Nominal coordination and numeral specifiers

Mary Dalrymple

University of Oxford
Nominal coordination

Three readings for *five linguists and philosophers*:
Nominal coordination

Three readings for *five linguists and philosophers*:

- Reading 1: 5 people; each is both a linguist and a philosopher
Nominal coordination

Three readings for *five linguists and philosophers*:

- Reading 1: 5 people; each is both a linguist and a philosopher
- Reading 2: 5 people; some are linguists, some are philosophers
Nominal coordination

Three readings for *five linguists and philosophers*:

- Reading 1: 5 people; each is both a linguist and a philosopher
- Reading 2: 5 people; some are linguists, some are philosophers
- Reading 3: 10 people; 5 linguists, 5 philosophers
Nominal coordination

Three readings for *five linguists and philosophers*:

- **Reading 1**: 5 people; each is both a linguist and a philosopher
- **Reading 2**: 5 people; some are linguists, some are philosophers
- **Reading 3**: 10 people; 5 linguists, 5 philosophers

How to account for all three readings?
More generally, how can we combine meanings of words to form meanings of phrases and sentences?
Semantics: Traditional assumptions

• Compositionality: meaning of a sentence depends on meaning of words and how those meanings are put together; the meaning of the whole depends on the meanings of the parts.
Semantics: Traditional assumptions

- Compositionality: meaning of a sentence depends on meaning of words and how those meanings are put together; the meaning of the whole depends on the meanings of the parts.
- Montague’s view: for each syntactic (phrase structure) rule, there is a corresponding semantic rule.
Montague’s compositionality

- VP → V: meaning of VP = meaning of V
Montague’s compositionality

- **VP** → **V**: meaning of VP = meaning of V
- **NP** → **N**: meaning of NP = meaning of N
Montague’s compositionality

- VP → V: meaning of VP = meaning of V
- NP → N: meaning of NP = meaning of N
- I′ → VP: meaning of I′ = meaning of VP

David yawned
Montague’s compositionality

- **VP** → **V**: meaning of VP = meaning of V
- **NP** → **N**: meaning of NP = meaning of N
- **I’** → **VP**: meaning of I’ = meaning of VP
- **IP** → **NP I’**: meaning of the IP is the result of applying the I’ meaning to the NP meaning
Phrase structure varies from language to language: it’s not a good guide for semantic composition.
Warlpiri

IP

NP

N

kurdu-jarra-rlu

child-dual-erg

NP

I

kapala

pres

S

NP

V

wajilipi-nyi

NP

N

maliki

dog-abs

wita-jarra-rlu

NP

N

small-dual-erg
F-structure for English and Warlpiri

```
PRED 'chase'
  PRED 'children'
   SPEC 'the'
   MODS {'small'
     PRED 'small'
   }
PRED 'dog'
  SPEC 'the'
```
• F-structure is a better basis for semantic composition.
• F-structure is a better basis for semantic composition.
• In that case, we can’t specify meaning instructions in terms of phrase structure rules.
F-structure is a better basis for semantic composition.

In that case, we can’t specify meaning instructions in terms of phrase structure rules.

Actually, we can do BETTER: we can use a formal logic to write instructions for putting together meanings on the basis of f-structure configuration.
Semantics in LFG

Overview: “Glue” theory of semantic composition
Composing meanings via deduction

Meaning assembly and linear logic:
Composing meanings via deduction

Meaning assembly and linear logic:

- Logic of meanings (semantic level): the level of meanings of utterances and phrases
Meaning assembly and linear logic:

- Logic of meanings (semantic level): the level of meanings of utterances and phrases
- Logic for composing meanings (‘glue’ level): the level responsible for assembling the meanings of parts to get the meaning of the whole
Choice of glue language

Klein and Sag (1985, page 172):
Translation rules in Montague semantics have the property that the translation of each component of a complex expression occurs exactly once in the translation of the whole. . . . That is to say, we do not want the set S [of semantic representations of a phrase] to contain all meaningful expressions of IL which can be built up from the elements of S, but only those which use each element exactly once.
Linear logic: a resource logic *without* rules of weakening and contraction.
Linear logic

Linear logic: a resource logic *without* rules of weakening and contraction.

- Weakening: we can include additional hypotheses in forming a conclusion.
Linear logic

Linear logic: a resource logic *without* rules of weakening and contraction.

- **Weakening**: we can include additional hypotheses in forming a conclusion.
- **If it is raining, you might get wet. It is raining. Therefore you might get wet.**
Linear logic

Linear logic: a resource logic *without* rules of weakening and contraction.

- **Weakening**: we can include additional hypotheses in forming a conclusion.
- If it is raining, you might get wet. It is raining. Therefore you might get wet.
- (Also:) If it is raining you might get wet. It is raining. It is Wednesday. Therefore, you might get wet.
Linear logic: a resource logic *without* rules of weakening and contraction.
Linear logic

Linear logic: a resource logic *without* rules of weakening and contraction.

- **Contraction**: a hypothesis can be used any number of times.
Linear logic

Linear logic: a resource logic *without* rules of weakening and contraction.

- Contraction: a hypothesis can be used any number of times.
- If it is raining, you might get wet. If it is raining, you might catch a cold. It is raining. Therefore, you might get wet, and you might catch a cold.
Weakening unwanted:
Bill yawned Fred $\neq$ Bill yawned.
Weakening unwanted:
Bill yawned Fred $\neq$ Bill yawned.

Contraction unwanted:
He thought that would win $\neq$ He thought that he would win.
the red rose $\neq$ the red, red rose
Linear logic connectives

multiplicative conjunction: \(\otimes\)
linear implication: \(\multimap\)

(“and”)
(“implies”)
Linear logic connectives

- multiplicative conjunction: $\otimes$ ("and")
- linear implication: $\multimap$ ("implies")

- INCORRECT: $A \multimap (A \otimes A)$
Linear logic connectives

- multiplicative conjunction: $\otimes$ ("and")
- linear implication: $\multimap$ ("implies")

- INCORRECT: $A \vdash (A \otimes A)$
- INCORRECT: $(A \otimes B) \vdash A$
Linear logic connectives

- Multiplicative conjunction: $\otimes$ ("and")
- Linear implication: $\rightarrow$ ("implies")

- INCORRECT: $A \vdash (A \otimes A)$
- INCORRECT: $(A \otimes B) \vdash A$
- CORRECT: $(A \otimes (A \rightarrow B)) \vdash B$
Linear logic connectives

- multiplicative conjunction: \( \otimes \)
- linear implication: \( \multimap \)

\[ \text{INCORRECT: } A \vdash (A \otimes A) \]
\[ \text{INCORRECT: } (A \otimes B) \vdash A \]
\[ \text{CORRECT: } (A \otimes (A \multimap B)) \vdash B \]
\[ \text{INCORRECT: } (A \otimes (A \multimap B)) \vdash (A \otimes B) \]
An example: Syntax and semantics for “David yawned”
The goal

Meanings of words and how they combine with other meanings are specified logically; meaning composition then proceeds according to rules of logic.
Meaning specifications in the lexicon

\[
\begin{align*}
\text{David} & \quad \text{N} \quad (\uparrow \text{PRED}) = \text{’DAVID’} \\
\text{David} & \quad : \uparrow_\sigma \\
\text{yawned} & \quad \text{V} \quad (\uparrow \text{PRED}) = \text{’YAWN}$$(\text{SUBJ})$$’ \\
\lambda X.\text{yawn}(X) & \quad : \,(\uparrow \text{SUBJ})_\sigma \rightarrow \uparrow_\sigma
\end{align*}
\]
David yawned

\[ \lambda X. \text{yawn}(X) : (\uparrow \text{SUBJ})_\sigma \rightarrow \uparrow_\sigma \]
F-structure solution

\[
\begin{align*}
\lambda X. \text{yawn}(X) &: (y \ \text{SUBJ})_\sigma \rightarrow y_\sigma \\
\text{David} &: d \sigma \\
\text{David} &: d \ PRED \rightarrow \text{DAVID'} \\
yawned &: (y \ \text{PRED}) \rightarrow \text{YAWN} \langle \text{SUBJ} \rangle \\
\text{David} &: d \ PRED \rightarrow \text{DAVID'} \\
\text{NP} &: (y \ \text{SUBJ}) = d \\
\text{IP} \\
\end{align*}
\]
David  \quad David : d_\sigma

yawn  \quad \lambda X. \text{yawn}(X) : d_\sigma \rightarrow y_\sigma
Modus ponens

\[
\begin{align*}
  f_\sigma \\
  f_\sigma \circ g_\sigma \\
  g_\sigma
\end{align*}
\]
Meaning logic

Modus ponens in linear logic corresponds to function application in meaning logic:

\[
\begin{align*}
X & : f_\sigma \\
P & : f_\sigma \circ g_\sigma \\
P(X) & : g_\sigma
\end{align*}
\]
Meaning deduction premises

- *David*: $d_\sigma$

  The meaning *David* is associated with the *SUBJ* semantic structure $d_\sigma$. 
Meaning deduction premises

- \textit{David} : \(d_\sigma\)
  
  The meaning \textit{David} is associated with the \texttt{SUBJ} semantic structure \(d_\sigma\).

- \(\lambda X.\text{yawn}(X) : d_\sigma \rightarrow y_\sigma\)

  On the glue side, if we find a semantic resource for the \texttt{SUBJ} \(d_\sigma\), we consume that resource and produce a semantic resource for the full sentence \(y_\sigma\). On the meaning side, we apply the function \(\lambda X.\text{yawn}(X)\) to the meaning associated with \(d_\sigma\).
\textit{yawn}(David) : y_\sigma

We have produced a semantic structure for the full sentence $y_\sigma$, associated with the meaning $\textit{yawn}(David)$. 
Summary

The glue approach:
The glue approach:

- Exploits the ability of the logic to capture the f-structural syntactic constraints on semantic composition
The glue approach:

• Exploits the ability of the logic to capture the f-structural syntactic constraints on semantic composition

• Enables a flexible interface between syntax and semantics; functional structure differences can correlate with meaning differences, even with the same phrase structure (and vice versa)
Five linguists and philosophers

Syntax and semantics for nominal coordination
Coordination in LFG

A coordinate structure is usually represented as a set, with the conjunct f-structures as members of the set (we will propose an alternative representation later):
Coordination in LFG

Bill and Fred

\[
\begin{align*}
\{ & \begin{array}{c}
\text{PRED} & \text{'BILL'} \\
\text{PRED} & \text{'FRED'}
\end{array} \\
\end{align*}
\]
Three readings for *five linguists and philosophers*:

**Reading 1:** 5 people; each is both a linguist and a philosopher

**Reading 2:** 5 people; some are linguists, some are philosophers

**Reading 3:** 10 people; 5 linguists, 5 philosophers
five linguists and philosophers: 5 people; each is both a linguist and a philosopher

More examples:

Although Palmer’s theory of the physics of colour was mistaken (he held there were three discrete forms of light), it is remarkable that this entrepreneur and tradesman came so close to a modern account of the physiology of colour vision. (BNC)
This was the time for *each wife and mother* to bring her finest and greatest delicacies. (www.rusty1.com/rsbc.history1.htm)

The three women, with their distinctive and symbolic survival suits, will no doubt be greeted by a massive press interest when they arrive in London. “We are simply going to London as *three wives and mothers* who care about the future of the fishing community. ...” (www.peterhead.org.uk/industry_overview/ peterhead_fishing_industry_cod_crusaders220103.htm)
Reading 1

Reading 1 can be obtained through standard Boolean analysis of the contribution of \textit{and} as \( \land \) or intersection (Bergmann 1982, Keenan and Faltz 1985, Winter 2001):

\[
\text{this entrepreneur and tradesman} \equiv \text{this individual who is both an entrepreneur and a tradesman} \equiv \text{this member of the intersection of the set of entrepreneurs and the set of tradesmen}
\]
Reading 1

However, this does not explain why this reading is **semantically constrained**: 
However, this does not explain why this reading is \textit{semantically constrained}:

- the students and women (\(\neq\) the female students)
However, this does not explain why this reading is semantically constrained:

- the students and women (≠ the female students)
- the children and Americans (≠ the American children)
However, this does not explain why this reading is **semantically constrained**: 

- the students and women ($\neq$ the female students) 
- the children and Americans ($\neq$ the American children) 
- the Muslims and doctors ($\neq$ the Muslim doctors)
Reading 1

However, this does not explain why this reading is semantically constrained:

- the students and women \( \neq \) the female students
- the children and Americans \( \neq \) the American children
- the Muslims and doctors \( \neq \) the Muslim doctors

**Claim:** This reading involves *natural coordination.*
Semantics of natural coordination

• “Natural coordination ... implies, among other things, that the parts express semantically closely associated concepts, such as ‘brother and sister’, ‘hands and feet’, ‘eat and drink’, ‘knife and fork’, etc...” (Wälchli 2003, p. 1)
Semantics of natural coordination

- “Natural coordination ... implies, among other things, that the parts express semantically closely associated concepts, such as ‘brother and sister’, ‘hands and feet’, ‘eat and drink’, ‘knife and fork’, etc...” (Wälchli 2003, p. 1)

- *accidental coordination*: “coordination of items which are not expected to co-occur, and which do not have a close semantic relationship” (Wälchli 2003, p. 4)
Different markers of coordination: Udihe (Nikolaeva and Tolskaya 2001)

- bi Sergej zuže
  - I Sergej with
  - ‘I and Sergej’
Syntax of natural coordination

Different markers of coordination: Udihe (Nikolaeva and Tolskaya 2001)

- bi Sergej zuņe
  ‘I and Sergei’

- bi mamasa mule
  ‘I and my wife’
Syntax of natural coordination

Single inflectional marking: Eastern Armenian (Wälchli 2003)

- dproc’-i-s ev usuc’ic’-ner-i-s
  school-DAT-1SG & teacher-PL-DAT-1SG
  ‘for my school and my teachers’
Syntax of natural coordination

Single inflectional marking: Eastern Armenian (Wälchli 2003)

- dproc’-i-s ev usuc’ic’-ner-i-s school-DAT-1SG & teacher-PL-DAT-1SG
  ‘for my school and my teachers’

- al u hac’-d salt & bread-2SG
  ‘your salt and bread (= hospitality)’
Syntax of natural coordination

Lack of determiners: Swiss German (Wälchli 2003)

• Tüt si dr Simon u d Valeri z Bsuech choo today is DEF S. & DEF V. at visit come ‘Today Simon and Valeri came for a visit [they are not partners]’
Syntax of natural coordination

Lack of determiners: Swiss German (Wälchli 2003)

• Tüt si dr Simon u d Valeri z Bsuech choo today is DEF S. & DEF V. at visit come ‘Today Simon and Valeri came for a visit [they are not partners]’

• Tüt si Simon u Valeri z Bsuech choo today is S. & V. at visit come ‘Today Simon and Valeri came for a visit [they are partners]’
Types of natural coordination

Semantically, coordinate structures can exemplify

• Accidental coordination, or
Types of natural coordination

Semantically, coordinate structures can exemplify

- Accidental coordination, or
- Natural coordination, which encompasses:
  - Intrinsic or conventionalized relation between conjuncts, or
  - Contextually established salient relation between conjuncts
**Types of natural coordination**

**Claim** (Dalrymple and Nikolaeva 2006): there is a special functional structure which is reserved for natural coordination, even when there is no difference in phrase structure for accidental and natural coordination. Supported by syntactic data from agreement with conjoined nouns in Finnish and other languages.
Satisfies criteria for natural coordination: “a semantic relation in which two entities are closely related in meaning and form a conceptual unit” (Haspelmath 2004, 2007; Dalrymple and Nikolaeva 2006)
Assume that the contribution of \textit{and} in natural coordination is $\wedge$ or intersection
• Assume that the contribution of *and* in natural coordination is $\wedge$ or intersection

• Also assume that the denotation of plural *linguists* is the set of all sets containing two or more linguists, and similarly for *philosophers* (Winter 2001, Heycock and Zamparelli 2005)
• Assume that the contribution of *and* in natural coordination is $\wedge$ or intersection

• Also assume that the denotation of plural *linguists* is the set of all sets containing two or more linguists, and similarly for *philosophers* (Winter 2001, Heycock and Zamparelli 2005)

• *linguists and philosophers* is the set of sets that are in both *linguists* and *philosophers* (the sets of linguist-philosophers)
Reading 1: Glue analysis

\[c : \begin{array}{l}
\text{CONJ AND} \\
\text{CONJ1} \quad l : [\text{PRED ‘LINGUIST’}] \\
\text{CONJ2} \quad p : [\text{PRED ‘PHILOSOPHER’}] \\
\text{SPEC} \quad [\text{PRED ‘FIVE’}] 
\end{array}\]

\[
\begin{align*}
\text{five} & \quad \lambda R. \lambda S. 5(R, S) : \forall F. [(c_\sigma \text{VAR}) \circ (c_\sigma \text{RESTR})] \\
& \quad \circ [(c_\sigma \circ F_\sigma \circ F_\sigma] \\
\text{and} & \quad \lambda L. \lambda P. \lambda C. L(C) \land P(C) : [l_\sigma \text{VAR}) \circ (l_\sigma \text{RESTR})] \\
& \quad \circ [(p_\sigma \text{VAR}) \circ (p_\sigma \text{RESTR})] \\
& \quad \circ [(c_\sigma \text{VAR}) \circ (c_\sigma \text{RESTR})] \\
\text{linguists} & \quad \lambda L. \text{linguists}(L) : (l_\sigma \text{VAR}) \circ (l_\sigma \text{RESTR}) \\
\text{philosophers} & \quad \lambda P. \text{philosophers}(P) : (p_\sigma \text{VAR}) \circ (p_\sigma \text{RESTR})
\end{align*}
\]


**Reading 1: Glue analysis**

**Premises:**

- **five**
  \[
  \lambda R. \lambda S. 5(R, S) : \forall F. [(c_\sigma \text{VAR}) \rightarrow (c_\sigma \text{RESTR})] \\
  \rightarrow [(c_\sigma \rightarrow F_\sigma) \rightarrow F_\sigma]
  \]

- **and**
  \[
  \lambda L. \lambda P. \lambda C. L(C) \land P(C) : [(l_\sigma \text{VAR}) \rightarrow (l_\sigma \text{RESTR})] \\
  \rightarrow [(p_\sigma \text{VAR}) \rightarrow (p_\sigma \text{RESTR})] \\
  \rightarrow [(c_\sigma \text{VAR}) \rightarrow (c_\sigma \text{RESTR})]
  \]

- **linguists**
  \[
  \lambda L. \text{linguists}(L) : (l_\sigma \text{VAR}) \rightarrow (l_\sigma \text{RESTR})
  \]

- **philosophers**
  \[
  \lambda P. \text{philosophers}(P) : (p_\sigma \text{VAR}) \rightarrow (p_\sigma \text{RESTR})
  \]

**Conclusion:**

\[
\lambda S. 5(\lambda C. \text{linguists}(C) \land \text{philosophers}(C), S) : \forall F. [c_\sigma \rightarrow F_\sigma] \rightarrow F_\sigma
\]
five linguists and philosophers: 5 people; some linguists, some philosophers

More examples:

Five men and women from four states have been elected to serve on the University of Iowa Foundation Board of Directors. At its October meeting, the Foundation’s Board of Directors elected ... [list of five names]
(www.uifoundation.org/news/1999/dec05.shtml)
According to the Congregation for the Cause of Saints in Rome, a total of 1,359 beatifications and canonisations took place during this century alone, more than one a month. (BNC)
Claim: Reading 2 involves accidental coordination, with the number as an attribute of the coordinate structure: specifiers like *five* can be **nondistributive** (but need not be, as shown later by analysis of Reading 3).

\[
C : \left\{ \begin{array}{l}
\text{SPEC} \rightarrow \left[ \begin{array}{c}
\text{PRED} \quad \text{‘FIVE’}
\end{array} \right], \\
\text{CONJ} \quad \text{AND} \\
\left\{ \begin{array}{l}
\text{l} : \left[ \begin{array}{c}
\text{PRED} \quad \text{‘LINGUIST’}
\end{array} \right] \\

\left\{ \begin{array}{l}
\text{p} : \left[ \begin{array}{c}
\text{PRED} \quad \text{‘PHILOSOPHER’}
\end{array} \right]
\end{array} \right\}
\end{array} \right\}
\right\}
\]
Reading 2: Analysis

There does not seem to be an easy way to obtain this reading in a Boolean setting; another meaning for *and* in accidental coordination is required. Assume that there is another “set-product” meaning for *and*, as outlined in Winter’s (2006) discussion and reformulation of Heycock and Zamparelli (2005) (see also Link 1983):

\[ SP(A,B) = \{a \oplus b: a \in A \land b \in B\} \]
SP(A,B) = \{a \oplus b: a \in A \land b \in B\}

- Remember that the denotation of plural *linguists* is the set of all sets of at least 2 linguists, and similarly for philosophers; then \( \oplus \) is then just set union.
SP(A,B) = \{a\oplus b: a \in A \land b \in B\}

- Remember that the denotation of plural *linguists* is the set of all sets of at least 2 linguists, and similarly for philosophers; then \(\oplus\) is then just set union.
- SP(linguists,philosophers) is, then, all sets which contain some linguists and some philosophers,
SP(A,B) = \{a \oplus b: a \in A \land b \in B\}

- Remember that the denotation of plural *linguists* is the set of all sets of at least 2 linguists, and similarly for philosophers; then \oplus is then just set union.
- SP(linguists,philosophers) is, then, all sets which contain some linguists and some philosophers,
- and *five* will pick out the ones with five members.
SP(A,B) = \{a \oplus b: a \in A \land b \in B\}

Advantage (Heycock and Zamparelli 2005): correctly captures the fact that the referent of five linguists and philosophers must be a set containing both linguists and philosophers.
Reading 2: Glue analysis

\[
\begin{align*}
\lambda R. \lambda S. 5(R, S) & : \forall F. [(c_{\sigma} \text{VAR}) \circ (c_{\sigma} \text{RESTR})] \\
& \quad \circ [c_{\sigma} \circ F_{\sigma}] \circ F_{\sigma} \\
\end{align*}
\]

\[
\begin{align*}
\lambda L. \lambda P. \lambda C. C \in SP(L, P) & : [(l_{\sigma} \text{VAR}) \circ (l_{\sigma} \text{RESTR})] \\
& \quad \circ [(p_{\sigma} \text{VAR}) \circ (p_{\sigma} \text{RESTR})] \\
& \quad \circ [(c_{\sigma} \text{VAR}) \circ (c_{\sigma} \text{RESTR})] \\
\end{align*}
\]

\[
\begin{align*}
\lambda L. \text{linguists}(L) & : (l_{\sigma} \text{VAR}) \circ (l_{\sigma} \text{RESTR}) \\
\end{align*}
\]

\[
\begin{align*}
\lambda P. \text{philosophers}(P) & : (p_{\sigma} \text{VAR}) \circ (p_{\sigma} \text{RESTR}) \\
\end{align*}
\]
Reading 2: Glue analysis

Premises, with *five, linguists, philosophers* as above:

- **five**
  \[ \lambda R. \lambda S. 5(R, S) : \forall F. [(c_\sigma \text{VAR}) \circ (c_\sigma \text{RESTR})] \]
  \[ \circ [c_\sigma \circ F_\sigma] \circ F_\sigma \]

- **and**
  \[ \lambda L. \lambda P. \lambda C. C = SP(L, P) : [(l_\sigma \text{VAR}) \circ (l_\sigma \text{RESTR})] \]
  \[ \circ [(p_\sigma \text{VAR}) \circ (p_\sigma \text{RESTR})] \]
  \[ \circ [(c_\sigma \text{VAR}) \circ (c_\sigma \text{RESTR})] \]

- **linguists**
  \[ \lambda L. \text{linguists}(L) : (l_\sigma \text{VAR}) \circ (l_\sigma \text{RESTR}) \]

- **philosophers**
  \[ \lambda P. \text{philosophers}(P) : (p_\sigma \text{VAR}) \circ (p_\sigma \text{RESTR}) \]

**Conclusion:**

\[ \lambda S. 5(\lambda C. C = SP(\text{linguists, philosophers}), S) : \forall F. [c_\sigma \circ F_\sigma] \circ F_\sigma \]
Five men and women, representing the five military services, will learn who becomes the 1995 winners when the U.S. Military Sports Association announces the male and female winners here Jan. 19. In the men’s category, the candidates are ... [list of five names]. Competing for the female athlete of the year are ... [list of five names]. (www.defenselink.mil/news/Jan1996/n01041996_9601043.html)
Employee Teresa Irwin informed the officer that while she was stocking the cooler, she heard someone enter the store. As she came out of the cooler, she spotted two men and women standing at the counter. The two males attempted to make a purchase and while the clerk was distracted, the two female suspects stole fifteen packs of cigarettes.

**Claim**: Reading 3 is available when numerals distribute into each conjunct of a general coordinate structure; numerals as specifiers are **optionally distributive** (can either distribute into a set or not):

\[
\begin{align*}
C & : \{ \text{CONJ AND} \} \\
\{ \begin{align*}
L & : \{ \text{PRED} \quad \text{‘LINGUIST’} \\
\text{SPEC} & : \{ \text{PRED} \quad \text{‘FIVE’} \} \\
\end{align*} \} \\
\{ \begin{align*}
P & : \{ \text{PRED} \quad \text{‘PHILOSOPHER’} \\
\text{SPEC} & : \} \\
\end{align*} \}
\end{align*}
\]
This resembles an ellipsis analysis: the syntactic structure of *five linguists and philosophers* is very close to the structure of *five linguists and five philosophers*, and interpreted similarly. However, a distribution analysis is syntactically more tightly constrained.
Reading 3: Analysis

- Treat the conjuncts *five linguists* and *(five) philosophers* as generalized quantifiers, and
Reading 3: Analysis

- Treat the conjuncts *five linguists* and *(five)* *philosophers* as generalized quantifiers, and
- treat coordination as $\wedge$, to get all the properties that both five linguists and five philosophers have.
Reading 3: Glue analysis

\[ c : \begin{cases} \text{CONJ AND} \\ \begin{cases} l : \begin{cases} \text{PRED 'LINGUIST'} \\ \text{SPEC} \end{cases} \\ \begin{cases} p : \begin{cases} \text{PRED 'PHILOSOPHER'} \\ \text{SPEC} \end{cases} \\ \end{cases} \end{cases} \end{cases} \]

\[
\begin{align*}
\text{five} & \quad \lambda R.\lambda S.5(R, S) : \forall F. [(l_{\sigma} \text{VAR}) \circ (l_{\sigma} \text{RESTR})] \\
& \quad \quad \quad \circ [(c_{\sigma} \circ F_{\sigma}) \circ F_{\sigma}] \\
\text{five} & \quad \lambda R.\lambda S.5(R, S) : \forall F. [(p_{\sigma} \text{VAR}) \circ (p_{\sigma} \text{RESTR})] \\
& \quad \quad \quad \circ [(c_{\sigma} \circ F_{\sigma}) \circ F_{\sigma}] \\
\text{linguists} & \quad \lambda L.\text{linguists}(L) : (l_{\sigma} \text{VAR}) \circ (l_{\sigma} \text{RESTR}) \\
\text{philosophers} & \quad \lambda P.\text{philosophers}(P) : (p_{\sigma} \text{VAR}) \circ (p_{\sigma} \text{RESTR})
\end{align*}
\]

Premises:

five \[ \lambda R. \lambda S. 5(R, S) \] : \[ \forall F. [(l_{\sigma} \text{VAR}) \circ (l_{\sigma} \text{RESTR})] \]
\[ \circ [c_{\sigma} \circ F_{\sigma}] \circ F_{\sigma} \]

five \[ \lambda R. \lambda S. 5(R, S) \] : \[ \forall F. [(p_{\sigma} \text{VAR}) \circ (p_{\sigma} \text{RESTR})] \]
\[ \circ [c_{\sigma} \circ F_{\sigma}] \circ F_{\sigma} \]

linguists \[ \lambda L. \text{linguists}(L) \] : \[ (l_{\sigma} \text{VAR}) \circ (l_{\sigma} \text{RESTR}) \]

philosophers \[ \lambda P. \text{philosophers}(P) \] : \[ (p_{\sigma} \text{VAR}) \circ (p_{\sigma} \text{RESTR}) \]

(Intermediate) conclusion:

five-linguists \[ \lambda S. 5(\text{linguists}, S) \] : \[ [c_{\sigma} \circ F_{\sigma}] \circ F_{\sigma} \]

five-philosophers \[ \lambda S. 5(\text{philosophers}, S) \] : \[ [p_{\sigma} \circ F_{\sigma}] \circ F_{\sigma} \]
Combining five-linguists, five-philosophers, and and:

five-linguists \( \lambda S.5(\text{linguists}, S) : [l_\sigma \circ F_\sigma] \circ F_\sigma \)

five-philosophers \( \lambda S.5(\text{philosophers}, S) : [p_\sigma \circ F_\sigma] \circ F_\sigma \)

and \( \lambda \mathcal{L}.\lambda \mathcal{P}.\lambda C.\mathcal{L}(C) \land \mathcal{P}(C) : [\forall F.[l_\sigma \circ F_\sigma] \circ F_\sigma] \)

\( \quad \circ[\forall F.[p_\sigma \circ F_\sigma] \circ F_\sigma] \)

\( \quad \circ[c_\sigma \circ F_\sigma] \circ F_\sigma \)

Conclusion:

\( \lambda C.5(\text{linguists}, C) \land 5(\text{philosophers}, C) : \forall F.[c_\sigma \circ F_\sigma] \circ F_\sigma \)
Conclusion

Nominal coordination:
Conclusion

Nominal coordination:

- Restrictions on readings in nominal coordination motivate the postulation of two different functional structures for coordination, though there is no difference in phrase structure. This is reinforced by facts from agreement in some languages.
Conclusion

Nominal coordination:

• Restrictions on readings in nominal coordination motivate the postulation of **two different functional structures for coordination**, though there is no difference in phrase structure. This is reinforced by facts from agreement in some languages.

• Numeral specifiers like *five* can be either **distributive or nondistributive**, leading to a difference in interpretation for examples with nominal coordination.