Processing Explains Island Constraints

Ivan Sag (Stanford University)

Robert Kluender (UC San Diego)
Competence-Performance

- **Competence**: Our tacit, internalized knowledge of a language.

- **Performance**: The external evidence of language competence. Particular occasions of language usage, whose form is affected by factors other than competence.

- **Performance factors**: short term memory limitations, whether or not we have been drinking,...
Competence-Performance

- Not just knowledge vs. ‘performance errors’

- **Competence:** A central repository of linguistic knowledge.

- **Performance:** Specialized mechanisms for comprehension and production of language.
Performance-Based Accounts

• [[[That [that [[that Kim left] bothers Sandy] upsets them]]] is a problem].

S → NP VP

NP → that S
Performance-Based Phenomena: Graded Acceptability

- [[that [[that Kim left] bothers Sandy]] upsets them].

- [that [[for Kim to leave] would bother Sandy] upsets them].
Processing and Acceptability

- Intuitions of sentence well-formedness are intuitions of **acceptability**.
- Grammatical deviance can make sentences unacceptable.
- Processing difficulty can make grammatical sentences unacceptable (Fanselow and Frisch to appear).
Low Acceptability: Competence or Performance

- The boy the cat the dog bit scratched started crying
- The correspondent everyone I met trusts is interviewing the president
- **Similarity** between the embedded element and the embedding environment causes processing difficulty.
- Gradience and amelioration by orthogonal factors suggests a performance account.
Filler-Gap Constructions

• **What** did Sandy like ___?

• **What** did Sandy say she likes ___?

• **What** did Sandy say she thinks Kim likes ___?

• The person **who** we all said we wanted to meet ___ is...

• I met **more people** yesterday than anyone else in our group said they had been able to meet ___ in their time here.
Declarative Filler-Gap Constructions

- **Topicalization:** [Bagels], I like __ .

- **Negative adverb preposing:** [Never] did they drink wine __ .

- **Though-fronting:** [Happy] though she may appear to be __ , she....

- **As-fronting:** [As happy] as they might appear to be __ , nonetheless...

- **More-the-merrier-constructions:** The more you smoke __ , the less you feel the pain __ .
Lexically controlled Filler-Gap Constructions:

- **It-clefts**: It was [[Sandy] that Kim wanted to visit __ ].

- **Wh-clefts**: [[What] Kim wanted to visit __ most] was the Taj Mahal.

- **Tough-complements**: This is hard to digest __ .

- **ready-complements**: The turkey is ready (for you) to serve __ .
• Comparative deletion: Sandy ate more bagels than Kim had eaten __ .

• Comparative subdeletion: Sandy ate more bagels than they thought Kim had eaten __ donuts. [other ellipses in comparative clauses]
Adnominal relatives:

**Wh-relatives:**

- the book [[in which] you’ll find the answer __ ]
- the book [[in which] to find the answer __ ]
- the book [[which] __ will provide the answer]

**That-relatives:**

- the book [that Sandy liked __ ]
- the book [that __ will provide the answer]
• **Bare relatives:** the book [Sandy liked __ ]

• **Infinitival relatives:**
  the book [to read __ ]
  a book [__ to provide the answer]

• **Free relatives:** I’ll read [[what(ever)] you tell me to read __ ].
**Wh-Interrogative Clauses:**

- [Who(se books)] do you think Sandy likes ___ best?
- I know [who(se books)] you think Sandy likes ___ best.
- [Who(se books)] do you think ___ likes Sandy best?
- I know [who(se books)] to tell them to visit ___ first.
**Wh-Exclamatives:**

- [What slobs] Robin and his merry men turned out to be ___ !
- [What a bunch of con men] you’ve brought ___ home for dinner!
- [How harshly] you treat your servitors ___ !
All Filler-Gap Constructions are Unbounded I

- Sandy ate more bagels than they thought Kim had eaten __.
- Sandy ate more bagels than they thought Kim had eaten __ bananas.
- Sandy ate more bagels than they thought it was likely that Kim had eaten __.
- Sandy ate more bagels than they thought it was likely that Kim had eaten __ bananas.
All Filler-Gap Constructions are Unbounded II

- the book [[in which] they say it’s likely that you’ll find the answer __ ]

- [Who(se books)] do you think it’s likely that everyone thinks Sandy likes __ best?

- the book [[in which] they say it’s likely that you’ll find the answer __ ]

- [Who(se books)] do you think it’s likely that everyone thinks Sandy likes __ best?
The Original View in MGG:
FGD are to be analyzed in terms of Unbounded Movement

(Chomsky 1955, 1957; Ross 1967; Bresnan 1976)

WH+q you think everyone believe Sandy like who\textsubscript{i}. (DS)

\textbf{Who}\textsubscript{i} you think everyone believe Sandy like __ \textsubscript{i}. (Wh-Mvmt)

\textbf{Who}\textsubscript{i} do you think everyone believe Sandy like __ \textsubscript{i}. (SAI)
The Original Island Constraint

Chomsky’s (1962) **A-Over-A Constraint:**

An element of category A cannot be extracted out of a phrase of category A.

(a disambiguating constraint on the application of transformations)
The Standard View in MGG: Island Effects Due to Competence Constraints

*What did GWB hear [the rumor [that the EU invaded __ ]]?

cf. GWB heard [the rumor [that the EU invaded Moldova]]

*This was a puzzle that we met [the mathematician [who solved __ ]].

cf. We met [the mathematician [who solved that puzzle]].

*What did Clinton wonder [whether Hilary liked __ ]?

Clinton wondered [whether Hilary liked that].
• *Who did you meet [Kim and __ ]?*

• *Whose did you read [__ book]?*

• *How did you read the book [__ carefully]?*  

cf. How carefully did you read the book __ ?
Ross 1967: The A-Over-A Constraint is too strong!

• Who did you approve of [my visiting _ ]?

• The CIA reports, which_i the government approves [the height of [the lettering on [the covers of which_i ]]]... 

• The CIA reports, [the covers of which_i ]_j the government approves [the height of [the lettering on _ ]]... 

• The CIA reports, [the lettering on the covers of which_i ]_j the government approves [the height of _ ]...
Coordinate Structure Constraint and ATB Exceptions I

• Which dignitaries do you think [[Sandy photographed the castle] and [Chris visited __ ]]?

• Which dignitaries do you think
  [[Sandy photographed __ ] and [Chris visited the castle]]?

• Which dignitaries do you think
  [[Sandy photographed __ ] and [Chris visited __ ]]?
Coordinate Structure Constraint and ATB Exceptions II

•*Which of her books did you find both [[a review of Gould] and [a reply to ___ ]]?

•*Which of her books did you find both [[a reply to ___ ] and [a review of Gould’s new book]]?

• Which of her books did you read both [[a review of ___ ] and [a reply to ___ ]]?
The Coordinate Structure Constraint

- No conjunct can be extracted from a coordinate structure. (Conjunct Constraint)

- No Element within a conjunct of a coordinate structure can be extracted from that structure. (Element Constraint)

- ‘Across-the-Board’ Exception to the Coordinate Structure Constraint: Uniform extraction of an element from all conjuncts of a coordinate structure is permitted.
Coordinate Structure Constraint: Exceptions to the ATB Exception

• *Which of her books did you find both [[a review of ___ ] and [___ ]]?

• *Which of her books did you find [[___ ] and [a review of ___ ]]

• *Which rock legend would it be ridiculous to compare [[___ ] and [___ ]]?
  (cf. Which rock legend would it be ridiculous to compare ___ with himself?)
The Complex NP Constraint

No element can be extracted from a ‘complex NP’, i.e. an NP consisting of an N, a clause, and perhaps other material.

- [the fact/rumor [that people like vindaloo]]
- [people [ ___ who like vindaloo]]
- *What did Leslie regret the fact that people like ___ ?
- *What can't Leslie stand people who like ___ ?
The Left Branch Constraint

No element that is a ‘left branch’ of a constituent can be extracted from that constituent. For example, X cannot be extracted from a [X Y] constituent.

*How is Sandy __ tall?
  How tall is Sandy __?

*Whose did you talk about __ book?
  [Whose book] did you talk about __?
The Sentential Subject Constraint

No element can be extracted from a clause that functions as a subject.

• *Which book did that Sandy read ___ surprise Kim?

• Which book did it surprise Kim that Sandy read ___?

Potential Difficulties: Ad hoc; should be covered by other principles.
The Right Roof Constraint I

Rightward extraction out of a sentence is banned.

- [For pigs to fly] would be impossible.
- It would be impossible [for pigs to fly].
- [[That for pigs to fly] is impossible] is clear.
- [That it is impossible [for pigs to fly]] is clear.
- *[That it is impossible ___ ] is clear [for pigs to fly].
The Right Roof Constraint II

• [Someone [who can beat you to a pulp]] exists (right here in this room).

• [Someone __ ] exists (right here in this room) [who can beat you to a pulp].

• [That [someone [who can beat you to a pulp] exists]] is a foregone conclusion.

• [That [someone __ ] exists [who can beat you to a pulp]] is a foregone conclusion.

•*[That [someone __ ] exists] is a foregone conclusion [who can beat you to a pulp].
Negative Island Constraint

- No extraction of adverbials out of ‘negative’ environments

*Why don’t you think [we can help him __ ]?

*How did you deny [that you behaved __ ]?
Factive Island Constraint

• No extraction out of ‘factive’ environments
  *Why did they realize [they could help him __ ]?
  *How did you regret [that you behaved __ ]?
Adverbial Island Constraint

No extraction out of an adverbial modifier.

*Who did you [file the books [after visiting ___ ]]?
**WH-Island Condition**

No element can be extracted from a *WH*-clause.

*How did you wonder [whether we could help Kim __ ]?*

?Who did you wonder whether they saw __ ?

Who did you wonder if they saw __ ?

*What did you wonder who saw __ ?

Those are [the people]$_j$ that I was unsure [how many presents]$_i$ to give __ $i$ to __ $j$. 
Reanalysis as Subjacency (Chomsky 1973)

No rule may move a phrase from position $Y$ to position $X$ (or conversely) in:

$$ \ldots X \ldots [\alpha \ldots [\beta \ldots Y \ldots] \ldots] \ldots X \ldots , $$

where $\alpha$ and $\beta$ are cyclic nodes.

(Cyclic nodes in English are S (IP) and NP (DP))
Reanalysis via Local Movement

\[ \text{**Who}_i \ [S \text{ did you think } [S', \text{ e}_i \ [S \text{ Kim should help } \_ i]]]? \]

\[ ?\text{Who}_i \ [S \text{ did you wonder } [S', \text{ whether/e}_i \ [S \text{ Kim should help } \_ i]]]? \]

\[ *\text{Who}_i \ [S \text{ did you wonder } [S', \text{ what}_j/e_i \ [S \text{ Kim gave } \_ j \text{ to } \_ i]]]? \]

\[ *\text{Who}_i \ [S \text{ did you hear } [NP \text{ the rumor } [S', \text{ that/e}_i \ [S \text{ Kim helped } \_ i]]]? \]
Bridge Verbs

**Who** did Kim say that Sandy visited __ ?

*Who* did Kim mumble that Sandy visited __ ?
Bridge Verb Condition

No rule may move a phrase from position Y to position X (or conversely) in:

\[ \ldots X \ldots [ \alpha [ \ldots Y \ldots ] ] \ldots \]

unless \( \alpha \) is a ‘bridge verb’
Superiority Effects

Who ___ saw what?

*What did who see ___ ?

Who ___ talked to who?

*Who did who talk to ___ ?
Superiority Condition (Chomsky 1973)

No rule can involve $X, Y$ in the structure:

$$
... X ... [ ... Z ... \rightarrow WYV ... ] ... ,
$$

where the rule applies ambiguously to $Z$ and $Y$, and $Z$ is superior to $Y$. 
Subject Constraint

No rule can involve $X,Y$ in the structure:

$$\ldots X \ldots [S\ldots[\alpha\ldots Y \ldots ]\ldots ]\ldots ,$$

where $\alpha$ is the subject of $S$

(No extraction from a subject.)

*Who did you say [[my picture of ___] would make everyone upset]?
The Standard View in MGG:

- The constraints of competence grammar are intricate, arbitrary, and irreducible.
- The constraints of competence grammar are universal and specific to language.
- The constraints of competence grammar couldn't be learned from experience.
- The constraints of competence grammar are part of the human biological endowment for language.
Coordinate Structure Constraint: Potential Difficulties

Asymmetric Conjunction (Ross):

• There are several countries that my boss wants me to go and visit __.

Goldsmith/Lakoff Variations:

• [How many courses] can you take __ for credit, still remain sane, and get all As in __?

• The dinner that Dana will eat __ and then get sick...
CNPC/Subjacency: Potential Difficulties I

- Which East European country did you hear rumors that we had invaded __ ? (Pollard and Sag 1994, among others)

- What company does Mike hold the absurd belief that he can get a job with __ ?

- The CIA, I give you my assurance that I would never accept a penny from __ .
We have a *visitor* who *there's no one who's willing to host* __. (Chung and McCloskey 1983).

You’ve been talking with a person that I’ve never met *anyone who doesn’t like* __.

There were *several old rock songs* that *their 13 year-old daughter and I were the only two who knew* __.

*it was the distance to the chasm* that Frank *knew someone who was able to determine* __. (Goldberg 2006)
Left-Branch Condition: Potential Difficulties

- Not universal:

  French: Combien as-tu acheté [ ___ de livres]?  
  Serbo-Croatian: Koju si pronašla [ ___ knigu]?  
  (Which AUX you-found book?)

- Insufficiently general?

  A friend of Kim’s arrived.  
  *Whose did [a friend of ___ ] arrive?
Right Roof Constraint: Potential Difficulties

• Depends on what counts as an S:

  I’ve wanted [to know ___ ] for many years [exactly what happened to Rosa Luxembourg]. (Andrews 1975)

  I’ve wanted [to meet [someone ___ ]] for many years [who would be my complete soulmate in life].

  ?I’ve known [that she married [someone ___ ]] for many years now [who is always there for her].
Subject Condition: Potential Difficulties:

? Which cars were [[the hoods of ___ ] damaged in the accident]?

? These were the Iranian dignitaries that [[my talking to ___ ] was considered unacceptable].
Superiority Condition: Potential Difficulties

*What don’t you know who wrote?

?Which article don’t you remember who wrote? [Maling and Zaenen 1982]

Which newspaper did which student read __ ? [Karttunen 1977]

I know what just about everybody was asked to do, but what did who (actually) do __ ? [Bolinger 1978]
Much Critical Island Data is Graded I

Who did you see the pictures of? ≤

Who did you see his pictures of? ≤

Who did you see John’s pictures of? (adapted from Erteschik Shir 1977)
Much Critical Island Data is Graded II

That was the play that they wondered whether no student would like __.

That was the play that they wondered whether a student would like __.

That was the play that they wondered whether the class would like __. ≤

That was the play that they wondered whether I/we/you would like __.
Subjacency Effects are **Graded** (Chomsky 1986)

\[ \beta \text{ is } n\text{-subjacent to } \alpha \text{ iff there are fewer than } n+1 \text{ barriers for } \beta \text{ that exclude } \alpha \]

**Subjacency:** If \((\alpha_i, \alpha_{i+1})\) is a link of a chain, then \(\alpha_{i+1}\) is 1-subjacent to \(\alpha_i\).
non-finite wh-island: 1 barrier (CP by inheritance from IP – which is a blocking category but, by stipulation and exception, not inherently a barrier by virtue of being a blocking category)

finite wh-island: 2 barriers (IP inherently, because of another stipulation that the most deeply embedded finite IP is exceptionally an inherent barrier by virtue of being a blocking category)

non-finite sentential complement of NP: 1 barrier (CP by stipulation, because even though it is a complement, it is case-marked by a noun rather than a verb; NP again by stipulation does not inherit barrierhood in this particular case)
finite sentential complement of NP: 2 barriers (IP now inherently, because it is the most deeply embedded tensed IP, and CP by inheritance, but not NP for the same reason as above)

non-finite RC: 2 barriers (CP by inheritance from IP, NP by inheritance from CP)

finite RC: 3 barriers (IP inherently, because it is the most deeply embedded tensed IP, CP by inheritance from IP, NP by inheritance from CP)
Constraints on Pair-List Readings
(Huang 1982, p. 535)

Who remembers where we met who?
Who remembers where we bought what?
Who remembers what we bought where?
Who remembers what we bought when?
*Who remembers what we bought why?
*Who remembers what we bought how?
Referentiality Contrasts (Huang 1982, a.o)

From where did he come?

Since when have you been here?

*For why did he come?

*By how did he come?

Who remembers what we bought for what reason?

Who remembers what we bought in what manner?
Referentiality Contrasts wrt Superiority

Mary asked who read what.

*Mary asked what who read.

Mary asked which man read which book.

Mary asked which book which man read.

(Karttunen 1977, independently rediscovered by Pesetsky 1987)

*?What don’t you know who wrote?

Which article don’t you remember who wrote?

(Maling and Zaenen 1982)
More Referentiality Contrasts

*How many pounds did John wonder how to weigh __ ?

[Which apples]_i did John wonder how to weigh __ _i? (adapted from Rizzi 1990)

Limit ‘long’ extraction to referential elements bearing a thematic role.

But:

* [Every book]_i, I wonder why he bought __ _i.

[That book]_i, I wonder why he bought __ _i. (Cinque 1990)
**GB Accounts**

- **Cinque (1990):** Referential indices should be assigned only to noun phrases that actually refer.

- **Chung (1994):** But the bifurcation of noun phrases into referential vs. nonreferential has no obvious correlate in the theory of anaphora, and therefore muddies the whole concept of what an index is.
Who left?

Someone left.

*?How much money was John wondering whether to pay __ ?

There was a sum of money about which John was wondering whether to pay it.

*?How much did Bill wonder whether the book cost __ ?

There was a sum of money about which John was wondering whether the book cost that much.
A clause or phrase is semantically dominant if it is not presupposed and does not have contextual reference. (p. 9)

A presupposed complement is always semantically subordinate, since it must have contextual reference due to its being believed to be true by the speaker. (pp. 1-2)

Extraction can only occur out of clauses or phrases which can be considered dominant in some context. (p. 12)
Bill said: “John believes that Mary is a fool”
(a) ...which is a lie – he doesn’t.
(b) ...which is a lie – she isn’t.

A constituent c of a sentence S is dominant in S if and only if the hearer’s attention to the intension of c, by uttering S. (Erteschik Shir 1981)
The Dominance Hypothesis (Erteschik Shir and Lappin, 1979) An NP can only be extracted out of clauses which may be interpreted as dominant or out of phrases in which the NP may itself be regarded as dominant.

Who did Bo believe/*mumble that Sandy saw __ ?

Who did John see a/*the picture of __ ?
A thematic sentence represents a recognition of what the rest of the sentence is a predication about, and the affirmation or denial of that predication. On the other hand, a sentence with a syntactically marked focus involves recognition of a presupposed predication, and acceptance or rejection of the focus as a value for the variable in the predication. (Kuno 1976, p.443)
• The Topichood Condition (Kuno, 1987): Only those constituents in a sentence that qualify as the topic of the sentence can undergo extraction processes (i.e. Wh-Q Movement, Wh-Relative Movement, Topicalization, and It-Clefting). (p. 23)

• Backgrounded Constructions are Islands (Goldberg 2006, p. 135)
This is the kind of weather that there are many people who like.

This is the kind of weather that I know many people who like.

*This is the kind of weather that I am familiar with many people who like. (Erteschik Shir and Lappin 1979, p. 58)

Who did you give __ a book? ≤

Who did you give a book to __?
Processing and Acceptability

- Intuitions of sentence well-formedness are intuitions of **acceptability**.

- Grammatical deviance can make sentences unacceptable.

- Processing difficulty can make grammatical sentences unacceptable (Fanselow and Frisch to appear).
Conclusions

- Semantic and pragmatic factors pervade island phenomena and must be controlled if the true effects of purely structural island constraints are to be isolated.

- Island structures are all complex. This complexity must be controlled if the true effects of purely structural island constraints are to be isolated.

- We’ll argue that processing difficulty plays a significant role in explaining island effects.