lambda x_e.\text{fed exactly four pets}(x)) = \text{ada} \oplus \text{bea fed exactly four pets} \]

⇒ the cumulative reading is primitive

- The distributive reading of the sentences is derived by additional operations $\text{OP}_D$. They essentially apply the predicate to each atomic part of the individual plurality formed by the conjunction (see Link 1987 a.o.)
Cross-linguistic predictions of the cumulative hypothesis (very roughly)

If there is an interpretative asymmetry between morpho-syntactically ‘simple’ and morpho-syntactically ‘complex’ strategies for individual conjunction:

‘More morpho-syntactic complexity’ should correlate with the distributive reading (as it requires an extra operator).
Cross-linguistic predictions of the cumulative hypothesis (very roughly)

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| ‘More morpho-syntactic complexity’ should correlate with the distributive reading (as it requires an extra operator). |
Is one of the two hypotheses cross-linguistically valid?

We cannot answer this question based on the investigation of individual languages. But we saw that both hypotheses make cross-linguistic predictions.
What do we do?

- For each language, we identify pairs C1,C2 of ‘unmarked’ and ‘marked’ strategies for individual conjunction:
  C1 is morpho-syntactically contained in C2 – C2 contains an additional marker $\mu$.
- We consider two kinds of minimal pairs – because the ‘additional’ operators can occur in different syntactic positions
- Operators on VP: We consider pairs where C2 contains additional marking on the predicate – i.e. external to the coordinate structure.
  \[(12) \quad [C_1 [A \text{COORD} B] [P]] \quad \text{vs.} \quad [C_2 [A \text{COORD} B] [\mu P]]\]
- Operators on DP: We consider pairs where C2 contains additional marking internal to the coordinate structure.
  \[(13) \quad [[C_1 A \text{COORD} B] [P]] \quad \text{vs.} \quad [[C_2 A \text{COORD} B \mu] [P]]\]
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Methodology

- We are using the **Terraling** database
  - open ended, open source database
  - linguists answer yes/no questions on their native languages
  - results can be correlated (allows for complex queries)

- Our group, current stage: 79 questions, data for 24 languages from 10 major language families

- The first part of our study focusses on iterative conjunction strategies, with individual-denoting conjuncts, occurring in subject position.

- The predicates must contain a numeral or a degree expression – so that we can distinguish between readings.

  (14) **Ada and Bea fed exactly four pets.**

- Participants must identify the relevant sentences in their language and then check whether they are true or false in particular scenarios.

  (15) **SCENARIO 1:** Ada fed four pets. Bea fed four other pets.
  (16) **SCENARIO 2:** Ada fed three pets. Bea fed another pet.
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Results: Two generalizations

Generalization 1: Marker on the predicate (Flor et al. 2017a,b)

(17) \([C_1 [A\ COORD\ B]\ [P]]\) vs. \([C_2 [A\ COORD\ B]\ [\mu\ P]]\)

- Some conjunction patterns require one or more predicate-level markers for a **distributive** interpretation.

  (18) C1: [A, B ni C] bā-bi-kosná dikóó dísámal
      A B COORD C 2.SM-PST2-receive 13.thousands 13.six
      ‘A, B and C received six thousand francs in total.’

  (19) C2: [A, B ni C] bā-bi-kosná dikóó dísámal, hikií mut
      ‘A, B and C each received six thousand francs.’

- No iterative conjunction patterns require predicate-level markers for a **cumulative** interpretation.

  (20) \([C_1 [A\ COORD\ B]\ ...]\) **distributive** \([C_2 [A\ COORD\ B]\ [\mu\ ...]\] \) **(distributive/)** **cumulative**
      **not attested**
Results: Two generalizations

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  \hspace{1cm} A \ B \ COORD \ C \ 2.\ SM-PST2\text{-receive} \ 13.\text{thousands} \ 13.\text{six}$

  ‘A, B and C received six thousand francs **in total**.’

  (19) $C_2: \ [A, B \ ni \ C] \ bá-bí-kosná \ dikóó \ dísámal, \ hákií \ mut$

  ‘A, B and C **each** received six thousand francs.’

Basa’a P.R. Bassong, Terraling

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  (20) $[C_1 \ [A \ COORD \ B ..] \text{distributive} \ [C_2 \ [A \ COORD \ B ] \ [\mu ..] \text{(distributive/)}\text{cumulative}}$

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Results: Two generalizations

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Basa’a P.R. Bassong, Terraling

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(20) \([C_1 [A \text{COORD} B] \ldots ] \text{distributive} \quad [C_2 [A \text{COORD} B] \ldots ] (\text{distributive/} \text{cumulative}) \text{not attested}\)
Results: Two generalizations

Generalization 1: Marker on the predicate (Flor et al. 2017a,b)

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(18) \textbf{C1:} [A, B \textit{ni} C] bá-bí-kosná dikóó dísámal

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‘A, B and C each received six thousand francs.’

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Generalization 1: Marker on the predicate (Flor et al. 2017a,b)

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What does generalization 1 tell us?

- \( \mu \) is not part of the conjunction structure: Generalization concerns formal correlates of the two readings of the predicate.

(21) fed exactly four pets
    a. fed exactly four pets each
    b. fed exactly four pets in total

- suggests that distributive interpretation (but not cumulative interpretation) of such predicates cross-linguistically involves additional syntactic operator

(22) a. \([\text{OP}_D \text{ fed exactly four pets}]\) distributive
    b. \([\text{fed exactly four pets}]\) cumulative

- languages differ in whether they must spell out operator overtly (English vs. Basa’a)
- Languages where the operator is not obligatorily overt have ambiguous predicates – simple conjunction patterns should allow for both readings with such predicates.

(23) Ada and Bea fed exactly four pets.

- This will be our background for generalization 2
What does generalization 1 tell us?

\( \mu \) on predicate sometimes needed for distributive reading, never for cumulative reading

- \( \mu \) is not part of the conjunction structure: Generalization concerns formal correlates of the two readings of the predicate.

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What does generalization 1 tell us?

**µ** on predicate sometimes needed for distributive reading, never for cumulative reading

- **µ** is not part of the conjunction structure: Generalization concerns formal correlates of the two readings of the predicate.

  (21) *fed exactly four pets*
  
  a. *fed exactly four pets each*
  b. *fed exactly four pets in total*

- Suggests that distributive interpretation (but not cumulative interpretation) of such predicates cross-linguistically involves additional syntactic operator

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\(\mu\) on predicate sometimes needed for distributive reading, never for cumulative reading

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(21) \textit{fed exactly four pets}

a. \textit{fed exactly four pets each}

b. \textit{fed exactly four pets in total}

- suggests that \textit{distributive} interpretation (but not cumulative interpretation) of such predicates cross-linguistically involves additional syntactic operator

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b. \([\textit{fed exactly four pets}]\) \quad \text{cumulative}

- languages differ in whether they must spell out operator overtly (English vs. Basa’a)

  - Languages where the operator is not obligatorily overt have \textit{ambiguous} predicates – simple conjunction patterns should allow for both readings with such predicates.

(23) \textit{Ada and Bea fed exactly four pets.}

- This will be our background for generalization 2
What does generalization 1 tell us?

μ on predicate sometimes needed for distributive reading, never for cumulative reading

- μ is not part of the conjunction structure: Generalization concerns formal correlates of the two readings of the predicate.

(21) fed exactly four pets
  a. fed exactly four pets each
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- suggests that distributive interpretation (but not cumulative interpretation) of such predicates cross-linguistically involves additional syntactic operator

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\[(23) \quad \text{Ada and Bea fed exactly four pets.}\]

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Results: Two generalizations

Generalization 2: Marker on the coordinate structure (Flor et al. 2017a,b)

(24) \[[C_1 \text{ A COORD B }] [P] \] \[[C_2 \text{ A COORD B } \mu] [P]\]

- If C2 allows for a cumulative interpretation, so does C1.

(25) \[[C_1 \text{ A COORD B } \mu]...\]_{cumulative} \rightarrow \[[C_2 \text{ A COORD B}]...\]_{cumulative}

- If C1 allows for a distributive interpretation, so does C2.

(26) \[[C_1 \text{ A COORD B}]...\]_{distributive} \rightarrow \[[C_2 \text{ A COORD B } \mu]...\]_{distributive}

- example: attested (\(\mu\) removes possibility of cumulative reading)

(27) C1: \[[A (i) B \ i \ C] su \ zaradili \ tačno \ sto \ evra.\]  
A \ i \ B \ i \ C \ AUX.3PL \ earn.PART.PL.M \text{ exactly hundred euros.}GEN  
‘A,B and C each/between them earned exactly 100 euros.’

(28) C2: \[[i \ A \ i \ B \ i \ C] su \ zaradili \ tačno \ sto \ evra.\]  
‘A,B and C each earned exactly 100 euros.’

SerBoCroatian J. Gajić, Terraling

- not attested

(29) \[[C_1 \text{ A COORD B}]...\]_{(cumulative)/distributive} \[[C_2 \text{ A COORD B } \mu]...\]_{cumulative}
Results: Two generalizations

Generalization 2: Marker on the coordinate structure (Flor et al. 2017a,b)

(24) \[\left[ C_1 \; A \; COORD \; B \right] [P] \quad \left[ C_2 \; A \; COORD \; B \; \mu \right] [P] \]

- If \( C_2 \) allows for a cumulative interpretation, so does \( C_1 \).
  
  (25) \[\left[ C_1 \; A \; COORD \; B \; \mu \right] \ldots \]_{cumulative} \rightarrow \left[ C_2 \; A \; COORD \; B \right]_{cumulative} \ldots \]

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- example: attested (\( \mu \) removes possibility of cumulative reading)
  
  (27) \( C_1 \): \([ A \; (i) \; B \; i \; C ] \) su zaradili tačno sto evra.

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**Generalization 2: Marker on the coordinate structure** (Flor et al. 2017a,b)

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SerBoCroatian J. Gajić, Terraling

- **not attested**

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\(cumulative\) / **distributive**
Results: Two generalizations

Generalization 2: Marker on the coordinate structure (Flor et al. 2017a,b)

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(26) \([C_1 \text{ A COORD B }…]_{\text{distributive}} \rightarrow [C_2 \text{ A COORD B } \mu ]…]_{\text{distributive}}\)

- Example: attested (\(\mu\) removes possibility of cumulative reading)

(27) C1: \([A (i) \text{ B i C} ]\text{ su zaradili tačno sto evra.}\)
A i B i C AUX.3PL earn.PART.PL.M exactly hundred euros.GEN
‘A, B and C each/between them earned exactly 100 euros.’

(28) C2: \([i A i \text{ B i C} ]\text{ su zaradili tačno sto evra.}\)
‘A, B and C each earned exactly 100 euros.’

SerBoCroatian J. Gajić, Terraling

- Not attested

(29) \([C_1 \text{ A COORD B }…]_{\text{(cumulative)/distributive}} \quad [C_2 \text{ A COORD B } \mu ]…]_{\text{cumulative}}\)
Results: Two generalizations

Generalization 2: Marker on the coordinate structure (Flor et al. 2017a,b)

(24) \[[C_1 \text{ A} \text{ COORD B } [\text{P}]] \quad [C_2 \text{ A} \text{ COORD B } \mu [\text{P}]]\]

- If C2 allows for a cumulative interpretation, so does C1.
  (25) \[[C_1 \text{ A} \text{ COORD B } \mu ]... \text{cumulative} \rightarrow [C_2 \text{ A} \text{ COORD B } ]... \text{cumulative}\]
- If C1 allows for a distributive interpretation, so does C2.
  (26) \[[C_1 \text{ A} \text{ COORD B } ]... \text{distributive} \rightarrow [C_2 \text{ A} \text{ COORD B } \mu ]... \text{distributive}\]
- example: attested (\(\mu\) removes possibility of cumulative reading)
  (27) C1: \([A \ (i) \ B \ i \ C] \text{ su zaradili tačno sto evra.} \)
  \(\text{A i B i C AUX.3PL earn.PART.PL.M exactly hundred euros.GEN}
  \text{‘A,B and C each/between them earned exactly 100 euros.’}\)
  (28) C2: \([i A \ i \ B \ i \ C] \text{ su zaradili tačno sto evra.} \)
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- If C1 allows for a *distributive* interpretation, so does C2.

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- *example: attested* (\(\mu\) removes possibility of cumulative reading)

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SerBoCroatian J. Gajić, Terraling

- *not attested*

(29) \[[C_1 \text{ A COORD B }] [P] \rightarrow [C_2 \text{ A COORD B } \mu] [P]\]

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What does generalization 2 tell us?

\[ \mu \] on the conjunction may remove the cumulative reading, but not the distributive reading

For languages like English where predicates are ambiguous, the two hypotheses make different predictions w.r.t. marking on the conjunction

Cumulative hypothesis: Predictions

- For unmarked structures both readings should be possible.
  
  (30)  
  a. A and B [fed exactly four pets] \text{ cumulative}  
  b. A and B [OP \text{ D} fed exactly four pets] \text{ distributive}

- In order to derive conjunctions that lack the cumulative reading, we have to add \( \text{OP}_D \) to conjunction. We thus expect that some languages can ‘remove’ the cumulative reading via an extra operator on the conjunction.

  (31) \[ \text{OP}_D [A, B \text{ and } C] [(\text{OP}_D) \text{ fed exactly four pets}] \text{ distributive} \]

⇒ Predictions compatible with generalization 2
What does generalization 2 tell us?

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For languages like English where predicates are ambiguous, the two hypotheses make different predictions w.r.t. marking on the conjunction

Cumulative hypothesis: Predictions

- For unmarked structures both readings should be possible.

  (30) a. A and B [fed exactly four pets] cumulative
       b. A and B [OPD fed exactly four pets] distributive

- In order to derive conjunctions that lack the cumulative reading, we have to add OPD to the conjunction. We thus expect that some languages can ‘remove’ the cumulative reading via an extra operator on the conjunction.

  (31) [OPD [A, B and C ] [OPD fed exactly four pets]] distributive

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For languages like English where predicates are ambiguous, the two hypotheses make different predictions w.r.t. marking on the conjunction

**Cumulative hypothesis: Predictions**

- For unmarked structures both readings should be possible.

  (30)  
  a. \( A \ and_{\oplus} B \ [fed \ exactly \ four \ pets] \) cumulative  
  b. \( A \ and_{\oplus} B \ [^{OP}_D \ fed \ exactly \ four \ pets] \) distributive

- In order to derive conjunctions that lack the cumulative reading, we have to add \( ^{OP}_D \) to conjunction. We thus expect that some languages can ‘remove’ the cumulative reading via an extra operator on the conjunction.

  (31) \( [^{OP}_D \ [A, B \ and_{\oplus} C ]] [(^{OP}_D) \ fed \ exactly \ four \ pets] \) distributive

\( \Rightarrow \) Predictions compatible with generalization 2
What does generalization 2 tell us?

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  \[(31)\]

  \[ [\text{OP}_D [A, B \ and_{\oplus} C ]] [(\text{OP}_D) \text{ fed exactly four pets}] \]

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  b.  \( A \text{ and} \oplus B [\text{OP}_D \text{ fed exactly four pets}] \) \quad \text{distributive}  
  
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  (31)  
  
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What does generalization 2 tell us?

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  \( \text{[OP}_D [A, B \text{ and} \oplus C ]] [(\text{OP}_D) \text{ fed exactly four pets}] \)  

\( \Rightarrow \) **Predictions compatible with generalization 2**
What does generalization 2 tell us?

$\mu$ on the conjunction may remove the cumulative reading, but not the distributive reading.

**Distributive hypothesis: Predictions**

- For unmarked structures both readings can in principle be derived.

\begin{align*}
(32) & \quad \text{a. } A, B \text{ and } C \left[ (OP_D) \text{ fed exactly four pets} \right] \quad \text{distributive} \\
& \quad \text{b. } [OP_K [A, B \text{ and } C]] \text{ fed exactly four pets} \quad \text{cumulative}
\end{align*}

- But in order to obtain the cumulative reading, we have to add an extra-operator to the conjunction. Thus, if a language spells out operators on the conjunction, we would expect that the marker makes the cumulative reading available.

$\Rightarrow$ Predictions incompatible with generalization 2
What does generalization 2 tell us?

\( \mu \) on the conjunction may remove the cumulative reading, but not the distributive reading.

**Distributive hypothesis: Predictions**

- For unmarked structures both readings can in principle be derived.

  (32) a. \( A, B \text{ and}_\land C \ [(\text{OP}_D) \text{ fed exactly four pets}] \) distributive
  
  b. \( [\text{OP}_K [A, B \text{ and}_\land C]] \text{ fed exactly four pets}] \) cumulative

- But in order to obtain the cumulative reading, we have to add an extra-operator to the conjunction. Thus, if a language spells out operators on the conjunction, we would expect that the marker makes the cumulative reading available.

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**Distributive hypothesis: Predictions**

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  (32)  
  a.  \( A, B \text{ and}_\wedge C [\text{OP}_D \text{ fed exactly four pets}] \)  
  b.  \( \text{OP}_K [A, B \text{ and}_\wedge C] [\text{fed exactly four pets}] \)

- But in order to obtain the cumulative reading, we have to add an extra-operator to the conjunction. Thus, if a language spells out operators on the conjunction, we would expect that the marker makes the cumulative reading available.

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  \[(32) \quad \begin{align*}
  \text{a. } & A, B \text{ and } C \ [(\text{OP}_D) \text{ fed exactly four pets}] \\
  \text{b. } & [\text{OP}_K [A, B \text{ and } C]] \ [\text{fed exactly four pets}]
  \end{align*}\]

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\( \Rightarrow \) **Predictions incompatible with generalization 2**
Based on our sample: The lexical meaning of COORD is cumulative
1 Cross-linguistic evidence for a cumulative lexical meaning of COORD

2 An analytical problem

3 Analysis, part 1: Plural projection (informally)

4 Analysis, part 2: Distributive conjunctions and plural projection (informally)

5 Some cross-linguistic predictions
• We saw that the lexical meaning of COORD is cumulative

• This means that we have to also derive the meaning of distributive patterns on the basis of a cumulative meaning for COORD

(33) **C1:** \[A (i) B i C\] su zaradili tačno sto evra.
‘A, B and C each/between them earned exactly 100 euros.’

(34) **C2:** \[i A i B i C\] su zaradili tačno sto evra.
‘A, B and C each earned exactly 100 euros.’

• Existing analyses (Szabolcsi 2015, Mitrović and Sauerland 2016) essentially assume a distributive meaning for COORD incompatible with our data
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(33)  \[ [A \, (i) \, B \, i \, C] \text{ su zaradili tačno sto evra.} \]

‘A, B and C each/between them earned exactly 100 euros.’

(34)  \[ [i \, A \, i \, B \, i \, C] \text{ su zaradili tačno sto evra.} \]

‘A, B and C each earned exactly 100 euros.’

• Existing analyses (Szabolcsi 2015, Mitrović and Sauerland 2016) essentially assume a distributive meaning for COORD incompatible with our data
We saw that the lexical meaning of \textsc{coord} is cumulative.

This means that we have to also derive the meaning of \textit{distributive} patterns on the basis of a cumulative meaning for \textsc{coord}.

\begin{itemize}
\item \textbf{(33) C1:} [A (i) B i C] su zaradili tačno sto evra.  
\textit{A,B and C each/between them earned exactly 100 euros.}
\item \textbf{(34) C2:} [i A i B i C] su zaradili tačno sto evra.  
\textit{A,B and C each earned exactly 100 euros.}
\end{itemize}

Existing analyses (Szabolcsi 2015, Mitrović and Sauerland 2016) essentially assume a distributive meaning for \textsc{coord} incompatible with our data.
Deriving the meaning of distributive patterns compositionally will require us to make a number of assumptions (Haslinger and Schmitt 2019)

- We need a cumulative lexical meaning of COORD also in those cases where it does not conjoin individual-denoting phrases – we need a cumulative meaning for COORD also for ‘higher-order’ objects (see Link 1984, Krifka 1990, Heycock and Zamparelli 2005 for independent arguments)

- Cross-categorial meaning for COORD involves plurality formation – we need pluralities in ‘functional’ semantic domains (see Schmitt 2018 for independent arguments)

- Such ‘higher-order’ pluralities must reflect ‘part-structure’ of embedded pluralities (see Schmitt 2018, Haslinger and Schmitt 2018, 2019 for independent arguments)

These are exactly the properties of the plural projection mechanism (Schmitt 2018, Haslinger and Schmitt 2018, 2019) – which we will eventually connect the data to.
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These are exactly the properties of the plural projection mechanism (Schmitt 2018, Haslinger and Schmitt 2018, 2019) – which we will eventually connect the data to.
But let us first consider how we get to these assumptions.

What we will need for them is an intuitive notion of **cumulativity**, which was already implicit above.

We will say that two plural expressions exhibit cumulativity w.r.t. to one another whenever they exhibit particular weak truth-conditions (Langendoen 1978, Scha 1981 a.o.)

(35) a. *The two girls fed the two dogs.*
    b. *Ada and Bea fed Carl and Dean.*

(36) **SCENARIO:** Ada fed Carl. Bea fed Dean.  (35-a), (35-b) **true**
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\[ \text{a. } \text{The two girls fed the two dogs.} \]
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(35-a), (35-b) **true**
• We now know that distributive conjunctions consist of two (abstract) parts: cumulative \( \text{COORD}_\oplus \) and \( \text{OP}_D \) on the conjunction

• The morpho-syntactic coding of the ‘semantic contribution’ of \( \text{OP}_D \) is more complex: In many languages, distributive conjunctions exhibit conjunction particles on each conjunct (Szabolcsi 2015, Mitrović and Sauerland 2016)

\[(37)\]  
\begin{align*}
a. & \quad \text{C1: } A (i) B i C \\
b. & \quad \text{C2: } i A i B i C
\end{align*}

cumulative, distributive
distributive

• Syntactic assumption, following (Szabolcsi 2015, Mitrović and Sauerland 2016)

\[(38)\]

How do we derive the denotation of distributive conjunctions compositionally on the basis of \( \text{COORD}_\oplus \) and conjunction particles \( \mu \) on each conjunct?
Background: Syntax of distributive conjunctions

- We now know that distributive conjunctions consist of two (abstract) parts: cumulative COORD⊕ and OP_D on the conjunction.

- The morpho-syntactic coding of the ‘semantic contribution’ of OP_D is more complex: In many languages, distributive conjunctions exhibit conjunction particles on each conjunct (Szabolcsi 2015, Mitrović and Sauerland 2016)

  \[(37)\]
  \[
  \begin{align*}
  \text{a.} & \quad \text{C1: } A (i) B i C \\
  \text{b.} & \quad \text{C2: } i A i B i C
  \end{align*}
  \]

  \text{cumulative, distributive}

  \text{distributive}

- Syntactic assumption, following (Szabolcsi 2015, Mitrović and Sauerland 2016)

  \[(38)\]

  \[
  \begin{array}{c}
  \mu \\
  A \\
  \end{array}
  \quad \text{COORD}^{\oplus} \quad \begin{array}{c}
  \mu \\
  B \\
  \end{array}
  \]

How do we derive the denotation of distributive conjunctions compositionally on the basis of COORD⊕ and conjunction particles μ on each conjunct?
Background: Syntax of distributive conjunctions

- We now know that distributive conjunctions consist of two (abstract) parts: cumulative $\text{COORD} \oplus$ and $\text{OP}_D$ on the conjunction.
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(37)  
\begin{align*}  
\text{a.} & \quad \text{C1: } A \ (i) \ B \ i \ C \\
\text{b.} & \quad \text{C2: } i \ A \ i \ B \ i \ C \\
\end{align*}

- Syntactic assumption, following (Szabolcsi 2015, Mitrović and Sauerland 2016)

(38)  
\begin{tikzpicture}[level distance=1.5cm, sibling distance=3cm, grow cyclic, every node/.style={scale=0.8}, every edge/.style={draw}]
  \node {$\mu$} child {node {$\mu$} child {node {$A$} edge from parent node[below] {COORD}} child {node {$B$} edge from parent node[below] {}}};
\end{tikzpicture}

How do we derive the denotation of distributive conjunctions compositionally on the basis of $\text{COORD} \oplus$ and conjunction particles $\mu$ on each conjunct?
Background: Syntax of distributive conjunctions

- We now know that distributive conjunctions consist of two (abstract) parts: cumulative \texttt{COORD}_\oplus and \texttt{OP}_D on the conjunction.
- The morpho-syntactic coding of the ‘semantic contribution’ of \texttt{OP}_D is more complex: In many languages, distributive conjunctions exhibit conjunction particles on each conjunct (Szabolcsi 2015, Mitrović and Sauerland 2016).
  \begin{enumerate}
    \item \texttt{C1}: \texttt{A (i) B i C} \hspace{2cm} \text{cumulative, distributive}
    \item \texttt{C2}: \texttt{i A i B i C} \hspace{2cm} \text{distributive}
  \end{enumerate}
- Syntactic assumption, following (Szabolcsi 2015, Mitrović and Sauerland 2016)
  \begin{equation}
    \mu \quad A \quad \texttt{COORD}_\oplus \quad B \quad \mu
  \end{equation}

How do we derive the denotation of distributive conjunctions compositionally on the basis of \texttt{COORD}_\oplus and conjunction particles \( \mu \) on each conjunct?
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(37)  
\[
\begin{align*}
\text{a. } \ & \ A \ (i) \ B \ i \ C \\
\text{b. } \ & \ i \ A \ i \ B \ i \ C
\end{align*}
\]

- Syntactic assumption, following (Szabolcsi 2015, Mitrović and Sauerland 2016)

(38)  
\[
\begin{tikzpicture}
  \node (A) {\( \mu \)} child {node (B) {\( \mu \)}}
  child {node (COORD) {\( \text{COORD} \oplus \)}}
  child {node (A) {\( \mu \)}};
\end{tikzpicture}
\]

How do we derive the denotation of distributive conjunctions compositionally on the basis of \( \text{COORD} \oplus \) and conjunction particles \( \mu \) on each conjunct?
Step 1: Cumulative conjunction of ‘higher-order’ objects

- The distributive effect must be due to the conjunction particles, $\mu$
- They must achieve that the predicate applies to each conjunct individually.

(39) \[
[[\mu \text{ Ada} \ [\text{COORD} \oplus \ [\mu \text{ Bea}]]] \text{ ate exactly four cookies.}
\]

- This means that the individual conjuncts should take the predicate as their argument

(40) \[
[[\mu \text{ Ada}]] \approx \lambda P_{(e,t)} \cdot P(\text{ada})
\]

- Accordingly, we will have to conjoin higher-order objects by means of COORD
- But the lexical denotation of COORD is cumulative – which so far is only defined for individuals

(41)

\[
\begin{array}{c}
\lambda P_{(et)} \cdot P(\text{ada}) \\
\mu \text{A} \\
\mu \text{B} \\
\text{COORD} \oplus
\end{array}
\]

We must extend ‘cumulative conjunction’ to categories other than individuals.
Step 1: Cumulative conjunction of ‘higher-order’ objects

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\[
\mu \text{Ada} \oplus \mu \text{Bea} \] ate exactly four cookies.

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**Step 1: Cumulative conjunction of ‘higher-order’ objects**

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Step 2: Conjunction as cross-categorial sum formation

But how should we characterize cross-categorial cumulative conjunction?

- In some languages (e.g. Estonian, German, Hungarian, Polish) distributive conjunctions behave like pluralities in some syntactic positions.
- In Polish, \( i \ A \ i \ B \) behaves exactly as SerBoCroatian \( i \ A \ i \ B \) w.r.t. lower plural expressions – only distributive reading (M. Roszkowski, M. Wągiel, Terraling)
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COORD

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- The higher-order pluralities formed by distributive conjunctions seem to ‘reflect’ the part structure of pluralities scopally dependent on them.
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*SCENARIO: There are two dogs, Carl and Dean. Ada taught Carl tricks 1 and 2. Ada taught Dean trick 3 and Bea taught Dean trick 2. (45) true*

1. it is not the case that for each dog each of the girls taught it two tricks

   ⇒  *sowohl C als auch D cumulative wrt. Ada and Bea*

2. each dog was taught two tricks, tricks can be different

   ⇒  *sowohl C als auch D distributive wrt. two tricks*
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- An intuitive way to capture truth-conditions (Haslinger and Schmitt 2018, 2019)

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- \( \text{ada} \oplus \text{bea} \) must be in a cumulative relation with one of the predicate pluralities in the following set: Each predicate plurality reflects the ‘part-structure’ of the scopally dependent plural expression \( \text{zwei Tricks} \)

(49) \{ \text{taught}(t1)(c) + taught(t2)(c) + taught(t3)(d) + taught(t1)(d),
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This means we need ‘higher-order’ pluralities, like pluralities of predicates – we already saw independent evidence for this

But: It also means that combining distributive conjunctions with their scope must give us ‘higher-order’ pluralities that reflect the part-structure of scopally dependent pluralities.
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Interim summary

If **COORD** is lexically cumulative, the analysis of distributive conjunctions shows us that...

1. ‘Functional’ semantic domains also contain pluralities (pluralities of functions): **COORD** forms pluralities from the respective domain out of its conjuncts
   - In distributive conjunctions, lexically cumulative **COORD** must conjoin higher-order objects (functions)
   - Distributive conjunctions can cumulate with other plural expressions in some syntactic positions

2. We must account for asymmetry: Distributive conjunctions distribute w.r.t. lower plural expressions, but show ‘plurality-like’ behavior w.r.t. higher plural expressions
   - Subject-object asymmetries in Polish and other languages
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Cross-linguistic evidence for a cumulative lexical meaning of COORD

An analytical problem

Analysis, part 1: Plural projection (informally)

Analysis, part 2: Distributive conjunctions and plural projection (informally)

Some cross-linguistic predictions
• All semantic domains contain pluralities (i.e. we have pluralities of individuals, predicates, propositions)

We define a sum-operation $+$ for any type: Isomorphic to union of sets of atoms.

$D_e = \{ \text{Ada, Bea, Ada+Bea} \ldots \}$,
$D_{\langle e,t \rangle} = \{ \lambda x.\text{smoke}(x), \lambda x.\text{dance}(x), \lambda x.\text{smoke}(x) + \lambda x.\text{dance}(x) \ldots \}$

• The part structure of lower pluralities ‘projects’ up to higher pluralities (cf. focus projection / Hamblin sets)

(51)  
\[ \text{feed Carl and Dean} \]
\[ \text{feed}(\text{carl})_{\langle et \rangle} + \text{feed}(\text{dean})_{\langle et \rangle} \]
\]
\[ \text{feed}_{\langle e(\langle et \rangle) \rangle} \quad \text{carl} e + \text{dean} e \]

(52)  
\[ \text{feed and brush Dean} \]
\[ \text{feed}(\text{dean})_{\langle et \rangle} + \text{brush}(\text{dean})_{\langle et \rangle} \]
\]
\[ \text{feed}_{\langle e(\langle et \rangle) \rangle} + \text{brush}_{\langle e(\langle et \rangle) \rangle} \quad \text{dean} e \]
Plural projection (2/2)

- Crucial step: Cumulativity encoded in projection mechanism: Compositional rule

- For this rule to be generalizable – one more level of complexity: Plural sets ([ ])
  For every type \( a \) there is a type \( a^* \) of ‘plural sets’. \( D_{(a,t)} \) and \( D_{a^*} \) are disjoint, but have the same algebraic structure.

\[
D_{e^*} = \{ [ ], [Ada], [Bea], [Ada+Bea], [Ada, Bea], [Ada, Ada+Bea], [Bea, Ada+Bea], [Ada, Bea, Ada+Bea] \}
\]

- Compositional rule \( C \):

\[
(54) \quad \text{feed and brush Carl and Dean}
\]

\[
[\text{feed}(\text{carl}) + \text{brush}(\text{dean}), \text{feed}(\text{dean}) + \text{brush}(\text{carl}), \ldots ]
\]

\[
[\text{feed}_{\langle e(\text{et}) \rangle} + \text{brush}_{\langle e(\text{et}) \rangle}] \quad [\text{carl}_{e} + \text{dean}_{e}]
\]

- Takes two plural sets \( P^*_{(a,b)} \) and \( x^*_{a^*} \), gives us a plural set of type \( b^* \).
- We take all covers of some plurality from \( P^*_{(a,b)} \) and some plurality from \( x^*_{a^*} \).

\[
(55) \quad \{(\text{feed}, \text{dean}), (\text{brush}, \text{carl})\}
\]

- For each cover \( R \), we form the sum of values \( + \{ P(x) \mid (P, x) \in R \} \). (actually more complex)
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- For this rule to be generalizable – one more level of complexity: Plural sets ([ ])
  For every type \( a \) there is a type \( a^* \) of ‘plural sets’. \( (D_{\langle a, t \rangle} \) and \( D_{a^*} \) are disjoint, but have the same algebraic structure.)

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[\text{Ada, Ada}+\text{Bea}], [\text{Bea, Ada}+\text{Bea}], [\text{Ada, Bea, Ada}+\text{Bea}] \}
\]

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\[
\text{feed and brush Carl and Dean}
\]

\[
[\text{feed(carl)+brush(dean), feed(dean)+brush(carl), ... }]
\]

\[
\text{[feed}_{e(\langle e \rangle)}\text{ + brush}_{e(\langle e \rangle)}] \quad \text{[carl}_{e} + \text{dean}_{e}]
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\quad [\text{feed(carl)}+\text{brush(dean)}, \text{feed(dean)}+\text{brush(carl)}, \ldots ]\]

\[
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• Takes two plural sets $P^*_{\langle a, b \rangle}$ and $x^*_{a^*}$, gives us a plural set of type $b^*$.
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\[(55)\quad \{ \langle \text{feed}, \text{dean} \rangle, \langle \text{brush}, \text{carl} \rangle \}\]

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- For this rule to be generalizable – one more level of complexity: Plural sets ([ ])
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- Compositional rule $C$:

\[ \text{(54) feed and brush Carl and Dean} \]
\[ \text{[feed(carl)+brush(dean), feed(dean)+brush(carl), . . .]} \]
\[ \text{[feed}_{e\langle et \rangle} + \text{brush}_{e\langle et \rangle}] \]
\[ \text{[carl}_{e} + \text{dean}_{e}] \]

- Takes two plural sets $P_{(a,b)^*}^*$ and $x_{a^*}$, gives us a plural set of type $b^*$.
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\[ \text{(55) } \{\langle feed, dean\rangle, \langle brush, carl\rangle\} \]

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- For this rule to be generalizable – one more level of complexity: Plural sets ( [ ] )
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- Compositional rule $C$:

\[(54)\quad \text{feed and brush Carl and Dean}
\quad \text{[feed(carl)+brush(dean), feed(dean)+brush(carl), ... ]}
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\[\begin{align*}
\text{[feed}_{e\langle et \rangle}\text{ + brush}_{e\langle et \rangle}] & \quad \text{[carl}_e + \text{dean}_e]
\end{align*}\]

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\[(55)\quad \{\langle \text{feed, dean} \rangle, \langle \text{brush, carl} \rangle\}\]

- For each cover $R$, we form the sum of values $\{P(x) \mid (P, x) \in R\}$. (actually more complex)
We employ some ‘trivial’ type shifts between domains $D_a, D_{a^*}$ that we don’t indicate.

Plural definites and indefinites denote plural sets of type $e^*$

(56) $\llbracket \text{the girls} \rrbracket = [\text{Ada} + \text{Bea}]$

(57) $\llbracket \text{two pets} \rrbracket = [\text{Carl} + \text{Dean}, \text{Carl} + \text{Eric}, \text{Dean} + \text{Eric}]$

The lexical meaning of COORD cross-categorically involves ‘recursive’ sum $\oplus$

(58) $\llbracket \text{Ada and two pets} \rrbracket = [\text{Ada}] \oplus [\text{Carl} + \text{Dean}, \text{Carl} + \text{Eric}, \text{Dean} + \text{Eric}]$

$= [\text{Ada} + \text{Carl} + \text{Dean}, \text{Ada} + \text{Carl} + \text{Eric}, \text{Ada} + \text{Dean} + \text{Eric}]$

(59) $\llbracket \text{smoke and dance} \rrbracket = [\text{smoke} \oplus \text{dance}]$

Truth

A plural set $S$ of propositions is true iff $S$ contains at least one element $p$ such that all atomic parts of $p$ are true.
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(56) $\lbrack \text{the girls} \rbrack = \lbrack \text{Ada+Bea} \rbrack$

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The lexical meaning of COORD cross-categorically involves ‘recursive’ sum $\oplus$

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A plural set $S$ of propositions is true iff $S$ contains at least one element $p$ such that all atomic parts of $p$ are true.
Some denotations

We employ some ‘trivial’ type shifts between domains $D_a$, $D_{a^*}$ that we don’t indicate.

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A plural set $S$ of propositions is true iff $S$ contains at least one element $p$ such that all atomic parts of $p$ are true.
Sample derivation

\[ \text{Ada and Bea} \]

\[ \left[ \text{fed(c)(a)} + \text{fed(d)(b)}, \text{fed(c)(b)} + \text{fed(d)(a)}, \text{fed(c)(a)} + \text{fed(e)(b)}, \right. \\
\left. \quad \text{fed(c)(b)} + \text{fed(e)(a)}, \text{fed(d)(a)} + \text{fed(e)(b)}, \ldots \right] \]

\[ \left[ \text{fed(c)} + \text{fed(d)}, \text{fed(c)} + \text{fed(e)}, \text{fed(d)} + \text{fed(e)} \right] \]

\[ \left[ \text{fed}, \right. \quad \left. \text{c+d, c+e, d+e} \right] \]

\[ \text{two pets} \]
Plural projection

- Semantic plurality ‘projects’ by means of a cross-categorial operation $C$ which also encodes cumulativity.
- This is made possible by assuming pluralities and plural sets of any semantic type.
Plural projection

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- This is made possible by assuming pluralities and plural sets of any semantic type.
Our next step . . .

Give an informal treatment of distributive conjunctions in this type of system
1 Cross-linguistic evidence for a cumulative lexical meaning of COORD

2 An analytical problem

3 Analysis, part 1: Plural projection (informally)

4 Analysis, part 2: Distributive conjunctions and plural projection (informally)

5 Some cross-linguistic predictions
We now sketch a compositional treatment of distributive conjunction structures as in (60).

(60) \[
\text{[[} \mu \text{ Ada} \text{] [COORD} \oplus \text{ [} \mu \text{ Bea } \text{]] [fed two pets]}
\]

It has all the properties we motivated above:

1. COORD is lexically cumulative, expresses plurality-formation
2. COORD expresses plurality-formation across categories
3. Distributive conjunctions distribute w.r.t. lower plural expressions, but show ‘plurality-like’ behavior w.r.t. higher plural expressions
4. ‘Higher-order’ pluralities can ‘reflect’ part-structure of scopally dependent pluralities
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We now sketch a compositional treatment of distributive conjunction structures as in (60).

\[(\mu \text{ Ada} [\text{COORD} \oplus (\mu \text{ Bea} )]) \text{ [fed two pets]}\]

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4. ‘Higher-order’ pluralities can ‘reflect’ part-structure of scopally dependent pluralities
Basic idea (1/2)

- Conjunction particles map individuals to functions that take plural sets of their scope as their argument (this corresponds to our earlier intuition)

\[(61) \quad [\mu \ [Ada]] = [\mu] ([ada]) = \lambda P^*_{(e,t)^*}.C(P^*, [ada])\]

- each conjunct is shifted to a plural set

\[(62) \quad \lambda P^*_{(e,t)^*}.C(P^*, [ada]) \Rightarrow [\lambda P^*_{(e,t)^*}.C(P^*, [ada])]\]

- COORD forms the sum of these elements (cross-categorial sum-formation)

\[(63) \quad [\mu \ Ada [COORD \oplus [\mu \ Bea]]] = [\lambda P^*_{(e,t)^*}.C(P^*, [Ada]) \oplus \lambda P^*_{(e,t)^*}.C(P^*, [Bea])]\]

- Each atom of this plurality takes a plural set as its argument: This blocks the cumulative composition rule from applying and essentially gives us the distributive effect. (Some type-shifts omitted.)

\[(64) \quad [[fed \ two \ pets]] \quad = \quad [fed(c)+fed(d), fed(c)+fed(e), fed(d)+fed(e)]\]

\[(65) \quad C([[[\mu \ Ada] [COORD \oplus [\mu \ Bea]]]] \quad \Rightarrow \quad [fed(c)+fed(d), fed(c)+fed(e), fed(d)+fed(e)])\]

\[\Rightarrow \quad \text{with typeshift} \quad [fed(c)(a)+fed(d)(a)+fed(c)(b)+fed(e)(b),\quad fed(d)(a)+fed(e)(a)+fed(c)(b)+fed(e)(b), \ldots ]\]

- We obtain a plural set of propositional pluralities: Each plurality in this set maps ada to the feeding of two dogs and bea to the feeding of two dogs.
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\[(61) \quad \mu \quad [\text{Ada}] = \mu (\text{ada}) = \lambda P^*_{(e,t)^*} \cdot C(P^*, [\text{ada}])\]

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= \text{with typeshift} \quad [\text{fed(c)(a)+fed(d)(a)+fed(c)(b)+fed(e)(b), fed(d)(a)+fed(e)(a)+fed(c)(b)+fed(e)(b), . . . }]\]

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= \text{with typeshift} \ [\text{fed(c)(a)} + \text{fed(d)(a)} + \text{fed(c)(b)} + \text{fed(e)(b)}, \text{fed(d)(a)} + \text{fed(e)(a)} + \text{fed(c)(b)} + \text{fed(e)(b)}, \ldots]\]

- We obtain a plural set of propositional pluralities: Each plurality in this set maps \text{ada} to the feeding of two dogs and \text{bea} to the feeding of two dogs.
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\[(61) \quad [[\mu \ [\text{Ada}]]] = [[\mu]](\text{[ada]}) = \lambda P^*_{(e,t)} \cdot C(P^*, [\text{ada}])\]

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- We obtain a plural set of propositional pluralities: Each plurality in this set maps ada to the feeding of two dogs and bea to the feeding of two dogs.
Basic idea (1/2)

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\[
\llbracket \mu \ [ \text{Ada} ] \rrbracket = \llbracket \mu \rrbracket ([\text{ada}]) = \lambda P_{(e,t)}^* \cdot C(P^*, [\text{ada}])
\]

- each conjunct is shifted to a plural set

\[
\lambda P_{(e,t)}^* \cdot C(P^*, [\text{ada}]) \Rightarrow \llbracket \lambda P_{(e,t)}^* \cdot C(P^*, [\text{ada}]) \rrbracket
\]

- COORD forms the sum of these elements (cross-categorial sum-formation)

\[
\llbracket [\mu \text{Ada} [\text{COORD} \oplus [\mu \text{Bea}]]] \rrbracket = \llbracket \lambda P_{(e,t)}^* \cdot C(P^*, [\text{Ada}]) \oplus \lambda P_{(e,t)}^* \cdot C(P^*, [\text{Bea}]) \rrbracket
\]

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\[
\llbracket \text{fed two pets} \rrbracket = \llbracket \text{fed(c)+fed(d), fed(c)+fed(e), fed(d)+fed(e)} \rrbracket
\]

\[
C([\llbracket [\mu \text{Ada} [\text{COORD} \oplus [\mu \text{Bea}]]] \rrbracket ) (\llbracket \text{fed(c)+fed(d), fed(c)+fed(e), fed(d)+fed(e)} \rrbracket ) \]

\[
= \text{with type shift} \ [\text{fed(c)}(a)+\text{fed(d)}(a)+\text{fed(c)}(b)+\text{fed(e)}(b), \text{fed(d)}(a)+\text{fed(e)}(a)+\text{fed(c)}(b)+\text{fed(e)}(b), \ldots ]
\]

- We obtain a plural set of propositional pluralities: Each plurality in this set maps ada to the feeding of two dogs and bea to the feeding of two dogs.
Basic idea (2/2)

- While distributive conjunctions are distributive w.r.t. their scope (i.e. lower plural expressions), the output of combining them with their scope is again a plurality.

(66) *Die Ada und die Bea haben sowohl dem Carl als auch dem Dean zwei neue Tricks beigebraucht.*

‘Ada and Bea taught both Carl and Dean two new tricks’

(67) a. [[[μ Carl] COORD [μ Dean]] [taught two new tricks]]
    b. [taught(t1)(c)+taught(t2)(c)+taught(t1)(d)+taught(t2)(d),
       taught(t1)(c)+taught(t2)(c)+taught(t2)(d)+taught(t3)(d), ... ]

- This means we expect cumulative readings w.r.t. higher plural expressions
- And: Combining the distributive conjunction with its scope gives us a set of pluralities that reflect the part-structure of scopally dependent plural expressions.
While distributive conjunctions are distributive w.r.t. their scope (i.e. lower plural expressions), the output of combining them with their scope is again a plurality.

(66) Die Ada und die Bea haben sowohl dem Carl als auch dem Dean zwei neue Tricks beigebracht.
‘Ada and Bea taught both Carl and Dean two new tricks’

(67) a. [[[µ Carl] COORD [µ Dean]] [taught two new tricks]]

   [taught(t1)(c)+taught(t2)(c)+taught(t1)(d)+taught(t2)(d),
   taught(t1)(c)+taught(t2)(c)+taught(t2)(d)+taught(t3)(d), . . . ]

   [µ Carl COORD µ Dean]

   [taught(t1)+taught(t2),
   taught(t1)+taught(t3),
   taught(2)+taught(3)]

   taught two tricks

b. 

   \[\lambda P^*_\langle e,\langle e,t\rangle\rangle^* \cdot \mathcal{C} (P^*, [c]) \oplus \lambda P^*_\langle e,\langle e,t\rangle\rangle^* \cdot \mathcal{C} (P^*, [d])]\]

This means we expect cumulative readings w.r.t. higher plural expressions.

And: Combining the distributive conjunction with its scope gives us a set of pluralities that reflect the part-structure of scopally dependent plural expressions.
Basic idea (2/2)

• While distributive conjunctions are distributive w.r.t. their scope (i.e. lower plural expressions), the output of combining them with their scope is again a plurality.

(66)  Die Ada und die Bea haben sowohl dem Carl als auch dem Dean zwei neue Tricks beigebracht.
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        taught(t1)(c)+taught(t2)(c)+taught(t2)(d)+taught(t3)(d), ...]

b.  [λ P∗(e,(e,t))*. C(P∗,[c]) ⊕ λ P∗(e,(e,t))*. C(P∗,[d])]

[taught(t1)+taught(t2),
 taught(t1)+taught(t3),
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Interim summary

An analysis of distributive conjunctions via plural projection has the properties motivated before:

1. COORD is lexically cumulative, expresses plurality-formation
2. ‘COORD expresses plurality-formation across categories
3. Distributive conjunctions distribute w.r.t. lower plural expressions, but show ‘plurality-like’ behavior w.r.t. higher plural expressions
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Cross-linguistic evidence for a cumulative lexical meaning of COORD

An analytical problem

Analysis, part 1: Plural projection (informally)

Analysis, part 2: Distributive conjunctions and plural projection (informally)

Some cross-linguistic predictions
Our assumptions so far make a number of cross-linguistic predictions (Haslinger et al. 2019). We consider two of them in the following.
Prediction 1: Cross-categorial cumulative COORD

- Since we assume that COORD is cumulative across categories, we expect that ‘simple’ conjunction structures exhibit cumulative readings across languages.

- We know that we find this reading for VP-conjunctions in English and German (Link 1984, Krifka 1990, Schmitt 2013, 2018)

  (68) a. *The three children smoked and danced.*
  b. SCENARIO: C1 smoked. C2 danced. C3 danced.  \[(68\text{-a}) \text{true}\]

- This also seems to be the case in our current Terraling-sample on VP-conjunction (11 languages from 6 language families)

  (69) a. *Tih pet gostiju su pili i pevali i igrali.*
  
  these.GEN five guests.GEN AUX.3PL drink.part-pl.m I sing.PART-PL.M I dance.PART-PL.M
  'These five guests drank, sang and danced.' SerBoCroatian J. Gajić, pc
  b. SCENARIO: G1 and G2 drank. G3 sang. G4 and G5 danced. \[(69\text{-a}) \text{true}\]

- Note, however, that these data are not yet sufficient to show that the meaning of COORD actually involves plurality formation.
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      igrali.
dance.PART-PL.M
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**Prediction 2: Readings of ‘marked’ VP-conjunction**

- If we find the same ‘additional’ markers $\mu$ in individual and VP-conjunction and if we assume that they always make the same semantic contribution, we arrive at a certain prediction concerning structures marked with $\mu$ in VP-conjunction.

- We observed that the ‘distributive’ effect connected to these markers in individual conjunction vanishes w.r.t. higher plural expressions.

- If COORD uniformly expresses plurality-formation and if the markers make the same contribution across the board, then VP-conjunctions with additional markers $\mu$ should not have a distributive effect w.r.t. a plural subject – because the plural subject is a higher plural expression.

- Preliminary results suggest that this prediction could be correct.

(70) a.  

\begin{verbatim}
Tih pet gostiju su i pili i pevali
\end{verbatim}

\begin{verbatim}
these.GEN five guests.GEN AUX.3PL I drink.PART-PL.M I sing.PART-PL.M I
\end{verbatim}

\begin{verbatim}
dance.PART-PL.M
\end{verbatim}

‘These five guests drank and sang and danced.’

b.  


(70-a) true
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(70) a. $Tih$ $pet$ $gostiju$ $su$ $i$ $pili$ $i$ $pevali$ $i$
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igrali.
dance.PART-PL.M
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Summary

1. We considered cross-linguistic evidence for a cumulative lexical meaning of COORD in individual conjunction.

2. We saw that this forces us to derive the meaning of distributive conjunction patterns (like SerBoCroatian $i A i B$) on the basis of a cumulative lexical meaning for COORD.

3. Closer scrutiny of the data suggested that such a treatment requires us to encode the following in our analysis.
   - COORD expresses plurality-formation across categories (all semantic domains contain pluralities)
   - Distributive conjunctions distribute w.r.t. lower plural expressions, but show ‘plurality-like’ behavior w.r.t. higher plural expressions
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4. We considered an account in terms of plural projection that has all the relevant properties

5. We looked at some predictions concerning the behavior of conjunctions of other categories.
We considered cross-linguistic evidence for a **cumulative lexical meaning of COORD** in individual conjunction.

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Paul-Roger Bassong, Enrico Flor, Jovana Gajić, Clemens Mayr, Hilda Koopman, Marcin Wągiel and all the members of our Terraling group.

This research was funded by the Austrian Science Fund (FWF), project P-29240 ‘Conjunction and disjunction from a typological perspective’.


Appendix 1: Languages in sample

**individual conjunction:**
Akan, Basa’a, Baule, Cantonese, Chickasaw, Dagara, Dutch, Estonian, Greek, Hungarian, Igbo, Iraqi Arabic, Italian, Ivorian French, German, Japanese, Korean, Latvian, Nones, Polish, Russian, SerBoCroatian, Sicilian, Tagalog, Turkish, Wuhu Chinese

**VP-conjunction:**
Baule, Dutch Estonian, Cantonese, Iraqi Arabic, Italian, Japanese, Latvian, SerBoCroatian, Sicilian, Tagalog
## Appendix 2: conjunction strategies individuals

<table>
<thead>
<tr>
<th>Coordination of Proper Names</th>
<th>D-only</th>
<th>ND-only</th>
<th>D/ND</th>
<th>ext. Marker needed for D</th>
</tr>
</thead>
<tbody>
<tr>
<td>A, B ne C</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Akan, Twi (Niger-Congo, Kwa))</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>A, B ni C</td>
<td>x</td>
<td>x</td>
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<tr>
<td>(Basaa (Niger-Congo, Bantu))</td>
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<tr>
<td>A, B tung C</td>
<td>x</td>
<td></td>
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<tr>
<td>(Cantonese, Guangzhou (Sino-Tibetan, Chinese))</td>
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<tr>
<td>A, B ni C</td>
<td>x</td>
<td>x</td>
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<tr>
<td>(Dagara (Burkina))</td>
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<tr>
<td>A, B en C</td>
<td>x</td>
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<td></td>
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<tr>
<td>A, B en ook C</td>
<td>x</td>
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<tr>
<td>zowel A, B als ook B</td>
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<tr>
<td>(Dutch (Indo-European, Germanic))</td>
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<tr>
<td>A, B ja C</td>
<td>x</td>
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<tr>
<td>A, B ning C</td>
<td>x</td>
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<tr>
<td>(Estonian (Uralic, Finno-Ugric))</td>
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<tr>
<td>A, B und C</td>
<td>x</td>
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<tr>
<td>sowohl A als auch B als auch C</td>
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<tr>
<td>(German (Indo-European, Germanic))</td>
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<tr>
<td>A, B ce C</td>
<td>x [SV]</td>
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<td>x [SV]</td>
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<tr>
<td>A, B ala ce C</td>
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<tr>
<td>(Greek (Indo-European, Greek))</td>
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<tr>
<td>A o B o C</td>
<td>x</td>
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<tr>
<td>(Iraqi Arabic (Afro-Asiatic, Semitic))</td>
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<tr>
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<td>x</td>
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<td>A, B et puis C</td>
<td>x</td>
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<tr>
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<tr>
<td>A-to B-to C</td>
<td>x</td>
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<tr>
<td>(Japanese (Japonic))</td>
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<tr>
<td>A-wa B-wa C</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Korean (Koreanic))</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
## Appendix 2: conjunction strategies individuals

<table>
<thead>
<tr>
<th>Coordination of Proper Names</th>
<th>D-only</th>
<th>ND-only</th>
<th>D/ND</th>
<th>ext. Marker needed for D</th>
</tr>
</thead>
<tbody>
<tr>
<td>A, B un C</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>(Latvian (Indo-European, Balto-Slavic))</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A, B e C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Nones (Indo-European, Italic))</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>A, B i C</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i A i B i C</td>
<td>x</td>
<td></td>
<td>x [SV]</td>
<td></td>
</tr>
<tr>
<td>(Polish (Indo-European, Balto-Slavic))</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>A (i) B i C</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>i A i B i C</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A, B ali i C</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Serbo-Croatian (Indo-European, Balto-Slavic))</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A, B e C</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>(Sicilian (Indo-European, Italic))</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A, B ve C</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Turkish (Turkic))</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A dA, B dA ve C dA</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>¹</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>A, B ha-you C</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>(Wuhu Chinese (Sino-Tibetan, Chinese))</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>