Overview

- What we’re trying to do
- The pieces of our grammar
- Two extended examples
- Reflection on what we’ve done, what we still have to do
- Reading questions
What We’re Trying To Do

- Objectives
  - Develop a theory of knowledge of language
  - Represent linguistic information explicitly enough to distinguish well-formed from ill-formed expressions
  - Be parsimonious, capturing linguistically significant generalizations.

- Why Formalize?
  - To formulate testable predictions
  - To check for consistency
  - To make it possible to get a computer to do it for us
How We Construct Sentences

- The Components of Our Grammar
  - Grammar rules
  - Lexical entries
  - Principles
  - Type hierarchy (very preliminary, so far)
  - Initial symbol (S, for now)
- We combine constraints from these components.
- Q: What says we have to combine them?
An Example

A cat slept.

• Can we build this with our tools?

• Given the constraints our grammar puts on well-formed sentences, is this one?
Lexical Entry for *a*

- Is this a fully specified description?
- What features are unspecified?
- How many word structures can this entry license?
Lexical Entry for *cat*

- Which feature paths are abbreviated?
- Is this a fully specified description?
- What features are unspecified?
- How many word structures can this entry license?
Effect of Principles: the SHAC

\[
\begin{array}{c}
\text{word} \\
\text{SYN} \\
\langle \text{cat} \rangle, \\
\text{VAL} \\
\text{SEM} \\
\end{array}
\]

\[
\begin{array}{c}
\text{word} \\
\text{HEAD} \\
\text{AGR} \\
\text{D} \\
\text{SPR} \\
\text{COMPS} \\
\text{MODE} \\
\text{INDEX} \\
\text{RESTR} \\
\end{array}
\]

\[
\begin{array}{c}
\text{noun} \\
\text{AGR} \[3\text{sing}\] \\
\text{GEND} \text{neut} \\
\text{AGR} \[2\text{COUNT + INDEX} \{k\}] \\
\text{AGR} \[2\text{INDEX} k\] \\
\text{RELN} \{\text{cat}\} \\
\text{INSTANCE} \{k\} \\
\end{array}
\]
Description of Word Structures for *cat*

```
\[
\text{word} \|
\begin{array}{|c|}
\hline
\text{HEAD} \\
\text{AGR \ 2} \\
\hline
\end{array} \\
\begin{array}{|c|}
\hline
\text{noun} \\
3\text{sing} \\
\text{GEND neut} \\
\hline
\end{array} \\
\begin{array}{|c|}
\hline
\text{SEM} \\
\text{MODE \ ref} \\
\text{INDEX \ } k \\
\hline
\end{array} \\
\begin{array}{|c|}
\hline
\text{RESTR} \\
\text{RELN \ cat} \\
\text{INSTANCE \ } k \\
\hline
\end{array} \\
\begin{array}{|c|}
\hline
\text{VAL} \\
\text{D} \\
\text{SPR} \\
\begin{array}{|c|}
\hline
\text{AGR \ 2} \\
\text{COUNT \ +} \\
\text{INDEX \ } k \\
\hline
\end{array} \\
\text{COMPS \ } \langle \rangle \\
\text{MOD \ } \langle \rangle \\
\hline
\end{array} \\
\begin{array}{|c|}
\hline
\text{SYN} \\
\text{cat} \\
\hline
\end{array}
\]
```
Description of Word Structures for $a$

\[
\begin{align*}
\text{word} & = \begin{bmatrix}
\text{SYN} & \begin{bmatrix}
\text{HEAD} & \begin{bmatrix}
\text{det} & \begin{bmatrix}
\text{AGR} & 3\text{sing} \\
\text{COUNT} & + \\
\text{COMPS} & \langle \rangle \\
\text{SPR} & \langle \rangle \\
\text{MOD} & \langle \rangle
\end{bmatrix}
\end{bmatrix}
\end{bmatrix}
\end{align*}
\]

\[
\begin{align*}
\text{SEM} & = \begin{bmatrix}
\text{MODE} & \text{none} \\
\text{INDEX} & j \\
\text{RESTR} & \langle \begin{bmatrix}
\text{RELN} & a \\
\text{BV} & j
\end{bmatrix}\rangle
\end{bmatrix}
\end{align*}
\]

\[a\]
Building a Phrase

[ ]

[ ]
[ ]
Constraints Contributed by Daughter Subtrees

\[
\begin{align*}
\text{word} & \quad \text{SYN} \quad \text{VAL} \quad \text{SEM} \\
\text{HEAD} & \quad [\text{det} \quad \text{AGR} \quad \text{3sing}] \\
\text{COMPS} & \quad [\langle \rangle] \\
\text{SPR} & \quad [\langle \rangle] \\
\text{MOD} & \quad [\langle \rangle] \\
\text{MODE} & \quad \text{none} \\
\text{INDEX} & \quad j \\
\text{RESTR} & \quad [\text{RELN} \ a \ BV \ j] \\
\text{noun} & \quad \text{SYN} \quad \text{VAL} \quad \text{SEM} \\
\text{AGR} & \quad [\text{3sing}] \\
\text{GEND} & \quad \text{neut} \\
\text{D} & \quad \text{SPR} \quad [\text{AGR} \quad \text{COUNT} + \text{INDEX} \ k] \\
\text{COMPS} & \quad [\langle \rangle] \\
\text{MOD} & \quad [\langle \rangle] \\
\text{MODE} & \quad \text{ref} \\
\text{INDEX} & \quad k \\
\text{RESTR} & \quad [\text{RELN} \ cat \ INSTANCE \ k]
\end{align*}
\]
Constraints Contributed by the Grammar Rule
Constraints Contributed by the Grammar Rule

```
phrase
[ SYN [ VAL [ SPR ⟨⟩]]]
```

```
word

[ det
  HEAD
  AGR [ 3sing
        GEND neut]
  COUNT +
  COMPS ⟨⟩
  SPR ⟨⟩
  MOD ⟨⟩]

VAL

SEM

INDEX 7

MODE none

INDEX k

RESTR ⟨RELN a BV k⟩

```

```
word

[ noun
  HEAD
  AGR [ 3sing
        GEND neut]

VAL

SEM

INDEX 7D

SPR ⟨COUNT +⟩

INDEX k

COMPS ⟨⟩

MOD ⟨⟩

MODE ref

INDEX k

RESTR ⟨RELN INSTANCE k⟩
```
Constraints Contributed by the Grammar Rule

```
[phrase
  [SYN [VAL [SPR ⟨⟩]]]]
```

```
[word
  [det [3sing GEND neut]]
  [HEAD [AGR [COUNT +]]]
  [VAL [COMPS ⟨⟩ [SPR ⟨⟩ [MOD ⟨⟩]]]]
  [SEM [MODE none INDEX k [RESTR ⟨[RELN a BV k]⟩]]]]
```

```
[word
  [noun [3sing GEND neut]]
  [HEAD [AGR [COUNT +]]]
  [VAL [SPR ⟨⟩ [INDEX k COMPS ⟨⟩ [MOD ⟨⟩]]]]
  [SEM [MODE ref INDEX k [RESTR ⟨[RELN INSTANCE k]⟩]]]
```

```
[7]
```
Constraints Contributed by the Grammar Rule

[phrase
  SYN [ VAL [ SPR ⟨⟩]]]
Constraints Contributed by the Grammar Rule

phrase
SYN [ VAL [ SPR ⟨⟩]]

word
SYN
PHR
VAL
SEM

head
AGR
COUNT +
COMPS ⟨⟩
SPR ⟨⟩
MOD ⟨⟩

MODE none
INDEX k
RESTR ⟨RELN a BV k⟩

word
SYN
noun
HEAD
AGR
GEND neut
3sing

COUNT +

INDEX k
COMPS ⟨⟩
MOD ⟨⟩

MODE ref
INDEX k
RESTR ⟨RELN INSTANCE k⟩

word
SYN
noun
HEAD
AGR
GEND neut
3sing
COUNT +

INDEX k
COMPS ⟨⟩
MOD ⟨⟩

MODE ref
INDEX k
RESTR ⟨RELN INSTANCE k⟩
Constraints Contributed by the Grammar Rule
Constraints Contributed by the Grammar Rule

\[
\text{phrase} \quad \text{SYN} \quad \text{VAL} \quad \text{SPR} \langle \rangle
\]

\[
\text{word} \quad \text{SYN} \quad \text{VAL} \quad \text{SEM}
\]

\[
\text{word} \quad \text{HEAD} \quad \text{AGR} \quad \text{COUNT} + \quad \text{COMPS} \langle \rangle \quad \text{SPR} \langle \rangle \quad \text{MOD} \langle \rangle
\]

\[
\text{word} \quad \text{noun} \quad \text{AGR} \quad \text{3sing} \quad \text{GEND} \quad \text{neut}
\]

\[
\text{word} \quad \text{HEAD} \quad \text{AGR} \quad \text{COUNT} + \quad \text{INDEX} \quad \text{k}
\]

\[
\text{word} \quad \text{head} \quad \text{AGR} \quad \text{3sing} \quad \text{GEND} \quad \text{neut}
\]

\[
\text{word} \quad \text{HEAD} \quad \text{AGR} \quad \text{COUNT} + \quad \text{INDEX} \quad \text{k}
\]

\[
\text{word} \quad \text{HEAD} \quad \text{AGR} \quad \text{3sing} \quad \text{GEND} \quad \text{neut}
\]

\[
\text{word} \quad \text{HEAD} \quad \text{AGR} \quad \text{COUNT} + \quad \text{INDEX} \quad \text{k}
\]

\[
\text{word} \quad \text{HEAD} \quad \text{AGR} \quad \text{3sing} \quad \text{GEND} \quad \text{neut}
\]

\[
\text{word} \quad \text{HEAD} \quad \text{AGR} \quad \text{COUNT} + \quad \text{INDEX} \quad \text{k}
\]

\[
\text{word} \quad \text{HEAD} \quad \text{AGR} \quad \text{3sing} \quad \text{GEND} \quad \text{neut}
\]

\[
\text{word} \quad \text{HEAD} \quad \text{AGR} \quad \text{COUNT} + \quad \text{INDEX} \quad \text{k}
\]
Constraints Contributed by the Grammar Rule

\[
\begin{array}{c}
\text{phrase} \\
\text{SYN} [\text{VAL} [\text{SPR} \langle \rangle]]
\end{array}
\]

\[
\begin{array}{c}
\text{word} \\
\text{SYN} \\
\text{VAL} \\
\text{SEM}
\end{array}
\]

\[
\begin{array}{c}
\text{word} \\
\text{SYN} \\
\text{VAL} \\
\text{SEM}
\end{array}
\]

\[
\begin{array}{c}
\text{word} \\
\text{SYN} \\
\text{VAL} \\
\text{SEM}
\end{array}
\]
Constraints Contributed by the Grammar Rule

```
[phrase
 SYN [ VAL [ SPR ⟨⟩]]]
```

```
word

[SYN
  [VAL
    [det
      [HEAD
        [AGR
          [3sing
            [GEND neut]]]]]]]

[SEM
  [MODE none
    [INDEX k
      [RESTR ⟨RELN a BV k⟩]]]]
```

```
word

[noun
 SYN
  [VAL
    [SPR ⟨⟩]
    [COMPS ⟨⟩]
    [MOD ⟨⟩]]]

[SEM
  [MODE ref
    [INDEX k
      [RESTR ⟨RELN cat INSTANCE k⟩]]]]
```

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A Constraint Involving the SHAC

\[
\text{phrase} \left[ \text{SYN} \left[ \text{VAL} \left[ \text{SPR} \langle \rangle \right] \right] \right]
\]
Effects of the Valence Principle

[Diagram]

- **phrase**
  - **SYN**
  - **VAL**
    - **COMPS** 3
    - **MOD** 4

- **word**
  - **SYN**
  - **VAL**
    - **MODE** none
    - **INDEX** k
    - **RESTR**
      - RELN a
      - BV k

- **word**
  - **SYN**
  - **VAL**
    - **MOD** 4
    - **COMPS** 3
  - **HEAD**
    - AGR 2
    - 3sing
    - GEND neut
  - **INDEX** k
  - **RESTR**
    - RELN cat
    - INSTANCE k
Effects of the Head Feature Principle

\[
\text{phrase}
\]

\[
\text{SYN} \quad [\text{HEAD} \ 6]
\]

\[
\text{VAL} \quad [\text{SPR} \ \langle \rangle ; \ \text{COMPS} \ 3 ; \ \text{MOD} \ 4]
\]

\[
\text{word}
\]

\[
\text{SYN} \quad [\text{det} \quad \text{AGR} \ 2 ; \ \text{COUNT} \ + ; \ \text{COMPS} \ \langle \rangle ; \ \text{SPR} \ \langle \rangle ; \ \text{MOD} \ \langle \rangle ]
\]

\[
\text{VAL} \quad [\text{MODE} \ \text{none} ; \ \text{INDEX} \ k ; \ \text{RESTR} \ \langle \text{RELN} \ a \ BV \ k \rangle ]
\]

\[
\text{SEM} \quad [\text{MODE} \ \text{ref} ; \ \text{INDEX} \ k ; \ \text{RESTR} \ \langle \text{RELN} \ \text{cat} \ INSTANCE \ k \rangle ]
\]

\[
\text{word}
\]

\[
\text{SYN} \quad [\text{noun} \quad \text{AGR} \ 2 ; \ \text{3sing} \ ; \ \text{GEND} \ \text{neut}]
\]

\[
\text{VAL} \quad [\text{SPR} \ \langle 7 \rangle ; \ \text{COMPS} \ 3 \langle \rangle ; \ \text{MOD} \ 4 \langle \rangle ]
\]

\[
\text{SEM} \quad [\text{MODE} \ \text{ref} ; \ \text{INDEX} \ k ; \ \text{RESTR} \ \langle \text{RELN} \ \text{cat} \ INSTANCE \ k \rangle ]
\]
Effects of the Semantic Inheritance Principle
Effects of the Semantic Compositionality Principle
Is the Mother Node Now Completely Specified?

\[
\begin{align*}
\text{phrase} & : \text{HEAD } 6 \\
\text{Syn} & : \text{SPR } \langle \rangle \\
\text{Val} & : \text{COMPS } 3 \\
\text{Mod} & : \langle \rangle \\
\text{Sem} & : \text{MODE } 8 \\
& \quad \text{INDEX } k \\
& \quad \text{RESTR } A \oplus B \\
\text{word} & : \text{DET } 2 \\
\text{Syn} & : \text{COMPS } \langle \rangle \\
\text{Val} & : \text{SPR } \langle \rangle \\
\text{Mod} & : \langle \rangle \\
\text{Sem} & : \text{MODE } \text{none} \\
& \quad \text{INDEX } k \\
& \quad \text{RESTR } A \left[ \text{RELN } a \right. \\
\text{word} & : \text{NOUN } 2 \\
\text{Syn} & : \text{SPR } \langle \rangle \\
\text{Val} & : \text{COMPS } 3 \langle \rangle \\
\text{Mod} & : \langle \rangle \\
\text{Sem} & : \text{MODE } 8 \text{ref} \\
& \quad \text{INDEX } k \\
& \quad \text{RESTR } B \left[ \text{RELN cat} \right. \\
\end{align*}
\]
Lexical Entry for *slept*

\[
\langle \text{slept,} \rangle
\]

\[
\begin{array}{l}
\text{word} \\
\text{SYN} \\
\text{VAL} \\
\text{COMPS} \\
\text{MOD} \\
\text{INDEX} \\
\text{MODE} \\
\text{SEM}
\end{array}
\]

\[
\begin{array}{l}
\text{HEAD} \\
\text{SPR} \\
\text{spr} \\
\text{comps} \\
\text{mod} \\
\text{index} \\
\text{mode} \\
\text{reln}
\end{array}
\]

\[
\begin{array}{l}
\text{verb} \\
\text{agreement} \\
\text{case} \\
\text{comps} \\
\text{mod} \\
\text{index} \\
\text{restr} \\
\text{restr}
\end{array}
\]

\[
\begin{array}{l}
\text{NP}_{m} \\
\text{s}_{1} \\
\text{prop} \\
\text{s}_{1} \\
\text{sleep} \\
\text{s}_{1} \\
\text{m}
\end{array}
\]

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Another Head-Specifier Phrase
Another Head-Specifier Phrase

```
 phrase
    | phrase
    | noun
    | HEAD 6
    | AGR 3
    | GEND neut
    | CASE nom
    | SPR ⟨ ⟩
    | COMPS 3 ⟨ ⟩
    | MOD 4 ⟨ ⟩
    | MODE 8
    | INDEX k
    | RESTR A ⊕ B

 word
    | word
    | verb
    | HEAD 11
    | AGR 9
    | SPR ⟨14⟩NP_k[ AGR 9, CASE nom ⟩
    | COMPS 12 ⟨ ⟩
    | MOD 13 ⟨ ⟩
    | MODE 10
    | INDEX s_1
    | RESTR C
    | RELN sleep
    | SIT s_1
    | SLEEPER k
```

Key

- HSR
- SHAC
- Val Prin
- HFP
- SIP
- SCP
Another Head-Specifier Phrase

Key

- HSR
- SHAC
- Val Prin
- HFP
- SIP
- SCP

Phrase Structure:

- **SYN**
  - **HEAD** 11
  - **SPR** ⟨⟩
  - **COMPS** 12
  - **MOD** 13

- **VAL**
  - **SPR** ⟨⟩
  - **COMPS** 3 ⟨⟩
  - **MOD** 4 ⟨⟩

- **SEM**
  - **MODE** 10 prop
  - **INDEX** s₁
  - **RESTR** A ⊕ B ⊕ C

Word Structure:

- **SYN**
  - **HEAD** 11
  - **AGR** 9

- **VAL**
  - **SPR** ⟨⟩
  - **COMPS** 12 ⟨⟩
  - **MOD** 13 ⟨⟩

- **SEM**
  - **MODE** 10 prop
  - **INDEX** s₁
  - **RESTR** C
  - **RELN sleep**
  - **SIT** s₁

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Another Head-Specifier Phrase
Another Head-Specifier Phrase

```
phrase
  ↘
  HEAD [11]
SYN
  ↘
  SPR [⟩]
  COMPS [12]
  MOD [13]
VAL
  ↘
  MODE [10] prop
SEM
  ↘
  INDEX s₁
  RESTR A ⊕ B ⊕ C

phrase
  ↘
noun
  ↘
  HEAD [6]
  AGR [3sing GEND neut]
SYN
  ↘
  SPR [⟩]
  COMPS [3⟩]
  MOD [3⟩]
VAL
  ↘
  MODE [8] ref
SEM
  ↘
  INDEX k
  RESTR A ⊕ B

word
  ↘
SYN
  ↘
  SPR [⟩]
  COMPS [12⟩]
  MOD [13⟩]
VAL
  ↘
  MODE [10] prop
SEM
  ↘
  INDEX s₁
  RESTR C
  RELN sleep
  SIT s₁
  SLEEPER k
```

Key:
- HSR
- SHAC
- Val Prin
- HFP
- SIP
- SCP
Another Head-Specifier Phrase
Another Head-Specifier Phrase

**Key**
- HSR
- SHAC
- Val Prin
- HFP
- SIP
- SCP

---

**Phrase**

- **SYN**
  - **HEAD** 11
  - **VAL**
    - **SPR** ⟨⟩
    - **COMPS** 12
    - **MOD** 13

- **SEM**
  - **MODE** 10
  - **INDEX** $s_1$
  - **RESTR** $A \oplus B \oplus C$

---

**Word**

- **SYN**
  - **HEAD** 11
  - **AGR** 9
  - **VAL**
    - **SPR** ⟨⟩
    - **COMPS** 12 ⟨⟩
    - **MOD** 13 ⟨⟩

- **SEM**
  - **MODE** 10
  - **INDEX** $s_1$
  - **RESTR**
    - **RELN** sleep
    - **SIT** $s_1$
    - **SLEEPER** k

---

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Is this description fully specified?

phrase

[HEAD 11]

SYN

[SPR ]
[COMPS 12]
[MOD 13]

VAL

[MODE 10 prop]

INDEX s₁

SEM

[RESTR A ⊕ B ⊕ C]

[phrase]

[phrase]

[head 6]

AGR

[3sing]

GEND neut

CASE nom

[SPR ]
[COMPS 3⟨ ⟩]
[MOD 4⟨ ⟩]

VAL

[MODE 8 ref]

INDEX k

RESTR A ⊕ B

[word]

[head 11]

AGR

[verb]

[SPR 14NPₖ[A G R 9, CASE nom ]]

VAL

[COMPS 12⟨ ⟩]

[MOD 13⟨ ⟩]

MODE 10 prop

INDEX s₁

SEM

[RESTR C[{ RELN sleep s₁, SIT s₁, SLEEPER k }...}]}]
Does the top node satisfy the initial symbol?

```
phrase
    | HEAD 11
    |
SYN  | SPR ⟨ ⟩
    | COMPS 12
    | MOD 13
    |
VAL  | MODE 10 prop
    | INDEX s₁
    | RESTR A ⊕ B ⊕ C

word
    | HEAD 11
    | verb
    | AGR 9

phrase
    | HEAD 6
    | AGR 3sing GEND neut
    | CASE nom

14

SYN  | SPR ⟨ ⟩
    | COMPS 3 ⟨ ⟩
    | MOD 4 ⟨ ⟩

VAL  | MODE 10 prop
    | INDEX s₁

SEM  | RESTR C
    | RELN sleep
    | SIT s₁
    | SLEEPER k
```

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RESTR of the S node

\[ \langle \begin{bmatrix} \text{RELN} & a \\ \text{BV} & k \end{bmatrix}, \begin{bmatrix} \text{RELN} & \text{cat} \\ \text{INST} & k \end{bmatrix}, \begin{bmatrix} \text{RELN} & \text{sleep} \\ \text{SIT} & s_1 \\ \text{SLEEPER} & k \end{bmatrix}, \ldots \rangle \]
Another Example

S

NP

D

the

N

photos

P

of

NP

the

suspect

VP

V

disappeared

ADV

eyesterday
Head Features from Lexical Entries

S

NP


VP

[HEADverb] disappeared [HEADadverb] yesterday
Head Features from Lexical Entries, plus HFP
Head Features from Lexical Entries, plus HFP

[HEAD4]

[HEAD1]

[HEADdet]

the

[HEAD1noun]

photos

[HEAD2prep]

of

[HEAD3]

[HEADdet]

the

[HEAD3noun]

suspect

[HEAD2]

disappeared

[HEADadverb]

yesterday
Head Features from Lexical Entries, plus HFP

- [HEAD^1]
  - [HEAD^det] the
  - [HEAD^1noun] photos
    - [HEAD^2prep] of
    - [HEAD^3det] the
      - [HEAD^3noun] suspect
  - [HEAD^2verb] disappeared
  - [HEAD^adverb] yesterday
Head Features from Lexical Entries, plus HFP

[HEADdet] the
[HEAD[1]noun] photos
[HEAD[2]prep] of
[HEADdet] the


[HEADadverb] yesterday
Head Features from Lexical Entries, plus HFP


[HEAD[2] prep] of

[HEAD[1] noun] photos

[HEAD[1] det] the

[HEAD[4] det] the

the suspect disappeared yesterday

of
Valence Features: Lexicon, Rules, and the Valence Principle

Key

- Orange: Lexicon
- Yellow: Val. (Valence)
- Black: Rules

The diagram represents the structure of a sentence with the following components:

- **Lexicon**
- **Val. (Valence)**
- **Rules**

The sentence in the diagram is: "The photos of the suspect disappeared yesterday."
Valence Features: Lexicon, Rules, and the Valence Principle

The key to understanding the diagram is as follows:

- **Lexicon**
- **Val. Prin.**
- **Rules**

The diagram illustrates the structure of a sentence, with each node representing a word and its associated valence features. The valence features include SPR, COMPS, and MOD, indicating the syntactic role of the word within the sentence. The sentence in the diagram is: "the photos disappeared yesterday of the suspect."
Valence Features: Lexicon, Rules, and the Valence Principle

**Key**
- Lexicon
- Val.
- Rules

```
the photos disappeared yesterday
of the suspect
```
Valence Features: Lexicon, Rules, and the Valence Principle

Key

- **Lexicon**
- **Val.**
- **Rules**

```
LEXICON
Val. Prin.
Rules

the

photos

of

the

suspect

disappeared

yesterday
```
Valence Features:
Lexicon, Rules, and the Valence Principle
Valence Features:
Lexicon, Rules, and the Valence Principle

**Key**
- Lexicon
- Val. Prin.
- Rules

```
the SPR (D) COMPS (PP) MOD ()
photos SPR (D) COMPS (NP) MOD ()
of SPR (D) COMPS ( ) MOD ()
the SPR (D) COMPS ( ) MOD ()
suspect SPR (D) COMPS (NP) MOD ()
```

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Valence Features: Lexicon, Rules, and the Valence Principle
Valence Features: Lexicon, Rules, and the Valence Principle

Key
- Lexicon
- Val. Prin.
- Rules

Diagram:
1. SPR ( )
   - COMPS ( )
   - MOD ( )
2. SPR ( )
   - COMPS ( )
   - MOD ( )
3. SPR ( )
   - COMPS ( )
   - MOD ( )
4. SPR ( NP )
   - COMPS ( )
   - MOD ( )
5. SPR ( )
   - COMPS ( )
   - MOD ( )
6. SPR ( )
   - COMPS ( )
   - MOD ( )

Branches:
- the
- photos
- disappeared
- yesterday
- of
- the
- suspect

The diagram illustrates the valence features for the sentence: "the photos disappeared yesterday of the suspect."
the photos of the suspect disappeared yesterday
Required Identities: Grammar Rules

S

1NP

2D

the

N

[COMPS (3)]

photos

3PP
disappeared

4NP

OP

of

5D

the

[COMPS (4)]

6V

disappeared

6ADV

yesterday

[SPR (1)]

[SPR (2)]

[SPR (3)]

[SPR (4)]

[SPR (5)]

[SPR (6)]
Required Identities: Grammar Rules

\[
S \quad \text{(main clause)}
\]

\[
\begin{align*}
S & \rightarrow NP \quad \text{(Subject)} \\
NP & \rightarrow D \quad \text{(Determiner)} \\
D & \rightarrow \text{the} \\
NP & \rightarrow \text{NOM} \\
NOM & \rightarrow \text{NOM} \\
\text{V} & \rightarrow \text{disappeared} \\
\text{ADV} & \rightarrow \text{yesterday}
\end{align*}
\]
the photos of the suspect disappeared yesterday
Required Identities: Grammar Rules

S

[1] NP

1 D

[SPR 2]

the

N

[COMPS 3]

photos

P

[COMPS 4]

of

4 D

[SPR 5]

the

N

[COMPS 6]

suspect

VP

[SPR 1]

6 V

disappeared

ADV

[MOD 6]
yesterday
Required Identities: Grammar Rules

\[ S \]

\[ 1NP \]

\[ 2D \]

\[ the \]

\[ [SPR 2] \]

\[ NOM \]

\[ [COMPS 3] \]

\[ N \]

\[ photos \]

\[ [SPR 3] \]

\[ 3PP \]

\[ [COMPS 4] \]

\[ P \]

\[ of \]

\[ [SPR 5] \]

\[ 4NP \]

\[ 5D \]

\[ the \]

\[ [SPR 5] \]

\[ 6V \]

\[ disappeared \]

\[ [MOD 6] \]

\[ ADV \]

\[ yesterday \]
the photos of the suspect disappeared yesterday.
Two Semantic Features: the Lexicon & SIP

```
[MODE prop][INDEX s₃]

[MODE ref][INDEX j]

[MODE prop][INDEX s₃]

[MODE none][INDEX j]

[MODE ref][INDEX j]

[MODE ref][INDEX j]

[MODE none][INDEX k]

[MODE ref][INDEX k]

[MODE ref][INDEX k]

[MODE ref][INDEX k]

[MODE none][INDEX k]

[MODE ref][INDEX k]

[MODE ref][INDEX k]

[MODE none][INDEX k]

[MODE ref][INDEX k]

[MODE ref][INDEX k]

the

photos

of

the

suspect

disappeared

yesterday
```
Two Semantic Features: the Lexicon & SIP
Two Semantic Features: the Lexicon & SIP

MODE prop
INDEX s3

MODE ref
INDEX j

MODE none
INDEX j

MODE ref
INDEX j

MODE ref
INDEX k

disappeared

MODE prop
INDEX s3

MODE none
INDEX s4

MODE ref
INDEX k

MODE ref
INDEX k

yesterday

the

photos

of

the

suspect

MODE ref
INDEX k

MODE none
INDEX k

MODE ref
INDEX k
Two Semantic Features: the Lexicon & SIP

```
the
```

```
photos
```

```
of
```

```
disappeared
```

```
yesterday
```

```
the
```

```
suspect
```

```
MODE prop
INDEX s3
```

```
MODE ref
INDEX j
```

```
MODE ref
INDEX j
```

```
MODE ref
INDEX j
```

```
MODE none
INDEX j
```

```
MODE prop
INDEX s3
```

```
MODE prop
INDEX s4
```

```
MODE ref
INDEX k
```

```
MODE ref
INDEX k
```

```
MODE none
INDEX k
```

```
MODE ref
INDEX k
```

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Two Semantic Features: the Lexicon & SIP

```
the photos of the suspect disappeared yesterday
```

```
[MODE prop] [INDEX s3]
```

```
[MODE ref] [INDEX j]
```

```
[MODE ref] [INDEX k]
```

```
[MODE prop] [INDEX s3]
```

```
[MODE none] [INDEX j]
```

```
[MODE prop] [INDEX s3]
```

```
[MODE ref] [INDEX j]
```

```
[MODE none] [INDEX k]
```

```
[MODE none] [INDEX k]
```

```
[MODE ref] [INDEX k]
```

```
[MODE ref] [INDEX k]
```

```
[MODE none] [INDEX k]
```

```
[MODE ref] [INDEX k]
```

```
[MODE none] [INDEX k]
```

```
[MODE ref] [INDEX k]
```

```
[MODE ref] [INDEX k]
```

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Two Semantic Features: the Lexicon & SIP

- **the**
- **photos**
- **of**
- **disappeared**
- **yesterday**
- **the**
- **suspect**
RESTR Values and the SCP

The diagram illustrates the relationships between concepts using logical operations and relations. The nodes represent different elements and their connections, with labels indicating the relationships and attributes.
An Ungrammatical Example

* S

NP

them

VP

V

sent

NP

us

NP

D

a

N

letter

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An Ungrammatical Example

What’s wrong with this sentence?
An Ungrammatical Example

What’s wrong with this sentence?
An Ungrammatical Example

What's wrong with this sentence?

So what?
An Ungrammatical Example

The Valence Principle

*\(S\)

\[\begin{array}{c}
\text{NP} \\
\text{[CASE acc]} \\
\text{them}
\end{array}\]

\[\begin{array}{c}
\text{VP} \\
\text{[SPR \{\}]} \\
\text{V} \\
\text{sent}
\end{array}\]

\[\begin{array}{c}
\text{NP} \\
\text{us}
\end{array}\]

\[\begin{array}{c}
\text{NP} \\
\text{D} \\
a
\end{array}\]

\[\begin{array}{c}
\text{N} \\
\text{letter}
\end{array}\]
An Ungrammatical Example

The Valence Principle

*S

NP
[CASE acc]
them

VP
[SPR ⟨1⟩]

V
sent

NP
[SPR ⟨1⟩NP[nom]]

NP
us

D
a

N
letter
An Ungrammatical Example

HeadSpecifierRule

*S

1 NP
[CASE acc]

them

VP
[SPR ⟨1⟩ ]

V

[SPR ⟨1NP[nom]⟩ ]

sent

NP

us

NP

a

D

letter

N
An Ungrammatical Example

HeadSpecifier Rule

*S

NP [CASE acc]

them

NP

V

sent

[SPR ⟨NP[nom]⟩]

NP

us

[SPR ⟨⟩]

D

a

N

letter
An Ungrammatical Example

Head Specifier Rule

*S

[S

NP [CASE acc] them

| contradiction

V

sent

NP [SPR ⟨⟨1⟩⟩] us

NP

[SPR ⟨⟨1⟩⟩] NP[nom]]

D

a

N

letter
Exercise in Critical Thinking
Exercise in Critical Thinking

- Our grammar has come a long way since Ch 2, as we've added ways of representing different kinds of information:
  - generalizations across categories
  - semantics
  - particular linguistic phenomena: valence, agreement, modification
Exercise in Critical Thinking

• Our grammar has come a long way since Ch 2, as we've added ways of representing different kinds of information:
  • generalizations across categories
  • semantics
  • particular linguistic phenomena: valence, agreement, modification

• What else might we add? What facts about language are as yet unrepresented in our model?
Overview

• What we’re trying to do
• The pieces of our grammar
• Two extended examples
• Reflection on what we’ve done, what we still have to do
• Reading questions
• Next time: Catch up & review
Reading Questions

• How do we know whether it's D taking the N as COMPS, or the N taking the D as SPR?

• More generally, how do we decide how many semantic & syntactic arguments to posit? Why does letter have an ADDRESSEE? What if there's more than one addressee?

• What is INST for?
Reading Questions

• Is a lexical entry like an abbreviation? If not, how do we decide how much info to put in them?

• How do you build a lexicon, practically speaking?

• Why do we want NP and N to (sometimes) be equivalent?