Erasmus Lectures II: The Major Constructions of English Revisited

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1. Functor-Argument Structure and Coordination

1.1 Comparing Three Different Approaches

1.1.1 Basic differences between PSG trees and DBS trees

PSG: many non-terminal nodes, beginning with S
function words are part of the tree
trees defined in terms of dominance and precedence

DBS: no non-terminal nodes
no function words
/ and \ connect functor with argument
| connects modified with modifier
— connects conjunct with conjunct

[1] Thanks to Thomas Proisl for proof-reading, correcting, and help with the graphs.
1.1.2 Kinds of Semantic Relations in Natural Language

<table>
<thead>
<tr>
<th>obligatory</th>
<th>optional</th>
</tr>
</thead>
<tbody>
<tr>
<td>noun−verb</td>
<td>modifier−modified</td>
</tr>
</tbody>
</table>

The interpreted connection in a DBS graph may be summarized as the following combination of two crosses in a square:

1.1.3 Cross of semantic relations in DBS

The diagonal lines show the obligatory valency relation between a noun and a verb, one for the subject, the other
for the oblique cases, including prepositional phrases. The vertical line shows the optional relation between a modified and its modifier, the modified being either a noun (adnominal) or a verb (adverbial). The horizontal line shows the optional coordination relation between two conjuncts.

All three relations occur intrapropositionally and extrapropositionally. The extrapropositional obligatory valency relation between a noun and a verb covers subordinate clauses called subject sentence and object sentence. The extrapropositional optional relation between modifier and modified covers adverbial sentences and adnominal sentences (relative clauses). The extrapropositional optional coordination relation covers the concatenation of propositions.
1.1.4 Intrapropositional functor-argument structure

The dirty old dog snored loudly.

*Constituent Structure Analysis in Phrase Structure Grammar*

*Dependency Analysis in Dependency Grammar*
DBS analysis of *The dirty old dog snored loudly.*

**semantic relations analysis**

*in Database Semantics*

```
adj: dirty &
cat: adn
sem: pos
mdd: dog
nc: old
prn: 23
```

```
adj: old
cat: adn
sem: pos
mdd: 
nc: old
prn: 23
```

```
noun: dog
cat: snp
sem: def sg
mdd: 
fnc: snore
nc: dirty &
prn: 23
```

```
verb: snore
cat: decl
sem: past
arg: dog
mdr: dirty &
prn: 23
```

```
adj: loud
cat: adv
sem: pos
mdd: snore
nc: dirty &
prn: 23
```

```

```
adj: loud
cat: adv
sem: pos
mdd: snore
nc: dirty &
prn: 23
```

Surface order of core values. Cf. NLC’06, Chapt. 6.
1.1.5 Extrapropositional functor-argument structure

That Fido barked amused Mary.

**Constituent Structure Analysis in Phrase Structure Grammar**

**Dependency Analysis in Dependency Grammar**

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DBS analysis of That Fido barked amused Mary.

**Semantic relations**

- **amuse**
- **bark**
- **Mary**
- **Fido**

**Underlying navigation**

- **amuse**
- **bark**
- **Mary**

**Surface realization**

1 2 3 4 5 6

That Fido barked amused Mary.

- **noun: Fido**
  - cat: nm
  - sem: sg
  - fnc: bark
  - prn: 27

- **n/v: that bark**
  - cat: v
  - sem: past
  - arg: Fido
  - fnc: (amuse 28)
  - prn: 27

- **verb: amuse**
  - cat: decl
  - sem: past
  - arg: (bark 27) Mary
  - mdr:
  - prn: 28

- **noun: Mary**
  - cat: nm
  - sem: sg
  - fnc: amuse
  - mdr:
  - prn: 28

(surface order of core values, cf. NLC’06, Sect. 7.2)
1.1.6 Intrapropositional coordination

Tom, Dick, and Harry sing.

**Constituent Structure Analysis**
_in Phrase Structure Grammar_

**Dependency Analysis**
_in Dependency Grammar_

```
S
  NP
   NP
    N
     Tom
    NP
    N
     Dick
   NP
   N
    Cnj
   NP
   N
    Harry
  VP
    V
     sing
```

Tom — Dick — and — Harry
DBS analysis of Tom, Dick, and Harry sing.

**Semantic selections analysis**
*in Database Semantics*

**Underlying navigation**

**Surface realization**

\[
\begin{array}{ccc}
1 & 2 & 3 \\
4 & 5 & 6 \\
\end{array}
\]

Tom Dick and Harry sing.

\[
\text{noun: Tom \& cat: nm \hspace{1cm} noun: Dick cat: nm \hspace{1cm} noun: Harry cat: nm} \\
\text{sem: sg \hspace{1cm} sem: sg \hspace{1cm} sem: sg} \\
\text{fnc: sing \hspace{1cm} fnc: \hspace{1cm} fnc:} \\
\text{nc: Dick \hspace{1cm} nc: Harry \hspace{1cm} nc:} \\
\text{pc: Tom prn: 21 \hspace{1cm} pc: Dick prn: 21 prn: 21} \\
\end{array}
\]

(surface order of core values, cf. NLC’06, Sect. 8.2)
1.1.7 Extrapropositional coordination

Julia sleeps. John sings.

Constituent Structure Analysis in Phrase Structure Grammar

Dependency Analysis in Dependency Grammar

sleeps ——— sings

Julia  John
DBS analysis of *Julia sleeps. John sings.*

**semantic relations analysis**
*in Database Semantics*

```
<table>
<thead>
<tr>
<th>noun: Julia</th>
<th>verb: sleep</th>
</tr>
</thead>
<tbody>
<tr>
<td>cat: nm</td>
<td>cat: decl</td>
</tr>
<tr>
<td>sem: sg</td>
<td>sem: pres</td>
</tr>
<tr>
<td>arg: Julia</td>
<td>arg: John</td>
</tr>
</tbody>
</table>
```

```
<table>
<thead>
<tr>
<th>noun: John</th>
<th>verb: sing</th>
</tr>
</thead>
<tbody>
<tr>
<td>cat: nm</td>
<td>cat: decl</td>
</tr>
<tr>
<td>sem: sg</td>
<td>sem: pres</td>
</tr>
<tr>
<td>pc: (sleep 24)</td>
<td>nc: (sing 25)</td>
</tr>
<tr>
<td>prn: 25</td>
<td>prn: 25</td>
</tr>
</tbody>
</table>
```

(surface order of core values, cf. NLC’06, Sect. 9.2)

**underlying navigation**

```
1  
2  
3
4  
5
```

**surface realization**

```
Julia sleeps__. John sings__.
```
1.2 Intrapropositional Functor-Argument Structure

1.2.1: THREE-PLACE VERB
The man gave the child an apple.
Cf. NLC’06, Sect. 6.2.

1.2.2: ADNOMINAL ADJECTIVES
The little black dog barked.
Cf. NLC’06, 6.3.1 and 6.3.2.

1.2.3: ADVERBIAL ADJECTIVE
Julia has been sleeping deeply.
Cf. NLC’06, 6.3.3 and 6.3.4.
1.2.1 The man gave the child an apple. (three-place verb)

**Semantic relations**

```
  give
  /   \
man  child apple
```

**Underlying navigation**

```
  give
  / | \
1  2  3  4  5  6
man  child apple
```

**Surface realization**

```
The__man gave the__child an__apple .
```

```
noun: apple
cat: snp
sem: indef sg
fnc: give
mdr:
prn: 1

noun: child
cat: snp
sem: def sg
fnc: give
mdr:
prn: 1

verb: give
cat: decl
sem: past
arg: man child apple
mdr:
prn: 1

noun: man
cat: snp
sem: def sg
fnc: give
mdr:
prn: 1
```

(alphabetical order of core values)
1.2.2 The little black dog barked. (adnominal adjectives)

**Semantic relations**

<table>
<thead>
<tr>
<th>bark</th>
<th>dog</th>
<th>little</th>
<th>black</th>
</tr>
</thead>
</table>

**Underlying navigation**

1. bark
2. little
3. black
4. little
5. black
6. dog

The little black dog barked.

**Surface realization**

1 2 3 4–5 6

The **little** **black** **dog** barked.

---

<table>
<thead>
<tr>
<th>verb: bark</th>
<th>adj: black</th>
<th>noun: dog</th>
<th>adj: little &amp;</th>
</tr>
</thead>
<tbody>
<tr>
<td>cat: decl</td>
<td>cat: adn</td>
<td>cat: snp</td>
<td>cat: adn</td>
</tr>
<tr>
<td>sem: past</td>
<td>sem: pos</td>
<td>sem: def sg</td>
<td>sem: pos</td>
</tr>
<tr>
<td>arg: dog</td>
<td>mdd:</td>
<td>fnc: bark</td>
<td>mdd: dog</td>
</tr>
<tr>
<td>mdr:</td>
<td>pc: little</td>
<td>mdr: little &amp;</td>
<td>nc: black</td>
</tr>
<tr>
<td>prn: 2</td>
<td>prn: 2</td>
<td>prn: 2</td>
<td>prn: 2</td>
</tr>
</tbody>
</table>

(alphabetical order of core values)
1.2.3 Julia has been sleeping deeply. (adverbial adjective)

**semantic relations**

```
<table>
<thead>
<tr>
<th>sleep</th>
<th>deep</th>
</tr>
</thead>
<tbody>
<tr>
<td>Julia</td>
<td>deep</td>
</tr>
</tbody>
</table>
```

**underlying navigation**

```
1 2 3 4
```

**surface realization**

```
Julia has been sleeping deeply.
```

```
noun: Julia
cat: nm
sem: sg
fnc: sleep
mdr: 
prn: 3

verb: sleep
cat: decl
sem: pres perf prog
arg: Julia
mdr: deep
prn: 3

adj: deep
cat: adv
sem: pos
mdd: sleep
mdr: 
prn: 3
```
1.3 Extra-Propositional Functor-Argument Structure

1.3.1: Subject sentence
That Fido barked amused Mary.
Cf. NLC’06, Sect. 7.2.

1.3.2: Object sentence
John heard that Fido barked.
cf. NLC’06, Sect. 7.3.

1.3.3: Adnominal sentence, subject gap
The dog which saw Mary barked.
Cf. NLC’06, Sect. 7.4.

1.3.4: Adnominal sentence, object gap
The dog which Mary saw barked.
Cf. NLC’06, Sect. 7.5.

1.3.5: Adverbial sentence
When Fido barked Mary smiled.
Cf. NLC’06, Sect. 7.6.
1.3.1 That Fido barked amused Mary. (subject sentence)

semantic relations

underlying navigation

surface realization

That Fido barked amused Mary.

n/v: that bark
cat: v
sem: past
arg: Fido
fnc: (amuse 28)
prn: 27

noun: Fido
cat: nm
sem: sg
arg: Fido
fnc: bark
prn: 27

verb: amuse
cat: decl
sem: past
arg: (bark 27) Mary
mdr:
prn: 28

noun: Mary
cat: nm
sem: sg
fnc: amuse
mdr:
prn: 28
1.3.2 John heard that Fido barked. (object sentence)

**semantic relations**

```
  hear
  \   /  \
 John \   /  bark
   \ / 
    Fido
```

**underlying navigation**

```
  hear
  \   /  \
 1 \   /  6
   \ /  
    John

  hear
  \   /  \
 2 \   /  3
   \ /  
    bark

  hear
  \   /  \
 4 \   /  5
   \ /  
    Fido
```

**surface realization**

```
[1  2  3  4  5  6]
John heard that Fido barked.
```

**Features**

- **noun: John**
  - cat: nm
  - sem: sg
  - fnc: hear
  - mdr:
  - prn: 30

- **verb: hear**
  - cat: decl
  - sem: past
  - arg: John (bark 31)
  - mdr:
  - prn: 30

- **n/v: that bark**
  - cat: v
  - sem: past
  - arg: Fido
  - fnc: (hear 30)
  - mdr:
  - prn: 31

- **noun: Fido**
  - cat: nm
  - sem: sg
  - fnc: bark
  - mdr:
  - prn: 31

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1.3.3 The dog which saw Mary barked. *(adnominal sentence, subject gap)*

**semantic relations**

- *bark*
- *dog*
- *see*
- *Mary*

**underlying navigation**

```
1  2  3  4−5−6
The__dog  which__saw  Mary  barked__.
```

**surface realization**

<table>
<thead>
<tr>
<th>noun: dog</th>
<th>a/v: see</th>
<th>noun: Mary</th>
<th>verb: bark</th>
</tr>
</thead>
<tbody>
<tr>
<td>cat: snp</td>
<td>cat: v</td>
<td>cat: nm</td>
<td>cat: decl</td>
</tr>
<tr>
<td>sem: def sg</td>
<td>sem: past</td>
<td>sem: sg</td>
<td>sem: past</td>
</tr>
<tr>
<td>fnc: bark</td>
<td>arg: # Mary</td>
<td>fnc: see</td>
<td>arg: dog</td>
</tr>
<tr>
<td>mdr: (see 33)</td>
<td>mdd: (dog 32)</td>
<td>mdr:</td>
<td>mdr:</td>
</tr>
<tr>
<td>prn: 32</td>
<td>prn: 33</td>
<td>prn: 33</td>
<td>prn: 32</td>
</tr>
</tbody>
</table>
1.3.4 The dog which Mary saw barked. *(adnominal sentence, object gap)*

**semantic relations**

```
<table>
<thead>
<tr>
<th>bark</th>
<th>dog</th>
<th>see</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mary</td>
</tr>
</tbody>
</table>
```

**underlying navigation**

```
<table>
<thead>
<tr>
<th>bark</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
```

**surface realization**

```
1 2 3 4 5–6
The__dog which Mary saw barked__.
```

**noun: dog**
- cat: snp
- sem: def sg
- fnc: bark
- mdr: (see 33)
- prn: 32

**noun: Mary**
- cat: nm
- sem: sg
- fnc: see
- mdr:
- prn: 33

**verb: bark**
- cat: decl
- sem: past
- arg: dog
- mdr:
- prn: 32
1.3.5 When Fido barked Mary smiled. (adverbial sentence)

**semantic relations**

<table>
<thead>
<tr>
<th>smile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mary</td>
</tr>
<tr>
<td>bark</td>
</tr>
<tr>
<td>Fido</td>
</tr>
</tbody>
</table>

**underlying navigation**

1. When
2. Fido
3. barked
4. Mary
5. smiled

**surface realization**

When Fido barked Mary smiled.

```
<table>
<thead>
<tr>
<th>a/v: when bark</th>
<th>noun: Fido</th>
<th>noun: Mary</th>
<th>verb: smile</th>
</tr>
</thead>
<tbody>
<tr>
<td>cat: v</td>
<td>cat: nm</td>
<td>cat: nm</td>
<td>cat: decl</td>
</tr>
<tr>
<td>sem: past</td>
<td>sem: sg</td>
<td>sem: sg</td>
<td>sem: past</td>
</tr>
<tr>
<td>arg: Fido</td>
<td>fnc: bark</td>
<td>fnc: smile</td>
<td>arg: Mary</td>
</tr>
<tr>
<td>mdd: (smile 37)</td>
<td>mdr:</td>
<td>mdr:</td>
<td>mdr: (bark 36)</td>
</tr>
<tr>
<td>prn: 36</td>
<td>prn: 36</td>
<td>prn: 37</td>
<td>prn: 37</td>
</tr>
</tbody>
</table>
```
1.4 Intrapropositional Coordination

1.4.1: SIMPLE NOUN COORDINATION, SUBJECT
The man, the woman, and the child slept.
Cf. NLC’06, 8.2.1 and 8.2.2.

1.4.2: SIMPLE NOUN COORDINATION, OBJECT
John bought an apple, a pear, and a peach.
NLC’06, 8.2.4 and 8.2.5.

1.4.3: TWO SIMPLE NOUN COORDINATIONS, SUBJECT OBJECT
The man, the woman, and the child bought an apple, a pear, and a peach.
Cf. NLC’06, 8.2.3.

1.4.4: SIMPLE VERB COORDINATION
John bought, cooked, and ate a pizza.
Cf. NLC’06, 8.3.2 and 8.3.3.

1.4.5: ADNOMINAL COORDINATION
John loves a smart, pretty, rich girl.
Cf. NLC’06, 8.3.4.
1.4.6: ADVERBIAL COORDINATION

John talked slowly, gently, and seriously.

Cf. NLC’06, 8.3.5.
1.4.1 The man, the woman, and the child slept. (simple noun coordination, subject)

**semantic relations**

```
man — woman — child
```

**underlying navigation**

```
1
2
3
4
5
6
```

**surface realization**

```
The__man the__woman and__the__child slept__.
```
1.4.2 John bought an apple, a pear, and a peach. (simple noun coordination, object)

**semantic relations**

```
  buy
  └── John ─── apple ─── pear ─── peach
```

**underlying navigation**

```
buy

John  apple — pear — peach
```

**surface realization**

```
1  2  3  4  5  6–7–8
John bought an__apple a_pear and__a_peach.
```

```
[noun: John] [verb: buy] [noun: apple &]
  cat: nm   cat: decl  cat: snp
  sem: sg   sem: past  sem: indef sg
  fnc: buy  arg: John apple &
  prn: 27
```

```
[noun: pear] [noun: peach]
  cat: snp   cat: snp
  sem: indef sg  sem: indef sg
  fnc:   fnc:
  nc: pear  nc: peach
  pc: apple  pc: pear
  prn: 27  prn: 27
```
1.4.3 The man, the woman, and the child bought an apple, a pear, and a peach.
(two simple noun coordinations, subject object)

**semantic relations**

```
man — woman — child
```

**underlying navigation**

```
man — woman — child
```

**surface realization**

```
The__man__ the_woman__ and_the_child__ bought an_apple__ a_pear__ and_a_peach
```

```
1 2 3 4-5-6 7 8 9 10-11-12
```

```
[noun: man &
cat: snp
sem: def sg
fnc: buy
pc: woman
prn: 14]
```

```
[noun: woman &
cat: snp
sem: def sg
fnc: buy
pc: man
prn: 14]
```

```
[noun: child &
cat: snp
sem: def sg
fnc: buy
pc: woman
prn: 14]
```

```
[verb: buy &
cat: snp
sem: past
fnc: buy
arg: man & apple &
prn: 14]
```

```
[noun: apple &
cat: snp
sem: indef sg
fnc: buy
nc: pear
pc: apple
prn: 14]
```

```
[noun: pear &
cat: snp
sem: indef sg
fnc: buy
nc: peach
pc: pear
prn: 14]
```

```
[noun: peach &
cat: snp
sem: indef sg
fnc: buy
nc: peach
pc: pear
prn: 14]
```

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1.4.4 John bought, cooked, and ate a pizza. *(simple verb coordination)*

**semantic relations**

- buy — cook — eat

**underlying navigation**

```
  1   2   3   4   5−6−7   8
John bought cooked and_ate a_pizza .
```

**surface realization**

```
[ noun: John ]  [ verb: buy & cat: decl ]  [ verb: cook & cat: decl ]  [ verb: eat & cat: decl ]  [ noun: pizza ]
[ cat: nm ]  [ sem: past ]  [ sem: past ]  [ sem: past ]  [ cat: snp ]
[ sem: sg ]  [ arg: John pizza ]  [ arg: past ]  [ arg: past ]  [ sem: indef sg ]
[ fnc: buy & ]  [ arg: John ]  [ nc: cook ]  [ nc: eat ]  [ fnc: buy & ]
[ prn: 15 ]  [ pc: ]  [ pc: buy ]  [ pc: cook ]  [ prn: 15 ]
1.4.5 John loves a smart, pretty, rich girl. (Adnominal coordination)

**Semantic relations**

- John
  - love
    - girl
      - smart — pretty — rich

**Underlying navigation**

- John
  - love
    - girl
      - smart — pretty — rich

**Surface realization**

John loves a smart pretty rich girl.
1.4.6 John talked slowly, gently, and seriously. (Adverbial coordination)

**semantic relations**

- John
- talk
- slow — gentle — serious

**underlying navigation**

- John
- talk
- slow — gentle — serious

**surface realization**

John talked slowly gently and seriously.
1.5 Extrapropositional Coordination

1.5.1: COMBINING INTRA- AND EXTRAPROPOSITIONAL COORDINATION
Sue slept. John bought, cooked, and ate a pizza. Julia sang.
cf. NLC’06, 9.1.2.
1.5.1 Sue slept. John bought, cooked, and ate a pizza. Julia sang.
(combining intra- and extrapropositional coordination)

**semantic relations**

```
sleep —— buy —— cook —— eat —— sing
Sue       John   pizza   Julia
```

**underlying navigation**

```
sleep 3  buy 9  cook 8  eat 12  sing
Sue    John  pizza  Julia
```

**surface realization**

```
1  2  3−4  5  6  7  8−9−10  11  12−13  14
Sue slept. John bought cooked and ate a pizza. Julia sang.
```
2. Intrapropositional Coordination in Extrapropositional FA Structure

2.1 Subject sentence

2.1.1: Noun coordination as the subject of a subject sentence
That the man, the woman, and the child slept surprised Mary.
Cf. NLC’06, 9.3.1 (1).

2.1.2: Verb coordination in a subject sentence
That the man bought, cooked, and ate the pizza surprised Mary.
Cf. NLC’06, 9.3.1 (2).

2.1.3: Noun coordination as the object of a subject sentence
That Bob ate an apple, a pear, and a peach, surprised Mary.
Cf. NLC’06, 9.3.1 (3).
2.1.1 That the man, the woman, and the child slept surprised Mary.
(Noun coordination as the subject of a subject sentence)

**semantic relations**

```
surprise
  sleep
    man — woman — child
```

**underlying navigation**

```
surprise
  sleep
    man — woman — child
```

**surface realization**

```
That the man the woman and the child slept surprised Mary.
```

```
[ n/v: that sleep
  cat: v
  sem: past
  arg: man & fnc: (surprise 9)
  prn: 8 ]

[ noun: man &
  cat: snp
  sem: def sg
  fnc: sleep
  nc: woman
  pc: man
  prn: 8 ]

[ noun: woman
  cat: snp
  sem: def sg
  fnc:
  nc: child
  pc: man
  prn: 8 ]

[ noun: child
  cat: snp
  sem: def sg
  fnc:
  nc:
  pc: woman
  prn: 8 ]

[ verb: surprise
  cat: decl
  sem: past
  arg: (sleep 8) Mary
  prn: 9 ]

[ noun: Mary
  cat: nm
  sem: sg
  fnc: surprise
  prn: 9 ]
```
That the man bought, cooked, and ate the pizza surprised Mary.

(Verb coordination in a subject sentence)
2.1.3 That Bob ate an apple, a pear, and a peach, surprised Mary.
(Noun coordination as the object of a subject sentence)

**semantic relations**

```
<table>
<thead>
<tr>
<th>noun: Bob</th>
<th>cat: nm</th>
<th>sem: past</th>
<th>fnc: eat</th>
<th>prn: 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>apple &amp; pear</td>
<td>snp</td>
<td>indef</td>
<td>eat</td>
<td></td>
</tr>
<tr>
<td>peach</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mary</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

**underlying navigation**

```
That Bob ate an apple, a pear, and a peach, surprised Mary.
```

**surface realization**

```
That Bob ate an apple, a pear, and a peach, surprised Mary.
```
2.2 Object Sentence

2.2.1: Noun coordination as the subject of an object sentence
Mary saw that the man, the woman and the child slept.
Cf. NLC’06, 9.3.2 (1).

2.2.2: Verb coordination in an object sentence
Mary saw that the man bought, cooked, and ate the pizza.
Cf. NLC’06, 9.3.2 (2).

2.2.3: Noun coordination as the object of an object sentence
Mary saw that Bob bought an apple, a pear, and a peach.
Cf. NLC’06, 9.3.2 (3).
2.2.1 Mary saw that the man, the woman and the child slept.
(Noun coordination as the subject of an object sentence)

\[
\text{semantic relations} \\
\text{see} \\
\text{Mary} \quad \text{sleep} \\
\text{man} \quad \text{woman} \quad \text{child}
\]

\[
\text{underlying navigation} \\
\text{see} \\
\text{Mary} \quad \text{sleep} \\
\text{man} \quad \text{woman} \quad \text{child}
\]

\[
\text{surface realization} \\
1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7-8-9 \quad 10 \\
\text{Mary saw that the man the woman and the child slept}
\]

\[
\begin{align*}
\text{noun: Mary} & \quad \text{cat: nm} \\
\text{sem: sg} & \quad \text{fnc: see} \\
\text{prn: 14}
\end{align*}
\]

\[
\begin{align*}
\text{verb: see} & \quad \text{cat: decl} \\
\text{sem: past} & \quad \text{arg: Mary (sleep 15)} \\
\text{prn: 14}
\end{align*}
\]

\[
\begin{align*}
\text{n/v: that sleep} & \quad \text{cat: v} \\
\text{sem: past} & \quad \text{fnc: (see 14)} \\
\text{arg: man &} & \quad \text{prn: 15}
\end{align*}
\]

\[
\begin{align*}
\text{noun: man &} & \quad \text{cat: snp} \\
\text{sem: def sg} & \quad \text{fnc: sleep} \\
\text{nc: woman} & \quad \text{pc: woman} \\
\text{prn: 15}
\end{align*}
\]

\[
\begin{align*}
\text{noun: woman} & \quad \text{cat: snp} \\
\text{sem: def sg} & \quad \text{fnc:} \\
\text{nc: child} & \quad \text{pc: man} \\
\text{prn: 15}
\end{align*}
\]

\[
\begin{align*}
\text{noun: child} & \quad \text{cat: snp} \\
\text{sem: def sg} & \quad \text{fnc:} \\
\text{nc:} & \quad \text{pc: woman} \\
\text{prn: 15}
\end{align*}
\]
2.2.2 Mary saw that the man bought, cooked, and ate the pizza.
(Verb coordination in an object sentence)

**semantic relations**

```
see
Mary
buy — cook — eat
man pizza
```

**underlying navigation**

```
see
Mary
buy — cook — eat
man pizza
```

**surface realization**

1 2 3 4 5 6 7 8–9–10 11–12
Mary saw that the man bought cooked and ate the pizza.

```
[ noun: Mary
cat: nm
sem: sg
fnc: see
prn: 16 ]  
[ verb: see
cat: decl
sem: past
arg: Mary (buy & 17)
prn: 16 ]  
[ noun: man
cat: snp
sem: def sg
fnc: buy &
prn: 17 ]  
[ n/v: that buy &
cat: v
sem: past
arg: man pizza
fnc: (see 16)
nc: cook
pc: eat
prn: 17 ]  
[ verb: cook
cat: v
sem: past
arg: place
nc: eat
pc: buy
prn: 17 ]  
[ verb: eat
cat: v
sem: past
arg: place
nc: eat
pc: cook
prn: 17 ]  
[ noun: pizza
cat: snp
sem: def sg
fnc: buy &
prn: 17 ]
```
2.2.3 Mary saw that Bob bought an apple, a pear, and a peach.
(Noun coordination as the object of an object sentence)

**semantic relations**

```
see
Mary
  --
buy
Bob
  ---
apple — pear — peach
```

**underlying navigation**

```
see
Mary
  --
buy
Bob
  ---
apple — pear — peach
```

**surface realization**

```
Mary saw that Bob bought an apple a pear and a peach.
```

```
[noun: Mary
cat: nm
sem: sg
fnc: see
prn: 18]   [verb: see
cat: decl
sem: past
arg: Mary (buy 19)
prn: 18]   [noun: Bob
cat: nm
sem: sg
fnc: buy
prn: 19]   [n/v: that buy
cat: v
sem: past
arg: Bob apple &
fnc: buy
fnc: (see 18)
prn: 19]   [noun: apple &
cat: snp
sem: indef sg
nc: pear
pc: apple
prn: 19]   [noun: pear
cat: snp
sem: indef sg
nc: peach
pc: pear
prn: 19]   [noun: peach
cat: snp
sem: indef sg
fnc: pc:
prn: 19]
```
2.3 Relative Clause with Subject Gap

2.3.1 Noun coordination as the subject of an adnominal clause with a subject gap

Structurally excluded, cf. NLC’06, 9.3.3 (1).

2.3.2: VERB COORDINATION IN AN ADNOMINAL SENTENCE WITH A SUBJECT GAP
Mary saw the man who bought, cooked, and ate the pizza.
Cf. NLC’06, 9.3.3 (2).

2.3.3: NOUN COORDINATION AS THE OBJECT OF AN ADNOMINAL CLAUSE WITH A SUBJECT GAP
Mary saw the man who bought an apple, a pear, and a peach.
Cf. NLC’06, 9.3.3 (2).
2.3.2 Mary saw the man who bought, cooked, and ate the pizza.  
(Verb coordination in an adnominal sentence with a subject gap)
2.3.3 Mary saw the man who bought an apple, a pear, and a peach.
(Noun coordination as the object of an adnominal clause with a subject gap)

semantic relations

underlying navigation

surface realization

Mary saw the man who bought an apple, a pear, and a peach.
2.4 Relative Clause with Object Gap

2.4.1: Noun coordination as the subject of an adnominal clause with an object gap
Mary saw the pizza which Bob, Jim, and Bill ate.
Cf. NLC’06, 9.3.4 (1).

2.4.2: Verb coordination in an adnominal clause with an object gap
Mary saw the pizza which the man bought, cooked, and ate.
Cf. NLC’06, 9.3.4 (2).

2.4.3 Noun coordination as the object of an adnominal clause with an object gap

   structurally excluded, cf. NLC’06, 9.3.4 (3)
2.4.1 Mary saw the pizza which Bob, Jim, and Bill ate.

(Noun coordination as the subject of an adnominal clause with an object gap)
2.4.2 Mary saw the pizza which the man bought, cooked, and ate.  

(Verb coordination in an adnominal clause with an object gap)

*semantic relations*

```
see  
Mary  pizza  
     buy — cook — eat  
     man
```

*underlying navigation*

```
see  
Mary  pizza  
     buy — cook — eat  
     man
```

*surface realization*

```
Mary saw the_pizza which the_man bought cooked and_ate .
```

```
[noun: Mary] [verb: see] [noun: pizza] [noun: man] [a/v: buy &
cat: nm cat: decl cat: snp cat: v
cat: def sg cat: past arg: man #
cat: see mdd: (pizza 26)
cat: def sg mdr: (buy 27)
cat: see
fnc: see
fnc: buy &
prn: 26 prn: 26 prn: 27]
```

```
[verb: buy &
cat: v
sem: past
arg: man #
mdd: (pizza 26)
nc: cook
pc:
prn: 27]
```

```
[verb: eat
cat: v
sem: past
arg:
nc:
pc: cook
prn: 27]
```

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2.5 Adverbial Clause

2.5.1: Noun Coordination as the Subject of an Adverbial Sentence
Mary arrived after Bob, Jim, and Bill had eaten a pizza.
Cf. NLC’06, 9.3.5 (1).

2.5.2: Verb Coordination in an Adverbial Sentence
After Bob had bought, cooked, and eaten the pizza, Mary arrived.
Cf. NLC’06, 9.3.5 (2).

2.5.3: Noun Coordination as the Object of an Adverbial Sentence
Mary arrived after Bob had eaten an apple, a pear, and a peach.
Cf. NLC’06, 9.3.5 (3).
2.5.1 Mary arrived after Bob, Jim, and Bill had eaten a pizza.

(Noun coordination as the subject of an adverbial sentence)

**semantic relations**

arrive

<table>
<thead>
<tr>
<th>eat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mary</td>
</tr>
<tr>
<td>pizza</td>
</tr>
</tbody>
</table>

| Bob — Jim — Bill |

**underlying navigation**

arrive

<table>
<thead>
<tr>
<th>eat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mary</td>
</tr>
<tr>
<td>pizza</td>
</tr>
</tbody>
</table>

| Bob — Jim — Bill |

**surface realization**

Mary arrived after Bob, Jim, and Bill had eaten a pizza.
2.5.2 After Bob had bought, cooked, and eaten the pizza, Mary arrived.

(Verb coordination in an adverbial sentence)

**semantic relations**

```
<table>
<thead>
<tr>
<th>arrive</th>
</tr>
</thead>
<tbody>
<tr>
<td>buy — cook — eat</td>
</tr>
</tbody>
</table>
```

**underlying navigation**

```
<table>
<thead>
<tr>
<th>arrive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mary</td>
</tr>
</tbody>
</table>

| Bob        |
| pizza      |

<table>
<thead>
<tr>
<th>Bob</th>
<th>pizza</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mary</th>
<th>buy</th>
<th>cook</th>
<th>eat</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>4</td>
<td>7</td>
<td>9</td>
</tr>
</tbody>
</table>

**surface realization**

```
After Bob had bought, cooked and eaten the pizza, Mary arrived.
```

```
[noun: Bob] [cat: nm] [sem: sg] [fnc: buy &] [prn: 30]
[verb: cook] [cat: v] [sem: past perf] [arg: Bob pizza] [mdd: (arrive 31)]
[nc: eat] [pc: buy] [prn: 30]

[noun: pizza] [cat: snp] [sem: def sg] [fnc: buy &] [prn: 30]
[verb: arrive] [cat: decl] [sem: past] [arg: Mary] [mdr: (buy 30)] [prn: 31]
```
2.5.3 Mary arrived after Bob had eaten an apple, a pear, and a peach.
(Noun coordination as the object of an adverbial sentence)

**semantic relations**

```
<table>
<thead>
<tr>
<th>arrive</th>
<th>eat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mary</td>
<td></td>
</tr>
<tr>
<td>Bob</td>
<td>apple—pear—peach</td>
</tr>
</tbody>
</table>
```

**underlying navigation**

```
arrive

Mary

Bob

apple — pear — peach

1 2 3 4 5 6 7 8
```

**surface realization**

```
Mary arrived after Bob had eaten an apple, a pear, and a peach.
```
3. Coordination and Gapping

3.1 Gapping in Main Clause

3.1.1: Verb object coordination, subject gapping
Bob ate an apple, walked the dog, and read the paper.
Cf. NLC’06, 8.4.1, 8.4.5.

3.1.2: Corresponding simple verb and object coordinations – hypothetical
Bob ate, walked, and read the apple, the dog, and the paper.
Cf. NLC’06, 8.4.4.

3.1.3: Subject object coordination, verb gapping
Bob ate an apple, Jim a pear, and Bill a peach.
Cf. NLC’06, 8.5.1, 8.5.4.

3.1.4: Subject verb coordination, object gapping
Bob bought, Jim pealed, and Bill ate a peach.
Cf. NLC’06, 8.6.1, 8.6.4.
3.1.1 Bob ate an apple, walked the dog, and read the paper.

(Verb object coordination, subject gapping)

**semantic relations**

- **eat**
- **walk**
- **read**

- **Bob**
- **apple**
- **dog**
- **paper**

**underlying navigation**

- **eat**
- **walk**
- **read**

- **1**
- **2**
- **3**
- **4-5**
- **6**
- **7-8**
- **9**
- **10-11-12**

**surface realization**

1. Bob ate an apple walked the dog and read the paper.
3.1.2 Bob ate, walked, and read the apple, the dog, and the paper.  
(corresponding simple verb and object coordinations – hypothetical)

**semantic relations**

```
Bob —— eat —— walk —— read —— Bob
apple —— dog —— paper
```

**underlying navigation**

```
1. Bob
2. eat
3. walk
4. read
5. apple
6. dog
7. paper
```

**surface realization**

Bob ate walked and_read the_apple the_dog and_the_paper.

```
[noun: Bob]
  cat: nm
  sem: sg
  fnc: eat &
  prn: 7

[verb: eat &]
  cat: decl
  sem: past
  arg: Bob apple &
  pc: walk
  nc: read
  prn: 7

[verb: walk]
  cat: decl
  sem: past
  arg: Bob apple &
  pc: walk
  nc: read
  prn: 7

[verb: read]
  cat: decl
  sem: past
  arg: Bob apple &
  pc: walk
  nc: read
  prn: 7

[noun: apple &]
  cat: snp
  sem: def sg
  fnc: eat &
  prn: 7

[noun: dog]
  cat: snp
  sem: def sg
  fnc: apple
  prn: 7

[noun: paper]
  cat: snp
  sem: def sg
  prn: dog
  prn: 7
```

A meaningful example of the same structure is Bob bought, peeled, and ate an apple, a pear, and a peach.
3.1.3 Bob ate an apple, Jim a pear, and Bill a peach.

**Subject object coordination – verb gapping**

**semantic relations**

<table>
<thead>
<tr>
<th>eat</th>
<th>eat</th>
<th>eat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bob</td>
<td>Jim</td>
<td>Bill</td>
</tr>
<tr>
<td>apple</td>
<td>pear</td>
<td>peach</td>
</tr>
</tbody>
</table>

**underlying navigation**

<table>
<thead>
<tr>
<th>eat</th>
<th>eat</th>
<th>eat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bob</td>
<td>Jim</td>
<td>Bill</td>
</tr>
<tr>
<td>apple</td>
<td>pear</td>
<td>peach</td>
</tr>
</tbody>
</table>

**surface realization**

1 2 3 4−1−5 6−2−3−7 8−4−1−5−9 10−6−2−3−7−11 12−8−4

Bob ate an_apple Jim a_pear and Bill a_peach.
3.1.4 Bob bought, Jim peeled, and Bill ate a peach.

Subject verb coordination, object gapping

semantic relations

subject: Bob
verb: buy
object: peach

subject: Jim
verb: peel

subject: Bill
verb: eat

underlying navigation

subject: Bob
verb: buy
object: peach

subject: Jim
verb: peel

subject: Bill
verb: eat

surface realization

Bob bought, Jim peeled, and Bill ate a peach.
3.2 Subject Sentence

3.2.1: Verb–Object Coordination (Subject Gapping) in a Subject Sentence
That Bob ate an apple, walked the dog, and read a paper, amused Mary.
Cf. NLC’06, 9.4.1 (1).

3.2.2: Subject–Object Coordination (Verb Gapping) in a Subject Sentence
That Bob ate an apple, Jim a pear, and Bill a peach, amused Mary.
Cf. NLC’06, 9.4.1 (2).

3.2.3: Subject–Verb Coordination (Object Gapping) in a Subject Sentence
That Bob bought, Jim peeled, and Bill ate the peach, amused Mary.
Cf. NLC’06, 9.4.1 (3).
3.2.1 That Bob ate an apple, walked the dog, and read a paper, amused Mary.
(Verb–object coordination (subject gapping) in a subject sentence)

**semantic relations**

```
  amuse
    Mary

eat  walk  read
Bob  apple  dog  paper
```

**underlying navigation and surface realization**

```

amuse

1  15  16
14
Mary

eat  walk  read
13  12  9
11  10

Bob  apple  dog  paper
```

**surface realization**

```
That Bob ate an apple walked the dog and read the paper amused Mary.
```

```
[verb: walk cat: v sem: past arg: # dog fnc: read prn: 29]
[verb: read cat: v sem: past arg: # paper fnc: read prn: 29]

[noun: dog cat: snp sem: def sg fnc: walk prn: 29]
[noun: Mary cat: nm sem: sg fnc: amuse prn: 30]
```
3.2.2 That Bob ate an apple, Jim a pear, and Bill a peach, amused Mary.

(Subject–object coordination (verb gapping) in a subject sentence)
3.2.3 That Bob bought, Jim peeled, and Bill ate the peach, amused Mary.

(Subject–verb coordination (object gapping) in a subject sentence)
3.3 Object Sentence

3.3.1: **Verb–Object Coordination (Subject Gapping) in an Object Sentence**
Mary saw that Bob ate an apple, walked his dog, and read a paper.
Cf. NLC’06, 9.4.2 (1).

3.3.2: **Subject–Object Coordination (Verb Gapping) in an Object Sentence**
Mary saw that Bob ate an apple, Jim a pear, and Bill a peach.
Cf. NLC’06, 9.4.2 (2).

3.3.3: **Subject–Verb Coordination (Object Gapping) in an Object Sentence**
Mary saw that Bob bought, Jim peeled, and Bill ate the peach.
Cf. NLC’06, 9.4.2 (3).
3.3.1 Mary saw that Bob ate an apple, walked his dog, and read a paper.

(Verb–object coordination (subject gapping) in an object sentence)

**semantic relations**

Mary -> see

Bob -> eat

walk

dog

read

**underlying navigation**

Mary -> see

Bob -> eat

walk

dog

read

**surface realization**

1 2 3 4 5 6 7–8 9 10–11 12 13–14–15–16

Mary saw that Bob ate an__apple walked his__dog and__read the__paper.
3.3.2 Mary saw that Bob ate an apple, Jim a pear, and Bill a peach.
(Subject–object coordination (verb gapping) in an object sentence)

**semantic relations**

```
see

Mary  eat

Bob  apple

Jim  pear

Bill  peach
```

**underlying navigation**

```
see

Mary  eat

Bob  apple

Jim  pear

Bill  peach
```

**surface realization**

```
1

Mary saw that Bob ate an apple, Jim a pear, and Bill a peach.
```

**Treebank representation**

```
see

Mary:
  [noun: Mary]
  [cat: nm]
  [sem: sg]
  [fnc: see]
  [prn: 36]

eat

Bob:
  [noun: Bob & cat: nm]
  [sem: sg]
  [fnc: eat & arg: Mary eat & 37]
  [pc: 37]
  [prn: 37]

apple:
  [noun: apple & cat: snp]
  [sem: indef sg]
  [fnc: see & arg: Bob & apple & 36]
  [pc: 37]
  [prn: 37]

Jim:
  [noun: Jim]
  [cat: nm]
  [sem: sg]
  [fnc: eat]
  [arg: Bob & apple]
  [pc: Bob]
  [prn: 37]

pear:
  [noun: pear]
  [cat: snp]
  [sem: indef sg]
  [fnc: #]
  [nc: Bill]
  [pc: apple]
  [prn: 37]

Bill:
  [noun: Bill]
  [cat: nm]
  [sem: sg]
  [fnc: #]
  [nc: pc: Jim]
  [pc: pear]
  [prn: 37]

peach:
  [noun: peach]
  [cat: snp]
  [sem: indef sg]
  [fnc: #]
  [nc: pc: pear]
  [prn: 37]
```

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3.3.3 Mary saw that Bob bought, Jim peeled, and Bill ate the peach.

*(Subject–verb coordination (object gapping) in an object sentence)*

**semantic relations**

```
see

Mary --- buy --- peel --- eat

Bob peach Jim Bill
```

**underlying navigation**

```
see

Mary --- buy --- peel --- eat

Bob peach Jim Bill
```

**surface realization**

```
Mary saw that Bob bought, Jim peeled, and Bill ate the peach.
```

```
[noun: Mary]
cat: nm
sem: sg
fnc: see
prn: 38

[verb: see]
cat: decl
sem: past
arg: Mary
fnc: buy & see
prn: 39

[noun: Bob]
cat: nm
sem: sg
fnc: buy & see
prn: 39

[n/v: that buy & see]
cat: v
sem: past
arg: Bob peach
fnc: see 38
nc: peel
pc:
prn: 39

[noun: Jim]
cat: nm
sem: sg
fnc: peel
prn: 39

[verb: peel]
cat: v
sem: past
arg: Jim #
nc: eat
pc: buy
prn: 39

[noun: Bill]
cat: nm
sem: sg
fnc: eat
nc: pc: peel
prn: 39

[verb: eat]
cat: v
sem: past
arg: Bill #
nc: pc: peel
prn: 39

[noun: peach]
cat: snp
sem: def sg
fnc: buy & pee
prn: 39
```
3.4 Relative Clause

3.4.1: Verb–object coordination (subject gapping) in adnominal sentence with subject gap
The man who ate an apple, walked his dog, and read a paper loves Mary.
Cf. NLC’06, 9.4.3 (1).

3.4.2 Subject–object coordination (verb gapping) in an adnominal sentence with subject gap
   structurally excluded! Cf. NLC’06, 9.4.3 (2).

3.4.3 Subject–verb coordination (object gapping) in an adnominal sentence with subject gap
   structurally excluded! Cf. NLC’06, 9.4.3 (3).

3.4.4 Verb–object coordination (subject gapping) in a adnominal sentence with object gap
   structurally excluded! Cf. NLC’06, 9.4.4 (1).

3.4.5 Subject–object coordination (verb gapping) in an adnominal sentence with object gap
   structurally excluded! Cf. NLC’06, 9.4.4 (2).

3.4.6: Subject–verb coordination (object gapping) in adnominal sentence with object gap
Mary saw the peach which Bob bought, Jim peeled, and Bill ate.
Cf. NLC’06, 9.4.4 (3).
3.4.1 The man who ate an apple, walked his dog, and read a paper loves Mary.

(Verb–object coordination (subject gapping) in an adnominal sentence with subject gap)
3.4.6 Mary saw the peach which Bob bought, Jim peeled, and Bill ate.  
(Subject–verb coordination (object gapping) in an adnominal sentence with object gap)
3.5 Adverbial Clause

3.5.1: Verb–object coordination (subject gapping) in an adverbial sentence
Mary arrived after Bob had eaten an apple, walked his dog, and read a paper.
Cf. NLC’06, 9.4.5 (1).

3.5.2: Subject–object coordination (verb gapping) in an adverbial sentence
After Bob had eaten an apple, Jim a pear, and Bill a peach, Mary arrived.
Cf. NLC’06, 9.4.5 (2).

3.5.3: Subject–verb coordination (object gapping) in an adverbial sentence
Mary arrived after Bob had bought, Jim had peeled, and Bill had eaten the peach.
Cf. NLC’06, 9.4.5 (3).
3.5.1 Mary arrived after Bob had eaten an apple, walked his dog, and read a paper.

(Verb–object coordination (subject gapping) in an adverbial sentence)

**semantic relations**

```
arrive

Mary

eat       walk       read

Bob       apple      dog       paper
```

**underlying navigation**

```
arrive

Mary

eat       walk       read

Bob       apple      dog       paper
```

**surface realization**

Mary arrived after Bob had eaten an apple, walked his dog and read a paper.
3.5.2 After Bob had eaten an apple, Jim a pear, and Bill a peach, Mary arrived.

(Subject–object coordination (verb gapping) in an adverbial sentence)
3.5.3 Mary arrived after Bob had bought, Jim had peeled, and Bill had eaten the peach.

(Subject–verb coordination (object gapping) in an adverbial sentence)

**semantic relations**

```
arrive

Mary

buy

Bob

peel

Jim

eat

Bill
```

**underlying navigation**

```
arrive

Mary

buy

Bob

peel

Jim

eat

Bill
```

**surface realization**

```
Mary arrived after Bob had bought, Jim had peeled, and Bill had eaten the peach.
```
Reference