English Filler-Gap Constructions

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Chomsky on Constructions

[In a Principles-and-Parameters approach,] the notion of grammatical construction is eliminated, and with it, the construction-particular rules. Constructions such as verb phrase, relative clause, and passive remain only as taxonomic artifacts, collections of phenomena explained through the interaction of the principles of UG, with the values of the parameters fixed. [Chomsky 1993, p. 4]

Chomsky: Transformational Program Lacks 'Serious' Analyses

A look at the earliest work from the mid-1950s will show that many phenomena that fell within the rich descriptive apparatus then postulated, often with accounts of no little interest and insight, lack any serious analysis within the much narrower theories motivated by the search for explanatory adequacy and remain among the huge mass of constructions for which no principled explanation exists—again, not an unusual concomitant of progress.

Some Aux-Initial Constructs

[After Fillmore 1999 and Ginzburg/Sag 2000]

- May they live forever!
- May your teeth fall out on your wedding night!
- **Were they here now**, we wouldn't have this problem.
- **Should there be a need**, we can always call for help.

More Aux-Initial Constructs

- Boy, **was I stupid**!
- Wow, **can she sing**!
- Were they involved?
- Can she sing?
- So **can I**!
- We won't have to go, **will we**?

The Family Resemblance

- The head daughter is an initial, finite, auxiliary verb.
- The subject is realized in the position immediately following the auxiliary.
- The head daughter may not be an auxiliary like *better* (**Better I/we do that now?*).
- The head daughter may be an otherwise non-occurring finite auxiliary like first-person *aren't* (*Aren't I allowed to go?* vs. **I aren't allowed to go.*).

Filler-Gap Constructs are a Family, Too

- They have two daughters: the filler daughter and the head daughter.
- The head daughter must contain a 'gap' corresponding to the filler daughter.
- The filler must contain/not contain a distinguished element of the appropriate kind.
- The gap position is subject to 'island' effects.
- The FG-clause has a clausal semantics - it denotes a proposition, question, fact, or outcome [the 4 kinds of **message** in Ginzburg/Sag 2000].

Wh-**Interrogative Clause:**

[How foolish] [is he __]?

I wonder **[how foolish] [he is __]**.

Wh-**Exclamative Clause:**

[What a fool] [he is __]!

It's amazing **[how odd] [it is __]**.

Topicalized Clause:

[The bagels], [I like __].

Wh-**Relative Clause:**

I met the person **[who] [they chose ___]**.

I'm looking for a bank **[in which] [to place my trust ___]**

The-**Clause:**

The more people I met, **[the happier] [I became ___]**.

[The more people] [I met ___], the happier I became.

Parameters of Variation in FG Clauses:

- Is there a distinguished *wh* element in the filler daughter, and if so, what kind?
- What are the possible syntactic categories of the filler daughter?
- What are the possible syntactic categories of the head daughter?

Parameters of Variation in FG Clauses (2):

- Can the head daughter be inverted/finite? Must it be?
- What semantics/synactic category is associated with the mother?
- What semantics/syntactic category is associated with the head daughter?
- Is the clause an island? Must it be an 'independent clause'?

Distinguished Elements in the Filler Daughter:

- [My bagels], she likes. (Topicalization)
- [*What* (books)] do they like? (*Wh*-Interrogative)
- (the person) [*who*(*se* book)] they like ... (*Wh*-Relative)
- [*What* a play] he wrote! (*Wh*-Exclamative)
- [*the more* books] they read ... (*The*-Clause)

Mismatches of Distinguished Element

- *[*Which* bagels]/*[*Who*], she likes. (Topicalization)
- *[*What a* book] do they like? (*Wh*-Interrogative)
- *the thing [[*what*] they like] ... (*Wh*-Relative)
- *[*Which* bagels]/*[*What*] she likes! (*Wh*-Exclamative)
- *[*which* books] they read,
  the more they learn. (*The*-Clause)

WH-Word Diversity

wh-word	int	excl	rel	example
who (Noun)	+	−	+	*who*
whose(Det)	+	−	+	*whose book*
what(Noun)	+	−	%	*what*
what(Det$_{sing}$)	+	−	−	*what book*
what(Det$_{pl}$)	+	+	−	*what stories*
which(Noun)	−	−	+	*which*
which(Det)	+	−	+	*which book*
how(Adv$_{manner}$)	+	+	%	*how*
how(Adj)	+	−	−	*how*
how(Degree word)	+	+	−	*how tall*
when(Adv$_{time}$)	+	−	%	*when*
where(Adv$_{place}$)	+	−	+	*where*
why(Adv$_{reason}$)	+	−	+	*why*

WH-Word Mismatches

Who did they visit?

*Who they visited!

The person who they visited ...

Whose book did she read?

*Whose book she read!

The person whose book she read ...

WH-Word Mismatches (2)

What did she read?

*What she read!

%The only book what she read ...

What book did she read?

*What book she read!

*The only one what book she read ...

WH-Word Mismatches (3)

Which book did she read?

*Which book she read!

*The only one which book she read ...

How do they like it there?

How they like it there!

%The way how they liked it ...

WH-Word Mismatches (4)

How was it?

*How it was!

*The color how it was ...

How tall did they get?

How tall they've become!

*The extent how tall they got ...

WH-Word Mismatches (5)

When/Where did they do that?

*When/Where they did that!

The time when they did that ...

The place where they did that ...

Why did they do that?

*Why they did that!

The reason why they did that ...

Pied Piping Differences

Those dignitaries [[*pictures of whom*] the newspaper had already published] ... (*wh*-relative)

*I wonder [[*pictures of whom*] the newspaper had already published]. (*wh*-interrogative)

*[*pictures of what a liar*] the newspaper published! (*wh*-exclamative)

Syntactic Category of the Filler Daughter

Topicalization/*Wh*-interrogative:
NP, PP, AP, AdvP

Finite relative: NP, PP

Infinitival relative: PP

Wh-exclamative/*The*-clause: NP, AP, AdvP

Mismatched Filler Categories

*the person [[*happy with whom*] Kim is]...

*the people [[*who(m)*] to confer with]...

*[*In what a mansion*] they were living!

*[*To the more people*] I talk (, the more people listen).

Syntactic Category of the Head Daughter:

Top/Int/Rel/Excl Clauses: *S*

*Bagels, [that I like]

*who [that we like]. (*wh*-interrogative, relative or exclamative)

The-**Clause:** *S* or *CP*

The more [(that) you see](, the more (that) you like.)

Must/Can the H-DTR Be an Inverted Clause?

Topicalization: *never inverted*

Wh-**Int:** *inverted only in independent clause*.

How tall [is Kim?]/*[Kim is?]

I wonder how tall *[is Kim]/[Kim is].

Must/Can the H-DTR be an Inverted Clause?

Wh-**Rel**/*Wh*-**Excl**/*The*-**Clause:** *never inverted*.

*the one who did he see...

*How tall is Kim!

*What a nice person is Kim talking to!

*The more do you see (the more (do) you suspect).

Must/Can the H-DTR be Infinitival?

Top/*Wh*-Excl/*The*-Clause: always finite; never infinitival.

*It's amazing [how many people (for us) to talk to].

*The harder (for them) to come, the harder (for them) to fall.

Must/Can the H-DTR be Infinitival?

Wh-**Int/Rel**: infinitival VP head daughter possible.

I know how much time (*for them) to take.

The time in which (*for them) to finish ...

We need a theory of grammar that can accommodate the general, the idiosyncratic, and the huge area in between. We need a principled account of family resemblance across constructions.

Sign-Based Construction Grammar (SBCG)

- Synthesis of HPSG and Berkeley Construction Grammar
- Constraint-Based and Lexicalist
- Based on notion of **Sign** and licensing of signs
- Sag, Ivan A. 2007. Sign-Based Construction Grammar: An informal synopsis. Available at `http://lingo.stanford.edu/sag/publications.html`

Signs

$$\begin{bmatrix} \textit{sign} & \\ \text{PHON} & \textit{phonological-object} \\ \text{SYN} & \textit{syntactic-object} \\ \text{SEM} & \textit{linguistic-meaning} \\ \text{CNTXT} & \textit{context-object} \end{bmatrix}$$

Constructs

$$\begin{bmatrix} \textit{construct} & \\ \text{MTR} & \textit{sign}_0 \\ \text{DTRS} & \langle\ \textit{sign}_1,\ \ldots,\ \textit{sign}_n\ \rangle \end{bmatrix}$$

Sign Licensing Principle

Every sign must be lexically or constructionally licensed, where:

> a sign is lexically licensed only if it satisfies some entry in the lexicon, and
>
> a sign is constructionally licensed only if it is the mother of some construct.

Constructions

- Combinatoric Constructions:

  x-cxt $\Rightarrow$ [. . .]

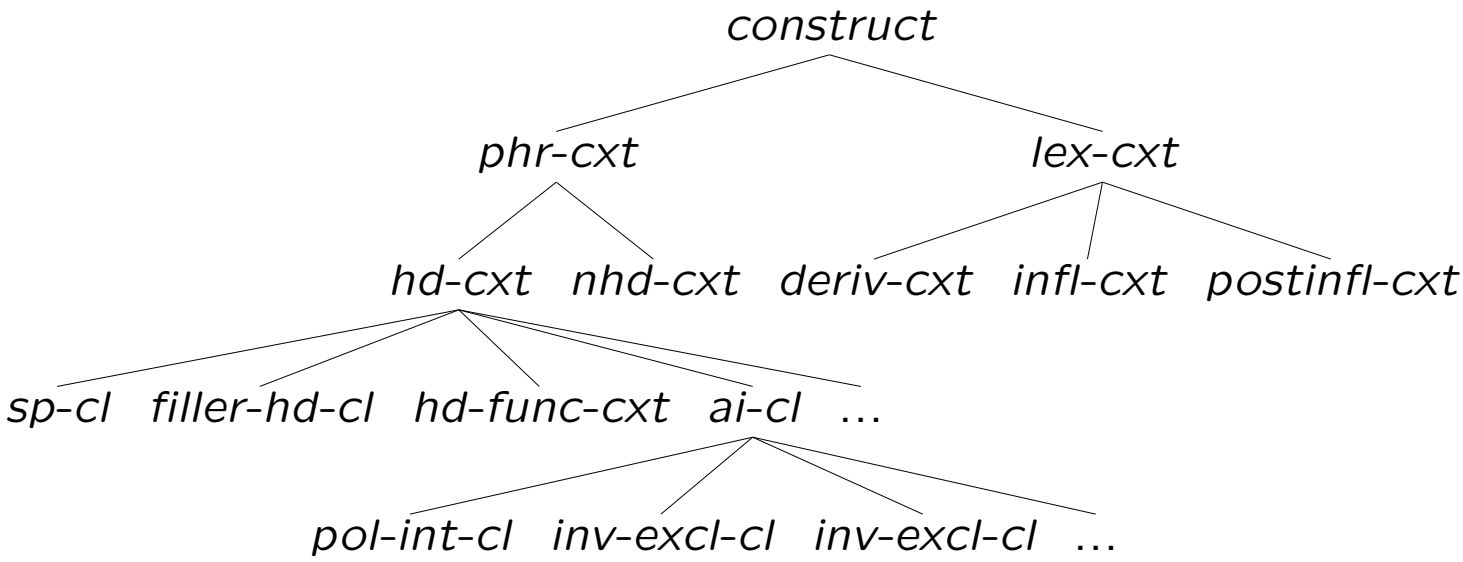
- Lexical-Class Constructions:

  x-lex $\Rightarrow$ [. . .]

Some Constructs of English

- *phrasal-construct* (*phr-cxt*) and *lexical-construct* (*lex-cxt*) are immediate subtypes of *construct*.
- *headed-construct* (*hd-cxt*) and *nonheaded-construct* (*nhd-cxt*) are immediate subtypes of *phr-cxt*.
- *aux-initial-clause* (*ai-cl*), *filler-head-clause* (*filler-hd-cl*), and *head-functor-construct* (*hd-func-cxt*) are immediate subtypes of *hd-cxt*.

Some Constructs of English: The Family Tree



Head Feature Principle:

$$\textit{hd-cxt} \Rightarrow \begin{bmatrix} \text{MTR} & \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{CAT} & \text{X} \end{bmatrix} \end{bmatrix} \\ \text{H-DTR} & \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{CAT} & \text{X} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

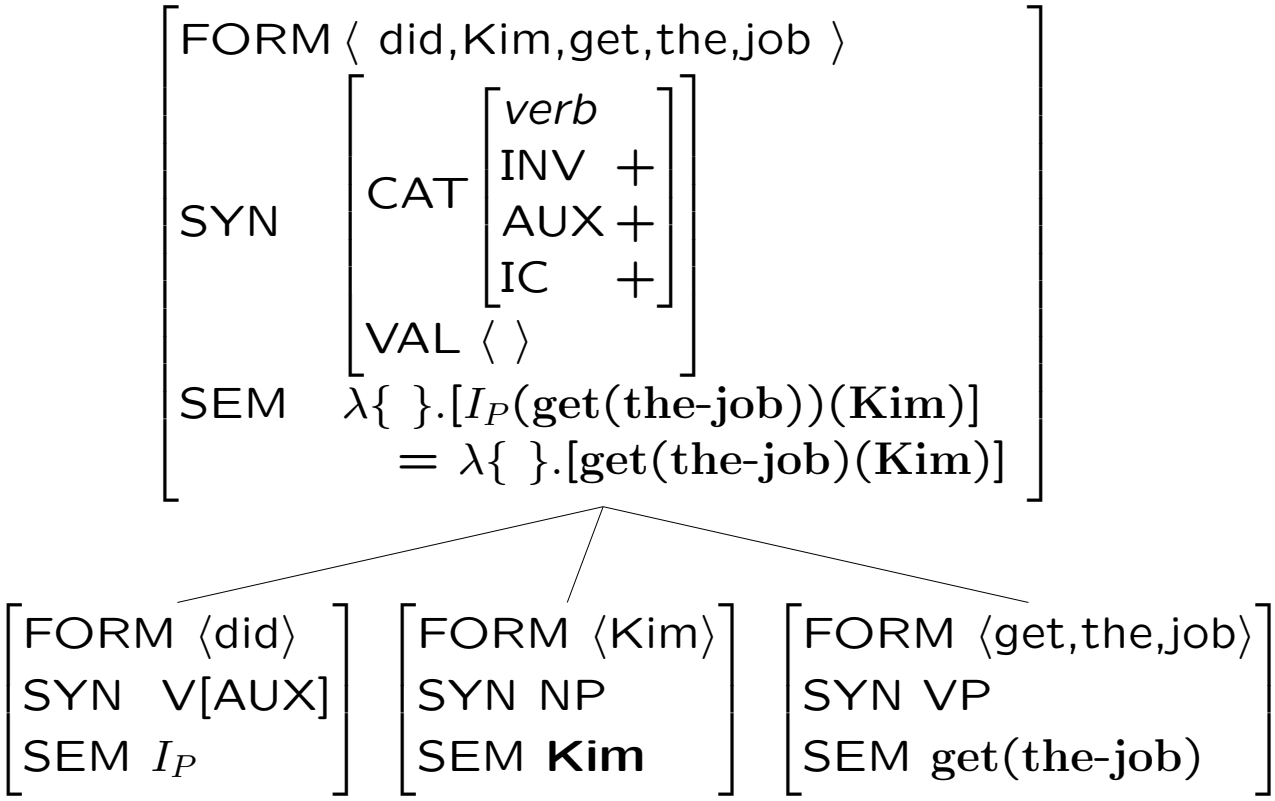
Auxiliary-Initial-Clause

$$\textit{ai-cl} \Rightarrow \begin{bmatrix} \text{hd-cxt} & \\ \text{MTR} & \left[\text{SYN} \quad \left[\text{VAL} \quad \langle\ \rangle\right]\right] \\ \text{DTRS} & \langle\ \text{H},\ \text{X}_1,\ \ldots\ \text{X}_n\ \rangle \\ \text{H-DTR} & \text{H:} \begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix} \text{CAT} \left[\text{INV} \quad + \right] \\ \text{VAL}\ \langle\ \text{X}_1,\ldots,\text{X}_n\ \rangle \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Polar Interrogative Clause:

$$\textit{pol-int-cl} \Rightarrow \begin{bmatrix} \textit{ai-cl} & \\ \text{MTR} & \begin{bmatrix} \text{SYN} & \left[\text{CAT} \quad \left[\text{IC} \quad +\right]\right] \\ \text{SEM} & \lambda\{\ \}[\mathbf{FR}_p(X_1, \ldots, X_n)] \end{bmatrix} \\ \text{DTRS} & \left\langle \left[\text{SEM } X_1\right], \ldots, \left[\text{SEM } X_n\right] \right\rangle \end{bmatrix}$$

$$\left[\begin{array}{ll}
\text{MTR} & \left[\begin{array}{ll}
\text{FORM} & \langle\ \text{did,Kim,get,the,job}\ \rangle \\
\text{SYN} & \left[\begin{array}{ll}
\text{CAT} & \left[\begin{array}{ll} \textit{verb} & \\ \text{INV} & + \\ \text{AUX} & + \\ \text{IC} & + \end{array}\right] \\
\text{VAL} & \langle\ \rangle
\end{array}\right] \\
\text{SEM} & \lambda\{\ \}.[I_P(\mathbf{get(the\text{-}job)})(\mathbf{Kim})] \\
 & \quad = \lambda\{\ \}.[\mathbf{get(the\text{-}job)(Kim)}]
\end{array}\right] \\
\text{DTRS} & \left\langle \left[\begin{array}{l} \text{FORM}\ \langle \text{did} \rangle \\ \text{SYN}\ \ \text{V[AUX]} \\ \text{SEM}\ I_P \end{array}\right], \left[\begin{array}{l} \text{FORM}\ \langle \text{Kim} \rangle \\ \text{SYN NP} \\ \text{SEM}\ \mathbf{Kim} \end{array}\right], \left[\begin{array}{l} \text{FORM}\ \langle \text{get,the,job} \rangle \\ \text{SYN VP} \\ \text{SEM}\ \mathbf{get(the\text{-}job)} \end{array}\right] \right\rangle
\end{array}\right]$$


FORM ⟨ did,Kim,get,the,job ⟩
SYN
CAT
verb
INV +
AUX +
IC +
VAL ⟨ ⟩
SEM λ{ }.[I_P(get(the-job))(Kim)]
= λ{ }.[get(the-job)(Kim)]
FORM ⟨did⟩
SYN V[AUX]
SEM I_P
FORM ⟨Kim⟩
SYN NP
SEM Kim
FORM ⟨get,the,job⟩
SYN VP
SEM get(the-job)

$$\textit{inv-excl-cl} \Rightarrow \begin{bmatrix} \textit{ai-cl} & \\ \text{MTR} & \begin{bmatrix} \text{SYN} & \left[\text{CAT} \quad \left[\text{IC} \quad + \right]\right] \\ \text{SEM} & fact(\mathbf{FR}_p(X_1, \ldots, X_n)) \end{bmatrix} \\ \text{DTRS} & \left\langle [\text{SEM} \quad X_1], \ldots, [\text{SEM} \quad X_n] \right\rangle \end{bmatrix}$$

$$\textit{inv-cond-cl} \Rightarrow \begin{bmatrix} \textit{ai-cl} & \\ \text{MTR} & \begin{bmatrix} \text{SYN} & \left[\text{CAT} \quad \begin{bmatrix} \text{IC} & - \\ \text{SELECT} & \text{S} \end{bmatrix}\right] \\ \text{SEM} & \lambda q.[\mathbf{FR}_p(X_1, \ldots, X_n) \Rightarrow q\ ] \end{bmatrix} \\ \text{DTRS} & \left\langle [\text{SEM}\ X_1], \ldots, [\text{SEM}\ X_n] \right\rangle \end{bmatrix}$$

$$\textit{inv-prop-cl} \Rightarrow \begin{bmatrix} \textit{ai-cl} & \\ \text{MTR} & \begin{bmatrix} \text{SYN} & \left[\text{CAT} \quad \left[\text{IC} \quad +\right]\right] \\ \text{GAP} & \textit{nelist} \\ \text{SEM} & \mathbf{FR}_p(X_1, \ldots, X_n) \end{bmatrix} \\ \text{DTRS} & \left\langle [\text{SEM } X_1], \ldots, [\text{SEM } X_n] \right\rangle \end{bmatrix}$$

Subject-Predicate Clause:

$$\textit{subj-pred-cl} \Rightarrow \begin{bmatrix} \textit{hd-cxt} \\ \text{MTR} \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{VFORM} & \textit{fin} \\ \text{INV} & - \end{bmatrix} \\ \text{VAL} & \langle\ \rangle \end{bmatrix} \\ \text{SEM} & \mathbf{FR}(X_1, X_2) \end{bmatrix} \\ \text{DTRS} \left\langle \textit{Y}\text{:}[\text{SEM } X_1\ ]\ ,\ \textit{H}\text{:}\begin{bmatrix} \text{SYN } [\text{VAL } \langle \textit{Y} \rangle] \\ \text{SEM } X_2 \end{bmatrix} \right\rangle \\ \text{H-DTR } \ \textit{H} \end{bmatrix}$$

Some Subject-Predicate Clauses

Sandy reads Proust.

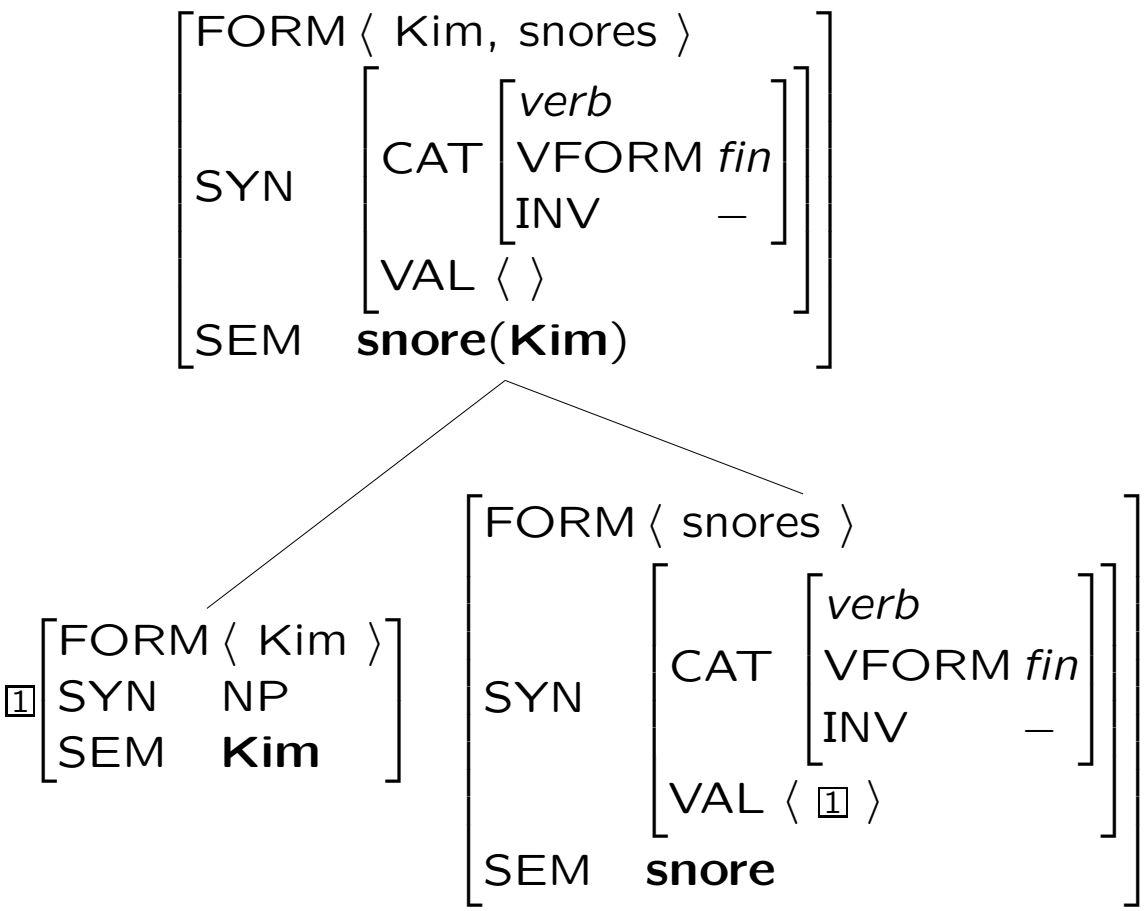
(I insist that) **Sandy read Proust**.

You/Everyone read Proust!

*Kim to go home.

*Pat standing on my foot.

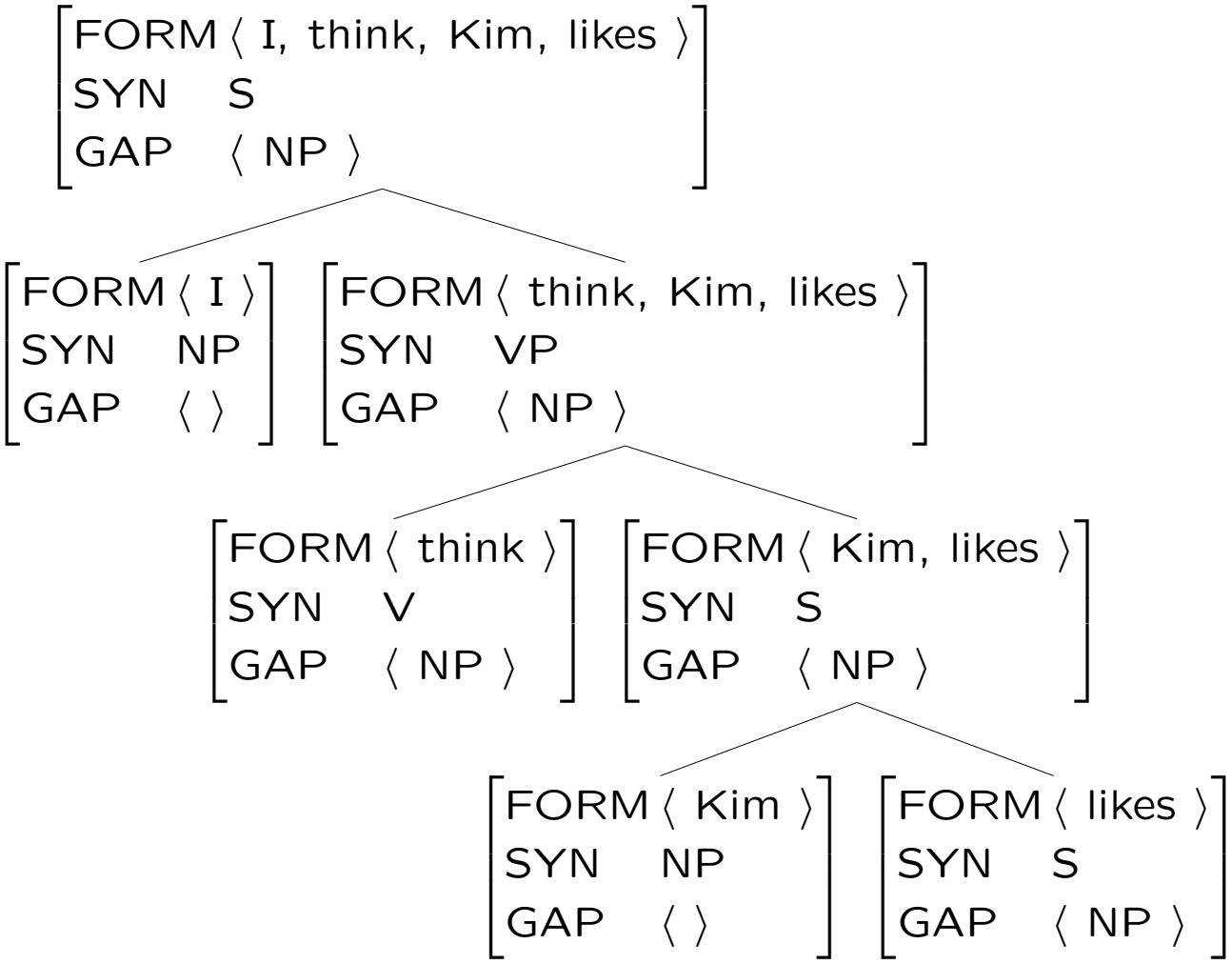
*I aren't coming to the party


FORM ⟨ Kim, snores ⟩
SYN
CAT
verb
VFORM fin
INV −
VAL ⟨ ⟩
SEM snore(Kim)
1
FORM ⟨ Kim ⟩
SYN NP
SEM Kim
FORM ⟨ snores ⟩
SYN
CAT
verb
VFORM fin
INV −
VAL ⟨ 1 ⟩
SEM snore

Filler-Head Clause

filler-hd-cl $\Rightarrow$

$$\left[\begin{array}{l} \textit{hd-cxt} \\ \text{MTR} \left[\begin{array}{ll} \text{SYN} & [\text{VAL} \ \langle\ \rangle\ ] \\ \text{GAP} & L_2 \end{array}\right] \\ \text{DTRS} \left\langle [\text{SYN}\ X\ ]\ ,\ H{:}\left[\begin{array}{l} \textit{phrase} \\ \text{SYN} \ \left[\text{CAT}\ \textit{verbal}\ \right] \\ \text{GAP} \ \langle [\text{SYN}\ X\ ] \rangle \ \oplus \ L_2 \end{array}\right] \right\rangle \end{array}\right]$$


FORM ⟨ I, think, Kim, likes ⟩
SYN S
GAP ⟨ NP ⟩
FORM ⟨ I ⟩
SYN NP
GAP ⟨ ⟩
FORM ⟨ think, Kim, likes ⟩
SYN VP
GAP ⟨ NP ⟩
FORM ⟨ think ⟩
SYN V
GAP ⟨ NP ⟩
FORM ⟨ Kim, likes ⟩
SYN S
GAP ⟨ NP ⟩
FORM ⟨ Kim ⟩
SYN NP
GAP ⟨ ⟩
FORM ⟨ likes ⟩
SYN S
GAP ⟨ NP ⟩

Why FGD Information is Registered Locally

Irish complementizer selection (McCloskey 79,90)
French 'stylistic' inversion (Kayne/Pollock 78)
Spanish 'stylistic' inversion (Torrego 84)
Kikuyu downstep suppression
(Clements 84, Zaenen 83)
Chamorro verb agreement (Chung 82, 95)
Yiddish inversion (Diesing 90)
Icelandic expletives (Zaenen 83)
Adyghe '*wh*-agreement' (Polinsky 07)

Semantics of the Clause

- **Interrogative:** question (propositional function)
- **Relative:** proposition
- **Exclamative:** fact
- *The*-**Clause**: proposition
- **Topicalization**: austinean (proposition or outcome)

Topicalization Construction:

top-cl $\Rightarrow$

$$\left[\begin{array}{l} \textit{filler-hd-cl} \\ \text{MTR} \quad \left[\begin{array}{ll} \text{SYN} & \left[\text{CAT} \quad \left[\text{IC} \quad +\right]\right] \\ \text{SEM} & [\lambda X.Y](Z) \\ \text{GAP} & \langle\ \rangle \end{array}\right] \\ \text{DTRS} \quad \left\langle \left[\begin{array}{ll} \text{SEM} & Z \\ \text{WH} & \{\ \} \\ \text{REL} & \{\ \} \end{array}\right], \textit{H}\text{:} \left[\begin{array}{ll} \text{SYN} & \left[\text{CAT} \left[\begin{array}{ll} \text{INV} & - \\ \text{VFORM} & \textit{fin} \end{array}\right]\right] \\ & \text{VAL}\ \langle\ \rangle \\ \text{SEM} & Y \\ \text{GAP} & \langle\ [\text{SEM} \quad X\ ]\ \rangle \end{array}\right] \right\rangle \end{array}\right]$$

Some Independent Clauses are Embedded

They seemed convinced that [[*problems of this sort*], we would never be able to solve __].

Nothing made things clearer than the fact that [[*the people from her district*], no one had issued an invitation to __].

$$\begin{bmatrix}
\text{FORM} & \langle\ \text{bagels, I, think, she, likes}\ \rangle \\
\text{SYN} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \textit{verb} \\ \text{VFORM} & \textit{fin} \\ \text{IC} & + \\ \text{INV} & - \end{bmatrix} \\ \text{VAL} & \langle\ \rangle \end{bmatrix} \\
\text{SEM} & [\lambda X.\mathbf{think}(\mathbf{like}(X)(\mathbf{she}))(\mathbf{I})](\mathbf{bagels}) \\
 & = \mathbf{think}(\mathbf{like}(\mathbf{bagels})(\mathbf{she}))(\mathbf{I}) \\
\text{GAP} & \langle\ \rangle
\end{bmatrix}$$

$$\begin{bmatrix}
\text{FORM} & \langle\ \text{bagels}\ \rangle \\
\text{SYN} & \text{NP} \\
\text{SEM} & \mathbf{bagels} \\
\text{WH} & \{\ \} \\
\text{REL} & \{\ \}
\end{bmatrix}$$

$$\begin{bmatrix}
\text{FORM} & \langle\ \text{I, think, she, likes}\ \rangle \\
\text{SYN} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \textit{verb} \\ \text{VFORM} & \textit{fin} \\ \text{IC} & + \\ \text{INV} & - \end{bmatrix} \\ \text{VAL} & \langle\ \rangle \end{bmatrix} \\
\text{SEM} & \mathbf{think}(\mathbf{like}(\ X\ )(\mathbf{she}))(\mathbf{I}) \\
\text{GAP} & \left\langle \begin{bmatrix} \text{SYN} & \text{NP} \\ \text{SEM} & X \end{bmatrix} \right\rangle
\end{bmatrix}$$

Fillers in Topicalized Clauses

Bagels, I like __ . (NP)

Onto the table, they managed to throw seven books __ . (PP)

Happy, I'm not __ . (AP)

Carefully, she rotated the timing device __ . (AdvP)

Go to the store, he wouldn't __ . (VP)

Indicative and Subjunctive Topicalizations

We suggest that [[proposals of this kind], *she be kept informed of* ___ .]

[Proposals of this kind], *nobody be taken in by* ___ !

[Proposals of this kind] bother me. [Unambiguous]

Wh-Exclamative Clause:

wh-excl-cl $\Rightarrow$

$$\left[\begin{array}{l} \textit{filler-hd-cl} \\ \textsf{MTR}\left[\textsf{SEM} \quad fact(E^{u}V[\lambda X.Y(Z)])\right] \\ \textsf{DTRS}\left\langle \left[\begin{array}{ll}\textsf{SEM} & Z \\ \textsf{WH} & \{V\} \\ \textsf{REL} & \{\ \}\end{array}\right], \left[\begin{array}{ll}\textsf{SYN} & \left[\begin{array}{ll}\textsf{CAT} & \left[\begin{array}{ll}\textsf{INV} & - \\ \textsf{VFORM} & \textit{fin}\end{array}\right] \\ \textsf{VAL} & \langle\ \rangle\end{array}\right] \\ \textsf{SEM} & Y \\ \textsf{GAP} & \langle\ [\textsf{SEM}\ X]\ \rangle\end{array}\right]\right\rangle \end{array}\right]$$

$$\begin{bmatrix}
\text{FORM} & \langle\ \text{what, a, play, I, saw}\ \rangle \\
\text{SYN} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \textit{verb} & \\ \text{VFORM} & \textit{fin} \\ \text{IC} & + \\ \text{INV} & - \end{bmatrix} \\ \text{VAL} & \langle\ \rangle \end{bmatrix} \\
\text{SEM} & fact(E^u v[\lambda\wp.\mathbf{see}(\wp)(\mathbf{I}) \\
 & (\lambda P \exists x[\mathbf{play}(x) \wedge x = v \wedge P(x)])]) \\
 & = fact(E^u v[\mathbf{play}(v) \wedge \mathbf{see}(v)(\mathbf{I})]) \\
\text{GAP} & \langle\ \rangle
\end{bmatrix}$$

$$\begin{bmatrix}
\text{form} & \langle\ \text{what, a, play}\ \rangle \\
\text{SYN} & \text{NP} \\
\text{SEM} & \lambda P \exists x[\mathbf{play}(x) \wedge \\
 & \qquad x = v \wedge P(x)] \\
\text{WH} & v \\
\text{REL} & \{\ \}
\end{bmatrix}$$

$$\begin{bmatrix}
\text{FORM} & \langle\ \text{I, saw}\ \rangle \\
\text{SYN} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \textit{verb} & \\ \text{VFORM} & \textit{fin} \\ \text{IC} & + \\ \text{INV} & - \end{bmatrix} \\ \text{VAL} & \langle\ \rangle \end{bmatrix} \\
\text{SEM} & \mathbf{see}(\wp)(\mathbf{I}) \\
\text{GAP} & \left\langle \begin{bmatrix} \text{SYN} & \text{NP} \\ \text{SEM} & \wp \end{bmatrix} \right\rangle
\end{bmatrix}$$

It's amazing [what a nice person Sandy is __].

*It's amazing [what a nice person is Sandy __].

What a nice person Sandy is __ !

*What a nice person is Sandy __ !

*It's amazing [what a nice person (for) Sandy to be __].

*What a nice person (for) Sandy to be __ !

*It's amazing [what a nice person just walked in].

*What a nice person is talking to Sandy.

*What a nice person [be sure to visit __]!

*It's amazing what a nice person [they be considering __].

*What a nice person [will you visit __]!/?

*What a nice person [am I fond of __]!

What a gem Kim wrote about __ ! (NP)

How happy Kim is __ ! (AP)

How quickly they forget __ ! (AdvP)

*About what a gem Kim wrote __ ! (*PP)

*Go to what a fine store he would __ ! (*VP)

Wh-Interrogative Clauses

What fell?

I wonder [what fell].

$\lambda\{x\}$[**fall**(x)]

Nonsubject Wh-Interrogative Clause:

ns-wh-int-cl $\Rightarrow$

$$\begin{bmatrix} \textit{filler-hd-cl} \\ \text{MTR} \quad \left[\text{SEM } \lambda\{V,\ldots\}[\lambda X.Y(Z)]\right] \\ \text{DTRS} \quad \left\langle \begin{bmatrix} \text{SEM} & Z \\ \text{WH} & \{V\} \end{bmatrix}, \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{INV} & W \\ \text{IC} & W \end{bmatrix} \end{bmatrix} \\ \text{SEM} & Y \\ \text{GAP} & \langle\ [\text{SEM} \quad X\ ]\ \rangle \end{bmatrix} \right\rangle \end{bmatrix}$$

$$\begin{bmatrix}
\text{FORM} & \langle\ \text{which, play, do, you, like}\ \rangle \\
\text{SYN} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \textit{verb} & \\ \text{VFORM} & \textit{fin} \\ \text{IC} & + \\ \text{INV} & - \end{bmatrix} \\ \text{VAL} & \langle\ \rangle \end{bmatrix} \\
\text{SEM} & \lambda\{v[\ldots] = \\
 & \lambda\{v\}[\mathbf{the}\ x[\mathbf{play}(x) \wedge x = v \wedge \mathbf{like}(x)(\mathbf{you})]] \\
\text{GAP} & \langle\ \rangle
\end{bmatrix}$$

$$\begin{bmatrix}
\text{FORM} & \langle\ \text{which, play}\ \rangle \\
\text{SYN} & \text{NP} \\
\text{SEM} & \lambda P.\mathbf{the}\ x[\mathbf{play}(x) \wedge \\
 & \quad x = v \wedge P(x)] \\
\text{WH} & \{v\} \\
\text{REL} & \{\ \}
\end{bmatrix}$$

$$\begin{bmatrix}
\text{FORM} & \langle\ \text{do, you, like}\ \rangle \\
\text{SYN} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \textit{verb} & \\ \text{VFORM} & \textit{fin} \\ \text{IC} & + \\ \text{INV} & + \end{bmatrix} \\ \text{VAL} & \langle\ \rangle \end{bmatrix} \\
\text{SEM} & \mathbf{like}(\wp)(\mathbf{you}) \\
\text{GAP} & \left\langle \begin{bmatrix} \text{SYN} & \text{NP} \\ \text{SEM} & \wp \end{bmatrix} \right\rangle
\end{bmatrix}$$

int-cl $\Rightarrow$

$$\begin{bmatrix} \text{MTR} & \begin{bmatrix} \text{SEM} & \begin{bmatrix} \textit{question} \\ \text{PARAMS} \quad \Sigma_1 \end{bmatrix} \\ \text{STORE} \quad \Sigma_2 \end{bmatrix} \\ \text{H-DTR} & [\text{STORE} \quad \Sigma_1 \cup \Sigma_2\ ] \end{bmatrix}$$

Who remembers where we bought what?

- Who remembers the answer to the question 'Where did we buy what?'
  $\lambda\{v\}[v$ **remembers** $\lambda\{x, y\}$[**we bought** x **at** y]]
- For which pairs $\langle x, y\rangle$, does x remember where we bought y?
  $\lambda\{v, x\}[v$ **remembers** $\lambda\{y\}$[**we bought** x **at** y]]

*Who [(everybody/you) visit __]!/?

*I wonder who [what a nice book you gave __ to __].

*I wonder when [what to read __ __]?

*I wonder [what you be upset about __].

Who will you visit __ ?

*Who you will visit __ ?

They don't know who you will visit __ .

*They don't know who will you visit __ .

I wonder who [to visit __].

Who did you see __ ?

To whom did you send the letter __ ?

How happy are they __ ?

How quickly do you think you can do that __ ?

How much does it cost __ ?

*Go to which store would they not __ ?

He is [the only one]$_i$ that I don't know [[what kind of present]$_j$ to give ___ $_j$ to ___ $_i$].

?He is [the only one]$_i$ that I don't know [[what kind of present]$_j$ I should give ___ $_j$ to ___ $_i$].

*He is [the only one]$_i$ that I don't know [[what kind of present]$_j$ they gave ___ $_j$ to ___ $_i$].

Finite *Wh*-Relative Clause:

fin-wh-rel-cl $\Rightarrow$

$$\left[\begin{array}{l} \textit{filler-hd-cl} \\ \text{MTR} \left[\begin{array}{ll} \text{SYN} & \left[\text{CAT} \quad \left[\text{SEL} \quad \left[\text{SYN} \quad \text{CNP}\right]\right]\right] \\ \text{SEM} & \lambda P \lambda x[\lambda \wp X(Y) \ \wedge \ P(x)] \end{array}\right] \\ \text{DTRS} \left\langle \left[\begin{array}{l} \text{SYN} \left[\begin{array}{l} \text{CAT} \ \textit{nom} \\ \text{VAL} \ \langle\ \rangle \end{array}\right] \\ \text{WH} \ \{\ \} \\ \text{REL} \left\{\text{x}\right\} \\ \text{SEM} \ Y \end{array}\right], \left[\begin{array}{l} \text{SYN} \left[\text{CAT} \left[\begin{array}{ll} \text{INV} & - \\ \text{IC} & - \\ \text{VF} & \textit{fin} \end{array}\right]\right] \\ \text{SEM} \ X \\ \text{GAP} \left\langle [\text{SEM} \ \wp\ ] \right\rangle \end{array}\right] \right\rangle \end{array}\right]$$

*[the people]$_i$ [who [what a story they told ___ to ___ $_i$]]... (*exclamative/fact)

*[the people]$_i$ [who [what else they read ___ to ___ $_i$]]... (*interrogative/question)

*[the people]$_i$ [who [what book to read ___ to ___ $_i$]]... (*interrogative/question)

*the books [which [be sure to read ___ by tomorrow]]... (*imperative/outcome)

*the books [which [he have ___ read by tomorrow]]... (*subjunctive/outcome)

the woman [[whose friend] *likes Kim*]...

$[_S$ NP $\text{VP}_{fin}]$

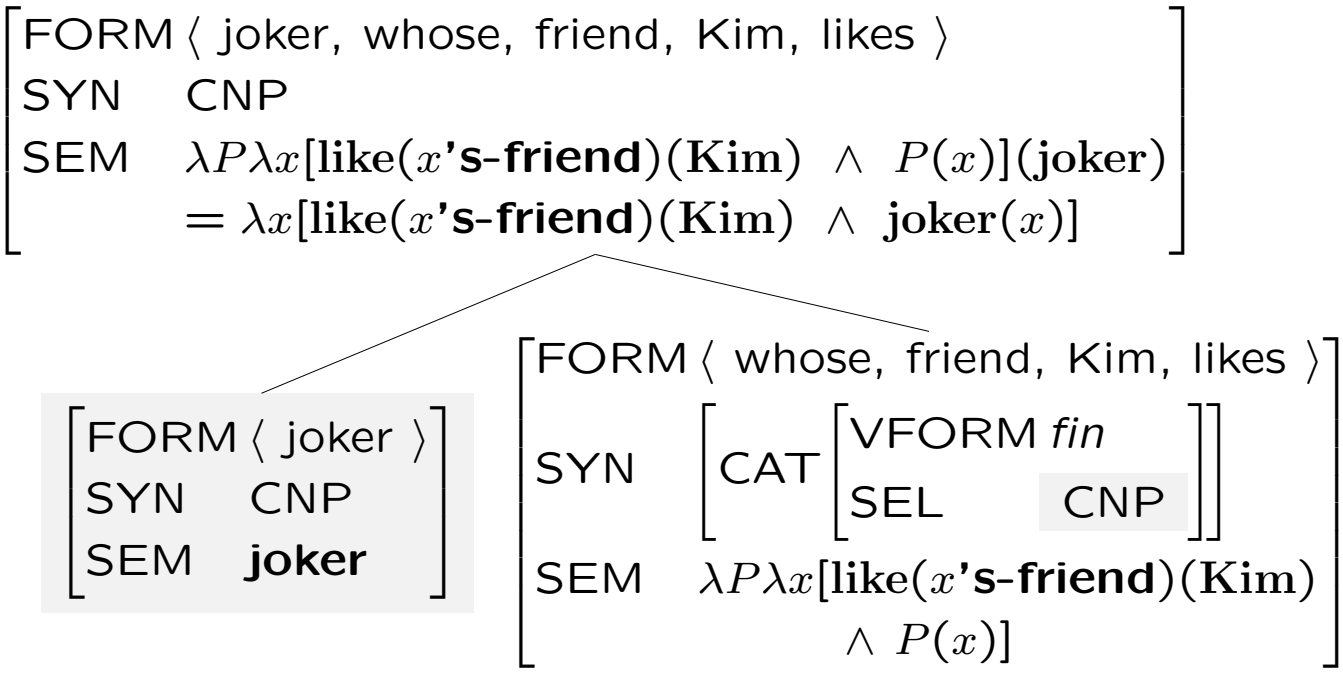
$$\begin{bmatrix}
\text{FORM} & \langle\ \text{whose, friend, Kim, likes}\ \rangle \\
\text{SYN} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \textit{verb} \\ \text{VFORM} & \textit{fin} \\ \text{INV} & - \\ \text{SEL} & \text{CNP} \end{bmatrix} \\ \text{VAL} & \langle\ \rangle \end{bmatrix} \\
\text{SEM} & \lambda P \lambda x[\lambda \wp[\mathbf{like}(\wp)(\mathbf{Kim})](x\textbf{'s-friend}) \ \wedge\ P(x)] \\
 & = \lambda P \lambda x[\mathbf{like}(x\textbf{'s-friend})(\mathbf{Kim}) \ \wedge\ P(x)]
\end{bmatrix}$$

$$\begin{bmatrix}
\text{FORM} & \langle\ \text{whose, friend}\ \rangle \\
\text{SYN} & \text{NP} \\
\text{SEM} & x\textbf{'s-friend} \\
\text{WH} & \{\ \} \\
\text{REL} & \{x\}
\end{bmatrix}$$

$$\begin{bmatrix}
\text{FORM} & \langle\ \text{Kim, likes}\ \rangle \\
\text{SYN} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \textit{verb} \\ \text{VFORM} & \textit{fin} \\ \text{INV} & - \\ \text{SEL} & \text{CNP} \end{bmatrix} \\ \text{VAL} & \langle\ \rangle \end{bmatrix} \\
\text{SEM} & \mathbf{like}(\wp)(\mathbf{Kim}) \\
\text{GAP} & \langle\ [\text{SEM}\ \wp\ ]\ \rangle
\end{bmatrix}$$

[[My uncle who lives in Oregon] whose friend Kim likes] ....

[[Any person whose friends Kim likes] that you failed to invite to the party] ....


FORM ⟨ joker, whose, friend, Kim, likes ⟩
SYN CNP
SEM $\lambda P\lambda x[\mathbf{like}(x\text{'}\mathbf{s\text{-}friend})(\mathbf{Kim}) \wedge P(x)](\mathbf{joker})$
$= \lambda x[\mathbf{like}(x\text{'}\mathbf{s\text{-}friend})(\mathbf{Kim}) \wedge \mathbf{joker}(x)]$
FORM ⟨ joker ⟩
SYN CNP
SEM **joker**
FORM ⟨ whose, friend, Kim, likes ⟩
SYN CAT VFORM *fin*
SEL CNP
SEM $\lambda P\lambda x[\mathbf{like}(x\text{'}\mathbf{s\text{-}friend})(\mathbf{Kim})$
$\wedge P(x)]$

people [with whom [to confer __]]... (PP)

*people [who(m) [to confer with __]]... (NP)

*the degree [how happy [to remain __]]... (AP)

*the degree [how happily [to agree __]]... (AdvP)

*the people [talk to whom [to dare to __]]... (VP)

Infinitival *Wh*-Relative Clause:

inf-wh-rel-cl $\Rightarrow$

$$\left[\begin{array}{l}\textit{filler-hd-cl} \\ \textsc{mtr} \quad \left[\begin{array}{ll}\textsc{syn} & \left[\textsc{cat} \quad \left[\textsc{sel} \quad \left[\textsc{syn} \quad \textsc{cnp}\right]\right]\right] \\ \textsc{sem} & \lambda P \lambda x[M[[\lambda_{\wp} X](Y) \wedge \ P(x)]]\end{array}\right] \\ \textsc{dtrs} \quad \left\langle \left[\begin{array}{ll}\textsc{syn} & \left[\begin{array}{l}\textsc{cat} \ \textit{prep} \\ \textsc{val} \ \langle \ \rangle\end{array}\right] \\ \textsc{sem} & Y \\ \textsc{wh} & \{\ \} \\ \textsc{rel} & \{x\}\end{array}\right], \left[\begin{array}{ll}\textsc{syn} & \left[\begin{array}{l}\textsc{cat} \ [\textsc{vform} \ \textit{inf}] \\ \textsc{val} \ \langle \ \textit{fni} \ \rangle\end{array}\right] \\ \textsc{sem} & X \\ \textsc{gap} & \left\langle [\textsc{sem} \quad \wp \ ] \right\rangle\end{array}\right] \right\rangle\end{array}\right]$$

The person [[in whom] to place your trust] is our president.

Rather, there, it seems a more reasonable hypothesis that Freud chose another, more obvious Jewish personage [[with whom to identify himself], ... [Blatt, D.S. (1988). *The Development of the Hero: Sigmund Freud and the Reformation of the Jewish Tradition*. Available online at `http://www.pep-web.org`]

*The person [[in whom] for you to place your trust] is our president.

The more you read, the more you understand.

If you read, (then) you'll understand.

As you read, (so) you'll understand.

Comparative Correlative Clause

comp-corr-cl $\Rightarrow$

$$\begin{bmatrix} \text{MTR} & \begin{bmatrix} \text{CREL} & \textit{none} \\ \text{SEM} & R(\alpha, \beta) \end{bmatrix} \\ \text{DTRS} & \left\langle \begin{bmatrix} \text{CREL} & \textit{the} \\ \text{SEM} & \alpha \end{bmatrix}, \text{H:} \begin{bmatrix} \text{CREL} & \textit{the} \\ \text{SEM} & \beta \end{bmatrix} \right\rangle \end{bmatrix}$$

Comparative Correlative Semantics (adapting Brasoveanu (2007,2008))

There is a natural correspondence between α and β, where α is the difference (differential) between (any) two natural numbers and β is the difference between the squares of those two numbers.

Given two natural numbers x and y, if $x - y$ is positive, then so is $x^2 - y^2$

Kim is three feet taller than Sandy is. [the positive difference between Kim's height and Sandy's height is three feet]

The taller Sandy is... [the positive difference between Sandy's height at t_1 and Sandy's earlier height at t_2 is Δ]

the more, *the taller*, *the taller a man*, *the more customers*, *the more customers' accounts*,....

The-**Clause:**

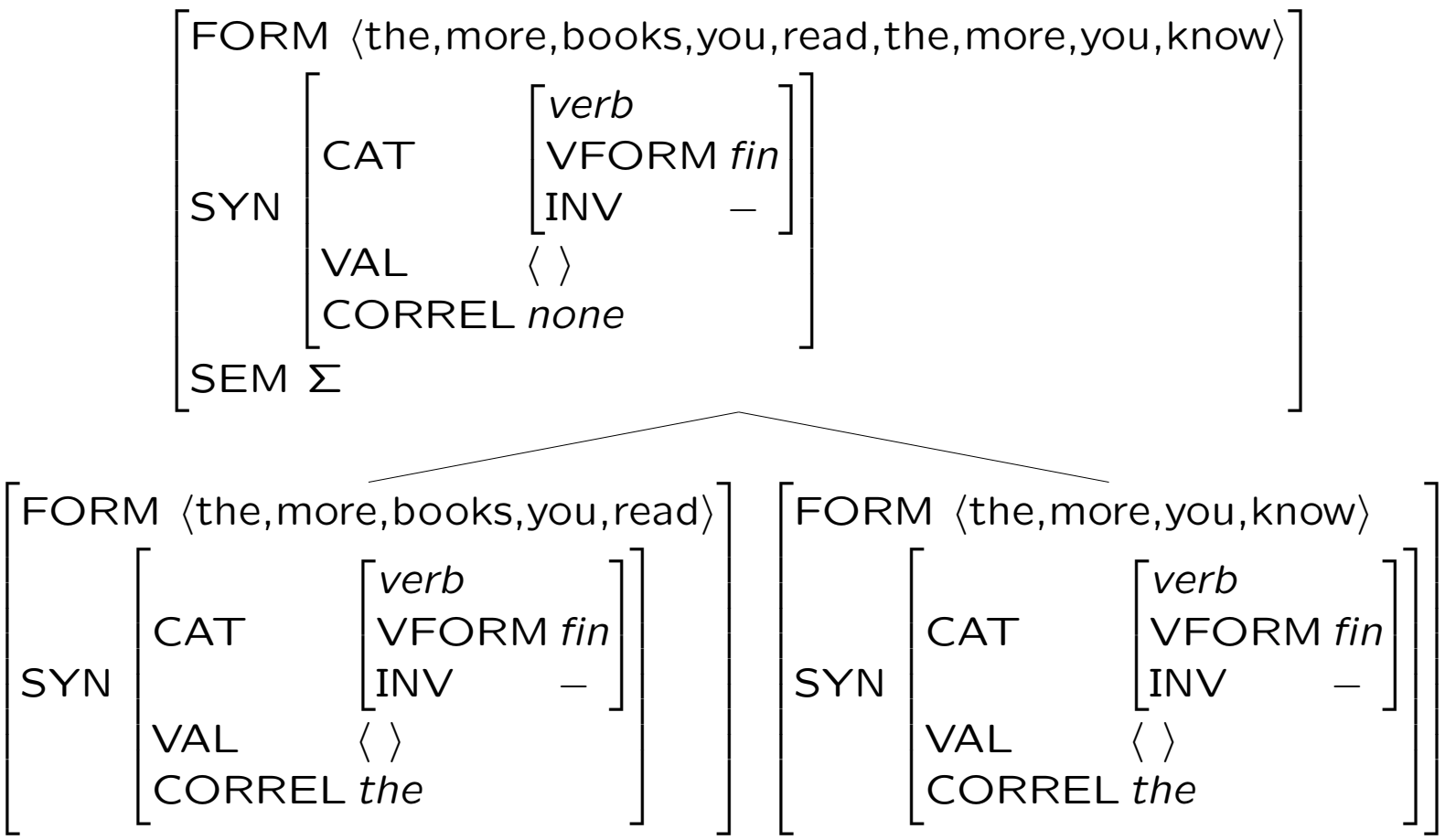
the-cl $\Rightarrow$

$$\left[\begin{array}{l}\textit{filler-hd-cxt} \\ \text{MTR} \quad \left[\begin{array}{ll}\text{SYN} & [\text{CREL} \quad \textit{the}\ ] \\ \text{SEM} & (\iota\Delta : [\lambda V.X](Y))\end{array}\right] \\ \text{DTRS} \quad \left\langle \left[\begin{array}{ll}\text{SYN} & \left[\begin{array}{l}\text{CAT} \ \textit{adjectival} \\ \text{VAL} \ \langle\ \rangle\end{array}\right] \\ \text{SEM} & Y \\ \text{WH} & \{\ \} \\ \text{REL} & \{\Delta\}\end{array}\right], \left[\begin{array}{ll}\text{SYN} & [\text{CAT} \ [\text{VFORM} \ \textit{fin}]] \\ \text{SEM} & X \\ \text{GAP} & \left\langle [\text{SEM} \quad V\ ] \right\rangle\end{array}\right] \right\rangle\end{array}\right]$$

$$\begin{bmatrix}
\text{FORM} & \langle\ \text{the, more, books, you, read}\ \rangle \\
\text{SYN} & \begin{bmatrix}
\text{CAT} & \begin{bmatrix} \textit{verb} \\ \text{VFORM} & \textit{fin} \\ \text{INV} & - \end{bmatrix} \\
\text{VAL} & \langle\ \rangle \\
\text{CREL} & \textit{the}
\end{bmatrix} \\
\text{SEM} & (\iota\Delta\ [\textbf{you read}\ \delta_1\ \textbf{many books at}\ t_1 \\
 & \&\ \textbf{you read}\ \delta_2\ \textbf{many books at an earlier}\ t_2 \\
 & \&\ \delta_1 > \delta_2\ \&\ \delta_1 - \delta_2 = \Delta\ ]) \\
\text{GAP} & \langle\ \rangle
\end{bmatrix}$$

$$\begin{bmatrix}
\text{FORM} & \langle\ \text{the, more, books}\ \rangle \\
\text{SYN} & \text{NP} \\
\text{WH} & \{\ \} \\
\text{REL} & \{\delta\}
\end{bmatrix}$$

$$\begin{bmatrix}
\text{FORM} & \langle\ \text{you, read}\ \rangle \\
\text{SYN} & \begin{bmatrix}
\text{CAT} & \begin{bmatrix} \textit{verb} \\ \text{VFORM} & \textit{fin} \\ \text{INV} & - \end{bmatrix} \\
\text{VAL} & \langle\ \rangle \\
\text{CREL} & \textit{none}
\end{bmatrix} \\
\text{SEM} & \textbf{read}(\wp)(\textbf{you}) \\
\text{GAP} & \langle\ [\text{sem}\ \wp\ ]\ \rangle
\end{bmatrix}$$


FORM ⟨the,more,books,you,read,the,more,you,know⟩
SYN
CAT
verb
VFORM fin
INV −
VAL ⟨ ⟩
CORREL none
SEM Σ
FORM ⟨the,more,books,you,read⟩
SYN
CAT
verb
VFORM fin
INV −
VAL ⟨ ⟩
CORREL the
FORM ⟨the,more,you,know⟩
SYN
CAT
verb
VFORM fin
INV −
VAL ⟨ ⟩
CORREL the

where $\Sigma =$

$R(\iota\Delta_1$ [**you read** δ_1 **many books at** t_1
you read δ_2 **many books at an earlier** t_2
& $\delta_1 > \delta_2$ & $\delta_1 - \delta_2 = \Delta_1$],
$\iota\Delta_2$ [**you understand** δ_3 **much at** t_1
& **you understand** δ_4 **much at an earlier** t_2
& $\delta_3 > \delta_4$ & $\delta_3 - \delta_4 = \Delta_2$])

Conclusions:

Parameters of Variation in Filler-Gap Clauses

- whether the head daughter can or must be inverted,
- what constraints are imposed on the grammatical category of the filler daughter,
- the presence of a particular kind of *wh*-word (interrogative, exclamative, or relative) within the filler vs. the absence of any *wh*-word,
- whether the head daughter can be subjectless or not,
- whether the clause can or must be be a main (independent) clause,
- whether the head daughter must be finite, must be infinitival, or may be either, and
- the semantics of the clause in relation to its components.

Conclusions

- A half century of research in generative-transformational grammar still has produced no systematic analyses of the data discussed here.
- SBCG provides an account of the full range of data that expresses the relevant generalizations.
- SBCG allows the observed idiosyncrasies to be accounted for.
- It does so within a lexicalist, constraint-based, model-theoretic, architecture that allows for realistic psycholinguistic plausibility. (Pullum/Scholz, Sag/Wasow)